Program of the Seventy-Seventh Annual Meeting of the American Association of Physical Anthropologists

to be held at
The Hyatt Regency Columbus Hotel
Columbus, Ohio
April 9 to April 12, 2008

AAPA Scientific Program Committee:

Dennis H. O'Rourke
Chair and Program Editor

Robert Anemone
Heather Edgar
Agustin Fuentes
Christine Hanson
Fredericka Kaestle
John Kappelman
Thomas McDade
G. Richard Scott
Christopher Tillquist

Chandler Gatenbee, Program Assistant
Edward Hagen, Computer Programming

Local Arrangements Committee:

Clark Spencer Larsen, chair
Tracy Betsinger
Douglas Crews
Debbie Guatelli-Steinberg
Dawn Kitchen
Lara McCormick
W. Scott McGraw
Jeffrey McKee
Barbara Piperata
Paul Sciulli
Samuel Stout

Message from the Program Committee Chair

The seventy-seventh annual meeting of the AAPA will be held at the Hyatt Regency Columbus Hotel in Columbus, Ohio. There will be 759 poster and podium presentations in 36 sessions, with over 1,500 participating authors. The program includes eight podium symposia and five poster symposia that span the breadth of our discipline. The program also includes the Sixth Annual Wiley-Liss Symposium; co-sponsored this year by the Gesellschaft für Anthropologie the contributions examine new perspectives and insights in the reconstruction of health and disease from hard tissue biology.

This year's program reflects the international nature of our meetings. Approximately 17% of the senior authors live outside the United States, representing 32 nations. The largest representations are from Germany (20 senior authors), the United Kingdom (18), Canada (17), Austria (7), Japan (7), Mexico (6) and South Africa (5). Our meeting also serves as an important avenue for presentation of student research; about 48% of all first authors are students.

This is the seventh year that we have used an online registration system for abstract submission and payment of registration fees. The entire meeting volume is again available at the AAPA website: http://www.physanth.org.

As is customary, we will meet in conjunction with a number of affiliated groups, including the American Association of Anthropological Genetics, the American Dermatoglyphics Association, the Dental Anthropology Association, the Human Biology Association (Wednesday and Thursday, April 9-10), the Paleopathology Association (Tuesday and Wednesday, April 8-9), and the Primate Biology and Behavior Interest Group.

In the following pages you will find a map of the Hyatt Regency Columbus and meeting rooms; a summary table of conference events; the daily conference schedule, including meetings of affiliated associations, editorial boards, workshops, and various business meetings; a detailed listing of AAPA poster and podium sessions; the abstracts of the presentations; and an index of the authors providing the session numbers and times of their presentations.

AAPA activities begin on Wednesday evening, April 9, with a session organized by the Career Development Committee. This year's discussion is entitled "Open Forum: Q&A with the Committee". Chaired by Joel Irish (University of Alaska, Fairbanks) the entire committee will be there to answer questions and poll topics of interest for students and newer members of the association. This event is followed by our annual welcoming reception. Poster and podium sessions begin Thursday morning and continue through Saturday afternoon.

The plenary session, scheduled for Thursday evening, takes on a new look this year with the first ever AAPA Auction. Don't miss it! Our annual luncheon on Friday features Agustin Fuentes, Professor of Anthropology at Notre Dame, speaking on "Are We Biological Anthropologists Yet? Contemplating Washburn's New Physical Anthropology in 2008." As always, the annual business meeting of the association is on Friday evening. We conclude the annual meeting with a Student Awards Reception on Saturday afternoon following the conclusion of scientific sessions.

The AAPA Program, Local Arrangements, and Executive Committees cordially invite you to our seventy-seventh annual meeting. Welcome to Columbus, and we look forward to seeing you.

Dennis H. O'Rourke

AAPA Vice President and
Program Committee Chair

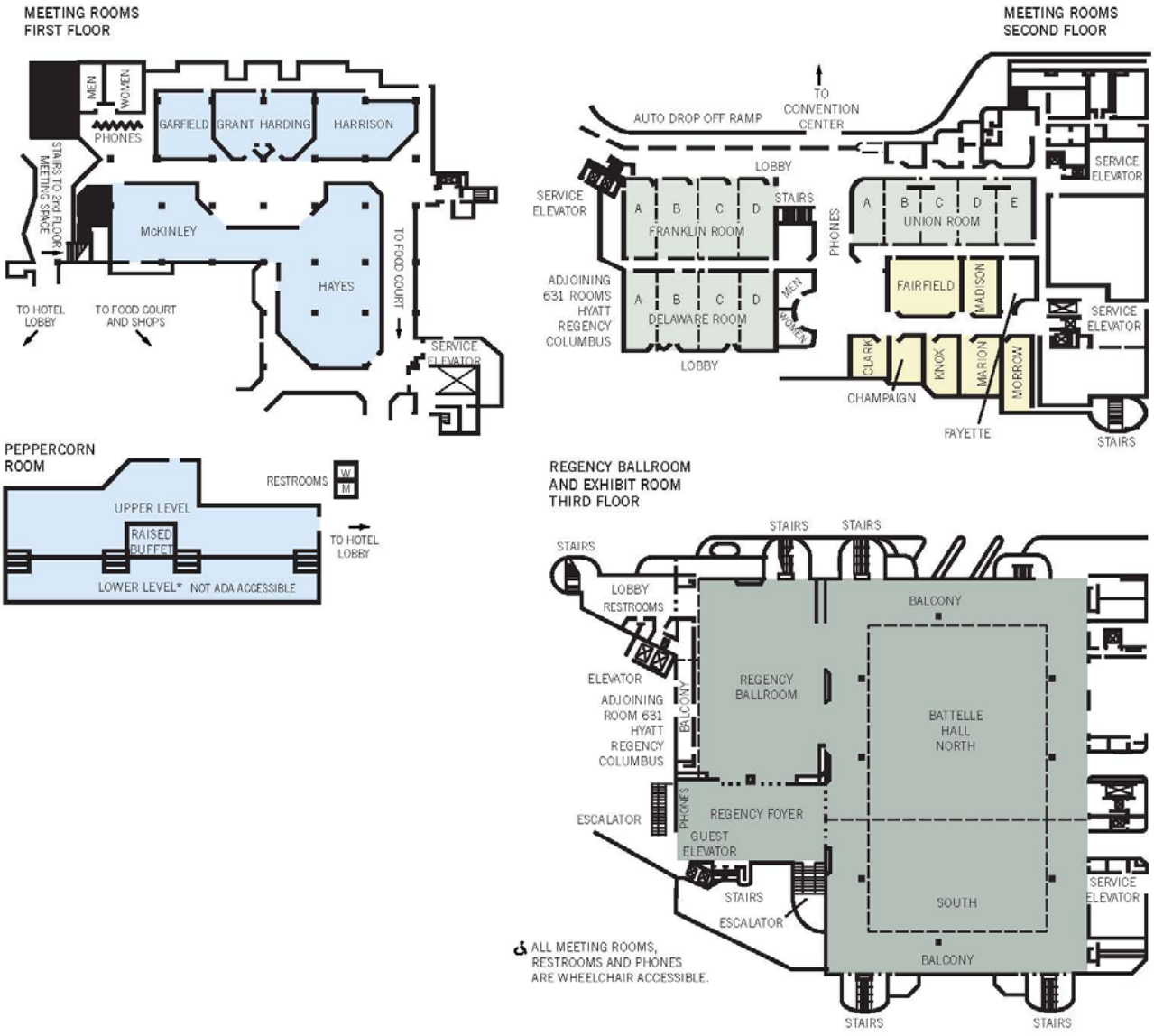
Contents

On the Cover: Columbus Skyline, photo by J.K. McKee

Supplement 43 was mailed the week of

Hyatt Recency Columbus Hotel Floor Plan

All meeting rooms are located on the first or second floor of the hotel. Larger venues for some receptions and the plenary session are located on the third floor.



The Conference at a Glance

Room	Tues AM	Tues PM	Tues Evening	Wed AM	Wed PM	Wed Evening
Franklin/ Country Foyer	PPA Registration	PPA Registration		PPA & AAPA Registration	PPA & AAPA Registration	
Delaware A/B						
Delaware C						HBA Student Reception
Delaware D		PPA Podiums		PPA Podium	PPA Podium	
Franklin		PPA Posters		PPA Posters and Exhibitors	PPA & HBA Posters and Exhibitors	
Madison				AJHB Editorial Board Breakfast 7:30-9:00am		
Marion	PPA Workshop 1			AAPA Executive Committee Mtg.	AAPA Executive Committee Mtg.	
Knox	PPA Workshop 2				AJPA Editorial Board Luncheon	AAPA Career Development, 6:30-8:00
Morrow		PPA Student Action Committee Noon-1pm				
Garfield			HBA Executive Committee Dinner		PPA Student Competition Committee	
Hayes				HBA Podium		Pearl Memorial Lecture 5:00-6:00pm
Regency Ballroom						AAPA Reception & Cash Bar 8:00-11:00pm
Clark	Speaker Ready	Speaker Ready		Speaker Ready	Speaker Ready	
Fayette	Press/Job Interview	Press/Job Interview		Press/Job Interview	Press/Job Interview	

Monday Evening: PPA Registration, Country Foyer, 5 - 7 pm.

Key to Acronyms:

AAAG American Association of Anthropological Genetics
AAPA American Association of Physical Anthropologists
ADA American Dermatoglyphics Association
AJHB *American Journal of Human Biology*
AJPA *American Journal of Physical Anthropology*
DAA Dental Anthropology Association
HBA Human Biology Association
JHE *Journal of Human Evolution*
PPA Paleopathology Association

The Conference at a Glance (continued)

Room	Thurs AM	Thurs PM	Thurs Evenig
Franklin Foyer	AAPA Registration	AAPA Registration	
Delaware A/B	Session 6 Primate Behavior, Ecology and Evolution.	Session 10: Functional & Evolutionary Morphology 1.	HBA Reception 7:30-10:30
Delaware C	Session 5: Dental & Forensic Anthropology	Session 12: Paleoanthropology: Hominid Evolution.	Wiley-Liss Reception 8:30-10:30
Delaware D	Session 4: Population Genetics.	Session 9: Reconstructing Health and Disease from Skeletal and Dental Biology.	
Fairfield	Session 3: Patterns and Processes of Morphological Integration in Primate and Human Evolution.	Session 11: Primate Behavior, Reproduction and Life History.	
Franklin	Session 1: Paleopathology & Brain Evolution. 8-noon. AAPA Exibitors	Session 7: Dental Anthropology and Paleopathology. AAPA Exhibitors.	
Madison	Session2: Isotopic Applications in Evolutionary Anthropology.	Session 8: Biological Anthropology of Human Sleep.	Primate Biology & Behavior Interest Group. 7:45-8:45
Knox			ADA Business Meeting 7:45-8:45
Morrow		HBA Awards Luncheon 12-1:30	AAAG Business Meeting 7:45-8:45
McKinley			HBA Reception 7:30-10:30
Harrison	HBA Plenary	HBA Plenary	HBA Business Meeting. 5:30-6:30pm
Regency Ballroom			AAPA Plenary Session 6:15-7:45
Clark	Speaker Ready	Speaker Ready	
Fayette	Press/Job Interview	Press/Job Interview	DAA Business Meeting 7:45-8:45

The Conference at a Glance (continued)

Room	Fri AM	Fri PM	Friday Evening	Sat AM	Sat PM
Franklin Foyer	AAPA Registration	AAPA Registration		AAPA Registration	
Delaware A/B	Session 15: Primate Evolution, Taxonomy & Morphology	Session 22: Functional & Evolutionary Morphology 2.		Session 27: Evolution of Hominin Bipedalism: New Perspectives.	Session 34: Primate Behavior & Ecology.
Delaware C	Session 17: Paleoanthropology: Functional & Evolutionary Anatomy.	Session 23: Women's Health: Endocrinology, Sexuality, and Life Phases.		Session 28: Human Variation, History and Evolution	Session35: Skeletal Biology - 1:00-3:00. Session 36: Paleoanthropology - 3:00-5:00.
Delaware D	Session 16: Skeletal Biologly: Bioarchaeology.	Session 21: Molecular & Primate Genetics.		Session 29: Paleopathology.	Session 32: Teaching Evolution & Promoting Quality Science Education.
Fairfield	Session 14: Integrative Approaches to the study of human adaptation and population health:	Session 20. The Importance of Fallback Foods in Priamte Ecology and Evolution.		Session 26: Human & Non-human Primate Genetics in the Post-Genomic Era.	Session 33: Human Biology .
Franklin	Session 13: Genetics & Human Biological Variation. AAPA Exhibitors.	Session 18: Skeletal Biology & Forensic Anthropology. AAPA Exhibitors		Session 24: Primate Social Behavior & Ecology. AAPA Exhibitors.	Session 30: Functional & Evolutionary Morphology.AAPA Exhibitors
Madison		Session 19: Consolidating Twenty Years of Bioarchaeological Inquiry:		Session 25: Migrants & Health.	Session 31: The State of the Face: An Evolutionary Update on the Muscles of Facial Expression.
Marion				Teaching Outreach Program 8-12	
Knox			JHE Editorial Board Dinner – 5:30-8:00		
Morrow					Student Awards Committee Meeting 4-5
McKinley		AAPA Luncheon . Agustin Fuentes. 12:00-2:00pm			
Hayes			AAPA Business Meeting 8-11		
McKinley					Student Awards Reception. 5:00-6:30pm
Clark	Speaker Ready	Speaker Ready		Speaker Ready	Speaker Ready
Fayette	Press/Job Interview	Press/Job Interview		Press/Job Interview	Press/Job Interview

Conference Schedule

For a schedule of individual AAPA poster and podium presentations, see page 14.

Tuesday, April 8, 2008

Paleopathology Association

8:00 am – 5:00 pm Registration. *Country Foyer*.

8:00 am – 12:00 pm Workshop 1. *Marion*.

8:00 am – 12:00 pm Workshop 2. *Knox.*

12:00 pm – 1:00 pm Student Action Committee. *Morrow*.

1:00 pm – 5:00 pm Podium Presentations. *Delaware D*.

1:00 pm – 5:00 pm Poster Presentations. *Franklin*.

Human Biology

6:00 pm – 10:00 pm Executive Committee Meeting and Dinner. *Garfield*

Wednesday, April 9, 2008

American Association of Physical Anthropologists

9:00 am – 5:00 pm Registration. *Franklin Foyer.*

8:00 am – 6:00 pm Executive Committee Meeting. *Marion*.

12:00 pm – 2:00 pm *American Journal of Physical Anthropology* Editorial Board Luncheon. *Knox*.

6:30 pm – 7:45 pm Career Development Committee Discussion: "Open Forum: Q&A with the Committee" presented by the Career Development Committee, Joel Irish (University of Alaska, Fairbanks), Chair. *Knox.*

8:00pm – 11:00 pm Reception & Cash Bar. *Regency Ballroom.*

Paleopathology Association

8:00 am – 10:00 pm Registration. *Country Foyer*.

8:00 am – 5:00 pm Podium Presentations. *Delaware D*.

8:00 am – 5:00 pm Poster Presentations and Exhibitors. *Franklin*.

3:00 pm – 5:00 pm Student Prize Committee. *Garfield*.

Human Biology Association

7:00 am – 8:30 am *American Journal of Human Biology* Editorial Board Breakfast. *Madison.*

8:00 am – 5:00 pm Registration. *1st Floor Foyer*.

8:00 am – 1:15 pm Plenary Session. *Hayes*.

2:00 pm – 5:00 pm Poster Session. *Franklin*.

5:30 pm – 6:30 pm Pearl Memorial Lecture. *Hayes*.

7:00 pm – 8:30 pm Student Reception. *Delaware C*.

Thursday, April 10, 2008

American Association of Physical Anthropologists

8:00 am – 8:00 pm Registration. *Franklin Foyer*.

8:00 am – 5:00 pm Posters and Exhibitors. *Franklin*.

8:00 am – 12:00 pm **Session 1. Paleoanthropology and Brain Evolution.** Contributed Posters. *Franklin*

8:00 am – 12:00 pm **Session 2. Isotopic Applications in Evolutionary Anthropology.** Poster Symposium. *Madison*.

8:00 am – 12:00 pm **Session 3. Patterns and Processes of Morphological Integration in Primate and Human Evolution.** Symposium. *Fairfield*.

8:00 am – 12:00 pm **Session 4. Population Genetics.** Contributed Papers. *Delaware D*.

8:00 am – 12:00 pm **Session 5. Dental and Forensic Anthropology.** Contributed Papers. *Delaware C*.

8:00 am – 12:00 pm **Session 6. Primate Behavior, Ecology, and Evolution.** Contributed Papers. *Delaware A/B*.

1:00 pm – 5:00 pm **Session 7. Dental Anthropology and Paleopathology.** Contributed Posters. *Franklin*.

1:00 pm – 5:00 pm **Session 8. Biological Anthropology of Human Sleep: Helping to Re-Do and Re-Think the Traditional Sleep Research Paradigm.** Poster Symposium. *Madison*.

1:00 pm – 5:00 pm **Session 9. Reconstructing Health and Disease from Skeletal and Dental Biology: New Perspectives, New Insights.** Sixth Wiley-Liss Symposium. *Delaware D.*

1:00 pm – 2:45 pm **Session 10. Functional and Evolutionary Morphology 1.** Contributed Papers. *Delaware A/B*.

3:00 pm – 5:00 pm **Session 11. Primate Behavior, Reproduction and Life History.** Contributed Papers. *Fairfield*.

1:00 pm – 5:00 pm **Session 12. Paleoanthropology: Hominid Evolution.** Contributed Papers. *Delaware C*.

6:15 pm – 7:45 pm **Plenary Session** – AAPA Auction. Regency Ballroom

8:30 pm – 10:30 pm **Wiley-Liss Reception**. *Delaware C/D.*

Human Biology Association

8:00 am – 12:00pm Registration. *1st Floor Foyer*.

8:30 am – 11:45 am Podium Sessions A & B. *Harrison*.

12:00 pm – 1:30 pm HBA Luncheon. *Morrow*.

2:00 pm – 4:45 pm Podium Sessions C & D. *Harrison*.

5:00 pm – 6:00 pm Business Meeting. *Harrison*.

7:30 pm – 10:30pm Reception. *McKinley*.

American Association of Anthropological Genetics

7:45 pm – 8:45 pm Business Meeting. *Morrow*.

Dental Anthropology Association

7:45 pm – 8:45 pm Business Meeting. *Fayette*.

American Dermatoglyphics Association

7:45 pm – 8:45 pm Business Meeting. *Knox*.

Primate Biology and Behavior Interest Group

7:45 pm – 8:45 pm Business Meeting. *Madison*.

Friday, April 11, 2008

American Association of Physical Anthropologists

8:00 am – 8:00 pm Registration. *Franklin Foyer*.

8:00 am – 5:00 pm Posters and Exhibitors. *Franklin*.

8:00 am – 12:00 pm **Session 13. Genetics and Human Biological Variation.** Contributed Posters. *Franklin*.

8:00 am – 12:00 pm **Session 14. Integrative approaches to the study of human adaptation and population Health: A symposium in honor of A. Roberto Frisancho.** Symposium (cosponsored by HBA). *Fairfield*.

8:00 am – 12:00 pm **Session 15. Primate Evolution, taxonomy and Morphology.** Symposium. *Delaware A/B*.

8:00 am – 12:00 pm **Session 16. Skeletal Biology: Bioarchaeology.** Contributed Papers. *Delaware D*.

8:00 am – 12:00 pm **Session 17. Paleoanthropology: Functional and Evolutionary Anatomy.** Contributed Papers. *Delaware C*.

12:00 pm – 2:00 pm AAPA Luncheon. *McKinley Ballroom*
Speaker: Agustin Fuentes. "Are We Biological Anthropologists Yet? Contemplating Washburn's New Physical Anthropology in 2008"

Over 50 years ago, Sherwood Washburn first called for a transition from measurement and classification towards a focus on the process and mechanisms of evolutionary change. He advocated multidisciplinary and interdisciplinary approaches to the understanding of human behavior, biology, and history. Many interpret this as a call for a practice that is both biological and anthropological. Is this what we do? Are we biological anthropologists yet? In this talk I will explore, through examples, what we as a discipline are doing in the context of a "New Physical Anthropology," where we might be headed, and why this discussion is central to our relevance.

2:00 pm – 6:00 pm **Session 18. Skeletal Biology and Forensic Anthropology.** Contributed Posters. *Franklin.*

2:00 pm – 6:00 pm **Session 19. Consolidating Twenty Years of Bioarchaeological Inquiry: An Emerging Regional Picture.** Poster Symposium. *Madison*.

2:00 pm – 6:00 pm **Session 20. The Importance of Fallback Foods in Priamte Ecology and Evolution.** Symposium. *Fairfield.*

2:00 pm – 6:00 pm **Session 21. Molecular & Primate Genetics.** Contributed Papers. *Delaware D.*

2:00 pm – 6:00 pm **Session 22. Functional and Evolutionary Morphology 2.** Contributed Papers. *Delaware A/B.*

2:00 pm – 6:00 pm **Session 23. Women's Health: Endocrinology, Sexuality, and Life Phases.** Symposium. *Delaware C*.

8:00 pm – 11:00 pm Business Meeting. *Hayes*.

5:30 pm – 8:00 pm Journal of Human Evolution Editorial Board Dinner. *Knox*.

Saturday, April 12, 2008

American Association of Physical Anthropologists

8:00 am – 12:00 pm Registration. *Franklin Foyer*.

8:00 am – 5:00 pm Posters and Exhibitors. *Franklin*.

8:00 am – 12:00 pm Teaching Outreach Program. *Marion*.

This program is intended for local area teachers, but is open to AAPA members on an available-space basis. The program is as follows:

8:00-8:15am	Registration and Welcome, Martin K. Nickels, Chair**.**
8:20-9:00am	"Primate clues to Human Behavior", Andrew Petto and Judith Corr.
9:05-9:45am	"Using the Fossil Record in Teaching Human Evolution", Martin K. Nickels.
10:05-10:45am	"Human Skin Color Variation and Race", Pamela Ashmore and Barbara O'Connell.
10:50-11:30am	"Who are You?: Strategies for Presenting Forensic Anthropology and Human Variation in the Classroom", Nancy Tatarek and K. Lindsay Eaves-Johnson.
11:30-12:00pm	Overview and Summary with focus on "creationism" and "intelligent design", Deborah Cunningham.

Michael Alan Park will serve as commentator on each presentation.

8:00 am – 12:00 pm **Session 24. Primate Social Behavior & Ecology.** Contributed Posters. *Franklin*.

8:00 am – 12:00 pm **Session 25. Migrants and Health.** Poster Symposium. *Madison*.

8:00 am – 12:00 pm **Session 26. Human and Non-Human Primate Genetics in the Post-Genomic Era.** (Co-sponsored by AAAG) Symposium. *Fairfield*.

8:00 am – 12:00 pm **Session 27. Evolution of Hominin Bipedalism: New Perspectives.** Symposium. *Delaware A/B.*

8:00 am – 12:00 pm **Session 28. Human Variation, History & Evolution.** Contributed Papers. *Delaware C*.

8:00 am – 12:00 pm **Session 29. Paleopathology.** Contributed Papers. *Delaware D.*

1:00 pm – 5:00 pm **Session 30. Functional & Evolutionary Morphology.** Contributed Posters. *Franklin*.

1:00 pm – 5:00 pm **Session 31. The State of the Face: An Evolutionary Update on the Muscles of Facial Expression.** Poster Symposium. *Madison*.

1:00 pm – 5:00 pm **Session 32. Teaching Evolution & Promoting Quality Science Education.** Symposium. *Delaware D*.

1:00 pm – 5:00 pm **Session 33. Human Biology.** Contributed Papers. *Fairfield*.

1:00 pm – 5:00 pm **Session 34. Primate Behavior & Ecology.** Contributed Papers. *Delaware A/B*.

1:00 pm – 2:45 pm **Session 35. Skeletal Biology.** Contributed Papers. *Delaware C*.

3:00 pm – 4:30 pm **Session 36. Paleoanthropology.** Contributed Papers. *Delaware C*.

4:00 pm – 5:00 pm Student Awards Committee Meeting. *Morrow*.

5:00 pm – 6:30 pm Student Awards Reception. *McKinley.*

AAPA Poster and Podium Presentation Schedule

For a schedule of all conference events, see page 8

Session 1. Paleoanthropology and Brain Evolution. Contributed Posters. *Franklin*.
Chair: SUSAN ANTÓN. New York University.

8:00 – 8:30 am	Poster set-up.
8:30 – 10:00 am	Authors of even-numbered posters present for questions.
10:30 am – 12:00 pm	Authors of odd-numbered posters present for questions.
12:00 – 12:30 pm	Poster take-down.

1. **Intraspecific relationships of molar size, jaw size, and mandibular cross-sectional area in *Homo*.** S.C. ANTÓN, H.G. CARTER-MENN AND V.B. DELEON.

2. **Postcranial proportional variation in *Australopithecus afarensis* and *A. africanus*.** D.L. CUNNINGHAM, T.M. COLE III, AND C.V. WARD.

3. **Were Neanderthals tongue-tied?** M. HESS AND R. MCCARTHY.

4. **Ontogeny of the hominoid carpus: Did we evolve from a knuckle-walking ancestor?** T.L. KIVELL.

5. **Structural Constraints on Temporalis Size and Shape in Primates and Hominins.** L. LUCAS AND R. MCCARTHY.

6. **Backpedaling in human evolution – adaptive values of bipedalism in reverse**. J.K. MCKEE, A. KOLATOROWICZ, L. REITSEMA, A. RUTH, S. SCHLECHT, O. ULVI, AND T. WESTON.

7. **Ontogeny of foot and hindlimb proportions in *Proconsul heseloni*.** H.M. DUNSWORTH.

8. **Re-evaluating the influence of cold stress on the Neanderthal nasal aperture.** L.N. BUTARIC.

9. **How three-dimensional surface data can be used to reconstruct fragmentary fossils**. S. FREIDLINE, P. GUNZ, K. HARVATI, E. DELSON, AND J.J. HUBLIN.

10. **Human cranial variation fits iterative founder effect model with African origin**. N. VON CRAMON-TAUBADEL AND S.J. LYCETT.

11. **Experimental facial growth alteration in *Sus scrofa* and its implications for the evolution of modern human craniofacial anatomy**. R.G. FRANCISCUS, N.E. HOLTON, M.A. NIEVES, T.E. SOUTHARD, S.B. REIMER, S.D. MARSHAL, K.E. KRIZAN, S.D. MADDUX.

12. **Grandmothers getting it done: Somatic durability in walking tasks.** M.J. MYERS AND C.M. WALL-SCHEFFLER.

13. **Working harder and taking longer: How frontal loads can impact female reproductive costs.** C.M. WALL-SCHEFFLER AND M.J. MYERS.

14. **The relationship between humeral morphology and time in the human fossil record.** C.C. BROWN AND H.M. MCHENR.

15. **Quantitative analysis of the primate first caudal vertebra**. A.E. MACKENZIE.

16. **Comparative morphology and functional anatomy of the second metatarsal in extant catarrhines and *Dryopithecus brancoi*.** I. GUIMONT AND D.R. BEGUN.

17. **Why small fossil samples are such a big problem.** P. GUNZ, F.L. BOOKSTEIN, G.W. WEBER, AND J.-J. HUBLIN.

18. **Functional linkages and the independence of characters in cladistic analysis.** N. LONERGAN.

19. **Testing the lateral angle method in chimpanzee petrous bones.** S.C. REEDY.

20. **Hadar hominins and cercopithecids: a taphonomic analysis of carnivore damage.** P. WEIS.

21. **Bringing the Stone Age into the Information Age: introducing the Paleoanthropology Database**. Z.J. THROCKMORTON.

22. **Evolution and development of the hominin brain.** S.R. Leigh.

23. **Frequency variation in *Victoriapithecus macinnesi* non-metric molar traits over three successive stratigraphic layers.** B.R. BENEFIT, A. LAMBIE, AND M.J. HOSKINS.

24. **Identification of an entepicondylar foramen on the humerus of an East African Miocene catarrhine.** M.L. MCCROSSIN, B.R. BENEFIT, AND L. GONZALES.

25. **Evidence of eagle predation in fossil cercopithecids from the Humpata Plateau, southern Angola**. W.S. MCGRAW, C.C. GILBERT, AND E. DELSON.

26. **Comparison of dietary morphological space among Paleogene primate communities.** L.K. STROIK AND L.K. DELEZENE.

27. **New primate dentition from the Tiburon Peninsula, Haiti.** S.B. COOKE.

28. **Phylogenetic analyses of behavior support existence of culture among wild chimpanzees**. S.J. LYCETT, M. COLLARD, AND W.C. MCGREW.

29. **Phylogenetic and biogeographic implications of the Dmanisi hominids**. K. OLIVER.

30. **An evaluation of *Tarsius* dental eruption.** E. HENDERSON AND S. FROST.

31. **A shape-based species definition for *Homo erectus*.** K.L. BAAB.

32. **Vertical position of the superior nasal aperture in *Homo sapiens* and *H. neanderthalensis***. B.E. PIERSON AND T.W. HOLLIDAY.

33. **Postcranial remains from Okladnikov Cave, Siberia.** T.B. VIOLA, M. TESCHLER-NICOLA, K. SCHAEFER, A.P. DEREVIANKO, AND H. SEIDLER.

34. **Luleche, a new paleontological site in the Cradle of Humankind, North West Province, South Africa**. J.W. ADAMS, J. HEMINGWAY, A.D.T. KEGLEY, AND J.F. THACKERAY.

35. **The effects of allometric scaling patterns on the template method for estimating dimorphism.** W.A. BARR.

36. **New taphonomic findings for eagle predation on the Taung child.** L.R. BERGER, W.S. MCGRAW, A. BALOYI, N. BARBOLINI, S. KARODIA, L.A. NORTON, AND G. TROWER.

37. **Mousterian children from Teshik-Tash and Staroselie: a 3D geometric morphometric analysis.** E. BULYGINA AND P. GUNZ.

38. **The short legs of great apes: evidence for aggressive behavior in australopiths.** D. R. CARRIER.

39. **Medial sagittal plan of human cranium and virtual reconstitution by mirroring.** G. GUIPERT AND B. MAFART.

40. **Metric variation in the genus *Homo***. K.M. HAMM, A.D. GORDON, R.C. MCCARTHY, L. LUCAS, AND D.S. STRAIT.

41. **Temporally related morphological trends in East African "robust" australopithecines.** J.A. LEDOGAR AND F.E. GRINE.

42. **Examination of the Florisbad microvertebrates.** P.J. LEWIS, J.S. BRINK, A.M. KENNEDY, AND T.L. CAMPBELL.

43. **Loaded and spaced out: plasticity and function of the palate in rabbits, with implications for australopith facial form**. R.A. MENEGAZ, S.V. SUBLETT, S.D. FIGUEROA, T.J. HOFFMAN, AND M.J. RAVOSA.

44. **The paleobiology of the robust australopithecines (*Paranthropus*): a test of the durophage model with a morphometric analysis of carnivoran skulls.** A.B. SHABEL.

45. **There is an optimal speed of human running: Implications for the evolution of hominin hunting strategies.** K. L. STEUDEL-NUMBERS AND C. M. WALL-SCHEFFLER..

46. **GIS and primate biostratigraphy in the early Eocene of southwestern Wyoming.** R. ANEMONE, W. DIRKS, W. MOORE, J. VAN REGENMORTER, J. MARSHALL, I. FELDER, AND E. DEMEESTER.

47. **Oxygen isotope analysis of tooth enamel carbonate from Plio-Pleistocene South African fossil sites.** E.N. CHAMBERS, J.K. MCKEE, AND K.L. KUYKENDALL.

48. **Inferring dietary behaviour for early Miocene catarrhines from incisor curvature and the role of Red Queen morphological shifting** A.S. DEANE.

49. **Morphological study of the Moroto vertebral specimens**. M. NAKATSUKASA.

50. **Footfall patterns and peak vertical substrate reaction forces in *Cebus apella***. I.J. WALLACE AND B. DEMES.

51. **Pisiform anatomy of *Kenyapithecus africanus* and a small-bodied "ape" from Maboko Island, Kenya**. K.L. ALLEN AND M.L. MCCROSSIN.

52. **New crania of a primitive plesiadapid (Mammalia: "Plesiadapiformes") from the Late Paleocene of Alberta.** D.M. BOYER, C.S. SCOTT, AND R.C. FOX.

53. **Gait selection in Japanese macaques while moving along a horizontal ladder**. Y. HIGURASHI, E. HIRASAKI, AND H. KUMAKURA.

54. **Fossil Cercopithecoidea from the Kapthurin Formation, Baringo, Kenya.** N.G. JABLONSKI AND S. MCBREARTY.

55. **Scaling primate molar enamel thickness: implications for hominin evolution.** A.J. OLEJNICZAK, M.M. SKINNER, AND J-J. HUBLIN.

56. **Tour of a labyrinth: The nose and nasal fossae of the mouse lemur (*Microcebus murinus*).** T.D. SMITH AND J.B. ROSSIE.

57. **What is the impact of phenotypic plasticity on the identification of hominin fossil species? An assessment using extant hominoid craniodental data**. M. COLLARD AND S.J. LYCETT.

58. **Comparing amygdala connectivity between monkeys, apes, and humans using diffusion tensor imaging.** E. HECHT, D. GUTMAN, M. GLASSER, J. MASCARO, S. HAMANN, T.M. PREUSS, AND J.K. RILLING.

59. **Issues of allometry in the scaling of the human brain.** K.P. LEWIS AND R.J. SMITH.

60. **Comparative analysis of the endocasts of fossil and modern strepsirhines using microtomography and 3D geometric morphometrics**. J.A. MAKEDONSKA.

61. **Long-chain polyunsaturated fatty acid composition of milk from wild and captive living anthropoids: is human milk composition unique?** L.A. MILLIGAN AND R.P. BAZINET.

62. **Differences in Cortical Dopaminergic Innervation Among Humans, Chimpanzees, and Macaque Monkeys: A Comparative Study.** M.A. RAGHANTI, C.D. STIMPSON, J.L. MARCINKIEWICZ, J.M. ERWIN, P.R. HOF, C.C. SHERWOOD.

63. **Endocranial ontogenetic trajectories in humans: a 3D geometric morphometrics analysis.** S. NEUBAUER, P. GUNZ, AND J.-J. HUBLIN.

64. **Endocast asymmetry in pongids assessed via non-rigid deformation analysis of high-resolution CT images.** P.T. SCHOENEMANN, R.L. HOLLOWAY, B.B. AVANTS, AND J.C. GEE.

Session 2. Isotopic Applications in Evolutionary Anthropology. Poster Symposium. *Madison*.

Organizers and Co-Chairs: BROOKE E. CROWLEY and NATHANIEL J. DOMINY, Universtiy of California – Santa Cruz.

8:00 – 8:30 am	Poster set-up.
9:00 – 10:30 am	Authors present for questions.
10:30 am – 11:00 pm	Discussion by posters
12:00 – 12:30 pm	Poster take-down.

Although isotopic ecology is a relatively young science, stable isotopes have begun to pervade the anthropological literature, including several high profile publications in *Nature* and *Science*. Interest in this technique has grown tremendously over the last few years and the use of isotopes in anthropological research is becoming increasingly common. However, isotopic analysis can be a difficult concept to grasp and the fundamental assumptions and uses of stable isotopes remain relatively unknown. There is still much to learn about this technical field and lack of understanding could lead to potential misinterpretation of results. It is therefore important to discuss both the successful applications as well as potential pitfalls with the broader anthropological community. This symposium will introduce and evaluate the application of isotopic research in anthropological research, with each contribution either reviewing the principles and practices of a particular technique or to provideing a case study based on the presenter's own research.

1. **Interpreting enamel isotopic variability in East African fossil assemblages**. J.D. KINGSTON.

2. **Stable Isotopes and Dietary Variability in Extinct and Extant Papionins.** N. H. FOURIE, D. CODRON, J. LEE-THORP, C. JOLLY AND J. PHILLIPS-CONROY.

3. **Isotopic fractionation patterns in primates.** B.E. CROWLEY, L.R. GODFREY, AND S. KARPANTY.

4. **The *Hadropithecus* conundrum.** L.R. GODFREY, B.E. CROWLEY, K.M. MULDOON, S.J. KING AND D.A. BURNEY.

5. **Ecological reconstruction using d^{13}C values in the unaltered bone mineral of select primate species.** M.J. SCHOENINGER.

6. **Lemurs eating isotopes: a stable isotope analysis of ring-tailed lemurs (*Lemur catta*) and their menu at the Beza Mahafaly Special Reserve**. J.E. LOUDON, D.C. WHITELAW, M. SPONHEIMER, M.L. SAUTHER, AND F.P. CUOZZO.

7. **The isotopic ecology of *Theropithecus* in North Africa: changes in foraging ecology and movement through time.** J.D. YEAKEL, D. GERAADS, P.L. KOCH AND N.J. DOMINY.

8. **Isotopic assessment of subannual diet and ecology through serial sampling of human molars.** J.S. KRIGBAUM, B.D. TUCKER, AND I.R. QUITMEYER.

9. **Optimization of method for compound specific isotope analysis of lipids extracted from archaeological bone.** A. LAFFEY, A.R. ZIMMERMAN, M-Y AHN AND J.S. KRIGBAUM.

10. **Investigating the effects of cooking on $\delta^{13}C$ and $\delta^{15}N$ of bone collagen, percent collagen yield, and $\delta^{18}O$ in bone apatite.** M.A. TEAGUE, B.D. TUCKER AND J.S. KRIGBAUM.

Session 3. Patterns and Processes of Morphological Integration in Primate and Human Evolution. Symposium. *Fairfield*.

Organizer and Chair: CAMPBELL ROLIAN, Harvard University and KATHERINE WILLMORE, Pennsylvania State University.

In 1958, Everett Olson and John Miller published a seminal book on morphological integration (MI) and its role in vertebrate evolution. Olson and Miller argued that phenotypic traits that share some aspect of function and/or development in common should show stronger patterns of covariation than unrelated traits, ultimately influencing how complex phenotypes evolve. Integration studies have played an important role in biological anthropology, and have traditionally sought to answer two main questions: 1) what are the developmental underpinnings for observed patterns of integration? and 2) what are the functional, behavioral and evolutionary consequences of integration? These questions are often addressed separately, but ultimately both have been important for gaining an understanding of the relationship between form, function and organismal development in primate and human evolution. This symposium, held on the 50th anniversary of Olson and Miller's landmark work, will highlight the diversity of recent bioanthropological questions that have been addressed within the framework of morphological integration. More than providing a showcase of methodological approaches, this symposium seeks to highlight the important theoretical concepts that MI studies can lend to our understanding of primate evolutionary biology.

8:00 am **Historical Introduction.** J. CHEVERUD.

8:15 am **Quantitative genetics, pleiotropy, and morphological integration in the primate dentition**. L.J. HLUSKO AND M.C. MAHANEY.

8:30 am **The Developmental Basis for Morphological Integration.** B. HALLGRÍMSSON, J.C. BOUGHNER AND H.A. JAMNICZKY.

8:45 am **The quantitative genetic basis of phenotypic integration in the mouse mandible with anthropological applications.** C.C. ROSEMAN, J.P. KENNY-HUNT, J.M. CHEVERUD.

9:00 am **Mandibular modularity of a rodent model system**. M.L. ZELDITCH.

9:15 am **Effects of development on the evolution of primate dentition.** J. JERNVALL, S.J. KING, A.R. EVANS, AND K.D. KAVANAGH.

9:30 am **Comparison of phenotypic and genetic integration between mouse and baboon**. K.E. WILLMORE, H.A. LAWSON, C.C. ROSEMAN, J.M. CHEVERUD, AND J.T. RICHTSMEIER.

9:45 am **Morphological integration and the interpretation of fossil diversity.** R.R. ACKERMANN.

10:00 am **Functional, developmental and morphological integration: the case of the head and forelimb in bipedal hominins.** D.E. LIEBERMAN, D.M. BRAMBLE, D.A RAICHLEN, AND K.W. WHITCOME.

10:15 am **Break**

10:30 am **The epigenetic effect of activity level on functional integration of the limbs.** N.M. YOUNG, B. HALLGRÍMSSON, AND T. GARLAND,JR.

10:45 am **Different approaches to integration in human skulls: insights from quantitative genetics and studies of artificial deformation.** R. GONZÁLEZ-JOSÉ AND N. MARTÍNEZ-ABADÍAS.

11:00 am **Morphological integration and the role of pleiotropy in the evolution of primate hands and feet.** C. ROLIAN.

11:15 am **Mosaic evolution, integration and modularity: evolution of the human cranial base.** M. BASTIR AND A. ROSAS.

11:30 am **Morphological integration patterns in the mammalian skull**. V. DE CONTO, A. PORTO, L. SHIRAI, F. OLIVEIRA, AND G. MARROIG.

11:45 am **Discussion:** J. CHEVERUD

Session 4. Population Genetics. Contributed Papers. *Delaware D*.

Chairs: CHRISTOPHER TILLQUIST. University of Louisville.

8:00 am **Cytokine expression polymorphism in European human populations.** F.A. CRESPO, R. OBERST, G.R. FERNANDEZ-BOTRÁN, M.F. CASANOVA, AND C.R. TILLQUIST.

8:15 am **Y-chromosome variation in Altaian ethnic groups.** M.C. DULIK, S.I. ZHADANOV, L.P. OSIPOVA, AND T.G. SCHURR.

8:30 am **Origin of genetic diversity among Malaysian Orang Asli : a simulation study.** A.G. FIX.

8:45 am **The Land of the Tired Ox: Ethnogenetic Insights into Rural Central Anatolian Population History.** O. GOKCUMEN, T. GULTEKIN, D. ALAKOC, A. TUG, E. GULEC, AND T.G. SCHURR.

9:00 am **Biological and Cultural Discontinuity from Wari Imperial Rule to Wari Collapse in the Former Imperial Heartland, Ayacucho, Peru**. B.M. KEMP, T. TUNG AND M. SUMMAR.

9:15 am **A three-stage model for the peopling of the Americas.** A. KITCHEN, M.M. MIYAMOTO AND C.J. MULLIGAN.

9:30 am **Population dynamics of HIV-1 evolution in breast milk and plasma.** R.R. GRAY, M. SALEMI, G.M. ALDROVANDI, C.J. MULLIGAN AND M.M. GOODENOW.

9:45 am **Complicating the genetic histories of the Amazon: insights from the Yekuana.** E.J. LEE AND D.A. MERRIWETHER.

10:00 am **Break**

10:15 am **Allelic variability and tests for natural selection at the human *ALDH2* locus.** J.C. LONG, C. LEWIS, J. L, R. MALHI AND K. HUNLEY.

10:30 am **Insight into the peopling of the Americas from whole-mtDNA genome analysis**. R.S. MALHI.

10:45 am **Molecular genetic diversity of Yemeni populations and implications for global expansions.** C.J. MULLIGAN, R.L. RAAUM, A. AL-MEERI, L. SANCHEZ AND C. BLOMMEL.

11:00 am **Do new *Alu* polymorphism data distinguish the Northern vs. Southern routes out of Africa?** R.L. RAAUM, W. AN, A.B. WANG, A. AL-MEERI, T. KIVISILD AND C.J. MULLIGAN.

11:15 am **500 years of Ojibwa history: lessons from and insight into using mitochondrial DNA.** B.A.S. SHOOK.

11:30 am **Tests of association between Y chromosomal and autosomal short-tandem-repeats.** A.J. REDD, B. WALSH AND M.F. HAMMER.

11:45 am **Reconstruction of the Early Neolithic/Bronze Age Population Diversity of the Lake Baikal Region Using mtDNA Polymorphism from Shamanka II Cemetery.** H. VAHDATI NASAB, T.A. THOMSON, F.J. BAMFORTH, AND V. I. BAZALIISKI.

Session 5. Dental and Forensic Anthropology. Contributed Papers. *Delaware C*.

Chairs: G. RICHARD SCOTT. University of Nevada - Reno.

8:00 am **Biological affinity of two non-ruling elite Classic Maya plazuela groups.** S.B. BLACK.

8:15 am **Dental biodistance analysis and evidence for interregional interaction in pre-contact Mesoamerica.** B.S. AUBRY.

8:30 am **Metric and non-metric trait variation in the dentition of Holocene Khoesan populations.** W. BLACK, R.R. ACKERMANN, AND J. SEALY.

8:45 am **Are the inhabitants of Madaklasht an emigrant Persian population in northern Pakistan?: a dental morphometric investigation.** B.E. HEMPHILL.

9:00 am **Sexual dimorphism of maxillary molars: an odontometric analysis of cusp dimensions in the context of evolutionary and ontogenetic development.** L.T. JONES, J.H. LANGDON, AND C.W. SCHMIDT.

9:15 am **Stress Markers in Tooth Cementum caused by Pregnancy.** M. KUENZIE AND U. WITTWER-BACKOFEN.

9:30 am **The dental morphology of modern and prehistoric Sri Lanka and its implications for the peopling of Australasia.** D.R.T. RAYNER.

9:45 am **Manufactured Populations: What Do Contemporary Reference Skeletal Collections Represent**? C.R. GRIVAS AND D.A. KOMAR.

10:00 am **Break**

10:15 am **The sacral auricular surface and its significance in age estimation.** A.K. KUTYLA.

10:30 am **Postmortem dismemberment and fire exposure: the identification of saw mark characteristics on burned bone.** S. MARCINIAK.

10:45 am **ADBOU age-at-death estimation in South Africa.** N.M. UHL.

11:00 am **Age evaluation of the living: using the Greulich and Pyle method.** N. LYNNERUP, E. BELART, K. BUCH-OLSEN AND B. SEJRSEN.

11:15 am **Age change in the white female scapula.** G.R. DABBS AND P.H. MOORE-JANSEN.

11:30 am **The relationship between initial bone development and age estimation.** J.A. NEWNAM.

11:45 am **The Sex of Skulls: A Study of Age and Population Difference in Sexually Dimorphic Cranial Traits.** P.L. WALKER.

Session 6. Primate Behavior, Ecology, and Evolution. Contributed Papers. *Delaware A/B.*
Chair: CHERYL KNOTT. Harvard University.

8:00 am **Geographic variation in wild orangutan diet: evidence for social learning.** M.L. BASTIAN, N. ZWEIFEL, E.R. VOGEL, S.A. WICH AND C.P. VAN SCHAIK.

8:15 am **Female social relationships in *Gorilla gorilla* at Mondika.** J.L. LODWICK AND D.M. DORAN-SHEEHY.

8:30 am **The efficacy of the auditory brainstem response (ABR) in the assessment of auditory sensitivity in primates**. M.A. RAMSIER, J.D. MCGEE, N.J. DOMINY, D.L. ARMSTRONG, AND E.J. WALSH.

8:45 am **Play behavior by young male chimpanzees at Ngogo, Kibale National Park, Uganda.** H.M. SHERROW.

9:00 am **Association between male testosterone and *friendship* formation with lactating females in wild olive baboons (*Papio hamadryas anubis*)**. M.D. SHUR, R.A. PALOMBIT AND P.L. WHITTEN.

9:15 am **Why do males remain and females stay faithful? The mating system and population dynamics of the Milne-Edward's sifaka.** T.L. MORELLI AND P.C. WRIGHT.

9:30 am **Monitoring primate predators: Lessons from simultaneously studying leopards (*Panthera pardus*) and chacma baboons (*Papio hamadryas ursinus*) in South Africa.** L.R. BIDNER.

9:45 am **Break**

10:00 am **Niche diversity and evolution of Malagasy primates.** J.M. KAMILAR, S.L. LEHMAN, AND K.M. MULDOON.

10:15 am **Comparing responses to novel objects in wild baboons and geladas.** D.M. KITCHEN AND T.J. BERGMAN.

10:30 am **Indirect paternal investment in white-handed gibbons.** J.M. PRIME AND U.H. REICHARD.

10:45 am **Optimal foraging on the roof of the world: Himalayan langurs and the classical prey model.** K. SAYERS, M.A. NORCONK, AND N.L. CONKLIN-BRITTAIN.

11:00 am **Lomako bonobo population dynamics, habitat productivity, and the question of tool use.** F.J. WHITE, M.T. WALLER, A.K. COBDEN, AND N.M. MALONE.

11:15 am **Multiple males sire offspring in groups of wild spider monkeys (*Ateles belzebuth*).** A. DI FIORE, A. LINK, AND S.N. SPEHAR.

11:30 am **Kin biased social behavior in wild white-faced capuchin monkeys, *Cebus capucinus*.** S.E. PERRY, L. MUNIZ, J.H. MANSON, J. GROS-LOUIS, AND L. VIGILANT.

11:45 am **Thermoregulatory selection pressures and savanna chimpanzees: climatological data from Assirik, Senegal.** L.F. MARCHANT, W.C. MCGREW, C.E.G. TUTIN AND P.J. BALDWIN.

Thursday Afternoon – April 10, 2008

Session 7. Dental Anthropology and Paleopathology. Contributed Posters. *Franklin*.
Chair: DEBBIE GUATELLI-STEINBERG. Ohio State University.

1:00 – 1:30 pm Poster set-up.
2:00 – 3:30 pm Authors present for questions.
3:30 – 4:00 pm Discussion by posters
5:00 – 5:30 pm Poster take-down.

Thursday Afternoon – April 10, 2008

1. **The discovery of a premolar with distosagittal ridge from the Spanish Cooper Age**. A. GALLARDO AND M. PIMIENTA.

2. **Enamel defects in the deciduous dentition of the SunWatch (33 MY 57) skeletal sample.** S.A. MARTIN AND P.W. SCIULLI.

3. **Dental morphometrics in Sudanese Dinka and Nuer refugees to the U.S.** M.S. WILLIS AND E.R. SMITH.

4. **Evidence of significant Sr isotope heterogeneity in Upper Paleolithic human teeth from the Mladeč caves**. P. GALLER, T. PROHASKA, AND M. TESCHLER-NICOLA.

5. **Indigenous inhabitants of Pakistan or intrusive emigrants? An odontometric investigation of the Chengazi of Baltistan.** A.M. CAMP AND B.E. HEMPHILL.

6. **Are the Burusho an indigenous population of the Northern Areas, Pakistan? An odontometric investigation.** C.A. WILLIS AND B.E. HEMPHILL.

7. **Comparing the results of trace element analysis of human tissues using ICP-MS versus LA-ICP-MS.** J.E. LAFFOON, L.A. CURET, P.R. WILLIAMS, W. PESTLE, AND L. DUSSUBIEUX.

8 **Botanical medicines for dental health and healing.** R.A. HALBERSTEIN.

9. **Biocultural implications from scanning electron microscopy of prehistoric human dental calculus, Ohio**. S.H. BLATT.

10. **Hypoplastic dental emamel defects among the Classic Period Belizian Maya**. R. SCOPA KELSO.

11. **Archaic stress: a tale of two cemeteries.** J.C. BERBESQUE AND G.H. DORAN.

12. **Hominine mandibular molar identification using 3D geometric morphometrics.** C. ROBINSON, M. SINGLETON, A. ROSENBERGER, AND R. O'NEILL.

13. **Diagnostic dentition: diet and dental health in a historic frontier town.** K.L. CHELOTTI AND C.A. BROWN.

14. **A light microscopy study of the effect of betel nut chewing on enamel microstructure.** G.C. NELSON.

15. **Dental development and enamel thickness in northwestern African modern humans.** D. J. REID, T. M. SMITH, AND J.-J. HUBLIN.

16. **Sexual dimorphism in lateral enamel formation in *Cercocebus* and *Papio*: Time vs. rate**. D. GUATELLI-STEINBERG, R.J. FERRELL, A. HUBBARD, S. SCHMIDT, AND T. TALABERE.

17. **Ecological stress and linear enamel hypoplasia in *Cebus*.** M.B. CHOLLET AND M.F. TEAFORD.

18. **Buccal dental microwear in a living population of baboons from Amboseli (Kenya).** J.GALBANY, J.ALTMANN, A.PÉREZ-PÉREZ, AND S.C. ALBERTS.

19. **Morphological affinities and migratory patterns in Precontact Maya populations from the Yucatan Peninsula: a dental non-metric analysis.** A. CUCINA AND V. TIESLER.

20. **Occlusal microwear texture analysis and the diets of historic/prehistoric hunter-gatherers**. S. EL ZAATARI.

21. **Pay the boatman: green stained teeth and jaws in medieval and post-medieval Spanish skeletons.** K. A. HOPKINSON, S. M. YEATS, J. SHEARER AND G.R. SCOTT.

22. **Modern European population affinities: a dental study.** S.T. PRICE.

23. **Dental Texture Analysis of Late Archaic Amerindians from southern Indiana.** M.S. ZOLNIERZ AND C.W. SCHMIDT.

24. **An analysis of the dental and mandibular morphology of the Makapansgat hominids.** T.C. CRAWFORD, K.L. KUYKENDALL, J.K. MCKEE, AND G.C. CONROY.

25. **Similarity of dental microwear between late Neolithic (Jomon) and Yayoi age following Jomon in the west seacoast of Kyushu-Japan .** T. HOJO.

26. **Senescence in wild lemurs: does it happen?** S.J. KING, S. ZOHDY, A.R. EVANS, L.R. GODFREY, J. JERNVALL, AND P.C. WRIGHT.

27. **Intra- and Inter regional dental morphological variation in South American populations.** A. ORTIZ AND S.E. BAILEY.

28. **Ontogeny of airorhynchy in male-female orangutans: analysis of palate and frontal bone.** N. SINGH AND S. SENCK.

Thursday Afternoon – April 10, 2008

29. **Anterior alveolar process curvature and diet in two West African colobine species.** O.S. ULVI, W.S. MCGRAW, AND D. GUATELLI-STEINBERG.

30. **Roughing it: what it takes for Hapalemur, bears and rodents to chew bamboo.** S. ZOHDY , A. EVANS, P.C. WRIGHT, AND J. JERNVALL.

31. **Anomalous enamel growth in a modern human molar.** P. MAHONEY AND C.A. DETER.

32. **Diet inference based on dental microwear analysis of an early LKB cemetery site in Moravia, the Czeck Republic**. P. NYSTROM.

33. **Dental Development in Pigs - A New Model for Studying the Evolutionary Morphology of Primate Teeth.** B.A. ARMFIELD, J.G.M. THEWISSEN, W.E. HORTON, AND C.J. VINYARD.

34. **An initial description of the Quaker Hills Quarry human remains, Shenks Ferry culture.** C GIARDANO AND KC HOOVER.

35. **Histological assessment of age at death in long bones of mature and senile individuals of known age**. J. NOVÁČEK, E. DROZDOVÁ AND M. SCHULTZ.

36. **Molecular diagnosis of ancient tuberculosis: Is it really necessary to screen for host DNA?** A.K. WILBUR, T. CAMPBELL, J.E. BUIKSTRA AND A.C. STONE.

37. **Positive and negative compensatory effects as a result of bilateral femoral dislocation: a case study from Baga Gazaryn Chuluu, Mongolia.** J.J. BEACH AND M.L. MACHICEK.

38. **Daily life in French colonial Louisiana: combining bioarchaeology of the Moran site (22HR511) and ethnohistory of the French colonial Gulf Coast.** T.D. HENSLEY.

39. **Dental diseases of human skeletal remains of the early-modern period from Kumejima Island, Okinawa, Japan.** H. ISHIDA, K. IREI,T. HANIHARA AND M. YONEDA.

40. **Teeth as tools in an early Neolithic population from Central Germany.** S. KLINGNER, W.-R. TEEGEN AND M. SCHULTZ.

41. **An examination of osteoarthritis in a medieval skeletal population from Sudanese Nubia.** B. KYLE.

42. **Lucayan burials from Preacher's Cave, Eleuthera, The Bahamas.** W.C. SCHAFFER AND R.S. CARR.

43. **The Late Neolithic Collective Burial of Bolóres (Torres Vedras), Portugal: Preliminary Results.** A.J. WATERMAN, J.C. WILLMAN AND K.T. LILLIOS.

44. **Dental health and settlement change at Early Bronze Age Bab edh-Dhra', Jordan**. J. ULLINGER

45. **A preliminary bioarchaeological analysis of health among the inhabitants of Kish, Iraq.** B.M. DAVERMAN, C. TORRES-ROUFF, AND W.J. PESTLE.

46. **Bioarchaeological analysis of a late prehispanic population from two burial towers in the Colca Valley, Peru**. C. DOMANSKA, T.A. TUNG AND S. WERNKE.

47. **Butting heads: interpersonal violence at Early Bronze Age Bab edh-Dhra'.** M.G. GASPERETTI AND K.W. KIM .

48. **Put your back into it: analysis of Schmorl's nodes at Early Bronze Age Bab edh-Dhra'.** S. HENKLE, L. MAJOR, J. ULLINGER, AND S.G. SHERIDAN.

49. **Reality bites: monastic dentition refutes historical claims for a vegetarian diet.** K. KEEGAN AND S.G. SHERIDAN.

50. **Patterns in head and forearm removal traumata during the Late Archaic in southern Indiana.** R.A. LOCKHART AND C.W. SCHMIDT.

51. **Use of logistic regression in population comparisons of health.** D.J. LYBARGER AND R.J. WILSON.

52. **Up a hill, down a mountain: change in ankle joint stability at Early Bronze Age Bab edh-Dhra', Jordan.** S. MIMNAUGH, J. ULLINGER, D. ORTNER, AND S.G. SHERIDAN.

53. **Periosteal reaction in medieval populations from England: issues of sex and gender.** B.M. MORGAN AND A.L. GRAUER.

54. **The frequency and etiology of rib fractures in the skeletal remains of Washington DC's African American poor.** J.L. MULLER.

55 **The frequency of cranial trauma among the Iron Age Vestini of Abruzzi, Italy.** R.R. PAINE, D. MANCINELLI, V. D'ERCOLE, AND A. COPPA.

56. **It's the hard knock life: degenerative joint disease in a post-imperial Andean population.** EA SHARP AND TA TUNG.

57. **Kleippel-Feil Syndrome at Newton Plantation, Barbados: implications for African Diaspora genetic patterns.** K. SHULER.

Thursday Afternoon – April 10, 2008

58. **Whale hunting may place individuals at risk for spondylolysis.** M.B. TIMM.

59. **Age at death disparities between African-Americans and Euro-Americans in the Robert J. Terry Anatomical Collection.** D.L. TOMPKINS.

60. **Dental evidence for subsistence strategies at the Mississippian site of Spiro Mounds, Oklahoma.** A.T. MAYES.

61. **Working class diet in Predynastic Egypt: as examined through dental indicators.** T.R.GREENE AND J.D.IRISH.

62. **Dental development in the Neanderthal child of Roc de Marsal (Dordogne, France).** P. BAYLE, J. BRAGA, A. MAZURIER AND R. MACCHIARELLI.

63. **Parasite survey of guinea baboons, rhesus macaques, and pigtail macaques in an outdoor breeding colony in Louisiana: implications for paleoparasitology.** A. ROLLINS, K.SNOOK, P. DORN, M. MCNEESE, R.LUNDQUIST AND F.B. COGSWELL.

Session 8. Biological Anthropology of Human Sleep: Helping to Re-Do and Re-Think the Traditional Sleep Research Paradigm. Poster Symposium. *Madison*.

Organizers and Chair: JAMES J. McKENNA, University of Notre Dame.

8:00 – 8:30 am	Poster set-up.
9:00 – 10:30 am	Authors present for questions.
10:30 am – 11:00 pm	Discussion by posters (FRED COOLIDGE)
12:00 – 12:30 pm	Poster take-down.

Biological anthropologists have for the last twenty years been making significant contributions and helping to re-cast, re-think and ultimately change in dramatic ways the western sleep research paradigm. Unfortunately, this research remains somewhat unknown or hidden from many biological anthropologists because in order to make significant contributions anthropological sleep research must be published in journals appropriate to the sleep research community; journals are not regularly subscribed to by anthropologists. Hence, the major disadvantage of doing what anthropologists do best, challenging ways of thinking to become broader with more evolutionary based perspectives, is lost to many of our colleagues. This symposium is organized in hopes of exposing especially younger colleagues to the significant work that has already been done, much of which is impacting public health discourse in a variety of ways but most notably in the pediatric, neonatal and SIDS research communities.

1. **Introduction: Biological Anthropologists and human sleep: Overview of on-going contributions and future possibilities.** J.J. MCKENNA

2. **The human ecology of sleep: cross-cultural co-sleeping and childcare patterns.** P. MCNAMARA, A. KOOKOOLIS, N. WARWICK, AND V. VAN DOREN.

3. **Sleep predicts chronic disease: Evidence from laboratory and field studies.** K.L. KNUTSON.

4. **Night work: sleep, state regulation, and life history.** C.M. WORTHMAN.

5. **Altering the nocturnal habitat of newborn infants: the effects of postnatal sleep location on breastfeeding duration.** H.L. BALL AND M.P. WARD-PLATT.

6. **Do the Nighttime Nutritional Needs of the Infant Drive the Duration of the Human Sleep Cycle?** L.T. GETTLER AND J.J. MCKENNA.

7. **Maternal sleep and tiredness after scheduled non-labour caesarean section delivery.** K.P. KLINGAMAN AND H.L. BALL.

8. **Exploring sleep and obesity in English primary school children.** C.H.D. JONES, E.J. HENDERSON, T.M. POLLARD AND H.L. BALL.

Session 9. Reconstructing Health and Disease from Skeletal and Dental Biology: New Perspectives, New Insights. Wiley-Liss Symposium. (Co-sponsored by Gesellschaft für Anthropologie) *Delaware D.*

Organizers and Co-Chairs: MICHAEL SCHULTZ, University of Göttingen, SAMUEL D. STOUT and CLARK SPENSER LARSEN, Ohio State University, and URSULA WITTWER-BACKOFEN, University of Freiburg.

Thursday Afternoon – April 10, 2008

The last decade has seen impressive advances in understanding of health patterns and disease processes in past populations. These advances have been made possible by the development of new methods of documenting and interpreting patterns of health from skeletal and dental remains. This symposium presents a series of papers on new analytical methods used to address issues relating to interpretation of growth and development, disease, and key distinctions between normal and abnormal. In addition to discussion of methods, the papers focus on timing and duration of physiological processes with relation to early-life stress and implications for growth and health in later life.

1:00 pm **Reconstructing health and disease: introduction to the symposium**. C. LARSEN, M. SCHULTZ, S. STOUT AND U. WITTWER-BACKOFEN

1:15 pm **An interdisciplinary study of human growth in London over the past 1000 years**. D.M. ANTOINE, S.W. HILLSON, D. KEENE, G. MILNE, A. WALDRON AND W. WHITE.

1:30 pm **Assessing the duration of physiological stress episodes represented by linear enamel hypoplasias: implications for health**. A. HUBBARD AND D. GUATELLI-STEINBERG..

1:45 pm **Reconstructing infant and childhood population health from internal defects of enamel growth.** C. FITZGERALD, S. SAUNDERS, A. NAVA, L. BONDIOLI, R. MACCHIARELLI, AND A. COPPA.

2:00 pm **Cementum annulations as physiological events: Its potentials and its limits**. U. WITTWER-BACKOFEN.

2:15 pm **The role of micro-morphological stress markers in the differential diagnosis of infectious bone diseases.** M. SCHULTZ AND T.H. SCHMIDT-SCHULTZ.

2:30 pm **Proteomic profiling of the extracellular matrix proteins in ancient bone.** T.H. SCHMIDT-SCHULTZ AND M. SCHULTZ.

2:45 pm **The combined use of cortical, endosteal, and trabecular bone histomorphometry to assess health and disease in ancient skeletal remains.** S.D. STOUT, L. PECK, D. PINTO AND L. MCCORMICK.

3:00 pm **Break**

3:15 pm **Advances in high resolution imaging and the emerging application of 3D cortical bone histomorphometry in interpreting health.** D.M.L. COOPER, J.G. CLEMENT, C.D.L. THOMAS, B. HALLGRÍMSSON, A.L. TURINSKY, C.W. SENSEN, H.M. GOLDMAN.

3:30 pm **Bone Histomorphometry: Validating methods of age estimation.** C. M. CROWDER AND S. PFEIFFER.

3:45 pm **Identification of a distinct histomorphological feature of long bones: Potential applications in paleopathology and bioarchaeology.** C.M. MAGGIANO, I.S. MAGGIANO, H. KIERDORF, V. TIESLER BLOS, S. STOUT, AND M. SCHULTZ.

4:00 pm **New diagnostic frontiers in imaging bone anatomy and pathology by synchrotron light, confocal laser scanning microscopy and clinical MRI.** F. RÜHLI, G. KUHN, H. VON WALDBURG, P. SPEIER, S. NIELLES-VALLESPIN, AND C. PAPAGEORGOPOULOU.

4:15 pm **Age and sex-related changes in trabecular architecture over the life cycle in past populations**. S.C. AGARWAL AND P. BEAUCHESNE.

4:30 pm **Microarchitectural analysis of juvenile trabecular bone from archaeological context of the Ohio River Valley: Implications for human ontogeny.** J.H. GOSMAN AND R.A. KETCHAM.

4:45 pm **Discussant**: P.L. WALKER.

Session 10. Functional and Evolutionary Morphology 1. Contributed Papers. *Delaware A/B*.

Chairs: JOHN POLK. University of Illinois.

1:00 pm **A new method for predicting the lumbar lordosis angle in early hominids.** E. BEEN.

1:15 pm **The effect of pelvic dimorphism on locomotor cost: are women less efficient than men?** A.BLACKBURN WITTMAN AND H. PONTZER.

1:30 pm **Hominin Paleoecology and Cervid Ecomorphology**. S. CURRAN.

1:45 pm **Revisiting the midtarsal break.** J.M. DESILVA AND L.M. MACLATCHY.

2:00 pm **Finite element modelling of anterior dental loading in modern human and Neanderthal mandibles.** F. GRÖNING AND P. O'HIGGINS.

Thursday Afternoon – April 10, 2008

2:15 pm **The Evolution of Throwing: Improving Performance through Kinematic Optimization.** N.T. ROACH, P. ROEBUCK, D.E. LIEBERMAN.

2:30 pm **A taxonomic and functional examination of the Sangiran 7 *Homo erectus* molars using novel imaging technologies.** J. TAUSCH AND O. KULLMER.

2:45 pm **Break**

3:00 pm **Head roll stabilization and muscle mitigation mechanism in human distance running.** K.K. WHITCOME, D.E. LIEBERMAN, D.M. BRAMBLE, D.A. RAICHLEN, AND C. SLOAN.

3:15 pm **Gait patterns in primates and marsupials: similarities and differences.** M. CARTMILL, D. SCHMITT, P. LEMELIN, E. A. CARTMILL, AND C. D.ATKINSON.

3:30 pm **The use of binocular cues in feline locomotion - consequences for primate evolution.** T.R.T. MITCHELL AND KL BISHOP.

3:45 pm **Speed effects on palmar pressure in digitigrade baboons (*Papio anubis*).** B.A. PATEL AND R.E. WUNDERLICH.

4:00 pm **Walking on small branches: convergent solutions in chameleons, marsupials, and primates.** M. SCHMIDT, K. E. LILJE AND M. S. FISCHER.

4:15 pm **The influence of diet and activity pattern on visual acuity: implications for primate evolution.** C.C. VEILLEUX.

4:30 pm **Evolution of low-frequency hearing in primates: evidence from fossils.** M. N. COLEMAN AND D. M. BOYER.

4:45 pm **Forelimb and hind limb forces in developing squirrel monkeys (*Saimiri boliviensis*).** J.W. YOUNG.

Session 11. Primate Behavior, Reproduction and Life History. Contributed Papers. *Fairfield*.

Chair: ANTHONY DI FIORE. New York University.

1:00 pm **Lifetime reproductive output in a female common marmoset (*Callithrix jacchus*): a case study.** W.C. MCGREW AND J. BARNETT.

1:15 pm **Developmental patterns in the secretion of testosterone in white-faced sakis.** M.A. NORCONK, P. WHITTEN, D. WINKLER, AND K. VACCO.

1:30 pm **Twinning reconsidered: A new math for litter size variation in the callitrichine primates.** J.N. RUTHERFORD AND S.D. TARDIF.

1:45 pm **The emergence of sex-segregated association patterns in juvenile spider monkeys (*Ateles geoffroyi*).** M.A. RODRIGUES.

2:00 pm **Alternative reproductive strategies in male hamadryas baboons: leaders, followers, and solitary males**. L. SWEDELL, J. SAUNDERS, M. PINES, A. SCHREIER AND B. DAVIS.

2:15 pm **Adult responses to seasonality and unpredictability: Fecal cortisol levels in the red-bellied lemur, *Eulemur rubriventer*.** S.R. TECOT.

2:30 pm **Costs of large groups: developmental and reproductive rates in wild Phayre's leaf monkeys (*Trachypithecus phayrei*).** C. BORRIES, E. LARNEY, A. LU, K. OSSI, AND A. KOENIG.

2:45 pm **Proximity patterns of female brown capuchins in Suriname are inconsistent with expectations of female-bonded primates.** E. EHMKE AND S. BOINSKI.

3:00 pm **Break**

3:15 pm **The function of female copulation calls in wild chimpanzees (*Pan troglodytes schweinfurthii*).** S. GUNTER AND D.P. WATTS.

3:30 pm **Career or Family?: Maternal Style and Status-Seeking Behavior in Captive Bonobos (*Pan paniscus*).** E.M. JOHNSON.

3:45 pm **The influence of habitat acoustics on alarm calls of sifaka (*Propithecus* spp.).** E.C. KIRK.

4:00 pm **New data on the positional behavior of wild white-handed gibbons (*Hylobates lar*) at Khao Yai National Park, Thailand.** M.G. NOWAK AND U.H. REICHARD.

4:15 pm **Handedness and the percent of time spent feeding unimanually or bimanually in captive siamangs (*Hylobates syndactylus*) at the Rosamond Gifford Zoo (Syracuse, N.Y.).** L.M. PACIULLI, K. SABBI AND G.E. MONTANEZ.

4:30 pm **Female dominance and monomorphism: are patterns of intersexual dominance influenced by sexual dimorphism?** R.J. LEWIS AND E.C. KIRK.

Thursday Afternoon – April 10, 2008

4:45 pm **The influence of habitat quality on juvenile ring-tailed lemur (*Lemur catta*) feeding ecology and glucocorticoid levels**. M. TEAGUE O'MARA.

Session 12. Paleoanthropology: Hominid Evolution. Contributed Papers. *Delaware C*.

Chairs: JOHN HAWKS. University of Wisconsin.

1:00 pm **LB1 did not have Laron Syndrome**. D. FALK, C. HILDEBOLT, K. SMITH, W.L. JUNGERS, S.G. LARSON, M.J. MORWOOD, T. SUTIKNA, JATMIKO, E.W. SAPTOMO, AND F. PRIOR.

1:15 pm **Developmental anomalies of the wrist in LB1 from Flores, Indonesia.** R.B. ECKHARDT.

1:30 pm **A Humanian Model of human evolution: Evidence that habitual upright bipedality is a synapomorphy that defines a hominiform clade of hominoids including humans and all extant apes.** A.G. FILLER.

1:45 pm **Proportional dwarfism in foxes, mice, and humans: implications for relative brain size in *Homo floresiensis***. A.D. SCHAUBER AND D. FALK.

2:00 pm **Revision of the Dryopithecinae: Phylogenetic and paleobiogeographic implications.** D.R. BEGUN, M.C. NARGOLWALLA, AND L. KORDOS.

2:15 pm **Does hominid bipedalism arise from arboreal locomotion on flexible branches?** S. CACHEL AND M. CRISFIELD.

2:30 pm **Indications of habitat preference/avoidance of *Australopithecus robustus* in the Bloubank Valley, South Africa**. D.J. DERUITER, M. SPONHEIME, AND J.A. LEE-THORP.

2:45 pm **Break**

3:00 pm **Oldowan mobility and site formation: modeling the effects of prior deposition**. M.J. GROVE.

3:15 pm **Significance of biotic controls on hominid paleoenvironments**. R.S. SCOTT.

3:30 pm **Is there a biological rationale to the Frankfurt horizontal plane?** A. BARASH AND A. MAROM.

3:45 pm **A Single Lineage Hypothesis for the Habiline to Erectine transition in the Lower Pleistocene Hominin Record**. A. VAN ARSDALE AND M. WOLPOFF.

4:00 pm **The Mark of Ancient Java is on none of them - Replacement without assimilation**. M.C. WESTAWAY.

4:15 pm ***Ouranopithecus turkae* from the late Miocene of Anatolia: It's Metric and Statistical Implications in Dental Size Variations and Sexual Dimorphism.** E. GÜLEÇ, A. SEVIM, C. PEHELVAN, İ. ÖZER AND F. KAYA.

4:30 pm **Dental development and enamel thickness in the Neanderthal molar from Lakonis, Greece.** T.M. SMITH, K. HARVATI, A.J. OLEJNICZAK, D.J. REID, J.-J. HUBLIN, AND E. PANAGOPOULOU.

4:45 pm **Comparative morphology and morphometric assessment of the occipitals from the El Sidrón Neanderthals (Asturias, Northern Spain).** A. ROSAS, M. BASTIR, A. GARCÍA-TABERNERO, M. DE LA RASILLA, AND J. FORTEA.

Friday Morning – April 11, 2008

Session 13. Genetics and Human Biological Variation. Contributed Posters. *Franklin*.

Chair: D. ANDREW MERRIWETHER. Binghamton University.

8:00 – 8:30 am	Poster set-up.
8:30 – 10:00 am	Authors of even-numbered posters present for questions.
10:30 am – 12:00 pm	Authors of odd-numbered posters present for questions.
12:00 – 12:30 pm	Poster take-down.

1. **Novel methods of molecular sex determination utilising the amelogenin gene.** V.E. GIBBON, C.B. PENNY, G. ŠTRKALJ AND P. RUFF.

2. **Species identification using ancient DNA.** D.A. MERRIWETHER AND J.A. HODGSON.

3. **Interaction in pigmentation genes creates variation in brown irises.** E.E. QUILLEN, S. BELEZA, E.J. PARRA, R.W. PEREIRA, AND M.D. SHRIVER.

4. **Horizontal gene transfer events may impair phylogenetic reconstruction of the genus *Mycobacterium*: considerations for human and mycobacterial coevolutionary studies.** S.E. SMITH, A.M. SCOLA, AND C.D. GATENBEE.

5. **Evolution of the Toll-like Receptor 7 Gene In Primates.** K.N. STERNER.

6. **Genetic Heritage and Native Identity of the Seaconke Wampanoag Tribe of Massachusetts.** S.I. ZHADANOV, M.C. DULIK, M. MARKEY, AND T.G. SCHURR.

7. **HLA Genes in Cubans and the detection of Amerindian alleles.** A ARNAIZ-VILLENA, J. MOSCOSO, I. SERRANO-VELA, M. MARTIN-VILLA, AND R. ALEGRE.

8. **Patterns of Linkage Disequilibrium at the SORT1 Locus: Implications for Demographic History.** M.C. CAMPBELL , S.A. TISHKOFF, J.H. LEE, A. CARRACEDO, AND R.L. HOLLOWAY.

9. **A mouse model for the genetic relationships between obesity, leptin, and bone morphology and biomechanics.** E.A. CARSON, M.S. REICH AND J.M. CHEVERUD.

10. **Using mitochondrial DNA in human population genetic research: A comparison of the information content of the mitochondrial D-loop and the coding region.** M.E. HEALY AND K. HUNLEY.

11. **Admixture mapping genes for facial features in African Americans.** D.K. LIBERTON, K.A. MATTHES, X. MAO, M. THOMAS, T. FRUDAKIS, AND M.D. SHRIVER.

12. **Ties to the land: An example of a strategic secondary interment at the Elizabeth Mound Group in West-Central Illinois.** C.M. PINK, J.E. BUIKSTRA, AND L.W. KONIGSBERG.

13. **Analysis of mtDNA in Mongolian Populations** L. PIPES, A.A. PAI, D. LABUDA, AND T.G. SCHURR.

14. **Craniometric investigation and biological variability of a North American historic Chinese cemetery.** R.W. SCHMIDT.

15. **From hypervariable region to complete mitochondrial DNA analysis in the Americas.** R. Y. TITO, S. E. SMITH, AND R. S. MALHI.

16. **Mitochondrial DNA genetic diversity and New World demographic history.** K. BATAI AND S.R.WILLIAMS.

17. **Genetic structure of Bering populations using anthropometrics.** A. JUSTICE, R. RUBICZ, G. CHITTOOR, AND M.H. CRAWFORD.

18. **Variation in masseter muscle fiber architecture in five strains of inbred mice: implications for heritability of fiber architecture.** A.B. TAYLOR, C.J. VINYARD, AND B.A. PAYSEUR.

19. **Genetic Variation and Population Structure in the Owl Monkey, *Aotus azarai*.** P.L. BABB, P. GAGNEUX, E. FERNANDEZ-DUQUE, AND T.G. SCHURR.

20. **Genetic variation for life history and morphology in the Cayo Santiago female rhesus macaques (*Macaca mulatta*).** G.E. BLOMQUIST.

21. **Molecular genetic study of non-invasively collected samples from *Alouatta pigra* at the Calakmul Biosphere Reserve, Mexico**. K. FORGEY, J. SCALZITTI, K. RIZZO, J. GARZA, ANDA. STAHLER..

22. **Phylogenetic relationship of the Platyrrhini inferred from complete mitochondrial genome sequences.** J.A. HODGSON, K.N. STERNER, L.J. MATTHEWS, R. JANI, C.B. STEWART, AND T.R. DISOTELL.

23. **Testing for historical population bottlenecks in a wild lemur population (*Propithecus verreauxi verreauxi*).** R.R. LAWLER AND J.A. PARGA.

24. **Monoamine oxidase A (*MAOA*) gene promoter variation influences aggressive behavior towards an unfamiliar intruder in rhesus macaques (*Macaca mulatta*).** M.L. SCHWANDT, T.K. NEWMAN, S.G. LINDELL, J.D. HIGLEY, D. GOLDMAN AND C.S. BARR.

25. **ASPM and the evolution of cortical size in an adaptive radiation of New World Monkeys.** F.A. VILLANEA, G.H. PERRY, G. GUTIERREZ-ESPELETA, N.J. DOMINY.

26. **The viability of mtDNA and STR analysis following chemical and heat maceration of human bone.** J.G. LUEDTKE, E.J. LEE, D.A. MERRIWETHER, AND D.W. STEADMAN.

27. **A phylogenetically controlled analysis of the relationship between temperature and modern human limb length variation.** M. DEMBO, A. CROSS AND M. COLLARD.

28. **Preliminary observations of the effects of ambient temperature on activity budgets of gorillas and siamangs in captivity.** R. GRAVES

29. **Modern human limb proportions follow Allen's rule predictions and reflect long term climate adaptations rather than short term epigenetic influences.** R.W. HIGGINS.

30. **Ecological and life course effects on mid upper arm somatic muscle allocation and skeletal stature among Bangladeshi male migrants to the UK.** K.S. MAGID, F.U. AHAMED, AND G.R. BENTLEY.

31. **Strontium isotope analysis of Neolithic and Copper Age populations from the Great Hungarian Plain.** J.I. GIBLIN.

32. **Limiting inter-observer error in determination of sex and age at death of human skeletal remains.** M.E. KOVACIK AND J.J. CRAY.

33. **Morphological variation in the eye orbit among modern human populations.** M.P. MASTERS.

34. **Do monks live longer? Tooth cementum annulation analysis of a Cistercian monastic sample**. J. SOMERVILLE AND H. SCHUTKOWSKI.

35. **Patterns of disease and death of children in early nineteenth century Rochester, New York.** J.E. SIRIANNI AND R.L. HIGGINS.

36. **Differential growth of Han and Tibetan children at high altitude**. S.M. BAILEY AND J. XU .

37. **The nutritional status of the Serbian Roma: a preliminary study.** J. ČVOROVIĆ, A. GALLAGHER, V.E. GIBBON, AND G. ŠTRKALJ.

38. **Asymmetry of the human pelvis: a preliminary study.** K. DRISCOLL.

39. **Resolving stressful relationships in prehistory: macroscopic and histological indicators of growth disruption in subadult long bones.** G. ROBBINS.

40. **Quantitative comparison of midface morphology in Down syndrome individuals and unaffected siblings**. J. STARBUCK, K. WILMORE, R. REEVES, AND J. RICHTSMEIER.

41. **Physical activity assessment of children from the Jirel ethnic group in eastern Nepal**. K.D. WILLIAMS, S.A. CZERWINSKI, AND J.SUBEDI, J. JHA, J. BLANGERO, S. WILLIAMS BLANGERO, AND B. TOWNE.

42. **Patterns of accidental deaths in Rochester, New York during the nineteenth century**. B.S. BROWN, J.E. SIRIANNI, AND R.L. HIGGINS.

43. **The consistency of ethnic differences in diurnal heart rate variation in employed women**. G.D. JAMES.

44. **Which anthropometric measures best predict body fat percent measured by electrical bio-impedance?** L. MADRIGAL, E. RUIZ, AND M. BLELL.

45. **Taking a closer look at the institutionalized: the late 19th century Colorado Insane Asylum**. A.L. MAGENNIS AND M.G. LACY.

46. **Human immune functions are energetically costly.** M. MUEHLENBEIN.

47. **The epidemiology of spina bifida in Ireland: an anthropological approach.** K.A. O'DONNELL.

48. **The Boy from Abydos: CT Scanning of a Ptolemaic Dynasty Egyptian Mummy Elucidates His Physical Condition and Mortuary Treatment.** S. L. OLSEN, T.M. LUCIO, A. NAGY, AND J.D. TOWERS,

49. **Dental decoration and residential mobility in 8th century Pamplona, northern Spain.** E.A. PREVEDOROU, M. DIAZ-ZORITA BONILLA, J.E. BUIKSTRA, M.P. DE MIGUEL IBÁÑEZ AND K.J. KNUDSON.

50. **Height, Health and Mortality in 19th Century Youths**. N.E. TATAREK.

521 **Bioarchaeology of the early contact period Oliver site (22CO503), Coahoma County, Mississippi.** A. THOMPSON.

52. **Methodological considerations: Osteoarthritis and the significance of porosity in the William M. Bass Donated Skeletal Collection.** K.T. WREN.

53. **Diet and health of an antebellum African-American slave population from central Virginia**. C.J. YODER, D.C. BOYD, C.C. BOYD AND E.J. BARTELINK.

54. **Mathematical analyses suggest evolutionary significance for underground storage organ diets.** J. G. CHAMBERLIN.

55. **Menstrual cycle characteristics in Blackfeet women.** S.L. JOHNSTON.

56. **Historical patterns of birth seasonality in the United States.** J.H. LANGDON.

57. **Determinants of variation in ovarian function: A comparison of progesterone and estradiol data.** A. NÚÑEZ-DE LA MORA, R.T. CHATTERTON, AND G.R. BENTLEY.

58. **Are there significant interpopulational differences in the ratio of salivary to serum progesterone?** J. THORNBURG, H. SPIELVOGEL, AND V.J. VITZTHUM.

59. **Age at weaning predictors among foragers in the Standard Cross-Cultural Sample.** K.R.HURLAHE.

60. **Does increased ranging effort lead to fewer wasted menstrual cycles?** M. WATSA AND H.D. PONTZER.

61. **Y-chromosomal evidence of a pastoralist migration through Tanzania to southern Africa**. B.M. HENN, P.A. UNDERHILL, A.A. LIN, P.J. OEFNER, S.A. TISHKOFF, F. CRUCIANI, P. SHEN, C. GIGNOUX, AND J.L. MOUNTAIN

Session 14. Integrative approaches to the study of human adaptation and population Health: A symposium in honor of A. Roberto Frisancho. Symposium (cosponsored by the Human Biology Association). *Fairfield*.

Organizer and Chair: WILLIAM R. LEONARD, Northwestern University.

Over the last 40 years, the field of human population biology has expanded and matured, moving beyond simple descriptions of human variation to more explicitly address the nature and evolutionary origins of human biological diversity and their implications for differences in health and disease patterns. One of the principal architects of the development of human biology and adaptability has been A. Roberto Frisancho of the University of Michigan. Frisancho's groundbreaking research, influential writing and skilled graduate mentoring have had a profound impact on current research directions in human biology. This symposium will explore recent advances in our understanding of human adaptive strategies and population variation in health, highlighting Frisancho's contributions. The papers in this session will address current developments in research areas strongly shaped by Frisancho's work; including: (1) functional adaptation to high altitude, (2) developmental influences on adaptive capacity and adult health outcomes, (3) genetic, environmental and nutritional influences on physical growth and the emergence of chronic health problems, and (4) methodological innovations for assessing variation in nutritional status. The maturation and growing influence of human population biology on evolutionary and biomedical science owe much to the remarkable contributions of A. Roberto Frisancho over the arc of his career.

8:00 am **Contributions of A. Roberto Frisancho to human population biology: An Introduction.** W.R. LEONARD.

8:15 am **Factors influencing relative sitting height at high altitude**. S. STINSON.

8:30 am **Mandibular canine and premolar root growth: a mixed-longitudinal radiographic study**. S.L. SMITH AND P.H. BUSCHANG.

8:45 am **Functional adaptation: a view from in utero.** L.G. MOORE**.**

9:00 am **An evolutionary perspective on malaria during pregnancy**. E.T. ABRAMS.

9:15 am **Parental investment and child growth in Papua New Guinea.** D.P. TRACER.

9:30 am **Influence of infectious disease on childhood nutritional status and growth.** SUSAN TANNER.

9:45 am **Break**

10:00 am **The influence of undernutrition on immune response: Public health insights from adaptationist perspectives**. B. SHELL-DUNCAN.

10:15 am **Influence of maternal and early childhood undernutrition on obesity risks in adulthood.** M.I. VARELA-SILVA, A.R. FRISANCHO, B. BOGIN, F. DICKINSON, D. CHATKOFF, P. SMITH, AND D. WINHAM.

10:30 am **Adult health outcomes and their implications for childhood nutritional stress in Jamaica.** R.G. NELSON.

10:45 am **Sodium homeostasis and ethnic variation in blood pressure: What have we learned?** L.GLEIBERMAN.

11:00 am **From biological anthropology to applied public health: epidemiological approaches to the study of human disease.** R. ALBALAK.

11:15 am **Future directions in the study of human adaptation: Where do we go from here?** A. ROBERTO FRISANCHO.

11:30 am **Discussants**: A.T. STEEGMANN AND R.B. THOMAS

Session 15. Primate Evolution, taxonomy and Morphology. Contributed Papers. *Delaware A/B*.

Chair: RUSSELL L. CIOCHON, University of Iowa.

8:00 am **Discovery of sympatric *Cheirogaleus* species in the high-altitude rainforest of Tsinjoarivo, eastern central Madagascar: implications for biogeography and conservation.** M.B.BLANCO, L.R. GODFREY, M. RAKOTONDRATSIMA, K. SAMONDS, J-L. RAHARISON, AND M.T. IRWIN.

8:15 am **Generic comparisons of extant primates with implications for fossil hominin genera.** J.A. COATE, H. GREEN AND D. CURNOE.

8:30 am **Narrow allometry in phylogenetic analysis of morphological data.** C.C. GILBERT AND J.B. ROSSIE.

8:45 am **Bringing up baby: Developmental simulation of adult cranial shape in *Rungwecebus kipunji*.** K.P. MCNULTY, M. SINGLETON, AND S.R. FROST.

9:00 am **Meet the new kid: Phenetic affinities of the *Rungwecebus kipunji* juvenile.** M. SINGLETON.

9:15 am **Neutrally evolving intergenic, non-coding DNA markers provide a resolved genus level phylogeny of neotropical primates (Platyrrhini).** D.E. WILDMAN, J.C. OPAZO, AND S.V. YI.

9:30 am **The scale of it all: postcanine teeth, the taxon-level effect, and the universality of Gould's scaling law**. L. COPES AND G.T. SCHWARTZ.

9:45 am **Break**

10:00 am **Ontogeny of locomotion in western lowland gorillas (*Gorilla gorilla gorilla*) I. Positional behavior and habitat use in captive environments.** R.M. LAROCQUE.

10:15 am **Is primate-like grasping needed for fine branch feeding? Terminal branch use in eastern gray squirrels, *Sciurus carolinensis.*** J.D. ORKIN AND H. PONTZER.

10:30 am **A reconstruction of the Vienna skull of *Hadropithecus stenognathus*.** T.M. RYAN, D.A. BURNEY, L.R. GODFREY, U. GÖHLICH, W.L. JUNGERS, N. VASEY, RAMILISONINA, A. WALKER, AND G. WEBER.

10:45 am **Primitive anthropoids from the oldest primate-bearing locality in the Fayum Depression, northern Egypt.** E.R. SEIFFERT AND E.L. SIMONS.

11:00 am **Intraspecific sex differences among primates in the density of lingual fungiform papillae.** L. ALPORT.

11:15 am **Center of mass movements in arboreal and terrestrial prosimians.** D. SCHMITT, A.K. PAI, M.C. O'NEILL, AND K.L. BISHOP.

11:30 am **Variation in Lemur Genital Anatomy: Implications for taxonomy and functional morphology**. K. TREATMAN-CLARK.

11:45 am **The environment of Early Miocene catarrhines at Kalodirr and Moruorot Hill.** A. GROSSMAN.

Session 16. Skeletal Biology: Bioarchaeology. Contributed Papers. *Delaware D*.

Chair: HOLGER SCHUTKOWSKI. University of Bradford.

8:00 am **What do patterns of sex distribution among excavated skeletons tell us?** P. BENNIKE.

8:15 am **Social status and health status in late Anglo-Saxon England.** J.L. BUCKBERRY, R.A. STORM AND E.F. CRAIG.

8:30 am **Geographic origins and residential mobility at the Pilgrimage Center of Pachacamac, Peru.** K.J. KNUDSON, M. PALMA MÁLAGA, I. SHIMADA, AND R. SEGURA LLANOS.

8:45 am **Maximum likelihood estimation of perinatal mortality in paleodemography**. L.W. KONIGSBERG, D.W. OWSLEY, AND R.L. JANTZ.

9:00 am **A comparison of age estimations and burial records from a late nineteenth and early twentieth century almshouse cemetery.** C.F. MILLIGAN, L.A. DEVITT, AND N.C. SULLIVAN.

9:15 am **A paleodemographic analysis and comparison of ageing methods for a Middle Mississippian skeletal sample from west-central Illinois.** J.J. WILSON AND D.W. STEADMAN.

9:30 am **Use of three-dimensional (3D) image analysis and binder-jet printing for the estimation of age-at-death of an Iron Age peat bog body from northern Germany.** H.C. GILL-ROBINSON AND J. SCHANANDORE.

9:45 am **Postmarital residence practices change in prehistoric south Brazil coastal groups.** M. HUBBE, W. A. NEVES, AND E. C. OLIVEIRA.

10:00 am **Break**

10:15 am **Morphological affinities of South and Mesoamerican Early skeletons: evidence of a widespread Paleoamerican morphology in the New World.** W.A. NEVES AND M.HUBBE.

10:30 am **Dietary Practices in Roman Britain: The evidence from carbon and nitrogen stable isotopes**. C. CUMMINGS.

10:45 am **Dietary changes during the development of Nasca social complexity (AD 1-750).** C.M. KELLNER AND M.J. SCHOENINGER.

11:00 am **Demographic collapse, and microevolutionary change, and ethnogenesis: a population history of the late pre-Hispanic and postcontact Lambayeque Valley.** K.D. HAAGEN, P. SCIULLI, AND M. TAM .

11:15 am **Small sample aggregation in bioarchaeology: necessary and preferred**. C.M. STOJANOWSKI.

11:30 am **Comparison of paleodemographic age estimation methods: case study of the East Smithfield Black Death cemetery.** S.N. DEWITTE, G.M. HUGHES, AND S.C. REEDY.

11:45 am **Variation in stature between Jomon and Yayoi people from prehistoric Japan**. D.H. TEMPLE.

Session 17. Paleoanthropology: Functional and Evolutionary Anatomy. Contributed Papers. *Delaware C*.

Chair: KRISTIAN CARLSON. New York College of Osteopathic Medicine.

8:00 am **Mesowear analysis of ungulate diet during MIS 4-3 in the Levant: Implications for extinction of the Neanderthals.** M. BELMAKER.

8:15 am **How to grow like a Neandertal: the ontogeny of Late Pleistocene postcranial robusticity.** L.W. COWGILL.

8:30 am **Voices out of the past: synthesizing Neanderthal speech.** R. MCCARTHY, A. HAMMOND, F. YATES, AND P. LIEBERMAN.

8:45 am **The hallucal metatarsal in the evolution of the modern human foot.** D.J. MELDRUM AND R.E. CHAPMAN.

9:00 am **Skeletal indications for distance locomotion in early *Homo erectus*.** M.R. MEYER.

9:15 am **Limb strength proportions of OH 62 and locomotion among early African *Homo*.** C.B. RUFF.

9:30 am **Systematic and functional significance of the OH 8 foot**. E.E. SARMIENTO.

9:45 am **New Evidence bearing on the status of *Homo habilis* from Olduvai Gorge.** R.L. SUSMAN.

10:00 am **Break**

10:15 am **The effective mechanical advantage of the australopithecine knee.** A.D. SYLVESTER AND M.R. MAHFOUZ.

10:30 am **Renewed investigations at the late Miocene hominoid locality of Leilao, Yunnan, China** T. HARRISON, X. JI, AND L. ZHENG.

10:45 am **New partial pelvis of *Dryopithecus brancoi* from Rudabánya, Hungary.** C.V. WARD, D.R. BEGUN, AND L. KORDOS.

11:00 am **The uniqueness of the human cranium and the importance of fossils**. J.G. FLEAGL, C.C. GILBERT, AND A.L. BADEN.

11:15 am **Comparison of hominin dimorphism using different methods, and their impact on behavioral reconstructions.** J.M. PLAVCAN.

11:30 am **New *Homo erectus* crania from Ethiopia** S.W. SIMPSON, S. SEMAW, J. QUADE, N.E. LEVIN, R. BUTLER, M.J. ROGERS, R.L. HOLLOWAY, P.R. RENNE, G. DUPONT-NIVET, D. STOUT, M. EVERETT.

11:45 am **Jaw-muscle electromyography during chewing in humans from a primate perspective**. C.J. Vinyard, H.M. Wasserman and N.M. Friedman.

Friday Afternoon – April 11, 2008

Session 18. Skeletal Biology and Forensic Anthropology. Contributed Posters. *Franklin.*

Chair: KATE SPRADLEY. University of West Florida.

2:00 – 2:30 pm Poster set-up.
2:30 – 4:00 pm Authors of even-numbered posters present for questions.
4:00 – 5:30 pm Authors of odd-numbered posters present for questions.
5:30 – 6:00 pm Poster take-down.

Friday Afternoon – April 11, 2008

1. **Prisoners of war or victims of raids? Population dynamics and their relationship to dynastic upheaval in southern Mongolia c. 1300-1350 AD.** B.L. TURNER, M.K. ZUCKERMAN, B.A. CARLSON, J.D. KINGSTON, G.J. ARMELAGOS , D.R. HUNT, T. AMGALANTUGS , AND B. FROHLICH.

2. **Use of metric analysis on human thoracic vertebrae as a means to determine sex and to aid in the seriation of isolated vertebrae**. H.C. FREIMAN, C.J. ZAMBRANO, AND A.B. FALSETTI.

3. **Musculoskeletal stress markers and their utility in distinguishing between obesity and athleticism.** K. GODDE AND R. J. WILSON.

4. **Age estimation from the human os coxa: a test on a documented Italian collection.** S.M. HENS, E. RASTELLI, AND M.G. BELCASTRO.

5. **Vertebral heights in the anatomical method for stature estimation.** H. MAIJANEN.

6. **The effect of vertebral numerical variation on anatomical stature estimates.** M.H. RAXTER AND C.B. RUFF.

7. **Evaluating Cranial Morphometric Relationships using Discriminant Function Analysis.** M.K. SPRADLEY, S.D. OUSLEY AND R.L. JANTZ.

8. **Modeling mortality in the Forensic Anthropology Center's body donation program.** R.J. WILSON, B.F.B. ALGEE-HEWITT AND L. MEADOWS JANTZ.

9. **Feasibility of histological aging on Bronze Age Albanian skeletons: a comparison of methods and observers.** L.L. JENNY, K.E. SKORPINSK AND T.W. FENTON.

10. **Sexual dimorphism and group variation in orbital aperture shape.** W.R. TRASK AND P.H. MOORE-JANSEN.

11. **Change is good: Using advanced statistical methods for the identification of secular change in femoral head size**. S. CRIDLIN, W.L. SEAVE, AND R.L. JANTZ.

12. **Physical characteristic of archaeological populations of Mongolia.** D.TUMEN AND CH. VANCHIGDASH.

13. **Femoral head articular surface area in different human populations.** T. PFISTERER, T.B. VIOLA, F.L. BOOKSTEIN, AND H. SEIDLER.

14. **The effects of exercise and age on diaphyseal modeling of the femoral midshaft.** J.H. PLOCHOCKI, M. DELISSER, T. CRUZ AND A. OBAFEMI.

15. **The error of midshaft cross-sectional location on human femora.** V. SLADEK, M. BERNER AND L. FRIEDL.

16. **Morphological variation in the human hyoid and its relationship to basicranial and mandibular morphology.** H.M. GARVIN AND L. CABO.

17. **Geometric Morphometrics Craniofacial Analysis of early Bronze Age Austrian Populations.** A. PELLEGRINI, M. TESCHLER-NICOLA, P. MITTERÖCKER AND F. BOOKSTEIN.

18. **World-wide variation in the body-size-adjusted torsional strength of major long bones.** O.M. PEARSON AND T.R. PETERSEN.

19. **Age is subjective: a non-traditional method of age estimation for the adult skeleton.** B.F.B. ALGEE-HEWITT, K.E. WEISENSEE AND G.R. MILNER.

20. **Reconstructing age at death in the Postclassic population of Cholula, Puebla: a comparison of transition analysis and traditional methods of aging adult skeletal remains.** M.M. BULLOCK AND E.C.O. CHÁVEZ.

21. **A multidisciplinary approach to analysis of historic cemetery populations.** C.M. STIGLER, A.B. ERIKSEN AND S.P. NAWROCKI.

22. **Reconciling Biological Sex and Gender Construction on the Great Hungarian Plain during the Middle Copper Age.** I. PAWN.

23. **Harris lines in the first metatarsal bones.** B. MAFART.

24. **Assessing the relationship between skin pigmentation and measures of bone strength in adolescent females living in Hawaii**. D.L. OSBORNE, C.M. WEAVER, L.D. MCCABE, G.M. MCCABE, R. NOVOTONY, C. BOUSHEY AND D.A. SAVAIANO.

25. **Isotopic signals of the petrous bone may reflect the diet the early years of life.** M.L.S. JØRKOV, N. LYNNERUP AND J. HEINEMEIER.

26. **Paleodietary change among pre-state metal age societies in northeast Thailand.** C.A. KING.

27. **The effects and identification of diabetes mellitus in skeletal material.** S.E. MAY.

28. **Analysis of musculoskeletal stress markers and joint disease on the early medieval skeletons from Thunau (Austria) and the evaluation of a new methodological approach.** D. PANY, T.B. VIOLA AND M. TESCHLER-NICOLA.

Friday Afternoon – April 11, 2008

29. **Current bioarchaeological investigations at the Castro del Chao Samartín, Asturias, Spain**. N.V. PASSALACQUA, L.L. CABO AND Á. VILLA VALDÉS.

30. **Biogeochemical evidence of human mobility in medieval Nubia.** P. SANDBERG, V. GRIMES, C. SMITH, M. RICHARDS, M. SPONHEIMER AND D. VAN GERVEN.

31. **History and demographic profile of the George S. Huntington Collection at the Smithsonian Institution.** D.R. HUNT AND B. SPATOLA.

32. **The development of temporal bone pneumatization in humans.** C.A. HILL.

33. **Biocultural analysis of Nubian fetal pot burials from Askut, Sudan**. L.R. BRITTON AND T.L. DUPRAS.

34. **A mathematical description of MSM: disease versus stress.** C.Y. HENDERSON.

35. **The Plash Island Burials: the bioarchaeology of a prehistoric gulf coast community.** N.P. HERRMANN, M.K. SPRADLEY, R.J. WILSON AND S. PRICE.

36. **Living with the dead: burial patterns at the site of Kenan Tepe, Turkey.** D.E. HOPWOOD.

37. **An osteobiography of an African diasporic skeletal sample: integrating skeletal and historical information.** E.S. RENSCHLER.

38. **Dental health and political instability in early medieval France.** E.A. TYLER.

39. **Bone remodeling in historical African Americans.** V.L. WEDEL.

40. **Demographic composition and health at Pueblo Grande de Nevada.** J.L. THOMPSON, D.L. MARTIN AND K.G. HARRY.

41. **Remodeling variation in human skeletal elements**. R.A. WALKER, C.O. LOVEJOY AND R. CORDES.

42. **Growth and development in medieval Écija (Spain).** S.R. ZAKRZEWSKI AND A. DI LORETO.

43. **Murine metapodophalangeal sesamoid bone mineralization: A light and electron microscopy study.** A.H. DOHERTY, E.M. LOWDER, R.D. JACQUET AND W.J. LANDIS.

44. **The impact of Roman imperialism: skeletal evidence of physiological stress and deprivation in Britain.** J.J. PECK.

45. **Strontium isotope ratio determination in enamel and dentin of individuals of the excavation site Thunau/Kamp (Austria) (~900-1000 AD) by MC-ICP-MS**. C. HUEMER, M. TESCHLER-NICOLA, S. BOULYGA AND T. PROHASKA.

46. **A Magdalenian perinatal skeleton from Wilcyzce, Poland.** J.D. IRISH, B. BRATLUND, R. SCHILD, E. KOLSTRUP, H. KRÓLIK[3]D. MAŃKA AND T. BOROŃ.

47. **Effects of nickel and zinc administration on rabbit's compact bone: an experimental animal model.** M. MARTINIAKOVÁ, R. OMELKA, B. GROSSKOPF, H. CHOVANCOVÁ, P. MASSÁNYI AND P. CHRENEK.

48. **Stable carbon and nitrogen analysis of diet from the medieval cemetery at Giecz, Poland.** L.J. REITSEMA, D.E. CREWS, H.M. JUSTUS AND A.M. AGNEW.

49. **Biocultural approaches to the study of mortuary practices in the Early Byzantine populations from Greece; the cases of Akraiphnio, Boeotia and Maroneia, Thrace.** P. TRITSAROLI.

50. **Morphological Limb Variation in Three Eco-geographically Distinct Native North American Populations.** E.B. WAXENBAUM, M.A. AND A. B. FALSETTI.

51. **Cranial nonmetric study of archaeological populations from different historical periods of Mongolia.** E. MYAGMAR.

52. **Analysis of the auricular surface on multi-slice computed tomography reconstructions for assessment of aging: a preliminary study**. F. DEDOUIT , P. BARRIER , N. TELMON , P. OTAL , F. JOFFRE , H. ROUSSEAU , J. BRAGA AND D. ROUGE.

53. **The potential discriminant of femur, tibia and the fibula for sex determination. Discriminant functions for Mexican population**. M. PIMIENTA, A. GALLARDO AND H. CISNEROS.

54. **Entheses: are they reliable indicators of activity?** S. SCHLECHT.

55. **Pathological indicators of inbreeding and management issues in vervet and macaque skulls.** G.P. ARONSEN, S. WENTWORTH, A. HEINZELMAN, AND J. Pennington.

56. **Skeletal age-at-death using the Sugeno fuzzy integral.** M. F. ANDERSON AND D. T. ANDERSON.

Friday Afternoon – April 11, 2008

57. **A human maxilla trophy from Los Mogotes, Oaxaca, Mexico.** W.N. DUNCAN, C. ELSON, C. SPENCER AND E. REDMOND.

58. **Age-related histomorphometric changes in human fetal long bones.** C.D. ELEAZER.

59. **Covariation in the upper and lower midfacial complex in North American populations.** A.D. FOSTER.

60. **Estimation of sex and ancestry from the foramen magnum.** B.M. HILEMAN AND J.E. LITTLE.

61. **Transition analysis: forensic application of a new symphyseal aging technique.** C.V. HURST.

62. **Analysis of secular change in the mandible.** D.C. MARTIN AND M.E. DANFORTH.

63. **Sex assessment from metacarpals using the William M. Bass Skeletal Collection.** S.E. MCMANUS, M.K. SPRADLEY AND J.B. DEVLIN.

64. **Accuracy of metric infant age estimation methods.** K. STULL, BA, K. FRAZEE, BA AND L. CABO-PEREZ.

65. **New ways in the documentation of human burials using 3D-laser scanning and digital microscopy: Two late Roman sarcophagus burials from Trier-St. Maximin (Germany).** W-R. TEEGEN AND N. REIFARTH.

66. **Testing histological age determination techniques on Prehispanic Maya skeletal populations.** V. TIESLER, S. SUZUKI, S.D. STOUT AND M. STREETER.

67. **New formulas to estimate age at death in Maya populations using histomorphological changes in the fourth human rib.** M. VALENCIA PAVÓN, A. CUCINA, AND V. TIESLER.

68. **Techniques for the identification of missing persons at the FBI Laboratory.** R.M. THOMAS, E. O'DONNELL, E. POKORAK, AND J.E.B. STEWART.

69. **Biological and social relatedness in Woodland Period mounds in Illinois.** J.L. KING.

70. **Age-related changes in the pubic symphysis: a topographical approach.** S. SHOLTS, P.L. WALKER AND S. WARMLANDER.

71. **Diagenesis scale for bone microstructure.** M. STREETER.

72. **Diet and Disease in Times of War: Analysis of Mummified Human Remains from Southern Mongolia c. 1300-1350 AD.** M.K. ZUCKERMAN, B.L. TURNER, B.A. CARLSON, J.D. KINGSTON, G.J. ARMELAGOS, D.R. HUNT, T. AMGALANTUGS AND B. FROHLICH.

73. **A comparison of craniofacial secular trends during the 19th and 20th centuries in the U.S. and Portugal.** K.E.WEISENSEE AND R.L.JANTZ.

74. **The Long and the Short of It: A Case of Diminutive Stature in Prehistoric Ridges Basin.** A.J. OSTERHOLTZ.

75. **A Bronze Age woman in an Anglo-Saxon village.** L.C.D. SCHOSS AND S.S. LEGGE.

Session 19. Consolidating Twenty Years of Bioarchaeological Inquiry: An Emerging Regional Picture. Poster Symposium. *Madison*.

Organizers and Co-Chairs: MARIA O. SMITH, Loyola University, Chicago and TRACY K. BETSINGER, Ohio State University.

2:00 – 2:30 am	Poster set-up.
3:00 – 4:30 am	Authors present for questions.
4:30 am – 5:00 pm	Discussion by posters (CLARK SPENCER LARSEN)
5:30 – 6:00 pm	Poster take-down.

A recent florescence in substantive bioarchaeological research from the upper Tennessee River valley in east Tennessee has contributed to the general knowledge of subsistence strategy co-associations and temporal change across the full spectrum of subsistence shifts documented in eastern North America. The objective of this symposium is to consolidate the fundamental information already known about riverine east Tennessee with this new layer of multiple site health, lifestyle, and demographic information. The emerging diachronic picture not only frames future local research, but provides more detailed health status co-associations with particular sociopolitical (sex, status, centralized versus non-centralized authority), and economic (dispersed versus aggregate agricultural settlement patterns) circumstances.

1. **Patterns of oral health between elites and non-elites in Late Mississippian Period chiefdom level societies: An inter-area comparison within the upper Tennessee River drainage area.** TRACY K. BETSINGER AND MARIA O. SMITH.

2. **Burial location and variation in long bone morphology at the Toqua site (40MR6), Tennessee**. K. A. KING.

3. **Bioarchaeological Approaches in Understanding East Tennessee, Mississippian Diversity: A View from the Fains Island site (40JE1).** M.S. HARLE.

4. **Dental variation and biological distance of Late Mississippian populations from eastern Tennessee.** T.C. WESTON AND M.C. GRIFFIN.

5. **Prehistoric health in Tennessee during subsistence transition using the Western Hemisphere health index**. E.A. DIGANGI.

6. **Mound vs. Village: A Biocultural Analysis of Status and Health at the Cox Site (40AN19), Anderson County, Tennessee.** J.R. VOGEL.

7. **The unique paleoepidemiology of treponemal disease in Late Woodland/Early Mississippian samples from southern Appalachia and its implications**. A.M. ROBBINS AND M.O. SMITH.

8. **Violent is as violent does: the correlates of political contact, political isolation and agonistic behavior from the Late Woodland to the Late Mississippian periods of east Tennessee.** M.O. SMITH.

9. **Dental defects in the deciduous dentition of two late Mississippian period subadults with arguable treponemal disease: cases of possible congenital transmission.** D.L. HUTCHINSON, E.A. DIGANGI, M.O. SMITH, AND T.K. BETSINGER.

10. **Determining paleodemographic correlates of settlement patterning using samples from the upper Tennessee River valley.** B.T. SMITH, L.W. KONIGSBERG, AND T.K. BETSINGER.

11. **Gender and status differences in treponemal disease vulnerability in Late Mississippian Period chiefdom level samples**. L.L. WILLIAMS, M.O. SMITH AND T.K. BETSINGER.

Session 20. The Importance of Fallback Foods in Priamte Ecology and Evolution. Symposium. *Fairfield.*

Organizers and Co-Chairs: BARTH WRIGHT, Kansas City University of Medicine and Biosciences and PAUL CONSTANTINO, George Washington University.

The role of fallback resources in shaping primate ranging, socioecology, and particularly morphology has recently become a topic of particular interest to biological anthropologists, yet few attempts have been made to define fallback foods or to explore their implications for understanding primate ecology and evolution. The goal of this symposium is to define fallback foods, explore their role in the ecology and evolution of primates, discuss methods for measuring and evaluating fallback dietary strategies, and present studies of extant primates that explore fallback resource use and its implications.

2:00 pm **Defining fallback foods and considering their importance in primate ecology and evolution.** A.J. MARSHALL.

2:15 pm **Fallback foods and the packaging problem.** S.A. ALTMANN.

2:30 pm **Evaluating alternative scenarios for fallback foods in early hominin evolution.** R.W. WRANGHAM.

2:45 pm **How enamel form may provide key information on the properties of fallback foods.** P.W. LUCAS, P. CONSTANTINO, B.A. WOOD, AND B.R. LAWN.

3:00 pm **Are fallback foods driving masticatory morphology? The case of the African apes.** P. CONSTANTINO.

3:15 pm **Fallback or fall forward: food dispersion, canopy complexity, and the foraging adaptations of apes in Southeast Asia.** N.J. DOMINY, E.R. VOGEL, L. HAAG, C.P. VAN SCHAIK, AND G.G. PARKER.

3:30 pm **Using Stable Isotope Analysis to Identify Fallback Foods in Fossil Taxa.** M. SPONHEIMER, B.H. PASSEY, T.E. CERLING, J.A. LEE-THORP AND D.J. DE RUITER.

3:45 pm **Investigating the importance of fallback foods in early hominins using dental microwear.** P.S. UNGAR AND R.S. SCOTT.

4:00 pm **Break**

4:15 pm **Fallback foods within an anthropogenically disturbed habitat: Effects on patterns of mortality, demography, and biology among wild ring-tailed lemurs.** M. L. SAUTHER AND F. P. CUOZZO.

4:30 pm **Fallback foraging as a way of life: dietary variability and skeletal morphology in tufted capuchins.** B.W. WRIGHT, K.A. WRIGHT, J. CHALK, M. P. VERDERANE, D. FRAGASZY, E. VISALBERGHI, P. IZAR, AND E.B. OTTONI.

4:45 pm **Fallback foods and primate adaptability: Primates in temperate environments.** C.C. GRUETER AND Z.-F. XIANG.

Friday Afternoon – April 11, 2008

5:00 pm **The role of leaves and herbs as fallback foods in *Gorilla gorilla* diet at Mondika: an examination of nutrient content and seasonal variation in intake.** D. DORAN-SHEEHY, P. MONGO, J. LODWICK AND N.L. CONKLIN-BRITTAIN.

5:15 pm **Fallback foods and dietary partitioning among Pan and Gorilla.** J. YAMAGIWA.

5:30 pm **The impact of seasonality and fallback foods on Hadza hunter-gatherers.** F.W. MARLOWE AND J.C. BERBESQUE.

5:45 pm **Discussant:** J.E. LAMBERT.

Session 21. Molecular & Primate Genetics. Contributed Papers. *Delaware D*.

Chair: RIPAN MALHI. University of Illinois.

2:00 pm **Primate pigmentation: Understanding the genetic basis of convergent coat color phenotypes.** B.J. BRADLEY, M. IRWIN, P.M. KAPPELER, P. MOISSON, T.L. MORELLI, J. PASTORINI, AND N.I. MUNDY.

2:15 pm **The evolution of aggression: analysis of SLC6A4 variation in *Macaca mulatta*.** M.R. SHATTUCK, R.Y. TITO, AND R.S. MALHI.

2:30 pm **Phylogeny and phylogeography of the chacma baboon (*Papio ursinus*); an assessment of evolutionary history and genetic variation.** R. SITHALDEEN, R.R. ACKERMANN, AND J.BISHOP.

2:45 pm **Extinction of critically endangered West African colobus monkeys will lead to a major loss in molecular diversity**. N. TING.

3:00 pm **Examining natural selection in primate non-coding DNA**. H.A. LAWSON , H. AKASHI, K.M. WEISS, AND R.C. HARDISON.

3:15 pm **Comparing signatures of natural selection in two high altitude human groups.** A.W. BIGHAM, X. MAO, T. BRUTSAERT, L.G. MOORE, R. MEI, AND M.D. SHRIVER.

3:30 pm **3-Dimensional molecular modeling and comparison of human and chimpanzeechemokine receptors CCR2, CCR3 and CX3CR1**. J. F. BRINKWORTH AND J. L. HO.

3:45 pm **Break**

4:00 pm **Patterns of phylogenetic diversity in the serotonin transporter gene (5-HTT, SLC6A4) across a broad sample of primates.** M.L. CHANG, J.B. KRAFT, AND S.P. HAMILTON.

4:15 pm **Phylogeny of New World monkeys (Primates: Platyrrhini) based on large genomic sequence data.** A. DACIER, A.L. MORALES-JIMENEZ, M. BLAIR, T.R. DISOTELL.

4:30 pm **Effects of sexual selection and sperm competition on transcriptional regulation of seminal proteins in hominoids.** K.A. HOOPER-BOYD AND M.I. JENSEN-SEAMAN. .

4:45 pm **Gene duplication, loss, and conversion in the hominoid relaxin gene cluster.** M.I. JENSEN-SEAMAN, J.J. GARCIA, AND H.M. BROCKWAY.

5:00 pm **Mitochondrial DNA polymorphism and the evolution of human host defense.** K.P. MOODER.

5:15 pm **Full genome comparisons of *Mycobacterium:* Insight into the origin of tuberculosis and leprosy.** L.A. PFISTER, M.S.ROSENBERG, AND A.C. STONE.

5:30 pm **Distinct genomic signatures of adaptation in pre- and post-natal environments during human evolution**. M. UDDIN, M. GOODMAN, C.C. SHERWOOD, T.E. STARZL, L.I. GROSSMAN , R. ROMERO, AND D.E. WILDMAN.

5:45 pm **Detecting natural selection in modern human skulls**. N. MARTÍNEZ-ABADÍAS, M. ESPARZA, T. SJØVOLD, R. GONZÁLEZ-JOSÉ, M. SANTOS, M. HERNÁNDEZ AND C.P. KLINGENBERG.

Session 22. Functional and Evolutionary Morphology 2. Contributed Papers. *Delaware A/B.*

Chair: ROBERT ANEMONE. Western Michigan University.

2:00 pm **Full field noncontacting strain measurements in the colobine mandibular symphysis.** A.J. RAPOFF, R.B. BUCINELL, W.S. MCGRAW, D.J. DAEGLIN.

2:15 pm **Cranial suture complexity in marmosets and tamarins.** C.W. NICOLAY AND M.A. HUTCHINGS.

2:30 pm **Vibrissae, the infraorbital foramen, and maxillary mechanoreception: Exactly how special are primates?** M.N. MUCHLINSKI.

2:45 pm **Hallucal grasping in *Nycticebus coucang*: further implications for the functional significance of a large peroneal process** A.K. KINGSTON, D.M. BOYER, B.A. PATEL S.G. LARSON, J.T. STERN JR.

3:00 pm **The role of primate hip extensors in diminishing forelimb forces during quadrupedalism.** S.G. LARSON AND J.T. STERN, JR.

3:15 pm **In vitro bone strain in a macaque pelvis during hindlimb loading**. K.L. LEWTON, M.A. SPENCE, AND N.R. CRAWFORD.

3:30 pm **The scaling of behaviorally significant gape: gape, fiber length, and skull dimensions in strepsirrhines**. A. HARTSTONE-ROSE AND J.M.G. PERRY.

3:45 pm **Comparative anatomy, phylogeny and evolution of the head and neck musculature of hominids: a new insight .** R. DIOGO AND B. WOOD.

4:00 pm **Break**

4:15 pm **Is premaxilla morphology determined by the spatial requirements of the developing incisor dentition?** S.N. COBB AND A. WILLIS.

4:30 pm **Directly relating trabecular architecture to locomotion – an experimental model of locomotor behavior effects**. K.J. CARLSON, S. LUBINSKY, AND S. JUDEX.

4:45 pm **Chewing muscle size and diet in Eocene adapines.** J.M.G. PERRY AND A. HARTSTONE-ROSE.

5:00 pm **Staggering under the load: biomechanics of carrying as indicated by footprint trail parameters.** D. WEBB AND H. WARD.

5:15 pm **The influence of foot posture on effective mechanical advantage at the knee and ankle during human bipedalism.** A. ZEININGER.

5:30 pm **Scaling of chewing frequency in Primates.** C.F. ROSS, R.L. WASHINGTON, A. ECKHARDT, E.R.VOGEL, N.J. DOMINY.

5:45 pm **The effects of food processing on masticatory force and comminution: implications for the evolution of cranio-dental morphology**. K. DUNCAN AND D. LIEBERMAN.

Session 23: Women's Health: Endocrinology, Sexuality, and Life Phases. Symposium. Delaware C.

Organizers and Co-Chairs: LYNN MORRISON and SUSAN BROWN, University of Hawaii at Hilo.

Women's sexual and reproductive health is a focus of current research by human biologists, physical and cultural anthropologists, psychologists, and biomedical researchers. Topics of women's health include ovarian function, reproductive energetics and hormonal variation during menstruation, pregnancy, and menopause across women with different cultural and genetic backgrounds. Researchers use a variety of perspectives to examine women's health including focusing on evolutionary, immunological, geographical, seasonal, and biological variation. A variety of research designs, including retrospective, prospective, longitudinal, and cross-sectional perspectives, capture a full and rich range of women's reproductive variability across cultures, ethnicities, and in different climatic zones. The outcomes provide baseline information on 1) variation in ovarian function and sexuality across women's life phases 2) cross-cultural variations in reproductive hormones and menopause, and 3) the energetics of reproduction. This symposium highlights current and salient research on the above topics conducted by researchers interested in women's reproductive health.

2:00 pm **Ovulation and sexual behavior: relations to the stress and immune systems.** S.G. BROWN AND L.A. MORRISON.

2:15 pm **In-utero risk factors for women's reproductive health: Correlates of luteal and placental progesterone levels throughout pregnancy in Bolivian Aymara agropastoralists.** V.J. VITZTHUM, H. SPIELVOGEL AND J. THORNBURG.

2:30 pm **Determinants of variation in human female ovarian function: genetic polymorphism, developmental conditions and adult lifestyle**. G. JASIENSKA

2:45 pm **Ovarian function across two life history transitions: puberty and the postpartum resumption of fecundity**. P.T. ELLISON, M. REICHES, S.F. LIPSON, AND C.R. VALEGGIA.

3:00 pm **Determinants of variation in ovarian function: a comparison of progesterone and estradiol data.** A. NÚÑEZ-DE LA MORA, R.T. CHATTERTON AND G.R. BENTLEY.

3:15 pm **Understanding variation in maternal energetics during lactation among subsistence farmers in the eastern Amazon.** B.A. PIPERATA.

3:30 pm **Emerging role of menstrual fluid as health indicator.** L.A. MORRISON AND S.G. BROWN.

3:45 pm **Break**

Friday Afternoon – April 11, 2008

4:00 pm **Variation in endometrial function and its role in elucidating reproductive pathology.** K.B.H. CLANCY.

4:15 pm **Sex, symptoms and daily life during the menopause transition in a sample of North American women**. W.R. TREVATHAN AND M.H. BURLESON.

4:30 pm **Circadian rhythms and levels of concordance between measures of objective and subjective hot flashes in a multiethnic population.** L.L. SIEVERT, A. REZA, P. MILLS, AND D. BROWN.

4:45 pm **A Comparison of Menopausal Symptoms among Women in Sylhet, Bangladesh and Sylheti Migrants in London, UK**. T. SHARMEEN, L.L. SIEVERT, K. BEGUM, S. MUTTUKRISHNA AND G.R. BENTLEY.

5:00 pm **Menopausal symptoms among British Pakistani women.** M. BLELL.

5:15 pm **Discussants:** L.A. MORRISON AND S.G. BROWN.

Saturday Morning – April 12, 2008

Session 24. Primate Social Behavior & Ecology. Contributed Posters. *Franklin*.

Chair: HOGAN M. SHERROW. Ohio University.

8:00 – 8:30 am	Poster set-up.
8:30 – 10:00 am	Authors of even-numbered posters present for questions.
10:30 am – 12:00 pm	Authors of odd-numbered posters present for questions.
12:00 – 12:30 pm	Poster take-down.

1. **A chimpanzee (*Pan troglodytes*) learns to pick binary oppositions**. A.R. HALLORAN AND D. BROADFIELD.

2. **Ecological and social correlates of ectoparasite infections in Milne-Edwards' sifakas (*Propithecus edwardsi*), in Ranomafana National Park, Madagascar.** S.J. ARRIGO-NELSON AND P.C. WRIGHT.

3. **Habitat variation in patterns of ring-tailed lemur (*Lemur catta*) gross tooth wear and functional tooth loss indicates "ecological disequilibrium" in Madagascar**. F.P. CUOZZO AND M.L. SAUTHER.

4. **Adaptive behaviors of free ranging squirrel monkeys (*Saimiri sciureus*) in the semi-natural environment of Naples, Florida.** A.A. ELGART.

5. **Spatial and temporal variability in predation by *Cryptoprocta ferox* on sifakas in continuous and fragmented rainforest in Madagascar: Do forest fragmentation and predation act synergistically?** M.T. IRWIN, J.-L. RAHARISON, AND P.C. WRIGHT.

6. **Ranging behavior of white-fronted capuchins (*Cebus albifrons*) in the Ecuadorian Amazon: effects of resource use and intergroup interactions.** L.J. MATTHEWS.

7. **Habitat structure variation: implications for understanding the feeding ecology of black-shanked douc in Cat Tien National Park, Vietnam**. J.A. O'BRIEN, T.V. THANH, P.H. KHANH, T.H. NGUYEN AND H.H. COVERT.

8. **Using proximity to understand association patterns among adult mantled howler monkeys (*Alouatta palliata*).** E.M. PERRIN AND D.M. KITCHEN.

9. **The effects of human encroachment and seasonality on the risk of mantled howler monkey (*Alouatta palliata*) predation by dogs on Ometepe Island, Nicaragua.** M. RAGUET-SCHOFIELD.

10. **A comparison of inexpensive methods for obtaining DNA from the feces of baboons.** M.E. STEIPER, L. SWEDELL, S. CHOWDHURY, E. GARRETT.

11. **The mechanical properties of foods processed by *Cebus libidinosus* at Boa Vista, Brazil**. J. CHALK, B.W. WRIGHT, P.W. LUCAS, M.P. VERDERANE, D. FRAGASZY, E. VISALBERGHI, P. IZAR, E.B. OTTONI.

12. **Methods for collecting salivary cortisol from unrestrained, adult, captive brown capuchin monkeys (*Cebus apella*).** M.E. BENITEZ, S.F. ANESTIS, L.R. SANTOS, R.G. BRIBIESCAS.

13. **Glucocorticoids and the question of egalitarianism in bonobos (*Pan paniscus*).** A.K. COBDEN, F.J. WHITE, M.T. WALLER, N.M. MALONE AND P.L. WHITTEN.

14. **So hot you could fry a monkey: Behavioral thermoregulation in human-commensal white-fronted capuchins (*Cebus albifrons).*** M.Y. FIELD.

15. **Crop-raiding of mango fruits, *Mangifera indica*, by mantled howlers (*Alouatta palliata*) in the Refugio de Vida Silvestre Curú, Costa Rica.** T. MCKINNEY AND C.O. ZAMORA.

16. **Preliminary data on affiliation, agonism, and reconciliation in an all-male group of ringtailed lemurs (*Lemur catta*).** A.D. COHEN, L.L. TAYLOR AND C. MANTIS.

17. **Intra-community infanticide and forced copulation in spider monkeys: a multi-site comparison between Cocha Cashu, Peru and Punta Laguna, Mexico**. K.N. GIBSON, L.G. VICK, A.C. PALMA AND F.M. DEL ROCÍO CARRASCO.

18. **Reproductive competition and ambush behaviors in black and gold howler monkeys.** M. KOWALEWSKI, P. A. GARBER, S. M. PEKER AND G. E. ZUNINO.

19. **To be or not to be eaten: social behavior and interactions of a predated infant *Lemur catta* compared to her peers**. S.L. MEREDITH.

20. **Habitat fragmentation: valid conservation concern or misguided effort.** E.M. MERTZ AND D.C. WHITELAW.

21. **The effects of deforestation on stress and reproductive hormone levels in red colobus monkeys (*Piliocolobus tephrosceles*).** K. M. MILICH AND R.M. STUMPF.

22. **What moves Hanuman langurs? Temperature and leafy foods as predictors of daily path length.** P.E. SCHLICHTING, C. BORRIES, AND A. KOENIG.

23. RECONCILIATORY BEHAVIOR IN CAPTIVE FEMALE CHIMPANZEES (PAN TROGLODYTES). M.E. UPSHAW AND L.D. WOLFE.

24. **Rank in female chimpanzees (*Pan troglodytes*) is shown to be more positively correlated with alpha male association rather than female competition.** C. CLOUTIER, A.R. HALLORAN AND D. BROADFIELD.

25. **Using camera-traps and traditional knowledge to estimate population parameters and movements of carnivores in southeastern Madagascar: tools towards better understanding lemur predation risk from a predator's perspective.** S.M. KARPANTY, C. CRAWFORD, B. GERBER AND M. KOTSHWAR.

26. **The effect of male presence on female chimpanzee feeding efficiency.** Z.P. MACHANDA.

27. **Adult male-juvenile interactions in captive hamadryas baboons (Papio hamadryas).** C.E. QUINN BAKER AND L.D. WOLFE.

28. **To fight or to cooperate? Reproductive dilemmas in male black howler monkeys.** S. VAN BELLE, K.B. STRIER AND A. ESTRADA.

29. **Comparing female initiation across the estrous cycle among captive *Pan paniscus* and *Pan troglodytes.*** J.T. WALZ, D.E. CREWS, AND D.M. KITCHEN.

30. **What to do with something new. Food presentation affects food sharing in owl monkeys.** R.M. HORES, C.K. WOLOVICH, S. EVANS.

31. **Maternal investment in *Callimico goeldii* and *Callithrix jacchus***. A.C. ROSS.

32. **Effects of food exploitation on activity and group size of Mantled Howlers (*Alouatta palliata*).** A. TINNEY AND M. BEZANSON .

33. **Preliminary Evidence of Fission-Fusion Sub-Grouping Behavior in White-Fronted Brown Lemurs (*Eulemur fulvus albifrons*) in Betampona Natural Reserve, Madagascar.** C. TOBOROWSKY.

34. **Factors affecting foraging decisions in a wild population of sympatric orangutans (*Pongo pygmaeus wurmbii*) and white-bearded gibbons (*Hylobates albibarbis*): evidence of cognitive maps.** E.R. VOGEL, L. HAAG, S.A. WICH, M.L. BASTIAN AND C.P. VAN SCHAIK.

35. **Search for the Elusive Pygmy Tarsier.** N.B. GROW, S. GURSKY, AND J.E. LEGAN.

36. **Behavioral indicators of female choice in blue monkeys in the Kakamega Forest, Kenya.** M. BLAIR AND M. CORDS.

37. **Grooming reciprocity in Verreaux's sifaka (*Propithecus verreauxi verreauxi*)**. L.M. CARNES AND R.J. LEWIS.

38. **Juvenile-directed aggressive and agonistic interactions in *Alouatta paliatta,* mantled howler monkeys.** K.L. HANSON.

39. **How reliable are density estimates in diurnal primates?** H. HASSEL, C. BORRIES, E. LARNEY, M. UMPONJAN, A. KOENIG.

40. **Effects of habitat characteristics on the behavioral ecology and habitat use patterns of mantled howler monkeys, *Alouatta palliata*.** C.A. JOST.

41. **Do Tana River mangabeys (*Cercocebus galeritus*) exhibit age differences in the diet that relate to diet item puncture and crushing resistance values?** R. MEDEIROS AND J. WIECZKOWSKI.

42. **Ranging patterns in wild hamadryas baboons in Ethiopia.** A.L. SCHREIER.

43. **Hunting pressure and declining monkey populations on Bioko Island, Equatorial Guinea.** I. SHMULENSON, G.W. HEARN, W.A. MORRA, T.B. BUTYNSKI.

44. **Transfer behavior and association patterns of female spider monkeys (*Ateles belzebuth belzebuth*) in Yasuní National Park, Ecuador.** T.H. WEBSTER AND S.A. SUAREZ.

45. **Synchronizing behavior: the use of gestural communication in a captive group of white-cheeked gibbons (*Hylobates concolor*).** E.J. INGMANSON.

46. **Ecological flexibility at the edge: ranging patterns and habitat use of tonkean macaques (*Macaca tonkeana*) in a human-modified habitat.** E.P. RILEY.

47. **Do primates see ecotourists as potential predators?** L. KAUFFMAN AND S. BOINSKI.

48. **The socioecology of Javan gibbons (*Hylobates moloch*): tests of competing hypotheses**. N.M. MALONE AND F.J. WHITE.

59. **The role of long-distance vocalizations in regulating association patterns and social interactions in white-bellied spider monkeys (*Ateles belzebuth*).** S.N. SPEHAR AND A. DI FIORE.

50. **Factoring in rural demography and land use in GIS-based modeling of Japanese macaque habitat expansion.** D.S. SPRAGUE AND N. IWASAKI.

51. **Are the alarm calls of tufted capuchin monkeys (*Cebus apella*) functionally referential?** B.C. WHEELER.

Session 25. Migrants and Health. Poster Symposium. *Madison*.

Organizers and Co-Chairs: DIANE MARKOWITZ, Rowan University and MARIA INÊS VARELA-SILVA, Loughborough University.

8:00 – 8:30 am	Poster set-up.
9:00 – 10:30 am	Authors present for questions.
10:30 am – 11:00 pm	Discussion by posters (DIANE MARKOWITZ AND MARIA INÊS VARELA-SILVA)
12:00 – 12:30 pm	Poster take-down.

Migration over short or long distances to perceived better environments, or as a result of forced relocation, has always been a fact of human history. Both biological and cultural security have deteriorated in many locations in recent years and so emigration may be conceptualized as an adaptive response. In the case of families, migration decisions often represent a commitment to children's well-being. Results of these decisions can be seen as changes in children's growth and development in the new location. Migrants may be at risk for a host of acute and chronic illnesses with which they previously have had little experience. In the face of these exposures, health outcomes will depend on the quality of support networks within migrant communities, the types of interactions with the native community, and changes in diet and activity patterns. This symposium will present information about the variety of ways in which the migratory experience affects the health and growth of migrants, particularly children. Influences on migrant health to be examined will include the nutrition transition, the availability (or lack of it) of health care, changing activity patterns and the migrants' relative biological adaptability. These subjects will be framed within the context of family and social support networks, as well as the migrants' pre-existing beliefs about disease etiology, healthcare and growth.

1. **Risk factors for the metabolic syndrome in South Asian migrants in the UK.** W.O. JOHNSON AND N. CAMERON.

2. **Health implications of migration for Mexican children and adolescents**. F. DICKINSON, H. AZCORRA AND G. VALENTÍN.

3. **An application of Life History and Parental Investment Theory to settlement decisions of Guatemalan Maya women in Los Angeles**. B. BOGIN AND J. LOUCKY.

4. **Do children get fatter the longer their mothers are living in the U.S? Migration and nutritional status among Puerto Rican children**. D.A. HIMMELGREEN, R. PÉREZ-ESCAMILLA, E. AMADOR, E. DANFORTH, AND E. RUIZ.

5. **Risks and odds ratios of becoming at-risk-of-overweight and overweight among migrant children in New Jersey.** D.L. MARKOWITZ AND S. COSMINSKY.

6. **Iron Deficiency and Prolonged Bottle-Feeding: Risk Factors for Hispanic Migrants.** J.M. BROTANEK, D. SCHROER AND G. FLORES.

7. **The household food insecurity and health outcomes of U.S.-Mexico border migrant and seasonal farmworkers.** M.M.WEIGEL AND R.X. ARMIJOS.

8. **The social and reproductive health implications of independent north-south child migration in Ghana.** S.O. KWANKYE.

9. **Health outcomes of Cape-Verdean migrants to Lisbon. A historic note on colonialism in Portugal.** I. FRAGOSO, M.I. VARELA-SILVA AND N. CAMERON.

10. **The Growth of Low Altitude Migrants at High Altitude on the Qinghai-Tibetan Plateau: The Effects of Socio-Economic Status and Hypoxia**. C.A. WEITZ AND R.M GARRUTO.

11. **Differential growth of Han and Tibetan children at high altitude.** S.M. BAILEY AND J. XU .

Session 26. Human and Non-Human Primate Genetics in the Post-Genomic Era. Symposium. (Co-sponsored by American Association of Anthropological Genetics) *Fairfield*.

Organizers and Co-Chairs: RAVINDRANATH DUGGIRALA and LORENA M. HAVILL, Southwest Foundation for Biomedical Research.

In recent years, progress in understanding the genetic architecture of normal and disease-related complex phenotypes has been phenomenal, fueled by the explosion of research activities related to the Human Genome Project, non-human primate comprehensive sequencing projects, molecular genetics, and statistical genetics. The gene mapping and genomics activities in humans and non-human primates have generated an enormous amount of information related to evolution, phylogenetics, population genetics, and biomedical research. Elucidation of gene function, expression, and regulation, and of variation and conservation among primate species have exciting potential for informing anthropological investigations in this post-genomic era. This information, together with advanced analytical tools involved in its generation, has tremendous applied value in disciplines such as anthropology and medicine. The goals of this symposium are twofold: 1) it will provide an overview of the state-of-the-art molecular, epidemiologic, and statistical genetic techniques currently used to dissect the genetic architecture of complex phenotypes, both normal and disease-related, using data from both human and non-human primates, and 2) it will present examples of successful and ongoing applications of these methods to traits of particular interest in biological anthropology using a broad array of analytical tools.

8:00 am **Current trends in human genomic science in relation to the dissection of human variation.** J. BLANGERO.

8:15 am **Sequencing the genomes of nonhuman primates: Progress and future.** J. ROGERS.

8:30 am **Gene mapping and analytical techniques: Localization of genes that shape human variation.** L. ALMASY.

8:45 am **Expression profiling: A new approach for understanding the determinants of human variation.** H.H.H. Göring.

9:00 am **Comparative genomics: tools for study of complex diseases.** L. COX.

9:15 am **Genetics of cardiovascular disease in non-human primates.** M.C. MAHANEY AND A.G. COMUZZIE.

9:30 am **Variation, genetics, and evolution of the primate craniofacial complex.** R.J. SHERWOOD, M.C. MAHANEY, D.L. DUREN, L. M. HAVILL, L.A. COX, J. ROGERS AND B. TOWNE.

9:45 am **Break**

10:00 am **Genetic influences on behavior in non-human primates**. J.N. BAILEY AND L.A. FAIRBANKS.

10:15 am. **Genetics of bone-related phenotypes in non-human primates.** L.M. HAVILL AND J.A.K. HARRIS.

10:30 am **Population Structure Measured by Molecular Genetic Markers: Aleutian Archipelago.** M.H. CRAWFORD, A.J. REDD AND M. ZLOJUTRO.

10:45 am **Genetics of Type 2 Diabetes and the Metabolic Syndrome in Mexican Americans.** C.P JENKINSON, R. ARYA AND R. DUGGIRALA.

11:00 am **Genetics of cardiovascular disease in minority populations.** J.W. MACCLUER, S.A. COLE, A.G. COMUZZIE, J. BLANGERO, AND B.V. HOWARD.

11:15 am **Genetics of behavioral traits and psychiatric disease in human populations.** D.C. GLAHN.

11:30 am **Genomic studies of human populations: Resequencing approaches for the identification of human quantitative loci.** J.E. CURRAN.

11:45 am **Discussants:** S. WILLIAMS-BLANGERO AND A.G. COMUZZIE.

Session 27. Evolution of Hominin Bipedalism: New Perspectives. Symposium. *Delaware A/B.*

Organizers and Co-Chairs: WILLIAM HARCOURT-SMITH, American Museum of Natural History and ELIZABETH HARMON, Hunter College, CUNY.

The purpose of this symposium is to address the current state of research regarding the origins of hominin bipedalism. Bipedal locomotion is one of the defining characteristics of the hominin lineage. A large number of new hominin taxa that have been discovered and described in the last 15 years, which add data about the origin and proliferation of bipedalism. These discoveries suggest greater taxonomic diversity among hominins than previously thought, but there has been little discussion of this taxonomic diversity in relation to locomotor behaviour. Nevertheless, new research from a diverse range of subjects, including developmental biology, paleoecology and kinematics, has shed new light on the selection pressures, environmental context, and mechanics of this unique form of primate locomotion. It is clear that these research avenues combined with new data from recently discovered and described taxa will have important implications for the origins and prolifer`ation of bipedal locomotion.` Therefore, our goal in organizing this symposium is to take a multi-disciplinary approach to the issue, rather than the traditional approach wherein a series of speakers simply profess the degree to which certain homi`nins` were or were not bipedal`.` We thus aim to incorporate perspectives from several distinct but complementary areas that will provide a holistic perspective on hominin bipedality.

8:00 am **Mio-Pliocene African habitats: local and regional contexts for the earliest bipeds.** K.E. REED AND C.J. CAMPISANO.

8:15 am **Has the sun set on the savanna? Environmental determinants and the evolution of bipedality.** C.J. CAMPISANO AND K.E. REED.

8:30 am **Developmental anatomy of the hominoid lumbar transverse process: a comparative anatomical framework for examining lumbar natural history in early hominids.** B.A. ROSENMAN AND C.O. LOVEJOY.

8:45 am **Wired to run? The evolution of novel locomotor behaviors in hominins.** D.A. RAICHLEN, B.K. KEENEY, G. GERDEMAN, T.H. MEEK, R.S. WIJERATNE AND T. J. GARLAND.

9:00 am **Endurance versus efficiency in humans and chimpanzees: a new look at the old problem of becoming bipedal**. H. PONTZER, D.A. RAICHLEN, AND M.D. SOCKOL.

9:15 am **Stiffness of the longitudinal foot arch : in vivo measurement and functional implications.** K. D'AOÛT, D. FRANS, B. VAN GHELUWE, D. DE CLERCQ AND P. AERTS.

9:30 am **Kinematics of the os centrale in *Pongo pygmaeus*: implications for the knuckle-walking hominin ancestor hypothesis.** C.M. ORR, E.L. LEVENTHAL, F.S. CHIVERS, J.J. CRISCO.

9:45 am **Break**

10:00 am **Metatarsal head torsion in apes, humans and *A. afarensis***. M.S.M. DRAPEAU AND E.H. HARMON.

10:15 am **Early hominin greater trochanter shape**. E.H. HARMON.

10:30 am **What does the proximal femur tell us about the evolution of bipedalism over the past six million years?** B.G. RICHMOND AND W.L. JUNGERS**.**

10:45 am **Hobbit bipedalism: functional anatomy of the foot of *Homo floresiensis.*** W.L. JUNGERS, W.E.H. HARCOURT-SMITH, S.G. LARSON, M.J. MORWOOD, AND T. DJUBIANTONO.

11:00 am **Locomotor diversity in the hominin record: fact or fiction?** W.E.H. HARCOURT-SMITH AND M. TALLMAN.

11:15 am **Discussant:** L. AIELLO

Session 28. Human Variation, History and Evolution. Contributed Papers. *Delaware C*.

Chair: THOMAS McDADE. Northwestern University.

8:00 am **Variations on a theme? Early Holocene human morphological variation in the New World.** B. M. AUERBACH.

8:15 am **Higher blood flow and circulating nitric oxide products among high-altitude Tibetans.** C. M. BEALL, S. GHOSH, A. J. JANOCHA, W. XU, S. BAUER, N. S. BRYAN, J. TEJERO, C. HEMANN, R. HILLE, D. J. STUEHR, M. FEELISCH, S. C. ERZURUM.

8:30 am **Chin size and its relationship to facial prognathism in humans.** D. DURAND AND D.R. HUNT.

8:45 am **Two perspectives on occupational activity patterns: do examinations of entheses and cross-sectional data result in similar physical activity reconstructions?** I.S. MAGGIANO, C.M. MAGGIANO, V. TIESLER, H. KIERDORF, M. SCHULTZ.

9:00 am **Late reproduction and parental investment increase reserve capacity and longevity in humans.** D.E. CREWS.

9:15 am **Phylogeny of the southern Plateau.** R.P. HARROD.

9:30 am **Biological continuity, cultural discontinuity and the collapse of the Meroitic state: Intra-cemetery biodistance analysis of ancient Nubians at Semna South.** K.M. JOHNSON.

9:45 am **Cemetery age distributions and modern fertility: estimating mortality, age structure, and annual growth from the paleodemographic record.** R.S. MEINDL, R.P. MENSFORTH, AND C.O. LOVEJOY.

10:00 am **Break**

10:15 am **Migration from medieval Europe to the Middle East with the crusades**. P.D. MITCHELL AND A.R. MILLARD.

10:30 am **The applicability of cladistic methods in biodistance analysis.** J.C. REED.

10:45 am **Does the convergence of multiple inconvenient truths signal the threshold of demographic and societal collapse?** J.K. SMAIL.

11:00 am **Ontogenetic scaling of brain size in haplorhines**. N. BARRICKMAN

11:15 am **Adaptive evolution of human hearing and the appearance of language**. J. HAWKS.

11:30 am **A Novel Transgenic Mouse Model for Primate Fetal Encephalization and Craniofacial Development**. E.K. NICHOLSON, S.R. STOCK, A. CHENN, M.J. RAVOSA.

11:45 am **Evolutionary oral ecology: how subsistence pattern acts as a selective force in the evolution of cariogenic bacteria (*Streptococcus mutans*) in human populations.** M.J. SOLTZ, AND J. BOCK.

Session 29. Paleopathology. Contributed Papers. *Delaware D*.

Chair: NIELS LYNNERUP. University of Copenhagen.

8:00 am **Skeletal pathologies associated with pellagra mortality: a comparative analysis of pellagrins from the Raymond Dart and Robert Terry anatomical skeletal collections.** B.P. BRENTON, D. TOMPKINS AND R.R. PAINE.

8:15 am **The mastoid process and its significance for palaeopathological investigations on human skeletal remains investigated by means of two different early medieval skeletal samples from Germany.** S. FLOHR AND M. SCHULTZ.

8:30 am **Torture in the Old Kingdom of Egypt? Investigation of frequency and cause of fracture traumas among a population of the Old Kingdom on the Island of Elephantine/Egypt.** J. GRESKY, N. ROUMELIS, A. KOZAK AND M. SCHULTZ.

8:45 am **Death, disease and unhealthy living conditions in 1880-1920 Los Angeles: Paleopathology of the historic Los Angeles Cemetery.** K.M. HOUCK.

9:00 am **Backbreaking business? An analysis of osteopathic vertebral lesions from the working-class cemetery at Hierakonpolis, Egypt.** A. KUMAR.

9:15 am **The Social Underpinnings of Economic Decisions and Health Outcomes in the Age of Agriculture.** P. LAMBERT.

9:30 am **Possible Macrocephaly in a Ptolemaic Child Mummy.** T. M. LUCIO, A. NAGY, S. L. OLSEN AND J.D. TOWERS.

9:45 am **Break**

10:00 am **Body mass estimation from the human skeleton in terms of paleopathology of the vertebrae, proximal tibia and heel spurs.** M.K. MOORE.

10:15 am **Violence in post-imperial times: cranial trauma among post-Wari burials in the former imperial heartland, Peru**. TIFFINY A. TUNG.

10:30 am **The transverse midtrochlear ridge: Pathological response or morphological adaptation at the humeroulnar joint at Tell Abraq, United Arab Emirates?** J.M. COPE, D.L. MARTIN, D. MILLER, AND D.D. POTTS.

10:45 am **When it rains it pours: Multiple congenital pathologies in single individuals.** E. WEISS.

11:00 am **The pathology reference series "Galler collection" (part 2): Paleopathological significance and digital recording.** R. SCHIESS, G. KUHN, M. I. HOFMANN AND F. J. RÜHLI.

11:15 am **Slums or suburbs? Health status of a population from Imperial Rome.** K. KILLGROVE.

11:30 am **Function and wear pattern analysis in Neanderthal and early *Homo sapiens* dentitions.** L. FIORENZA, O. KULLMER, S. BACSO AND F. SCHRENK.

11:45 am **Subsidiary burials from First Dynasty royal funerary enclosures of Aha at Abydos, Egypt.** B.J. BAKER.

Saturday Afternoon – April 12, 2008

Session 30. Functional & Evolutionary Primate Morphology. Contributed Posters. *Franklin*.

Chair: PATRICIA KRAMER. University of Washington.

1:00 – 1:30 pm Poster set-up.
1:30 – 3:00 pm Authors of even-numbered posters present for questions.
3:30 – 5:00 pm Authors of odd-numbered posters present for questions.
5:00 – 5:30 pm Poster take-down.

1. **Phenotypic integration in the macaque postcranial skeleton.** M.W. GRABOWSKI, S.A. WILLIAMS, C.C. ROSEMAN, AND J.D. POLK.

2. **Phenotypic integration and evolution of the African ape third manual ray.** S.A. WILLIAMS, M.W. GRABOWSKI, J.D. POLK, C.C. ROSEMAN.

3. **Humans, geometric similarity and the Froude number: Is "reasonably close" really close enough?** P.A. KRAMER AND A.D. SYLVESTER.

4. **Myostatin deficiency does not reduce intracranial volume in a murine knock-out model.** J.J. CRAY JR., J. MILLER, L. VECCHIONE, C. BYRON, G.M. COOPER, T.E. BARBANO, M.I. SIEGEL, M. HAMRICK, J. SCIOTE AND M.P. MOONEY.

5. **Variation in the lateral corpus of the mandible in hominins extant from 3-1.8 Ma**. A.D. BALES.

6. **Developmental integration in the primate sphenoid and ethmomaxillary complex.** M.A. HOLMES, R.C. MCCARTHY, M.P. MOONEY, M.I. SIEGEL.

7. **A comparative 3D micro-CT study of trabecular architecture in the second metacarpal of *Homo* and *Pan*.** R.A. LAZENBY, M.M. SKINNER, J.-J. HUBLIN, D.M.L. COOPER, B. HALLGRÍMSSON.

8. **A predictive model for hominid lower limb lingth based onmean annual temperature, day reange and body mass**. J. MAKI AND H. PONTZER.

9. **Quantitative Shape Analysis of the Proximal Metatarsal Articular Surfaces in *Homo* and *Pan*: A Pilot Study.** D. PROCTOR.

10. **Can morphometrics be used to identify knuckle walking features of the hominoid wrist?** M.S. SELBY AND C.O. LOVEJOY.

11. **Characterization of primate head accelerations during locomotion: a novel application of 3D motion analysis with comparative implications.** M. MALINZAK, R.F. KAY, E.L. SIMS AND R. QUEEN.

12. **Patterns of upper rib morphology in hominoids.** K. B. BARKER AND C. V. WARD.

13. **Tibial ontogeny and locomotor development in *Macaca*.** C.D. FELLMANN.

14. **Adaptations for human striding gait revealed in the histoarchitecture of the sole of the foot**. K.R. GEHRET AND D.J. MELDRUM.

15. **Ontogenetic variation in the trabecular architecture of the femoral head in *Papio cynocephalus*.** A.D. GOSSELIN-ILDARI AND R.A. KETCHAM.

16. **Comparative in vivo forefoot kinematics in extant hominids.** N.L. GRIFFIN, K. D'AOÛT, P. AERTS AND B.G. RICHMOND

17. **Sexual dimorphism in long bone midshaft cross-sectional properties of *Papio cynocephalus*.** M.A. KILBERGER.

Saturday Afternoon – April 12, 2008

18. **Ontogeny of cranial features associated with wide jaw gapes in common marmosets (*Callithrix jacchus*).** A.L. MORK AND C.J. VINYARD.

19. **Diaphyseal and joint properties of metacarpals and metatarsals of Hominoidea and their relationships with locomotor behavior.** D. MARCHI.

20. **Linking behavior and estrus cycling: Premenstrual syndrome in common chimpanzees (*Pan troglodytes*).** A.D. NEWMAN, E.N. VIDEAN, AND J. FRITZ .

21. **Fiber architecture of *mm. intertransversarii caudae* in the prehensile and nonprehensile tail.** J.M. ORGAN, M.F. TEAFORD, AND A.B. TAYLOR.

22. **Sexual dimorphism, body size and joint posture in primates.** J.D. POLK AND J. PETERSON.

23. **An examination of the association between thoracolumbar mobility and thoracolumbar osteoarthritis patterns in cercopithecines.** M.G. SALA.

24. **The influence of body size and substrate size on quadrupedalism in *Monodelphis domestica*.** L.J. SHAPIRO, A. ZEININGER , AND J.L. VANDEBERG.

25. **The ontogeny of masticatory system configuration in humans and its influence on the timing of molar eruption.** M.A. SPENCER AND G.T. SCHWARTZ.

26. **Functional models of morphological integration in *Propithecus verreauxi verreauxi*.** R.E. WUNDERLICH AND R.R. LAWLER.

27. **Effects of load carrying on the metabolic cost of locomotion in *Lemur catta*.** M. C. O'NEILL.

28. **Hominoid facial position variation within a phylogenetic context.** E.R. LESLIE AND B.T. SHEA.

29. **Axes of elastic symetry in bulk specimens of primate midfacial cortical bone correlate with microstructural variation** P.C. DECHOW AND S. ALAQEEL.

30. **Phenotypic variation within and between 'genetically homogeneous' mouse litters.** C. PERCIVAL, CA HILL, M SUN , Y WANG, EW JABS, AND JT RICHTSMEIER.

31. **The relationship between lower limb length and midshaft diaphyseal shape of the femur and tibia among modern humans**. C.N. SHAW AND J.T. STOCK.

32. **Modeling the elastic properties of sutures in finite element analysis** Q. WANG, D.S. STRAIT, A.L. SMITH, J. CHALK, B.W. WRIGHT, P.C. DECHOW, B.G. RICHMOND, C.F. ROSS, M.A. SPENCER, C.D. BYRON, PETER LUCAS, IAN GROSSE, D.E. SLICE, G. WEBER.

33. **An experimental test of activity effects on femoral diaphyseal shape.** B. DEMES, K.J. CARLSON, S. LUBLINSKY, S. JUDEX.

34. **Walkers vs. non-walkers: a comparison of femoral neck cortical bone in humans**. M.M. MORAN.

35. **Untangling the effects of terrain and mobility on the cross-sectional geometry of the femur and tibia.** V. S. SPARACELLO, O. M. PEARSON, AND T. R. PETERSEN.

36. **A test of dynamic similarity using ground reaction forces.** J.T. ACHTERBERG AND P.A. KRAMER.

37. **Prehensile tail use in white-faced capuchins *Cebus capucinus* at La Suerte Biological Field Station, Costa Rica**. R.M. COVEY.

38. **Craniofacial adaptations to tree-gouging in marmosets: biomechanics and implications for platyrrhine evolution.** E.C. FORSYTHE AND S.M. FORD.

39. **Geometric morphometric analysis of the ontogeny of canine and craniofacial growth in *Colobus guereza*: implications for its lack of canine dimorphism.** E.C. GARRETT AND E. DELSON.

40. **Agreement between interspecific variation in vocalization patterns and cranial base morphology in *Alouatta*: preliminary results and future directions.** L.B. HALENAR.

41. **Dynamics of foot use during bipedal and quadrupedal locomotion in Japanese macaques.** E. HIRASAKI, Y. HIGURASHI AND H. KUMAKURA.

42. **Variation among subspecies of *Pan troglodytes* in limb bone metrics.** R.S. JABBOUR.

Saturday Afternoon – April 12, 2008

43. **Does a large peroneal process on the first metatarsal reflect leaping behavior in prosimian primates?** R.L. JACOBS, B.A. PATEL AND D.M. BOYER.

44. **Quantifying fetal spinal growth in a digital environment: A nonhuman primate study focused on reliability and reproducibility of employed methods.** R.M. LISJAK, G.E. WILDING AND J.E. SIRIANNI.

45. **Evidence from finger length ratios (2D:4D) of prenatal androgen effects associated with selection for canine size, but not body size in anthropoids.** E.C. NELSON AND S. SHULTZ.

46. **An investigation of internal midsagittal cranial morphology in African papionins.** T.A. PEBURN AND M. SINGLETON.

47. **Microanatomical assessment of fusion in facial sutures of bushbabies.** L.E. REINHOLT, A.M. BURROWS, E.R. DUMONT AND T.D. SMITH.

48. **Allometry of trabecular thickness in the non-human primate astragalus**. A. SU.

49. **Environmental and dietary correlates of papionin temporal bone variation.** C.E. TERHUNE, H.F. SMITH AND C.C. GILBERT.

50. **A comparison of gastrointestinal tracts of sympatric *Hapalemur* species.** N. YAMASHITA, C.L. TAN AND C.J. VINYARD.

51. **Variation in the platymeric index of wild baboons.** S.K. AMUGONGO.

52. **Application of geometric morphometrics to aid analyses of the 3D joint axis complex: the axis triangle.** T.M. GREINER AND K.A. BALL.

53. **The importance of bipedality/bending in mediating morphological adaptation in the chimpanzee femoral neck might be overstated**. J.G. SKEDROS, A.B. BECKSTROM, C.J. KISER AND R.D. BLOEBAUM.

54. **Distal tibial shape and presentation reflect the type of substrate.** K. TURLEY, E. HENDERSON AND S. FROST.

55. **Forearm kinematics and hand postures: implications for interpreting subchondral bone density patterns in the primate distal radius.** K.M. CARL, B.A. PATEL AND S.G. LARSON.

56. ***In Vitro* Fermentation of Dietary Carbohydrates in African Monkeys and Apes.** J.E. LAMBERT AND V. FELLNER.

57. **Evaluating the stress response of black howler monkeys (*Alouatta pigra*) through fecal glucocorticoid metabolite measurements.** R. MARTÍNEZ-MOTA, C. VALDESPINO AND R. PALME.

58. **Patterns underlying Retzius period variation in primates and mammals.** R.T. HOGG.

59. **Cortical bone remodeling and trabecular architecture in Japanese macaques with degenerative joint disease.** A.N. LIPPS, S.C.AGARWAL, P. BEAUCHESNE, AND Y.HAMADA.

60. **Mid-palatal suture complexity in African papionins.** J.L. HOTZMAN.

61. **Comparisons of dental microwear texture attributes between facets in three primate taxa.** K.L. KRUEGER, J.R. SCOTT, P.S. UNGAR AND R.F. KAY.

Session 31. The State of the Face: An Evolutionary Update on the Muscles of Facial Expression.

Poster Symposium. *Madison*.

Organizers and Co-Chairs: KAREN L. SCHMIDT, University of Pittsburgh and ANNE BURROWS, Duquesne University.

8:00 – 8:30 am	Poster set-up.
9:00 – 10:30 am	Authors present for questions.
10:30 am – 11:00 pm	Discussion by posters
12:00 – 12:30 pm	Poster take-down.

The structure and function of the face have long been of interest to biological anthropologists because of its pivotal role in behavioral, cognitive, and sensory adaptations. The evolution of the muscles of facial expression specifically, however, has been relatively neglected in primate and human evolutionary studies despite the role of these muscles in nonverbal communication as well as in articulatory movements of speech, audition, olfaction, tactile exploration, and social interaction. The goal of this symposium is to draw together researchers currently studying the evolution of the muscles of facial expression from comparative, developmental, histological, anatomical, and behavioral perspectives to update the biological anthropological understanding of the face. A secondary goal is to identify novel evolutionary interpretations of the structure and function of the muscles of facial expression, in both human and

nonhuman primates. The role of adaptational processes in the development of species-specific features of the facial musculature will be addressed. Recent work in nonhuman primates as well as in humans will be incorporated. We also aim to identify new avenues of understanding the face that incorporate both communicative and noncommunicative functions of the muscles of facial expression and closely associated structures.

1. **Comparative microanatomy of primate facial musculature: facing up to function.** B.A. DOCHERTY, J.J. CRAY, JR., T.D. SMITH, L.E. REINHOLT, AND A.M. BURROWS.

2. **Allometry of facial mobility in anthropoid primates: implications for the evolution of facial expression**. S.D. DOBSON.

3. **Intramuscular electrical stimulation of facial muscles in humans, chimpanzees and rhesus macaques.** B.M. WALLER, L.A. PARR, K.M. GOTHARD, S-J. VICK, K.A. BARD, A.M. BURROWS AND A.J. FUGLEVAND.

4. **An introduction to ChimpFACS: Facial measurement in chimpanzees.** S-J. VICK, B.M. WALLER, L.A. PARR, M. SMITH PASQUALINI, AND K.A. BARD.

5. **The perception of primate facial expressions with regard to component movements**. L.A. PARR AND B.M. WALLER.

6. **Different Place, Different Meaning?: The Importance of Color Location in Primates.** M.S. GERALD.

7. **Movement Analysis of Two Facial Social Signals in Humans.** K.L. SCHMIDT.

Session 32. Teaching Evolution & Promoting Quality Science Education. Symposium. *DelawareD*.

Organizers and Co-Chairs: ANGI M. CHRISTENSEN, FBI Laboratory, BRIAN J. CARROLL, FBI Laboratory and ADAM D. SYLVESTER, Johns Hopkins University.

There has been a recent increase in responsiveness and discourse concerning the general public's lack of understanding of evolution and the process of scientific inquiry itself, and many feel that individual scientists have a responsibility to actively contribute to increasing public knowledge. The purpose of this symposium is to promote quality science education by encouraging physical anthropologists and other academics and scientists to work with local teachers, policy makers, and other scientists and educators to positively impact the public's understanding of scientific concepts with an emphasis on evolution. Discussion will include student perspectives on evolution and religion, challenges faced by some anthropologists, evolutionary biologists and other scientists who teach or interact with the general public on scientific issues including evolution, suggestions for meeting these challenges in effective and innovative ways, and resources and ideas for assisting local teachers and policy makers and confronting challenges to evolution and science education.

1:00 pm **The truth, the whole truth, and nothing but the truth - so help me Darwin: Legal decisions and evolution in the classroom.** R. B. HENDRIX AND A. D. SYLVESTER .

1:15 pm **Teaching the controversy – properly: Lessons from the intelligent design challenge.** W. M. RAMSEY.

1:30 pm **Knowledge is power, but attitude is everything: religion and evolution from the other side of the lectern.** K.H. BREUER AND P.A. KRAMER.

1:45 pm **On the value of anthropology for teaching about religion and science.** J. MARKS.

2:00 pm **The Darwin Day Teachers' Workshop at the University of Tennessee: scientists aiding teachers who confront challenges to teaching evolution in public schools**. A. KRAMER.

2:15 pm **How lawyers and theologians can help save evolution without wearing a lab coat.** B.W. LYNN.

2:30 pm **Expert Witnesses as Science Educators**. V.A. SMITH, B.J. CARROLL AND A. CHRISTENSEN.

2:45 pm **Evolution without Dogma.** K.M. WEISS.

3:00 pm **Break**

3:15 pm **What happened to evolution after the synthesis?: the stultification of alternative thinking.** J. H. SCHWARTZ.

3:30 pm **Evolution in Museums: The Spitzer Hall of Human Origins at the American Museum of Natural History.** I. TATTERSALL AND W.E.H. HARCOURT-SMITH.

3:45 pm **Museum opportunities for public science education.** D.H. UBELAKER.

4:00 pm **The pleasures and pitfalls of teaching human evolution in the museum.** M. SCOTT.

Saturday Afternoon – April 12, 2008

4:15 pm **Putting your scientific expertise to work: Suggestions for science education activism in your community.** A.M. CHRISTENSEN.

4:30 pm Discussant: A.J. PETTO

Session 33. Human Biology 2. Contributed Papers. *Fairfield*.

Chair: DAVID HIMMELGREEN. University of South Florida.

1:00 pm **Lead in the human femoral head.** J.J. PRUTSMAN-PFEIFFER.

1:15 pm **A deformable template for geometric morphometric studies of whole mandibles**. F.L. BOOKSTEIN AND D.E. SLICE

1:30 pm **New light on brachycephalization based on juvenile crania from Japan.** K. OKAZAKI.

1:45 pm **Understanding HIV Epidemiology: Why is Heterosexual Transmission So Much More Common in sub-Saharan Africa?** D. A. FELDMAN.

2:00 pm **Cultural ecology and epidemiology of vitamin A deficiency among lactating mothers in northern Kenya.** M. FUJITA.

2:15 pm **Bone fracture patterns and cortical bone loss in an Anatolian Neolithic population.** B. GLENCROSS, S.C. AGARWAL, P.BEAUCHESNE, C.S. LARSEN.

2:30 pm **Functional gene polymorphisms in Canadian Aboriginal populations with high rates of tuberculosis.** L.A. LARCOMBE.

2:45 pm **Break**

3:00 pm **Social classification, skin color, and genetic ancestry: a bio-cultural analysis of health disparities.** A.L. NON, C.C. GRAVLEE AND C.J. MULLIGAN.

3:15 pm **Cultural and ecological factors impeding AIDS programs in rural northwestern Tanzania.** L.A. WINKLER.

3:30 pm **Population specific craniofacial variation and its relevance to the clinical application of anthropometry.** R.E. WARD, E.S. MOORE, L. WETHERILL, T. FOROUD, AND THE COLLABORATIVE INITIATIVE ON FETAL ALCOHOL SPECTRUM DISORDERS CONSORTIUM.

3:45 pm **Abdominal depth as a principal determinant of human female attractiveness.** J.K. RILLING, T.L. KAUFMAN, E.O. SMITH, R. PATEL AND C.M. WORTHMAN.

4:15 pm **Peripubertal estrogen levels and physical activity affect young adult bone strength in women.** M.J. DEVLIN, C.M. STETTER, H.-M. LIN, T.J. BECK, R.S. LEGRO, D.E. LIEBERMAN AND TOM LLOYD.

4:30 pm **Smoking, birthweight, and infant mortality.** T.B. GAGE, E. O'NEILL, F. FANG AND H. STRATTON.

4:45 pm **Genetic analyses of *Mcyobacterium tuberculosis* strains in Kansas.** J.F. MUNGER, P. GRIFFIN, M.H. CRAWFORD AND A.J. REDD.

Session 34. Primate Behavior & Ecology. Contributed Papers. *Delaware A/B*.

Chair: LISA PACIULLI. Ithaca College.

1:00 pm **Pull or push? Experimental field study of problem-solving using tools in wild capuchins (*Cebus nigritus*).** P.A. GARBER, D.F. GOMES, J.C. BICCA-MARQUES.

1:15 pm **Female-female competition and ranging in Bornean orangutans.** C.D. KNOTT, L. BEAUDROT, T. SNAITH.

1:30 pm **Is climate change affecting plant phenology and rain forest lemurs in Madagascar**? P.C. WRIGHT, B. GREENE, P. RAKOTONIRINA AND J. SCIRBONA.

1:45 pm **A video based study of wild ateline positional behavior.** D.M. GUILLOT.

2:00 pm **Does predator risk influence when and where *Lepilemur leucopus* gives loud calls and how fast the travel? – Interaction of Moon Phase and Height in Canopy**. L. T. NASH.

2:15 pm **Grooming symmetry in male chimpanzee dyads at Ngogo.** D.P. WATTS.

Saturday Afternoon – April 12, 2008

2:30 pm **Impact of fruit abundance on bonobo party composition and social structure.** M.T. WALLER, F.J. WHITE, A.K. COBDEN AND N.M. MALONE.

2:45 pm **The interrelationship between population structure, forest ecology and behavior in red howler monkeys (*Alouatta seniculus*).** A.M. DERBY.

3:00 pm **Break**

3:15 pm **Solitary space use in male chimpanzees: inheritance of maternal range and avoidance of feeding competition.** I.C. GILBY, C.M. MURRAY, S.V. MANE, A.E. PUSEY.

3:30 pm **Activity budget of mona monkey (*Cercopithecus mona*) all-male groups.** M.E. GLENN, M.A. RAMSIER, K.J. BENSEN.

3:45 pm **Food availability affects male deference behavior in a female dominant primate, the ring-tailed lemur (*Lemur catta*).** J. A. PARGA.

4:00 pm **Elements of obesity in Orangutans (*Pongo* sp.).** A. PORPORA, L.L. TAYLOR.

4:15 pm **Variation in nutritional intake across the year for Phayre's leaf monkeys (*Trachypithecus phayrei*).** S.A. SUAREZ AND M.A. REILLY.

4:30 pm **Behavioral indicators of stress in female chacma baboons: social structure, female reproductive state, and human impact.** J.S. STEPHENSON, L. SWEDELL, M.J. O'RIAIN.

4:45 pm **Patch depletion, satiation, and patch occupancy: ecological constraints in Phayre's leaf monkeys (*Trachypithecus phayrei*).** A. KOENIG, E. MCCULLOUGH, C. BORRIES.

Session 35. Skeletal Biology. Contributed Papers. *Delaware C*.

Chair: CHRISTINE HANSON. University of Alaska, Anchorage.

1:00 pm **Assessment of upper limb bilateral asymmetry and implications for the evolution of handedness.** L.A. CASHMORE & S.R. ZAKRZEWSKI.

1:15 pm **Artificial cranial deformation in the Pleistocene Australian population at Coobool Creek.** A.C. DURBAND.

1:30 pm **A Magdalenian perinatal skeleton from Wilcyzce, Poland.** J.D. IRISH, B. BRATLUND, R. SCHILD, E. KOLSTRUP, H. KRÓLIK, D. MAŃKA, T. BOROŃ.

1:45 pm **The phylogenetic signal of the 3D morphology of endochondral *vs*. intramembranous regions of the skull.** HEATHER F. SMITH.

2:00 pm **Long sacrum in human obstetrics.** R.G. Tague.

2:15 pm **Correspondence and divergence among seven measures of long bone robusticity.** T.R. PETERSEN, O.M. PEARSON.

2:30 pm **Re-analysis of the ainu-samurai hypothesis using population genetic analysis.** N. SEGUCHI AND H. UMEDA.

Session 36. Paleoanthropology. Contributed Papers.

Chair: BRIAN RICHMOND. George Washington University.

3:00 pm **Evolution of M^1 cusp proportions in the genus *Homo*.** S.E. BAILEY, R.M. QUAM, B.A. WOOD.

3:15 pm **Distinct patterns of protostylid expression at the enamel-dentine junction of *Paranthropus robustus* and *Australopithecus africanus* lower molars**. M.M. SKINNER, B.A. WOOD, J-J. HUBLIN.

3:30 pm **Characterizing neurocranial shape in microcephalic children.** B.C. FRAZIER, K.E. WILLMORE AND J.T. RICHTSMEIER.

3:45 pm **Hominin cranial base evolution.** L. NEVELL AND B. WOOD.

4:00 pm **Evolution of Late Pliocene hominin midfacial morphology. An approach using three-dimensional surface registration.** J. BRAGA, G. SUBSOL, F. THACKERAY, G. DASGUPTA, V. BALTER, F. DEDOUIT AND N. TELMON.

4:15 pm **New fossils and studies confirm the affinities of the human remains from the Neandertal type site (Kleine Feldhofer Grotte), Germany.** F.H. SMITH, S.E. BAILEY, S.C. FEINE, K. F. HILLGRUBER AND R.W. SCHMITZ.

Author/Session Index

Decimal numbers represent poster numbers within a poster session (e.g., "13.14" is poster number 14 within Poster Session 13). Brackets represent time on a 24 hour clock within a podium session (e.g., "32[16:45]" is a paper at 4:45 pm within Podium Session 32). A number followed by a "C" indicates a chair for a session, while a number followed by a "D" indicates a discussant for a session.

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

Abstracts of AAPA Poster and Podium Presentations

An evolutionary perspective on malaria during pregnancy.

E.T. Abrams. Department of Anthropology, University of Illinois at Chicago.

Even though adults living in endemic regions are generally immune to malaria, pregnant women are susceptible to particularly frequent and severe malaria infections. Although other infectious diseases also worsen during pregnancy, the combination of altered immune and hormone profiles of pregnancy and the ability of malaria-infected red blood cells to localize in the placenta leads to particularly severe malaria infections. Despite the proximity of the parasites to the fetus, however, congenital malaria is rare. Nonetheless, both mother and infant suffer the ill effects of placental malaria, including low birth weight and maternal anemia. Poor birth outcomes are associated with the activation of both maternal and fetal immune responses that are quiescent in normal pregnancies, suggesting that these immune responses may represent a compromise between maternal and fetal health. Inspired by the work of Dr. A. Roberto Frisancho on maternal-fetal growth competition in adolescent pregnancies, this presentation will draw on research in Malawi to address the multiple levels of adaptation, including genetic, developmental, and behavioral, that enable a balance between maternal and fetal health during malaria-infected pregnancies.

A test of dynamic similarity using ground reaction forces.

J.T. Achterberg, P.A. Kramer. Department of Anthropology, University of Washington.

An understanding of hominoid locomotor patterns can explain much about both morphological function and subsistence behavior. The concept of dynamic similarity (Alexander and Jayes 1980), which states that different mammal species move in dynamically similar manners when they travel at equivalent velocities, has been proposed to compare the locomotion of animals from different species. Alexander and Jayes established five criteria as necessary for dynamic similarity, including equivalent ground reaction force (GRF) profiles. The GRF profiles can be described mathematically using Fourier analysis and ratios of the Fourier coefficients can be compared to test for dynamic similarity. Though used to predict and compare locomotor patterns of and between species, the variability of these ratios within and among individuals and groups has not been adequately characterized. We present data from 30 individuals, each of whom completed 30 trials walking across a 3-dimensional force plate (15 left foot contact, 15 right foot). Participants (age 19-57 years, mass 52-97 kg, stature 1.5-1.9 m) walked at self-selected velocities (slow, normal, and fast). All individuals gave informed consent. The data from each trial was characterized using a Fast Fourier Transform (FFT) analysis. Pearson product-moment correlation coefficients for the vertical GRFs ranged from 0.95-0.99, indicating that the equations represented the empirical data well. The Fourier coefficients from the FFT were compared within and among individuals. Interestingly, the intra-individual and inter-individual variation was comparable, and the degree of equivalence among GRF profiles was the same as the animals present by Alexander and Jayes' original study.

Morphological integration and the interpretation of fossil diversity

R.R. Ackermann, Department of Archaeology, University of Cape Town, South Africa

The fossil record of primate and human evolution cannot provide accurate estimates of within species variation and integration. This means that we cannot directly observe how patterns of integration have evolved over time in this lineage. And yet, our interpretations of fossil diversity are awash with assumptions about variation patterning in precisely these fossil taxa. Most commonly, researchers rely on extant models of variation for interpreting past diversity, by assuming equality of variation (and occasionally covariation) among extant and fossil populations. Yet one of the things we know from studies of integration in primates is that patterns of morphological covariation can differ among even closely related taxa, indicating that they have diverged over evolutionary time, either in response to selection or as the result of neutral evolution. At the same time, overall patterns of integration remain remarkably similar, meaning that in many respects they are highly conserved evolutionarily. Taken together, these seemingly contradictory observations offer an important conceptual framework for interpreting patterns that we observe in the fossil past. This framework dictates that while we can use patterns of covariation in extant taxa as proxies for extinct diversity, and indeed their conserved nature makes them superior to approaches that rely on variation alone, we also need to account for the fact that such patterns change over time, and incorporate that into our models. Here I provide examples that demonstrate how covariation patterns estimated from modern humans and African great apes can be fruitfully applied to interpreting Plio-Pleistocene hominin diversity.

Luleche, a new paleontological site in the Cradle of Humankind, North West Province, South Africa

J.W. Adams[1,2], J. Hemingway[2], A.D.T. Kegley[2], J.F. Thackeray[3]. [1]Department of Biomedical Sciences, Grand Valley State University, [2]School of Anatomical Sciences, University of the Witwatersrand Medical School, [3]Department of Palaeontology and H.O.P.E., Transvaal Museum.

Excavation in the Cradle of Humankind World Heritage Site in South Africa has produced a rich sample of Pliocene and Pleistocene fossil mammals, primarily from sites (e.g. Sterkfontein, Swartkrans, Kromdraai, Drimolen) located in the southwestern, Gauteng Province region of the designated Site. Here we report on a new fossil-bearing site, named Luleche, located in the North West Province region of the Cradle near the previously described sites of Gondolin and Haasgat. Fossil specimens were surface collected or sifted from shallow test pits from the decalcified surface sediments on an ex situ miner's dumpsite located to the south of the original cave system. No in situ fossil-bearing deposits have been identified so far, and it is unknown if the fossil materials were decalcified prior to deposition in the dumpsite or became decalcified after mining and interment in the dumps. The current fossil sample contains few identifiable craniodental specimens, but the recovered species are similar to those that occur in other South African Plio-Pleistocene assemblages. While no detailed taphonomic interpretation of the ex situ assemblage is offered, carnivore modifications on recovered specimens indicates their involvement in the initial accumulation of the skeletal materials. The discovery of fossil materials at Luleche, along with recent description of other Plio-Pleistocene localities in the region, highlights the need for continued paleontological exploration within this region of the Cradle of Humankind.
Excavation at the Luleche fossil locality was provided by a Faculty Research Fund Grant from the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg.

Age and sex-related changes in trabecular architecture over the life cycle in past populations

S.C Agarwal[1] and P. Beauchesne[1]
[1]Department of Anthropology, University of California Berkeley

Bone loss and abnormal bone remodeling are key indicators of disturbances in bone metabolism. There has been steady interest in the study of bone quantity and osteoporosis in past populations, but little examination of aspects of bone quality such as trabecular microarchitecture. We can now do this non-invasively using intact whole bones in human archaeological samples with methods such as micro- and peripheral quantitative computed tomography. While such methods have been used to routinely examine fossil specimens and/or to examine biomechanical influences on bone morphology, there use in bioarchaeology to examine health and disease patterns at the population level is unique. Here we present an overview of the use of High Resolution Peripheral Quantitative Computed Tomography (HR-pQCT) (XtremeCT, Scanco Medical AG, Bassersdorf, Switzerland) to look examine preliminary age and sex-related patterns of bone maintenance in adults and juveniles in two archaeological populations (Neolithic Çatalhöyük and Roman Velia). 4th lumbar vertebrae were scanned to examine bone mineral density, bone connectivity, anisotropy, and classic histomorphometric parameters (BV/TV, Tb.N, Tb.Th, Tb.Sp) (41µm isotropic voxels, 220 slices spanning 9.02mm, 200ms integration time per angle, 1000 angles over 180degrees, source: 60kVp, 900µA). While age-related loss of bone structure and connectivity is seen in these paleopopulations, differing age and sex-related patterns of bone loss are seen when observed across the entire life course, as compared to observations in modern populations. The implication of these findings for the interpretation and reconstruction of past lifeways from observations of bone maintenance and fragility are discussed.

From biological anthropology to applied public health: epidemiological approaches to the study of human disease.

R. Albalak. Division of Tuberculosis Elimination, Centers for Disease Control and Prevention.

Tuberculosis (TB) research in the United States faces a paradox: because of success in reducing TB incidence, there are too few cases in any one area to support the research needed to maintain and accelerate the decline. Fewer cases and resources call for creative and efficient approaches to applied TB research. The Tuberculosis Epidemiologic Studies Consortium (TBESC) pools the expertise and TB cases from 21 academic, clinical, and governmental sites across the United States and Canada. Since its formation by the Centers for Disease Control and Prevention (CDC) in 2001, the TBESC has launched 16 studies on topics ranging from immunologic markers of disease progression to the epidemiology of multidrug-resistant (MDR) TB. The TBESC's research looks for breakthroughs that will dramatically accelerate the decline in TB incidence. It also focuses on programmatic needs for more effective TB control. We describe the consortium's formation, structure, mission, and research and describe how this experience may serve as a model for other applied health care research. We also present preliminary results from a TBESC study evaluating the latest version of a recently developed *in vitro* test of cellular immune response, the quantiFERON®-TB in-tube test (QFT3), that addresses limitations of the tuberculin skin test (TST), the only test for diagnosing TB infection for more than 100 years.

Age is subjective: a non-traditional method of age estimation for the adult skeleton

B.F.B. Algee-Hewitt[1], K.E. Weisensee[1], G.R. Milner[2]. [1]Department of Anthropology, University of Tennessee, [2]Department of Anthropology, Pennsylvania State University.

Skeletal biologists often apply single-indicator age-estimation methods, such as those for the pubic symphysis and auricular surface. Even when used in combination (e.g., the "complex" method), only a few parts of the skeleton tend to be examined systematically. Problems with these methods are widely recognized: the necessary indicators are often absent, age intervals are broad, old age is typically defined as an open-ended terminal interval, and estimates are frequently biased. For adult skeletons in particular, experienced anthropologists often rely on their cumulative expertise to informally supplement standard indicator methods, observing a variety of age-related changes throughout the entire skeleton. These subjective (expert) assessments include traits that undergo limited change throughout adulthood so they individually offer little information about age. Recent work, however, indicates that collectively these traits yield reasonably accurate and highly repeatable adult age estimates. With a few notable exceptions, such as McKern and Stewart's (1957) study of young males, little attention has been directed toward quantitatively documenting rates of change in a large suite of traits.
We present criteria for systematically scoring non-traditional, mostly presence-absence, age-progressive traits distributed throughout the skeleton. Transitions from one stage to the next are estimated using 150 American White males aged 20-90 years from the William Bass Skeletal Collection. The development of methods for quantitatively treating these traits in a statistically meaningful manner is essential to their successful application in age estimation; therefore, it is necessary to identify the ages when transitions occur and the rates of change from one stage to another.

Pisiform anatomy of *Kenyapithecus africanus* and a small-bodied "ape" from Maboko Island, Kenya.

K.L. Allen, M.L. McCrossin. New Mexico State University.

We describe two similarly shaped hominoid pisiforms from the middle Miocene of Maboko Island (Kenya). These specimens provide the first evidence of the ulnar side of the proximal carpal row for *Kenyapithecus* and the small-bodied "ape" once referred to *Micropithecus leakeyorum*.
Both specimens exhibit facets for the ulnar styloid process and the triquetral. Ulnocarpal contact is a primitive primate condition, lending ulnar stability in pronograde quadrupedalism. In modern hominoids, the insertion of an intra-articular meniscus prevents the ulna from contacting the carpal row, allowing for a greater degree of ulnar deviation at this joint.
The shaft and palmar tubercle of these specimens are distinctive. The shaft manifests a strong degree of torsion, whereby the palmar process is oriented perpendicular to the long axis of the articular end. The palmar process is strongly compressed proximodistally and radioulnarly expanded. We hypothesize that the radioulnar expansion of the palmar tubercle in the Maboko apes may be related to the weak development of the hamulus in Miocene hominoids. The flexor retinaculum of *Kenyapithecus* was probably more proximally positioned than the extant hominoid condition, in which a strong hamulus anchors it distally.
The large, fan-shaped palmar tubercle, accompanied by a deep groove on the proximoulnar aspect of the shaft also suggests strong development of *m. flexor carpi ulnaris,* which is active in ulnar deviation of the wrist. This may represent a unique compromise in capacity for such movement while retaining ulnocarpal carpal contact and may relate to motions of the wrist during vertical climbing.

Gene mapping and analytical techniques: Localization of genes that shape human variation.

L. Almasy, Department of Genetics, Southwest Foundation for Biomedical Research

Genome-wide gene mapping studies for anthropological and biomedical traits in humans have become increasingly feasible in the last decade and there have been many recent successes in this area. Recent papers have reported the mapping of genes related to diabetes, obesity, alcoholism, height, bone structure, skin and eye color variation, hand preference, and the ability to digest milk sugars.
This presentation will provide a basic overview of the approaches used to localize genes influencing human variation, with a focus on techniques designed for the analysis

of complex quantitative traits that are likely influenced by multiple genes and by the interaction of these genes with each other and with the environment. Methods for linkage and association analyses, the two primary methods for gene localization, will be reviewed, compared, and contrasted and the difference between linkage and linkage disequilibrium will be explained. The study design, sample configuration (i.e. families and/or unrelated individuals), sample size, and genotyping requirements for each type of study will be discussed.
This work was supported in part by NIH grants MH59490, HL070751, AA08403, GM31575, and HL45522.

Intraspecific sex differences among primates in the density of lingual fungiform papillae.

L. Alport. Dept. of Anthropology, University of Texas at Austin.

Among humans, females have more sensitive gustatory systems than males. This difference in taste sensitivity is reflected in the density of lingual fungiform papillae (DFP). Fungiform papillae play a vital role in detecting the chemical contents of foods, and are the only gustatory structures on the anterior two-thirds of the tongue that contain taste buds. Because food selection is particularly important for the reproductive success of females, I hypothesized that sex differences in DFP would also be present in non-human primates. To test this hypothesis, DFP was measured for five primate species, including *Alouatta palliata* (n = 14), *Cebus apella* (n = 12), *Cercopithecus aethiops* (n = 18), *Pan troglodytes* (n = 46), and *Varecia variegata* (n = 18). Data were tested for sex differences using an ANOVA. In both *C. apella* and *P. troglodytes*, females were found to have significantly higher DFPs than males ($p < 0.05$ and $p < 0.01$, respectively). These results were also significant when correcting for body mass. No sex differences were found in *A. palliata, C. aethiops,* or *V. variegata.* Interestingly, there is also convergence among capuchins, chimpanzees, and humans in their large brain size relative to body mass and the slow rate at which the brain develops. Because adequate nutrition is essential to the developing brain, females of these species may have benefited from having more sensitive gustatory systems.

Fallback foods and the packaging problem.

S.A. Altmann. Dept. of Ecology and Evolutionary Biology, Princeton University.

For omnivorous primates, seasons requiring fallback foods aggravate the packaging problem: costs and benefits are inextricably linked. An animal cannot forage without exposure to risks. "There's no such thing as a free lunch!" •*Not all nutrients are present in requisite amounts in any food; not all risks are absent.* Consequently, no food has any intrinsic value, only relative to what others offer.
Two other antithetical trait pairs facilitate primates' solutions to the packaging problem. •*Deleterious effects of many toxins are non-additive; many nutrients' benefits are non-subtractive.* •Potential foods exhibit toxin and nutrient complimentarity. *Neither nutrients nor toxins occur with the same abundance or even the same abundance rank in all foods, nor do all nutrients rank inversely with all hazards.*
Seven solutions to the packaging problem enable primates and other animals to survive periods of fallback foods. 1.--Exploit areas of localized food abundance. **2.--**Among foods, select those that are relatively high in nutrients and/or low in hazards, taking advantage of nutrient and toxin complimentarity. These are the primary solutions of many omnivores. **3.--**Evolve specialized organs and physiology that facilitate getting at nutritious foods and extracting their nutrients. **4.--**Evolve specialized mechanisms for minimizing hazards that are entailed by harvesting various foods. **5.--**Evolve metabolic pathways for synthesizing those organic compounds that are not reliably present in the diet or for which the cost of obtaining them from foods exceed the cost of internal synthesis from more reliable resources. **6.--**Induce local food abundance. **7.--**Utilize nutrient storage.

Variation in the platymeric index of wild baboons.

S.K. Amugongo, Department of Integrative Biology, University of California Berkeley

Various traits on the femur are used for the determination of sex, stature, ancestry and racial variation. One trait of interest is the platymeric index (PI). Variation in this trait may also correlate with variation in locomotory habitus. In order to better understand how the PI varies in wild baboons, I calculated the PI for 240 *Papio hamadryas cynocephalus* (including 60 females and 58 male adults, as well as 122 juveniles). This skeletal population is housed at the Kenya National Museum in Nairobi and is part of the culling of baboons from a sisal plantation in Kibwezi.
The adult male and female means were statistically different (♀ mean = 99.05 , stdv = 0.48 ; ♂ mean = 99.36 , stdv = 0.58 ; $p<0.002$). This indicates that, at least in this population of baboons, the PI could possibly be used for sex determination. The standard deviation was significantly higher for the PI on the left femur compared to the right. Preliminary analyses indicate that the infants and juveniles had a lower PI, suggesting that PI changes with ontogeny.
A previous quantitative genetic analysis performed on a pedigreed captive population of *Papio hamadrayas* demonstrated that half of the variance on the PI is due to additive genetic effects (Kesterke et al., 2007). An important next step is to reconcile the quantitative genetic study with the analysis I have done on the wild population to better determine the influence of non-genetic affects on the heritability of the PI.

Realistic human reconstructions; a help or a hindrance to the promotion of scientific knowledge.

K.J. Anderson, M. Henneberg. Discipline of Anatomical Sciences, University of Adelaide, Australia.

Research into facial reconstruction/approximation is commonly linked to forensic or archaeological cases rather than display within a museum context. Forensic research focuses on the accuracy of methods which is, however, only a fraction of the information reconstructions convey to the museum public. Human face/body reconstructions in a variety of forms have been displayed by museums for over a century. These reconstructions are regularly used by institutions, journals, books and documentaries to illustrate scientific knowledge and findings to the general public. To determine the type, range and quality of facial and body reconstructions in museums KJA documented 451 life-sized human reconstructions by visiting 44 European institutions in 10 countries and interviewing 5 artists. These reconstructions range from a head to full figure, singly and as a group, (often dioramas or tableaux) with associated contextual information displayed. The reconstructions were evaluated for accuracy, realism and cultural bias using a semantic scale. It is suggested that the impact on the public and their perception of the reconstructions depends upon realism rather than the correctness of scientific content conveyed by the reconstruction. Details of the "hyper-realistic" reconstructions displaying individual hairs, skin texture, etc, create an impression of anatomical accuracy while the actual anatomical information is as limited as in the bronze statue-like reconstructions with less surface detail and no realistic colours. Cultural bias and scientific biases are present affecting for example hair styles, covered genitals and make all individuals close to average rather than presenting normal range of biological variation.

Skeletal age-at-death using the Sugeno fuzzy integral.

M.F. Anderson[1], D.T. Anderson[2]. [1]Dept. of Anthropology, University of Missouri-Columbia, [2]Dept. of Electrical and Computer Engineering, University of Missouri-Columbia.

Age-at-death of an individual skeleton is important to forensic and biological anthropologists for identification and demographic analysis, but it has been shown that current aging methods are often unreliable because of skeletal variation and taphonomic factors. Due to this, it seems

necessary to explore different ways to account for this inherent inaccuracy in the aging methods to produce better results when determining age-at-death. Multifactorial methods have been shown to produce better results when determining age-at-death than single indicator methods. However, multifactoral methods are difficult to use for single skeletons and they rarely provide the investigator with information about the reliability of the estimate. The goal of this research is to examine the validity of the Sugeno fuzzy integral for modeling age-at-death of an individual skeleton.
The Sugeno fuzzy integral is an information fusion technique that can handle uncertainty that is inherent in the aging methods. Since the age determination methods are not intended to be a rigid set of typological standards but rather describe modal age changes, uncertainty is inherent in skeletal age determination. The Sugeno fuzzy integral allows the use of as many age indicators available, the condition of the skeleton, and the accuracy of the skeletal age indicators to produce a more informed decision of age-at-death in an adult skeleton. This method is described and examples are presented using three commonly used aging methods on a known-age skeletal sample from the Terry Collection.

GIS and primate biostratigraphy in the early Eocene of southwestern Wyoming.

R. Anemone[1], W. Dirks[2], W. Moore[3], J. Van Regenmorter[1], J. Marshall[1], I. Felder[1], E. DeMeester[1]. [1]Department of Anthropology, Western Michigan University, [2]School of Dental Sciences, Newcastle University, [3]Department of Anthropology, Southern Illinois University.

The Great Divide Basin is a large sedimentary basin in southwestern Wyoming with extensive exposures of early Tertiary fossil-bearing deposits where we have worked since 1994. Much of this work has been directed towards developing a geologic and biostratigraphic framework for interpreting temporal changes in faunal associations among mammalian (and especially primate) taxa. We have identified and mapped two laterally extensive marker beds representing incursions of the Green River Formation into deposits of the Wasatch Formation in the Freighter Gap area. By measuring the vertical distance from each locality to both marker beds and to the base of the overlying Bridger Formation, we have developed a local stratigraphic section that reveals the relative sequence of fossil localities. The presence of distinctive index fossils demonstrates that the fossil faunas near Freighter Gap date from the Lysitean (Wa6) and Lostcabinian (Wa7) periods of the Wasatchian North American Land Mammal Age, roughly 52 MA. Geographic Information Systems (GIS) provide a set of cartographic and analytical tools for exploring spatial aspects of fossil data in new and exciting ways (Conroy, 2006). We have created a GIS database incorporating geological data (rock units, lithologies, and marker beds) with fossil occurrence data (ca. 2500 specimens from 30 localities) for the Freighter Gap area. In this poster we present a series of interactive maps derived from our GIS model relating the distribution of adapid and omomyid primates to geological marker beds, to mammalian index fossils, and to the overall stratigraphic section and biostratigraphic framework.
Financial support was generously provided to the senior author by Western Michigan University's FRACASF program.

An interdisciplinary study of human growth in London over the past 1000 years.

D.M. Antoine[1], S.W. Hillson[1], D. Keene[2], G. Milne[1], A. Waldron[1] AND W. White[3]. [1]Institute of Archaeology, University College London, [2]Institute of Historical Research, University of London, [3]Centre for Human Bioarchaeology, Museum of London.

The aim of this project is to investigate secular change in the rate and pattern of dental and skeletal growth in 11th-19thcentury London children, using the Museum of London's bioarchaeological collection of 17,000 skeletons. In 19th-20th century Europe there was a consistent rise in growth rate, apparently due to improved health, diet and social conditions. The direction of secular growth rate change before the 19th century is not known because there are no appropriate records of stature and there have until now been no independent ways to determine age-at-death, against which the size and shape of growing bones and teeth can be calibrated. In the project described here, age-at-death is being established by counting daily growth layers in microscope sections of the teeth of children who died before their dental development was completed. These counts are not affected by changes in growth rate and so provide an independent estimate of the number of days of growth which had taken place between birth and death. They are being used to compare growth in size and shape of long bones, skull bones, and tooth development stages in several hundred children spread over different periods of London's history. The first phase of this project has focused on the analysis of children from the sites of St Nicholas Shambles (11-12th century), St Mary Graces (14th century catastrophic Black Death assemblage), Broadgate (16th-18th century) and Old Church Street (17th-19th century). Research supported by the Leverhulme Trust.

Intraspecific relationships of molar size, jaw size, and mandibular cross-sectional area in *Homo*.

S.C. Antón[1], H.G. Carter-Menn[1] and V.B. DeLeon[2], [1]Department of Anthropology Center for the Study of Human Origins, New York University, [2]Center for Functional Anatomy & Evolution, Johns Hopkins University School of Medicine.

The role of tooth-size in dictating mandibular proportions has important implications for whether past dietary shifts can be read from fossil mandibles. Mandibular dimensions are often used to infer biomechanical aspects of diets – a questionable practice if spatial requirements of large teeth are a significant factor in producing larger mandibles. Although such spatial requirements do not universally explain mandibular corpus size in anthropoids (Plavcan and Daegling, 2006); the presence of such linkages in some taxa (including some apes), suggests that lineage-specific factors may be at play and may influence hominin mandibles.
We explore how well M_1 size explains jaw size in *H. sapiens*, and thus whether other members of the *Homo* lineage might be similarly influenced. We compare five human samples (n = 198) of differing dental size, masticatory pattern, vault proportions, and ancestry. Groups include native Australians and Alaskans with known or inferred 'heavy masticatory patterns' and precontact Peruvians and Californians and Industrial-era Americans not known for their masticatory robusticity. We scale M_1 linear-size and crown-base area (from occlusal photographs) against external and internal corpus dimensions at M_1 (internal from CT scans).
We find little support for a link between molar size and mandibular size or architecture across samples. There are fewest significant correlations in the Alaskans, who also exhibit clear evidence of adaptation to high occlusal loads. The most correlations are found in the Industrial-era sample, which arguably experienced the least loading. Within *Homo,* mandibular dimensions cannot be predominantly explained by molar size. Supported by NSF BCS 9804861.

Dental Development in Pigs - A New Model for Studying the Evolutionary Morphology of Primate Teeth.

B.A. Armfield, J.G.M. Thewissen, W.E. Horton, C.J. Vinyard
Department of Anatomy and Skeletal Biology Research Focus Area, NEOUCOM

For over 100 years, biological anthropologists have relied on teeth in evaluating the phylogeny, behavior, life history, diet and function of living and fossil primates. Alternatively, studies of tooth development have only flourished in the past 10 years. Most of this developmental research, however, has been conducted on mice with their highly derived dentitions that are not morphologically similar to primate teeth. In spite of this disjunction, biological anthropologists have begun incorporating mouse developmental data into their hypotheses regarding primate dental form and evolution.
We examine dental development in the pig, *Sus scrofa*. Because pigs have incisors,

canines, premolars and molars, they are a model for generalized mammalian dentitions and may be more appropriate for studying primate tooth development. Primates and pigs share several similarities in their dentitions and pigs are repeatedly used as models for primate craniofacial and dental research.
Embryos from 10 developmental ages were collected and categorized according to dental development stage. We are evaluating gene expression in the dental lamina via immunohistochemistry according to when genes influencing dental development are found in mice. Mouse tooth identity is believed to be determined by spatial demarcation of the proteins BMP4 and FGF8. Preliminary results suggest these proteins are expressed differentially in pigs. We are currently exploring additional pig developmental stages to document how these and other genes establish tooth identity. By combining our results with mouse data we will further studies of genetic mechanisms involved in evolution of primate tooth form and number.
Supported by NSF (# BCS-0725951).

HLA Genes in Cubans and the Detection of Amerindian alleles.

A. Arnaiz-Villena, J. Moscoso, I. Serrano-Vela, M. Martin-Villa, R. Alegre. Dept Immunology ,University Complutense Madrid and Instituto Ignacio Chavez,Havana,Cuba

Caribbean Islands including Cuba were first inhabited by Meso-American and later by Arawak-speaking Amerindians from nowadays Venezuela.Spanish invaders brought to almoust extinction to the Amerindian population after 1492.Black slaves from West Africa were taken into Cuba by Europeans.The degree of admixture among populations is approached.HLA alleles were studied both by serological and DNA tewchniques.Comparison with other worldwide populations (a total of 14.094 chromosomes) ,including genetic distances,Neighbour-Joining dendrograns,correspondence analyses and calculation of extended haplotypes.While African-European HLA features were clearly found,Amerindian characteristics are less evident,indicating that Amerindian devastation was paeticularly marked after 1492 AD.However,typical Amerindian alleles have been found in our Cuban sample,i.e.:DRB!*0403,DRB1*0404,DRB1*0407,DRB1*o411,DRB1*0802 and DRB1*0809.The presence of Amerindian alleles in Cubans may have a bear in the making up of transplantation lists at the regional level.

Pathological indicators of inbreeding and management issues in vervet and macaque skulls.

G.P. Aronsen[1], S. Wentworth[2], A. Heinzelman[1], and J. Pennington[1].
[1]Department of Anthropology, Yale University, [2]Connecticut Department of Environmental Protection.

We report a series of skeletal pathologies in a sample of Old World monkeys housed in the Yale Biological Anthropology Laboratories. While no provenience data exists for these specimens, the presence of genetic abnormalities, complications from dental surgery, and evidence of healed fractures suggests that these animals were housed in captive colonies. We examined morphometric and epigenetic features of these animals given the frequency of abnormalities observed. The macaque individuals show a number of unusual dental features, including presence of a supernumerary molar, retention of deciduous teeth, lack of third molars, crowding, and enamel pearls. The vervet sample shows a high frequency of complications possibly associated with canine blunting, including incomplete filling of pulp cavities, acute necrotizing ulcerative gingivitis, abscesses, and antemortem tooth loss. Additional pathologies, such as healed fractures in several individuals, suggest multiple issues in the captive management of these primates. These include veterinary care of individual animals, potentially high levels of aggression due to overcrowding or lack of isolation of dominant/aggressive group members, and inbreeding. Comparative craniometric and dental data are also provided. The presence of these pathological indicators of stress and inbreeding provide insight into captive management issues, and their evaluation can assist in addressing these issues via training, preparation, and legislation.

Ecological and social correlates of ectoparasite infections in Milne-Edwards' sifakas (*Propithecus edwardsi*), in Ranomafana National Park, Madagascar.

S.J. Arrigo-Nelson[1,2] and P.C. Wright[2,3].
[1]Department of Anthropology, University of Notre Dame, [2]Centre International de Formation pour la Valorisation de la Biodiversité - Madagascar, [3]Department of Anthropology, Stony Brook University, Stony Brook, NY 11794 USA

It seems clear that understanding the impact of parasites and disease on lemurs living in diminishing and degraded habitats will be crucial to their successful conservation. However, baseline data on these important factors were widely unknown for wild lemur populations until recently. This study provides investigates the richness and intensity of ectoparasite infections within populations of Milne-Edwards' sifakas (*Propithecus edwardsi*) living in both disturbed and undisturbed regions of Ranomafana National Park, Madagascar. Screenings of anesthetized animals, conducted from 2002-2007 (n = 97), revealed infection by lice, ticks, mites, biting flies and leeches at multiple stages of maturity; with over 90% of the sifakas sampled found to be infected with at least one species of ectoparasite. In this study, multiple regression analyses were employed to examine the impact of both ecological (e.g., season and magnitude of habitat disturbance), demographic (age and sex), and social (e.g., group composition and social dominance) variables on parasite loads within the sifaka populations. Our results provide much needed baseline data on the identity of ectoparasites infecting lemurs within the southeastern rainforests of Madagascar, and support earlier findings that seasonality is a dominant force shaping parasite infections in sifakas. However, they also call attention to the complex relationship that exists between ecological, demographic and social variables and ectoparasite infections within the study populations, and highlight the need for further research to clarify the conservation implications of these findings.
Funding for this project was provided by: The Earthwatch Institute, Fulbright (IIE), St. Louis Zoo (FRC), National Science Foundation (DDIG), Primate Conservation, Inc., Stony Brook University, and University of Notre Dame.

Dental biodistance analysis and evidence for interregional interaction in pre-contact Mesoamerica

B.S. Aubry, Ohio State University

The purpose of this paper is to address long standing issues regarding the nature of biological relationships between the sub-regions of pre-contact Mesoamerica. This study analyzed dentitions from sites throughout Mesoamerica including Teotihuácan, Monte Albán, Tikal, and Chichén Itzá. Other sites from each area were included in order to obtain a more comprehensive understanding of the biological relationships and to better estimate genetic heterozygosity for each sub-region. In total 2,135 individuals were analyzed, including 435 from the Valley of Mexico, 315 from Oaxaca, and 1,475 from the Maya area. Both metric and non-metric data were recorded. Non-metric traits were scored according to the ASU system, and dental metrics include the mesiodistal and buccolingual dimensions at the CEJ following a modification of Hillson et al. (2005). Biodistance estimates were calculated for non-metric traits using Mean Measure of Divergence. R-matrix analysis, which provides an estimate of average genetic heterozygosity, was applied to the metric data. R-matrix analysis was performed for each of the sub-regions separately in order to detect specific sites that deviate from expected levels of genetic heterozygosity in each area.
Results indicate interactions between sites from different sub-regions that in some ways are consistent with archaeological models. However, the results also identified previously undetected complex interactions between Central Mexico and the Maya Lowlands. The scope of the present study

results in a more comprehensive understanding of population interaction both within and between the sub-regions of Mesoamerica, and allows for the assessment of differential interaction between sites on a regional scale.
Research supported by the National Science Foundation, the Center for Latin American Studies (Ohio State University), and Alumni Grants for Graduate Research (Ohio State University).

Variations on a theme? Early Holocene human morphological variation in the New World.

B. M. Auerbach. Center for Archaeological Investigations, Southern Illinois University, Carbondale

The origins of the earliest human colonizers of the Americas remain under debate. Comparisons of the morphologies of the earliest available samples from the Early Holocene (EH) have been used to address this topic. Most of these investigations have compared New World crania, potentially indicating multiple affinities while providing little information about adaptations. Postcranial variation, however, may indicate information about origins by revealing information about climatic adaptations and population history.
In this study, body proportions, body mass, stature, and body breadth were reconstructed where possible for the earliest adult skeletons from the Americas. These are compared under the hypothesis that the EH individuals demonstrate little variation within the context of more recent human morphological variation in the New World. Osteometrics for reconstructing morphology were obtained from seven male EH New World skeletons, and from 173 adult male skeletons from seven archaeological sites reflecting a range of morphological diversity found among more recent indigenous New World populations. Univariate analyses indicate variation among the EH New World male skeletons, which present a mosaic of morphologies. All EH skeletons demonstrate body proportions within the range of more recent populations from temperate climates, although the two males preserving body breadth—Kennewick and Spirit Cave—are wider than all more recent skeletons, including the Inuit. Discriminant function analyses only successfully assign some EH skeletons to more recent populations; two EH males present morphologies unique from more recent New World populations. Results argue for heterogeneity in the earliest skeletons, and for ancestor(s) from colder, arctic climates.
This research was supported by funding from a National Science Foundation Doctoral Dissertation Improvement Grant (#0550673) and National Science Foundation Graduate Research Fellowship.

A shape-based species definition for *Homo erectus*

K.L. Baab, Department of Anthropology, City University of New York and NYCEP

Defining *Homo erectus* has been problematic for a number of reasons, including 1) disagreements about the phylogenetic significance and taxonomic distribution of discrete characters and 2) a historical focus on differentiating this species from modern humans rather than more closely related *Homo* species. While both non-metric traits and shape-related aspects of cranial morphology (e.g., long low cranial vault, sharply angulated occipital bone, wide posterior cranial vault) have figured prominently in descriptions of *H. erectus*, most definitions have been based primarily on discrete traits. However, cranial shape remains a viable (and underutilized) source of data with which to define *H. erectus*. 3D geometric morphometric analysis allows the original geometry of the fossils to be quantified and group differences to be assessed statistically.
3D cranial landmarks were acquired from a large sample of fossil *Homo* crania, including *H. habilis*, *H. erectus*, mid-Pleistocene *Homo*, Neanderthals and fossil and extant *H. sapiens*. Principal components analysis was used to explore shape differences among these closely related species. I propose a shape-based combination species definition for *H. erectus* that includes a long, low neurocranium with a long, receding frontal squama, a prominent supraorbital torus with no posterior torsion of the anterior surface, a wide and angulated occipital bone, and an inferiorly projecting entoglenoid process. Fossils of less certain taxonomic status were then evaluated against this definition (e.g., Dmanisi, KNM-ER 42700). By comparing species averages along the *Homo* evolutionary tree, it was also possible to distinguish between primitive retentions vs. derived cranial features in *H. erectus*.
Grant support provided by NSF (BCS 04-24262, DGE 03-33415 and DBI 96-02234), L.S.B. Leakey Foundation and Sigma Xi.

Genetic Variation and Population Structure in the Owl Monkey, *Aotus azarai*

P.L. Babb (1), P. Gagneux (2), E. Fernandez-Duque (1)(3), T.G. Schurr (1). (1) Department of Anthropology, University of Pennsylvania; (2) UCSD Project for Explaining the Origin of Humans; (3) Cecoal-Conicet, Argentina.

The genus *Aotus* provides a fascinating case for the study of behavioral and morphological evolution in their possession of peculiar traits when compared to other primate taxa. Yet, despite their adaptation to a nocturnal existence, monogamous social organization and high degree of paternal care, there has been a paucity of genetic research conducted on this genus. Here, we present our initial findings from studies of mitochondrial and autosomal variation in a population of wild *Aotus azarai* individuals living in the Gran Chaco region of Argentina. These individuals exhibit a surprising diversity of mtDNA haplotypes that largely fall into distinct subclades which relate to distinct family lines and migration events, and which coincide with observed field data collected over the past decade. Through the investigation of the population structure and the phylogeographic distribution of *Aotus azarai* using mtDNA and autosomal marker data, we will provide new insights into the social organization of the owl monkey and its patterns of reproductive behavior.
The authors would like to thankfully acknowledge the support for their research from the University Research Fund at the University of Pennsylvania, for Dr. Fernandez-Duque from the National Science Foundation, and for Mr. Babb from the Department of Anthropology at the University of Pennsylvania.

Genetic influences on behavior in non-human primates

J.N. Bailey, L.A. Fairbanks. Center for Primate Neuroethology, Semel Institute for Neuroscience and Human Behavior, UCLA.

Current studies of genetic influenes on behavior in non-human primates has both expanded and confirmed studies on genetic influences on human behaviors. Most of the genetic methods have focused on candidate gene approaches, looking at associations and linkages of candidate genes identified through the human literature, with particular focus on genes in the serotonin and dopaminergic systems. An advantage of studying these systems in non-human primates is that it is possible to get repeated measures of expression levels of these neurotransmitters, allowing for a more accurate evaluation of the effects genetic variation has on neurotransmittor activity. There are have also been several reports of gene X environment interactions; demostrating that environmental effects such as rearing methods have influence on gene and phenotype expression. Recently whole-genome linkage scans have been performed, using human genetic markers that are polymorphic in the species understudy. Whole genome scans allow us to look for genes outside of candidate gene areas, and allows us to potentially identify novel genes.

Evolution of M^1 cusp proportions in the genus *Homo*.

S.E. Bailey[1,2], R.M. Quam[3,4], B.A. Wood[5]. [1]Department of Anthropology, New York University, [2] Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, [3]Department of Anthropology, American Museum of Natural History, [4]Centro UCM-ISCIII de Investigación sobre la Evolución y Comportamiendo Humanos, Madrid, [5] CASHP, Department of Anthropology, The George Washington University.

Previous research has shown that tooth crown dimensions and cusp proportions are useful for taxonomic identification in Pliocene and Pleistocene hominins. This study focuses on M^1 crown size and cusp proportions within the genus *Homo*.
The results show that early members of the genus *Homo* combine a relatively small paracone with a relatively large metacone. The presence of these same cusp proportions in *Australopithecus* and *Paranthropus*, suggests they may represent the primitive condition for the hominin clade. Although the condition in *H. ergaster* is unclear due to the small sample size, all subsequent species of *Homo*, except *H. antecessor*, combine a relatively large paracone with a relatively small metacone. The Neandertal lineage exhibits further reduction of the metacone. Fossil and contemporary *H. sapiens* show a different trend toward increasing the relative size of the protocone and decreasing the hypocone. However, modern cusp proportions are not reached until Upper Palaeolithic times; and early *H. sapiens* specimens from Qafzeh resemble earlier *Homo* taxa in their relatively large hypocone.
These differences in cusp proportions appear to be related to changes in the crown area. As M^1 crown area decreases in the genus *Homo*, so does the absolute size of the metacone. In the *H. sapiens* lineage, hypocone reduction correlates with further reduction in crown area. These relationships suggest that the cusp proportions of the M^1 scale allometrically and not isometrically. Although there is some variation within taxa, these results suggest that M^1 cusp proportions provide useful information for differentiating between different *Homo* taxa.

Differential growth of Han and Tibetan children at high altitude

S.M. Bailey[1], J. Xu [2]. [1]Department of Anthropology, Tufts University, Medford, MA, [2]Sichuan University

To address the impact of immigration to an environment with novel stresses, we compared data from 253 Tibetan and Han children aged 8 to 13 in Lhasa, Tibet, at 3650 m, in Barkam, Sichuan, at 3000 m, and in Hongyuan, Sichuan, at 3100 m. All children were prepubescent, and data were covariate adjusted for age. Han children were predominantly first or second generation immigrants. Tibetan children were significantly larger than their Han peers in nearly all dimensions. They were 7 to 9 cm taller and 5-7 kg heavier, with 5-8 cm longer legs, 4-6 cm larger chests, 11-15% greater arm muscle lean area, and 9-13 mm wider ankles. BMI was .9-1.3 higher, and bodyfat 2.2-3.4% greater. In terms of proportion, Han children had greater waist to hip ratios, relatively longer forearms, but shorter calves, and shorter trunks.
On the other hand, Han and Tibetan children were similar for all skinfolds. Finally, scattered sexual dimorphism was present – Tibetan boys were significantly taller and fatter than Tibetan girls, Han girls were significantly fatter than Han boys, both sets of boys had greater arm muscle area – but there were no clear trends and the effects were small compared to ethnicity.
Tibetan children had greater FVC and percent blood oxygen saturations than their Han classmates. In age corrected MANOVAS with various measures of caloric and oxygen status, Han children's leg dimensions were particularly impacted by hypoxemia, while their overall height, waist/hip ratio and some arm dimensions more reflect caloric status and ethnicity. Soft tissue measures are affected by all three factors.
These findings suggest that movement into environments containing stresses that require genetic adaptation may place immigrants at adaptive disadvantage, and that simple measures of height or weight may fail to capture the degree of growth stress.
To partition the relative impacts of oxygen and calories, we performed several three-way MANOVA's, with ethnicity, blood oxygen saturation or vital capacity terciles, and percent body fat or BMI terciles as factors, and a set of skeletal size measures as dependent variables. For the latter, we used standardized residuals of regressions to correct for age and sex.

Subsidiary burials from First Dynasty royal funerary enclosures of Aha at Abydos, Egypt.

B.J. Baker. School of Human Evolution and Social Change, Arizona State University.

The tomb complexes of Egypt's first pharaohs are located at Abydos, Egypt, 260 miles south of modern Cairo. Since 2002-03, four funerary enclosures discovered by the University of Pennsylvania Museum, Yale University, New York University Institute of Fine Arts Expedition have been excavated in the North Cemetery, 1.2 miles (1.9 km) northeast of the royal tombs. Three of these enclosures belong to Aha, the first pharaoh of Dynasty 1, c. 3000 BCE. Five of six subsidiary graves around the principal enclosure were excavated. Looted in antiquity, skeletons were largely disarticulated, though some elements were still in situ in each grave. Five more subsidiary graves, one still intact, were excavated around two smaller enclosures to the northwest. Identities of those interred differ, based on age, sex, health status, and the quality and quantity of grave goods. The richly furnished graves around the main enclosure include a child of 3-5 years, a young adult male, two middle and one old adult females. Graves around the two smaller enclosures had fewer objects of lesser quality. All were women with a younger age profile (four young adults and one middle adult). No skeletal evidence of sacrifice is present, although archaeological data indicate the graves were roofed simultaneously.
Compared to later commoners from the North Cemetery, these royal courtiers were taller and had better dental health. Healed trauma, infection, and hyperostosis frontalis interna, however, are present. Torsion of proximal femora and other indicators among the adults suggest habitual donkey riding by courtiers.

Variation in the lateral corpus of the mandible in hominins extant from 3-1.8 Ma.

A.D. Bales. School of Human Evolution and Social Change, Arizona State University.

Between 3 and 1.8 Ma there are six hominin species that are well represented in the fossil record: *A. afarensis, A. africanus, A. aethiopicus, A. boisei, A. robustus,* and *Homo habilis*. The phylogenetic relationships of these species have been much debated over the past 50 years. I have described the lateral corpus of the mandible in each of these species and was able to identify unique morphologic patterns in this region. The lateral corpus was chosen due to its high variability across these species. Primarily non-metric traits were used in an attempt to preserve the morphologic complexity of this region, which is so often lost in purely metric considerations. Suwa (1996) defined patterns in the dentition based on a sample from the Shungura Formation in the Omo river Basin, Southern Ethiopia. This sample spans this entire diverse period. In this study I follow the pattern of Suwa's (1996) analysis, testing his hypothesis, taken from the dentition, against my observation of the mandibles from the same sample. Mosaic morphology in many of the Shungura mandibles supports the *Paranthropus* clade. The origin of the clade must be, as Suwa suggest, between 2.9-2.7 Ma. *A. robustus* evolved in eastern Africa from *A. aethiopicus* prior to 2.6 Ma. *A. boisei* appears to have evolved from an as yet unnamed "robust" Australopith prior to 2.2 Ma. Early *Homo* and *A. africanus* were found to be sister taxa, evolving from an *A. afarensis*-like ancestor prior to 2.5 Ma.

Altering the nocturnal habitat of newborn infants: the effects of postnatal sleep location on breastfeeding duration.

H.L. Ball[1], M.P. Ward-Platt[2]. [1]Parent-Infant Sleep Lab., Department of Anthropology, Durham University, UK, [2]Newcastle Neonatal Service, Royal Victoria Infirmary, Newcastle-upon-Tyne, UK.

The physiology of successful lactation requires frequent suckling--particularly at night--and mother-infant sleep contact is a normal component of night-time breastfeeding. We conducted a randomised trial to explore the effects of mother-infant sleep proximity (baby in mother's bed, side-car crib, and separate bassinette) on breastfeeding behaviour on the postnatal ward of a large UK maternity unit, using video to observe night-time mother-infant interactions. We have previously reported that unhindered access between mother and infant significantly increased both attempted

and successful night-time feed frequency in comparison with standard rooming-in (Ball et al 2006). Here we report on breastfeeding duration as assessed via telephone interview conducted at 2, 4, 8 and 16 weeks following receipt of the post-natal ward sleep location intervention. We hypothesised, based on current understanding of lactation physiology, that increased mother-infant contact and breastfeeding frequency in the initial post-partum period would be associated with greater breastfeeding duration. Significantly more dyads randomised to the bed (p=0.022) and crib (p=0.015) conditions continued exclusive breastfeeding >= 16 or more weeks than those randomised to the bassinette. We conclude that mother-infant sleep contact in the early postnatal period facilitates normal lactation physiology.
Funding provided by Babes-in-Arms.

Is there a biological rationale to the Frankfurt horizontal plane?

A. Barash, A. Marom. Department of Anatomy and Anthropology, Sackler School of Medicine, Tel Aviv University, Israel

The Frankfurt horizontal plane (FHP) is one of the most frequently used reference planes in morphological sciences, cranial surgery and dental medicine. The biological basis for this plane is that in humans it puts the line of vision parallel to the ground, perpendicular to earth's gravitational field. Over the years several authors have criticized the use of this plane. While some doubted the spatial stability of the reference points, others claimed that, as intended by its original proponents, the plane should only be used in humans, since most other animals, including non-human primates, do not hold their head in the same manner as humans.
The object of this study was to asses the nature of the FHP in human and non-human primates. This was done by defining a new plane, an optic plane (OP), using the orientation of the medial rectus (MR) muscle. The rationale behind this new plane was the assumption that humans and most primates, gaze habitually parallel to the ground, and that the medial recti muscles only rotate the eyes about the vertical axis. Three points- the origin of the left MR and the insertion of the left and right MR where digitized from CT scans. This new plane was compared with the FHP. The results indicate that in humans the two planes are almost parallel, demonstrating that the FHP indeed applies to human studies. Additionally discussed are the nature of the plane in non-human primates and its possible role as cross species plane

Patterns of upper rib morphology in hominoids.

K. B. Barker[1], C. V. Ward[2]. [1]Deparment of Anthropology, University of Missouri, [2] Department of Pathology and Anatomical Sciences, University of Missouri.

Humans are considered to differ from great apes in having a "barrel-shaped" rather than "cone-shaped" upper thorax. These differences are commonly inferred to be related a high shoulder position and so below-branch arboreality and/or knuckle-walking. Because the thorax is comprised of multiple bony elements, the ability to identify differences among taxa in rib cage shape by using disarticulated skeletons is necessary for developing methods of determining thoracic shape in fossil taxa. Jellema and colleagues (in Walker and Leakey, 1993; The Nariokotome Homo erectus skeleton) noted that chimpanzees and humans differ in their patterns of change in length, curvature, costal area, and posterior angle throughout the rib cage. This research explores the extent to which the chimp-like pattern also characterizes the other great apes and hylobatids to identify variation in rib morphology among hominoids and its association with locomotion.
Curvature, length, inscribed area, and neck angle were collected from the first six ribs of Homo, Pan, Gorilla, Pongo, and Hylobates. Ribs two through four in humans have greater curvature and a more posteriorly flaring neck, while great apes steadily increase in all dimensions from rib 1-6. Hylobatids resemble humans, reflecting a broader upper thorax
than that of great apes. No taxa differed in rib length or area.
Results demonstrate consistent differences in rib morphology associated with overall thoracic shapes described for hominoid taxa. Similarities between humans and hylobatids underscore the observation that neither a "cone-" nor "barrel-shaped" thoracic shape is not consistently associated arboreal locomotion.

The effects of allometric scaling patterns on the template method for estimating dimorphism.

W.A. Barr – Dept. of Anthropology, University of Texas at Austin.

The template method described by Reno et al. (2003) is a novel technique for estimating dimorphism in fossil taxa. This method has been used to support the contentious assertion that *A. afarensis* exhibited only human-like levels of dimorphism. In the template method, fossil samples are compared against random subsets of extant skeletal collections with known dimorphism levels. From the various skeletal elements represented in these samples femoral head diameters (FHDs) are 'predicted' by use of simple ratios computed for a relatively complete 'template specimen'. Statistical estimators of dimorphism are then calculated from these 'predicted' FHD values. Reno et al. note that their procedure tends to overestimate levels of dimorphism. The authors consider this overestimation to be a uniform bias introduced by the method which does not alter comparisons between different taxa.
The results of the present study show that allometric scaling patterns directly influence the output of the template method. Several data sets with varying allometric scaling patterns are subjected to the template methodology. Scaling patterns influence the output of the template method in a straightforward fashion. When a sample exhibits positive allometry with respect to FHD, the template method overestimates dimorphism levels. However, when a sample is characterized by negative allometry with respect to FHD, the template method underestimates dimorphism. Because levels of allometry directly influence the output of the template method, any implementation of the method that neglects this confounding variable is impossible to rigorously interpret.
This work was supported by a National Science Foundation Graduate Research Fellowship.

Ontogenetic scaling of brain size in haplorhines.

N.L. Barrickman, Department of Biological Anthropology and Anatomy, Duke University

The evolution of large brain size in humans and other haplorhines occurred through adjustments of growth trajectories. It is possible that the relationship between brain growth and body growth is congruent throughout ontogeny, such that interspecific scaling relationships are maintained. Alternatively, species may vary their relative growth rates to arrive at a different interspecific scaling relationship in adulthood. More encephalized species may extend the period of brain growth relative to body growth, or they may increase their brain growth rate relative to body growth rate.

Ontogenetic trajectories of brain and body size were constructed for thirteen haplorhines (five hominoids, 4 cercopithecoids, and 3 ceboids). All non-human data derived from skeletal material of individuals from the wild. Human data derived from the Dart and Hamann-Todd collections. Brain size was determined by taking measurements of cranial capacity. Body size was estimated from a geometric mean of several measurements of the splanchnocrania and postcrania. Loess regressions were used to plot the ontogenetic trajectories. Brain size scaling in neonates and adults was determined using linear regression.

The results show that scaling of brain size in adults has a negative allometry, while the scaling pattern of neonates is close to isometry. This curve shift during ontogeny occurs because more encephalized species have faster brain growth relative to body growth during early stages. Humans have more extreme encephalization in adulthood than at birth, and particularly rapid brain growth relative to body growth. These results suggest that energy is directed towards brain growth rather than body growth.

Geographic variation in wild orangutan diet: evidence for social learning.

M.L. Bastian[1], N. Zweifel[2], E.R. Vogel[3], S.A. Wich[4,5], C.P. van Schaik[2,1]
[1]Department of Biological Anthropology & Anatomy, Duke University, [2]Anthropologisches Institut & Museum, Universität Zürich, [3]Department of Anthropology, University of California-Santa Cruz, [4]Great Ape Trust of Iowa, [5]Behavioural Biology, University of Utrecht.

Intraspecific geographical variation in diet selection is typically attributed to differences in optimal diet, but in diverse habitats individual or social learning may be critical in approaching the optimum diet. We compare the diets of two ecologically similar Bornean orangutan populations, separated by an impassable river. To minimize the number of false negatives and positives, we applied rigorous criteria to identify food items present at both sites, but eaten at only one. As many as 79 (59%) of the 133 food items potentially shared between sites were eaten at one site only. The observed diet difference is not an artifact of differential sampling intensity. First, within-site analyses revealed no statistical differences in the mean number of individuals (1) feeding on items occurring at both, but consumed at only one site and (2) feeding on items available at one site only. Second, of the items available at both sites, 96% and 85% of the food items eaten exclusively at one site are eaten by > 1 individual. The analysis indicates that less profitable items are significantly less likely to be shared between sites. After rejecting alternative explanations, we present a model in which individuals rely on a mix of individual and social learning to approach their optimum diet. One incidental product of this process is that marginally profitable items are often unique at particular sites.
Funding for this research was provided by the L.S.B. Leakey Foundation, National Science Foundation, Wenner-Gren Society for Anthropological Research, Aleane Webb, American Society of Primatologists, The Netherlands Organisation for Scientific Research (NWO), and the Denver Zoological Society.

Mosaic evolution, integration and modularity: evolution of the human cranial base.

M. Bastir[1], A. Rosas[1].[1]Department of Paleobiology, Museo Nacional de Ciencias Naturales, CSIC.

Mosaic evolution is important in the understanding of the evolution of complex morphological structures. Mosaic evolution describes different rates of evolutionary change in different body structures, units or functions. From a morphological point of view, these units of change are characterised by increased levels of morphological integration, that is, more relationships within a unit than between different units. Such semi-independency, or modularity, is the morphological basis of mosaic evolutionary change. In this paper we present ongoing research on the development and evolution of the human basicranium and its relations to encephalisation and the morphology of the human skull. The aim of this paper is to relate static covariation, growth and development, and evolution of the human cranial base in order to shade light on possible ontogenetic and developmental underpinnings of morphological integration in the human basicranium. Geometric morphometrics of x-rays of adult humans from different geographic origins, and longitudinal data from the Denver Growth Study are used to test the hypothesis of spatial and temporal dissociations in basicranial development and variation. This information is compared with 3D analysis of morphological changes at the basicranium in fossil hominins. Our results support the view that mosaic evolutionary change can be related to mosaic developmental change. Thus, the notion "mosaic" includes spatial as well as temporal aspects and the morphological units of evolutionary change can be considered modules with specific spatio-temporal structures.
Funding: CGL-2006-02131, and MRTN-CT-2005-019564 (EVAN)

Mitochondrial DNA genetic diversity and New World demographic history

K. Batai, S.R.Williams. Department of Anthropology, University of Illinois, Chicago.

Population genetic theory predicts the correlation between effective population size and genetic diversity. However, correlation between current ethnic population size and genetic diversity among human populations are not well demonstrated using empirical data. On the other hand, post-marital residence, which can greatly affect effective population size, has been shown empirically to affect mtDNA and Y chromosome genetic variation. In this study we used published mitochondrial DNA HVRI sequence data to understand the demographic history of the New World populations. Four measurements of sequence diversity (H, θ_k, θ_S and θ_π) were compared to 1) post-marital residence pattern, 2) ethnic population size, and 3) haplogroup gene diversity calculated from haplogroup frequency. First, as expected, post-marital residence pattern was highly correlated with all the genetic diversity measurements in our analysis using a larger number of population samples. Second, ethnic population size was highly correlated with the two theta values (θ_k and θ_S) that reflect recent demographic events. Ethnic population size was not correlated with the two measurements of genetic diversity (H and θ_π) influenced by very ancient demographic events, however. Finally, haplogroup gene diversity was correlated well with all the sequence diversity measurements, as expected. From the comparison of haplogroup gene diversity with θ_k and θ_S, we hypothesize that the populations that experienced founder effect followed by reproductive isolation have fewer haplogroups, lower haplogroup gene diversity, and lower sequence variation. Populations that experienced recent bottlenecks have relatively more haplogroups and higher haplogroup gene diversity, but similarly low sequence variation.

Dental development in the Neanderthal child of Roc de Marsal (Dordogne, France).

P. Bayle[1,2], J. Braga[2], A. Mazurier[3], R. Macchiarelli[4,5]. [1]Neanderthal Museum, Mettmann, Germany, [2]FRE 2960 CNRS, Université P. Sabatier, Toulouse, France, [3]ERM, Poitiers, France, [4]Dép. Préhistoire, UMR 5198, MNHN, Paris, France, [5]Dép. Géosciences, Université de Poitiers, France.

The assessment of time and patterns of dental mineralization and eruption represents a sensitive tool to infer phylogenetic relationships, evolutionary pathways, and adaptive strategies in extinct taxa. The currently available fossil record suggests that a truly modern dental development, characterized by a prolonged condition of tooth growth, emerged relatively late in human evolution. In this context, both timing and patterning in Neanderthals are still controversial.
The analysis by Tompkins (1996) of a radiographic record of 27 subadult Neanderthals (OIS 5e-OIS 3) showed only minor differences in relative mineralization with respect to 55 Upper Paleolithic specimens from Europe and Middle East, as well as to three Holocene samples.
Based on the high-resolution (45.5 µm) synchrotron radiation microtomographic record (SR-µCT) of its maxillae and mandible, we investigated the mixed dentition (41 dental elements) of the 2.5-4 years old Neanderthal child from Roc de Marsal (Dordogne, France; OIS 4-OIS 3) by assessment of the maturational stage of each virtually extracted and 3D rendered element following Demirjian (1973, revised by Liversidge & Molleson, 2004). By using a Bayesian approach, we also calculated the probability that its deciduous and permanent mandibular sequences, based on five and six dental elements, respectively, are found within the extant human variation sampled so far.
Results show that both specific sequences are not represented within our currently available orthopantomographic- and tomodensitometric-based reference samples made of 30 deciduous and 343 permanent dentitions of living children of both sexes of African, European, and Middle Eastern origin.

Positive and negative compensatory effects as a result of bilateral femoral dislocation: a case study from Baga Gazaryn Chuluu, Mongolia

J.J. Beach[1], M.L. Machicek[2]. [1]Dept. of Anthropology, University of Indianapolis, [2]Dept. of Archaeology, University of Sheffield.

Here the findings are presented of a multi-dimensional osteological analysis of an intriguing case study discovered in 2007 in Baga Gazaryn Chuluu, Mongolia. The examined remains are of a young adult female dating to the Medieval Period. The individual suffered from a traumatic bilateral dislocation of the hip joints. Both femoral heads were completely separated from their sockets. In turn, secondary articular facets formed immediately posterior to the acetabula; the femoral heads were profoundly eburnated and remodeled. It is believed that several attributes are present on the skeletal remains that can be linked to the pathology of the hips.

To place this particular pathological condition into an osteological context, additional analyses of the skeleton have commenced. To date, these have focused on dental health and musculo-skeletal markers. The dental remains of the young woman exhibited large calculus deposits, periodontal disease, and antemortem tooth loss. These dental markers suggest rather poor dental health of the individual. However, the lack of caries data is unremarkable as it is commonplace in human populations living in Mongolia during the Medieval Period. Study of her musculo-skeletal landmarks indicates that the upper limbs were probably used for locomotion likely as a result of the lower-limb pathology. The humeri bear exceptionally large insertion points for pectoralis major. The lower limbs are not noticeably reduced in robusticity. The distinct contrast between the pronounced upper musculature markings and unremarkable lower musculature markings suggests a possible compensatory reaction as a result of the lower limb pathology.

Higher blood flow and circulating nitric oxide products among high-altitude Tibetans.

C. M. Beall[1], S. Ghosh[2], A. J. Janocha[2], W. Xu[2], S. Bauer[3], N. S. Bryan[3], J. Tejero[2], C. Hemann[4], R. Hille[4], D. J. Stuehr[2], M. Feelisch[3], S. C. Erzurum[2]. [1]Department of Anthropology, Case Western Reserve University, [2]Department of Pathobiology, Cleveland Clinic Foundation, [3]Whitaker Cardiovascular Institute, Boston University School of Medicine, [4]Department of Molecular and Cellular Biochemistry, Ohio State University.

The low barometric pressure at high altitude causes lower arterial oxygen content among Tibetan highlanders. This study tested the hypothesis that Tibetans balance physiological hypoxia with higher blood flow enabled by higher levels of biologically active forms of nitric oxide (NO), the main endothelial factor regulating blood flow and vascular resistance. The natural experimental study design compared Tibetans at 4200m and U.S. residents at 206m. 88 Tibetan and 50 U.S. residents 18-56 years of age, healthy, non-smoking, non-hypertensive, non-pregnant volunteers with normal pulmonary function participated. Forearm blood flow, an indicator of systemic blood flow, was measured noninvasively using plethysmography. NO products in plasma and red cells were measured using an amperometric sensor, the Griess reaction, chemiluminescence, high performance liquid chromatography and electron spin resonance. The Tibetans had more than double the forearm blood flow of low-altitude residents and, as a result, delivered oxygen to the tissues more rapidly than the sea-level sample. In comparison to the low-altitude sample, Tibetans had more than ten-fold higher circulating concentrations of biologically active NO products that could increase oxygen delivery but lower concentrations of an NO product that could decrease oxygen delivery. These results are consistent with previous studies reporting high concentrations of NO in exhaled breath and an association with pulmonary blood flow among Tibetans. Together, these findings highlight the role of NO and vascular factors in adaptation to high-altitude hypoxia in the Tibetan population.

The research was supported by HL60917, HL69029, NSF0452326, NSF0215747, M01 RR018390, and M01 RR00080

A new method for predicting the lumbar lordosis angle in early hominids.

E. Been. Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Tel Aviv University, Israel

Reconstructing the lordotic curvature of the lumbar spine in early hominids is essential for understanding their posture and locomotion. To date there is still no reliable method for predicting the lordotic curvature of disarticulated spines (in the absence of intervertebral disks) of early hominid. Lately it has been found that in modern humans the best way to predict the lordosis angle of a disarticulated spine is based on a lateral view of the orientation of the inferior articular processes.

This paper examines two possible methods for predicting the lordotic curvature of the lumbar spine of early hominids. The first – the traditional method – is based on the degree of wedging of the vertebral bodies, and the second – the suggested new method – is based on the orientation of the inferior articular processes.

Lateral lumbar radiographs of modern humans and primates were examined. The results show very high correlation ($r > 0.9$) between the lumbar lordosis angle and the orientation of the inferior articular processes, and moderate to high correlation ($r = 0.7$) between vertebral body wedging and the lordosis angle.

Since the preliminary results show that quadruped monkeys and bipedal humans adhere to the same model it makes prediction vis-à-vis early hominids reliable as well. Therefore a linear regression model for predicting the lordotic curvature of the lumbar spine (lordosis angle) in disarticulated spines of hominids is presented. This model, derived directly from the new method, is a more reliable predictor of the lumbar lordosis angle in disarticulated spines.

Revision of the Dryopithecinae: Phylogenetic and paleobiogeographic implications.

D.R. Begun[1], M.C. Nargolwalla[1], and L. Kordos[2]. [1]Department of Anthropology, University of Toronto, [2]Geological Institute of Hungary.

Recent discoveries of relatively complete European middle and late Miocene hominid crania clarify issues of taxonomic diversity and phyletic relations. Well-preserved specimens are known for *Dryopithecus brancoi*, *Dryopithecus laietanus* and *Pierolapithecus catalaunicus*. *P. catalaunicus* is the most primitive taxon. While only directly comparable via the I^1 and M^3, the hypodigm of *D. fontani* and *P. catalaunicus* are highly compatible, and temporally and geographically proximate. *D. laietanus* shares derived dental characters with *D. brancoi*, but retains primitive facial characters. *D. brancoi* shares characters with extant hominines, although most of these are unknown for the other taxa examined here. We suggest the following: 1) *P. catalaunicus* is a junior subjective synonym of *D. fontani*; 2) *D. laietanus* is sufficiently distinct from *D. brancoi* to warrant a genus distinction; 3) all three taxa share derived characters with extant hominines. Paleobiogeographic and paleoclimatic data provide additional evidence of dispersal and evolutionary patterns in European hominines. *Dryopithecus* diversifies into at least two genera, one endemic and the other more cosmopolitan, following the pattern in other land mammals in their respective regions. We suggest that hominines evolved from an early/middle Miocene thickly enameled taxon, becoming increasingly suspensory in response to the mildly seasonal, forested conditions of the European middle Miocene. Late Miocene taxa are more diverse, but go extinct in the Turolian, with the onset of increasingly dry, seasonal conditions in Europe. Many land mammals disperse to Africa from Europe at this time, and we suggest that hominines were among them. Supported by NSERC and OGS.

Mesowear analysis of ungulate diet during MIS 4-3 in the Levant: Implications for extinction of the Neanderthals.

M. Belmaker. Department of Anthropology, Harvard University. 11 Divinity Ave. Cambridge, MA 02138.

The extinction of Neanderthals has been attributed to climatic fluctuations during the middle pleniglacial (Finlayson and Carrión, 2007). In the Levant, speleothem stable isotope analyses (Bar-Matthews et al., 1999) indicates temperature and precipitation

changes during this period. However, the amplitude of these climatic fluctuations may not have been severe enough to cause an appreciable shift in vegetation types and habitats.
Mesowear (Fortelius and Solounias, 2000) measures the height and relief of upper molar paracones on selenodont ungulates and can be used to distinguish between the diet of browsers, grazers and mixed feeders. It was hypothesized that if climate change in the Levantine ecosystem had a palpable effect on vegetation, ungulates would increase the proportion of graze in their diet in response to changes from woodland to scrubland within the Mediterranean biome.
Mesowear was recorded on populations of *Dama mesopotamica* and *Gazella gazella* during MIS 4-3 (ca. 75-30 ky) from Israel and correlated with stable isotope data from the literature. Results indicate that no significant shift in diet is recorded for *Dama mesopotamica* or *Gazella gazella* during the early and middle pleniglacial in the Southern Levant. Moreover, the relative proportion of each taxon is persistent, suggesting no change in population carrying capacity. This indicates that during this time frame, the relative distribution between woodland and scrubland was stable. These results are consistent with paleoecological data obtained from micromammals assemblages (Tchernov, 1992). This study suggests that the role of climate change in the extinction of Levantine Neanderthals may not be significant.

Support for this research was made available by the Irene Levy Sala CARE Foundation, the American School of Prehistoric Research (ASPR), Peabody Museum, Harvard University and the Wenner Gren Richard Carley Hunt fellowship.

Frequency variation in *Victoriapithecus macinnesi* non-metric molar traits over three successive stratigraphic layers.

B.R. Benefit, A. Lambie, and M.J. Hoskins. Department of Anthropology, New Mexico State University.

This project examines non-metric molar traits from three successive stratigraphic layers from the Middle Miocene site of Maboko Island in order to ascertain whether samples from each stratum could be interpreted as distinct populations. Beds 3 and 5w have been interpreted as open woodland with equal numbers of *Climacoceras* and *Dorcatherium*, while the intervening Bed 5b as a swamp forest with more tragulids than giraffids. Maxillary M1-M3s were scored for crista obliqua, protocone shelf, distal loph and interconulus expression. Mandibular M1-M2s were analyzed for hypoconulid presence and orientation, as well as for accessory cuspules on the mesial shelf, the mesial clefts, and between the entoconid and hypoconulid. Bed 5b maxillary M2s have, using the χ^2 test, fewer crista obliqua ($p<.05$) and higher frequencies of interconulus expression ($p<.05$) than either Bed 3 below or Bed 5w above. The upper M3s exhibit a reduction ($p<.01$) in the presence of distal lophs, from 50% (n=34) in Bed 3 to 5% (n=19) in Bed 5w. Bed 5b mandibular M2s show fewer accessory cuspules than Bed 3 ($\chi^2=7.991$, $p<.05$), especially between the hypoconulid and entoconid ($\chi^2=6.975$, $p<.05$).
The difference in maxillary M2 crista obliqua and interconulus expression in Bed 5b, with respect to Beds 3 and 5w, may be due to their environmental dissimilarities. Maxillary M3 distal loph and mandibular M2 accessory cuspule reductions appear to be temporal trends which document populational differences. These results provide a backdrop by which to evaluate the validity of taxonomic distinctions based on variation in non-metric dental traits.

Methods for collecting salivary cortisol from unrestrained, adult, captive brown capuchin monkeys (*Cebus apella*).

M.E. Benitez, S.F. Anestis[1], L.R. Santos[2], R.G. Bribiescas[1]. [1]Department of Anthropology, [2]Department of Psychology, Yale University.

Collecting saliva from nonhuman primates is a relatively new method that allows researchers to non-invasively analyze hormone steroid levels. Salivary cortisol has been used as a measure of stress in a few non-human primates but the methods for both collection and analysis are unclear and incomplete. We developed a practical saliva sampling technique and validated a commercially available enzyme immunoassay (EIA) to analyze salivary cortisol levels in captive, socially housed brown capuchins. We found that our method was successful in collecting sufficient saliva for analysis (mean 70 ul produced and 50 ul needed for assay) and that blood contamination was negligible (mean transferrin value = 0.164 mg/dl). A commercially available human saliva EIA kit was successfully validated by performing a dilution (correlation between expected and observed dilution cortisol values was $r = 0.96$; $N = 13$, $p < 0.00$) and spiking experiment (correlation between expected and observed cortisol values was $r = 0.99$, $N = 5$, $p < 0.00$). Preliminary results show that there are statistical differences between morning and afternoon cortisol ($Z = -2.225$, $N = 45$, $p = 0.026$), as well as significant differences among differently-ranked males ($Z = 1$, $N = 17$, $p = .011$). However, we found no effects of trapping and isolation on cortisol in this sample. These preliminary results suggest that saliva collection for hormone analysis from captive capuchins is feasible and can provide potentially relevant information on stress and its behavioral correlates.

What do patterns of sex distribution among excavated skeletons tell us?

P. Bennike. Laboratory of Biological Anthropology, Institute of Forensic Medicine, University of Copenhagen.

The sex distribution in substantial collections of skeletal material from archaeological excavations does not always follow the same pattern, even when the remains are from the same period. Studies dealing with sex distribution interpret pattern differences in a large variety of ways. Samples of Danish skeletons from inhumation and mass graves with "known" sex distribution patterns (based on archaeological records and historical aspects and facts) demonstrate the importance of methodology and taphonomy. The variation through time of sexual dimorphism from the Mesolithic to the present population in Denmark discloses an interesting pattern.
A special focus is placed on the sex and gender variation in Iron Age Denmark related to average age, dental pathology, asymmetry of long bones, stature and bone mineral content. It is demonstrated that the type and value of grave goods are not only related to gender but also to age and stature.

Archaic stress: a tale of two cemeteries.

J.C. Berbesque, G.H. Doran Florida State University, Department of Anthropology

Here we examine the prevalence of Linear Enamel Hypoplasias (LEHs) in Buckeye Knoll from Victoria, Texas (2500-6500 ^{14}C years B. P. uncorrected) as compared to a temporally and spatially similar population, Windover, from Titusville, Florida (6980-8,120 ^{14}C years B. P. uncorrected). Digital photographs taken under controlled conditions were used to determine LEH counts on skeletal material for both sites. Data on prevalence was collected and analyzed on an aggregate basis as well as by sex. Buckeye Knoll has an overall mean LEH count in the permanent dentition of 0.935. In contrast, the Windover population has an overall mean LEH count of 2.1. Mean number of defects in both mandibular and maxillary canines for Windover were significantly higher than for Buckeye Knoll. Windover had more defect in males, females, and juveniles. Juveniles in both populations had more defects than either males or females.
This project was funded by the United States Army Corp of Engineers, Galveston.

New taphonomic findings for eagle predation on the Taung child.

L.R. Berger[1], W.S. McGraw[2], A. Baloyi[3], N. Barbolini[3], S. Karodia[3], L.A. Norton[3], G. Trower[3]. [1]Institute for Human Evolution and the Bernard Price Institute for Palaeontological Studies, University of the Witwatersrand, [2]Department of Anthropology, The Ohio State University, [3]Junior authors in alphabetical order, Bernard Price Institute for Palaeontological Studies, University of the Witwatersrand.

Breakage patterns have previously suggested that a large bird of prey was responsible for the death of a juvenile hominin from South Africa, the so-called Taung child, holotype of *Australopithecus africanus*. In a comparative study, the skull of the Taung child was compared to crania of modern monkeys killed and partially consumed by African Crowned Hawk Eagles (*Stephanoaetus coronatus*). The primate skulls were obtained from the Tai Forest of the Ivory Coast. Taphonomic analysis revealed eagle predation damage in the orbital, fontal, temporal, parietal and occipital regions. The comparative study revealed a strong similarity between the size and distribution of damage marks between the Taung child and the primate feeding remains of crown eagles. This new taphonomic evidence supports the hypothesis of eagle predation on the Taung child.

Patterns of oral health between elites and non-elites in Late Mississippian Period chiefdom level societies: An inter-area comparison within the upper Tennessee River drainage area

T.K. Betsinger[1], M.O. Smith[2]. [1]Department of Anthropology, The Ohio State University, [2] Department of Anthropology, Loyola University of Chicago

Dental health provides insight into dietary variation in a population. Status- and sex-based differences are reflected in the prevalence of dental pathological conditions within each demographic group. In many cases, the high-status group has a greater frequency of these conditions than the low-status group due to more access to refined carbohydrates. However, this pattern is not observed in all groups. In many populations, females have a higher prevalence of dental pathological conditions because they consume more cariogenic foods. In this study, we test the hypothesis that the high-status group from the Cox site, a Mississippian maize agricultural population, will have a greater prevalence of dental pathological conditions than the low-status group. In addition, based on previous research in this region, we test the hypothesis that males and females will have similar frequencies for these conditions. Dental caries, antemortem tooth loss, and dental calculus were documented in the permanent teeth of 94 adults (43 females (8 high-status, 35 low-status), 51 males (13 high-status, 38 low-status)). Statistical analyses reveal several significant results in which the high-status group has a greater prevalence than the low-status group (chi-square, $p<0.05$), indicating that the former had a more cariogenic diet. The majority of the statistical comparisons of males and females reveal no significant differences, suggesting that males and females had a similar diet and thus, similar oral health. These results support both of the hypotheses and corroborate a regional pattern.

Monitoring primate predators: Lessons from simultaneously studying leopards (*Panthera pardus*) and chacma baboons (*Papio hamadryas ursinus*) in South Africa.

L.R. Bidner, School of Human Evolution and Social Change, Arizona State University

The risk of being killed by a predator is considered to be both a critical factor affecting primate behavioral ecology and a major driving force within primate evolution. Predators of living primates are often difficult to detect and thus extremely difficult for primatologists to monitor. Evaluation of the accuracy of methods used to monitor predator presence is critical for assessing the degree of predation risk faced by primate study subjects. In this study, three methods (radiotelemetry, observation of 'sign' such as tracks and feces, and remote camera traps) were used to monitor leopards in the home range of a chacma baboon study troop, as part of a larger project on predation risk at Loskop Dam Nature Reserve, South Africa.
Two female leopards were fitted with VHF transmitting collars and tracked for nine months of the study. At the same time, the location and estimated age of all observed leopard signs was recorded. Two remote digital camera traps were also set up at various locations within the baboon troop's home range during this period. The patterns of leopard presence produced by these three methods differed dramatically. Both sign observation and camera trap photos revealed a much lower leopard presence than was actually detected using radiotelemetry. These results indicate that predator signs and camera trap photos do not provide an accurate measure of predator presence. Given this, any estimation of predator presence or predation risk based on either of these methods should be used with caution and considered to be an underestimation.
This research was funded by the Leakey Foundation, NSF (BCS-0550918), Wenner-Gren Foundation (Gr-7365), Sigma-Xi, American Society of Primatologists, and Arizona State University.

Comparing signatures of natural selection in two high altitude human groups.

A.W. Bigham[1], X. Mao[1], T. Brutsaert[2], L.G. Moore[3], R. Mei[4], M.D. Shriver[1]. [1]Department of Anthropology, Pennsylvania State University, [2]State University of New York at Albany, [3]Health and Behavioral Sciences/Anthropology, University of Colorado at Denver and Health Sciences Center, [4]Affymetrix Inc, Santa Clara, California.

High altitude environments, wherein geographically distinct human populations have adapted to hypoxic conditions, provide anthropologists with a natural laboratory to study the effects of selective pressures on human variation. To further understand the role of hypoxia in shaping genetic diversity in two high altitude population groups (Quechua- Aymara and Tibetan), we performed a genome scan using 1 million single nucleotide polymorphisms (SNPs) scattered throughout the genome. Using the statistics F_{st}, LSBL, ln*RH*, Tajima's *D* and a whole genome long range haplotype test (WGLRH), we compared the signatures of selection found in Tibetan populations to those found in Andean populations. Based on the results of this genome scan, we identified similarities and differences between populations. This study lays the ground work for future research that correlates genotype to phenotype.

Biological affinity of two non-ruling elite Classic Maya plazuela groups.

S.B. Black, San Diego State University

Buenavista del Cayo is a Classic Period Lowland Maya site located in the upper Belize River Valley. As part of the San Diego State University Mopan-Macal Triangle Project, this site was excavated between 1984 and 1989. A number of burials were excavated from two plazuela groups, Plazuela 1 (Archangel) and Plazuela 2 (Angel), which are considered non-ruling elite populations dating from the terminal Early Classic period through full Late into Terminal Classic periods. These two groups show artifactual and spatial ties to or even into the high-elite or regal status Buenavista-Cahal Pech court and associated lineage and courtly activities. Two essential research questions regarding Archangel and Angel were (1) Are the individuals interred at Archangel and Angel biologically related and (2) Is either group related to the Buenavista-Cahal Pech ruling elite? Dental morphology, as well as dental metric traits, is an informative source of data for establishing segregation within lineages and differences between populations; and therefore to answer these research questions, dental non-metric and metric traits of the permanent dentition were recorded. Statistical analysis (Hierarchical Cluster Analysis, ANOVA, Fisher's Exact Test; $p<0.05$) reveals that Archangel and Angel had more non-metric and metric dental traits in common with each other than with the Buenavista-Cahal Pech ruling elite; and this is complimentary to previous results for this site. Furthermore, the close geographical proximity and occupational history of Archangel and Angel suggests the abandonment and use of these two plazuelas by the same people.

Metric and non-metric trait variation in the dentition of Holocene Khoesan populations.

W. Black, R.R. Ackermann, J. Sealy. Department of Archaeology, University of Cape Town.

There have been many studies of dental variation in Holocene populations of Europe

and the Americas, but few of African populations. Here, we present preliminary work on dental variation in the Khoesan, an African people who have received considerable attention from archaeologists and physical anthropologists. Recent research on well-dated Khoesan skeletal material has revealed general cranial size and stature fluctuations during the past 12,000 years, which appear to result from intrinsic factors affecting the populations, rather than gene flow from outlying areas. These results are consistent with hypotheses of morphological and genetic continuity in Southern African populations during this time. Most previous work has, however, focused on the second half of the Holocene. Here, we add to this body of work by examining dental variation among the Khoesan, extending back into the early Holocene.
Metric and non-metric data were collected from >500 adult individuals. When possible, standard dental measurements were taken on all teeth. Cervical measurements, which are less affected by heavy wear, were also taken on all molars. Additionally, dentition was scored for a suite of dental morphological attributes, including 40 crown, root and intra-oral osseous traits. Results demonstrate fluctuations in tooth size that generally conform with the mid- to late Holocene size variations observed in cranial and post-cranial material. Teeth, during this time period, appear to be smaller than Early Holocene counterparts and discernible reductions are identified through most measurements. Qualitative trait variation is largely consistent throughout sample, supporting the hypothesis of population continuity throughout the Holocene.

The effect of pelvic dimorphism on locomotor cost: are women less efficient than men?

A. Blackburn Wittman, H. Pontzer. Washington University in St. Louis.

While the human pelvis has been shaped primarily by the demands of bipedal locomotion, it has long been argued that sex differences in pelvic shape related to parturition negatively impact locomotor efficiency in women. We tested this hypothesis using a biomechanical approach. Force plate, kinematic, and oxygen consumption data were used to calculate the mechanical advantage of the hip abductor muscles (gluteus medius and gluteus minimus), active muscle volume at the hip, and metabolic energy expenditure during walking and running in 11 subjects (6 males, 5 females). Results indicate that there are no significant differences in effective mechanical advantage (EMA) of the abductor muscles, or active muscle volume between men and women either during walking or running. Metabolic cost was also not significantly different between the sexes. However, EMA did change significantly with gait, decreasing during running Finally, active muscle volume at the hip was similar in magnitude to the muscle volume from other joints of the leg during both walking and running, indicating the gluteal abductors may be an overlooked source of energy expenditure during locomotion. These results have important implications for the evolution of pelvic dimorphism and endurance running in hominins.

Behavioral indicators of female choice in blue monkeys in the Kakamega Forest, Kenya

M. Blair, M. Cords. Department of Ecology, Evolution and Environmental Biology, Columbia University, New York Consortium in Evolutionary Primatology (NYCEP).

Recent analyses of paternity highlight the importance of female choice in the mating strategies of some primates. This study addressed several questions about female blue monkey (*Cercopithecus mitis stuhlmanni)* sexual behavior using observational data from three social groups (N=61 adult females) in the Kakamega Forest, Kenya over five years. Females exhibited all five suspected proceptive behaviors (presenting, puckering, head-flagging, grooming, and following a male) to a given male significantly more than expected on days when copulation behavior with that male occurred. Our findings thus confirm that these behavioral elements indicate female mating interest. Breeding seasons sometimes include the influx of multiple adult males into a group. During their conception periods, females directed proceptive behavior to and copulated with significantly more males in influx than non-influx seasons, suggesting that fertile females respond to the increased number of available mates. Comparing females' sexual partners in conceptive vs. non-conceptive estrous periods, we found that females in one group copulated with significantly more males during conceptive estrous periods. Finally, females clearly interacted with many males non-randomly, showing both preferences and avoidance. Not all females in a group preferred the same male. Our data suggest that behavioral mechanisms of female choice occur in this species, and that they influence the mating patterns of conceptive females. Some aspects of these patterns may reduce the probability of infanticide. We will pair these behavioral data with genetic paternity data in a forthcoming study to confirm the effectiveness of female choice on mating behavior and paternity success.

Discovery of sympatric *Cheirogaleus* species in the high-altitude rainforest of Tsinjoarivo, eastern central Madagascar: implications for biogeography and conservation.

M.B.Blanco[1], L.R. Godfrey[1], M. Rakotondratsima[2], K. Samonds[3], J-L. Raharison[4], and M.T. Irwin[5].[1]Department of Anthropology, University of Massachusetts, [2]Département de Paléontologie et d'Anthropologie Biologique, Université d'Antananarivo, [3]Redpath Museum, McGill University, [4]Département de Biologie Animale, Écologie-Environnement, Université d'Antananarivo, [5]Department of Biology, McGill University

The number of species within the genus *Cheirogaleus* is currently under debate. Museum-based studies are inadequate due to the spotty representation of individuals in collections, and field work, supplemented by morphometric and genetic analysis, remains essential for documenting the geographic distributions and ecological characteristics of dwarf lemur populations. One of the regions in Madagascar that has been understudied is the central high plateau. Tsinjoarivo, an eastern-central high altitude rainforest, is biogeographically unique because it spans the highest elevations known for rainforest in Madagascar and is isolated between two major river barriers. In November-December, 2006, we conducted a survey of nocturnal lemur species at two research sites at Tsinjoarivo, one located in continuous forest (Vatateza), and the other in a forest fragment (Andasivodihazo), about 12 km northwest. Ten Tomahawk traps were set daily and captured dwarf lemurs were anesthetized, marked and measured (n=11). Skeletal and dental morphology was studied using dental molds of the captured animals' lower dentition, one naturally-dead individual, and museum specimens. We report evidence of two dwarf lemur species at Tsinjoarivo. One, from the continuous forest, resembles *C. major*, although it is smaller than its counterpart at Ranomafana National Park, a southern rainforest. The other, from the fragment, displays coat and dental characteristics similar to *C. sibreei*, a species described only from museum specimens and for which no living population has been reported in eastern Madagascar. In consequence, this study represents the first confirmation of a living population of "*C. sibreei*-like" dwarf lemurs in Madagascar.
Supported by: David J. Klingener Endowment Fellowship, MMBF/CI Primate Action Fund, The Rufford Foundation to MBB and Margot Marsh Biodiversity Foundation, NSERC to MTI.

Current trends in human genomic science in relation to the dissection of human variation.

J. Blangero. Dept. of Genetics, Southwest Foundation for Biomedical Research

In this presentation, I review the current state-of-the-science with regard to the dissection of the genetic basis of complex human phenotypes. Tremendous progress in genotyping and sequencing technologies now allow us to examine millions of potential sequence variants at a time in our search for genetic factors underlying human biological variation. Using an objective prioritization approach based around formal statistical

inferential procedures, it is now feasible to identify many of the causal genetic factors influencing a specific quantitative phenotype. In particular, Bayesian quantitative trait nucleotide analysis can be used to provide posterior probabilities of a gene's likely causal involvement in the determination of a given phenotype. Advanced parallel computing approaches utilizing large numbers of processors can be exploited to overcome the great computational burden associated with such analyses. To show the utility of this general integrative genomic procedure, several examples of the statistically driven identification of genes and functional sequence variants influencing human quantitative endophenotypes related to complex disease risk will be highlighted. Both genome-wide association analysis and comprehensive resequencing approaches are utilized. Finally, the extension of these approaches to the impending future case of whole genome resequencing is developed.

Biocultural implications from scanning electron microscopy of prehistoric human dental calculus, Ohio.

S.H. Blatt. Department of Anthropology, The Ohio State University.

Dental calculus, though it provides a unique calcium reservoir of bacteria and dietary debris seldom preserved elsewhere in the archaeological record, is an overlooked source of data in anthropological literature. Small particles of archaeobotanical debris can adhere and become incorporated into unmineralized plaque on teeth during mastication. The physical inclusion of bacteria and archaeobotanical debris in the matrix of calculus is direct evidence for the contemporaneity of both structures, because the mineralization of dental plaque occurs only in the presence of saliva. This research reassesses the value of collecting human dental calculus from archaeological remains and provides insight into the oral health and diet of prehistoric Native Americans in northern Ohio.
Samples of dental calculus (n=20) were collected from the Danbury site (33OT16) in Ottawa County, Ohio. AMS dating indicated habitation of the site from the Late Archaic through Late Prehistoric periods. The amount and location of calculus was scored according to Brothwell's (1981) index. Each specimen was diluted with 5% hydrochloric acid to remove carbonates and contamination and examined for possible inclusions using a JEOL JSM 820 scanning electron microscope. Analysis yielded a variety of noticeable inclusions, including both mineralized bacteria, calcium-phosphate (CaP) crystalline structures, numerous phytoliths (amorphous, grass, and non-grass types), and cotton-like cellulose fibers. SEM analysis of was limited, however, by the disaggregation of debris and the lack of standardization of phytolith and starch grain classification. These microscopic remains provide insight into dental health and paleoethnobotanical history and should be supplementary to other paleodietary and paelopathology analyses.

Menopausal symptoms among British Pakistani women.

M. Blell. Department of Anthropology, Durham University.

Menopause is both a biological universal for women and a personal experience shaped by biology, culture, and society. Studies have previously shown differences in reported symptom experience at menopause between ethnic groups/populations; this is the first large scale study to examine the menopausal experience in women of Pakistani origin in the UK. One factor not always considered is that researchers' and participants' ideas may differ about which physical and emotional changes experienced at mid-life are related to menopause and which are not. Moreover, the frequent use of symptom checklists to determine symptom experience can obscure these differences. Understanding these differences is important for determining the universality of the menopause syndrome, as distinct from final menstrual period. As part of a biosocial study of menopause, semi-structured interviews were carried out with 256 British Pakistani women aged 40-60 living in the Leeds/Bradford area of West Yorkshire, UK. Participants were asked to report any changes they had personally experienced (positive or negative) which they associated with menopause and to rate them in severity (for negative symptoms) or how big a change it was (for positive or neutral symptoms). The interviewer also read aloud a list of 34 symptoms related to menopause in other studies and asked the participant whether she associated each symptom with menopause. Symptom experience frequencies were compared to existing studies carried out in Pakistan and Britain and factor analysis was used to investigate underlying higher-order abstractions in the understanding of menopause symptomatology using the menopause symptom checklist responses.
Supported by the Parkes Foundation, Overseas Research Students Awards Scheme (ORSAS), and Durham University Doctoral Fellowship.

Genetic variation for life history and morphology in the Cayo Santiago female rhesus macaques (*Macaca mulatta*).

G.E. Blomquist. Department of Anthropology, University of Missouri.

For populations to be affected by selection and drift there must be genetic variation in traits. Several explanations predict how the standing level of additive genetic variation should be patterned according to a trait's relationship with fitness. In populations close to an evolutionary equilibrium, traits tightly associated with fitness are predicted to have low genetic variance, because of the "erosion of variance" by selection. Other explanations focus on the genetic and developmental processes that generate genetic and residual variance in traits—either through differences in mutational input or interdependencies among traits.
I tested these predictions by calculating the heritability and coefficients of additive genetic and residual variation for 6 life history traits (including fitness) and 15 skeletal measurements using long-term demographic records and the skeletal collection of female macaques from Cayo Santiago. REML methods, allowing maximum use of pedigree information, were implemented in the program DFREML. Only sexually mature females were included in the analysis (n = 98 to 883). The association between each trait and fitness was estimated by the parametric correlation between them. In contrast to expectations of the "erosion of variance" view, fitness and life history traits closely correlated with it have modest heritabilities. Additionally, the patterning of coefficients of variation offers support to models stressing the incorporation of residual variance, due to functional interdependence, by traits closely associated with fitness. While these results do not match equilibrium expectations, they are not unusual when compared to similar investigations of genetic variation in other mammalian species.
Research supported by the University of Illinois Graduate College. Cayo Santiago and the Caribbean Primate Research Center are NSF, NIH, and University of Puerto Rico funded facilities. Paternity data, used under agreement in this research, was gathered by John Berard, Fred Bercovitch, Matt Kessler, Michael Krawczak, Peter Nurnberg, and Jorg Schmidtke.

An application of Life History and Parental Investment Theory to settlement decisions of Guatemalan Maya women in Los Angeles.

B. Bogin[1], J. Loucky[2]. [1]Department of Human Sciences, Loughborough University, UK, [2]Department of Anthropology, Western Washington University, USA.

The well-being of children and families is critical in guiding the settlement processes of refugee and immigrant parents. Parental Investment Theory, which is a part of the larger field of Life History Theory, predicts and explains the reproductive behavior strategies of many species. Human beings are no exception, but human technology, social organization, and ideology add novel cultural dimensions. For example, while children are financially draining, there are powerful cultural values associated with having and raising them. Life History and Parental Investment Theory are little utilized to inform Migration Theory. This presentation examines how Maya women from Guatemala respond to the multiple challenges of establishing new lives in the urban neighborhoods of Los Angeles, through work strategies, social networks, and residence decisions that foster the family

health and safety of their children. Three parental investment strategies characterize the Maya women in Los Angeles: 1) greater involvement in wage labor than in Guatemala, 2) greater reliance on non-kin social networks than in Guatemala, and 3) greater mobility to find safe and culturally meaningful places of residence for their children than in Guatemala. Life history stage of the offspring (i.e., infant, child, juvenile, or adolescent) modulate these investment strategies. Our findings contradict many common assumptions about the behavior of immigrant women. Closer attention should be given to Life History and Parental Investment Theory as a significant, and to date neglected, area of Migration Theory.

A deformable template for geometric morphometric studies of whole mandibles.

F.L. Bookstein[1,2] and D.E. Slice[1], [1]Department of Anthropology, University of Vienna, Austria,and [2]Department of Statistics, University of Washington, Seattle.

Today's conventional toolkit of geometric morphometric methods for 3D data is standardized for landmark points but is not yet standardized for the more attractive, extensive, and realistic 'semilandmark' data types arising from curves and surfaces. Furthermore, the standard descriptions of anatomical surface forms (as from bones)or solid anatomical form (as from space-filling organs) interweave descriptors of all three types. Landmark points typically lie on curves (and often delimit them), and curves likewise typically lie on surfaces that they may delimit. But not all landmark points lie on curves, and not all curves lie on surfaces. What we mean by 'digitizing' then, is often the instantiation of a complex and delicate template by deformation partly onto a specimen surface and partly 'into its vicinity.' In those applications, the points and curves have to be deformed consistently with the surfaces on which they lie, and the technology must be coherent with the full range of shape factors and global and regional shape differences, ontogenetic or phylogenetic, under study.

This presentation demonstrates all of these options using a simple deformable template of the left hemimandibular bone as extracted from a CT scan. The scheme includes 14 landmark points, four curves(symphysis, mandibular border, alveolar ridge, and coronoid notch), and two surface patches. Four of the landmark points lie on the curves, and ten on the surface, along with three of the curves. Complex surface features such as ridge curves can be digitized expeditiously using the deformation machinery of one software testbed for this purpose, the {\tt edgewarp} program package out of Vienna and Seattle.

This research is supported by EU Marie Curie grant MRTN-CT-2005-019564, 'EVAN', to the University of Vienna.

Costs of large groups: developmental and reproductive rates in wild Phayre's leaf monkeys (*Trachypithecus phayrei*)

C. Borries[1], E. Larney[2], A. Lu[2], K. Ossi[2], A. Koenig[1]. [1]Department of Anthropology, Stony Brook University, [2]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

Group size of gregarious primates is suggested to be constrained by feeding competition, which may cause slower somatic growth rates and may ultimately lead to reduced reproductive rates in larger groups. If feeding competition is relaxed, as is assumed for more folivorous species, such reproductive disadvantages are not expected. However, competition for food has now been documented in a number of studies on folivorous primates, even though ultimate consequences for larger groups have rarely been determined. We investigated speed of infant development and female reproductive rates in an Asian colobine monkey (*Trachypithecus phayrei*). Since October 2000 a wild population has been studied at the Phu Khieo Wildlife Sanctuary, Thailand. The three main study groups averaged 11.4, 18.3 and 25.8 individuals respectively. Data span 185 group months. Measures of developmental speed of infants include age at completion of fur color changes after birth (N=13) as well as weaning age (N=35). Reproductive rates were determined via interbirth intervals (N=38). Rearing success was approximated via infant survival to one and two years of age (N=53 and 43). Both measures of developmental rate decreased significantly with increasing group size. Interbirth intervals were about 13% longer in the large group while there was no difference in infant survival rates. Thus, females in larger groups ultimately pay a price in terms of slower infant development and reproduction. Future analyses will reveal whether scramble competition for food or group specific differences in habitat quality is the main influencing factor in the study population.
Supported by NSF (BCS-0215542, 0542035), NSF DDIG (BCS-0452635, 0647837), American Society of Primatologists, Leakey Foundation, Stony Brook University, and Wenner-Gren Foundation.

New crania of a primitive plesiadapid (Mammalia: "Plesiadapiformes") from the Late Paleocene of Alberta.

D.M. Boyer[1], C.S. Scott[2], R.C. Fox[3]. [1]Department of Anatomical Sciences, Stony Brook University Medical Center, [2]Royal Tyrrell Museum, [3]Department of Biological Sciences, University of Alberta Laboratory for Vertebrate Paleontology.

"Plesiadapiforms" are known from the Paleogene of North America, Europe, Asia, and possibly Africa. Cranial features often cited as evidence for a close phylogenetic relationship between "plesiadapiforms" and Euprimates include presence of a laterally-positioned groove for a transpromontorial branch of the internal carotid plexus (ICP) and a petrosal bulla in the plesiadapid *Plesiadapis tricuspidens*. This relationship has been questioned by alternative interpretations of plesiadapid cranial material, based on morphological patterns in crania of other "plesiadapiforms," extant euarchontans, and rodents. We describe four new cranial specimens of the primitive plesiadapid *Pronothodectes gaoi*. Crania of *P. gaoi* are similar in morphology to those of other well-preserved plesiadapid specimens. A laterally-positioned groove, often interpreted as marking the course of the ICP, is clearly present on all specimens. In two specimens, the groove is biconcave with a midline ridge, as is frequently the case for the ICP route in extant mammals. We evaluate the composition of the bulla with high resolution x-ray computed tomography of a petrosal of *P. gaoi* and of some extant rodents with ectotympanic bullae that appear continuous with the petrosal. Our observations suggest that primitive plesiadapids, as represented by *P. gaoi*, retained a laterally-positioned groove for the ICP and a petrosal bulla. A laterally positioned groove is thus likely plesiomorphic for Plesiadapoidea (Carpolestidae, Chronolestidae, Plesiadapidae, Saxonellidae) given its presence in paromomyid "plesiadapiforms." A petrosal bulla in primitive plesiadapids, as also seen in euprimates and carpolestids, but not in paromomyids, strengthens cranial evidence supporting the recently hypothesized plesiadapoid-euprimate clade (Euprimateformes).
This research is supported by a NSF DDIG to Doug Boyer (BCS0622544)

Primate pigmentation: Understanding the genetic basis of convergent coat color phenotypes.

B.J. Bradley[1], M. Irwin[2], P.M. Kappeler[3], P. Moisson[4], T.L. Morelli[5], J. Pastorini[6], N.I. Mundy[1]. [1]Department of Zoology, University of Cambridge, UK, [2]Department of Biology, McGill University, [3]German Primate Center, Goettingen, [4]Mulhouse Zoo and Botanical Garden, France, [5]Department of Ecology and Evolution, Stony Brook University, NY, [6]Centre for Conservation and Research, Rajagiriya, Sri Lanka.

Primates exhibit striking pelage color variation both within and across taxa. But while closely-related species often look very different, distantly-related taxa can show marked similarities in coat color phenotype. For example, white hair patches and black-and-white variegated patterns are common in many primates (e.g. indri, black & white ruffed lemur, black & white colobus monkey)

as well as other mammals (e.g. panda, Malayan tapir, killer whale).
Although we know surprisingly little about the genetic basis and evolution of coat coloration in primates, the genetic basis of pigmentation in mice and domestic animals is relatively well understood. In mice and domestic pigs, the presence of white hair patches is usually controlled by genes involved in the distribution of melanocyte (pigment-producing cell) precursors during embryogenesis, and white hairs generally lack functioning melanocytes. To assess whether white patches in primates have a similar proximate mechanism, we examined gene expression in the follicles of white and pigmented hair tufts from living monkeys (2 species) and lemurs (6 species) and checked for the presence of active melanocytes via quantitative RT-PCR of a melanocyte marker gene (*MITF*). For all individuals, white hair follicles showed high *MITF* expression levels, similar to those of pigmented hair, indicating that white patches in these primates have functioning melanocytes, unlike white patches in mice. Our results indicate that convergent color phenotypes (in this case white patches) observed among primates and other mammals can come about via different molecular mechanisms. Identifying the proximate bases of pigmentation is an important step toward understanding the evolution of coat color diversity in primates.

Evolution of Late Pliocene hominin midfacial morphology. An approach using three-dimensional surface registration.

J. Braga[1], G. Subsol[2], F. Thackeray[3], G. Dasgupta[4], V. Balter[5], F. Dedouit[1], N. Telmon[1]. [1]Department of Biological Anthropology, University Paul Sabatier, France [2]Department of Informatics, LIRMM, University Montpellier, France [3]Transvaal Museum, Pretoria, South Africa [4]Department of Engineering Mechanics, Columbia University [5]Ecole Normale Superieure, Lyon, France.

The three-dimensional (3D) morphology of the facial skeleton is complex because it comprises several curved and small localized surfaces which form may help to differentiate masticatory patterns, species and phylogenetic relationships among fossil hominins. We quantified and visualized the facial shape variation in Late Pliocene hominins using the cutting-edge computational, similarity-based methods of 3D surface fine registration and 3D inspection colour mapping.
Samples included specimens from Sterkfontein Member 4 and Kromdraai B, South Africa. For comparative purposes, we added 10 adult chimpanzees and 10 adult bonobos with equal numbers of males and females, as well as some Early Pleistocene hominins from South and East Africa. Computed tomography data were used to generate three-dimensional triangulated mesh models which midfacial components were then converted into smooth NonUniform Rational B-Spline (NURBS) surfaces. In addition to the overall study of the midface, four separate analyses were conducted, each focused on a surface patch representing an area of morphology which have raised interest in the past (*e.g.*, infraorbital region, zygomatic process, anterior pillar ...).
Preliminary results suggest that the adult midfacial remains represented in our sample from Sterkfontein Member 4 show a greater range of morphological differences when compared to the shape differences observed within each of our two extant samples (chimpanzees and bonobos). We discuss the implications of our results for the understanding of the facial differentiation and evolution among the Late Pliocene hominins (particularly, the gracile/robust lineage).
Research supported by the Centre National de la Recherche Scientifique (PEPS-ODENT Project), the French Ministry of Foreign Affairs and the EU PF6 Marie Curie Actions grant MRTN-CT-2005-019564 'EVAN'.

Skeletal pathologies associated with pellagra mortality: a comparative analysis of pellagrins from the Raymond Dart and Robert Terry anatomical skeletal collections.

B.P. Brenton[1], D. Tompkins[2], R.R. Paine[3]. [1]Department of Sociology and Anthropology, St. John's University, [2]Department of Anthropology, University of Massachusetts-Amherst, [3]Department of Sociology and Anthropology, Texas Tech University.

This paper reports on an analysis of skeletal pathologies from 25 individuals known to have died from pellagra. Fourteen pellagrins (Black South Africans) are part of the Raymond Dart Skeletal Collection, housed at the University of Witwatersrand Medical School, Johannesburg, South Africa. A comparative sample of 11 pellagrins (African-Americans and European-Americans) is from the Robert Terry Anatomical Skeletal Collection located at the Smithsonian Institution. Both collections have available individual profiles that include age, sex, ethnicity, and cause of death.
Pellagra, primarily a niacin deficiency disease, is most often associated with high-maize/low protein diets and poverty. Both samples are drawn from historical and geographical contexts in which pellagra was common in populations whose diets were highly maize dependent. Overall, these pellagrins exhibit periostitic lesions of the lower limbs, and show a high incidence of alveolar bone loss and dental caries. This corresponds to regions where soft tissue is known to be affected by pellagra. Additional pathologies noted for both samples include: osteomyelitis, cribra orbitalia, cranial pitting, and enamel hypoplasias. A high frequency of skeletal trauma is also seen in these sub-populations.
Although neither a specific skeletal signature of pellagra or distinctive pattern between these two samples is noted, the findings do offer new insights into skeletal-based interpretations of nutrition-related health problems, and for the paleopathology of maize-dependent prehistoric and historic populations. Future research for the Terry Collection will include the histological examination of ribs to compare microstructural patterns already initially reported for the Dart Collection pellagrins (Paine and Brenton 2006).

Knowledge is Power, but Attitude is Everything: Religion and Evolution from the Other Side of the Lectern.

K.H. Breuer[1] and P.A. Kramer[2] [1]Department of History, The University of Texas at Arlington, [2]Department of Anthropology, University of Washington

With the resurgence of anti-evolution rhetoric in recent years, teaching the principles of the modern synthesis has become, on the one hand, more important and, on the other, more tricky. For biological anthropologists, the issues are exacerbated because the topic is not evolution in the general sense, but *human* evolution in the particular. Given that these issues have been contended for almost 150 years, we wondered if the teaching of evolutionary theory to current college anthropology students might be enhanced by the methods of historians, who also teach evolutionary theory.
Today, most scientists and religions accept Darwin's theory and the more complete ideas of the modern synthesis. Nonetheless, substantial misconceptions still exist in the general population and some groups remain vocally anti-evolutionary. Evolutionary theory forms the framework for most introductory classes in biological anthropology, while for historians, it serves as the starting point for the discussion of the rise of civilization in World and American history survey classes. How well we do at convincing students of the validity of the modern synthesis is unknown and what we might do to improve our presentation of these ideas remains unidentified.
In this project, we sought to harmonize historical and anthropological approaches to the teaching of evolutionary theory by evaluating the perspectives of the students exposed to these ideas. Of particular interest to us was the effect of prior knowledge, faculty attitude, and belief systems of college students on their understanding of evolutionary theory.

3Dimensional molecular modeling and comparison of human and chimpanzee chemokine receptors CCR2, CCR3 and CX3CR1.

J. F. Brinkworth[1] and J. L. Ho[2], [1]Department of Anthropology, City University of New York and New York Consortium on Evolutionary Primatology, [2]Departments of

Medicine and Microbiology, Weill Medical College of Cornell University, New York.

Chimpanzee and human immune responses to immunodeficiency viruses (IV) are divergent. IV infected chimpanzees typically do not progress to AIDS while IV infected humans typically do. Chemokine receptors are G protein-coupled receptors, found mainly on leukocyte cell membranes. Chemokine receptors CC-motif receptor 2 (CCR2) and CX3C motif receptor 1 (CXC3CR1) are know to interact with IVs and variants have been linked to delayed and rapid progression to AIDS, respectively, in HIV-1 infected humans. CC-motif receptor 3 (CCR3) is a known co-receptor for HIV-1. Given the divergence in IV disease progression in humans and chimpanzees, we tested the hypothesis that structural variations may exist in these receptors of these species. Comparisons of published CCR2 isoforms 1 and 2, CCR3 and CX3CR1 revealed 2, 1, 5 and 5 divergent amino acids, respectively, between humans and chimpanzees. Divergent amino acids are primarily located in the domains most likely to interact with the virus (extracellular) or initiate cell signaling (cytoplasmic). Chimpanzee sequences did not contain the residues noted as effecting AIDS progression in humans. Residue differences between the extracellular and cytoplasmic domains of CX3CR1 lead to major protein structural changes in these regions. The receptors were modeled in 3-dimensions (3D) using fold recognition and homology-based programs (Fugue, 123D+, CPH and 3D-jigsaw) and bovine rhodopsin as the primary template. Model shape differences were quantified with DaliLite. Models were strongly verified with 3D verify. Prosa II generated energy profiles. This study raises important questions regarding the role of IVs in chimpanzee and human chemokine receptor evolution.

Biocultural analysis of Nubian fetal pot burials from Askut, Sudan.

L.R. Britton, T.L. Dupras. Department of Anthropology, University of Central Florida.

The skeletal remains in this study were excavated from the archaeological island site of Askut (ca. 1850 BC - 1070 BC, New Kingdom/Third Intermediate period), located at the 2nd Cataract of the Nile river in Sudan. A sample of seven fetal skeletons (dated ca. 1260-770 BC) was examined for their biocultural significance. These individuals were excavated from the pomoerium (the religious/sacred boundary or symbolic wall) of Askut's fortress. Each individual was buried in a ceramic pot. The interment style and burial location indicate that these individuals were treated differently in comparison to the children and adults of Askut, who were most likely buried in the cemeteries along the banks of the Nile. As Nubia was an Egyptian colony at this point in history, Egyptian influences and ideology would have had a big impact on Nubian culture, and this is reflected in the burial treatment of these individuals. Biological analysis of these individuals indicates a range in developmental age from 36 to 40 weeks gestation. Four of the seven individuals show no signs of pathology. Pathologies on the other three individuals include vertebral lesions, a deformed sphenoid, and cranial infectious bone reaction.

Iron Deficiency and Prolonged Bottle-Feeding: Risk Factors for Hispanic Migrants

J.M. Brotanek, MD, MPH; D. Schroer; and G. Flores, MD
Division of General Pediatrics, Department of Pediatrics, University of Texas Southwestern Medical Center, Dallas, TX; Medical College of Wisconsin, Milwaukee, WI

Iron-deficiency anemia in infancy and early childhood is associated with behavioral and cognitive delays. Several studies have shown that prolonged bottle-feeding is associated with iron deficiency (ID). Mexican-American toddlers (MATs) are the racial/ethnic group at greatest risk for prolonged bottle-feeding and ID, yet no studies have examined reasons for prolonged bottle-feeding in MATs.
Ethnographic interviews were conducted (in English and Spanish) of parents of MATs 15-48 months old presenting at 3 community sites (urgent care facility, pediatric clinic, and daycare center) over a 6-week period. A 31-question moderator's guide was used addressing 4 domains: 1) knowledge and cultural beliefs; 2) sources of nutritional information; 3) anticipatory guidance; and 4) suggestions for ways to change infant feeding practices. Interviews were audiotaped, transcribed, and analyzed using grounded theory.
Parents often cited convenience as a reason for prolonged bottle-feeding ("when she goes to sleep she asks for the bottle and we give it to her so she can sleep"), and believed that they should give toddlers as much milk as they want ("give them as much milk as they want…that's what I say"). Many parents lacked essential knowledge regarding infant feeding practices and ID, including when to stop bottle-feeding, health problems caused by prolonged bottle-feeding, the quantity of milk to give a child > 1 year old, and ID as a complication of prolonged bottle-feeding. Parents reported not receiving enough education from physicians, and supported educational interventions on healthy infant feeding practices, including physician teaching, refrigerator magnet charts, videos, and bilingual brochures.

Patterns of accidental deaths in Rochester, New York during the nineteenth century.

B.S. Brown, J.E. Sirianni, R.L. Higgins. Department of Anthropology, SUNY at Buffalo.

Cemetery interment records are valuable historic resources for providing insights to demographic profiles and patterns of death. In previous studies, death records from the Mt. Hope Cemetery were used to report disease specific mortality (Sirianni, 2002) and gastrointestinal infection (Sirianni and Higgins, 2007) for Rochester, NY during the nineteenth century. These records, which include age, gender, and cause of death were examined to determine if there are patterns for deaths recorded 'accidental' for the period, 1837-1856. Of the 8,822 deaths recorded, 260 were noted as accidental. The causes of death varied: blasting rocks, burned, drowned, hit by railroad cars, shot, and choking. Males had a higher incidence of accidental deaths than females. Drowning occurred most frequently at 33% for males and 8% for females. Females had a higher incidence of dying from burns. Beginning at 1847, there was an increase in deaths caused from being hit by railroad cars. Males again had a higher incidence at 8% and females at 1%. Historic information offers possible explanations as to why certain accidents occurred more often. For example during this period, the Erie Canal was built and put into operation (Lawson 2002) and the Genesee River runs through this region with a strong current (Rochester 1924) explaining the prevalence of drowning deaths. A railroad line was built in later years which may account for the rise in death along the tracts. Additionally, deaths attributed to blasting rocks may be explained by the use of dynamite in building the Erie Canal (Way 1993).

The relationship between humeral morphology and time in the human fossil record.

C.C. Brown, H.M. McHenry. Department of Anthropology, University of California, Davis.

The craniodental remains of Plio-Pleistocene hominins accumulate synapomorphies with later *Homo* such as brain size, premolar metaconid size, and depth of the temporomandibular joint through geological time. In general, postcranial remains show a similar trend. However, postcranial studies of hind-forelimb proportions, femoral diaphyses, and morphology of the ulna and pelvis do not show such a clear, linear relationship and suggest that the relationship of postcrania through time is much more complex.
This study examines the morphology of the most frequently preserved element in the human fossil record—the distal humerus—and finds it also shows a non-progressive pattern through time. Multivariate discriminant analysis compares 14 fossil humeri, assigned to various species of *Australopithecus*, *Paranthropus*, and early *Homo*, to four genera of extant hominoids. From these discriminant functions we calculate Mahalanobis distances between fossils and extant species centroids and plot the relationship through time.

Mahalanobis distances show that the humeri most similar to later *Homo* are also the earliest in time. Humeri dating to around 1.5-2m.y.a. however, have surprisingly large distances from the human centroid and a large amount of heterogeneity. In combination with postcranial studies showing similar patterns, humeral morphology suggests that the postcranial hominin fossil record does not show a progressive march to homininization, but instead a path characterized by unique morphologies, which are perhaps better explained by adaptation to proximate environments.
This research is sponsored by the Committee of Research, University of California, Davis.

Ovulation and sexual behavior: relations to the stress and immune systems.

S.G. Brown[1], L.A. Morrison[2]. [1]Department of Psychology, [2]Department of Anthropology, University of Hawaii at Hilo.

Researchers of human sexuality often report increased libido and sexual behavior during the ovulatory phase of the menstrual cycle. We examined sexual behavior, stress (as measured by salivary cortisol), immune activity (as measured by salivary IgA), and emotional and physical well-being in naturally cycling women who identified as heterosexuals or lesbians or who were abstaining from sex. Our participants provided us with data across three menstrual cycles that were divided into 5 phases based on LH surges: menstrual, follicular, ovulatory, luteal and premenstrual. Like previous researchers, we found increased sexual behavior and libido at mid-cycle in all of our groups. The increase in sexuality was accompanied by increased positive affect. We also found decreased salivary IgA levels in sexually active heterosexuals compared to women abstaining from sex, however all groups reported decreased numbers of health symptoms from their ovulatory through their luteal phases. Lesbians had significantly lower salivary cortisol levels than women abstaining from sex and higher levels of autosexual behavior than heterosexual women. We hypothesize that there might be a male pheromone influencing the immune activity in heterosexual women. Decreasing the female's immune response might protect the male's sperm.
This research was supported by NIH grant #S06-GM0873-33.

Social status and health status in late Anglo-Saxon England.

J.L. Buckberry[1], R.A. Storm[1] and E.F. Craig[2]. [1] Biological Anthropology Research Centre, Archaeological Sciences, University of Bradford, UK. [2] Department of Archaeology, University of Sheffield, UK.

The Christian cemeteries of late Anglo-Saxon England contain a wide variety of grave furniture (coffins, sculpture, charcoal and stone arrangements) within supposedly 'egalitarian' cemeteries. It has been argued that grave furniture, cemetery choice and grave location within cemeteries were influenced by the status of the deceased or their family (Buckberry 2004; 2007; Craig and Buckberry 2007; Hadley 2004).
The present study investigated if those buried in more elaborate graves or in more prestigious locations enjoyed better health and lived longer than those buried in less elaborate graves or locations. Five cemeteries with excellent archaeological preservation, including preserved wooden coffins, were analysed: York Minster, Swinegate (York), St Peter's Barton-on-Humber (Lincs.), Guildhall Yard (London) and Raunds (Northants.). Age, sex, stature and prevalence rates of cribra orbitalia, tibial periostitis, enamel hypoplasia and dental caries were recorded for all individuals. At many sites, older individuals tended to be buried in more elaborate graves, indicating either a cultural choice in funerary treatment for older individuals, or longevity of those buried in more elaborate graves. Stress markers tended to be more prevalent in lower status populations, for example prevalence rates at York Minster (very high status) were lower than at Swinegate (lower status). In addition, prevalence rates of stress markers tended to be higher in plain graves within cemeteries. This study supports the theory that grave location and elaboration was used to convey social status in the late Anglo-Saxon period.
This research was supported by The British Academy, NERC and a White Rose Studentship awarded by the Universities of Sheffield, York and Leeds.

Reconstructing age at death in the Postclassic population of Cholula, Puebla: a comparison of transition analysis and traditional methods of aging adult skeletal remains.

M.M. Bullock[1] and E.C.O. Chávez[2]. [1]Department of Anthropology, Pennsylvania State University, [2]Department of Anatomy, Universidad Nacional Autónoma de México.

Most paleodemographic age-at-death distributions constructed using traditional techniques for estimating age in adult skeletons show high adult mortality that accelerates rapidly and few individuals surviving into old age. As this mortality pattern is not consistent with known human mortality patterns from either modern or well-documented historic populations, critics of paleodemography argue that it is likely the result of methodological error in determining the age of adult skeletons. A more recently developed adult aging method, transition analysis, addresses many of the problems associated with adult age estimation (Boldsen et al. 2002). It provides a statistically valid means of combining age-related data from the cranial sutures, the pubic symphysis, and the auricular surface; it more accurately determines the ages of older individuals; and it corrects the problem of the age distribution of the research sample mimicking that of the modern reference sample used to estimate ages. In order to compare transition analysis to more traditional aging techniques, 341 Postclassic skeletons from Cholula, Puebla, were aged using both transition analysis and traditional methods such as Todd (1921), Lovejoy et al. (1985), Brooks and Suchey (1990), and McKern and Stewart (1957). Age-at-death distributions constructed for the Cholula population using traditional aging techniques resemble most paleodemographic age-at-death distributions in that young adult mortality is high and few older individuals are present. In contrast, the age-at-death distribution constructed using transition analysis reflects an expected human mortality pattern with low mortality among young adults and the majority of adult deaths occurring after age 50.
This data was collected as part of the project *Mortality in a Preindustrial New World City: The Effects of Urbanism on the Postclassic Population of Cholula, Puebla*, which was funded by a grant from FAMSI, a Penn State RGSO Award, a Penn State Hill Award, and a Penn State Sanders Award given to Meggan Bullock.

Mousterian children from Teshik-Tash and Staroselie: a 3D geometric morphometric analysis.

E. Bulygina[1], P. Gunz[2]. [1]Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, [2]Max Planck Institute for Evolutionary Anthropology, Leipzig.

Skeletal remains of juveniles from Teshik-Tash (Uzbekistan) and Staroselie (Crimea) were found by Soviet archaeologists in the 1930s and 1950s respectively. Both discoveries were in association with Mousterian artefacts. The general interpretation of the scientific community has been that Teshik-Tash is a Neanderthal and Staroselie is a modern human. However, some have considered the morphology of the Teshik-Tash cranium to be more similar to modern humans such as those represented at Skhul and Qafzeh. The affinities of the Staroselie child have also been debated, and one possibility is that it derives from an intrusive Middle Age burial.
We present an analysis of the 3D morphology of the frontal bone, comparing the two specimens with an ontogenetic sample of nine recent modern human populations, Neanderthals, Upper Palaeolithic modern humans and a number of West Asian and African Middle to Late Pleistocene hominins. Landmarks and semilandmarks were collected on the complete surface of the frontal and analysed with geometric morphometrics. We demonstrate that the Teshik-Tash frontal bone morphology is intermediate between classical Neanderthals and early modern humans, whereas Staroselie has a firm association with recent modern human children. Our results are consistent with the interpretation of Staroselie as an intrusive modern burial, and suggest that the Teshik-Tash specimen may

be an 'Eastern', non-classical, Neanderthal, similar to those at Amud and Shanidar.

Re-evaluating the influence of cold stress on the Neanderthal nasal aperture.

L.N. Butaric, Department of Anthropology, Texas A&M University.

Much of Neanderthal facial morphology, including their large nasal apertures, has historically been explained by glacial environments; however, some morphological studies and paleoenvironmental reconstructions have called these cold adapted theories into question. One of the more intriguing hypotheses is that the Neanderthals' large nasal aperture acted as a means for heat dissipation during high levels of physical activity. While this theory is not solely dependent on cold-stress it still relies on the assumption that Neanderthals lived in a cold environment where sweating may have been detrimental. If a theory relying on a cold adapted nasal morphology is to be accepted, one would expect significant differences between Neanderthal populations living in different environments. Following this expectation the current study analyzes external nasal measurements to determine whether significant differences exist between the Western European and West Asian Neanderthal populations, and if these differences follow climatic patterns. One-way analysis of variance (ANOVA) tests and independent t-tests were utilized to identify significant differences between the Western European and West Asian Neanderthals. Product moment analyses were then employed to determine which (if any) nasal measurements were correlated with latitude and estimated Pleistocene temperatures. Both the ANOVA and t-tests failed to establish significant differences between the Neanderthal populations. Product moment correlations also failed to find a significant correlation between any of the nasal measurements and climatic variables. Rationales for these results as well as future avenues of testing are discussed.

Does hominid bipedalism arise from arboreal locomotion on flexible branches?

S. Cachel, M. Crisfield. Department of Anthropology, Rutgers University.

It has recently been argued that arboreal bipedalism in orangutans indicates that hominid bipedalism originated in an arboreal setting (Thorpe et al., 2007). Specifically, orangutan movement on flexible branches that are small relative to the body size of the ape is targeted as the locomotion pre-adapting hominid ancestors to terrestrial bipedalism. However, the derived hand and foot morphology of *Pongo* indicates a specialization for arboreal locomotion on small, flexible branches. Hallux and pollex are reduced, and the lateral rays are elongated. As noted by Napier, this morphology, in conjunction with the orangutan's long metacarpals and metatarsals allow the digits to double-lock when fully flexed. Thus, climbing and feeding can take place on small flexible arboreal supports. This specialized morphology is not found in other living hominoids, or in surviving fossils of Miocene apes, such as the African proconsulids or European *Pierolapithecus*. Furthermore, early hominid foot morphology and the Laetoli trackways document the presence of a robust hallux. It appears that hominids evolved from an ancestor that also possessed a large hallux, a trait that is characteristic of the primate order. Bipedalism may first have evolved in an arboreal setting, as illustrated by the locomotion of living hylobatids. However, a large-bodied arboreal biped using small, flexible branches would have evolved the hand and foot morphology seen in the modern orangutan.

Indigenous inhabitants of Pakistan or intrusive emigrants? An odontometric investigation of the Chengazi of Baltistan.

A.M. Camp and B.E. Hemphill. Dept. of Sociology and Anthropology, California State University, Bakersfield.

The Chengazi, an ethnic group of Baltistan in the Northern Areas of Pakistan, are a population that figure prominently in the current debate over whether descendents of Genghis Khan's army may be found in modern Pakistan and Afghanistan. This debate has been stimulated by a series of Y-chromosome studies that show the Hazara to possess haplotypes in common with Mongolians. Such findings have direct implications for the Chengazi, for they claim to be Hazara emigrants from Afghanistan who changed their name to Chengazi after migrating to Pakistan in the 19th century. This research tests whether the Chengazi stand apart from prehistoric and contemporary inhabitants of South Asia, western Central Asia and the Iranian Plateau, as expected if, in fact, the Chengazi represent an intrusive population of Mongolian ancestry. Maximum mesiodistal and buccolingual diameters were measured for all permanent teeth, except third molars, from 197 Chengazi school children from Skardu, the capital of Baltistan. These data were contrasted with 17 samples encompassing some 1,734 individuals. Patterns of sample differences were assessed with cluster analyses and principal components analysis. Results obtained indicate the Chengazi share closest affinities to Central Asians, but little affinity to prehistoric inhabitants of peninsular India, the Indus Valley, or the Iranian Plateau. Such findings are consistent with the claim that the Chengazi represent an intrusive population into Pakistan, perhaps of Mongolian origin.

Patterns of Linkage Disequilibrium at the SORT1 Locus: Implications for Demographic History.

M.C. Campbell[1,2], S.A. Tishkoff[2], J.H. Lee[3], A. Carracedo[4], and R.L. Holloway[1]. [1]Department of Anthropology, Columbia University, New York, NY, [2]Department of Biology, University of Maryland, College Park, MD, [3]Sergievsky Center, College of Physicians and Surgeons, Columbia University, New York, NY, [4]Institute of Legal Medicine, University of Santiago de Compostela, Galicia, Spain.

To date, little information exists regarding patterns of linkage disequilibrium (LD) within major continental regions, especially in Africa. Given the central role of African populations in human evolution, characterizing their patterns of genetic diversity and LD is crucial for reconstructing human prehistory. In this study, we examined the population recombination rate (ρ) across a 78 kb region of the SORT1 gene to assess patterns of LD in 59 populations (~1300 individuals), including 11 distinct African populations. SORT1 is a receptor protein that binds a number of neuropeptides, and has been associated with late-onset neurological disorders. Common HapMap SNPs were selected from the coding and non-coding regions of SORT1 for genotyping. SNP haplotypes were statistically reconstructed from the genotype data, and ρ was estimated using composite likelihood methods. Our results showed that the overall recombination rate was low at this locus. Moreover, the mean ρ value was significantly higher in Africa than outside of Africa consistent with the Recent African Origin hypothesis. The variance in ρ was also greater in sub-Saharan Africa than in other continental regions. Similarly, pairwise comparisons of segregating sites showed that patterns of LD varied substantially among African populations compared to populations from other geographic regions. These results suggest that ancestral Africans may have been subdivided during human history, leading to divergent patterns of LD in sub-Saharan Africa. This study provides further information regarding intracontinental variability using a large sample of healthy individuals from diverse human groups, including African populations which are mostly underrepresented in genetic studies. Funding for this project was provided by a National Science Foundation Doctoral Dissertation Improvement Grant (#0550998) to M.C. Campbell.

Has the sun set on the savanna? Environmental determinants and the evolution of bipedality.

C.J. Campisano, K.E. Reed. Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University.

The development of the savanna biome and its influence on hominin evolution has been a theme in the scientific community since the

time of Darwin. While simple cause and effect stories have long fallen by the wayside, environmental change and variability, particularly an increase in open habitats, still plays a pivotal role in paleoanthropological theories. In this presentation we revisit the plausibility that the spread of the savanna was related to the origin of and developments in bipedalism. The savanna biome is one where trees and grasses interact, often forming a dynamic ecotone between woodlands or forests and grasslands. Variations within the savanna biome typically reflect the influence and interaction of climate (rainfall and seasonality), soil type, and disturbance, which are equally dynamic across the African continent. While the savanna hypothesis of the past may no longer have two legs to stand on, savanna biomes did exist in the vicinity of early hominin localities in the late Miocene and early Pliocene, and the extent to which these habitats might have played a role in their life ways cannot be overlooked. In contrast, there is no *a priori* reason to assume that the origins of bipedalism must be a result of environmental determinism. Although still speculative, the origins of the *Homo ergaster/erectus* lineage - with its fully humanlike bipedal locomotion - and its geographic dispersal out of Africa in the early Pleistocene likely relates to a significant increase in arid conditions and grassland biomes in regions of Africa and Asia.

Forearm kinematics and hand postures: implications for interpreting subchondral bone density patterns in the primate distal radius.

K.M. Carl[1], B.A. Patel[1,2], S.G. Larson[3]. [1]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University, [2]Department of Biomedical Sciences, College of Osteopathic Medicine, Ohio University, [3]Department of Anatomical Sciences, Stony Brook University Medical Center.

Quadrupedal primates habitually use palmigrade, digitigrade, or knuckle-walking hand postures. Subchondral bone density patterns in the distal radius reflect these different hand postures, although differences are greatest between knuckle-walkers and non-knuckle-walkers (Patel & Carlson, 2007). While all primates have dense subchondral bone in the dorsal region of the distal radius, only knuckle-walkers have dense bone in the volar region. It was proposed that different wrist joint configurations in each hand posture influence force transmission through the distal radius differently, resulting in different subchondral density patterns. In this study, we investigate whether forearm orientation may also influence how forces are transmitted through the distal radius. Specifically, in a vertically oriented forearm, the distal radial articular surface would be aligned more perpendicular to the vertical component of the ground reaction force vector, possibly resulting in more uniform distribution of dense bone across the articular surface.
Forearm orientation at midsupport was measured relative to the substrate from videos of 18 catarrhine species (3-121kg) that use different hand postures (n=177). Non-parametric analyses of variance show that knuckle-walkers adopt more vertical forearm postures than other primates, whereas palmigrade and digitigrade catarrhines do not differ from each other. These patterns are consistent with published subchondral bone density data. Although larger taxa appear to have more vertical forearms at midsupport, non-parametric correlations between forearm angles and body mass were not significant. We conclude that, in addition to the specific nature of the radiocarpal articulation associated with a specific hand posture, forearm kinematics also influence subchondral bone density patterns in the distal radius.
Funded by NSF Grant BCS 0524988.

Directly relating trabecular architecture to locomotion – an experimental model of locomotor behavior effects.

K.J. Carlson[1], S. Lubinsky[2], S. Judex[3]. [1]Department of Anatomy, New York College of Osteopathic Medicine, [2]Department of Biomedical Engineering, Stony Brook University, [3]Department of Biomedical Engineering, Stony Brook University.

With the advent of microcomputed tomography, quantifying variability in primate trabecular architecture has provided useful insights into loading patterns experienced during their locomotor modes (e.g., leaping, climbing, and quadrupedalism). Typically, the response in an architectural property is associated with a set of loading conditions that occurs during a particular locomotor mode. Comparative studies using museum specimens, however, are limited to correlative relationships. Usually these relationships emphasize broad locomotor differences, and are unable to eliminate potentially confounding non-mechanical factors such as age, sex, body weight, and hormonal fluctuations. Here we present a novel animal model designed to isolate direct relationships between trabecular architectural properties and specific locomotor activities (i.e., linear locomotion and turning).
We assess trabecular architecture of hind limb elements at multiple volumes of interest (VOIs) for thirty day-old female (BALB/cByJ) mice divided into three groups (n=10 per group). Each mouse was single-housed for 8 weeks in a custom-designed cage that accentuated linear or turning locomotion or in a standard cage allowing the subject to roam freely. Hind limb skeletal elements were removed and scanned (microCT40, Scanco) at the termination of the protocol. Groups differed significantly in several architectural properties, including trabecular shape, thickness, number, spacing, and bone volume fraction. Properties of the turning group, more than the linear group, often resembled properties of the 'free-ranging' control group. This study provides a crucial contextual basis for evaluating comparative studies of primate trabecular architecture, and thus provides a footing for reconstructing locomotor repertoires of extant and extinct primates, particularly small-bodied taxa.
We gratefully acknowledge NASA and NSF for supporting this research.

Grooming reciprocity in Verreaux's sifaka (*Propithecus verreauxi verreauxi*).

L.M. Carnes, R.J. Lewis. Department of Physical Anthropology, University of Texas at Austin.

Reciprocal altruism is a powerful model used to explain repeated cooperation between unrelated individuals. In anthropoids, the model is often applied to grooming relationships to ascertain whether partners within a dyad contribute equally or whether rank differences lead to asymmetrical grooming relationships. We tested the hypothesis that grooming relationships are reciprocal in Verreaux's sifaka (*Propithecus verreuaxi verreauxi*) using all occurrence data of mutual and unidirectional grooming collected during 868 hours of observation of 15 adults in five social groups in the Kirindy Forest (C.F.P.F.) of Madagascar. Our analyses provide mixed evidence of reciprocity in mutual grooming. Correlations between the grooming contributions of dyadic partners were not statistically significant in the case of mutual grooming. Matrix correlation tests, however, indicated reciprocity in mutual grooming. In contrast, analyses of unidirectional grooming demonstrated that partners did not contribute equally. For example, the average bout length of grooming by one individual in a dyad was as much as 76 seconds longer than its partner's average bout length. Some individuals groomed their partner as much as 32 times more frequently than they received grooming. Moreover, males were significantly more reciprocal in their grooming relationships than females ($p<0.01$). We conclude that grooming relationships in Verreaux's sifaka do not appear to be reciprocal. Because female Verreaux's sifaka are more powerful than males, these results suggest that, as in anthropoids, rank differences can lead to asymmetrical grooming relationships.

The short legs of great apes: evidence for aggressive behavior in australopiths.

D. R. Carrier, Department of Biology, University of Utah

Early hominins, australopiths, were similar to most large primates in having relatively short hindlimbs for their body size. The short legs of large primates are thought to represent specialization for vertical climbing and quadrupedal stability on branches. Although this may be true, there are reasons

to suspect that the evolution of short legs may also represent specialization for physical aggression. Fighting in apes is a behavior in which short legs are expected to improve performance by lowering the center of mass during bipedal stance and by increasing the leverage through which muscle forces can be applied to the ground. Among anthropoid primates, body size sexual dimorphism (SSD) and canine height sexual dimorphism (CSD) are strongly correlated with levels of male-male competition, allowing SSD and CSD to be used as an indices of male-male aggression. Here I show that the evolution of hindlimb length in apes is inversely correlated with the evolution of SSD (R2 = 0.683, P-value = 0.006) and the evolution of CSD (R2 = 0.630, P-value = 0.013). These observations are consistent with the suggestion that selection for fighting performance has maintained relatively short hindlimbs in species of Hominoidea with high levels of male-male competition. Although australopiths were highly derived for striding bipedalism when traveling on the ground, they retained short legs compared to those of Homo for over 2 million years, approximately 100,000 generations. Their short legs may be indicative of persistent selection for high levels of aggression.

Gait patterns in primates and marsupials: similarities and differences.

M. Cartmill[1], D. Schmitt[1], P. Lemelin[2], E. A. Cartmill[3], and C. D. Atkinson[4]. [1]Dept. of Biological Anthropology and Anatomy, Duke University, [2]Division of Anatomy, University of Alberta, [3]School of Psychology, University of St Andrews, [4]Boston Medical Center.

Most quadrupedal primates differ from typical eutherians in having diagonal-sequence (DS) rather than lateral-sequence (LS) walking gaits. We have argued that DS gaits represent an adaptation for controlled locomotion involving pedal grasping of relatively thin arboreal supports (Zool. J. Linn. Soc. 136: 401-420). This model is supported by studies showing that arboreal marsupials with grasping hind feet have predominantly or exclusively DS gaits, while terrestrial marsupials with reduced pedal grasp have LS gaits. These studies were based mainly on data from didelphids. The present study is the first to compare a wide range of arboreal and terrestrial marsupials. Videorecordings of six Australian marsupials show that the ring-tailed possum *Pseudocheirus*, which is highly arboreal and has grasping feet, also has DS gaits. More terrestrial forms (*Lasiorhinus, Dasyurus, Myrmecobius*) and arboreal forms with non-prehensile feet (*Dendrolagus*) have LS gaits. These findings support a strong relationship between prehensility, arboreality, and footfall patterns. However, the koala (*Phascolarctos*), another arboreal animal with grasping hands and feet, exhibits exclusively DS gaits on the ground and predominantly LS gaits in the trees. This unexpected finding presents fundamental challenges to current theories of the distribution of gait patterns in mammals.
Supported by NSF Grant BCS-0137930.

Assessment of upper limb bilateral asymmetry and implications for the evolution of handedness

L.A. Cashmore & S.R. Zakrzewski. Centre for the Archaeology of Human Origins (CAHO), Department of Archaeology, University of Southampton, UK.

With population-level handedness considered to be one of the defining features of *Homo sapiens* and the proposed links between manual dexterity and language capabilities, investigation of how hand preference is expressed, and subsequently measured, on the skeleton is of importance to understanding the development of the human genus.
Studies of upper limb bilateral asymmetry generally focus on either metric analysis of robusticity or assessment of musculoskeletal stress marker (MSM) development to ascertain patterns of hand preference. The bones of the hand are often conspicuous by their absence from this arena. Little research has addressed the role of the bones of the hand in the expression of handedness or compared the methods by which it can be assessed.
Analysis of MSM development and metric data from the humeri and hand bones of 96 modern humans from Écija, Spain and Greenwich Naval Hospital, London, plus 40 non-human primates (20 *Pan troglodytes* and 20 *Gorilla gorilla*) suggest that there are important differences in the ways in which asymmetry is expressed in the hand compared to the humerus. A clear distinction has also been found between the two methodologies, with MSM analysis likely to underestimate the degree of asymmetry in a sample.
Taken together, these results suggest an important role for the bones of the hand in the assessment of upper limb bilateral asymmetry and handedness. Additionally care must be taken when selecting the method by which asymmetry is to be assessed.
Partially funded by the British Academy (Centenary Project "From Lucy to Language: The Archaeology of the Social Brain") & BABAO.

The mechanical properties of foods processed by *Cebus libidinosus* at Boa Vista, Brazil.

J. Chalk[1], B.W. Wright[2], P.W. Lucas[3], M.P. Verderane[4], D. Fragaszy[5], E. Visalberghi[6], P. Izar[4], E.B. Ottoni[4].
[1]Hominid Paleobiology Doctoral Program, Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University, [2]Department of Anatomy, Kansas City University of Medicine and Biosciences, [3]Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University, [4]Department of Experimental Psychology, Institute of Psychology, University of São Paulo, [5]Psychology Department, University of Georgia, [6]Istituto di Scienze e Tecnologie della Cognizione, Consiglio Nazionale delle Ricerche.

Food mechanical properties and their associated processing behaviors are hypothesized to influence the evolution of morphological adaptations in the primate masticatory apparatus. Tufted capuchins occupy a range of distinct habitats throughout South America and exhibit a robust masticatory apparatus proposed to be an adaptation to the oral processing of mechanically demanding food items. As a result, tufted capuchins provide an opportunity to test hypotheses concerning relationships among food material properties, dietary ecology, and morphology. Previous studies have reported the mechanical properties of foods ingested by tufted capuchin in tropical rainforest environments. Here, we present the mechanical properties of foods selected by a tufted capuchin species, *Cebus libidinosus*, at Boa Vista, Brazil, a dry woodland habitat. Values of toughness (*R*) and Young's modulus (*E*) were estimated for over four hundred plant and animal tissues using a portable food mechanical property tester developed by Lucas et al (2001). We found the average toughness (2002 Jm^{-2}) of foods processed by the capuchin groups at Boa Vista to be more than two times the average toughness (807 Jm^{-2}) of foods processed by *C. apella* in Guyana. The average Young's modulus of orally processed foods at Boa Vista was 116.4 MPa, with grass and tree bark exhibiting the highest values. These results suggest that woodland habitats may place greater dietary challenges on tufted capuchins than rainforest environments. We hypothesize that this may account for the more complex suite of foraging behaviors (e.g. tool use) exhibited by tufted capuchins at Boa Vista.
Supported by NSF IGERT 9987590, Lewis N. Cotlow Fund, and Kansas City University of Medicine and Biosciences.

Mathematical analyses suggest evolutionary significance for underground storage organ diets.

J. G. Chamberlin. 2007 Olduvai Landscape Paleoanthropology Project (OLAPP); Chamberlin Research.

Personal discussions with Dr. L. Hlusko (UC Berkeley) and Dr. F. Masao (OLAPP) during work at Olduvai Gorge in August 2007 suggested relevance of mathematical analyses of traditional human diets by Chamberlin, Stickney, and Abbot at MIT to current studies of hominid diets, including connections to the 'Expensive Tissue Hypothesis' and the role of underground storage organs (USOs). The MIT research explored protein-calorie malnutrition using the simplex algorithm to analyze human diets based on traditional

grains and USOs in relation to constraints on calories, amino acids, and consumable bulk. Relevant conclusions quantified difficulty in meeting nutritional needs within constraints of gut capacity and extreme sensitivity of USO-based diets to deficiencies of sulfur amino acids, suggesting that prolonged reliance upon USOs in ancestral diets could have evolutionary significance. Constraints on consumable bulk relate to trade offs in reducing gut size while increasing brain size, and sulfur amino acids are major components of the human hair protein keratin. Prolonged adaptation to USO diets might provide an evolutional pressure for hair loss in humans, permitting higher priority use of consumed sulfur amino acids in growth and development. In modern humans, similar nutritional deficiencies often lead to kwashiorkor in children, with symptoms including swollen bellies and hair loss. Analysis indicates the bulk and sulfur amino acids constraints are most binding on pregnant/ lactating women and post-weaning children, providing significant leverage for survival of children and mothers with less need for sulfur amino acids.

Oxygen isotope analysis of tooth enamel carbonate from Plio-Pleistocene South African fossil sites.

E.N. Chambers[1], J.K. McKee[1], K.L. Kuykendall[2]. [1]Department of Anthropology, The Ohio State University, [2]Department of Archaeology, University of Sheffield, UK.

Paleoecological studies play an important role in understanding parameters driving the evolution of hominins and other mammals. Oxygen isotope analysis of tooth enamel carbonate provides insight into climatic variations affecting past populations and aids in ecological reconstruction. In this study, oxygen isotope signatures of fossil cercopithecoids from Makapansgat and Taung are used to explore local oxygen isotope heterogeneity within and between fossil sites and taxa.

A total of 27 enamel samples were analyzed: *Parapapio broomi* (n=14), *Theropithecus darti* (n=2), *Parapapio jonesi* (n=2), and *Cercopithecoides williamsi* (n=3) from Makapansgat and extinct baboon species from Taung (n=5). Enamel was removed at the University of Witwatersrand and prepared using standardized laboratory procedures. Prepared samples were analyzed in the Stable Isotope Biogeochemistry Laboratory at The Ohio State University under the direction of Dr. Andréa Grottoli.

Results are within the expected range for these South African sites and taxa. Data for *P. broomi* from Makapansgat are tightly constrained (31.76 0.70 permil). The Taung cercopithecoid data (32.55 permil 1.77) and other Makapansgat cercopithecoid data (32.36 permil 2.40) show greater variation when compared to *P. broomi* samples from Makapansgat. Overall, these values reflect climatic similarities between sites and confirm diagenesis is not an obscuring factor in these analyses. Differences between species from Makapansgat may be linked to differences in preferred food or water availability. The consistency of *P. broomi* data reflect dietary stability and emphasize the usefulness of this species for future oxygen isotope research.

This research is supported by the National Science Foundation (NSF 0128770).

Patterns of phylogenetic diversity in the serotonin transporter gene (5-HTT, SLC6A4) across a broad sample of primates.

M.L. Chang, J.B. Kraft, S.P. Hamilton. Neurogenetics Laboratory, Department of Psychiatry, University of California, San Francisco.

Variation in the serotonin transporter gene (5-HTT, SLC6A4) exhibits significant functional effects on social behavior, having been linked to anxiety, major depression, and aggression in studies involving humans, nonhuman primates, and other mammals. Effects on behavioral variation related to the serotonin system are observed both within and between species, and investigations in one anthropoid genus *(Macaca)* suggest that variation in the serotonin transporter gene is phylogenetically patterned, and correlated with social structure.

For the present study, we examined variation in the serotonin transporter gene in a broader, explicitly phylogenetic context. We sequenced the 5-HTT gene-linked polymorphic region (5-HTTLPR), exons 6 and 7, and their intervening intronic region, across a diverse sample of 20 primate species, including six hominoids, eight catarrhines, four platyrrhines, and two prosimians. We aligned and examined these sequences using ClustalW and eShadow's phylogenetic shadowing tool, which incorporates a method for identifying conserved elements under probable selective pressure in multiple sequence alignments of closely related genomes. We then derived an allele tree for 5-HTT using MrBayes 3.1.2, and compared this allele tree to null models simulated using published molecular phylogenies of the Primates and coalescence functions implemented in Mesquite 1.12.

The identification of probable functional elements in 5-HTT, and patterns of evolutionary change in this gene throughout primate phylogeny, suggest a history of selection with possible significance for the evolution of primate social behavior. The implications of these results for discussions about the evolution of human social behavior are explored.

Diagnostic dentition: diet and dental health in a historic frontier town.

K.L. Chelotti, C.A. Brown. California State University, Chico.

This study assesses dental disease in an unmarked historical cemetery from Palisades, Nevada, a ghost town officially abandoned in 1962. In February 2000, human remains representing nine individuals were accidentally uncovered, which resulted in the full excavation of the cemetery. Preliminary craniometric and DNA analyses suggest a non-European ancestry for the cemetery sample. Because these individuals were interred in a separate location from the main town cemetery, it was hypothesized that the site may have represented a segregated burial ground. Results of this study indicate the individuals interred within the unmarked cemetery exhibited a large number of dental pathologies. Dental caries were recorded in 45 of 153 teeth observable, a prevalence of 29.4%. Of 240 possible teeth, 28 were absent due to antemortem tooth loss, a prevalence of 11.7%. Alveolar abscesses were present in 5 of 8 individuals, a rate of 62.5% for the group. Dental attrition ranged from slight to severe with low rates of observed calculus. The pathological conditions targeted maxillary dentition more than mandibular dentition, and posterior teeth more than anterior teeth. Presence and severity of carious lesions and dental attrition likely indicate a cariogenic diet consisting of coarse foods. The large number of dental pathologies in this group is in agreement with the results of previous research suggesting that this was a segregated cemetery for individuals of lower socioeconomic status.

Ecological stress and linear enamel hypoplasia in *Cebus*.

M.B. Chollet and M.F. Teaford, Functional Anatomy & Evolution, Johns Hopkins University School of Medicine, Baltimore MD.

Linear enamel hypoplasia (LEH) is a tooth defect generally thought to result from disruptions of physiological development. Thus its incidence can be used to gauge whether or not a population was under stress during periods of tooth development. While monkeys in some environments may experience more environmental stress than others, little research has been done on this topic. The present study examines the relationship between LEH frequency and environmental indicators of nutritional resources in *Cebus* monkeys from Brazil. As water availability is associated with high net primary productivity and biodiversity, and thus greater nutritional resources, it is predicted that animals in environments with high rainfall will experience less physiological stress, and therefore have a lower frequency of linear enamel hypoplasia, than those in environments with less rainfall. To test this hypothesis, the frequency of LEH was calculated for a sample of *Cebus* (n = 38) from fifteen locations within Brazil and compared based on habitat and annual rainfall. LEH frequency for *Cebus* from semideciduous forest, savanna, and scrubland was significantly higher than that for individuals from tropical rainforest or coastal regions, indicating greater stress in the former environments ($\chi^2 = 4.795$, d.f. = 1; $p = 0.029$).

However, no significant difference was found between LEH frequency and gross estimates of annual rainfall ($\chi^2 = 1.56$, d.f. = 1; p = 0.211). This may indicate that either finer-resolution analyses of rainfall need to be run, or that a factor other than precipitation is driving the difference in stress levels between habitats.

Putting your scientific expertise to work: Suggestions for science education activism in your community

A.M. Christensen, Federal Bureau of Investigation, Forensic Anthropology Program

As scientists, we can play an active role in promoting quality science education. Our expertise in various fields related to evolution and scientific inquiry make us valuable resources. Physical anthropologists, in particular, seem well-equipped for this task due to our diverse backgrounds, cultural awareness and familiarity with integrated, multidisciplinary approaches.
In pursuit and support of this charge, this paper will provide a number of suggestions for scientists interested in taking a more active role in promoting quality science education in their communities. Specifically, we can: *Be aware of current challenges to teaching evolution*. Effective advocates are well-informed, and many challenges are local so make sure you are aware of current issues in your community. *Communicate with the public*. Write letters and participate in local meetings, but keep it simple and respectful. *Work with teachers*. Provide guidance or curricular material, talk to students, plan courses or organize a lecture series. *Work with policy makers*. Make a connection and help develop pro-science legislation. *Work with other scientists*. Get involved with existing networks or create new ones because organized groups can have more impact, and teamwork limits individual workload. *Take advantage of resources*. Various scientific and educational organizations have resources, tips and suggestions for teaching evolution and science.
By working together and with others in our communities, we can have a positive impact on the public's understanding of evolution and emphasize why teaching and understanding evolution is important.

Variation in endometrial function and its role in elucidating reproductive pathology.

K.B.H. Clancy, Department of Anthropology, Harvard University

Over six million people are afflicted with infertility in the United States, but the current understanding of reproductive physiology and pathology limits our ability to treat or describe a significant portion of infertility. Endometriosis is the cause of at least 40% of documented infertility cases across the US, yet existing treatments are only effective for a minority of cases. A review of the literature begins to demonstrate how the study of endometrial function in healthy women helps to elucidate what conditions lead to pathology.
Our adaptations that evolved under energy constraint become handicaps under conditions of energy surplus, as we allocate our excess energy to reproduction. The reproductive system bears a large part of the energy surplus burden, and many reproductive pathologies appear to be linked to obesity, overweight, and positive energy balance. My review demonstrates associations between energetics and endometrial cancer, endometriosis, polycystic ovarian syndrome and uterine fibroids, and that most of these illnesses occur in greater proportion in westernized countries. I propose that the increase in circulating hormone concentrations in modern populations with energy surplus leads to increases in flowback of endometrial tissue into the abdominal cavity, and may increase the incidence of uncontrolled proliferation or differentiation, both of which may lead to endometriosis, uterine fibroids and endometrial cancer.

Rank in female chimpanzees (*Pan troglodytes*) is shown to be more positively correlated with alpha male association rather than female competition.

Cloutier, Christina[1,2] Halloran, A.R [1] and Broadfield, Douglas[1,2]. [1]Lion Country Safari's Elgin Center for Conservation and Behavioral Research, [2]Florida Atlantic University, Anthropology Department.

A population of semi-free ranging chimpanzees (*Pan troglodytes*) was evaluated based on individual proximity to the alpha male as well as the context of this proximity. Results show that when none of the females in the group are at the height of their estrus cycles, the highest-ranking females would spend a disproportionate amount of time in affiliative social interactions with the alpha male rather than in competitive interactions with each other. The results show that affiliative behavior with the alpha male is more profound with regard to individual rank than individual competitive actions. These results also suggest that, within chimpanzees, rank is established in female dominance hierarchies in positive correlation with the degree of association with the alpha male. Additionally, the study indicates that close social affiliation with high-ranking males is conceivably a strategy utilized by female chimpanzees in an attempt to gain or maintain rank.

Generic comparisons of extant primates with implications for fossil hominin genera.

J.A. Coate[1], H. Green[2] & D. Curnoe[1] .[1] University of New South Wales, School of Medical Sciences, Dept. of Anatomy and [2]University of Technology Sydney, Dept. of Medical and Molecular Biosciences.

In recent years the number of hominin genera has dramatically increased. However, the genus category has received very little attention in comparison to species concepts. To examine and gauge the validity and usefulness of these genera the extant primates (Groves, 2001) were used as a comparative benchmark or biological yardstick. In addition, many forms of evidence were also considered, from cranial morphometrics to genetics and limb proportions. These comparative results offer many analogies and useful guidelines in considering the fossil evidence of the human clade's earliest representatives. In particular, the average number of species per genus, body size (i.e. mass), inter-specific hybridizations, genetic distances, awareness of the potential for homoplasy and postcranial locomotor anatomy may assist in the biological classification of the initial hominins as well as provide some form of taxonomic stability and equivalence to extant primates.

Is premaxilla morphology determined by the spatial requirements of the developing incisor dentition?

S.N. Cobb[1], A. Willis[2]. [1]Functional Morphology and Evolution Unit, Hull York Medical School, University of Hull, UK, [2]Department of Biology, University of York, UK.

Interspecific variation in the morphology of the hominoid premaxilla and its phylogenetic utility are well documented. The main focus of previous research has been on the spatial configuration of the premaxilla with the maxillary hard palate, and the subnasal morphology as a whole, with a number of developmental hypotheses being proposed to explain this variation. The premaxilla houses the deciduous and permanent incisors during development, eruption and occlusion and so it is hypothesised that adult premaxilla length is determined by the maximal spatial demands of housing the unerupted developing permanent incisors and the erupted deciduous incisor roots. This model predicts that premaxilla length will no longer continue to increase subsequent to the eruption of the permanent incisors. This study forms part of a larger ongoing study into the relationship between the spatial demands of the developing dentition and both mandibular and facial morphology. Premaxilla length, mandibular length (used here as a measure of masticatory development) and incisor developmental status were obtained from lateral radiographs of cross-sectional ontogenetic series of *Pan troglodytes* and *Gorilla gorilla*, and a mixed longitudinal ontogenetic series of *Homo sapiens*. In all three species, the premaxilla continues to increase in length subsequent to the eruption of the permanent incisors thus falsifying the hypothesis. The constancy of the scaling relationship between premaxilla and

mandibular length across the whole ontogenetic period suggests that premaxilla length is more related to the size of the masticatory apparatus than the length of the dentition that it houses during development and occlusion.

Glucocorticoids and the question of egalitarianism in bonobos (*Pan paniscus*).

A.K. Cobden[1], F.J. White[2], M.T. Waller[2], N.M. Malone[2], P.L. Whitten[1]. [1]Department of Anthropology, Emory University, [2]Department of Anthropology, University of Oregon.

The egalitarian nature of bonobo (*Pan paniscus*) social structure has been contested on many levels, focusing largely on aspects of feeding competition. However, the relationship between physiological expression of stress (as represented through glucocorticoids) and environmental stressors remains virtually unexamined in wild populations of bonobos. If bonobos truly display egalitarianism, then variance in glucocorticoid levels are likely due mainly to environmental stressors, such as changes in food availability or seasonality.
This study examined various indices of egalitarianism via measurement of environmental factors that would support an egalitarian social structure (e.g. patch size, fruit abundance), as well as direct measures, such as party composition and non-invasive measures of glucocorticoid levels. Fecal and urine samples were collected with accompanying behavioral and party composition data from the Enyengo bonobo community in Lomako Forest, Democratic Republic of Congo during the months of July and August, 2007. Fruit transects were also conducted inside this community's home range to assess relative fruit abundance available to the bonobos during this time. Average party size remained small in spite of a relative abundance of available fruit, THV and other protein sources, suggesting a cost imposed upon individuals in large groups. This was verified using previously validated methods for analysis of urinary and fecal glucocorticoids. 24 fecal samples and 19 urine samples were analyzed from 10 separate follows. This is the first examination of excreted glucocorticoids in a wild population of bonobos, facilitating future examination of socio-endocrine relationships within *Pan*.

Preliminary data on affiliation, agonism, and reconciliation in an all-male group of ringtailed lemurs (*Lemur catta*).

A.D. Cohen, L.L. Taylor, and C. Mantis. Department Anthropology, University of Miami.

The Lemur Conservation Foundation (Myakka City, FL) houses an all-male group of ringtails in a 5.5 ha forest habitat. No female ringtails are present on the 36.4 ha reserve. This group of 3 lemurs (Y, B, and W) offers a unique opportunity to study male behavior in a female-dominant species. We gathered data using continuous focal animal sampling to test hypotheses concerning male-male affiliation, agonism, and reconciliation in the absence of females and incentives for competition (e.g., access to food). A total of 375 social interactions were observed. Of these, 323 were affiliative and 52 were agonistic. The frequency distribution of interactions was not symmetrical. We scored 141 friendly interactions between Y-B, 101 between Y-W, and 85 between W-B. We observed 14 agonistic interactions between Y-B, 27 between Y-W, and only 7 between W-B. Only 1 agonistic interaction included physical contact, Y cuffed B. Subsequently B emitted a submissive spat call, ran, and then avoided Y for 15 minutes. B then approached Y and groomed him 3 times within 10 minutes. In a species characterized by simultaneous mutual grooming, unreciprocated allogrooming may constitute reconciliation. Facial expressions, or other forms of reconciliation, may be very subtle and therefore difficult to observe in such small primates. In general, this group was characterized by a low frequency of agonistic behaviors. The onset of the fall breeding season may alter the pattern by virtue of increased testosterone production, even in the absence of females.
This research was supported in part by an Innovative Teaching Grant (LT) from the University of Miami and the Mianatra Center for Lemur Studies at LCF.

Evolution of low-frequency hearing in primates: evidence from fossils.

M. N. Coleman[1], D. M. Boyer[2]. [1]Department of Anthropology, Stony Brook University, [2]Department of Anatomical Sciences, Stony Brook University Medical Center.

Hearing sensitivity in extant primates varies according to phylogenetic patterns. For example, anthropoids have significantly greater sensitivity to low-frequency sounds than similarly-sized prosimians. Overall, data from extant euarchontans shows a trend towards increasing low-frequency sensitivity proceeding from tree shrews to catarrhines. In this study we begin to test the evolutionary reality of this apparent trend by including estimates of low-frequency hearing from several fossil euprimates (adapoids and omomyoids) and representatives of fossil sister taxa (plesiadapids).
Cochlear length was used to estimate hearing in fossils because it has been found to show a strong correlation to low-frequency sensitivity and because the inner-ear is one of the more commonly preserved skeletal elements. We used data from high resolution x-ray computed tomography (HRXCT) to measure cochlear length in a large extant comparative sample and all fossil specimens. Results show that plesiadapids had low-frequency hearing that was similar to that exhibited by extant tree shrews, despite being considerably larger in body size. In contrast, adapoids and omomyoids sampled have cochlear lengths suggesting a "prosimian-grade" of low-frequency sensitivity (i.e. they were not as sensitive as anthropoids). These findings, plus results from previous studies, suggest two major shifts in the evolution of low-frequency hearing in primates. The first shift is an increase in low-frequency sensitivity compared to the apparently primitive tree shrew-like or plesiadapiform-like condition: it appears to have occurred around the beginning of the Eocene. The second shift is a further increase to the "anthropoid-grade" of hearing that can be traced back to at least the middle-Miocene.

What is the impact of phenotypic plasticity on the identification of hominin fossil species? An assessment using extant hominoid craniodental data.

M. Collard[1], S.J. Lycett[2]. [1]Department of Archaeology, Simon Fraser University, Canada, and AHRC Centre for the Evolution of Cultural Diversity, University College London, UK. [2]British Academy Centenary Research Centre, SACE, University of Liverpool, UK.

It has been proposed that phenotypic plasticity may be a major confounding factor in attributing hominin fossils to species. Characters subject to masticatory strain have been hypothesised to be particularly problematic in this regard. Here, we report a study in which this hypothesis was tested with craniodental data (36 measurements) from *Homo sapiens, Gorilla gorilla, Pan troglodytes*, *Pongo pygmaeus* and *Colobus guereza*. First, we used ANOVA to investigate whether masticatory strain is a significant cause of epigenetic variability. This analysis indicated that characters from cranial regions associated with high masticatory strains generally exhibit significantly higher levels of variability compared with low-to-moderately strained characters and dental characters. Subsequently, we used Discriminant Analysis to test the hypothesis that heightened variability is a confounding factor when identifying species. In the case of the high strain measurements 97.6% of specimens were correctly classified. One hundred percent of the specimens were classified correctly when the low-to-moderately strained measurements were analysed, and 98.6% of the specimens were classified correctly when the dental measurements were employed. Thus, the high-strain measurements were less effective at distinguishing the species than the other measurements, but only marginally so. When all 36 characters were included 100% of specimens were classified correctly, which suggests that the inclusion of high strained/variable characters does not have a negative effect. We conclude from this that phenotypic plasticity likely plays only a minor confounding role in fossil hominin species identification, and that researchers

should simply maximise the number of characters examined.

Are fallback foods driving masticatory morphology? The case of the African apes.

P. Constantino. Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University

Lambert et al. (2004) compared the mechanical properties of foods eaten by two sympatric primates and showed that fallback foods may serve as the selective pressure for enamel thickness. I further explore the role of fallback foods as a selective agent by comparing the masticatory morphology of gorillas (n=30) and chimpanzees (n=15). Field studies show that lowland gorillas and chimpanzees both have diets dominated by ripe fruits throughout most of the year, but that in times of resource scarcity, chimpanzees will continue to search out fruit while gorillas rely more on tougher terrestrial herbaceous vegetation (THV). Using 3D geometric morphometrics and biomechanical comparisons of both raw and size-adjusted data (66 landmarks), I investigate whether lowland gorillas feature masticatory adaptations for chewing these tougher foods. The results show that lowland gorillas have a greater ability than chimpanzees to both generate and resist high masticatory forces, and these patterns exist even after allometric scaling patterns are taken into account.
Research funded by the National Science Foundation (#9987590) and the GWU Strategic Plan for Academic Excellence.

Morphological integration patterns in the mammalian skull

Conto, V. De, Porto, A., Shirai, L., Oliveira, F. & Marroig, G. Universidade de São Paulo, Brazil

Morphological integration (MI) refers to the relationships and connections among morphological elements. Quantitative genetics studies and comparative analyses of these MI patterns uncover a general pattern in nature: the modular organization of complex morphological structures. Far from being an "all traits connected to all traits" scenario, overall complex morphological structures like the mammalian skull present a modular organization, most likely reflecting a modular genotype-phenotype map. Morphological integration patterns can be described and quantified by correlations among traits. These correlation matrices can then be compared in a phylogenetic context to understand the changes (if any) in trait complexes during the diversification of a given group. Here we compare MI patterns among a broad diversity of mammals, including marsupials, rodents and several other Eutheria orders. Our emphasis is on living anthropoid primates, with more than 10,000 skulls measured so far, covering all the diversity in living Platyrrhines and Catarrhines. Our analyses are focused on comparisons between phenotypic correlation patterns, but we also included genetic matrices for groups in which they are available. Our results are to some extent unexpected, exhibiting a high degree of similarity in MI patterns in the skull of various mammalian orders. Specific instances of change in those patterns are identified and their possible relationships to ecology and development discussed.
Funded by: FAPESP, CNPq, PRP-USP

New primate dentition from the Tiburon Peninsula, Haiti.

S.B. Cooke, The Graduate Center, The City University of New York, NYCEP

In recent years, the Greater Antilles have yielded a number of enigmatic primate fossils, providing new information on platyrrhine evolutionary history and expanding upon the previously known biogeographical range of the group. Today, there are four named species: *Xenothrix mcgregori* from Jamaica, *Antillothrix bernensis* from Hispaniola, and *Paralouatta varonai* and *P. marianae* from Cuba. While MacPhee and colleagues suggest these species form a monophylum, Rosenberger and others hold that they have a variety of phylogenetic affinities with several living and extinct taxa. Here, I describe fossil material recovered in 1984 by Woods and colleagues from a sinkhole site in southwestern Haiti. The assemblage includes an associated nearly complete and unworn dentition of a young adult, and a mandibular and maxillary fragment. The Haitian dentition was compared to a sample of living and extinct platyrrhines including the type specimen of *A. bernensis* and was found to be distinct. The anterior premolars are small with bucco-lingually narrow roots, but a P^4 that is bucco-lingually elongated with strong cingular development, features absent in *A. bernensis*. The maxillary molars are somewhat cristodont. M^1 exhibits a large hypocone and pericone, while M^2 lacks a pericone. In contrast, the *A. bernensis* M^2 lacks a distinct hypocone, while preserving this feature on M^1, a morphological configuration unique in platyrrhines that retain M^3. While most Antillean platyrrhine specimens are "Holocene" in age, this unique species, and Miocene age of *P. marianae,* may indicate an early entry, giving us an unusual window on the Miocene evolution of the platyrrhines.

Advances in high resolution imaging and the emerging application of 3D cortical bone histomorphometry in interpreting health.

D.M.L. Cooper[1], J. G. Clement[2], C. D. L. Thomas[2], B. Hallgrímsson[3], A.L. Turinsky[3], C. W. Sensen[3], H.M. Goldman[4]. [1]Department of Anatomy and Cell Biology, University of Saskatchewan, [2]School of Dental Science, University of Melbourne, [3]Faculty of Medicine, University of Calgary, [4]College of Medicine, Drexel University.

Over the last decade, micro-computed tomography (micro-CT) imaging has revolutionized the study of trabecular bone microarchitecture by facilitating a shift from 2D to 3D histomorphometric analysis. Through continual improvements in spatial resolution, micro-CT has also advanced to the point where its analytical advantages can be extended to the cortical envelope. Current desktop micro-CT systems have spatial resolutions that are more than sufficient for imaging human cortical bone vascular (osteonal) porosity. Further, the limitations of desktop systems – including beam-hardening effects and extended scan times – are being overcome with synchrotron radiation (SR) micro-CT systems. SR micro-CT provides a window down to the cellular level of bone structure and is closing the gap between non-destructive imaging and conventional histological techniques. These emerging analytical capabilities are providing a novel perspective on the processes associated with the growth, maintenance, and loss of cortical bone across the human lifespan. The most notable anthropological application of this technology is the analysis of bone rarefying diseases. The shift from assessment of bone density to the direct analysis of microarchitecture, provided by micro-CT, will ultimately facilitate more direct and meaningful comparisons of bone health between past and present populations. This presentation provides an overview of recent advances and future frontiers in high resolution micro-CT imaging and 3D histomorphometric analysis of cortical bone. The potential of this emerging research methodology will be discussed within the context of ongoing studies focused on human bone health, including growth in juveniles, age-dependent 3D microarchitectural change across the adult lifespan, and cellular-level remodeling events.

The transverse midtrochlear ridge: Pathological response or morphological adaptation at the humeroulnar joint at Tell Abraq, United Arab Emirates?

J.M. Cope[1&2], D.L. Martin[3], D. Miller[4], D.D. Potts[5]. [1]Department of Anthropology, University of Massachusetts, [2]Department of Physical Therapy Education, Elon University, [3]Deparment of Anthropology and Ethnic Studies, University of Nevada, Las Vegas, [4]Department of Physical Therapy, Springfield College, [5]Department of Archaeology, University of Sydney.

An unusual transverse ridge was documented at the trochlear notch of the ulna in an adult sample from the Bronze Age tomb at Tell Abraq, United Arab Emirates (2200 BC), located on the Arabian gulf. The tomb housed over 300 individuals that were disarticulated and commingled. Previous research with upper extremity elements of this skeletal population revealed a high level of

osteoarthritis at the trapeziometacarpal joints (mild to severe OA in 53% of the sample individuals).

The ulna (n = 166), radius (n = 201) and scaphoid (n = 274) bones were assessed for morphological variations and pathology. Eighty-five percent of assessed radii had a depressed facet for attachment of the volar carpal ligament and 34% of the scaphoid bones had an exaggerated dorsal ridge for attachment of the dorsal carpal ligament. While assessing the ulnae an elevation at the transverse midtrochlear region was identified on 58% of the sample. This ridge appears to be a newly documented anatomical phenomenon. There was a strong positive correlation between the presence of this transverse midtrochlear ridge (TTR), proximal elbow joint OA (r_s = .330, p<.01) and assigned sex (r_s = .263, p<.01) showing a strong correlation in males. We hypothesize that this transverse elevation at the trochlear notch increased stability at the medial elbow joint in this population. The presence of the TTR in conjunction with the findings on the radii and scaphoid bones suggest that the inhabitants of Tell Abraq lived physically arduous lives that were likely related to maritime subsistence activities.

The scale of it all: postcanine teeth, the taxon-level effect, and the universality of Gould's scaling law.

L. Copes, G.T. Schwartz. Institute of Human Origins, Arizona State University.

Paleobiologists frequently predict body mass from dental remains so that finding an appropriate scaling relationship between body and tooth size in extant organisms is essential. Gould proposed that postcanine occlusal area (PCOA) should scale metabolically (slope, m=0.75) with body mass across mammals. By regressing PCOA of only eight bovid species against skull length, Gould found marginal support for his hypothesis, which he then extrapolated as a universal scaling law for Mammalia.
Our goal was to test the universality of Gould's prediction and the impact of the taxon-level effect on regressions of tooth size on body mass in a large extant mammalian sample (629 species spanning 15 orders). The hypothesis of metabolic scaling can be rejected for most subgroups of Mammalia. Furthermore, no taxon-level effect is evident at the level of class: all analyses of PCOA on body mass have slopes ranging from 0.573 to 0.593 regardless of whether input values to the class-wide regression analysis represent means of species, genera, families, or orders. Interestingly, within some orders, such as Primates, a significant taxon-level effect exists, where slopes from analyses using species means (m=0.604±0.021) are significantly higher than those using means of subfamilies (0.527±0.057), families (0.504±0.065), or superfamilies (0.446±0.099). Gould's hypothesis can be rejected, but more importantly, the scaling relationship of tooth size to body mass is highly dependent on the taxonomic level of analysis, which has major implications for paleoprimatologists attempting to predict body mass from fossilized dental remains.
Funding provided by a NSF GRF to LC.

Prehensile tail use in white-faced capuchins *Cebus capucinus* at La Suerte Biological Field Station, Costa Rica.

R.M. Covey. Department of Anthropology, The Ohio State University.

Prehensile tails have likely evolved at least twice in New World Monkeys; once in Atelines and once in the genus *Cebus*. Compared to Atelines, prehensile tails in *Cebus* are shorter, fully haired, lack specialized tactile receptors, and differ in the extent of dorsal and ventral muscle bundle development. Given these morphological differences, it is plausible that functional roles of prehensile tails differ between platyrrhine clades.
Here I present data on the context of prehensile tail use in *Cebus capucinus* and compare my results to published data on tail use in several Ateline species. Data on *Cebus capucinus* tail use and positional behavior were collected during August 2004 and January 2006 at La Suerte Biological Field Station in Northeast Costa Rica. I used instantaneous focal animal sampling to sample tail use frequencies and associated contextual data on a fully habituated capuchin group containing fifteen individuals. My results indicate white-faced capuchins use their prehensile tails most frequently during feeding and foraging. Suspensory activities involving the tail occurred most often when feeding on insects. In contrast, capuchins did not employ their prehensile tail often during travel. This pattern of tail use contrasts strongly with studies of Atelines who are reported to employ their tail in similar frequencies during feeding and traveling. Factors responsible for parallel development of prehensile tails in platyrrhines are not completely understood, however my preliminary data support the hypothesis *Cebus* evolved its specialized appendage primarily as a postural feeding adaptation and less as a means for more efficient locomotion.

How to grow like a Neandertal: the ontogeny of Late Pleistocene postcranial robusticity.

L.W. Cowgill, Department of Anthropology, Washington University, St. Louis.

While studies of adult remains have identified patterns of temporal variation in postcranial robusticity, relatively less research has focused on possible differences in developmental trajectories that result in variable levels of skeletal robusticity in the adult form. This study aims to clarify the developmental basis for the acquisition of adult postcranial strength in both Late Pleistocene and Holocene humans by addressing two research questions: When during growth do the differences in postcranial strength that differentiate Late Pleistocene and Holocene adults manifest themselves in subadults? Are immature Late Pleistocene individuals attaining postcranial strength at the same rate and following the same pattern as Holocene subadults? Cross-sectional geometry was used to compare the developmental trajectories of humeral, tibial, and femoral growth in Late Pleistocene Neandertal and modern human subadults (N=104) to a sample of immature humans from seven geographically diverse Holocene populations (N=621).
The results of this research indicate that populational differences in postcranial robusticity emerge early in development. While individual variation is common, cross-sectional geometric properties of immature Late Pleistocene individuals general fall at the limits of recent human variation, although the general pattern of the acquisition of postcranial robusticity between Late Pleistocene and Holocene groups is fundamentally similar. These results highlight the complex mosaic of processes that result in adult postcranial robusticity, and suggest that further exploration of the developmental interplay between intrinsic and extrinsic influences on skeletal robusticity will likely enhance our understanding of adult postcranial morphology.
Support provided by the Leakey Foundation, Wenner-Gren Foundation, and NSF BCS-0549925.

Comparative genomics: tools for study of complex diseases

L. Cox, Department of Genetics, Southwest National Primate Research Center, Southwest Foundation for Biomedical Research

Completion of each successive mammalian genome sequencing effort has exponentially increased the information available and provided new tools necessary to support comparative genomic analyses. Technologies are now available that allow genome sequence comparison from large chromosomal regions to individual nucleotides among multiple individuals of a single species and among multiple species. Comparative genomic tools are being used for the study of complex diseases by comparison of model organism genomes with the human genome to identify: syntenic quantitative trait loci, putative regulatory elements, conserved gene coding sequence domains, polymorphic elements in coding and non-coding sequences, and conserved gene networks.
In studies of pedigreed baboons, my colleagues and I are using comparative genomic tools combined with classic genetic tools to identify genes that influence variation in complex disease traits. I will present examples of the use of these new tools for identification of concordant quantitative trait

loci, regulatory elements, conserved gene domains, gene expression profiles, and gene networks relevant to cardiovascular disease. In addition, I will present use of these tools for identification of specific polymorphic nucleotides that influence variation in a cardiovascular disease-related quantitative trait in a non-human primate and show how these results can be used for identification of polymorphisms that are likely to influence variation in that quantitative trait in humans. The marked reduction in sequencing costs will soon provide additional data on numerous individuals in multiple species that will again significantly expand the information gained using comparative genomics tools.

Population Structure Measured by Molecular Genetic Markers: Aleutian Archipelago

M.H. Crawford, A.J. Redd, M. Zlojutro. Department of Anthropology, University of Kansas

The Aleutian Archipelago provides a unique opportunity to apply newly developed analytical methods, based on DNA sequences and haplotypes, to the characterization of the population structure of island groups--distributed over 1,500 kilometers from the Alaska Peninsula to Kamchatka in Siberia. The following analytical methods were applied using molecular markers, mt-DNA, STRs and NRY: mismatch analysis, SAMOVA, MDS, spatial autocorrelation, residual genetic distance interpolation and Delaunay triangulation methods for detecting genetic discontinuity.
A strong statistical relationship was demonstrated using Mantel tests between geographic and genetic distances ($r = 0.72$; $p > 0.00$) for mt-DNA sequences. No statistically significant association for GEO and GEN was detected for NRY markers. Genetic discontinuity was demonstrated using SAMOVA, triangulation methods, and residual genetic distance interpolation of mtDNA haplotypes. Spatial autocorrelation demonstrates that the isolation-by-distance model best explains the observed relationship between genetics and geography. Admixture estimates based on Y-haplogroups reveal that only 15% of the Aleut Y chromosome is Native American.
The use of both mt-DNA and NYR markers reveals an extreme asymmetry in the reconstruction of the Aleut population structure. Participants whose mothers are of Aleut ethnicity display only the founder haplogroups A and D. In contrast, 85% of the Y-chromosomes are of Russian, Scandinavian or English origin. Systems that recombine, such as STRs and HLA, provide ambiguous affinities—clustering the Aleuts with Central Asian populations. Without the use of mt-DNA sequences, the indigenous signal in Aleut populations would not be observable.
This research was supported by grant from NSF: OPP-990590 and OPP-0327676

An analysis of the dental and mandibular morphology of the Makapansgat hominids.

T.C. Crawford[1], K.L. Kuykendall[2], J.K. McKee[3], G.C. Conroy[4]. [1]Dept. of Anthropology, Washington University, [2]Dept. of Archaeology, University of Sheffield, [3]Dept. of Anthropology, The Ohio State University, [4]Dept. of Anatomy and Neurobiology, Washington University Medical School.

Hominids from the Makapansgat Limeworks have been used routinely in comparative analyses of Plio-Pleistocene hominids. Although they currently are referred to *Australopithecus africanus*, the sample has been noted to differ from *A. africanus* elsewhere. Authors have made a variety of suggestions regarding how to interpret this variation. Some suggest the Makapansgat hominids represent a new species, some suggest one mandibular specimen should be referred to *Australopithecus robustus*, and others indicate they are part of a highly variable *A. africanus* hypodigm. All of the Makapansgat hominids are estimated to be 2.8-3.2 million years old. Thus, the Makapansgat hominids are temporally and geographically unique as they are currently the earliest and most northern South African australopithecines known.
The Makapansgat assemblage has never been the focus of a systematic analysis. Comparative analyses of mandibular and dental metrics from *A. africanus*, *A. robustus*, and *Homo*, *Pan*, *Gorilla*, and *Macaca* will be presented. We include two new mandibular specimens, and compare the patterning of mandibular and dental variation at Makapansgat and Sterkfontein. Supporting previous assertions, the Sterkfontein assemblage exhibits a wide range of mandibular and dental variation. The Makapansgat sample is less variable, although this likely results from sample size. There is considerable overlap in dental and mandibular metrics from Makapansgat and Sterkfontein, although the Makapansgat assemblage can be distinguished. Analyses comparing the Makapansgat dental and mandibular samples to Swartkrans, Kromdraai, and Sterkfontein samples indicate a complex patterning of variation across and within South African Plio-Pleistocene sites, reflecting the ambiguity of many individual taxonomic attributions.

Myostatin deficiency does not reduce intracranial volume in a murine knock-out model.

J.J. Cray Jr.[1]; J. Miller[2], L. Vecchione[3,5], C. Byron[4], G.M. Cooper[5,8], T.E. Barbano[1], M.I. Siegel[1,7], M. Hamrick[6], J. Sciote[7], M.P. Mooney[1,3,7,8]. [1]Department of Anthropology, University of Pittsburgh, [2]University of Pittsburgh School of Dental Medicine, [3]Division of Plastic Surgery, University of Pittsburgh, [4]Department of Biology, Mercer University, [5]Division of Pediatric Plastic Surgery, Children's Hospital of Pittsburgh, University of Pittsburgh, [6]Department of Cellular Biology & Anatomy, Medical College of Georgia, [7]Department of Orthodontics & Dentofacial Orthopedics, University of Pittsburgh, [8]Department of Oral Biology, University of Pittsburgh.

Stedman et al., (2004) suggested that a mutation in the myosin heavy chain gene (MYH 16) may have indirectly increased brain size in human evolution by reducing masticatory muscle size, decreasing its subsequent compressive effects on cranial vault growth, and thus removing a constraint on greater encephalization. If masticatory muscle size were increased, then a reduction in brain growth should also occur. The present study was designed to test this hypothesis using a Myostatin (GDF-8) knockout mouse model. Myostatin is a negative regulator of skeletal muscle growth, and individuals lacking this gene show significant hypermuscularity.
Fourteen (8 wild-type and 7 GDF-8 -/- knockout), 1 day old and 16 (9 wild-type and 7 GDF-8 -/- knockout), 180 day old male CD-1 mice were used. Body and masseter muscle weights were obtained. Standardized lateral and dorsoventral radiographs were taken of each skull. Cephalometric landmarks were identified on the radiographs and intracranial volume (cranial vault length*width*height) was calculated. Mean differences were assessed using a two-way ANOVA.
Myostatin knock-out mice had significantly greater body ($F=7.9$;$p<0.01$) and masseter muscle weights ($F=22.35$;$p<0.001$) compared to wild-type controls by 180 days. No significant differences ($F=2.38$;ns) in intracranial volume were noted between myostatin knock-out mice and wild-type controls. Muscle weight was not significantly correlated with intracranial volume in 1 or 180 day old mice.
Results from this model demonstrate that masticatory hypermuscularity did not inhibit intracranial volume. Furthermore, it has been demonstrated that neural capsule growth determines cranial vault growth and morphology and that the masticatory apparatus only affects ectocranial morphology. Results do not support the Stedman et al., (2004) hypothesis. Alternative hypotheses should be explored.

Cytokine expression polymorphism in European human populations.

F. A. Crespo[1,2], R. Oberst[3], G. R. Fernandez-Botrán[4], M.F. Casanova[2], and C.R. Tillquist[1].[1]Department of Anthropology, [2]Department of Psychiatry and Behavioral Sciences, [3]Department of Biology, [4]Department of Pathology and Laboratory Medicine, University of Louisville.

Cytokines and their receptors are often encoded by highly polymorphic genes. These polymorphisms appear responsible for the observed inter-individual differences in

cytokine production and capable of modifying immune response. We report results from a survey of common polymorphisms giving differential expression in anti-inflammatory (TGFß1 and IL-10) and pro-inflammatory (TNFα, IFNγ, and IL-6) cytokines in eighteen geographically distinct European populations. We combine previously published data for European populations with newly generated data. Analyses reveal that frequencies of certain genotypes for specific cytokines document a non-random distribution with significant regional variation. In some cases, the ancestral allele is maintained at high frequency, while in others there is an increased frequency of the derived allele when compared to other non-European populations. Specifically, there may be ongoing selective sweeps in IFNγ, IL-6, TGFß1 codon 10, and IL-10. In the case of pro-inflammatory cytokines, the most frequent allele of a given cytokine is the one contributing to lower expression, while in the case of anti-inflammatory cytokines the most frequent allele is the one giving higher expression. Geographically, an apparent clinal distribution of genotypes is not evident for all cytokines, supporting the role of selection versus the impact of demographic expansion. From an evolutionary perspective, humans may be undergoing a shift in the balance of pro- and anti- inflammatory cytokines favoring less inflammation. It may be useful to think about the balance between pro- and anti-inflammatory cytokines as constituting an integrated phenotype.

Late reproduction and parental investment increase reserve capacity and longevity in humans.

D.E. Crews, Anthropology and Public Health, The Ohio State University.

Disposable soma theory suggests that trade-offs between reproductive success and longevity provide the basis for evolution of life history (LH) traits. Young age at fist birth and high parity exact high physical costs from mothers and associate with shorter life spans. Species that reproduce less live longer. When parents must survive long-term, limiting reproduction saves resources for self-investment (SI). Human LH traits are associated with the need to rear altricial infants and children. Data on LH traits and longevity [mean ages at menarche, first birth, childbearing, and menopause, life expectancy at birth, and wealth (per capita GDP)] of women representing 77 populations were obtained to examine correlates of longevity. Associations of age at menarche and life expectancy (R= .29) and age at first birth and menopause (R= .29) were of borderline significance. Wealth significantly predicted age at menopause (R= .64), life expectancy (R= .60), and age at first birth (R= .55). In multivariate regression, wealth was not a significant predictor of life expectancy ($p = 0.129$). However, both age at first birth ($p \leq 0.001$) and age at childbearing ($p = 0.001$) were (Model R = .73). Delayed reproduction is consistently associated with increased life span. Children who receive high PI (wealth) have high reserve capacity (RC) and the potential to live longer (given all other trade-offs are held constant). Fewer stressors affect parents and children today than when hominins originally evolved and greater PI was necessary for offspring. This allows retention of RC for SI in late life.

Change is good: Using advanced statistical methods for the identification of secular change in femoral head size.

S. Cridlin[1], W.L. Seaver[2], and R.L. Jantz[1]. [1]Department of Anthropology, University of Tennessee, [2]Department of Statistics, Operations, and Management Science, University of Tennessee.

Identification of secular trends can provide evidence of how a population responds to environmental transitions. Cohort comparisons of trends can reveal differing degrees of change experienced among groups within a single population or between different populations. Studies typically employ the linear regression model, which has shortcomings, to identify significant morphological changes over time. The objective of this study is to evaluate secular changes in the femoral maximum vertical head diameter (MVHD) of American males and females through the application of advanced statistical methods that are appropriate for time-series data and the identification of trends.
Femoral head diameters of 19th Century and modern Americans (n=1,217) were examined from the Robert J. Terry Anatomical Collection, the M. F. Ericksen Collection, and the University of Tennessee Forensic Data Bank. Two cohorts categorized by sex were evaluated for autocorrelation prior to performing additional statistical analyses. Statistical evaluation of a secular trend for the male sample was executed via an Autoregressive Integrated Moving Average (ARIMA) model of the average MVHD variable on the year-of-birth variable, and a subsequent regression analysis of lag first-differences on a five year year-of-birth variable. Results indicate the average head diameter appears to fluctuate in size over time among males. Piecewise regression analysis, employed to identify the trend in the female sample, indicate that head diameters increase in size until approximately 1910 and rapidly decrease in diameter size thereafter. Both the ARIMA model and the piecewise regression revealed trends in the data that were not apparent with the linear regression model.

Bone Histomorphometry: Validating methods of age estimation.

C. M. Crowder[1], S. Pfeiffer[2]. [1]Office of Chief Medical Examiner, New York City, [2]Department of Anthropology, University of Toronto.

The estimation of age is an important aspect of personal identification and reconstruction of population demographics. Given the variation observed in the morphological pattern of age related changes and the complications that postmortem taphonomic factors can introduce, adult age can often be the most difficult analysis to perform. Differentiating error levels caused by biological variability from those originating from methodological or post-mortem diagenetic factors is essential. Gross morphological methods of age estimation are commonly applied and well tested, but histological methods have not been subjected to the same levels of scrutiny.
This research applied six previously published histological methods that analyze cortical bone cross-sections from the ribs (three methods) and femoral mid-shafts (three methods). The known age skeletal sample consists of 250 individuals from the crypt of Christ Church, Spitalfields, London, with ages ranging from 13 to 93. Histomorphometric data were collected from 440 undecalcified rib and femur thin-sections, including 149 rib-femur pairs.
Results indicate that bone histomorphometry is a useful method for estimating age, with some methods producing accuracy values comparable to gross morphological methods. Other methods generated poor age estimates for this sample. In addition to bias that may arise from a method's source sample, technique is a factor in the amount of objectivity, accuracy, and observer error that is introduced. Histological methods using the rib can be as accurate as those using the femur, and so may be more convenient and efficient. Those using the femur may be more promising than gross morphological methods for increasing the accuracy of age estimates in individuals over 50 years of age. This research identifies techniques to reduce observer error and suggests changes that are needed to improve accuracy of future histological methods of age estimation.

Isotopic fractionation patterns in primates.

B.E. Crowley[1], L.R. Godfrey[1], S. Karpanty[3]. [1]Department of Anthropology, University of California-Santa Cruz. [2]Department of Anthropology, University of Massachusetts-Amherst, [3]Department of Fisheries and Wildlife Sciences, Virginia Tech.

It is well established that stable isotopes in animals fractionate differently depending on body size, physiology, and diet. Yet the extent to which isotopes fractionate in primate tissues and between taxa remains largely unexplored. Due to physiologic and nutritional differences, diet-tissue and within-animal fractionation should differ across species. Previous fractionation studies have found that diet and gut length can substantially affect these patterns, with a three-fold range in both carbon and nitrogen collagen-diet spacing. Accordingly, to improve our understanding of isotope chemistry and

interpretations of primate dietary and habitat preference based on isotopic results, we have studied isotopic fractionation patterns in several primate species with differing physiologies, habitat and dietary preferences. This research focuses on a suite of carbon, nitrogen and oxygen isotopes from hair, muscle, and bone collagen and carbonate. Captive specimens are required because it is essential to isolate the factors associated with digestive physiology by controlling for diet and environmental variables. Specimens from the wild are essential because they permit an improved understanding of isotopic variability in the environment and more relevant interpretations of the isotopic ecology of extant primates.
Here we identify how stable isotopes vary within and between animals of the same species, how these patterns vary across species, and whether or not captive populations can be used as proxies for wild animals. First, we examine fractionation patterns in captive genera and then we discuss how patterns identified in captive individuals compare to those in wild primates from both moist and dry forest habitats.

Morphological affinities and migratory patterns in Precontact Maya populations from the Yucatan Peninsula: a dental non-metric analysis.

A. Cucina, V. Tiesler. Facultad de Ciencias Antropológicas, Universidad Autónoma de Yucatán.

The Postclassic Maya period is characterized by the rise of new centers in northern Yucatán as a consequence of the decline of important centers in the southern Lowland, and consequently of Chontal Maya groups migrating into the peninsula from what is nowadays the Tabasco region. To contribute to the understanding of Yucatec Maya population's dynamics through time, we investigated the dental morphological affinities among Maya groups that settled the Yucatan peninsula during the Classic and Postclassic period in order to assess the extent of replacement or continuity in the peopling of the northern regions at the onset of the Postclassic. In order to achieve this goal, twenty-seven non-metric dental traits were scored on nineteen skeletal series dated to the Classic and Postclassic periods, following the Arizona State University Dental Anthropology System standard. The pattern of morphological affinities between time periods and geographical areas were validated statistically through PCA, MMD, Cluster Analysis and Maximum Likelihood methods. Results clearly indicate differences between Classic and Postclassic populations and point towards south-to-north migrations at the onset of the Postclassic period. This could be connected to the vacuum produced by the fell of the Iztaes at the beginning of the second millennium AD, and the following development of trade systems by the Putun-Chontal groups the eventually brought new human groups into the peninsula.

Dietary Practices in Roman Britain: The evidence from carbon and nitrogen stable isotopes.

C. Cummings. Research Laboratory for Archaeology, University of Oxford.

A lack of direct textual evidence has hindered the production of a comprehensive study of dietary practices in the Romano-British context. Skeletal evidence, however, may offer greater insights into Romano-British diet. This paper will explore dietary patterns using carbon and nitrogen stable isotopes. In order to allow both inter- and intra- site comparisons, in this project I have analysed a total of 388 human adults from a range of sites in southern Britain (primarily 3rd to 4th centuries ce). In addition, a total of 201 animals of a variety of species from the same sites have been analysed to provide information on food chain relationships and agricultural practices. The results suggest considerable heterogeneity in dietary practices within the sites, particularly within the larger settlements, and unexpected similarities between urban and rural diets. Of particular interest is the evidence of increased marine fish consumption among certain segments of the population, potentially linked to higher status groups.

Postcranial proportional variation in *Australopithecus afarensis* and *A. africanus*.

D.L. Cunningham[1], T.M. Cole III[2], C.V. Ward[1]. [1]University of Missouri-Columbia, [2]University of Missouri-Kansas City.

Recent research comparing postcranial variation in *A. afarensis* and *A. africanus* has been equivocal; some find differences between the taxa in body proportions, while one study concluded that A.L. 288-1 and Stw 431 are not significantly different. We test the patterns of variation in the postcrania of *A. afarensis* and *A. africanus*, comparing them to each other and to extant great apes.
We examine unscaled and scale-adjusted (shape) measurements for isolated postcrania from Hadar and Sterkfontein Member 4. Using a special multivariate statistical model where all possible "composite" individuals are considered, we measure variation with the sum of eigenvalues for the commingled-sample covariance matrix.
Variation at Hadar exceeds *Pan* and *Homo* for upper and lower limbs, and for all elements combined (for both unscaled data and shape), but does not exceed that of *Gorilla* or *Pongo*, suggesting a single, dimorphic species. Lower-limb variation at Sterkfontein exceeds *Homo* and *Pan*, but not *Gorilla* or *Pongo,* for both scaled and unscaled data. Upper–limb variation exceeds *Homo* for unscaled data and is comparable to *Homo* and *Pongo* for shape. For both limbs combined, the fossil variation exceeds *Homo* and is comparable to *P. paniscus* for both scaled and unscaled data. These results suggest a single, dimorphic species. When we combine the fossils from Hadar and Sterkfontein, we find that variation exceeds *Pan* and *Homo*, but not *Gorilla* or *Pongo*. The patterns of variation in these fossils likely reflect the complexity of sexual dimorphism as well as functional demands.

Supported by NSF BCS-0234193, Sigma Xi, AMNH, and PEO.

Habitat variation in patterns of ring-tailed lemur (*Lemur catta*) gross tooth wear and functional tooth loss indicates "ecological disequilibrium" in Madagascar

F.P. Cuozzo[1], M.L. Sauther[2]. [1]Department of Anthropology, University of North Dakota, [2]Department of Anthropology, University of Colorado-Boulder.

Gallery forest ring-tailed lemurs at the Beza Mahafaly Special Reserve (BMSR), Madagascar exhibit a remarkably high level of gross tooth wear and functional loss which begins at an early age, can occur rapidly, and appears related to processing large, hard tamarind fruit (*Tamarindus indica*), a critical fallback food. As tooth morphology is adaptive, this pattern suggests a "mismatch" between tooth structure (e.g., thin enamel) and a dominant food source. To test this "ecological disequilibrium" hypothesis, we evaluated gross tooth wear in the ring-tailed lemurs at Tsimanampesotse National Park (TNP), Madagascar a habitat with both limestone spiny and dry coastal forests. In striking contrast to BMSR, the vast majority of individuals at TNP (n = 24) showed only light to moderate gross wear. Also, no individuals in this population displayed significant tooth loss, with only one individual showing functional tooth loss of the first maxillary molars. At BMSR, 22.8% (n = 167) show severe wear and functional tooth loss, with 3.6% exhibiting loss of over half of their dentition. *T. indica* is rare at TNP, found only along a single transect that includes a collapsed limestone depression with an ephemeral water source. The rarity of tamarind at TNP, combined with the absence of severe wear and rare tooth loss, support our hypothesis that gallery forest ring-tailed lemurs rely on a food for which they are not adapted, thus displaying ecological disequilibrium. Our data illustrate the power of using gross tooth wear to identify niche discordance among living and fossil primates.
Funding for this project was provided by the St. Louis Zoo (FRC Grant 06-1), the University of North Dakota, and the University of Colorado.

Genomic studies of human populations: Resequencing approaches for the identification of human quantitative loci.

J.E. Curran. Dept. of Genetics, Southwest Foundation for Biomedical Research

In this post-genomic era, our approach to understanding the genetic architecture of a complex phenotype follows a specific route. Genome scans are used to localize underlying QTL to a potentially large chromosomal region. However, the next step in identifying a disease gene from among up to several hundred genes in the region presents a formidable task. The chromosomal location may be refined by saturating the positional candidate region with additional genetic markers. Alternatively, independent methods (*in silico* bioinformatic analysis and transcriptional profiling) can be used to objectively prioritize positional candidate genes for comprehensive resequencing. Most candidate gene studies and genome-wide association studies focus on polymorphic variants with relatively high frequency (MAF > 0.15). However, data is rapidly accumulating that rare variants have a large cumulative effect on normal phenotypic variation, requiring different strategies to identify functional variants. A key factor in the identification of rare variants is resequencing sufficient numbers of the founder chromosomes to capture all sequence variation within a candidate gene. I will present examples where we have used 1) a two-stage approach, combining human linkage and animal model data in combination with bioinformatic analyses, to assist in the identification of genes involved in disease development; and 2) genome wide transcriptional profiling to identify *cis*-regulated genes, and functional sequence variations, correlated with disease phenotypes. With the current and rapid technological advances in the genomics field, new approaches for identifying human QTLs are becoming increasingly common and more cost effective. Feasibility of these new techniques will also be discussed.

Hominin Paleoecology and Cervid Ecomorphology

S. Curran, University of Minnesota.

As many of the pressures of natural selection stem from environmental conditions, accurate reconstructions of paleoenvironmental conditions are imperative for testing hypotheses concerning human evolution. By introducing techniques to analyze cervid ecomorphology, this study expands the use of mammalian remains, often one of the best-preserved paleoecological proxies. Cervids are often the dominant taxa in Eurasian paleoanthropological sites. Included in this analysis are 140 individuals from 30 species and all extant cervid genera. These specimen represent cervids from almost all habitat types in Eurasia and the Americas (tropical rainforests, temperate forests, woodlands, parklands, swamps, grasslands, tundra, etc.) except deserts. Further, species are represented from areas of varying topographic relief (lowlands through mountains) and substrates with varying degrees of resistivity (very hard to springy tundra). While there is some overlap with African habitat types, habitats in Eurasia and the Americas differ from their African counterparts in terms of the type and duration of seasonality and the influence of extreme cold.
Bovid morphometric measurements are tested for their utility in cervid ecomorphology to compare Eurasian and African habitats. Additionally, several methods for evaluating cervid ecomorphology are presented. Morphological characters were chosen that reflect aspects of cervid functional morphology and appear on portions of elements likely to be preserved. This study examines joint surface morphology, which indicates the type and range of motion at a joint, using 3D geometric morphometrics and elliptical Fourier analysis. Principal components and canonical variates analyses of several joint surfaces and margins are presented showing good separation between habitat types.

The nutritional status of the Serbian Roma: a preliminary study

J. Čvorović[1], A. Gallagher[2], V.E. Gibbon[2], G. Štrkalj[2,3]. [1]Institute of Ethnography, Serbian Academy of Sciences, [2] School of Anatomical Sciences, University of the Witwatersrand, Johannesburg, [3] Department of Health and Chiropractic, Macquarie University.

According to official estimates, between 360,000 and 500,000 Roma people currently inhabit the Republic of Serbia. Historically, Serbian Roma occupy the lower socio-economic strata and their position was further exacerbated during the 1990s when the general population suffered a decrease in quality of life due to political and economic crises. The aim of this study was to establish whether the Roma's disadvantaged position in Serbia is reflected in their nutritional status. The study focused on anthropometric data of three groups, all from the vicinity of Belgrade; Gurbet, Ashkari and Romanian Roma (who migrated to Serbia in 18th and 19th centuries).
346 volunteers (226 females and 120 males) were surveyed. The Roma samples were compared to two European comparatives: European sample-means (Eveleth and Tanner, 1976) and a sample of British volunteers (Porter, 1996). Generally, Serbian Roma males and females show little difference in stature and body mass compared with European and British samples. Comparisons of Body Mass Index indicate that Roma males have significantly higher BMI than contemporary British males. Only the Gurbet females display a mean BMI that is significantly greater than in their British counterparts. Our results indicate that little support for the hypothesis that Serbian Roma are poorly nourished. Indeed, some groups may have a moderate/high proportion of individuals whom might be classified as overweight and even at-risk of clinical obesity.

Age change in the white female scapula.

G.R. Dabbs[1] and P.H. Moore-Jansen[2]. [1]Dept. of Anthropology, University of Arkansas, [2]Dept. of Anthropology, Wichita State University

This work shows that some of the generalized scapula age changes reported by William Graves (1922) are not universally applicable across groups, and should be reexamined. Previous work on the human scapula has shown it to be a dynamic skeletal element, changing morphologically and metrically with advancing age. The pattern of age related changes has been shown to vary on sex and group specific bases. This paper elucidates the unique pattern of change observed in white female scapulae with advancing age. Twenty-three measurements were collected from 125 white females ranging in age from 25 to 93 years. This sample was pulled from the Hamann-Todd Osteological Collection, a 19th-20th century American population. The findings include an overall decrease in the maximum length of the spine, an increase in the breadth of the mid-body, a general increase in the thickness of the vertebral borders at five sites, four of which show statistical significance, and an increase in the breadth of exterior margins of the glenoid fossa. Contrary to the early work of William Graves (1922), as well as age changes observed by the authors in white males, black males and black females, the white female scapula does not increase in ventral curvature with advancing age. Therefore, as this study demonstrates, it is inappropriate to assume a single pattern of change is applicable to all individuals as they age without careful examination of the population by sex and group specific categories.

Phylogeny of New World monkeys (Primates: Platyrrhini) based on large genomic sequence data.

A. Dacier[a,c], A.L. Morales-Jimenez[a,c], M. Blair[b,c], T.R. Disotell[a,c]. [a]Department of Anthropology, New York University, [b]Department of Ecology, Evolution and Environmental Biology, Columbia University, [c]New York Consortium in Evolutionary Primatology (NYCEP).

This study explores the contentious relationships among platyrrhine families and the position of *Aotus* within the cebids by analyzing long nuclear DNA sequences obtained through data mining. For five genera of neotropical primates (*Aotus, Ateles, Callicebus, Callithrix,* and *Saimiri)*, the phylogenetic tree inferred from the data strongly supports a Cebidae/Atelidae clade to the exclusion of the Pithecidae. Within the Cebidae, *Aotus* clusters with *Saimiri*, to the exclusion of *Callithrix*, further suggesting the placement of *Aotus* in this family. This topology has not received strong support from relatively short intronic DNA sequence data, but is strongly supported by analyses of rare genomic events, such as insertion of interspersed elements. A molecular clock

analysis was also conducted to estimate relative divergence dates; results are presented relative to the split between *Homo sapiens* and *Chlorocebus aethiops* and therefore can be improved when better calibration points are available. Our results support the idea that increasing DNA sequence length in molecular phylogenetic analyses significantly enhances phylogenetic resolution, overcoming factors that might result in topology mismatch.

Stiffness of the longitudinal foot arch : in vivo measurement and functional implications.

K. D'Août [1,2], D. Frans [1], B. Van Gheluwe [3], D. De Clercq [4] & P. Aerts [1,4]
[1] University of Antwerp, Belgium, [2] Centre for Research and Conservation, Belgium, [3] Free University Brussels, Belgium, [4] Ghent University, Belgium.

The emergence of a well-developed longitudinal foot arch is a key factor in the evolution of the hominin foot and in the acqusition of an efficient bipedality. The arch's main function is to provide stiffness to the foot (as opposed to the flexible ape-like foot) and, by doing so, enhancing leverage at push-off. However, it is very hard to deduce arch stiffness from fossil bones or tracks. Here, we attempt to correlate footprint characteristics, anatomical foot type and longitudinal foot stiffness in a population of native barefoot walkers from South India. The data were compared with barefoot walking, but habitually shod South Indians and Caucasians.
We collected morphometrics (toe spread, navicular height and anatomical foot type), dynamic plantar pressures (Footscan) and foot kinematics (50Hz). Barefooters had a larger toe spread and a slightly lower foot arch than habitually shod subjects. Interestingly, the variation in foot type is significantly higher in shod walkers (i.e. higher incidence of pes planus and pes cavus) than in barefoot walkers. During midstance, the navicular drop (a measure for arch stiffness) correlated poorly with foot type and did not differ between the three populations. During toe dorsiflexion at push-off, the arch structure and the windlass effect likely co-operate in stiffening the foot.
Supported by the FWO-Flanders and by the Centre for Research and Conservation.

A preliminary bioarchaeological analysis of health among the inhabitants of Kish, Iraq.

B.M. Daverman[1], C. Torres-Rouff[1], and W.J. Pestle[2]. [1]Department of Anthropology, Colorado College, [2]Department of Anthropology, University of Illinois, Chicago.

In the 1920s and 1930s, the Field Museum of Natural History and the University of Oxford excavated one of the world's first true cities. Kish, located on the Euphrates floodplain, was the dominant regional polity in Mesopotamia 5000 years ago. As part of a project to produce a long-delayed site report, we have undertaken reanalysis of the human skeletal remains and their burial contexts. The research presented here results from preliminary investigations of health indicators and their relationship to increasing complexity and urbanization for that portion of the sample for which reliable chronological control has been established. Osteological analyses were conducted on 699 individuals; however, only 130 could be securely dated. We hypothesized that the population from Kish would display escalating rates of nutritional stress and other pathological indicators reflecting increasingly complex social hierarchies and differential access to resources. Our data reveal that health, as reflected through indicators of nutritional disruption and violence, declined during the three Early Dynastic periods (n=90; 3000-2350 BC). During the Akkadian period (2350-2150 BC), Kish was no longer the center of regional political gravity. There is no evidence of health disruption in our small Akkadian sample (n=11). Data from the much later Neo-Babylonian era (n=32; 1000-500 BC), a period when the significance of Kish rebounded, again demonstrates skeletal evidence of stress. Our data suggest that EDIII is of particular interest as a time of growing political unrest raising intriguing questions for investigation once chronological control of the entire sample has been obtained.

This project was supported by NEH Grant PI-500014-04, The Field Museum of Natural History, Colorado College Venture and Jones Funds, and the Associated Colleges of the Midwest.

Indications of habitat preference/avoidance of *Australopithecus robustus* in the Bloubank Valley, South Africa

D.J. deRuiter[1], M. Sponheimer[2], J.A. Lee-Thorp[3]. [1]Department of Anthropology, Texas A&M University, [2]Department of Anthropology, University of Colorado at Boulder, [3]Department of Archaeological Science, Bradford University.

The paleoenvironment associated with *Australopithecus robustus* has been reconstructed as a predominantly open, arid grassland situated within a habitat mosaic that included a more wooded segment with a nearby perennial water source. Most studies have concluded that the open grassland component represents the habitat preference of the hominins. This study investigates indicators of habitat preference or avoidance preserved in the animal paleocommunities represented in a series of fossil cave infills in the Bloubank Valley of South Africa, including Swartkrans, Sterkfontein, Kromdraai and Coopers. Testing for conditions of isotaphonomy reveals a bias relating to depositional matrix, though this bias has not significantly influenced the taxonomic composition of any particular assemblage. Correspondence analysis of census data from modern African nature reserves demonstrates patterns of habitat utilization by large mammals that in turn allow assignment of fossil taxa to a series of broadly defined habitat categories. Fluctuations in the relative abundance of fossil taxa assigned to these categories reveals a strong, significant negative correlation between *A. robustus* and open, arid adapted taxa. Thus it appears that the open grasslands that comprise the majority of the reconstructed paleoenvironment of *A. robustus* represent a habitat that was avoided by the hominins. Indications of the precise habitat favored by the hominins are elusive, though several lines of evidence point toward a preference for a more wooded portion of the habitat mosaic. The capacity of *A. robustus* to incorporate significant amounts of C_4 resources in their diet, perhaps during times of relative resource stress, allowed them to survive in what otherwise might have been a suboptimal environment.

Inferring dietary behaviour for early Miocene catarrhines from incisor curvature and the role of Red Queen morphological shifting

A.S. Deane. Department of Pathology and Anatomical Sciences, University of Missouri - Columbia

The early Miocene catarrhine fossil record of East Africa represents a diverse adaptive radiation. It is well accepted that these taxa encompass a range of dietary behaviour similar to extant hominoids in addition to the potential for some novel dietary behaviours. Several studies have previously attempted to infer dietary behaviour for these taxa from patterns of dental allometry and incisor and molar microwear, however, analyses of gross dental morphology have been exclusive to the post-canine dentition. Given the key functional role of the incisors in pre-processing food items prior to mastication, it is reasonable that these teeth may better represent the overall complexity of ape diets and the unique selective pressures imposed by diet specific mechanical loading.
This study seeks to re-examine existing dietary hypotheses for large-bodied early Miocene catarrhines using comparative models derived from correlations between incisor curvature and feeding behaviour. These models are based on an extant sample including hominoids (n=304) and selected ceboids and cercopithecoids with specialized dietary behaviours (n=47). Incisor curvature was quantified for 78 incisors representing seven fossil genera and results demonstrate that increases in mechanical loading are positively correlated with proportionate increases in crown curvature. Additionally, incisors from early Miocene taxa are typically less curved than extant hominoid incisors indicating a general pattern of increasing mesio-distal and labial curvature through time consistent with Van Valen's Red Queen Hypothesis (1973). This predicts that taxa

removed from one another by geological time, although potentially having similar diets, may reflect differing degrees of a similar dietary adaptation.

Axes of elastic symetry in bulk specimens of primate midfacial cortical bone correlate with microstructural variation

P.C. Dechow, S. Alaqeel, Baylor College of Dentistry, Department of Biomedical Sciences, Texas A&M Health Science Center, Dallas.

Elastic properties define the relationship in cortical bone between loading and deformation. Our investigations have noted that considerable variations exist in 3D elastic properties in the craniofacial skeleton, in particular, variations in anisotropy and the axes of minimum and maximum stiffness. Quantification of anisotropy is important not only to formulate accurate biomechanical models, but because variations reflect bone adaptation at the level of bone cells and matrix. This study tests the hypothesis that variations in cortical elastic anisotropy correlate with variations in 3D osteonal structure. A positive correlation would support the claim that 3D osteonal structure is influenced by mechanical load orientation. Cortical bone of the human midface was investigated because it has large variations in anisotropy. Ultrasonic methods were used to determine 3D elastic properties in 100 cylindrical cortical specimens from 10 frozen human crania. MicroCT was used to quantify variations in Haversian canal orientations in 23 specimens, selected from the 100 specimens, so that a range of anatomical locations and anisotropies were represented. The ratio of the elastic modulus in the direction of minimum stiffness to that in the direction of maximum stiffness ranged from 0.26 to 0.92. Average osteon orientation weighted by osteon length was within 15° of the direction of maximum stiffness in all but 2 specimens. The anisotropy ratio was moderately correlated with the standard deviation of osteon orientation at R=0.48 ($P<0.05$). Results suggest that osteon orientation is a structural correlate of cortical anisotropy. The moderate correlation suggests that other factors, such as collagen orientation, or the quantity and structure of primary bone, are also important in determining bulk cortical bone anisotropy.
Supported by NSF BCS-0240865 and HOMINID grant 0725141.

Analysis of the auricular surface on multi-slice computed tomography reconstructions for assessment of aging: a preliminary study

F. Dedouit [1], P. Barrier [1], N. Telmon [1], P. Otal [2], F. Joffre [2], H. Rousseau [2], J. Braga [1], D. Rouge [1]. [1] Department of Biological Anthropology, University Paul Sabatier, France, [2] Department of Radiology, Rangueil Hospital, Toulouse, France.

The goal of this presentation is to assess the possibilities of aging on two and three dimensional multi-slice computed tomography (MSCT) reconstructions of the auricular surface using criteria previously described and specific MSCT criteria. 46 coxal dry bones were examined with a MSCT. Two and three–dimensional post-processing was made. On 3D reconstructions and photos, transverse organisation, pattern, macroporosity, apical and retro apical activities were analysed. On 2D reconstructions, macroporosity, auriculo-acetabular line and bone gradient under and above this line were quantified. All these criteria were assessed by two different observers. Values of the inter-observers and intra-observer variabilities were good. The inter-method error varied according to the criteria. For criteria used for the age of death, the box- and whiskers-plots illustrate the pertinence of the staging performed. For *transposed dry bones criteria*: moderate or absent transverse organisation or macroporosity isolate cases younger than 40 years old; absence of apical and retro apical activities differentiate people younger than 45 years old; dominant pattern separate people older or younger than 40 years old. For *specific MSCT criteria*: the loss of the continuity of the auriculo-acetabular line associated to the absence of juxta-linear cells isolates individuals older than 50 years old; the difference of bone density under and above the auriculo-acetabular line differentiates people older than 50 years old. Using MSCT reconstructions of the auricular surface in order to estimate the age of a person using transposed and specific MSCT seems to be efficient. Analysis on a larger population is necessary.
Research supported by the Centre National de la Recherche Scientifique (PEPS-ODENT Project), the French Ministry of Foreign Affairs and the EU PF6 Marie Curie Actions grant MRTN-CT-2005-019564 'EVAN'.

A phylogenetically controlled analysis of the relationship between temperature and modern human limb length variation.

M. Dembo, A. Cross and M. Collard. Department of Archaeology, Simon Fraser University.

Several studies have found that modern human limb length variation is consistent with Allen's Rule, which holds that there is a positive correlation between peripheral body part length and temperature in homeothermic species. However, none of these studies has controlled for the phylogenetic relationships among populations. This is potentially problematic because such relationships render taxa non-independent, and data point independence is a key assumption of correlation analysis.
To investigate this issue, anthropometric and temperature data were collected from the literature for indigenous populations from five continents. Next, the impact of mean annual temperature on limb segment length was investigated by analyzing subsamples stratified in such a way as to counter the over representation of warm climate populations in the complete sample. Subsequently, subsamples that returned significant correlations were subjected to phylogenetically controlled correlation analysis in CAIC. CAIC calculates correlation coefficients from "independent contrasts", which estimate the amount of change in variables since taxa last shared a common ancestor. The phylogenetic trees used in CAIC were generated from published genetic distance data. To produce fully resolved trees, modifications were made to the genetic trees based on the linguistic affiliations of the populations.
When the issue of over representation was addressed, only two limb segment lengths were significantly correlated with mean annual temperature: lower arm and foot. Only two of the 10 subsamples for these segments returned statistically significant correlations in CAIC. Thus, the analyses do not support the hypothesis that modern human limb length variation is consistent with Allen's Rule.
Research funded by SSHRC-CGS# 766-2006-0940, SSHRC-CGS# 767-2006-1902, and the Canada Research Chairs Program.

An experimental test of activity effects on femoral diaphyseal shape.

B. Demes[1], K.J. Carlson[2], S. Lublinsky[3], S. Judex[3]. [1]Department of Anatomical Sciences, Stony Brook University, [2]Department of Anatomy, New York College of Osteopathic Medicine, [3]Department of Biomedical Engineering, Stony Brook University.

It has been suggested on theoretical grounds that high levels of activity produce anteroposteriorly elongated diaphyses in lower limb bones. This is because the forces that presumably dominate bone loading during locomotion presumably act in sagittal planes. Empirical data support such an interpretation. Prehistoric populations with high mobility, such as hunter-gatherers, not only have more robust bones, but they also have less circular cross sections than more sedentary counterparts. *In vivo* measurements of bone deformation, on the other hand, are not entirely supportive of anteroposterior bone loading. Here we present an experimental approach to elucidate the relationship between cross-sectional shape and activity level, for which wheel-running served as a proxy measure. Growing rats subjected to a 12-day running exercise regime were matched with control rats housed in standard cages without wheels. Animals were sacrificed at 40 days of age, and femora extracted and microCT-scanned. Principal moments of area (Imax and Imin) at midshaft were determined. While moments did not differ significantly between runners and controls, Imax/Imin ratios were lower in the runners, which

indicated a significant shape difference between the two groups. The Imax in rat femora is aligned with the mediolateral plane. It is not clear how rat femora in hind limbs that are abducted up to 30 degrees during stance phase are loaded in locomotion. While results demonstrate that increased running causes diaphyseal shape changes in the femora of growing animals, the direction of this change is more difficult to interpret than often presumed.
Supported by NSF BCS 0548892

The interrelationship between population structure, forest ecology and behavior in red howler monkeys (*Alouatta seniculus*).

A.M. Derby. Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

Comparative behavioral ecology seeks to understand how behavioral and morphological traits contribute to the survival and reproduction of individual animals under different ecological circumstances. In order to fully address these inquiries longitudinal data is needed; yet time is a limiting factor for many primate populations threatened by the effects of anthropogenic disturbance activities. It has therefore become increasingly important for ecologists and primatologists to design studies investigating the determinants of primate abundance capable of yielding more immediate and informative results. With this goal in mind, this study employed a multivariate approach that examined the role forest ecology plays in influencing population density, demography, and behavior of *Alouatta seniculus* at two Western Amazonian sites in Ecuador (Yasuní National Park).
Study sites were located close in proximity and were identical in their primate community, but differed in habitat type and howler monkey density. Results indicate significant differences in activity budgets between the two populations, with primates at the low-density site spending significantly less time feeding and more time moving ($P<0.05$; Mann-Whitney test). Additional differences include smaller home range with significantly longer between patch distances ($P<0.05$; 1-way ANOVA) and significantly lower number of feeding trees used per day (95% Confidence Limits). Nutritional data also indicate a lower availability of high quality resources (i.e., protein to fiber ratio, total energy) at the low-density site. These results suggest that increased energetic constraints associated with particular ecological landscapes influences behavior and is potentially limiting population density.
Supported by grants from the National Science Foundation DDI (BCS-0524996) and the American Society of Primatologists.

Revisiting the midtarsal break.

J.M. DeSilva, L.M. MacLatchy. Department of Anthropology, University of Michigan.

The midtarsal break was first described nearly 75 years ago to explain the ability of non-human primates to lift their heel independently of the rest of the foot. Since the initial description of the midtarsal break, the calcaneocuboid joint has been assumed to be the anatomical source of this motion. Recently, two studies have suggested that the midtarsal break may occur between the cuboid and the fifth metatarsal joint, rather than at the calcaneocuboid joint (D'Août et al., 2002; Vereecke et al., 2003). Data compiled from x-rays, dissections, manual manipulation of living primate feet, video of captive and wild apes, and osteological specimens all concur that the midtarsal break is primarily caused by flexion at the cuboid-fifth metatarsal joint, with only slight contribution from the calcaneocuboid joint. Superior expansion of the distal articular surface of the cuboid and the proximal articular surfaces of metatarsals IV and V provide skeletal correlates for the presence of the midtarsal break. Study of hominin metatarsals from South Africa (StW 114/115 and StW 485), a fifth metatarsal from Kenya (KNM-ER 803), and the metatarsals and a cuboid from the OH 8 foot show no evidence for flexion at the cuboid-fifth metatarsal joint. These results suggest that hominins had already evolved a stable midfoot region well adapted for the push-off phase of bipedalism by 2 million years ago. Examination of earlier hominins is underway. Support for this research provided by the University of Michigan and the Leakey Foundation.

Peripubertal estrogen levels and physical activity affect young adult bone strength in women

M.J. Devlin,C.M. Stetter, H.M. Lin, T.J. Beck , R.S. Legro, D.E. Lieberman, T. Loyd Department of Anthropology, Harvard University; Department of Public Health Sciences, Pennsylvania State University, College of Medicine ;Department of Public Health Sciences, Pennsylvania State University, College of Medicine;Department of Radiology, The Johns Hopkins University School of Medicine;Department of Obstetrics and Gynecology, Pennsylvania State University, College of Medicine;Department of Anthropology, Harvard University;Department of Public Health Sciences, Pennsylvania State, UniversityCollege of Medicine

Understanding how growing bones adapt to mechanical loading is a fundamental problem in human biology. Exercise-induced changes in bone strength are greater in women who start exercising premenarchally vs. postmenarchally, suggesting that estrogen (E2) may mediate these bone-strain interactions. Here we evaluate the contributions of peripubertal physical activity and estrogen levels to young adult bone strength in subjects from the Penn State Young Women's Health Study (N=84). We hypothesize that women who 1) had higher E2 levels or 2) were more physically active during puberty will have greater adult bone strength. To test this hypothesis, we divided subjects into tertiles of physical activity and of E2 level. We then compared cross-sectional moment of inertia (CSMI) and section modulus (Z) in the femoral narrow neck, intertrochanteric region, and proximal shaft at age 17 (measured using DXA and the HSA algorithm) among these E2 and activity tertiles.
Results indicate that women with the highest E2 levels in the first year after menarche had 11% greater CSMI in the narrow neck and 6-12% greater Z in the narrow neck and intertrochanteric region, vs. women with lower postmenarchal E2 levels. The most physically active women had 16-18% greater femoral CSMI in the narrow neck and intertrochanteric region, and 9-11% greater Z in the narrow neck, vs. less active women. These results support the hypothesis that peripubertal estrogen and physical activity are important determinants of adult bone strength. Physiological factors such as hormone levels may be crucial mediators of human osteogenic responses to exercise.

Comparison of paleodemographic age estimation methods: case study of the East Smithfield Black Death cemetery.

S.N. DeWitte[1], G.M. Hughes[1], S.C. Reedy[2]. [1] Department of Anthropology, University at Albany, [2] Department of Anthropology, University of Massachusetts Amherst.

The accurate estimation of age is an important problem within paleodemography, and statistical methods have recently been developed to overcome the biases associated with traditional methods of age estimation. This project is a methodological comparison of traditional and new approaches to paleodemographic age-at-death estimation using a large medieval skeletal collection from London. Approximately 300 adults from the East Smithfield Black Death cemetery in London were scored for age using the Lovejoy et al. (1985) and Suchey-Brooks (Brooks and Suchey, 1990) methods, traditional methods used by a great number of paleodemographers. The same individuals were also scored for age using the skeletal age indicators described by Boldsen et al. (2002), and the newly developed Rostock protocol was applied to these scores. The age estimates and the mortality patterns produced by the tradition and newer methods are compared to determine what affect these methods have on inferences about population-level patterns of Black Death age-specific mortality and selectivity of the disease with respect to health.
Funding for the research was provided by the National Science Foundation (grant number BCS-0406252), the Wenner-Gren Foundation for Anthropological Research (grant number 7142), Penn State University's Research and Graduate Studies Office, the University at

Albany Center for Social and Demographic Analysis, and the University at Albany Faculty Research Awards Program.

Multiple males sire offspring in groups of wild spider monkeys (*Ateles belzebuth*).

A. Di Fiore[1,2,3], A. Link[2,3], S.N. Spehar[2,3,4]. [1]Center for the Study of Human Origins, New York University, [2]Department of Anthropology, New York University, [3]New York Consortium in Evolutionary Primatology, [4]Department of Religious Studies and Anthropology, University of Wisconsin Oshkosh.

Spider monkeys (genus *Ateles*) live in multimale-multifemale, fission fusion societies similar to those of chimpanzees. Although several species of *Ateles* have been the subjects of long-term fieldwork, little is known about patterns of reproduction in wild populations. During long-term field research on the socioecology of *Ateles belzebuth* in lowland Ecuador, we conducted a genetic study of parentage in two social groups. All nonjuvenile group members, as well as four juveniles in one group and six in the second, were genotyped at 15 to 20 variable STR loci using DNA extracted from noninvasively collected fecal samples. These data were then used to assess maternity and paternity using both exclusion and maximum likelihood methods.
Maternity for each juvenile was assigned with high confidence to a single adult female, who invariably was the female presumed from observational data to be the mother. Paternity analysis revealed that eight different males sired offspring. In the first group, one juvenile was assigned to each of three males. In the second group, another three males sired five of the sampled offspring. Only one male was identified as the sire for more than juvenile. Paternity for the remaining juvenile in each group could not be assigned to any sampled male, raising the possibility that they were sired by males outside of the group in which they were sampled. As qualitatively similar patterns of paternity have been reported for wild chimpanzees, our results reflect yet another example of the strong convergence in the social systems of *Ateles* and *Pan*.
This research was supported, in part, by the L.S.B Leakey Foundation, Primate Conservation, Inc., the National Science Foundation, the New York Consortium in Evolutionary Primatology, and New York University.

Health implications of migration for Mexican children and adolescents.

F. Dickinson, H. Azcorra, G. Valentín. Department of Human Ecology, Cinvestav-Mérida.

Internal migration in Mexico as a country has contributed to the growth of urban areas. Beside its socioeconomic and cultural effects, migration could have positive or negative implications on the health of migrant people, particularly of migrant children and adolescents since somatic growth is a process highly sensitive to environmental changes. Here we review the literature on the health implications for Mexican children and adolescents in three different kinds of migration: that of day laborers, and rural-to-urban and forced migration. Children and adolescent migrate as members of the family of farming day laborers and have poor care, housing, nutritional, educational, and transportation conditions; frequently they became involved in heavy and long working tasks on the field, carried out on environments that could be dangerous due to the use of agrochemicals.
In general, the rural-urban migration in Mexico involves low socioeconomic groups that, once in the city, settle in poor neighborhoods. These areas, usually called poverty belts, have poor environmental conditions and the risks of suffer malnutrition and infectious diseases are high. Such environmental conditions could mask the health implications of migration on children and adolescents growth.
Finally, since 1994, some people living in highland communities in the Mexican state of Chiapas has been involved in forced migration due to the low intensity conflict between *Zapatistas*, the Mexican army, and paramilitary groups. These forced migrant have very poor live conditions, and experiment great insecurity and stress. In other words, they live in an unfavorable environment for somatic growth.

Prehistoric health in Tennessee during subsistence transition using the Western Hemisphere health index.

E.A. DiGangi. Department of Natural and Behavioral Sciences, Pellissippi State Technical Community College, Department of Anthropology, The University of Tennessee.

Understanding the effects of subsistence change on prehistoric health is a line of inquiry that anthropologists have investigated for decades, as it answers questions about the costs and benefits incurred by human populations undergoing such a change. The Western Hemisphere Health Index (WHHI) (Steckel and Rose, 2002) is a method that was developed to enable comparisons of overall health between populations by calculating quality-adjusted life years (QALY), an index value that depicts health status. As the WHHI includes data for 65 sites from the Western Hemisphere, the results from individual sites can be compared with other sites on a wider scale, allowing the elucidation of broad patterns within the Western Hemisphere. Individuals dating to the Archaic (n=45), Woodland (n=55), and Mississippian (n=160) time periods from sites in Tennessee were analyzed here after Steckel and Rose (2002) and the data were input into the health index statistical program. Results show that the QALY as a percentage of the maximum attainable for the Archaic, Woodland, and Mississippian time periods were low (62%; 69%; 67%, respectively) and when compared to the 65 sites in the health index, these sites fall into the lower half in terms of overall health. It is well demonstrated that the transition to maize agriculture was accompanied by a decline in health. The pattern observed here was similar, and this has implications for further understanding not only the effect that subsistence change has on populations, but the patterns that emerge when such populations are compared on a regional scale.

Comparative anatomy, phylogeny and evolution of the head and neck musculature of hominids: a new insight

R. Diogo, B. Wood. Department of Anthropology, George Washington University.

The anatomy of hominids has been the subject of numerous comparative studies. However, the vast majority of these studies deal with skeletal structures. In fact, the most detailed and comprehensive works on hominid myology were done decades ago, and those works were usually mainly focused on the musculature of one of the four extant hominid genera, i.e. *Pongo*, *Gorilla*, *Pan* or *Homo*, and not on the comparative anatomy of these genera. This lack of detailed myological comparative works creates difficulties in the discussion of subjects such as the evolution of human feeding mechanisms, of human facial expressions or of human speech.
In this work, we provide a brief description, complemented with several photographs, of the head and neck muscles of various great ape specimens. The configuration found in the dissected specimens is compared to that found in specimens of *Homo sapiens* observed by us as well as in other human and non-human primates described in the literature. The functional and evolutionary implications of some interesting differences regarding the musculature of the four extant hominid taxa, especially regarding their facial and hyoid muscles (e.g. risorius, zygomaticus major and minor, platysma, omohyoideus, digastricus) are analyzed and discussed in a phylogenetic framework.

Allometry of facial mobility in anthropoid primates: implications for the evolution of facial expression.

S.D. Dobson. Department of Anthropology, Dartmouth College.

Facial mobility, or the variety of facial movements, may be an important constraint on the evolution of facial expression in primates. I have previously reported that hominoids tend to have the most mobile faces on average, while ceboids exhibit the least mobility, and cercopithecoids are intermediate. In the present study, I test the

hypothesis that this taxonomic pattern is due primarily to size differences between species. I used the human Facial Action Coding System to estimate facial action repertoire size (FARS) in 12 anthropoid species, based on video recordings of facial activity in zoo animals. Body mass data were taken from the literature. I used phylogenetic generalized least-squares to perform a multiple regression analysis with FARS as the dependent variable and two independent variables: log body mass and dummy-coded infraorder. I assessed the statistical significance of regression coefficients using 95% confidence intervals.
Together, body mass and infraorder explain 91% of the variance in FARS (multiple r = 0.96). However, the partial effect of body mass is much stronger (b = 2.08 ± 0.54) than for infraorder (b = 0.26 ± 1.46). Thus, taxonomic differences in facial mobility among nonhuman anthropoids appear to be caused by variation in overall body size. The results of my study suggest that allometry is an important factor in the evolution of facial mobility, which may explain why smaller taxa tend to exhibit fewer facial displays than larger ones. More work is needed to clarify the structural bases of this allometric pattern.
This research was supported by the National Science Foundation and Sigma Xi.

Comparative microanatomy of primate facial musculature: facing up to function.

B.A. Docherty[1], J.J. Cray, Jr.[2], T.D. Smith[2, 3], L.E. Reinholt[3], A.M. Burrows[1, 2]. [1]Dept. of Physical Therapy, Duquesne University, [2]Dept. of Anthropology, University of Pittsburgh, [3]School of Physical Therapy, Slippery Rock University.

The human face has long been held to be the most complex among primates in terms of the high number of movements possible and the great number of small, discrete facial expression (or mimetic) muscles that produce these movements, with complexity corresponding to phylogenetic position. Recent studies, however, suggest that these muscles may be specialized across taxa to reflect specific functional demands associated with social and ecological niches and not merely a reflection of phylogenetic position. The present study is designed to evaluate this prediction at the microanatomical level using species from diverse phylogenetic positions, ecological niches, and social systems. Muscles were sampled from different regions of the face (upper lip, nose, superciliary region, orbit, pinna, lower lip, and midface) and were drawn from humans, chimpanzees (*Pan troglodytes*), macaques (*Macaca mulatta* and *M. fascicularis*), black lemurs (*Eulemur macaco*), and greater bushbabies (*Otolemur crassicaudatus*). All samples were processed for paraffin-based histology, sectioned at 10-13 microns, and stained with hematoxylin/eosin or Gomori trichrome. Sections were examined for factors that could reveal potential contractile force of each muscle: density of muscle fiber packaging into fascicles, fiber diameters, and relative area of the section occupied by connective tissue vs. muscle fiber. Results revealed that these measurements varied more according to ecological niche and social system than phylogenetic position. Thus, a more appropriate way of conceptualizing evolution and function of the primate face may be to consider the potential roles played by ecological niches and social systems instead of merely phylogenetic positions.

Murine metapodophalangeal sesamoid bone mineralization: A light and electron microscopy study.

A.H. Doherty[1,2], E.M. Lowder[1], R.D. Jacquet[1], and W.J. Landis[1]. [1]Department of Integrative Medical Sciences, Northeastern Ohio Universities College of Medicine, [2]Department of Anthropology, Kent State University

In calcifying cartilage, mineral formation appears to occur first in matrix vesicles (MV). In certain normally mineralizing avian tendons, type I collagen independently initiates mineralization in areas isolated from MV (Landis and Silver, 2002). Sesamoid bones, unique in their close tendon association, provide an opportunity to examine possible vesicle- and/or collagen-mediated mineralization (related to bone and tendon) in this tissue. Information regarding initial mineralization processes will contribute to our understanding of the variable development of sesamoids among primate species.
This study established a maturation timeline of one- to six-week-old murine metapodophalangeal sesamoid bones (MSB) through use of radiography, histology, and whole mount staining. Mice were selected as an analogous model of primate sesamoid mineralization. Selected two-week-old specimens were used to test the hypothesis that MV initiate calcification in murine MSB. Sesamoid calcification begins in one-week lateral sesamoids of the murine metacarpophalangeal joint of the second digit. All sesamoids were completely calcified by four weeks. Transmission electron microscopy of two-week lateral metacarpophalangeal sesamoids revealed few MV. MV were seemingly uninvolved with mineral formation in this bone. Thus, the role of MV in mineralizing MSB was inconclusive. Observed proteoglycan networks and type II collagen fibers, however, most likely mediate initial mineralization in murine MSB. These results are important in describing the onset and progression of mineral formation within MSB and in providing a framework with which to understand the genetic and mechanical influences that could affect the early development of primate sesamoid bones.
Supported by the KSU GSS and the NEOUCOM Skeletal Biology Focus Area.

Bioarchaeological analysis of a late prehispanic population from two burial towers in the Colca Valley, Peru

C. Domanska, T.A. Tung, S. Wernke. Department of Anthropology, Vanderbilt University.

Excavations by *Proyecto Arqueológico Tuti Antiguo* yielded at least 30 commingled and incomplete individuals from two prehispanic *chullpas* (burial towers) in the Colca Valley, of southern highland Peru. We report the demographic profile, health status and trauma patterns of this Late Horizon burial population (AD 1450 – 1532), known as the Collagua ethnic group, which was integrated into the Inka empire. We also describe late prehispanic burial customs in the region before the Spanish attempted to eradicate native mortuary practices, such as banning the use of *chullpas*.
Mortuary analysis indicates that this is a high-status burial population, as these are the largest burial towers among a group of several dozen, which have the most prominent location on the landscape, overlooking the deep Colca valley and river. Preliminary skeletal analyses show a high number of juvenile burials, perhaps reflecting high fertility rates, increased juvenile mortality, or in-migration during this period of Inka imperialism. Although the *chullpas* were looted, some partially intact skeletons were recovered, including a pregnant female. Evidence for violent conflict is present in this subject population of the Inkas; two adult males display healed cranial fractures and another exhibits multiple premortem head wounds. Coinciding with the premortem cranial fractures is a healed ulnar parry fracture and several examples of healed rib fractures, likely sustained in violent encounters. Taken together, these archaeological and skeletal data provide significant insights into the lifeways of hinterland peoples that were incorporated into the Inka empire.

Fallback or fall forward: food dispersion, canopy complexity, and the foraging adaptations of apes in Southeast Asia.

N.J. Dominy[1], E.R. Vogel[1], L. Haag[2], C.P. van Schaik[2], G.G. Parker[3]. [1]Dept. of Anthropology, University of California – Santa Cruz, [2]Anthropologisches Institut & Museum, Universität Zürich, [3]Forest Ecology Lab, Smithsonian Environmental Research Center.

Fallback foods are utilized when preferred foods are scarce. Such foods may drive adaptive radiations because the partitioning of vital resources is expected to exert a strong selective pressure on the behavior, ecology, and phenotypic diversity of primate species. For instance, fallback resources are often a physical challenge to extract and/or chew, and authors have emphasized the mechanical properties of such foods when discussing the evolution of tooth morphology. Fewer studies

have examined the effect of fallback episodes on primate ranging and locomotor behaviors. Here we examine the physical properties of tropical forest canopies and the foods of agile gibbons (*Hylobates agilis*) and orangutans (*Pongo pygmaeus*) in Borneo. We show evidence of substantial dietary overlap (95%) during periods of high forest-wide fruit availability. During a fallback episode, the diets of the two species diverged; the orangutans shifted to fracture-resistant plant tissues whereas the gibbons simply ranged farther for soft fruits. We also used ground-based LiDAR to measure the structure of 13 forest canopies distributed globally. We found that the rugosity and porosity of canopies differed; Southeast Asian forests exhibited the most variation in these variables and the largest gap size distribution.
We suggest that the craniodental morphology of gibbons imposes constraints; they appear to be limited to a mechanically narrow diet of soft fruits, which are dispersed widely. The richochetal brachiation of gibbons may have evolved as a compensatory adaptation to fallback episodes. For soft-fruit specialists, natural selection is expected to favor efficient locomotion amid spatially unpredictable and porous canopies.
This research was funded by the A.H. Schultz Foundation, the Leakey Foundation, and the UC-Santa Cruz Committee on Research

The role of leaves and herbs as fallback foods in *Gorilla gorilla* diet at Mondika: an examination of nutrient content and seasonal variation in intake.

D. Doran-Sheehy[1], P. Mongo[1,3], J. Lodwick[2], N.L. Conklin-Brittain[4],[1]Anthropology and [2]IDPAS, Stony Brook University, [3]W.C.S.-Congo, [4]Anthropology, Harvard University.

Herbs have been hypothesized to play an important role in the evolution of African ape sociality, although they are thought to provide lower sugar and protein content relative to other available ape foods, such as leaves. Here we examine the role of herbs in adult western gorilla diet, based on one-minute instantaneous sampling and nutritional analyses of 29 important gorilla foods. Gorillas spent roughly equal amounts of time feeding on fruits, leaves and herbs, although the relative contribution of each varied significantly through time. As fruit availability increased, fruit consumption increased, accounting for more than 60% of feeding time during periods of peak fruit production, and less than 10% during periods of low fruit availability. Leaves and some herbs (of Zingiberaceae and Commelinaceae families) were fallback foods, i.e. their consumption was inversely correlated with fruit availability and consumption. Other herbs (of the families Marantaceae and Hydrocharitaceae) were dietary staples, fed upon throughout the year, relative to their availability. Contrary to earlier predictions, staple herbs were not significantly higher in protein content than fallback herbs, nor were they significantly lower in protein, lignin, or neutral detergent fiber content compared to leaves. Additionally, the presumed dichotomy between herb and leaf chemistry is not as strong at Mondika as in previous studies; herbs were not significantly lower in protein, lignin, or neutral detergent fiber content compared to leaves. This may result from the considerably higher protein content in herbs in general at Mondika than that found in earlier studies of gorillas.
Sponsored by L.S.B. Leakey Foundation, U.S. Fish and Wildlife Services Great Ape Conservation Fund and Conservation International.

Metatarsal head torsion in apes, humans and *A. afarensis.*

M.S.M. Drapeau[1], E.H. Harmon[2]. [1]Dept. of Anthropology, Université de Montréal, [2]Dept. of Anthropology, Hunter College, City University of New York.

Ape characteristics have been identified in the foot of *Australopithecus afarensis* and have been interpreted often as retention of an arboreal mode of locomotion. These traits include, for example, an opposable great toe and long lateral toes, which would facilitate grasping of the foot during climbing. The prehensile foot of apes has a first metatarsal that is rotated laterally combined with metatarsals 2-5 that are rotated medially. In contrast, human metatarsal heads rest directly on the ground, which increases contact of the plantar surface with the substrate. Thus, human metatarsal heads 2-5 are rotated laterally relative to their base. The recovery in 2000 of a complete fourth metatarsal from Hadar allows us to determine the direction of head torsion in *A. afarensis* and compare it to apes and humans. Metatarsal head torsion was recorded with a digitizer in *Pan troglodytes* (n=29), *Gorilla gorilla* (n=26), and *Homo sapiens* (n=61). Our results show that human head torsion is significantly different from that of apes for all metatarsals except the fifth. As predicted, the first metatarsal head of apes is rotated laterally but has a plantar orientation in humans, while the metatarsal 2-4 heads are medially rotated in apes and laterally rotated in humans. The *A. afarensis* fourth metatarsal falls within the distribution of humans and outside the distribution of apes, which suggest that fossil species had forsaken a certain facility in foot prehensility in favor of the more human-like, pronated distal foot.
This research is supported by the Fond québécois de la recherche sur la société et la culture (grant #108312).

Asymmetry of the human pelvis: a preliminary study.

K. Driscoll. Department of Anthropology, University of Tennessee.

The human pelvis is a source of much research and debate. In this preliminary study, the William M. Bass donated skeletal collection was analyzed for pelvic asymmetry, its distribution and whether this asymmetry could be used diagnostically. Specifically, the height, weight and breadth of each innominate and sacrum were examined. 437 known, white individuals were used in this examination; ancestry was self reported. Of this sample, 112 were individuals identified as female and 325 as male. Paired t-test indicated that females exhibited heavier right innominates while taller left innominates were characteristic of males. Both sexes displayed broader right innominates. Directional asymmetries were also calculated for each individual. Discriminant analyses were run using all nine measurements. A high (94%) classification rate was achieved; this was an expected result as males and females have visibly different and well documented differences. After using McHenry's algorithm for variable selection using only the innominates, a four variable model was also successful with a 93% classification rate.

Y-chromosome variation in Altaian ethnic groups.

M.C. Dulik[1], S.I. Zhadanov[1, 2], L.P. Osipova[2], T.G. Schurr[1]. [1]Department of Anthropology, University of Pennsylvania, [2]Institute of Cytology and Genetics, SB RAS.

In the past, the genetic diversity of southern Siberian populations was investigated mainly from the perspective of clarifying Native American origins and the peopling of North Asia. Consequently, if populations from the Altai region were analyzed, then they were generally lumped together as a single group. To clarify the relationships of these Altaian groups with other Siberian populations, as well as with their nearest neighbors, sequence variation in the non-recombining portion of the Y chromosome (NRY) was characterized in Chelkan, Tubalar, Kumandin, Altai-kizhi and Altaian Kazakh populations. TaqMan probes were used to assess the presence of SNPs, indels were determined by electrophoresis of PCR fragment length variants, and AmpFlister Y-filer kits were used to characterize 17 STR loci. A large portion of all Altaian haplotypes belonged to haplogroup R. Differences in haplogroup frequency between the northern and southern Altaian populations were also observed, with more individuals from northern groups belonging to haplogroups N and Q, and haplogroup C being more prevalent in southern populations. In addition, there were village level patterns of NRY variation, while the overall diversity of NRY haplotypes suggested a significant cultural influence on the partitioning of genetic variation (i.e., patrilocality). Compared to the mtDNA genetic diversity in these groups, the NRY data showed a reduced amount of variation, and a more localized distribution. A phylogeographic approach using both NRY and mtDNA data provides a deeper understanding for the history and processes shaping the current gene pool of southern Siberia.

This study was supported by funding from the University of Pennsylvania, a National Science Foundation Doctoral Dissertation Improvement Grant, the National Geographic Society, the Social Sciences and Humanities Research Council of Canada, and the Russian Basic Fund for Research.

The effects of food processing on masticatory force and comminution: implications for the evolution of cranio-dental morphology.

K. Duncan and D. Lieberman. Department of Anthropology, Harvard University.

Is food processing responsible for facial and tooth size decreases in the genus *Homo*? This study experimentally tests the extent to which two processing techniques, cooking and pounding, influence masticatory performance capabilities. 10 subjects masticated standardized samples of meat and root vegetables that were raw, roasted, or pounded (meat only). Temporalis and masseter EMG data were collected and calibrated to masticatory force using a force transducer. Comminution (fragmentation) performance was assessed by measuring the particle size distribution of unswallowed boluses. Preliminary results indicate that masticatory performance is affected differently depending on both the food and the processing technique. Peak masticatory force *per chew* is increased when meat is roasted, but not pounded. Conversely, roasting vegetables results in a reduction of peak masticatory force. Roasting also affects the degree to which meat, but not vegetables, are broken-down in the oral cavity. Pounding meat does not alter comminution performance, however subjects chewed the samples significantly less than raw and roasted samples. This behavior decreased *total* masticatory force production by an average of 19%. Although complex, these results suggest that food pounding might have played an important intermediate step in hominid cranio-dental evolution prior to the advent of cooking.

A human maxilla trophy from Los Mogotes, Oaxaca, Mexico.

W.N. Duncan[1], C. Elson[2], C. Spencer[2], E. Redmond[2]. [1]Department of Anthropology, St. John Fisher College, 3690 East Ave., Rochester, NY 14618, [2]Division of Anthropology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024.

A left human maxilla was found in a surface collection adjacent to a looted tomb from the Late Preformative (100 B.C. – A.D. 200) Los Mogotes site in Oaxaca, Mexico. In this paper we describe the maxilla, its manufacture, and its significance for analyzing and understanding trophy taking in Mesoamerica. The maxilla is cut anterior-posteriorly approximately at the plane of the inferior border of the nasal aperture. The posterior aspect of the bone was broken postmortem. The maxilla likely reflects an attempt to appropriate enemies' animating essences from a potent locus, the mouth. The significance of this maxilla is that it is identical to the human maxillae found in necklaces worn by sacrificed victims at the site of Teotihuacan in central Mexico. Cultural connections between Oaxaca and Teotihuacan have been long established. However recent analysis of oxygen isotopes from the maxillae from Teotihuacan found that those trophies came from a variety of locales in Mexico but not from Oaxaca. This maxilla then, is the first such trophy from Oaxaca and it highlights the need to establish a more comprehensive regional baseline for isotopic signatures for future migration studies and analyses of trophies made from human remains in Mexico.
Financial support for the survey and excavations carried out by members of the Tilcajete Project was provided by: the National Science Foundation, the Foundation for the Advancement of Mesoamerican Studies, Inc., the Heinz Family Foundation, the National Geographic Society,the University of Michigan Museum of Anthropology, and the American Museum of Natural History.

Ontogeny of foot and hindlimb proportions in *Proconsul heseloni*.

H.M. Dunsworth. Department of Anthropology, Pennsylvania State University.

Bivariate and multivariate statistical analyses were performed on the linear proportions of the feet and hindlimbs of six *Proconsul heseloni* individuals from the Kaswanga Primate Site, Rusinga Island. The individuals range in age from infant to adult. Comparative cross-sectional ontogenetic samples included *Pan troglodytes*, *Gorilla gorilla gorilla*, and *Macaca mulatta* and samples of adults included *Pan paniscus*, *Colobus* (*angolensis, guereza,* and *badius*), *Nasalis proboscis*, and *Hylobates lar*.
The proportions of the *Proconsul* foot display a mixture of features that center on generalized arboreality. *Proconsul* aligned with *Colobus* and *Nasalis* in overall proportions and with apes in certain metatarsal proportions. The relatively long phalanges of *Proconsul*, resembling *Colobus* and *Pan*, are consistent with an emphasized need for grasping during locomotion. The mechanical units of the foot as well as the overall hindlimb proportions are monkey-like and the relative lengths of the first metatarsal, and the first and third proximal phalanges align with arboreal monkeys and apes. The overall findings support the "generalized arboreal quadruped" hypothesis for *Proconsul* locomotion.
The drastic difference between the growth of some particular *Macaca* hindlimb proportions compared to those of *Gorilla* and *Pan* is signaling their different developmental mechanisms and may be reflecting differences in infant clinging and mother-infant carrying behaviors between the species. Dissimilarities to macaques and similarities to apes in growth patterns suggest *Proconsul* was not born with relatively large feet like macaques. Thus, *Proconsul* may have shared life history traits, like increased altriciality in infant locomotor and positional behaviors, with *Pan* and *Gorilla*.
This research was funded by grants from the L.S.B. Leakey Foundation and the Pennsylvania State University.

Chin size and its relationship to facial prognathism in humans.

D. Durand[1], D.R. Hunt[2]. [1]Department of Anthropology, The George Washington University, [2]Department of Anthropology, Smithsonian Institution.

The presence of a mental eminence has been identified as a trait unique to *Homo sapiens*. Hypotheses to account for its presence have ranged from a functional adaptation to a byproduct of morphological changes in the skull. The absence of a chin in *Homo floresiensis* has been used by some scientists to argue that it was not human. Other researchers regard it as a rare trait shared with modern day Australomelanesians, who also lack an apparent chin. In response to this, it has been suggested that there is no such thing as a chinless human, but rather that increased facial prognathism may de-emphasize the expression of the chin. The present study tests whether modern humans with greater prognathic faces have smaller chins. Cranial and mandibular measurements were taken from forty-three European-American and African-American individuals and a ratio of facial prognathism to chin size was calculated. Results indicate there is a moderate inverse relationship between chin size and facial prognathism in humans. While these finding do not resolve the debate of adaptation versus a morphological byproduct of change, it appears that the morphological changes producing contraction of the lower face influence an increase in chin size. With this continuum of chin expression in the human species, it is apparent that this trait is not an accurate feature for species identification.

Artificial cranial deformation in the Pleistocene Australian population at Coobool Creek.

A.C. Durband. Department of Sociology, Anthropology, and Social Work; Texas Tech University.

Several authors have suggested that some Pleistocene Australian crania have been altered by artificial cranial deformation. The large sample from Coobool Creek has featured prominently in this debate. The present study reevaluates the evidence for artificial cranial deformation in this population using both larger cranial samples and more comprehensive measurement sets than those that have been used in earlier work on this subject. Additionally, random

expectation statistics are used to calculate statistical significance for these examinations. The results of this study agree with prior work indicating that a portion of this sample shows evidence for artificial deformation of the cranial vault. Many Coobool Creek crania display strong shape similarities with a population of known deformed individuals from New Britain. Coobool Creek crania 1, 41, 65, and 66 show the strongest indications of deformation, but several other individuals from this sample also show morphological patterns that are consistent with culturally manipulated changes in cranial shape. This project provides added support for the argument that at least some Pleistocene Australian groups were practicing artificial cranial deformation. Likewise, these results highlight the difficulties with using frontal flatness and other non-metric characteristics of the frontal bone in arguments for regional continuity between the earliest Australians and archaic populations from Indonesia.

Developmental anomalies of the wrist in LB1 from Flores, Indonesia.

R.B. Eckhardt. Laboratory for the Comparative Study of Morphology, Mechanics, and Molecules, Department of Kinesiology, The Pennsylvania State University.

Apocrypha of Samuel Johnson include this critical reply to an author: "Your manuscript is both good and original. But the part that is good is not original, and the part that is original is not good." A parallel assessment applies to the Liang Bua skeletons. Aside from errors subsequently documented (Jacob, et al., 2006) in the original description (Brown, et al., 2004), defining phenotypic characteristics of "*Homo floresiensis*" are both normal and exceptional, ostensibly as required for recognition of a new species. However, the features that are normal (occurring in members of extant Australomelanesian regional populations) are not exceptional, and the ones that are exceptional (outside standard developmental ranges for *Homo sapiens*) are not normal; consequently, evidence for the proposed new species is lacking.
Key features of the original framing hypothesis (evolution on Flores from *Homo erectus* ancestors isolated for more than 800,000 years) now are abandoned (Morwood, 2007), and none of the original species-defining attributes (380 ml endocranial volume, 1 m stature, humeral torsion outside extant human range, etc.) have survived independent analysis. Ancillary new "unique" characters not part of the original species diagnosis now are proposed, notably "primitive" morphology of the carpal bones of LB1 (Tocheri, et al., 2007).
Wrist bone shape and articular variants are extensive, with many described specifically as atavisms (recurrences of ancestral, genetically-influenced features). We reviewed records of more than 4000 wrist radiographs, including several patients with Laron Syndrome. Wrist bone morphology does not support the hypothesis that LB1 represents a new hominin species.

Proximity patterns of female brown capuchins in Suriname are inconsistent with expectations of female-bonded primates.

E. Ehmke, S. Boinski. Department of Anthropology, University of Florida.

Compelling data demonstrate that within the taxonomically diverse female-bonded primate (FBP) species, females sharing strong social bonds (a.k.a. affiliative relationships) obtain significant survival and reproductive advantages compared to females lacking such bonds. The mechanisms by which social bonds, a seemingly intangible commodity, endows bearers with such tangible benefits is a paradox stimulating much contemporary investigation. Brown capuchin monkeys (*Cebus apella*) are a renowned exemplar of FBP. Yet initial observations of brown capuchin troops in Suriname indicated weak expression of classic characteristics: grooming, coalitions and proximity between females. Therefore, from January-December 2006, we quantified the form of female sociality in a Surinamese study troop (n=7♀♀; 27 $_{total}$). We report findings pertaining to the close proximity expected among FBP. (1) No female preferentially associated with other females. Two females exhibited significant preference for males. (2) Infants also failed to promote female-female proximity. (3) These results suggest strategic flexibility and cost-benefit tradeoffs to social bonds not previously recognized among FBP.

Occlusal microwear texture analysis and the diets of historic/prehistoric hunter-gatherers.

S. El Zaatari. Stony Brook University.

With the exception of few studies (Hojo, 2001; Molleson et al. 1993, Pastor, 1992; Teaford, 1991), occlusal microwear of pre-agricultural modern humans has not been documented. In this study, microwear fabrics of samples from six historic/prehistoric hunter-gatherer populations with known and diverse dietary habits, representing mostly meat-eaters from different environments, arctic/tundra (Ipiutak and Tigara from Point Hope), cold-steppe (Fuegians) and Mediterranean (Chumash), and mixed-diet hunter-gatherers from tropical climates (Khoe-San and Andamanese), were documented to better understand how dietary differences affect microwear in these groups and to establish a reasonable comparative database for interpreting fossil hominins microwear. Significant microwear differences, related to diet and food preparation techniques, between the meat-eaters and mixed-diet hunter-gatherers were detected. Finer scale differences within each of these dietary categories were also observed. Ethnographic accounts indicate that the Point Hope populations and Andamanese ingested hard particles attached to their food as a result of their food preparation techniques; their microwear fabrics also reflect highly abrasive diets. On the other hand, as expected, the microwear signatures of the Chumash and Fuegians indicate a diet low in abrasives, reflecting their almost exclusive reliance on marine meat for subsistence and the low amounts of extraneous particles attached to this meat. The mixed-diet Khoe-San occupy an intermediate position between the Point Hope populations and Andamanese on the one hand, and the Chumash and Fuegians on the other, with regard to the level of abrasives ingested. The Khoe-San ate large amounts of hard plants, most likely responsible for abrading their enamel surface.
This project was funded by the National Science Foundation (BCS-0452155), Leakey Foundation, and Ruggles-Gates Fund for Biological Anthropology (The Royal Anthropological Institute of Great Britain and Ireland).

Age-related histomorphometric changes in human fetal long bones.

C.D. Eleazer. Department of Anthropology, University of Tennessee, Knoxville.

The goal of this preliminary study is to investigate the potential of utilizing histomorphometry in the estimation of age at death of fetal long bone remains. Histological studies have become increasingly important in distinguishing fragmentary human remains from non-human remains, as well as estimating age at death. However, little work has been done with subadult material due to its distinct growth patterns and unique microscopic composition. Microscopic methods may prove invaluable to the task of aging fragmentary remains that lack the characteristic features necessary for conventional methods.
Seven stillborn cadavers of known gestational age and sex were donated by the Medical Examiner's Office of the University of Tennessee Regional Medical Center. The sample ranges in age from 17 to 35 weeks gestation with no two fetuses having the same gestational age. Thin sections were taken from the midshafts of each long bone and analyzed with a Leica DMRX light microscope.
Analysis of thin sections showed great potential for age estimation via measurement of multiple woven bone trabeculae widths. The results of an ANCOVA indicate that age is a significant linear predictor of these widths in all long bones except the radius. Due to the small sample size utilized for this study and the lack of replication in gestational age among these seven fetuses, the results of histomorphometric analysis should be interpreted as extremely preliminary in nature. Future research will benefit from the utilization of a much larger sample size containing multiple fetal

specimens sampled from each gestational week.

Ovarian function across two life history transitions: puberty and the postpartum resumption of fecundity.

P.T. Ellison[1], M. Reiches[1], S.F. Lipson[1], C.R. Valeggia[2]. [1] Dept. of Anthropology, Harvard University, [2] Dept. of Anthropology, University of Pennsylvania.

Female ovarian function undergoes a progressive transition from amenorrhea to fully competent ovulatory cycles both during puberty and during the postpartum lactational period. These two periods represent state transitions in reproductive effort during which energy allocation shifts from the support of growth, either of self or of offspring, toward potential support for a new pregnancy. We present a model of the hormonal mechanisms involved in these two transitions, a model which emphasizes their formal similarity. Related pituitary hormones, human growth hormone and prolactin, are responsible for the direction of metabolic energy toward anabolic processes, either adolescent growth or milk production. Both of these anabolic processes lead to peripheral insulin resistance and rising insulin levels, which eventually synergize with low gonadotropin levels to stimulate ovarian function. Rising estrogen levels resolve the transitory period of insulin resistance and restore peripheral insulin sensitivity. Data supporting this model are presented from 70 lactating Toba women of northern Argentina and from an initial pilot study of Toba adolescents. The implications of the model for the integrity of human life history strategies and for relationships between adolescent and adult health are noted.

LB1 did not have Laron Syndrome.

D. Falk[1], C. Hildebolt[2], K. Smith[2], W.L. Jungers[3], S.G. Larson[3], M.J. Morwood[4], T. Sutikna[5], Jatmiko[5], E.W. Saptomo[5], F. Prior[2]. [1]Department of Anthropology, Florida State University, [2]Mallinckrodt Institute of Radiology, Washington University School of Medicine, [3]Department of Anatomical Sciences, Stony Brook University, [4]Department of Archaeology & Palaeoanthropology, University of New England, New South Wales, [5]Indonesian Centre for Archaeology, Jakarta.

In the latest round of "sick hobbit" theories, the type specimen (LB1) of *Homo floresiensis* is hypothesized to be a pathological human afflicted with Laron Syndrome (LS), a type of primary growth hormone insensitivity (Hershkovitz et al., 2007). Comparing measurements, photographs and 3D-CT reconstructions of LB1 with data and diagnoses from the literature, we critically evaluated the skull and postcranial traits purported to be shared by LB1 and LS patients. Most traits differ markedly in LB1 and LS patients; many claims are new to the extensive LS clinical literature and lack quantitative support.
Cranial bones are thick in LB1 but thin in LS. Cranial bones are highly pneumatized in LB1 but weakly so in LS. Maximum cranial breadth is low in LB1 but high in LS. LB1 is prognathic; retrognathism characterizes LS. LB1 has supraorbital tori; these are lacking in LS. The face and mandibles are large in LB1 but small in LS (acromicria). LB1 lacks a chin; LS patients have receding chins. LB1's head circumference is smaller than reported in LS. Long-bone cortical thickness is normal in LB1 but is described as thin in LS (Laron, 2004). LS is characterized by small feet, but the feet of LB1 are relatively very long. Claims that LS patients display short clavicles, low degrees of humeral torsion, and curved tibia are not supported by data. The primitive carpal and tarsal morphology seen in LB1 is also not seen in individuals suffering from growth hormone insensitivity. LB1 did not suffer from LS.

Understanding HIV Epidemiology: Why is Heterosexual Transmission So Much More Common in sub-Saharan Africa?

D. A. Feldman. Department of Anthropology, SUNY Brockport.

Heterosexual transmission of HIV-1 is much more common in sub-Saharan Africa than in North America or Europe. Over the past quarter century, there have been numerous attempts to explain this difference, none of which have been entirely successful. It is likely that the answer is highly multifactorial. Recently, two explanations have gained much popularity: 1) Lack of male circumcision increases risk of transmission. Prior research have shown that African tribes and ethnic groups which lack male circumcision were at greater risk for heterosexual HIV transmission, while current research have demonstrated that adult male circumcision lowers risk of HIV infection. However, it is unclear why heterosexual transmission remains low in Europe where male circumcision is infrequent. 2) The prevailing African custom of men having a mistress increases HIV risk. While this theory seems plausible, it does not explain why the subset of North American and European men who also have a mistress are not at equal risk. Other explanations include the practices of dry sex, virgin curing, ritual sexual healing, stretching the labia, multipartnering, and polygyny. One explanation that has been dismissed is that the HIV-1 subtype itself, might have a different transmission pattern. While epidemiologists have rejected this, a review of the literature shows that this may have been premature. Based in part on research conducted by the author in Zambia and Rwanda, this topic will be explored.

Tibial ontogeny and locomotor development in *Macaca*.

C.D. Fellmann. Department of Anthropology and Center for the Study of Human Origins, New York University and New York Consortium in Evolutionary Primatology (NYCEP).

Adult primate limb proportions differ markedly among taxa and correlate with locomotor behavior. However, the growth rate of individual limb segments changes during ontogeny as does locomotor behavior. I examine tibial growth in *Macaca mulatta* (n=200) and *M. fuscata* (n=200) representing individuals from infants, juveniles, adolescents, and adults. Developmental stages are based on crown tooth eruption. Measurements reflect the linear growth of maximum tibial length and length of the lever (T1) and load arm of the *quadriceps femoris* muscle. Comparisons of log-transformed data in bivariate ordinary least squares describe differences in growth trajectories and ANOVA tests for differences in growth occurring at each developmental stage across and within taxa. Results of log-log bivariate analyses show a common growth pattern for hind limb length across taxa. All regressions are nearly isometric. However, T1 is negatively allometric relative to total tibial length, increasing at a slower rate than does the distal tibia with significant differences in leverage occurring during the juvenile and adolescent stages. Thus tibial length increases while lever arm length decreases as monkeys grow, resulting in higher leverage early in ontogeny and higher leverage in males throughout ontogeny. These ontogenetic changes may be an adaptive response to compensate for smaller muscle mass in young individuals by improving the mechanical advantage of the *quadriceps femoris*. A similar locomotor output could thus be achieved even at smaller muscle size thus facilitating leaping and climbing behaviors early in ontogeny.
Support for this study has been provided by NYCEP, the NSF 0333415 (NYCEP IGERT), the Caribbean Primate Research Center, University of Puerto Rico, and the National Institutes of Health (RR03640).

So hot you could fry a monkey: Behavioral thermoregulation in human-commensal white-fronted capuchins (*Cebus albifrons*).

M.Y. Field. Dept. of Anthropology, The Ohio State University.

Nonhuman primates living in urban areas in the tropics are especially vulnerable to heat stress due to lack of shade and the heatsink effect of large volumes of concrete and asphalt. This study examines the effect of heat stress on behavior and ranging patterns in a group of human-commensal white-fronted capuchins.
Data was collected from April to December 2006 on the free-ranging *C. albifrons* group living in the town of Misahuallí, Ecuador. During day follows, the behavior of all group members, location, and weather (temperature

and relative humidity) were recorded every 30 minutes (N=1126 scans).
Three behaviors were significantly associated with higher than average temperatures ($p<0.05$): 1) "Belly flat": Lying ventrally on a cool horizontal surface (damp soil, sand, shaded metal/concrete benches). The individual often digs away the dry top layer of soil/sand prior to lying down (N=82); 2) "Bathing/Washing": Immersing part or all of the body in water for a period of longer than five seconds (without drinking the water) (N=53); 3) "Self bury": Covering body parts with damp sand (e.g., pulling a large pile of sand against the abdomen with both arms) (N=6).
Age-sex variation in thermoregulative behaviors, the effect of location on such behaviors, the effect of diurnal temperature change on ranging patterns, and the impact that such ranging has on foraging patterns will be discussed.

A Humanian Model of human evolution: Evidence that habitual upright bipedality is a synapomorphy that defines a hominiform clade of hominoids including humans and all extant apes.

A.G. Filler, MD, PhD, FRCS. Department of Neurosurgery, Institute for Spinal Disorders, Cedars Sinai Medical Center, Los Angeles, CA.

Developmental anatomy of young juveniles in all extant hominoids reveals a homological discontinuity producing a transposition of the dorso-ventral body septum and the neuraxis when compared with other catarrhines. This study evaluates this among 250 mammalian species.
Osteological evidence shows the character in *Morotopithecus*, but not in proconsulid hominoids such as *Proconsul* and *Nacholapithecus*. The functional implications have a major bearing on the biomechanics of postural spinal architecture and reflect the onset of habitual orthogrady in this clade as synapomorphic. This study also suggests that heelstrike bipedalism, revealed in juvenile Siamangs in this study, is also synapomorphic for a hominiform clade.
Since the boxlike cross-section of the lumbar transverse process in *Morotopithecus* and *Homo* is unusual and adaptive to habitual bipedal as opposed to suspensory orthogrady, it constitutes a fourth synapomorphy for hominiforms. These four traits place habitual orthograde bipedalism as a synapomorphy at the stem of an Early Miocene hominiform clade. Since this proposed ancestral, clade-founding species is a hominoid with habitual upright posture and heelstrike bipedalism, this constitutes a "Humanian" model as opposed to the "Troglodytian" model in which bipedalism arises from a knuckle walking ancestor or the "Hylobatian" model in which it arises from a brachiating ancestor.
This Humanian model proposes a continuous series of primarily upright bipedal hominoids from the Early Miocene to the time of the chimp/human split 6 million years ago (e.g. *Oreopithecus, Pieralopithecus, Sahelanthropus*). Hominoids with other specialized forms of locomotion emerge to enter different niches at various intervals.

Function and wear pattern analysis in Neanderthal and early *Homo sapiens* dentitions.

L. Fiorenza, O. Kullmer, S. Bacso, F. Schrenk. Department of Paleoanthropology, Research Institute Senckenberg.

Occlusal movements during chewing produce tooth wear. Surface area and spatial orientation of wear facets are closely related to the direction of jaw movements. Various studies, including the analysis of stable isotopes from bone and teeth, dental microware and faunal remains, have led to hypotheses that Neanderthals were wide-ranging meat eaters while early *Homo sapiens* were a more opportunistic feeder with a broader dietary spectrum. In this study, wear pattern analysis derived from optical 3-D topometry is used to reconstruct jaw movements of the two species in order to interpret their diet. In Neanderthals buccal and lingual Phase I facets are well developed, whereas Phase II facets are less developed. First molars show a strong facet 5, especially in the upper molars, probably caused by the presence of Carabelli features. In addition, the wear areas show large, marked edges. In contrast early *Homo sapiens* molars show prominent Phase I and II facets with more rounded wear facet margins. The two species display a clear difference in tooth wear. Early *Homo sapiens* possess a generalized wear pattern with a well developed Phase II grinding activity that indicates the mastication of many varieties of food, including hard and fibrous materials, whereas Neanderthals appear to have been more specialized with a narrower diet.
Supported by EU Marie Curie Training Network MRTN-CT-2005-019564 EVAN.

Reconstructing infant and childhood population health from internal defects of enamel growth

C. FitzGerald[1], S. Saunders[1], A. Nava[2], L. Bondioli[2], R. Macchiarelli[3], A. Coppa[4]. [1] Dept. of Anthrop., McMaster University, Hamilton, Canada, [2]Sect. Anthrop., Nat. Prehist. Ethnogr. "L. Pigorini" Museum, Rome, Italy, [3]le Dép. de Préhistoire de la Musée National d'Histoire Naturelle de Paris, et le Dép. Géosciences de l'Univ. de Poitiers France. [4]Dept. of Human and Animal Biology, University of Rome "La Sapienza," Rome, Italy.

Enamel contains an important archive of physiological disruptions that affected the tissue during the sensitive period of its growth. Biological anthropologists, clinicians, and others have provided extensive information on a number of these disruptions and how they may be used as indicators of stress, and a large literature exists that records the existence of (mainly macroscopic surface) defects in living and archaeological children. However, our work has focused on internal defects of enamel, often called 'accentuated' striae of Retzius or Wilson bands, whose formation can be established in daily divisions using odontochronological techniques that rely on incremental markers formed during growth. This enables the production of prevalence distributions of morbidity events that portray a realistic risk profile for a past population of children. Using these methods, we have analysed both deciduous and permanent teeth of infants and children from the Imperial Roman necropolis of Isola Sacra, dating to the 1st to 3rd centuries A.D. The detailed timings of our results makes possible the application of a number of statistical adjustments that produce what we call "SMAP" (smoothed maximum prevalence) distributions. These enable us to discuss our outcomes in the light of historical records of Roman child rearing practices, where observed crests and dips in the distribution can be associated with common life history occurrences. In addition, because of the overlap in crown development chronologies between the permanent and deciduous dentitions and among tooth types within both, we can compare morbidity results, which provide insight into the nature of Wilson band formation and the reliability of observations.

Origin of genetic diversity among Malaysian Orang Asli : a simulation study.

A.G. Fix, University of California, Riverside.

The classic view of the origins of the Orang Asli, "aboriginal" peoples of the Malayan Peninsula, proposed a successive series of migrations. The most ancient brought the ancestors of the present-day Semang foragers to the peninsula. Later waves introduced farming Senoi ancestors followed by the farming-trading *Melayu Asli* or "aboriginal Malays". An alternative model argues that cultural differentiation arose in situ on the peninsula through a process of competitive displacement between the economies.
A recent study of mitochondrial DNA in Malaysian Orang Asli argues that they represent an isolated "relict" population of the original dispersal of modern *Homo sapiens* from Africa some 65,000 years ago (Macauley et al. 2005). However, half their Senoi sample comprises haplogroups common in mainland Southeast Asian groups such as the Vietnamese suggesting that an important component of Orang Asli populations derived from migrants bringing agriculture to the Peninsula ("demic diffusion").
The present paper will present a computer simulation model incorporating colonization, migration, and also natural selection showing that the pattern of genetic diversity in present-day Orang Asli reflects neither long term isolation nor massive waves of farming migrants. Instead a small colonizing agricultural group maintaining gene flow

with their parental population and with the already resident foraging groups would over time produce the mix of mtDNA types and hemoglobin E frequencies characterizing the current population.

The uniqueness of the human cranium and the importance of fossils.

J.G. Fleagle[1], C.C. Gilbert[2], A.L. Baden[2]. [1]Department of Anatomical Sciences, [2]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

Human crania are very odd by any standards. However, the uniqueness of human cranial morphology within the Order Primates has rarely, if ever, been evaluated quantitatively. In a project aimed at quantifying primate cranial diversity across all primates, we digitized a set of 17 landmarks designed to capture overall cranial shape on male and female crania representing 66 genera of living primates. The landmark data were aligned using a Generalized Procrustes Analysis and then subjected to a Principle Components Analysis to identify the major axes of cranial variation and to create a primate cranial morphospace. Morphological distances between individual taxa were calculated using geometric distances based on the first three principle components.
The morphological distance between *Homo sapiens* and our sister genus, *Pan*, is greater than the distances found in comparisons between other distinctive primate taxa and their sister genera, including *Mandrillus* and *Cercocebus*, *Alouatta* and *Ateles*, or *Daubentonia* and any other lemuriform. Indeed, the distance between *Homo sapiens* and *Pan* is over 50% greater than that between any of the other pairs of sister taxa. However, when a series of fossil hominins (*Australopithecus*, *Homo habilis*, *Homo erectus*, *Homo heidelbergensis*, and early *Homo sapiens*) are included in the analysis, they literally fill the morphological gap between *Pan* and modern *Homo sapiens* in the primate morphospace in chronological order.
Supported by funds from the NSF and the LSB Leakey Foundation.

The mastoid process and its significance for palaeopathological investigations on human skeletal remains investigated by means of two different early medieval skeletal samples from Germany.

S. Flohr, M. Schultz. Department of Anatomy, University of Goettingen.

The mastoid process provides information concerning pathological processes in different stages of an individual´s lifetime. While hypocellularity represents pathological conditions during early childhood, osseous changes in the pneumatized cells represent diseases in later periods of life. However, diseases in this region can cause life-threatening complications.
In the present study, the degree of pneumatization in the mastoid region and vestiges of mastoiditis in 265 temporal bones from 163 individuals from two early medieval cemeteries from the cities of Rhens and Dirmstein, Germany, were investigated. Macroscopic, endoscopic, radiologic, scanning-electron and light microscopic techniques were applied.
The examinations revealed that males were more often affected by severe hypocellularity than females in both populations. Whereas males feature similar frequencies of hypocellularity, females from the Rhens site exhibit lower frequencies than from Dirmstein. The people from Dirmstein were more often affected by mastoiditis than from Rhens and, in both sites, males were more often affected than females. The frequencies increase with age.
The higher frequency in Dirmstein may be associated with different risk factors such as higher exposure to smoke from open fires and harder living conditions. This is also suggested by the archaeological finds that places the Rhens population in an economically and ecologically more advantageous environment than the population of Dirmstein. The difference between males and females is difficult to explain. Possibly other factors, such as genetic factors or gender related activities, could have played an important role but cannot be identified at the present time.

Molecular genetic study of non-invasively collected samples from *Alouatta pigra* at the Calakmul Biosphere Reserve, Mexico

K. Forgey[1,2], J. Scalzitti[3], K. Rizzo[1], J. Garza[3], A. Stahler. [1]Department of Anthropology, University of Illinois at Chicago, [2]Department of Sociology and Anthropology, Indiana University Northwest, [3]Department of Biology, Indiana University Northwest.

Molecular genetic studies contribute to the investigation into analyses of overall demographics, dispersal patterns, kinship and paternity of primates in their natural habitat. Such studies are especially valuable for *Alouatta pigra*, where genetic data can contribute to interpretations of observed behavioral anomalies. For example, sentry behavior has uniquely been observed among howler groups inhabiting the archaeological zone at Calakmul (Rizzo, 2004, 2006). This is the first study to incorporate DNA analysis to explore kinship and demographics among *A. pigra* here. Further, genetic studies on wild primate species are complicated in research where non-invasive sampling techniques, specifically fecal collection, are the preferred method. Because of the high susceptibility of degradation in fecal samples, enormous care must be taken in field collection and extraction procedures.
We present a simple non-invasive collection strategy and extraction protocol used to obtain genomic DNA from fecal samples obtained from *A.pigra* (N=26) at Calakmul. The collection protocol developed incorporates a simple and sterile collection "kit" requiring no special knowledge, collection or storage constraints. A modified standard extraction protocol resulted in a 100% success rate. Furthermore, this project makes use of highly variable microsatellites, or simple sequence repeat loci. Previously published primers were combined with newly developed ones. Multiplex polymerase chain reaction (PCR), and polyacrylamide and agarose gel electrophoresis methods were used to test DNA primers and ultimately, to visualize individual variation. Results of this study provide a baseline snapshot of the genetic structure within this site and discussed in the context of kinship and sentry behavior.
This research has been supported by the University of Illinois at Chicago and Indiana University Northwest.

Craniofacial adaptations to tree-gouging in marmosets: biomechanics and implications for platyrrhine evolution.

E.C. Forsythe, S.M. Ford. Department of Anthropology, Southern Illinois University.

Marmosets are unique among anthropoid primates due to the use of their anterior dentition to elicit exudate flows, a behavior known as tree-gouging. Tree-gouging is an extremely stressful, craniofacially dominated feeding behavior, but craniofacial adaptations to this behavior remain poorly understood. Several studies have suggested that the orientation of the incisors, the distribution of enamel, and the muscle fiber architecture of marmosets are related to gouging, but broader correlates of this behavior are disputed. We report the findings from multivariate and univariate analyses of 25 variables collected on 305 callitrichid crania, suggest anatomical adaptations to tree-gouging among marmosets, and discuss the implications of these analyses to current models of platyrrhine evolution.
Analyses show that marmosets have relatively longer basicrania, narrower palates at the canines, anterior-posteriorly elongated mandibular condyles, and shorter ascending rami. Shortening of the ascending rami is accompanied by a posterior displacement of the condylar articular surface. These characters may allow for larger maximum jaw gapes during a gouging bout. The basicranial elongation of gougers (increased distance from the foramen magnum to prosthion) is possibly related to decreased flexion of the sphenoidal region of the basicranium. We compare these findings with studies of other gouging primates and suggest that marmosets exhibit a unique anatomical repertoire compared to other gougers. These findings further demonstrate that foraging strategies associated with exudativory are adaptively linked to the evolution of callitrichid primates, and the acquisition of a novel foraging strategy, tree-gouging, led to the divergence of marmosets.

Covariation in the upper and lower midfacial complex in North American populations.

A.D. Foster. Department of Anthropology, University of Arizona.

Determining the biological affiliation of unidentified skeletal material generally requires an analysis of cranial variables. Researchers use both anthroposcopic and anthropometric measures in these analyses, however anthroposcopic measures are most common. The problem with anthroposcopic methods is that they rely on a gradient or present/non-present scale, and are therefore quite subjective. Accurate anthropometric methods are more objective, and can complement already established anthroposcopic methods. Previous studies on North American populations using measures of either the upper and lower midface in isolation have accuracies ranging from 80-85% (see Gill et al., 1988; Gill and Gilbert, 1990; Willson, 2004). The goal of this study was to develop discriminant functions to determine biological affiliations of crania that unite objective measures of both the upper and lower midface in North American populations.
The sample examined here included African-Americans (n = 171), Euroamericans (n = 190), and Amerindians (n = 132) housed at the National Museum of Natural History in Washington, DC. A discriminant function employing Mahalanobis distance was generated from a set of 17 measurements of both the upper and lower midface. This analysis yielded a classification accuracy of 92%, 7-12% greater than the accuracy of similar analyses of the upper and lower midface in isolation. Due to the high number of variables necessary, this method requires the use of complete crania. However, the accuracy level does not change if problem areas (e.g. the area around the alveolus) are removed. Although this method has great utility for forensic analyses, other applications will be discussed.
Funding for this study was provided by the Graduate Research Fellows Program at the Smithsonian Institution, Washington, DC.

Stable Isotopes and Dietary Variability in Extinct and Extant Papionins

N. H. Fourie[1,3], D. Codron[1,4], J. Lee-Thorp[1,2], C. Jolly[5] and [6]J. Phillips-Conroy

[1]Department of Archaeology, University of Cape Town, [2]Department of Archaeological Sciences, University of Bradford, [3]Center for the Advanced Study of Hominid Paleobiology, George Washington University, [4]School of Biological and Conservation Sciences, University of Kwazulu-Natal, [5]Department of Anthropology and CSHO, New York University, and NYCEP, [6]Department of Anatomy and Neurobiology, Washington University Medical School

Multiple papionin taxa are represented in hominin bearing Plio-Pleistocene sites in South Africa. Stable isotope analyses of some of the closely related sympatric/parapatric *Parapapio* taxa indicate two overlapping dietary ecologies which are loosely correlated with the taxonomy of the specimens. However, sample sizes are small and may represent substantial periods of time during which environments may have undergone substantial oscillations. Small sample sizes may underestimate dietary variability in extinct populations, and samples with substantial time depth may exaggerate variability. Together, both factors may complicate the identification of discrete and/or adaptive eco-niches in taxonomically and/or ecologically related fossil species. Analyses of extant taxa with known ecological conditions can provide a valuable perspective for interpreting fossil data. In order to investigate the effects of sample size, time depth and environmental change, stable isotope data for sympatric/parapatric fossil papionin taxa from South Africa was compared and contrasted with a large isotope data set (approximately a thousand samples) of anubis, hamadryas and anubis-hamadryas hybrid baboons from the Middle Awash, Ethiopia. The Awash sample represents ten years, including a sample taken during a significant drought. The Awash data was subjected to random sub-sampling of various taxonomic, ecological and temporal groupings to simulate the fossil data sets from South Africa. Our results suggest that sample size, geographical features and environmental changes can have important effects on the apparent dietary variability observed within a sample. These results have important implications for understanding how dietary and ecological signals in fossil samples are interpreted.

Health outcomes of Cape-Verdean migrants to Lisbon. A historic note on colonialism in Portugal.

I. Fragoso[1], M.I. Varela-Silva[2], N. Cameron[2]. [1]Faculty of Human Kinetics, Technical University of Lisbon, Portugal, [2]Department of Human Sciences, Loughborough University, UK

People from the Cape Verde islands in Portugal are the most numerous of the immigrants from the former Portuguese colonies in Africa. Health surveys conducted during the Colonial period portrayed the Cape Verdeans as "tall," "strong," and "well-proportioned," but the original anthropometric and physical performance data were never presented in these reports. Good health is unexpected because Cape Verde was regularly plagued by droughts, famines, poverty, and epidemic diseases. After independence in 1975, living conditions began to improve, but thousands of Cape Verdeans continued to migrate to Portugal. We recovered and analyzed the colonial period growth data and also collected new data from post-independence samples, both in Cape Verde and in Portugal. Cape Verdeans from the colonial times were not healthy, rather they were, on average, 1.5 SD below the WHO growth references for height, weight, and sitting height ratio, and the girls achieved menarche at an average age of 16 years. Post-independence Cape Verdean sedentes show an improvement in growth status, but are still significantly below the WHO references. Migrants to Portugal, measured in 1993 and 2000, are taller, heavier than the sedentes, and the girls reach menarche at 12.5 years. The migrants do not differ in growth status from Portuguese boys and girls living in the same area near Lisbon. From these comparisons we conclude that colonialism fostered a racist ideal about the health of the colonized. The legacy of colonialism continues in Cape Verde and is one of the "push" factors which promote emigration.

Experimental facial growth alteration in *Sus scrofa* and its implications for the evolution of modern human craniofacial anatomy.

R.G. Franciscus[1], N.E. Holton[1], M.A. Nieves[2], T.E. Southard[3], S.B. Reimer[2], S.D. Marshal[3], K.E. Krizan[3], S.D. Maddux[1]. [1]Department of Anthropology, University of Iowa, [2]Department of Veterinary Clinical Sciences, Iowa State University, [3]Department of Orthodontics, University of Iowa.

Reduction in facial size and length is a defining characteristic of anatomically modern humans. While ultimate explanations for facial reduction have centered on technocultural adaptation, alterations in facial sutural growth rates may underlie proximate evolutionary changes in modern human facial form. We used rigid plate fixation on *Sus scrofa* to experimentally attenuate facial growth at the circumfacial sutures to test the hypothesis that sutural growth inhibition would produce significantly smaller and shorter faces. Ten female sibship cohorts, each consisting of three individuals, were allocated to one of three trial groups. In the experimental group (n=10), rigid miniplates were affixed bilaterally across the zygomaxillary and frontonasomaxillary sutures using monocortical screws at age 2 months. The sham group (n=10) underwent the identical surgical procedure, receiving only screw implantation. The controls (n=10) underwent no surgery. Diet was kept constant among the three groups. Following four months post-surgical growth, we conducted (on dry skulls) principal components analysis of Procrustes scaled landmarks (types I-III). No significant differences occurred between the control and sham groups, while the experimental group exhibited a highly significant reduction in facial length and size. We further documented other key significant differences: infraorbital planes oriented anteroinferiorly and coronally, rather than anterosuperiorly and sagittally; and deeply excavated infraorbital depressions rather than flat infraorbital

planes. These differences are markedly similar to important facial features that define modern humans relative to pre-modern *Homo*, and suggest that evolutionary changes in facial sutural growth rates may be key to understanding the evolution of modern human facial morphology.

Characterizing neurocranial shape in microcephalic children.

B.C. Frazier, K.E. Willmore, J.T. Richtsmeier. Department of Anthropology, Pennsylvania State University.

Microcephaly has come to the forefront of discussion in physical anthropology in light of the hominid findings from Flores, Indonesia. Because the clinical term "microcephaly" describes a symptom rather than a disorder, any of a variety or combination of causes may underlie the phenotype. This ambiguity makes characterizing a generalized "microcephalic shape" difficult, and existing literature on the topic is scarce.
By examining a sample of modern clinical cases, this study attempts to define specific morphometric traits that are shared among children clinically diagnosed with microcephaly. Three-dimensional coordinate landmark data collected from computed tomography scans of microcephalic children and age-matched unaffected children are analyzed using multiple quantitative techniques: 1) differences in cranial shape are explored using Euclidean Distance Matrix Analysis (EDMA), 2) Levene's tests are used to compare variance between groups, and 3) cranial base flexion is compared using t-tests. Microcephalic children have a relatively shorter and narrower cranial base than unaffected children, and show a significantly higher variance in these dimensions. Additionally, measures of neurocranial height are more variable in microcephalic individuals than in their unaffected counterparts. Despite these differences, the angle of cranial base flexion does not differ significantly between the two groups. These characters, along with more traditional cranial metrics, such as circumference, volume, and cranial indices, enable a quantitative evaluation of the microcephalic cranial phenotype. We discuss the implications of these results for interpreting the human fossil record.
This work was supported in part by an NSF Graduate Research Fellowship (BCF) and PHS grants (JTR).

How three-dimensional surface data can be used to reconstruct fragmentary fossils.

S. Freidline[1, 2, 3], P. Gunz[1], K. Harvati[1,3], E. Delson[3,4,5], J.J. Hublin[1]. [1]Max Planck Institute for Evolutionary Anthropology, [2]The Graduate School and University Center of the City University of New York, [3]New York Consortium in Evolutionary Primatology (NYCEP), [4]Dept. of Anthropology, Lehman College/CUNY, PhD Program in Anthropology, CUNY Graduate School, [5]Dept. of Vertebrate Paleontology, American Museum of Natural History.

Semilandmarks make it possible to quantify shape information on curves and surfaces using coordinate-based statistics. They can be used in geometric-morphometric analyses of shape variation as if they were homologous landmarks, and are therefore particularly helpful in regions where osteometric points are sparse (like e.g. the neurocranium). We test whether the additional effort in collecting curve and surface data, rather than traditional landmark points, is warranted. 138 landmark points, 34 curves totaling 299 semilandmarks and four patches (frontal, maxilla, zygomatic and two occipital) totaling 661 semilandmarks were collected from forty-nine surface scans of recent human crania from the collections of the AMNH, obtained with a XYZ surface scanner. Our sample comprises ten widespread populations. Six scans of Pleistocene fossil crania were also included. 3D-coordinates of these points were converted to shape-coordinates using Procrustes superimposition. We then standardized each specimen by thin-plate spline unwarping to the Procrustes average of (1) just the landmarks, and (2) landmarks and semilandmarks on curves. Thereby we can visualize the information gained by measuring the curves, and curves and surfaces respectively.
We show that the surface patches are largely redundant with landmark and curve data, providing little additional morphological information. These findings have important implications for reconstructing fragmentary fossil material; such fossils are often neglected because they contain too few landmark points. Curve and patch data can be collected from fragmentary fossils material thereby increasing the sample size.
Supported by the Marie Curie Actions grant MRTN-CT-2005-019564 "EVAN," the Max Planck Society and NSF 0333415 (NYCEP IGERT)

Use of metric analysis on human thoracic vertebrae as a means to determine sex and to aid in the seriation of isolated vertebrae.

H.C. Freiman, C.J. Zambrano, and A.B. Falsetti. C.A. Pound Human Identification Laboratory, Department of Anthropology, University of Florida.

Visual identification of transitional vertebrae, in all regions of the vertebral column, can be conducted with a reasonable degree of confidence. However, accurate assessment of "middle" vertebrae is often difficult without a complete series. The purpose of this pilot study is to develop and test a set of metric measurements for human thoracic vertebrae. Formulae derived from the data will both aid in the determination of sex and in assigning a positional identity to isolated thoracic vertebrae. While previous research examines cervical and lumbar series, information on thoracic vertebrae is sparse even though they are often well preserved in skeletal assemblages.
Seventeen measurements were taken on each thoracic vertebrae (T1-T12) from 47 individuals with seriated vertebral columns (20 male, 27 female) ranging in age from 19 to 89 years. The results show no significant asymmetry between right and left side measurements. Marked sexual dimorphism is present, and sample discriminant function equations for individual vertebrae correctly classify sex with an accuracy between 85-100%. The vertebrae identification model created through canonical discriminant analysis is significant – indicating that there is a difference in measurements by vertebrae number. The first three canonical axes account for 97% of the variation in the sample.
Therefore, the data collected indicate that: 1) sex can accurately be determined from a vertebra of known position (e.g. T2), and 2) an unknown vertebrae can be assigned a position within the series. This information has broad applications for skeletal biologists working in both forensic and archaeological contexts.

Future directions in the study of human adaptation: Where do we go from here?

A.R. Frisancho. Department of Anthropology. University of Michigan.

Human adaptability is a multi-factorial trait influenced by a mixture of genetic and environmental factors. Hence, the conceptual framework of the study of human adaptation is that population differences in physiological and morphological traits reflect the organism response to the diverse environmental conditions during growth and development. Current evidence suggests that genetically programmed developmental differences in human adaptive responses may play an important role in individual and population functional differences. Because human adaptability requires the interaction of environmental factors and developmental genes epigenetic studies provides an important approach for evaluating variability in the expression of functional. Epigenetics refers to the study of heritable changes in gene expression that occur without a change in the DNA sequence and comprise an important mechanism whereby dietary components can selectively activate or inactivate gene expression. Epigenetic genetic studies can be applied to explain the increased frequency of obesity in both industrialized and developing nations, and the thrifty phenotype that account for the high frequency of cardiovascular diseases experienced among populations that have grown under the conditions of under-nutrition. It is quite possible the epigenetic modification can also result from the influence of environmental factors other than nutrition. Hence, future studies of human adaptation concerned with issues of human growth, environmental pollution, and life at

high altitudes, chronic cold stress, and hypertension risk must incorporate the epigenetic research strategy.

Cultural ecology and epidemiology of vitamin A deficiency among lactating mothers in northern Kenya.

M. Fujita. Department of Anthropology, University of Washington

Vitamin A is essential for vision, growth, immunity, and reproduction. Vitamin A deficiency (VAD) even at the subclinical level is associated with elevated risk of morbidity and mortality, especially for children and women of reproductive age. By incorporating VA status as a variable, anthropologists can refine hypotheses which were previously tested only in terms of anthropometry and energy balance. This paper presents data from 2006 dissertation fieldwork among 241 lactating Ariaal mothers in three communities of northern Kenya to determine the prevalence of maternal VAD as it relates to nutritional status, dietary intake, sociodemographic factors, infant's age, breastfeeding patterns, and food beliefs affecting maternal diets. Based on preliminary analyses, the prevalence of clinical VAD based on night-blindness questionnaire was 2.2%. The prevalence of subclinical VAD was 0% and 4.5% based on serum retinol and relative dose-response test representing liver VA stores, respectively, underscoring the importance of liver VA estimates. The prevalence of protein-energy malnutrition (PEM), defined by body-mass index <18.5, was 32.7%. It was hypothesized that PEM is positively associated with VAD and infant's age is negatively associated with maternal VAD, since these are epidemiological factors of maternal VAD. Results indicate that neither PEM nor infant's age affects the odds of maternal VAD. However, when communities were examined separately, infant's age was found negatively correlated with maternal serum retinol (P>0.006, R2=0.18, N=41) in an agricultural community of Kituruni, suggesting that maternal circulatory VA decreased throughout the postpartum year only in this community. Cultural and ecological context merits a further investigation.
Supported by NSF Dissertation Improvement Grant # 0622358, Wenner-Gren Dissertation Grant #7460, the Micronutrient Initiative, and the Center for Studies in Demography and Ecology (CSDE), University of Washington.

Expression profiling: A new approach for understanding the determinants of human variation

H.H.H. Göring. Department of Genetics, Southwest Foundation for Biomedical Research.

Molecular biological technologies are improving at a rapid pace. As a result, some approaches that were previously limited in their use to specific candidate genes or regions can increasingly be applied on a genome-wide scale. This is already the case for SNP genotyping and for gene expression profiling, with chip-based technologies allowing simultaneous assessment of hundreds of thousands of SNPs and virtually the entire known transcriptome. Other methods such as sequencing and protein profiling are not far behind. In our quest to understand the determinants of human characteristics, it thus behooves us to make use of as many sources of information as possible. The integration of the various genomic technologies thus is at the cutting edge of complex trait gene discovery efforts. In this presentation, the focus will be on how expression profiling can be combined with (re-) sequencing and association analysis to rapidly identify novel candidate genes for complex traits. As an example, I will describe research of the San Antonio Family Heart Study, where we have generated expression profile data on lymphocytes from >1,000 family members. We determined by linkage analysis which transcripts are substantially *cis*-regulated (i.e., self-regulated) and correlated these transcripts with high density lipoprotein-cholesterol (HDL-C) levels, an important clinical risk factor for cardiovascular disease. This led to the identification of *VNN1* as a candidate gene, which we subsequently confirmed by promoter re-sequencing and association analyses.

Smoking, birthweight, and infant mortality.

T.B. Gage[1,2], E. O'Neill[1], F. Fang[1], H. Stratton[2]. [1] Department of Anthropology, [2]Department of Epidemiology and Biostatistics, University at Albany.

Smoking during pregnancy is an important correlate of adverse birth outcomes. This research determines if the increase in infant mortality with maternal smoking is attributable to "indirect" effects operating through shifts in birthweight or to "direct" effects independent of birthweight. The data included all singleton, African, and European American births in the US, 2001. Smoking was defined as "never smoked during pregnancy" versus, "smoked". The analysis was carried out using Covariate Density Defined mixtures of logistic regression, which estimates "direct" and "indirect" effects, on two components of the birth cohort separately; "normal" and "compromised" births. The results indicate that smoking has strong influences on the birthweight distribution. The proportion of "compromised" births increases significantly in all birth cohorts (1.2-3.9%) and birthweight declines 172 to 245 grams in "normal" subpopulations. Among "compromised" births, European American means decline 244-245 grams, but African American means increase 6-35 grams. Despite significant shifts in birthweight means in "normal" and "compromised" births in all populations, "indirect" effects are significant only in "normal" African American females and tend to reduce the detrimental effects of smoking, due to shifts in birthweight-specific mortality. The increase in proportion of "compromised" births (a second kind of indirect effect) increases infant mortality by 0.24-1.60 deaths/1000 births. The largest negative effects are "direct" and occur among "normal" births in all 4 birth cohorts, deaths increase by 3.15-5.88/1000 births. The only significant "direct" effect among "compromised" births occurs in European American males. The implications for intervention to reduce infant mortality are discussed.
This work supported by NIH grant R01 HD037405.

Buccal dental microwear in a living population of baboons from Amboseli (Kenya)

J.Galbany[1,3], J.Altmann[2], A.Pérez-Pérez[3], S.C. Alberts[1]. [1]Department of Biology, Duke University, [2]Department of Ecology and Evolutionary Biology, Princeton University, [3]Departament of Animal Biology, University of Barcelona (Spain).

Analysis of buccal dental microwear has been used for the interpretation of the alimentary habits of hunters-gatherer populations. Among non human primates, it has been studied in a number of ways and results have been applied to the characterization of the alimentary habits of fossil species. Most studies have been carried out from dental molds obtained in osteologic collections. Studies carried out in populations *in vivo* are very scarce because of the difficulties of collecting the relevant samples, but such studies provide a lot of information about the processes responsible of the formation of dental microwear patterns by the abrasive nature of the foods or the presence of extrinsic particles during chewing.
The present study shows the variability of buccal dental microwear obtained *in vivo* in the population of Amboseli baboons, *Papio cynocephalus*, obtained in 2006 and 2007 field work, in comparison with other primate species in which samples were obtained from osteological collections. The results show significant differences among species in the density of microstriations and its length, suggesting that these patterns are correlated with the feeding ecology of each species. Amboseli baboons show dental microwear patterns more similar to *Cercopithecus sp.*, than to baboon specimens from other geographic locations. These differences may be directly related to the abrasiveness of the diet and the ecological conditions.
A good knowledge of dental microwear patterns in living populations of primates can bring information about the alimentary habits and the use of the territory of Plio-Pleistocenic African hominid.

The discovery of a premolar with distosagittal ridge from the Spanish Cooper Age

[1]A Gallardo and [2] M. Pimienta [1]Centro INAH Yucatán, [2] Centro Peninsular en Humanidades y Ciencias Sociales., UNAM

The study describes the discovery of a first superior right premolar with disto-sagittal ridge, known as a Uto-Aztecan premolar. The teeth belong to an andaluz individual of 8 to 10 years old and four thousand years of antiquity from the cooper age or Spanish Calcolitic (2300-1800 b.C.). The discovery is exceptional, because the geographical distribution of this morphological dental trait until now, are among the Native American populations. The discovery is significant for the dental anthropology and for the studies of interrelationships between populations.

Evidence of significant Sr isotope heterogeneity in Upper Paleolithic human teeth from the Mladeč caves.

P. Galler[1], T. Prohaska[1], M. Teschler-Nicola[2]. [1]Department of Chemistry, Division of Analytical Chemistry, University of Natural Resources and Applied Life Sciences, [2]Department of Anthropology, Natural History Museum Vienna.

The Upper Paleolithic human fossils of the Mladeč Caves in the Czech Republic, recently dated to ~ 31 ^{14}C kyr BP, hold a key position in the current discussion on modern human emergence within Europe and the fate of the Neandertals.
To identify locals and non-locals in (pre)historic human populations the strontium (Sr) isotope ratio technique has been applied successfully within the last decade as one method of choice. It has been proofed by solubility distributions of hydroxyapatite that biogenic strontium is sufficiently conserved in enamel over long term periods. Under favorable conditions a significant difference in the strontium isotope signature between enamel and dentine can point to a residential change of an individual. This is an important prerequisite for the present study of the Mladeč Upper Paleolithic specimen.
The strontium isotope ratio technique has rarely been used for identifying locals and non-locals in the Paleolithic. One of the reasons might be the fact that the common technologies for the determination of Sr isotopes have been of an invasive nature. Here we present the results of Sr isotope ratio determinations in dental enamel and dentine of 5 human individuals as well as from faunal remains (fox) from the Upper Paleolithic Mladeč site by a newly developed, semi-invasive high throughput laser sampling technique (LA-MC-ICP-MS). Our results suggest significant Sr isotope variation of the samples investigated which will be discussed with respect to the assumed mobility in hunter-gatherer populations.
This work was financially supported by the Austrian Science Fund (FWF "Start 267N11").

Pull or push? Experimental field study of problem-solving using tools in wild capuchins (*Cebus nigritus*).

P.A. Garber[1], D.F. Gomes[2], J.C. Bicca-Marques[2]. [1]Department of Anthropology, University of Illinois, Urbana, IL, [2]Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brazil.

Several species of capuchins are reported to occasionally use tools to solve foraging problems in the wild. In most cases, this involves the act of pounding. The use of probing tools by wild capuchins is much less common. Here we report on the results of an experimental field study conducted in southern Brazil to examine the ability of wild black-horned capuchins (*Cebus nigritus*) to use a wooden dowel as a probe to obtain an embedded food reward. A group of eight capuchins was presented with two experimental platforms, each supporting a clear Plexiglas box containing two bananas on a shelf and four inserted dowels. Depending on the conditions of the experiment, the capuchins were required either to pull (EXP 1) or push (EXP 2) the dowels in order to dislodge the food reward from the shelf and retrieve it below. In EXP 1 the capuchins arrived at the platforms on 24 days (291 individual capuchin visits). In EXP 2 they visited the platforms on 16 days (151 individual capuchin visits). Five individuals solved the first foraging problem by pulling the dowels in 31% (89/291) of visits (range 4-62%). In EXP 2, however, no capuchin successfully pushed the dowels forward to obtain the food reward. In fact, during 35% (53/151) of these visits individuals continued to pull the dowels, even though this behavior could not result in foraging success. Additional information on the affects of social dominance on individual variation in dowel manipulation and capuchin tool-mediated problem-solving abilities are discussed.
Supported in part by a grant from the University of Illinois, Urbana, IL. USA.

Geometric morphometric analysis of the ontogeny of canine and craniofacial growth in *Colobus guereza*: implications for its lack of canine dimorphism.

E.C. Garrett[1,2,4,5], E. Delson[1,2,3,4,5]. [1]Department of Anthropology, City University of New York; [2]Dept. of Anthropology, Lehman College/CUNY; [3]Dept. of Vertebrate Paleontology, American Museum of Natural History; [4]New York Consortium in Evolutionary Primatology (NYCEP); [5]NYCEP Morphometrics Group.

Canine sexual dimorphism in anthropoid primates is largely the product of sexual selection. Intrasexual competition has selected large male canines in many anthropoids, and maxillary canine dimorphism broadly correlates with polygyny. *Colobus guereza* is perplexing in their male-sized female canines despite a social organization of single (or few) males and multiple females with intense inter-male competition. Only hylobatids (and tamarins) present comparably non-dimorphic canines, while other *Colobus* species and all other anthropoids are dimorphic or have small male canines (humans, marmosets). Delson and others have noted this phenomenon in passing, but without formal analysis of factors producing large female canines. Ontogenetic trajectories influence the expression of sexual dimorphism through bimaturism or differential growth rates. Most anthropoid canine dimorphism is the result of earlier eruption and growth termination in females, with male canines developing later and over a longer period of time. Dental eruption patterns indicate that *C. guereza* follows this pattern, so their large female canines are unexpected. Data on canine dimensions and the craniofacial complex in an ontogenetic sample were collected to test whether differentiation in growth patterns is responsible for large female canines and low rates of dimorphism.
Principal components analysis of three-dimensional landmark data from an ontogenetic sample of *C. guereza* allowed an examination of whether maxillary canine and craniofacial growth patterns differed significantly between males and females. Canines do erupt earlier in females, but there is no canine dimorphism in adults or juveniles, and growth trajectories appear similar in both sexes.
This research was supported, in part, by NSF awards 0333415 (NYCEP) and 0513660.

Morphological variation in the human hyoid and its relationship to basicranial and mandibular morphology.

H.M. Garvin[1], L. Cabo[2]. [1]Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine, [2]Department of Applied Forensic Sciences, Mercyhurst College.

Allometry and shape variability of the human hyoid bone are rarely correlated and discussed in the literature. In paleoanthropology, the hyoid attracted attention in the debate regarding Neandertal speech capabilities, based on overall shape similarities, but these studies rarely included functional interpretation. Overall, few studies attempt to provide allometric models to assess the covariance of hyoid traits, or of hyoid morphology with that of other structures. This may be a result of the unique anatomical context of the hyoid. Often referred to as the "floating" bone, it articulates to the cranial base, mandible, manubrium, clavicle, scapula and thyroid cartilage solely through muscle and ligament intermediaries. Given the functional and embryological connection among pharyngeal, laryngeal, basicranial and mandibular structures, it is reasonable to expect hyoid morphology to be highly related to these structures.

The present study examines variation and possible influences in hyoid morphology (n=361) and the correlation between hyoid, mandibular and cranial base morphologies (n=199), of a sample from the Hamann-Todd Osteological Collection.
Preliminary analyses suggest a strong relationship between hyoid, basicranial and mandibular morphologies. In particular, hyoid antero-posterior dimensions appear to be highly correlated with cranial length and prognathism. Discriminant function analyses of hyoid measurements suggest a clear distinction between sex and ancestry groups. This is expected because cranial dimensions are good predictors of sex, and degree of prognathism is diagnostic of geographic affinity. Given the results of this study, the allometric trajectories between hyoid and cranial dimensions provide a possible model to assess and interpret hominin evolutionary patterns.

Butting heads: interpersonal violence at Early Bronze Age Bab edh-Dhra'

M.G. Gasperetti[1], K.W. Kim[2]
[1]Department of Anthropology, University of Notre Dame, [2]Department of Anthropology, University of California, Berkeley.

A biocultural approach is utilized to assess the prevalence of cranio-facial and forearm fractures in the Early Bronze Age walled town of Bab edh-Dhra'. The ulnae (n=105), radii (n=158), and crania (n=78) from Charnel House A22, dating to the EB II-III period (2950-2300 B.C.E.), were analyzed in the current study. The commingled nature of these ossuary remains is accounted for in the methodology, which further addresses the presence, location, and alignment of fracture when appropriate for each bone.
The results show high frequencies for both forearm (ulna 4.8%; radius 3.2%) and cranio-facial fractures (3.9%). The rates at Bab edh-Dhra' are greater than the majority of the comparative frequencies employed in this study (such as St. Helen-on-the-Wall p= .036, Blackfriars (p= 0.007), Cemetery 24 at Dabod (p= 0.04), Cemetery 40 at Siali (p= 0.009), Point Barrow and Point Hope Alaska (p= 0.009). Radiographic analysis helped corroborate the identification of four parry fractures of the ulna and five Colles' fractures of the radius. Additionally, analysis of cranio-facial fracture etiologies revealed numerous fractures resulting from blunt-force trauma and two fractures resulting from sharp force trauma. The combined evidence of high fracture frequencies, characteristic etiologies, and the presence of a large fortification structure in EB II-III indicates an increase in strife-related trauma, possibly attributable to interpersonal conflict. Other archaeological evidence, such as presence of metal weapons in the charnel houses, and written accounts of military presence from Egypt and Mesopotamia, further corroborate this interpretation.
This research was supported by the NSF-REU (SES 0649088) Summer Research in Biocultural Anthropology at Notre Dame program, and Notre Dame's Institute for Scholarship in the Liberal Arts Undergraduate Research Opportunities Program.

Adaptations for human striding gait revealed in the histoarchitecture of the sole of the foot.

K.R. Gehret, D.J. Meldrum. Dept. of Biological Sciences, Idaho State University.

The modern human striding gait and pedal adaptations for endurance walking and running concentrate compressive and shear forces at the heel and ball of the foot. In response to these peak pressures, the superficial tissues of the ball region of human foot have adapted by increased thickness and more complex connective macro-architecture in contrast to the African ape foot, as demonstrated previously. To examine the micro-architecture of the plantar sole pad, full thickness samples of the plantar superficial fascia were excised from the ball of cadaveric human, and cadaveric captive chimp and gorilla feet (male and female). Thin-sections were differentially stained using Mason's trichrome method for visualization of general morphology and Van Gieson's methods for collagen and elastin fibers. A Silver impregnating stain revealed density and distribution of sensory nerve endings. Quantification of differentially stained structures included density, distribution, and orientation of elastin and collagen fibers respectively, thickness and orientation of compartmental septae and trabeculae, and relative thickness and differentiation of fascial strata. Results indicate that contrasts in histoarchitectural features of the ball region of the human and African ape foot, correlate with human adaptations for bipedal locomotion on an arched foot.
This research was funded in part by ISU Faculty Research Committee grant #829 and the Leakey Foundation to DJM, and Biological Sciences Graduate Student Research Award to KRG.

Different Place, Different Meaning?: The Importance of Color Location in Primates.

M.S. Gerald[1,2] [1]Cayo Santiago, Caribbean Primate Research Center, [2]University of Puerto Rico, Department of Medicine, Medical Sciences Campus.

The primate face serves as a central focal point for much of visual communication in primates. Collectively, primates have an extensive facial signal repertoire including displays related not only to aggression, appeasement and subordination, but also to courtship. Facial communication can include displays, which may involve the movement of the mouth, exposure of the teeth or movement or gaze of the eyes alone, or in combination with each other, and jointly with other modes of communication. Each of these displays can convey different meanings.
Secondary sexual coloration on the primate face can also be used to convey information to conspecifics. In general, coloration can act as one of several signals, to allow for more accurate assessment of a single aspect of an animal's quality, as would be suggested by the back-up signal (or redundant signal) hypothesis (Johnstone, 1996); or to act as one of a suite of displays, that reveal different aspects of male quality, as would be predicted by the multiple-message hypothesis (ibid.); or to enhance the conspicuousness and reception of other visual displays which could serve as a back-up for other signals. In my presentation I evaluate how these hypotheses might account for facial coloration in primates. Visual signals need not be restricted to facial displays. Ano-genital displays can also be involved in communication. Considering evidence from observational and experimental data in rhesus macaques and vervet monkeys, I also offer comparative predictions for possible conditions whereby displays of facial coloration would be favored over ano-genital coloration in primates.

Do the Nighttime Nutritional Needs of the Infant Drive the Duration of the Human Sleep Cycle?

L.T. Gettler[1] and J.J. McKenna[2].
[1]Northwestern University and [2]University of Notre Dame.

Explanations of either the critical ecological or life history variables that shape or guide ultradian sleep cycles, i.e. the temporal patterning of a species' sleep architecture, remain a mystery. We examined 20 bed-sharing and 15 solitary sleeping, exclusively breastfeeding, Latino, mother-infant dyads in a sleep laboratory using infrared photography and poly-somnography. The hypothesis being tested is that the duration of maternal sleep cycles will show some functional complementarity to the apparent time it takes infants to digest their last feed, as determined by the infant's initiation of a sequence of behaviors that arouse the mother to breastfeed again. Preliminary data reveal that 143 breastfeeding intervals were identified as mothers and infant alternated between sleeping together in the same bed and alone in separate rooms over three consecutive nights. Once mother was in bed and after she breastfed her infant before falling asleep, the average intervals between breastfeeds for routinely bed-sharing mothers on their bed-sharing night was 97.8 minutes. Routinely solitary sleeping mothers and infants, on a solitary night, averaged 179.94 minutes. The average human adult sleep cycle is approximately between 90 and 110 minutes long. If additional data collection and analysis confirm these numbers for the routinely bed-sharing mothers and infants (the environment within which we can presume mother-infant sleep patterns evolved) the possibility is raised that the caloric density of human milk coupled with

the rapidity by which calories are burned in the infant's gut, may well help to explain the duration of the human sleep cycle.

Novel methods of molecular sex determination utilising the amelogenin gene.

V.E. Gibbon[1,2], C.B. Penny[2], G. Štrkalj[1,3] and P. Ruff[2]
[1]School of Anatomical Sciences, [2]Department of Medicine, University of the Witwatersrand, Johannesburg, [3]Department of Health and Chiropractic, Macquarie University.

This study presents novel methods of molecular sex determination using PCR amplification of the sex chromosome linked amelogenin gene. These methods were first optimised on blood and bone controls and then applied to skeletons sourced from the Raymond Dart Collection of Human Skeletons (University of the Witwatersrand, Johannesburg). The DNA was extracted using a silica based spin column (Qiagen Micro kit 50) that binds the DNA to the silica membrane. For the purposes of extracting DNA from bone obtained from the Dart collection, an additional step of 0.5 M EDTA (pH 8.0) and proteinase K was added to the lysis step in the protocol; together, these two chemicals assist in the breakdown of the mineral aspect of bone, which then increases the yield of DNA. The classification of sex was specifically determined using a nested conventional PCR reaction through the amplification of the amelogenin gene. The amplification isolates 16 highly conserved sex specific variations, in addition to a 6 bp deletion on the X chromosome. The amelX amplicon is 332 bp and the amelY is 338 bp in length. The deletion was visualized using the highly sensitive Bio-Rad Experion DNA 1K analysis kit. The classification of sex was subsequently confirmed through sequencing the PCR product by examining both the sex specific variations and the deletion. Each of these methods using the new area on the amelogenin gene proved to be reliable, easily replicable and successful in sex determination.

Strontium isotope analysis of Neolithic and Copper Age populations from the Great Hungarian Plain.

J.I. Giblin. Department of Anthropology, The Ohio State University

Central Europe played a pivotal role in the dispersal of people and new ways of life during the Neolithic and post-Neolithic. This study addresses changes in mobility, subsistence strategy, and social organization that occurred during the Late Neolithic and Copper Age cultures on the Great Hungarian Plain using geochemical techniques, specifically strontium isotopes. The $^{87}Sr/^{86}Sr$ isotope ratio has been used in previous studies to identify major events of population movement such as migration, conquest, and inter-marriage. Results from this study do not identify any non-local individuals in the Neolithic and Copper Age burials sampled; however, there is a change in the range of isotope values from a very narrow range to a much broader range between the Late Neolithic and the Copper Age, suggesting that local changes in lifestyle affected incorporation of strontium into the skeletal system. The results of this paper indicate that strontium is a valuable tool for identifying more subtle changes in prehistoric behavior such as a shift to a more pastoral economy and the exploitation of secondary products.

Intra-community infanticide and forced copulation in spider monkeys: a multi-site comparison between Cocha Cashu, Peru and Punta Laguna, Mexico.

K.N. Gibson[1], L.G. Vick[2], A.C. Palma[3,4], F.M. del Rocío Carrasco[5]. [1]Department of Anthropology, Yale University, [2]Department of Anthropology, Peace College, [3]Departamento de Ciencias Biológicas, Universidad de Los Andes, [4]Centro de Investigaciones Ecológicas Macarena (CIEM), [5]Departamento Académico de Biología, Universidad Nacional Agraria La Molina.

We describe two cases of infanticide, two possible infanticides, and a forced copulation by familiar resident males in two populations of wild spider monkeys (*Ateles belzebuth chamek* and *A. geoffroyi yucatanensis*). These are the first known infanticides and forced copulation in spider monkeys. Data were gathered from three neighboring communities of spider monkeys in Manu National Park at the Cocha Cashu Biological Station, Peru and two communities in the Otoch Ma'ax Yetel Kooh Reserve at Punta Laguna, Mexico during intensive field studies of over 2,000 hr each. At Cocha Cashu, the infanticidal male was a young subadult that appeared to be sexually immature (classified as a juvenile) when the victim was conceived. At Punta Laguna, the community's alpha male committed the infanticide. These are rare behaviors, but results suggest that mating history and sexual coercion are important in spider monkey social relationships.
Financial support was provided to L.G. Vick by Peace College, to A.C. Palma by the Universidad de Los Andes, and to K.N. Gibson by Fulbright IIE, L.S.B. Leakey Foundation, Organization for Tropical Studies, National Science Foundation, John Perry Miller Fund, Williams Fund, and Yale University.

Narrow allometry in phylogenetic analysis of morphological data.

C.C. Gilbert[1], J.B. Rossie[2].[1]Interdepartmental Doctoral Program in Anthropological Sciences, [2]Department of Anthropology, Stony Brook University.

Previous analyses have noted incongruence between primate phylogenetic analyses produced from morphological data and those produced from molecular data. In particular, phylogenetic studies of extant hominin and papionin craniodental anatomy have produced trees that are discordant with those produced from large molecular datasets for these primate groups. When such incongruence exists, many authors prefer to accept the results of molecular analyses and conclude that morphological characters are unreliable for reconstructing phylogeny. The assertion that morphological data are unreliable is especially dramatic for the study of primate evolution, given that the primate fossil record is largely composed of craniodental material.
One issue that can confound primate phylogenetic analyses is allometry. For example, the papionin skull has long been noted to be allometrically influenced, and yet most phylogenetic studies do not take this well-documented phenomenon into account. Here, we offer a novel approach in controlling for allometry in phylogenetic analysis. A dataset of 73 quantitative and qualitative craniodental characters was adjusted using a narrow allometric coding method in a parsimony analysis of the extant papionins. Resulting phylogenetic trees are congruent with phylogenetic trees based on molecular data for these species. If such congruence is considered to be a test of the reliability of morphological data, then craniodental data seems perfectly suitable for phylogenetic analysis. Rather than accepting phylogenetic hypotheses from one data source over another, we believe that other cases of incongruence should be examined with greater scrutiny.
This work was generously supported in part by a grant from the L.S.B. Leakey Foundation as well as a Graduate Council Fellowship from Stony Brook University.

Solitary space use in male chimpanzees: inheritance of maternal range and avoidance of feeding competition.

I.C. Gilby[1], C.M. Murray[2,3], S.V. Mane[4], A.E. Pusey[2]. [1]Department of Anthropology, Harvard University, [2]Department of Ecology, Evolution and Behavior, University of Minnesota. [3]Lester E. Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo, [4]Department of Computer Science, University of Minnesota.

Female chimpanzees minimize feeding competition by spending much of their time alone and by concentrating their movements in distinct but overlapping core areas to which they have high site fidelity. Continued use of the same area affords access to known resources. Despite the benefits of sociality, the costs of grouping may also force males to periodically adopt a similar strategy. Solitary foraging may therefore be critical to male survival and reproductive success. Here we investigate the potential correlates of alone space use and site fidelity in male chimpanzees at Gombe National Park, Tanzania. Point-pattern analyses indicate that 1) adult male and female chimpanzees

had comparable levels of alone core area fidelity; 2) adult male site fidelity was not correlated with habitat quality; and 3) each male preferentially concentrated his alone space use near the area where his mother ranged when he was a dependent. These results suggest that solitary travel allows males to avoid direct competition with conspecifics while foraging in known areas.

An initial description of the Quaker Hills Quarry human remains, Shenks Ferry culture.

C Giardano, KC Hoover. Department of Anthropology, Temple University.

This is the initial description of the human remains excavated in 2006-7 from the Quaker Hills Quarry site, Millersville Pennsylvania. This site is associated with the Shenks Ferry culture (1000-1500 CE) that disappeared prior to European contact. Typically, Shenks Ferry populations engaged in maize-based subsistence economies and lived in palisaded villages. Shenks Ferry cultures buried their dead within village walls but not in a designated cemetery. The Quaker Hills Quarry site so far consists of thirteen individuals in varying states of preservation. Remains were brought to the Archaeological Lab, Department of Anthropology at Temple University where they were cleaned, reconstructed, inventoried, and analyzed using standard osteological protocols. There were seven adults, three children, and three infants. Standard health markers did not show nutritional, pathological, or traumatic stress to a significant degree. In particular, there were no hypoplasias on the deciduous dentition and only a low frequency on the permanent dentition. This is unusual for maize-based agricultural populations. One adult of advanced age had sclerotic remodeling on the long bones indicating widespread and chronic infection, possibly bacterial: pathological lesions on the skull and long bones resemble treponemal infection. Some evidence of trauma to the long bones were found in two adults. One adult had porosity on the inner and outer tables of the skull but no strong diagnostic indicators of anemia. Adult burials included few, if any, grave goods. Children were mostly buried with ornate items, worked bone, teeth, and shell beads. The remains are scheduled for reburial next year.

Genetics of Behavioral Traits and Psychiatric Disease in Human Populations.

D.C. Glahn, Ph.D., Department of Psychiatry and Research Imaging Center,
University of Texas Health Science Center at San Antonio

Although at the macro level human behavior is complex, when behaviors are operationalized into discrete units they are often reliably measured. Indeed, the current psychiatric nosology is sufficiently detailed that diagnoses are typically reliable across clinicians and institutions. Using modern diagnostic procedures, most psychiatric illnesses are heritable. However, despite significant heritability, the discovery of genes predisposing these illnesses has been difficult. Although there are many possible reasons for our limited success, one possibility is that while psychiatric diagnoses are reliably measured, they may be biologically heterogeneous. Some researchers have argued that parsing behavior into finer categories may improve chances of gene discovery. To that end, the genetic influences of personality domains associated with psychiatric disorders have been studied. Many of these personality domains have been found to be moderately heritable and, in the case of neuroticism, linked to the genome. Other researchers have argued that rather than focusing on complex behaviors, genetic studies of psychiatric illnesses should focus on phenotypes that are genetically correlated with the disorder in question and may be indicators of processes mediating between genotype and phenotype. Such endophenotypic markers are often quantitative, allowing for powerful analysis strategies (e.g. QTL) not readily available for qualitative phenotypic markers such as diagnostic category. Here, we will discuss the merits of each method and review recent findings of genes that influence behavior.

Sodium homeostasis and ethnic variation in blood pressure: What have we learned?

L.Gleiberman. Dept. of Internal Medicine, University of Michigan.

Dahl (1961) presented the first cross-cultural data for an association between sodium (Na) intake and higher blood pressure (BP). Gleiberman (1973) presented data for 27 populations, showing an association between increasing Na intake and higher blood pressure. She proposed that genetic variants for sodium retention to prevent heat stroke in hot, tropical climates were selected for in Africans. The Intersalt Study (1988) sampled 52 populations and reported similar positive results. Although the work was scientifically rigorous, interpretation of results remains controversial.
In contrast to populations, it was difficult to show a relationship between sodium and BP among individuals. Experimental manipulations of sodium intake altered BP, and revealed a subset of "salt sensitive" individuals but with no consistent racial differences. Frisancho et al (1984) reported that A-A ingested less Na (in contrast to other studies) and less K than whites; however, blacks had higher Na/K ratios. Grim hypothesized that selection for salt sensitivity in Africans occurred dramatically during the transatlantic voyage to America under harsh conditions, but no rigorous evidence was presented. Genetic data pointed more toward A-A having become Na sensitive during early hominid evolution. However, no variants, which differ in frequencies by race/ethnicity have been associated consistently with BP levels. In sum, although we do not fully understand the gene-environmental factors that generate racial differences in hypertension, the accumulated knowledge and the new approaches of genetic epidemiology present excellent opportunities for future research.

Bone fracture patterns and cortical bone loss in an Anatolian Neolithic population.

B. Glencross[1], S.C. Agarwal[1], P.Beauchesne[1], C.S. Larsen[2].
[1]Department of Anthropology, University of California Berkeley, [2] Department of Anthropology, Ohio State University.

The Neolithic is broadly characterized by population aggregation, sedentariness and the adoption of an agricultural lifestyle. During this transitional period, the ready transmission of pathogens through concentrations of people living in close proximity to animals, poor sanitation and nutritional decline due to an increased reliance on a cereal based diet, are thought to have had a significant impact on quality of life, health and bone metabolism in particular. In the context described we would expect to see evidence for these negative influences in key indicators of bone metabolism, bone quantity, quality and fragility.
Here we introduce some preliminary evidence on the relationship between metacarpal cortical bone loss, bone fragility and skeletal fracture in individuals of the Neolithic community of Çatalhöyük, Turkey. Analyses of cortical bone loss patterns in the second metacarpal of adults (n=27) indicate statistically significant age-related change in cortical index (CI) and medullary width as expected based on observations of cortical bone loss in historic and modern populations. When loss of cortical bone is considered in relation to fracture, a pattern of low CI for age is associated with multiple fractures in two young adult individuals. Observations of cortical bone loss are also correlated with preliminary findings on age and sex-related changes seen in trabecular architecture over the life cycle. We conclude that while loss of cortical bone occurs with age, poor bone metabolism resulting from dietary and lifestyle stresses at a young age may also predisposed these individuals to bone fragility and fracture early in life.
Research supported by Stahl Faculty Fund (Archaeological Research Facility, UC Berkeley), Hellman Family Faculty Fund (UC Berkeley) (Agarwal), and by Social Sciences and Humanities Research Council (Glencross).

Activity budget of mona monkey (*Cercopithecus mona*) all-male groups.

M.E. Glenn[1,2], M.A. Ramsier[2,3], K.J. Bensen[2].
[1]Department of Anthropology, Humboldt

State University, [2]Windward Islands Research and Education Foundation, [3]Department of Anthropology, University of California, Santa Cruz.

Commonly, males of the genus *Cercopithecus* are thought to compete for access to females in family groups, with extragroup males remaining solitary and behaving aggressively towards or avoiding one another. On the island of Grenada in the West Indies, however, mona monkey males coexist in small, socially bonded all-male groups. To further understand this atypical social grouping, we review the activity budget of these all-male groups. Data were collected over 41 months between 1992 and 2002. Notably, on average, 23.8% of daily activity is devoted to affiliative behaviors, including grooming, resting in physical contact, tail twining, playing, and sex. All-male group membership shows marked fluidity. Whereas some males remain closely bonded, with pairs averaging 7.7 months together, other males frequently join and leave all-male groups. Attempts to join or interact with existing all-male groups are almost always met nonaggressively, demonstrating the remarkably peaceful nature of all-male group interactions. On average, less than 0.3% of all-male group activity is devoted to intragroup physical aggression. The commonality of mona monkey all-male groups on Grenada, coupled with sightings of all-male groups of forest guenons on mainland Africa, indicate that further evaluation of the behavior of extragroup male guenons is in order.

Musculoskeletal stress markers and their utility in distinguishing between obesity and athleticism.

K. Godde, R. J. Wilson. Department of Anthropology, University of Tennessee, Knoxville.

Robusticity and stress lesions at muscle attachment sites have been found to correlate to body size, and partially to activity levels (Weiss 2004). However, differences between high levels of musculature and obesity have not been examined. According to the National Center for Health Statistics (2007), 66% of US adults between the ages of 20-74 years are either overweight or obese. This large percentage of Americans demonstrates the need to be able to determine body size in skeletal analysis. In order to establish if there are distinct patterns of musculoskeletal stress between obese and athletic individuals, 50 obese (BMI greater than 30), 5 athletic, and 50 "typical" individuals were examined from the University of Tennessee William M. Bass Donated Skeletal collection. Each of the individuals selected for this study has documentation of weight, stature, age, sex and activity levels. Musculoskeletal stress markers were scored on the pectoral girdle, upper arm, pelvic girdle, and upper leg using the scoring methodology and muscle attachment choices of Hawkey (1988) and Hawkey and Merbs (1995) and Weiss (2004). Categorical statistical analyses indicate that there is no difference in the average severity score, but there is a difference in the distribution of robusticity scores. Further, a greater number of stress lesions were noted at specific muscle attachment sites in obese individuals. The information gained from the interpretation of musculoskeletal stress marker patterns can be used in forensic contexts for identification and can contribute to interpretations of lifeways of past populations, especially in relation to activity levels.

The *Hadropithecus* conundrum.

L.R. Godfrey[1], B.E. Crowley[2], K.M. Muldoon[3], S.J. King[4], D.A. Burney[5]. [1]Department of Anthropology, University of Massachusetts-Amherst, [2]Department of Anthropology, University of California-Santa Cruz, [3]Department of Anatomy, Dartmouth Medical School, [4]Department of Anthropology, Stony Brook University, [5]National Tropical Botanical Garden, Kalaheo.

The Archaeolemuridae have been dubbed "monkey lemurs" due to a variety of striking convergences with larger-bodied anthropoids. However, certain anthropoid likenesses have been the focus of radically different interpretations of their trophic adaptations. In particular, on the basis of studies of craniodental architecture and dental microwear (both SEM and low magnification), two distinctly different models have been defended for the largest-bodied archaeolemurid, *Hadropithecus stenognathus*. In 1970, Cliff Jolly proposed a *Theropithecus* model – i.e., that this lemur was a specialized graminivore consuming the leaves and seeds of grasses. More recently, a *Paranthropus* or a peccary model, positing a more generalist and coarser diet with some omnivory, was proposed.
The application of new analytical tools may help to resolve this conundrum. Stable isotope analysis is primary among them, and is particularly useful when a variety of isotopes are simultaneously analyzed. In the case of *Hadropithecus*, heavy carbon isotope values and exceedingly high nitrogen isotope values provide partial support for both models, causing us to rethink the application of analogues that may be too narrow. Additionally, complexity analysis has been shown to capture "homology-free" dietary signals from tooth crown topographic relief. Here we review the power of both methods, and we discuss preliminary insights gained from their application to this giant extinct lemur. We also present additional work, in progress, that promises to shed yet more light on the problem.
Support from NSF-BCS-0129185 (to DAB, LRG, and William L. Jungers), NSF BCS-0237388 (to LRG), NSF BCS-0721233 (to Patricia C. Wright, LRG and Jukka Jernvall) and a Vassar Graduate Fellowship (to BEC).

The Land of the Tired Ox: Ethnogenetic Insights into Rural Central Anatolian Population History

O. Gokcumen[1], T. Gultekin T[2], D. Alakoc[3], A. Tug[3], E. Gulec[2] and T.G. Schurr[1]. [1]University of Pennsylvania, Department of Anthropology; [2]Ankara University, Department of Anthropology; [3]Ankara University Medical School, Department of Forensic Medicine.

To document the regional genetic variation within Central Anatolia and to correlate it to historically and archaeologically known population movements, we conducted ethnographic and genetic research in numerous villages within Central Anatolia. Ethnographically contextualized sampling allowed us to delineate different influences on the population history within rural Central Anatolia localities by correlating regional genetic variation with oral histories, ethnographic observations, and archival information. Such correlations allowed us to assess the paternal and maternal genetic influences of specific population movements and demographic events in Turkey, such as the impact of the Turco-Russian war, the invasion of Turkic speakers, or Caucasian immigration to this region. For example, in one study area in the vicinity of Ankara, we have observed at least four distinct groups based on historical and ethnographic observations. Their self-claimed ancestries trace back to Afsar, Kurdish, Caucasian Cherkess, and Karaman groups. These groups came into the same area from different source regions and at different moments in history. Indeed, our data indicate that there were significant disparities between the paternal and maternal genetic diversity among these groups. These data also allow us to more accurately reconstruct the population history of the study area, as well as begin to provide new perspectives on the regional history of Central Anatolia in relation to historical Turkic invasions and perhaps the Neolithic transition. Finally, we discuss the utility of a more focal and detailed sampling approach for elucidating Anatolian population history.

Different approaches to integration in human skulls: insights from quantitative genetics and studies of artificial deformation.

R. González-José[1], N. Martínez-Abadías[2]. [1] Centro Nacional Patagónico, CONICET, Argentina, [2] Unitat d'Antropologia, University of Barcelona, Spain.

Artificially deformed skulls can be viewed as a "natural experiment" in which particular, recurrent, and localized strains are applied to the skull during early postnatal periods. These plastic changes result in an adult phenotype which strongly departs from the population's average variability. Here we apply a double approach to investigate the effects of artificial deformation on the

inherent patterns of morphological integration in the human skull. Differences in patterns of integration among the neurocranium, basicranium, and face were estimated after the analysis of two different databases. One of them consists of six Amerindian populations including deformed and non-deformed skulls, and presenting three ubiquitous deformatory types: anular, plano-lambdic, and fronto-occipital. The second database consists of a non-deformed series of skulls with genealogical associated data, which enables the estimation of the G matrix of additive genetic variance-covariance among traits. Simulations of response to selection were used to estimate the output of a putative selective event towards classic deformatory types. The "expected" patterns of integration and their putative disruptions were then compared with the "observed" covariances in the Amerindian groups, estimated after a Partial Least Squares analysis. In general terms, the observed integration patterns resemble the expected ones. This suggests that the genetic background implicit in G and the plastic response to strains experienced during post-natal periods follow similar developmental pathways. Finally, both analyses indicate that deformation practices affecting the basicranium results in a stronger disruption of the neurocranium-basal complex observed among other types, supporting previous assertions about the integrative role of the cranial base.

Microarchitectural analysis of juvenile trabecular bone from archaeological context of the Ohio River Valley: Implications for human ontogeny.

J.H. Gosman[1] and R.A. Ketcham[2].
[1]Department of Anthropology, The Ohio State University, [2]Department of Geological Sciences, University of Texas.

The goal of this research was to study trabecular bone microarchitecture during growth and development, producing new quantitative and structural knowledge, demonstrated in a subadult archaeological skeletal sample from the Late Prehistoric Ohio Valley. Relatively little research has been directed towards the structure of and variation in trabecular bone during ontogeny. This project tests hypotheses characterizing the temporal sequence and variation in trabecular bone volume fraction and degree of anisotropy during ontogeny as related to the acquisition of normal functional activities and changing body mass.
The skeletal sample from the Late Prehistoric site of SunWatch Village consisted of 37 subadult and three young adult proximal tibiae. The sample as a whole, as well as four maturity stage-related groups, were analyzed. The analyses consisted of nondestructive microCT scanning of the proximal metaphyseal tibia demonstrating the microarchitectural trabecular structure and quantitative 3-D structural analyses measuring bone volume fraction, degree of anisotropy, trabecular thickness, and trabecular number. Bone volume fraction and degree of anisotropy are highest at birth, decreasing to low values at one year of age, and then gradually increasing to the adult range around six to eight years of age. Trabecular number is highest at birth and lowest at skeletal maturity; trabecular thickness is lowest at birth and highest at skeletal maturity. The results of this study provide quantitative morphological and scan-image data on the ontogenetic patterned changes in human trabecular bone structure from birth to skeletal maturity, highlighting the dynamic sequential relationships between growth/development, general functional activities, and trabecular distribution/architecture.
This research was supported by the National Science Foundation (#0650727 and EAR-0345710).

Ontogenetic variation in the trabecular architecture of the femoral head in *Papio cynocephalus*.

A.D. Gosselin-Ildari[1], R.A. Ketcham[2].
[1]Interdepartmental Program in Anthropological Sciences, Stony Brook University, [2] Department of Geological Sciences, The University of Texas at Austin.

Analysis of trabecular bone architecture is a methodology employed by anthropologists to find functional correlates of joint loads to understand the locomotor patterns of extant and extinct primates. However, there has been limited study on intra-population variation of trabecular bone. Here we assess ontogenetic variation of femoral head trabecular architecture from wild-caught individuals of the Darajani *Papio cynocephalus* population. Higher degrees of anisotropy are expected in individuals with less epiphyseal fusion in order to compensate for the mechanical weakness of the cartilaginous physis. 17 individuals of *P. cynocephalus*, with ages ranging from four to 17 years, were selected from the Bramblett Collection at the University of Texas at Austin and scanned by the authors at the University of Texas High-Resolution X-Ray CT Facility. Sub-epiphyseal and supra-epiphyseal volumes of interest (VOI) were quantified. In all age groups trabecular architecture in the sub-epiphyseal VOI is highly anisotropic with trabecular struts oriented preferentially in superomedial directions. This pattern, which has been observed in several other primate species, is shown in this study to emerge at a young age when no epiphyseal fusion is present. Patterns of trabecular architecture in the supra-epiphyseal VOI are related to epiphyseal fusion. Individuals with an unfused epiphysis exhibit trabeculae oriented preferentially in superoinferior directions while individuals with at least partial fusion show more isotropic patterns. This result suggests that trabecular bone is incurring high levels of inferiorly directed stress in order to protect the physis from shearing and tension during development.

Phenotypic integration in the macaque postcranial skeleton.

M.W. Grabowski, S.A. Williams, C.C. Roseman, J.D. Polk. Department of Anthropology, University of Illinois at Urbana-Champaign.

Relationships between form and function are at the core of the study of adaptation. Principles of phenotypic integration predict that correlations and covariances between morphological characteristics should be structured by their function or developmental origin. In this study we examine the postcranial morphology of *M. fascicularis* to determine if traits identified in previous analyses (e.g., Rodman, 1979) as being functionally significant are integrated. We also test other hypotheses related to development using these same traits. Microscribe digitizers were employed to collect 3-D coordinate data on a total of 86 bony landmarks on the pelvis, humerus, ulna, femur and tibia of 38 individuals. Sets of interlandmark distances were calculated to reflect either functionally relevant characteristics identified in previous work, or less functionally interesting aspects of limb morphology. The data were standardized for sex using a difference of means method, and a correlation matrix was created. Functional and developmental hypothesis matrices were constructed and tested against this matrix using Mantel tests. Both hypotheses matrices were found to be not significantly correlated with the trait correlation matrix ($p = 0.373$ and $p = 0.784$, respectively). These results indicate that suites of functional or developmental characteristics are poor predictors of integration.

Preliminary observations of the effects of ambient temperature on activity budgets of gorillas and siamangs in captivity.

R. Graves, Department of Anthropology, Florida Atlantic University.

It is clear from previous research that ambient temperature affects the activity budgets of apes in the wild and that these effects may be differentially related to body size. While a few published reports document activity budgets of gorillas (*Gorilla gorilla gorilla*) and siamangs (*Hylobates syndactylus*) in the wild, even fewer document it in captivity, and none to date have addressed the effects of ambient temperature and body size on activity budgets of these species in zoos. This study was undertaken to assess the effects of ambient temperature on activity budgets and to determine if the effects vary based on overall body size.
To address this question, gorillas and siamangs were observed under a variety of conditions at three locations; the National Zoo (DC), the Nashville Zoo (TN) and the Miami

Zoological Park (FL). Observations were recorded using focal time sampling techniques and ambient temperatures were recorded at five minute intervals. Results from the three locations were compared to each other and to existing data for wild populations.
Preliminarily results indicate that high ambient temperatures have differential effects on the activity budgets of gorillas and siamangs, the former becoming less active, and the latter more, as temperatures increased. As noted by other researchers, comparisons of wild and zoo primates indicate that zoo conditions significantly affect how both species spend their day. Since primate activity budgets differentially affect fitness in zoos and natural habitats, understanding the effects of ambient temperature on these species may provide invaluable information for future conservation efforts.

Population dynamics of HIV-1 evolution in breast milk and plasma.

R.R. Gray[1,2], M. Salemi[2], G.M. Aldrovandi[3], C.J. Mulligan[1] and M. M. Goodenow[2]. [1]Deparment of Anthropology, University of Florida, [2]Department of Pathology, University of Florida, [3]Children's Hospital Los Angeles.

International guidelines currently advise HIV-1 positive women in resource-poor settings to exclusively breastfeed their infants for several months followed by an abrupt weaning to minimize overall infant mortality, despite the risk of transmitting the virus. These recommendations are based on the results of observational studies, although the benefits of abrupt weaning remain inconclusive. However, no studies have been published to date describing the molecular evolution of the virus in breast milk.
We analyzed HIV-1 gp120 sequences from plasma and breast milk sampled over a two year period from a Zambian individual infected with a subtype C virus. An alignment of non-recombinant sequences spanning the 3' end of the *env* region was analyzed using Bayesian and maximum likelihood phylogenetic methods. At the initial time point corresponding with delivery, three well-supported viral sub-populations were present in the breast milk distinct from the plasma viruses. By the fourth month after delivery, viruses from both tissues appeared as a single panmictic population. Finally, by the twelfth to the twenty-fourth month after delivery, viral sequences from plasma and from breast milk separated again into two well-supported monophyletic clades.
The loss of HIV-1 compartmentalization between breast milk and plasma four months after delivery may be the result of intense viral gene flow between the two tissues. In contrast the re-emergence of distinct populations by month twelve suggests a reduction of gene flow with consequent genetic drift. Understanding the complex population dynamic underlying HIV evolution within these tissues may be essential to uncover the molecular mechanisms responsible for the differential risk of transmission associated with duration and exclusivity of breastfeeding.

Working class diet in Predynastic Egypt: as examined through dental indicators.

T.R.Greene[1], J.D.Irish[2]. [1]Division of Math and Science, Arkansas State University-Beebe, [2]Dept. of Anthropology, University of Alaska-Fairbanks.

Seven dietary indicators on 364 dentitions of working class Predynastic Egyptians from Hierakonpolis and Naqada are examined. The majority of the samples from both sites date to the Naqada II period (3500-3200 BC), during which these were the two main urban centers for Upper Egypt. The samples consist of adults and juveniles ranging from 6 years to over 50 years of age. Dietary indicators, including caries, calculus, abscess, periodontal disease, macrowear, microwear, and hypoplastic enamel defects are used to look for statistically significant differences between working class inhabitants of the two sites as well as sex and age groups within each site. Three questions are addressed. (1) Which of the available flora and fauna were being eaten? While specific food could not be identified individually, cultivated items were being eaten in the form of bread, raw vegetables were consumed by all individuals at Hierakonpolis but mostly women and children at Naqada, and at least some meat and/or fish was consumed at both sites. (2) Were food types found as burial offerings being eaten? Consumption of at least two burial offerings, bread and yellow nutsedge (Hierakonpolis only), are supported by the data. (3) Were the working class inhabitants of Hierakonpolis and Naqada consuming the same diet? While the major portions of the diet appear to be similar, this study found both dietary and behavioral differences between the working class members of these sites.

Application of geometric morphometrics to aid analyses of the 3D joint axis complex: the axis triangle

T.M. Greiner[1] and K.A. Ball[2], [1]Department of Health Professions, University of Wisconsin – La Crosse; [2]Department of Physical Therapy, University of Hartford

The collection of multidimensional movement data is now routine in studies of functional morphology. Yet, these data can be so multifaceted that researchers are frequently unable to take full advantage of the data's correlated complexity. One such example are the orientations and associated movements around the multiple axes of rotation of each joint. Because of this complexity, researchers frequently fall back on preconceived notions of a single "important" joint axis; and thereby disregard two-thirds of the available data. We present a method that avoids this simplification by proportionately taking all the rotation movements of a joint into consideration.
The data that describe the orientation of a joint axis and the motion about it, can be converted into a point (X,Y,Z) in 3D space. Repeating this process for the three potential rotational axes of every joint yields three unique points that describe a triangular shape in 3D space. Using the perspectives of geometric morphometrics to examine these "axis" triangles allows for an analysis of the mutually dependent characteristics of joint axis orientations and motions.
To illustrate this method we make use of data drawn from an experimental observation of tibiotalar joint movements in 23 cadaveric specimens. The analysis compares male to female movement patterns. Conventional approaches would limit analysis of this joint to its plantarflexion-dorsiflexion axis, and would thereby fail to demonstrate significant male-female differences (λ=0.839, P=0.109). An analysis of the associated axis triangles finds that the male and female tibiotalar joint function is significantly different (λ=0.321; P=0.048).

Torture in the Old Kingdom of Egypt? Investigation of frequency and cause of fracture traumas among a population of the Old Kingdom on the Island of Elephantine/Egypt.

J. Gresky[1], N. Roumelis[2], A. Kozak[3], M. Schultz[1]. [1]Department of Anatomy, University of Göttingen, [2] Osteoarchaeological Research Laboratory, University of Stockholm, [3] Department of Anthropology, Ukrainian Academy of Sciences at Kiev.

Up to now, paleopathological investigations on archaeological skeletons dating from the Old Kingdom have revealed only small samples and individuals of the upper class. In this study, a large population of the middle class of the Old Kingdom was carefully examined for the first time. The striking fact that 30% of the inhabitants of Elephantine suffered from bone fractures is worth discussion.
The Elephantine skeletons (n = 405), dating from ca. 2200 BC were examined macroscopically. Up to now, 405 individuals have been examined: 101 subadults and 304 adults. 158 females, 75 males and 71 individuals of unknown sex.
Thirty percent (120/405) of all persons suffered from fractures of at least one part of the skeleton. In the group of the subadults only 8% (8/101) had been injured, in the group of the adults as many as 37% (112/304). Males were affected in 47% (35/75), females in 44% (69/158), individuals of unknown sex in 11% (8/71) of the cases.
Most of the individuals had traumas in more than one part of the body. It is also evident that the fractures in most cases happened at different times.
As Elephantine was a frontier town of Southern Egypt, border disputes will have happened frequently. Exhausting physical work and social conflicts could also have

caused traumas in females and children. Nevertheless, such a high frequency cannot only be explained by these aspects. Possibly, the inhabitants of Elephantine were tortured by physical punishment.

Comparative in vivo forefoot kinematics in extant hominids.

N.L. Griffin[1], K. D'Août[2,3], P. Aerts[2,4], B.G. Richmond[1]
[1] Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University. [2] University of Antwerp, Belgium, [3]Centre for Research and Conservation, Belgium, [4] Ghent University, Belgium.

Previous interpretations of australopith forefoot function have been based on the premise that specific characteristics of hominid metatarsals and phalanges reflect differences in habitual forefoot joint use. While much is known about human forefoot, little data are available regarding great ape forefoot kinematics. The lack of data, as well as disagreement over hominin morphology, has led to a debate over early metatarsophalangeal joint (MTPJ) function in *Australopithecus*.
As part of a larger primate forefoot functional morphology research project, this study compares hominid forefoot kinematics during locomotion. High resolution 2D and 3D video footage was collected in order to measure sagittal MTPJ excursions in adult bonobos (*Pan paniscus*) and habitually shod and unshod humans. It was expected the human forefoot would exhibit a greater degree of dorsiflexion prior to toe-off phase during walking than either quadrupedal or bipedal bonobos.
Preliminary results based on fifty humans and two bonobos reveal that during walking trials, the human first MTPJ dorsiflexes far more than those of quadrupedal bonobos (Watson-Williams test, $p<0.001$). It also appears that the minimal dorsiflexion in the bonobo forefoot is associated with a greater degree of ankle dorsiflexion prior to toe-off than has been measured in humans.
These kinematic results support the hypotheses that key differences in joint function during gait between great apes and humans underlie their differences in MTPJ shape and trabecular bone architecture. Variation in bonobo forefoot posture and the relationship between speed and the degree of MTPJ dorsiflexion will be discussed.
Supported by the L.S.B. Leakey Foundation, Sigma Xi Grant-in-Aid of Research, Lewis Cotlow Research Fund, NSF IGERT 9987590, FWO-Flanders Grant G.0125.05, and BOF-UA.

Manufactured Populations: What Do Contemporary Reference Skeletal Collections Represent?

C.R. Grivas[1], D.A. Komar[1,2]. [1]Dept. of Anthropology, [2]Office of the Medical Investigator, University of New Mexico.

The extent to which archaeological or cemetery skeletal collections accurately represent the population from which they were drawn cannot be known. The creation of contemporary documented or forensic skeletal collections, derived from donation or autopsy, was intended to overcome many of the problems inherent in archaeological populations. Yet, it is misleading to assume such collections represent a specific or defined population. This study addresses this issue by comparing the Documented Skeletal Collection curated in the Maxwell Museum of Anthropology at the University of New Mexico against annual demographic information from three relevant populations: the living population of New Mexico (NM), the deceased of NM, and the subset of decedents who undergo a medicolegal death investigation or autopsy.
Results indicate that the Maxwell Collection differs significantly from all three populations in every variable examined: age, sex, ethnicity/race, cause, and manner of death. Collection development that relies on body donation or retention of unclaimed bodies under Coroner/Medical Examiner statutes results in a biased sample, with a significant overrepresentation of males, the elderly, and those who die unnatural deaths. Equally problematic is the perception that the collection has "documented" race or ethnicity, when in reality only 16% of ethnicity was self-reported, while the affinity of the remaining individuals was determined by pathologists or other observers. Caution is warranted in how researchers use and interpret this and similar collections. While documented collections are ideal for developing methods of estimating age or sex, they are not a proxy for modern or racially/ethnically defined populations.

Finite element modelling of anterior dental loading in modern human and Neanderthal mandibles.

F. Gröning[1,2], P. O'Higgins[1,2]. [1]Functional Morphology and Evolution Unit, Hull York Medical School, [2]Department of Archaeology, University of York.

In Neanderthals, the relatively large and often heavily worn anterior teeth as well as the high prevalence of degenerative changes of the temporomandibular joint have been cited as evidence that Neanderthals used their front teeth regularly as a tool or "third hand". The anterior dental loading hypothesis posits that Neanderthal craniofacial morphology is specifically adapted to such regular heavy anterior dental loads. With traditional anthropological methods, this hypothesis is, however, difficult to test. This study uses finite element (FE) analysis to compare the dissipation of anterior dental loads in Neanderthal and modern human mandibles. FE models were generated based on medical and microCT scans of adult human mandibles and the nearly complete, virtually reconstructed Neanderthal mandible Krapina 59. The final FE models comprised up to 3.5 million cubic elements with bone and periodontal ligament material properties assigned from studies of modern human mandibles. Muscle forces for different anterior biting tasks were taken from the literature. The effects of cortical thickness were evaluated by experiments in which the FE models were manipulated by e.g. making them solid as opposed to anatomically accurate. The results indicate that anterior dental loads induce smaller strains in the Neanderthal mandible than are found in modern humans. However, whether the Neanderthal face is specifically adapted to anterior dental loading remains an open question that requires the synthesis of evolutionary, ontogenetic and functional analyses.
This research is supported by Marie Curie Action 020601 (PALAEO) and the generous efforts of colleagues at the Centre for Medical Engineering Technologies at the University of Hull.

The environment of Early Miocene catarrhines at Kalodirr and Moruorot Hill.

A. Grossman. Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

Early Miocene catarrhine taxa from Lake Turkana differ from those found near Lake Victoria. Habitat reconstructions of Early Miocene catarrhine localities around Lake Victoria (e.g. Songhor, Rusinga Island) indicate that the early catarrhines lived in a number of forest environment. No such analyses are available for Early Miocene catarrhine localities around Lake Turkana. Thus, it is unclear whether catarrhines in each region inhabited similar habitats or different ones.
An analysis using Taxonomic Similarity Indices suggest that the fauna from West Turkana represents a distinct assemblage, different from Early Miocene localities near Lake Victoria. The fauna from Kalodirr and Moruorot Hill shares similarities with Early Miocene sites of northern Africa and Middle Miocene sites near Lake Victoria. Habitat reconstructions of Kalodirr and Moruorot Hill using Ecological Structure analysis suggests that the primates at these sites inhabited drier habitats than those of Early Miocene sites such as Songhor, Napak, or Rusinga Island.
The results of this analysis suggest that the range of habitats inhabited by Early Miocene catarrhines of Africa included at least woodland to tropical forest. The sites in the Lake Turkana region were drier than contemporary localities in either western Kenya or eastern Uganda. Interestingly, a number of taxa found in Middle Miocene localities in western Kenya appear earlier in Kalodirr and Moruorot Hill suggesting faunal movement from north to south during the late Early Miocene and the early Middle Miocene.
This research is supported by a grant from the Leakey foundation.

Oldowan mobility and site formation: modeling the effects of prior deposition.

M.J. Grove. Department of Geography, Royal Holloway, University of London.

Most qualitative models of Oldowan land use postulate the existence of recurrently visited places in the landscape. Many of these are naturally occurring and immovable locations such as lithic and water sources, but others are created by the previous foraging activities of the hominins themselves. The prior deposition of transported lithics in particular has been argued to influence subsequent movements. The current paper employs the analogy of point resources as 'magnets' to develop an electrodynamic model of the foraging process based on Coulomb's law for the forces generated by stationary charges. Mobility rates are calibrated using ethnographic data and allometric relationships between body weight, home range size, population density and day range. Foragers move on a dynamic attraction surface formed initially by the superposition of the attractive forces exerted by various point resources; as the simulation progresses however, cultural deposition alters the surface, with foragers attracted to the presence of potentially re-useable material. This simple attraction mechanism combined with a Poisson regulated probability of cultural deposition generates a surprisingly complex dynamics. As simulations progress, 'favoured places' emerge at locations where paths cross between fixed resources, with such paths becoming entrenched. Large sites increase in size while small sites aggregate or disappear, creating a power-law distribution of material culture densities with an increasing exponent. Generalisation of model results allows the formulation of hypotheses concerning the dynamic processes of mobility underlying the static distributions of archaeological sites; such hypotheses are of particular value in the examination of palimpsest data.
This research is supported by the British Academy Centenary Research Project.

Search for the Elusive Pygmy Tarsier.

N.B. Grow, S. Gursky, J.E. Legan. Department of Anthropology, Texas A&M University.

In 1986 Musser and Dagosto described a new species of Sulawesian tarsier, the pygmy tarsier (*Tarsius pumilus*). Over the last two decades, attempts to locate the pygmy tarsier have been unsuccessful. However, in 2004 two Indonesian scientists accidentally captured one in a rat trap. From June 9-June 29, 2007, I set up a field site at 2120m at the coordinates 01°17'43S, 120°18'24E on Rore Katimbu, a mountain within Lore Lindu National Park. This study sought to find living specimens of the pygmy tarsier in order to determine its current population density and assess its conservation status. Transects were walked nightly at various elevations (1800m, 1900m 2000m, 2100m and 2200m) by a team of 5-8 individuals. In addition, 20 metal no-kill traps baited with dried coconut and one mist net were set up for several days. No pygmy tarsiers were captured in the traps or mistnets. However, vocalizations from this species as well as their scent marks were detected on multiple occasions at multiple elevations. The project was successful in that olfactory and auditory evidence affirm that the pygmy tarsiers still do in fact inhabit the area. These clear signs of inhabitation warrant future attempts to find pygmy tarsiers in the highlands with proper trapping equipment in order to gain valuable behavioral data on this obscure species.
Grant support for this research was provided by Primate Conservation, Inc. and the Department of Anthropology at Texas A&M University.

Fallback foods and primate adaptability: Primates in temperate environments.

C.C. Grueter[1], Z.-F. Xiang[2]. [1]Anthropological Institute, University of Zurich, Switzerland, [2]Central South University of Forestry and Technology, Changsha, China.
Most primate species inhabit tropical areas. Only a few outliers are able to deal with severe environmental factors associated with living in marginal habitats with relatively lower temperature, less rainfall, lower species diversity, higher elevation etc. Primates in temperate biomes experience seasonally pronounced dietary stress. Use of fallback resources is an adaptive strategy that sustains them through periods of overall resource scarcity and permits survival. Different evolutionary lineages have found different solutions to the problem of seasonal bottlenecks in resource availability. Phylogenetic constraints, species-specific anatomy and physiology as well as resource availability at a given locality determine the kind of foods a primate falls back on during the lean season. We review fallback food use strategies in primates in temperate environments and present data from a long-term study on ecological adaptations in snub-nosed monkeys *Rhinopithecus bieti*, one of the "hardiest" primates, at the Samage Forest, a new study site in Northwest Yunnan of China. Lichens (Usneaceae, Parmeliaceae) serve as both staple and fallback foods. Two other highly sought fallback foods in winter are withered fruits and winter buds of deciduous hardwoods. It is assumed that the snub-nosed monkeys' choice of lichens as fallback is based on availability as well as on nutritional and energetic requirements. The snub-nosed monkeys' fallback strategy has an influence on range use and social organization, e.g. the wide temporal and spatial availability of lichens makes ecological costs of grouping negligible and allows the formation of "supergroups", and the easily digestible energy in lichens may allow longer journeys compared to more "typical" leaf monkeys.

Sexual dimorphism in lateral enamel formation in *Cercocebus* and *Papio*: Time vs. rate.

D. Guatelli-Steinberg[1], R.J. Ferrell[2], A. Hubbard[1], S. Schmidt[1], T. Talabere[1]. [1]Department of Anthropology, The Ohio State University, [2]Department of Sociology and Anthropology, Howard University.

Recent studies suggest that canine sexual dimorphism in extant primates results predominantly from sex differences in the period of time over which canines grow (e.g., Schwartz and Dean, 2001). We examined the question of overall time vs. rate of growth in *Cercocebus* and *Papio*, using perikymata (enamel surface growth increments). Assuming similar perikymata periodicities for males and females, we predicted that if the overall time (rather than rate) of growth is responsible for canine sexual dimorphism, then male-female crown height ratios should be equivalent to male-female perikymata count ratios.
Crown height reconstructions were based on Saunders et al., 2007. Perikymata were counted on one mandibular canine crown per individual for 20 *Cercocebus* (13 female, 7 male), and 16 *Papio* (11 female, 5 male) individuals. Crowns with 80% or more of their reconstructed crown heights present were used; perikymata counts were limited to 80% of the reconstructed crown height. To assess possible sex differences in rates of enamel formation, distances between adjacent perikymata were measured.
For *Cercocebus,* the male-female crown height ratio is 1.92, very close to the perikymata count ratio of 1.90. For *Papio*, the male-female crown height ratio is 1.77; the perikymata count ratio is 1.50. Unlike *Cercocebus*, *Papio* showed consistent male vs. female perikymata spacing differences, with males having statistically significantly greater spacing than females in cervical crown regions. The *Cercocebus* data strongly support the crown-formation-time hypothesis. The *Papio* data also lend support to this hypothesis, but suggest an additional role for sex differences in enamel formation rates.
Funding provided by NSF grant BCS-0607520.

A video based study of wild ateline positional behavior.

D.M. Guillot. Department of Anthropology, Boston University.

Video collected at canopy-level heights has rarely been used to evaluate the positional behavior of wild primates. Quantitative analyses using such data collection techniques have the potential to provide important contextual and detailed behavioral information. In particular, transient behaviors that are easily missed by traditional observation techniques from the ground may be examined more closely.
In this study, video data were collected on the unrestricted canopy-level movements of

Alouatta seniculus, Lagothrix poeppigii, and *Ateles belzebuth* during 11 months of observation in the rainforests of Ecuador. In several cases, all three species were filmed using exactly the same branches suggesting that observed differences reflect differing capacities for positional behavior not differences in substrate availability or preference. Video segments were analyzed frame-by-frame in order to develop indices quantifying the relative frequency of hind-limb dominant behaviors as well as forelimb suspensory/hanging behaviors. Statistical comparisons were made using a combination of parametric and non-parametric tests. *Ateles* dynamically incorporated hind-limb dominated behaviors and used their arms overhead with fully flexed shoulders and extended elbows significantly more often. *Lagothrix* and *Alouatta* are more similar to each other in that both species use less hindlimb dominant and forelimb suspensory/hanging behaviors despite the fact that *Lagothrix* is capable of forelimb suspensory locomotion.
Video based studies conducted under naturalistic conditions have the potential to validate, extend and enrich findings from lab-based kinematic studies and to provide information relevant to the understanding of the anatomical correlates of behavior.
This research is supported by a NSF Dissertation Improvement Award (BCS-0452886) and Boston University.

Comparative morphology and functional anatomy of the second metatarsal in extant catarrhines and *Dryopithecus brancoi*.

I. Guimont and D.R. Begun. Department of Anthropology, University of Toronto

Many studies have addressed the relationships between foot morphology and locomotion and have shown that pedal morphology reflects broad locomotor categories among primates. Understanding the link between morphology and function in extant primates is imperative to the interpretation of extinct forms. Although postcranial remains are rare in the fossil record, excavations at Rudabánya, Hungary in the summer 2006 unearthed an isolated left second metatarsal fragment. Since little is known about the functional morphology of the metatarsus in primates, this study aims to fill in the gap. Through univatiate and multivariate morphometric analyses of linear and surface variables, investigations where carried out to test whether metatarsal morphology reflects locomotion in extant catarrhines, and whether the fossil specimen more likely belongs to *Dryopithecus*, the hominid from the locality, or *Anapithecus*, the pliopithecoid. In addition, a comparison of the fossil specimen to extant primates and its classification into one or more locomotor groups were undertaken. Results indicate that the morphology of the second metatarsal reflects broad primate locomotor categories. Metatarsal morphology distinguishes among extant locomotor groups, namely knuckle-walkers, orthograde suspendory apes, brachiators, arboreal quadrupeds, semi-terrestrial quadrupeds and terrestrial quadrupeds. Moreover, the fossil specimen most closely resembles apes, specifically *Hylobates*. These results indicate that based on functional interpretation of metatarsal morphology, this late Miocene metatarsal belongs to a hominoid that was capable of a wide range of behaviors involving mobility and extensive foot grasping.
Supported by NSERC and FQRNT.

Medial sagittal plan of human cranium and virtual reconstitution by mirroring.

G. Guipert, B. Mafart, Antenne de l'Institut de Paléontologie Humaine, UMR 5198, Europole Méditerranéen de l'Arbois, Aix en Provence, France

The sagittal symmetry is used for the virtual reconstitution of fragmented fossils by mirroring. This geometrical method is based on the assumption that all the sagittal landmarks are coplanar. Our purpose was to analyze the spatial variability of these landmarks within the medial sagittal plan for defining the best ones to mirror a cranium.
Material: The sample is constituted by 114 craniums from a French historical population of Notre-Dame-Du-Bourg, Dignes, France.
Method: The spatial relative positions of six sagittal cranium landmarks of types I and II (following the Bookstein classification) were determined using a 3D digitalizer MicroScribe ® (i.e. Prosthion, Nasion, Bregma, Sagittum, Lambda and Opisthocranion). The spatial deviation between each landmark and all the plans formed by three others landmarks was calculated and statistically analyzed by mean Kolmogorov – Smirnov test.
Results: The variation between a landmark and its theoretical position increases significantly as the angle formed by the three points constituting the plan tightens towards 180°. This is accentuated when the distance narrows between these three points. For example, the deviation between the Bregma and the plan formed by Prosthion – Nasion – Lambda and the plan formed by Sagittum – Lambda – Opisthocranion is significantly different ($p = 0{,}005$).
In conclusion, the medial sagittal plan used to symmetrize a fragmented cranium must therefore be defined with the three most distant possible landmarks.

***Ouranopithecus turkae* from the late Miocene of Anatolia: It's Metric and Statistical Implications in Dental Size Variations and Sexual Dimorphism.**

E. Güleç[1], A. Sevim[1], C. Pehelvan[2], İ. Özer[1] and F. Kaya[2], [1]Department of Anthropology, University of Ankara, [2]Department of Anthropology, Univeristy of Yüzüncüyıl

Three different Miocene hominoid clades (*Griphopithecus, Ankarapithecus* and *Ouranopithecus*) are known from Turkey, dated between approximately 16.7 and 8Ma. These clades lived in different geographic regions at various times in Anatolia. Recently announced *Ouranopithecus turkae*, dated from 8.7 to 7.4 Ma, is the youngest and largest among these hominoids. Statistical analyses of canine and postcanine metric values, along with morphological evaluations and comparisons with other East Mediterranean late Miocene hominoids, living great apes, early African hominids and *Australopithecines*, indicate that *O. turkae* has larger postcanine dentition and smaller canines than any other Miocene apes, besides *Gigantopithecus*. It's smaller relative canine to cheek tooth size proportions and shorter-crowned male canines may indicate that *O. turkae* has a tendency in reduction in regard to sexual dimorphism.
We thank the Republic of Turkey and the Turkish Ministry of Culture and Tourism, The Governor of Çankiri and National Science Foundation (including the Revealing Hominid Origins Initiative/HOMINID program, Grant No: 0321893) for financial support..

The function of female copulation calls in wild chimpanzees (*Pan troglodytes schweinfurthii*).

S. Gunter, D.P. Watts. Dept. of Anthropology, Yale University.

Vocalizations emitted during copulation are known in many primate species, but their adaptive significance is poorly understood. As many as 15 hypotheses have been presented to explain the function of copulation calls in primates, including the hypothesis that calls function to promote sperm competition, which could promote fertilization by "high quality" males and/or provide protection against infanticide. We used data on over 5000 copulations taken from 17 female chimpanzees over a six year period at Ngogo, Kibale National Park, Uganda to test relevant hypotheses. Logistic regression was used to consider the effects of male rank, male age class, male party size, rates of male aggression to females and to other male, the presence of other estrus females, and female ovulatory status on a female's likelihood of emitting a copulation call. Our data provide some support for the sperm competition hypothesis as a functional explanation of copulation calls in chimpanzees. However, our analyses show that male aggression toward females, male-male aggression rates and the presence of other estrus females have the greatest influence on a female's likelihood of calling. These results call for the consideration of a new explanation of the presence of female copulation calls, and suggest that female copulation calls may be responses to stress.

Why small fossil samples are such a big problem.

P. Gunz[1], F.L. Bookstein[2,3], G.W. Weber[2], J.J. Hublin[1]. [1]Dept. of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. [2]Dept. of Anthropology, University of Vienna, Austria. [2]Dept. of Statistics, University of Washington, Seattle, USA.

In order to interpret patterns of variability in extinct taxa understanding the covariation of shape and size is essential. However even for fossil groups that are comparably well-sampled like the australopithecine taxa, the number of specimens well preserved enough to assess craniofacial allometry is very small. Our own fossil sample comprises only three adult specimens and one juvenile for *A.africanus* and three adult specimens of *A./P.boisei.* Facial landmarks and semilandmarks were converted to shape coordinates by Procrustes superimposition and then analyzed in Procrustes form-space. Using cross-sectional ontogenetic series of humans (N=106), chimpanzees (N=154) and gorillas (N=55), we tested how a small sample would affect the comparison of growth allometries, by randomly taking small subsamples and calculating the allometric vectors as regressions of shape on log centroid-size. Then we measured the angles between these vectors and the allometric trajectory obtained from the full sample. We show that in form-space the errors in estimating the "true" ontogenetic allometry are quite small, even when using only three adult crania and a single juvenile specimen. To reliably estimate the static allometry from just three adults proved to be impossible however. The standard error of a regression-coefficient depends on the standard-deviation of the predictor (log centroid-size); the inclusion of a single juvenile specimen increases the predictor-variance by a factor of up to 20 (in *Pan paniscus*) so the uncertainty of the slope estimation decreases. It follows that the inclusion of a single juvenile specimen makes some allometric studies of small fossil groups feasible.

Research supported by the Austrian Council for Science and Technology grant GZ 200.093/I-VI/I/2004, Max Planck Society and Marie Curie grant MRTN-CT-2005-019564 'EVAN'.

Botanical medicines for dental health and healing.

R.A. Halberstein, Department of Anthropology, University of Miami.

The use of natural medicines for dental care is an ancient cross-cultural practice that persists in the majority of societies today. Botanical remedies have proven effective in the treatment and management of a variety of oral disorders, partly due to the action of beneficial phytochemicals they contain. The efficacy of herbal products with dental applications was investigated through a survey of the inventories of 91 medicinal plants shops ("*botanicas*") in Miami, Florida and interviews with the proprietors at 10 of those locations. Data on medicinal plant applications for dental problems were also collected from a sample of 290 Caribbean-American residents of Miami who reported the regular use of traditional herbal preparations in addition to any synthetic prescription pharmaceuticals. 32 plant species that are specifically indicated for dental disorders as their primary application were recorded in the *botanicas*. An additional 178 species employed for oral health treatment and maintenance in other populations were identified in the literature. The botanical materials are prepared and applied in several different forms ranging from seed and root tonics to tooth powders and pastes, herbal mouthwashes, teething rings, topical oils, toothbrushes, and toothpicks. Branches and stems are modified to create antiseptic chewing sticks/ sponges. A commercially produced "dental chewing gum" derived from the peelu tree (*Salvadora persica*) is recommended for the prevention of plaque formation. Clove oil (*Eugenia caryophyllus*), applied directly to teeth and gums, is the most frequently dispensed product for oral/dental care. Phytochemical assays of the botanical specimens indicate the presence of bioactive pharmaceutical constituents as claimed, and preparation procedures such as boiling decoctions serve to reduce or neutralize potential toxicity while simultaneously releasing and concentrating the therapeutic chemical components.

Agreement between interspecific variation in vocalization patterns and cranial base morphology in *Alouatta*: preliminary results and future directions.

L.B. Halenar. The City University of New York Graduate Center, New York Consortium in Evolutionary Primatology.

The genus *Alouatta* is one of many primate taxa that includes long calls as part of its vocal repertoire, but they are the only primate to have evolved a pneumatized hyoid bone, argued to act as a resonating chamber during calling bouts. While previous work has recognized intra- and inter-specific differences in hyoid morphology, little analysis has been conducted on the morphology of the basicranial region, to which the hyoid is attached by a chain of cartilaginous or ossified anatomical links. The current study begins to address this gap in our knowledge by using 3D geometric morphometric techniques to examine the basicranial morphology of *Alouatta* and explore morphological variations that may relate to vocalizations. Principal components analysis demonstrates interspecific shape differences mainly in the posterior half of the basicranium, and clear separation of *A. palliata* from the other species. The grouping pattern of the six species in multidimensional space resembles the pattern resulting from acoustical studies which have shown variation in the number, duration, and fundamental frequency of long-calling bouts, suggesting that there may indeed be a close relationship between basicranial morphology and calling behavior. Future studies will include three-dimensional measurement of hyoid shape so as to combine several lines of evidence in developing a better understanding of the functional morphology of *Alouatta* skulls in relation to their vocalizations. The fossil record of extinct alouattins may also contribute to elucidating the evolutionary history of this unusual genus, and the adaptive origins of their unique vocal apparatus.

The Developmental Basis for Morphological Integration

B. Hallgrímsson, J.C. Boughner and H.A. Jamniczky. Department of Cell Biology and Anatomy and the Bone and Joint Institute, University of Calgary.

Integrated variation is produced whenever a process has a non-uniform pattern of effects on the phenotype and when there is variation in that process. Most developmental processes fulfill these criteria. Covariation structure – the observed pattern of covariation– is produced by the combined effects of the variances of all such "covariation-generating" developmental processes. Such processes can be sequential, in which case the covariation structure is produced by their summed effect, or they can overlap in developmental time, in which case they will interact to produce covariation structure. Although dependent on variation in developmental processes, integration occurs even in the absence of genetic variance, because the developmental determinants of integration apply also to environmental, ontogenetic (age-related) and intrinsic (developmental noise and canalization) variation in covariance generating processes as well. Single mutations can produce dramatic alterations in integration or covariance structure simply by altering the variance of a developmental process. Changes to the variances of individual processes can dramatically alter covariance structure even though the nature of such interactions in development remains the same. Patterns of integration, therefore, have complex relationship to underlying developmental modularity. Patterns of integration are nonetheless important as integrated variation is required to maintain function across large ranges of variation in size and shape. Not surprisingly, therefore, covariance structure, despite its developmental lability, tends to be stable in comparisons among species. This view of integration, which we refer to as the Palimpsest model, is tested and illustrated with various examples of past and ongoing work from our lab.

A chimpanzee (*Pan troglodytes*) learns to pick binary oppositions.

A.R. Halloran[1] and D. Broadfield[1,2]. [1]Lion Country Safari's Elgin Center for Conservation and Behavioral Research, [2]Florida Atlantic University, Department of Anthropology.

Halloran et al. 2005, demonstrated that *Pan troglodytes* was able to discern binary oppositions. In this ongoing study, a chimpanzee was given geometric symbols representing presence versus absence oppositions and trained to choose the symbol representing absence at the command "opposite" from a selection of multiple symbols. In order to see if the concept can be generalized and transfered on to more abstract oppositions, the chimpanzee was given other symbols sets she had never seen before. These represented more abstract and complex oppositions such as up versus down (using arrows as a symbol set), open versus closed (using photographs), and male versus female (using photographs). The chimpanzee choose correctly at a rate greater than chance and was deemed proficient at discerning complex oppositions and generalizing the concept of presence versus absence into the concept of binary oppositions.

Metric variation in the genus *Homo*.

K.M. Hamm[1], A.D. Gordon[2], R.C. McCarthy[3], L. Lucas[4], D.S. Strait[1]. [1]Department of Anthropology, University at Albany, [2]Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University, [3]Department of Anthropology, Florida Atlantic University, [4] School of Human Evolution and Social Change, Arizona State University.

The number of species in the genus *Homo* has been a topic of considerable debate. One extreme view states that all *Homo* fossils belong to a single evolving species, *H. sapiens*, which exhibits morphological variation over time and space. The other extreme view is that there are as many as ten species in the genus. This study uses randomization methods to assess the degree of variation present in the genus *Homo* within samples in which the ages of the included fossils were within approximately 30 ky of each other. Test samples corresponding to six time periods were examined: 1) 1.75-1.78 my, 2) 195-225 ky, 3) 165-195 ky, 4) 100-133 ky, 5) 70-100 ky, and 6) 30-60 ky. Fossils in each time period consist of crania that are reasonably well dated and relatively complete morphologically. Using measurements and specimens from the Howells data set, the variation present in each test sample was compared to that in randomized samples derived from a larger reference collection of recent, Mesolithic and Upper Paleolithic anatomically modern humans representing regions from throughout the world. Thus, the time depth and geographic spread in both the test and reference samples is equivalent. Results indicate that variation in several test samples significantly exceeds that in the modern reference sample. Thus, when controlling for time and space, variation in *Homo* during many time periods exceeds that expected for *Homo sapiens*. This finding appears to be inconsistent with the hypothesis that *Homo* is monospecific.

Juvenile-directed aggressive and agonistic interactions in *Alouatta paliatta,* mantled howler monkeys.

K.L. Hanson, Departments of Psychology & Anthropology, University of Alaska Anchorage

Among *Alouatta palliatta*, both male and female juveniles disperse from the natal group prior to reproductive maturity. Aggression directed at younger females by older females in the group has been cited as a possible cause of dispersal in red howlers (*A. seniculus*), though this pattern has not been observed in mantled howlers. Despite low overall levels of reported agonistic social behavior, it was anticipated that such interactions may target juveniles specifically, as a means to encourage dispersal. Three juveniles were observed at Estación Biológica La Suerte in Costa Rica for a total of 23.9 hours. The incidence of agonistic interactions, as well as overall activity budget and incidence of affiliative social interaction, was examined. Four juvenile-directed agonistic interactions were observed in all, and included displacements, chasing, aggressive vocalizations, and one instance of food theft. Though these interactions, which occurred within a single group of howlers, are anecdotal and cannot be generalized to this or other species, the presence of juvenile-directed agonistic behavior may provide an important clue to the factors that facilitate and encourage natal emigration.

Locomotor diversity in the hominin record: fact or fiction?

W.E.H. Harcourt-Smith[1,2] and M. Tallman [2,3,4]. [1] Division of Paleontology, American Museum of Natural History; [2] NYCEP Morphometrics Group; [3] New York Consortium in Evolutionary Primatology; [4] Department of Anthropology, CUNY Graduate Center.

The numerous fossil discoveries of the last two decades have significantly altered the way that we look at the origins and radiation of the hominin clade. It now appears that there was considerably more taxonomic diversity than had previously been accounted for, resulting in a far more "bushy" tree. This diversity has been discussed mostly in the context of craniodental remains, and there has been little consideration of the postcranium. It is entirely possible that such craniodental diversity was matched by some degree of postcranial and associated locomotor diversity.
Here we present data that test the hypothesis that there were a number of different ways in which Plio-Plesitocene hominins were engaging in bipedal behaviours. We provide large datasets of 3D landmark configurations from functionally important joint complexes in both the upper and lower limb. An extensive range of fossils from multiple taxa were studied in the context of large comparative samples of modern humans and extant great apes.
Our results point to several different mosaic patterns of postcranial morphology, both within known species of hominin, and at localities where there are thought to be multiple taxa. We theorize that while it is still likely that bipedalism as a whole was selected for only once in the hominins, it is also likely that there were a number of different ways in which those functional complexes relevant to bipedalism responded to that selection. Such differences in the patterning of these morphologies have potential implications for the phylogenetic relationships of several hominin taxa.
(Supported in part by NSF # 0513660).

Bioarchaeological Approaches in Understanding East Tennessee, Mississippian Diversity: A View from the Fains Island site (40JE1)

M.S. Harle. Department of Anthropology, The University of Tennessee, Knoxville

Fains Island (40JE1), a Late Mississippian, Dallas Phase site, has one of the largest mound-based burial samples (N=338) of all Dallas sites. Material culture and mortuary patterning suggests interesting differences between the Fains Island site and other contemporaneous sites in the East Tennessee region. The analysis presented here uses a population perspective, including aspects of paleopathology, paleodemography (using hazard modeling), and trauma to examine the skeletal series and to compare segments of the population based on age, sex, and rank. Finally, intracemetary phenotypic variation, in the form of nonmetric cranial and dental traits, was examined in order to further explore the site's mortuary structure.
The findings indicate that age was the most important mitigating factor in the distribution of paleopathological lesions, with little gender or rank based differences in stress markers. Paleodemographic and biological distance analysis further point to the uniqueness of the Fains Island's mortuary program. These results when compared with other Dallas Phase sites suggest that based on sociocultural, physiological, and micro-environmental variables, the Fains Island inhabitants are distinct from that of other Dallas Phase communities. This research illustrates how bioarchaeological analysis can be utilized to shed light on the diversity of East Tennessee Mississippian cultural manifestations.

Early hominin greater trochanter shape.

E.H. Harmon, Department of Anthropology, Hunter College, City University of New York.

As the insertion site of the principal hip muscles, the greater trochanter is an important morphological clue to locomotor function. The shape of the greater trochanter varies across taxa, but is similar among African apes in which it is long superoinferiorly and narrow mediolaterally. The short and broad greater trochanter of humans is quite unlike that of African apes. These differences presumably relate to muscle recruitment during different locomotor strategies. This study aims to describe and explain the shape of the early hominin greater trochanter in the context of extant hominoid variation.
Landmarks were recorded from the greater trochanter of *Pan* (n=83), *Gorilla* (n=56), and *Homo sapiens* (n=80), and from the original fossil femora of *Australopithecus afarensis, Paranthropus robustus*, and early *Homo*. Principal components analysis and thin plate spline analysis of the Procrustes transformed landmarks demonstrate that early *Homo* femora are like recent humans, while those of early hominins are most similar to gorillas in greater trochanter shape.
Paranthropus, Australopithecus and African apes have a long and narrow greater trochanter owing to their longer, more linear gluteus minimus and vastus lateralis insertions compared to *Homo*. The insertion of the gluteus maximus is positioned on the posterolateral aspect of the shaft in *Homo*, *Gorilla,* and early hominins unlike the more laterally placed insertion of *Pan*. These findings could reflect the unique structure of the hips in *Paranthropus* and *Australopithecus*, or could be indicative of different approaches to bipedal locomotion in these early taxa compared to *Homo*.

Renewed investigations at the late Miocene hominoid locality of Leilao, Yunnan, China

T. Harrison[1], X. Ji[2], L. Zheng[2]. [1]Department of Anthropology, New York University, [2]Department of Vertebrate Paleontology and Paleoanthropology, Yunnan Institute of Cultural Relics and Archaeology.

Fossil hominoids are known from several late Miocene sites in Yunnan Province, China. One of the most productive of these localities is Leilao in the Yuanmou basin, which has yielded more than 300 hominoid specimens belonging to *Lufengpithecus* and *Yuanmoupithecus*. Hominoids were first reported from Leilao in 1996, and full-scale excavations were carried out in 1999. In December 2006 we initiated renewed paleontological investigations at Leilao with the aim of recovering additional fossil hominoids, as well as obtaining further detailed information on their paleontological, geological, and paleoecological contexts. New excavations were conducted at Dashuqingliangzi near Leilao and at Liujianfang near Leiyi, about 1.5 km northwest of Leilao. Paleomagnetic stratigraphy provides an estimated age of 7.1-8.2 Ma for the hominoid-bearing strata, and this is consistent with faunal correlations. The collection obtained in 2006-07 includes 99 specimens of *Lufengpithecus* and two specimens of *Yuanmoupithecus*. Most are isolated teeth, but two associated mandibular fragments, a maxilla, and several postcranials were also recovered.
The phylogenetic position of *Lufengpithecus* is contentious, but it is probably best interpreted as a primitive pongine. Additionally, *Lufengpithecus* from Leilao exhibits a high degree of variation, which could be interpreted either as intraspecific variation or that more than one species is represented. *Yuanmoupithecus*, originally considered to be closely related to East African proconsulids and dendropithecids, can now be shown to be a stem hylobatid. Future excavations and collections at Leilao will focus on an improved understanding of the phylogenetic relationships, paleobiology, paleoecology and taphonomy of the fossil hominoids.
Funded by the State Heritage Administration of China and the Center for the Study of Human Origins at New York University.

Phylogeny of the southern Plateau.

R.P. Harrod, Department of Anthropology, University of Idaho

The differentiation of populations using metric analysis is a highly contentious methodology. The intent of this project is to determine, using a fairly large sample size, if differences between closely affiliated populations is possible. The study includes previously recorded measurements on 123 crania, 88 right humerus, 84 left humerus, 125 right femur, 124 left femur, 100 right tibia, and 109 left tibia bones from male individuals, as well as 123 crania, 93 right humerus, 94 left humerus, 111 right femur, 121 left femur, 94 right tibia, and 100 left tibia bones from female individuals. The primary osteologists involved in the original analysis were Walter H. Birkby, Thomas M.J. Mulinski, and Donald E. Tyler.
The value of conducting such a study is that it provides a demographic for aboriginal peoples living within the Plateau cultural region. A second, but equally important, outcome of this kind of study is the implications it holds for researchers actively involved with NAGPRA cases in which the individuals lack sufficient provenience to be repatriated. Results of basic comparison indicate there are slight differences detectable among the populations. The most apparent disparities are seen in relation to the size and shape of the lower extremities, however more advanced statistical analysis will reveal if these variations are in fact significant.

The scaling of behaviorally significant gape: gape, fiber length, and skull dimensions in strepsirrhines.

A. Hartstone-Rose[1], and J.M.G. Perry[2]. 1) Department of Biological Anthropology and Anatomy, Duke University, 2) Department of Anatomical Sciences, Stony Brook University

Previously, we showed that one measure of linear gape during feeding, "preferred bite size" (PBS-the maximum food size that an animal consistently ingests whole), scales isometrically or with slight negative allometry with body size in strepsirrhines, and that folivorous taxa ingest smaller pieces of food compared to frugivorous species (Perry and Hartstone-Rose, 2007). We found the same scaling pattern in average masticatory fiber length (FL); taxa that have large PBS also have longer fibers. This led us to hypothesize that longer fibers allow species with high PBS to stretch their jaws to wider angles. To test this we combined PBS data, gathered on 17 strepsirrhine species at the Duke Lemur Center for three food types (melon, carrot, and sweet potato), masticatory muscle FL data gathered from several dozen dissected specimens, and cranial measures of gape. A regression of PBG (gape angle with jaws opened to the PBS at the m1 protoconid) against FL yielded a low r-squared value for all foods ($r^2<0.2$). There is a stronger relationship between PBS for all foods and relative jaw length. It appears that linear gape at PBS is more of a function of jaw length than gape angle. We also explore changes in FL at PBG in relation to muscle vectors, muscle leverages, and kinematic parameters such as maximum gape and the location of the mandibular center of rotation. Variation in FL is probably also influenced by fiber architecture (e.g., pinnation) and the need to generate force during chewing.
We thank the Molly H. Glander Student Research Grant, the Duke Lemur Center and the Department of Biological Anthropology and Anatomy for funding this research.

How reliable are density estimates in diurnal primates?

H. Hassel[1], C. Borries[2], E. Larney[1], M. Umponjan[3], A. Koenig[2]. [1]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University, [2] Department of Anthropology, Stony Brook University, [3]Department of Forest Biology, Kasetsart University, Thailand.

Reliable primate population assessments provide the basis for comparative studies and allow for determining population status and its development over time. The most widely used method is line transect sampling generating data fast and comparatively cheap. In contrast, supposedly the most reliable method is long-term monitoring of known groups, which is both slow and costly. Here we compare group and population density measures for Phayre's leaf monkeys (*Trachypithecus phayrei*) and lar gibbons (*Hylobates lar*) derived from transect walks and known home ranges sizes of the same primate community at Phu Khieo Wildlife Sanctuary, Thailand. A 4-km transect was walked over a period of 30 months 4 times each month (480 km total). Densities were

estimated using (a) the program DISTANCE, or the Kelker method based on (b) animal-to-observer (ATO) or (c) perpendicular distances (PD). These three estimates were compared to values based on known home ranges (gibbons 1 year; leaf monkeys 2.5 years) accounting for home range overlap (95% Kernels) combined with demographic data (gibbons 1 year; leaf monkeys 7 years). This calculation revealed for leaf monkeys 1.1 groups and 20.2 individuals per square kilometer, and for gibbons 2.0 groups and 8.0 individuals. In comparison, line transect data systematically overestimated density for both species although less so for gibbons living in more cohesive groups compared to the leaf monkeys. Estimates based on Kelker using ATO were closest to the values derived from home range data and are to be preferred provided that known home ranges yield the most reliable data.
Supported by Leakey Foundation, National Science Foundation (BCS-0215542), National Geographic CRE, and Stony Brook University.

Genetics of bone-related phenotypes in non-human primates

L.M. Havill, J.A.K. Harris. Dept. of Genetics, Southwest Foundation for Biomedical Research.

Skeletal variation results from a lifetime of interplay between genetic and environmental factors. Understanding the degree to which bone-related phenotypes are the result of genetic effects is essential for accurate interpretations of skeletally derived data that are central to a wide variety of anthropological investigations. Genes may influence a skeletal trait directly, or may mediate or direct environmental effects on the skeleton. Studies of inbred rodents have proven quite successful for generating hypotheses regarding the effects of genes on bone morphology and metabolism, but such studies reveal very little about the degree to which genes affect normal, population-level variation in a non-inbred population. The pedigreed colony of baboons at SNPRC/SFBR provides an opportunity to formally test for and quantify the additive effects of genes on normal variation in skeletal traits important to studies of primate evolution, adaptation, and variation using methods of variance component decomposition. Such studies have led to valuable insights into the degree to which femoral shape, osteonal remodeling dynamics, mechanical properties of vertebral trabecular bone, tooth morphology, and craniofacial traits are heritable (due to the additive effects of genes). Our ability to accurately quantify the degree to which variation in an increasing number of skeletal traits is due to the effects of genes has significant implications for our use of these traits in skeletal analyses. We now face new challenges in incorporating these results into our interpretations of the meaning of skeletal variation at the individual, population, and species levels.

Adaptive evolution of human hearing and the appearance of language.

J. Hawks. Department of Anthropology, University of Wisconsin-Madison.

Language requires not only a detailed anatomical and neurological system of language production, but also a highly adapted system of reception. Considering the frequency and amplitude range of human speech, the necessity of perceiving a large number of distinct speakers, the extended life history of humans, the need for children to learn phonemic distinctions at an early age, and the spatial distances covered by vocal communication in humans compared to other primates, it is likely that humans have distinctive auditory adaptations to language. This study tests the hypothesis of selection on the human auditory system, by interspecific genomic comparisons and genome-wide selection scans in living people. A set of hearing-related human genes shows clear signs of recurrent selected substitutions in humans compared to chimpanzees and macaques. These recurrent substitutions may have occurred at any time during human evolutionary history, but they were repeated with several selected variants for each gene. A smaller set of genes shows signs of significant population differentiation within the past 50,000 years, due to recent strong selection. Further, a relatively large set of hearing-related genes have segregating variants under recent strong selection in one or more human populations. These genes reflect continuing selection on hearing within the last 2000—3000 years. Together, these results suggest that human vocal communication exerted repeated selection pressures on the auditory system, that the system of human language continued to evolve during the Late Pleistocene, and that humans may still be adapting to language.

Using mitochondrial DNA in human population genetic research: A comparison of the information content of the mitochondrial D-loop and the coding region.

M.E. Healy, K. Hunley. Department of Anthropology, University of New Mexico

Despite the availability of abundant autosomal STR data, anthropologists continue to sequence and analyze mitochondrial (mt) DNA due to factors such as a lack of recombination, the relatively low mutation rate and the potential for gaining information about the maternal prehistory of our species. However, the commonly sequenced mt D-loop may be less useful than the mt coding region for looking at the past, as it is unclear how problems such as homoplasy may have affected the inferences made using the D-loop. Using a public database of whole human mtDNA sequences (Ingman & Gyllensten, 2006), we examined the information content of the D-loop in comparison to the coding region of the mt genome at both the sequence and the population level. Median Joining networks and parsimony trees provided similar results concerning the degree and distribution of homoplasy in mtDNA. Our findings indicated greater homoplasy and less internal branch resolution for the D-loop than for the coding region. Homoplastic D-loop sites often appear on both deep and shallow branches of the trees, suggesting that they are the result of mutational hot spots. The D-loop can therefore resolve only the distal branches of the overall mt genome phylogeny. In addition, homoplasy due to mutational hot spots may often lead to underestimation of between-population sequence variation. In contrast, coding region sequences allow construction of relatively unambiguous phylogenies and provide more information about ancient evolutionary events.

Comparing amygdala connectivity between monkeys, apes, and humans using diffusion tensor imaging.

E. Hecht[1], D. Gutman[2], M. Glasser[3], J. Mascaro[3], S. Hamann[4], T.M. Preuss[5,6,7], J.K. Rilling[2,3,5,8]. [1]Neuroscience Program, Graduate Division of Biological and Biomedical Sciences, Emory University, [2]Department of Psychiatry and Behavioral Sciences, Emory University Medical School, [3]Department of Anthropology, Emory University, [4]Department of Psychology, Emory University, [5]Center for Behavioral Neuroscience, Emory University, [6]Division of Neuroscience, Yerkes National Primate Research Center, [7]Department of Pathology, Emory University School of Medicine, [8]Division of Psychobiology, Yerkes National Primate Research Center.

The amygdala is a group of separate but functionally related nuclei involved in perceiving and responding to emotional stimuli. In humans, orbitofrontal input to the amygdala may provide top-down inhibition of emotional reactions. The objective of this study was to investigate possible human specializations for emotion regulation by comparing amygdala connectivity between humans, chimpanzees, bonobos, gorillas and macaques, using diffusion tensor imaging (DTI).
In all subjects, the FSL DTI software package was used to perform probabilistic tractography on white matter connections from the entire amygdala. In human subjects, probabilistic cytoarchitectonic maps (Amunts et al., 2005) were used to identify the laterobasal, centromedial, and superficial groups, and connections from these areas were tracked individually. A human group analysis was then performed to determine the amount of overlap across subjects at different probability threshold values.
The human group analysis revealed voxels with consistently high probability of connectivity with the amygdala, including the stria terminalis, amygdalofugal pathway, and connections to orbitofrontal cortex. The

laterobasal group was found to have strong connections with sensory areas, including cortex of the ventral visual stream, while the centromedial group connected heavily with the brainstem and hypothalamus. Non-human primate tractography results were compared with these human results to reveal both similarities and differences.
DTI probabilistic tractography of amygdala connectivity yielded results consistent with published experimental tract-tracing studies in nonhuman primates, and suggests that comparative DTI studies can be used to identify evolutionary modifications of this system.
Grant Support: Yerkes Base Grant (NIH RR-00165), Center for Behavioral Neuroscience, Emory University Research Committee; James S. McDonnell Foundation grant (JSMF 21002093).

Are the inhabitants of Madaklasht an emigrant Persian population in northern Pakistan?: a dental morphometric investigation.

B.E. Hemphill. Dept. of Sociology and Anthropology, California State University, Bakersfield.

The inhabitants of Madaklasht, an alpine valley in the Northwest Frontier Province of Pakistan, claim to be descendants of Persians who immigrated to this isolated region some 350 years ago. Though surrounded by Khowari speakers, Madaklashters speak Farsi, practice Persian customs, and do not intermarry with neighboring populations. Madaklashters assert their ancestors immigrated from northeastern Afghanistan and Tajikistan, a claim supported by their use of Dari, a distinctive dialect of Farsi still spoken in these same areas.
This investigation tests whether the inhabitants of Madaklasht represent a biologically intrusive population into Pakistan. This investigation is based on measurement of maximum mesiodistal lengths and buccolingual breadths of all permanent teeth, except third molars, and assessment of dental morphology variations scored in accordance with the Arizona State University Dental Morphology System in a sample of 194 Madaklasht school children. These data were contrasted with 17 samples of prehistoric and living individuals from Pakistan, peninsular India, Central Asia, and the Iranian Plateau. Patterns of intersample differences were examined with cluster analysis and principal coordinates analysis**.** Results obtained from odontometric and dental morphology analyses are virtually identical. In both cases, Madaklasters possess no affinities to either living or prehistoric inhabitants of Pakistan and peninsular India. Rather, Madaklasters share closest affinities to prehistoric Central Asians and more distant affinities to prehistoric inhabitants of the Iranian Plateau. Such results support the claim that the inhabitants of Madaklast are in intrusive population into Pakistan whose origins most likely may be found in northeastern Afghanistan and Tajikistan.

A mathematical description of MSM: disease versus stress.

C.Y. Henderson, Department of Archaeology, Durham University, United Kingdom.

Enthesopathies (also called musculoskeletal stress markers, MSM) are widely used by bioarchaeologists as indicators of levels of physical activity. However, their aetiology is multifactorial and one of the key factors in clinical literature is their relationship with disease processes. The aim is to present data which demonstrates the importance of recognizing bone-forming diseases when recording MSM.
Forty-three male skeletons from the medieval site of Fishergate House, York (England) were studied for the presence of enthesopathies; along with the shape and size of the insertions of the *supraspinatus* and *biceps brachii* tendons and of the common extensor origin. Presence of enthesopathy was assessed macroscopically, based on the deviation of the surface morphology from the normal smoothness. The presence of bone-forming disease was determined based on the presence of axial syndesmophytes; a key feature of many of these diseases (*e.g.* ankylosing spondylitis). The size of the entheses was measured using spreading calipers (Henderson and Gallant 2007); while surface roughness was measured using a profile gauge and quantified using roughness parameters commonly used in materials science (*ibid*.).
The data indicate that entheses in individuals who possibly have bone-forming diseases are statistically significantly (Student's t-test at 95% confidence level) larger than those without. Canonical discriminant functions based on the roughness parameters demonstrate that entheses in those with possible bone-forming diseases have a shape that is distinct from those not displaying signs of these diseases.
This research demonstrates the importance of differentiating the causes of enthesopathies and raises questions as to why these differences exist.

An evaluation of *Tarsius* dental eruption.

E. Henderson, S. Frost. Department of Anthropology, University of Oregon.

Dental eruption sequences (DES) describe relative order of appearance of the replacement dentition. Within extant anthropoids results indicate that DES's are stereotyped within hominoids and cercopithecines (relatively late molar eruption), but variable within platyrrhines and colobines (often relatively early molar eruption). Hence, the polarity of anthropoid DES's are not resolved. To evaluate evolution of DES in anthropoids, we document the DES for their closest relative, *Tarsius*. Subadult individuals of *Tarsius* were examined at the Smithsonian Institution following Harvati (2000). Molar eruption is uniquely delayed as P2 erupts immediately after M1 followed by the incisors. The relatively early eruption of P2 may indicate that haplorrhines are delayed in their molar eruption compared to strepsirrhines. *Tarsius* di1-2 and dp2 do not erupt. Deciduous tooth buds do form (which are reabsorbed or shed) confirming that teeth at these loci in adults are permanent. Thus, early eruption of I2 and P2 may result from the lack of a functional deciduous precursor. Therefore, we cannot fully explain this unusual pattern. Schultz's Rule posits relatively early replacement of deciduous dentition in 'slower'- growing animals and *Tarsius bancanus* seems to have a 'slow' life history pattern (Roberts, 1994). However, *Tarsius* is relatively rapid in its behavioral development with hunting skills by 80 days, which could make early deployment of P2 and I2 advantageous. Further, dental use wear patterns highlight the importance of high functioning dentition for prey acquisition in young tarsiers.
Supported by UO travel award to EH.

The truth, the whole truth, and nothing but the truth - so help me Darwin: Legal decisions and evolution in the classroom.

R. B. Hendrix[1], A. D. Sylvester[2]. [1]Patton Boggs, LLP, [2]Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine.

When advocates of creationism and its progeny, "Intelligent Design" (ID), successfully convince a public school board to include ID in the curriculum, the decision is often challenged in court. Perhaps the best example is the recent case from Dover, Pennsylvania, where the public school board voted to require high school science teachers to teach their students about ID. Opponents of the Board's actions brought suit against the school system, successfully arguing that ID is a religious theory, not a scientific one, and, as such, the Board could not require it to be taught without violating the First Amendment's Establishment Clause.
Here we review the findings and briefly explain the holding of the decision in that case, *Kitzmiller v. Dover Area School District*. We then argue that, while it is tempting to breathe a collective sigh of relief, we should temper our celebration. The fact that we are still debating evolution and creationism in the courts evinces a clear failure to both understand and effectively communicate the nature of science, particularly where evolution is concerned. An informed populace with a clear understanding of science and the value of a secular government will not elect school boards such as the one in Dover, obviating the need for (and significant risk of) litigation entirely. Scientists, particularly in education, play a major role in producing an informed populace. The decision by the school board in Dover is just one recent

example of our collective failure to play that role effectively.

Put your back into it: analysis of Schmorl's nodes at Early Bronze Age Bab edh-Dhra'.

S. Henkle[1], L. Major[2], J. Ullinger[3], S.G. Sheridan, Ph.D.[4]. [1] Dept. of Anthropology, Tulane University; [2]Dept. of Anthropology, Dickinson College, [3]Dept. of Anthropology, The Ohio State University, [4]Dept. of Anthropology, University of Notre Dame.

Schmorl's node frequency, location, and severity were analyzed for an Early Bronze Age II/III charnel house at Bab edh-Dhra', Jordan in adult (n=366) and subadult (n=91) lumbar vertebrae. Both age groups were included since the etiological basis for node formation is not always age-related. Due to the disarticulated nature of the collection, sex of the specimens could not be determined. Adults and subadults demonstrated a similar prevalence of affected vertebra (p=0.07) as well as number of nodes per vertebra (p=0.62). There was no significant difference in superior/inferior node location for the adults (p=0.14) or subadults (p=0.68), or when the two groups were compared (p=1.0). The majority of nodes were irregular in shape (63%; p=0.0001). Maximum depth measurements were also collected to determine the severity of node formation. The prevalence rates at Bab edh-Dhra' were compared to other sites, such as Alepotrypa Cave in Greece, Zmajavec in Croatia, and EB IA individuals from Bab edh-Dhra'. There was no significant difference in rate of occurrence with the EB IA Dhra' remains (p=0.24), however there was a highly significant difference found for the other two sites (p=0.0001 for each). The relatively low frequency of nodes may be attributed to the activities and social status of the individuals interred within the charnel house, although the idiopathic nature of Schmorl's nodes presents difficulties in drawing definitive conclusions.
This research was supported by the NSF (SES 0649088).

Y-chromosomal evidence of a pastoralist migration through Tanzania to southern Africa.

B.M. Henn[1], P.A. Underhill[2], A.A. Lin[2], P.J. Oefner[3], S.A. Tishkoff[4], F. Cruciani[5], P. Shen[6], C. Gignoux[1], and J.L. Mountain[1,2]. Departments of [1]Anthropology and [2]Genetics, Stanford University, [3]Institute of Functional Genomics, University of Regensburg, [4]Department of Biology, University of Maryland, [5]Dipartmento di Genetica e Biologia Molecolare, Università "La Sapienza", [6]Stanford Genome Technology Center, Stanford University.

The initial origin and mode of diffusion of pastoralism into southern Africa about 2,000 years ago continues to be debated among anthropologists. Were early instances of sheep, pottery and other traits of the pastoralist package transmitted to southern-central Africa by demic or cultural diffusion? Here we present a novel Y-chromosome specific mutation, E3b1f-M293, which is at high frequencies in pastoralist and hunter-gatherer groups across eastern and southern Africa, and now links the majority of haplotypes of the previously paraphyletic clade E3b1-M35*. Phylogeographic patterns of the E3b1f frequency distribution and associated microsatellite diversity are consistent with an migration through Tanzania to southern-central Africa. Our Y-chromosomal evidence supports a demic diffusion model of pastoralism from eastern to southern Africa, possibly involving a Southern Nilotic-speaking population. The genetic distribution suggests that this dispersal was distinct from the later migration of Bantu-speaking peoples along a similar route. Instead, the expansion time of the E3b1f lineage correlates with archaeological evidence for the arrival of the pastoralist economy in southern Africa about 2,000 years ago.

Age estimation from the human os coxa: a test on a documented Italian collection.

S.M. Hens[1], E. Rastelli[2], M.G. Belcastro[2]. [1]Department of Anthropology, California State University, Sacramento, [2]Department of Experimental Evolutionary Biology, University of Bologna, Italy.

The age at death of an individual is an essential demographic parameter in both forensic and bioarchaeological contexts. Physical anthropologists routinely determine age at death using two pelvic traits: the pubic symphysis and the auricular surface. Standards have been developed using these skeletal features and are based on Americans of European and African ancestry. However, these two morphological traits are population specific and our limited understanding of population variability hampers our ability to apply these techniques to the various skeletal populations around the world, especially in such forensic contexts as the former Yugoslavia and Iraq. However, skeletal samples of known sex and age are rare, limiting our ability to test our techniques. This study tested the pubic symphysis aging method developed by Brooks and Suchey (1990) and the auricular surface method developed by Lovejoy et al. (1985) on a large sample (n=404) of known sex and age from the Frassetto Collection, housed at the University of Bologna, Italy. The results indicate that the correlation of pubic symphysis stage with actual age was 0.64 in males and 0.50 in females, while the correlation of auricular surface stage with actual age was slightly higher at 0.67 for males and 0.55 for females. Additionally, for both methods, bias and inaccuracy demonstrated an increase with age and actual age tended to be underestimated over the age of 40 and drastically so over the age of 60. The auricular surface method performed slightly better, exhibiting slightly lower levels of bias and inaccuracy, especially for males.
The project was funded by a grant to S.M. Hens from the Office of Research and Sponsored Projects, California State University, Sacramento.

Daily life in French colonial Louisiana: combining bioarchaeology of the Moran site (22HR511) and ethnohistory of the French colonial Gulf Coast.

T.D. Hensley. Department of Anthropology and Sociology, Department of History, The University of Southern Mississippi.

In the aftermath of Hurricane Katrina, the salvage excavation of the Moran site (22HR511), an early 18th century cemetery in Biloxi, Mississippi, provided an opportunity to explore the French colonial period on the northern Gulf Coast. Historical records suggest that most immigrants entering the colony were indentured servants, criminals, or other forced exiles. Furthermore, the community was perpetually undersupplied with food and other necessities. Combining the methods and sources of bioarchaeology and ethnohistory, the goal of this study is twofold: 1) to add to the understanding of life in French colonial Louisiana, and 2) to shed light on situations of culture contact. Some 21 individuals have been recovered at the Moran site. The skeletal population is overwhelmingly young-adult and male. Average stature is 165.2 cm and 151.2 cm for males and females, respectively, which is shorter than most other contemporary populations. Linear enamel hypoplasias are present in all individuals, indicating the harsh childhood conditions most likely experienced. The caries and antemortem tooth loss rate of just over two caries per individual is lower than expected for a population reliant on agriculture in North America. Tooth wear is slight which suggests a diet of processed foods but also likely reflects the young age-at-death for most. Infection rates are surprisingly low. While these findings could point to a healthy population, it is likely that food and disease conditions in the colony were so poor that most individuals buried in the Moran cemetery perished before their skeletal systems could be affected.

The Plash Island Burials: the bioarchaeology of a prehistoric gulf coast community.

N.P. Herrmann[1], M.K. Spradley[2], R.J. Wilson[1], and S. Price[3]. [1]Department of Anthropology, University of Tennessee, [2]Department of Anthropology, University of West Florida, [3]Center for Archaeological Studies, University of South Alabama.

During mitigation efforts at the Plash Island site (1BA134) in Baldwin County, Alabama, numerous Native American burials were

encountered. The burial sample consists of individual internments, isolated crania and a multiple-use burial facility. The burials represent one of the largest prehistoric skeletal samples recovered from the Alabama coast (n=36). In addition, over 1700 isolated loose bones were recorded and documented during excavations.
The site represents an intermittent multicomponent occupation extending from the Woodland to Mississippian period. A majority of the burials date to the Woodland period and were located in the multiple-use burial area (n=26). The remaining burials date to the Mississippian period and were recovered from discrete contexts. The collection offers unique insight into Gulf coast adaptation by these prehistoric peoples. This presentation summarizes the mortuary and osteological data collected during field excavation and analysis. In addition, we compare the Plash Island community to other prehistoric and contact period Native American populations from the Gulf coast.

Were Neanderthals tongue-tied?

M. Hess, R. McCarthy. Department of Anthropology, Florida Atlantic University.

In contrast to chimpanzees and other non-human primates, humans have long, descended, circular tongues. Along with other components of our vocal tract, this long tongue allows us to produce maximally efficient, intelligible speech. Here, we use estimates of tongue length and shape in fossil humans to assess whether they possessed tongues tied to their oral cavities, as do other primates, or long descended tongues like those of modern humans.
We used several methods to reconstruct tongue length in Neanderthals and other early humans. First, we used independent contrasts analysis to estimate tongue lengths from body mass. Second, we used head and neck dimensions to assess limits on tongue length and vocal tract proportions. Third, we calculated tongue lengths and proportions for vocal tracts fit with differently-shaped tongues. For each tongue length reconstruction, we calculated vocal tract proportions by dividing the length of the horizontal tube (measured from the basicranium) by an estimate of the length of the tongue's pharyngeal component.
In Neanderthals, length of the face is such that a tongue tied to the oral cavity must have been very long, whereas a tongue with modern human proportions would have had a pharyngeal component in excess of the length of a Neanderthal's neck. These results suggest that Neanderthals did not have the ability to produce quantally-based spoken language, leading us to conjecture that the answer to the question posed in the title must have been "yes."
This research was supported in part by funds from a Leakey Foundation General Research Grant to R.M.

Modern human limb proportions follow Allen's rule predictions and reflect long term climate adaptations rather than short term epigenetic influences.

R.W. Higgins. Dept. Anthropology, George Washington University.

Distal limb segment length, relative to proximal limb segment length, is found to correlate with climate in modern human populations. The question remains whether this trait is determined by adaptation or epigenetic influences. Experiments on lab animals support the hypothesis that cold temperature influences limb development by reducing growth plate kinetics and/or vascular supply. Reduction in vascular supply would theoretically have a more pronounced effect on the smaller distal limb segments. This study uses a natural experiment, the migration of two modern human populations to North America, to examine the role of natural selection on human limb proportions. The hypotheses to be tested are: (1) If relative distal limb length is largely an inherited trait shaped over long periods of time by natural selection, then the trait should persist several generations after a population enters a new climate and (2) if limb proportions are largely a product of epigenetic influences, then limb proportions should not differ between populations living in the same environment. European American and African American long bones from the Terry Collection were measured (N = 80). Statistical analysis shows that (1) distal segments differed more between populations than did proximal segments with European Americans exhibiting relatively shorter distal segments, and (2) crural ($p < .01$) and brachial ($p < .01$) indices differed significantly between the two populations. These results suggest that European and African American limb proportions largely reflect ancestral climate adaptations rather than epigenetic influences.

Gait selection in Japanese macaques while moving along a horizontal ladder.

Y. Higurashi, E. Hirasaki, H. Kumakura. Department of Human Sciences, Osaka University.

In a primate species, gait transition can be addressed using a horizontal ladder with movable crosspieces. This artificial substrate forces animals to cross gaps, which simulates the arboreal environment. This study had two purposes: to see if primates alter the type of gait according to gap width, and to understand the relative advantages of each gait pattern observed. Two Japanese macaques were videotaped while traversing the ladder: a 4.8-kg male and a 4.3-kg female. The crosspieces were spaced evenly, and the gap width was varied between 30 and 80 cm at 5-cm intervals. Approximately 800 strides were analyzed to obtain kinematic data, such as the footfall pattern, duty factor, and diagonality.
One macaque trotted on the ladder when the gaps were narrowest and changed to a diagonal-sequence, diagonal-couplets (DSDC) gait at greater gap widths. When the gap was set even wider, the macaque moved with a lateral-sequence, diagonal-couplets (LSDC) gait. Finally, a novel type of gait was used, in which simultaneous touchdown of both forelimbs was followed by alternate touchdowns of one hindlimb. The other macaque predominantly used the DSDC gait to cross narrower gaps and the novel gait to cross broader ones. In certain settings, trotting and the LSDC gait would be more stable than the DSDC gait, although they are not requisite for ladder locomotion. The relationship between the transition to the novel gait and the emergence of a whole-body aerial phase can be considered.
Supported by JSPS Grant-in Aid (#17570194).

Estimation of sex and ancestry from the foramen magnum.

B.M. Hileman, J.E. Little. Youngstown State University.

When all that remains for a biological profile are single bones or fragments of bones, identification of the individual is extremely difficult. This study examined the usefulness of the foramen magnum as a supportive element in the identification of sex and ancestry of fragmented skeletal remains. We measured 510 skulls from the Hamman-Todd Collection at the Cleveland Museum of Natural History (128 European-American males, 150 African-American males, 112 European-American females, 120 African-American females). The maximum breadth and maximum length of the foramen magnum were measured. The area was calculated from those measurements. Descriptive statistics, t-test, and X^2 were analyzed using the SPSS statistical program and a linear discriminant function was created. The total mean for the maximum length was 35.63 ± 2.54, maximum breadth was 29.38 ± 2.51, and area was 834.00 ± 112.25. Analyses were then conducted separated by sex, ancestry, and sex/ancestry. Each measurement was significant ($p<0.001$) when analyzed by sex and sex/ancestry. Ancestry was significantly associated with the maximum breadth and area ($p<0.001$). Preliminary results testing a linear discriminant function, using 200 individuals, showed 61.9% of the individuals could be correctly classified. Although the foramen magnum alone may not be a good indicator of sex and ancestry, it could be useful as a supportive method. Additional testing of a linear discriminant function and the development of non-metric analysis would be beneficial to this study.

The development of temporal bone pneumatization in humans.

C.A. Hill. Department of Anthropology, Pennsylvania State University.

Clinical studies document developmental change in surface areas and volumes of temporal bone pneumatization. Details of developmental changes in these regions are unknown, especially in response to biomechanical influences. Knowledge of development of pneumatization in one species will augment use of this feature as a character in phylogenetic analyses. This study is part of a larger investigation of evolutionary and developmental change in temporal bone pneumatization in the hominid lineage.
High-resolution CT scans were acquired from the temporal bones of juvenile humans (N=19). Using Amira© surface areas and volumes of pneumatized spaces were collected from the entire temporal bone. Volumes of interest were cropped from the temporal bone using Quant3D software and analyzed for bone volume fractions, trabecular thickness and anisotropy. Individuals were divided into four age groups: 0-2 years; 2-4 years; 4-8 years; and 9-18 years for statistical analyses. Morphological changes in pneumatized bone are region-specific. Bone volume fractions decrease in the petrous portion and mastoid center, but increase in the mastoid antrum. Trabecular thickness increases with age in the antrum and petrous portions, but experiences no significant ontogenetic change in the center of the mastoid. Measures of anisotropy decrease with age in the petrous portion and the mastoid antrum, but remain stable in the center of the mastoid. These results indicate that the quantitative morphology of pneumatized spaces in the temporal bone change over the human lifespan. Whether the changes are due to biomechanical or developmental influences, ontogenetic dynamics should be considered in the analysis of specimens.
This project was supported in part by NSF (BCS-052493), the Leakey Foundation, Pennsylvania State University (Hill Foundation and Baker Fund) and PHS R01 DE016886.

Do children get fatter the longer their mothers are living in the U.S? Migration and nutritional status among Puerto Rican children

D.A. Himmelgreen[1], R. Pérez-Escamilla[2], E. Amador[1], E. Danforth, E. Ruiz[1]. [1]Department of Anthropology, University of South Florida, [2]Department of Nutritional Sciences, University of Connecticut.

In a previous study, Himmelgreen et al. (2004) showed that length of time in the U.S. was associated with a statistically significant increase in BMI for a sample of low-income Puerto Rican women (N=174) from Hartford, Connecticut. Further, Puerto Rican born women that were bilingual Spanish and English speakers had higher BMIs than those who were mono-lingual Spanish speakers. In this paper, migration factors and anthropometric nutritional indicators are examined for 161 children (33 to 59 months) of the women in this study. Nearly 33% of these children were categorized as overweight (BMI-for-age ≥ 95th percentile) and 22% had low height-for-age (< 5th percentile). There were no statistically significant differences in anthropometry when comparing males and females. Child BMI levels were negatively correlated maternal education, birth place of the mother (i.e., rural , peri-urban, urban), and food insecurity. There were marginally significant positive correlations between child BMI levels and the age of the mother when she first came to the U.S. and the number of generations that the family had resided in the U.S. Additional analyses are presented on proxy measures of acculturation and maternal characteristics as predictors of child nutritional status.

Dynamics of foot use during bipedal and quadrupedal locomotion in Japanese macaques.

Hirasaki, E., Higurashi, Y., Kumakura, H. Grad. Sch. of Human Sciences, Osaka University, Japan.

Previously, we compared the distribution of foot pressure during bipedal locomotion in bipedally trained Japanese macaques and ordinary macaques (Hirasaki *et al*., 2005). In this study, we focused on the differences in foot pressure distribution between quadrupedal and bipedal locomotion in ordinary Japanese macaques. The subjects (an adult male and a female) walked on a level walkway in our laboratory at their preferred walking velocities. The dynamic plantar pressures were recorded using a pressure mat (Nitta, Japan) at 120 Hz with a resolution of 5 mm. Two digital video cameras were set perpendicular to the walkway to record the lateral view of the subjects' motion. This revealed that during quadrupedal walking, the center of pressure (COP) started at the tarsal part of the foot and essentially moved straightforward. By contrast, during bipedal walking, the initial contact was made by the lateral mid-foot. The COP traveled backward to the tarsal part, then progressed anteriorly, and finally was transferred medially across the metatarsal heads in late stance phase. This medial transfer resembled the human COP trajectory, suggesting that this pattern is closely related to bipedal walking. Another difference was found in use of the hallux. During quadrupedal walking, the hallux contributed in early-to-mid stance phase, whereas the peak pressure of the first toe was observed in late stance phase during bipedal walking. Again, this is similar to the human foot motions, in which the big toe plays an important role in the late stance phase. Supported by JSPS 14704005 (for EH).

Quantitative genetics, pleiotropy, and morphological integration in the primate dentition

L.J. Hlusko[1], M.C. Mahaney[2]. [1]Dept. of Integrative Biology, University of California, Berkeley, [2]Dept. of Genetics, Southwest Foundation for Biomedical Research.

Fifty years ago, Olson and Miller formalized the concept of morphological integration (1958): i.e., that structures within anatomical regions may be developmentally and/or functionally interrelated, and that these non-independent regions will respond to selection in a coordinated fashion during evolution. While the evolutionary implications of this concept have been intuitively obvious from the outset, its formal application to the analysis and interpretation of paleontological data has not been facile. A primary problem is the determination of the extent to which correlated complexes of traits are actually due to common genetic effects (pleiotropy). Quantitative genetics approaches for detecting and quantifying the contribution of pleiotropy to variation in multiple traits provide one means of addressing this problem.
Here, we present an overview of our quantitative genetic analysis of dental variation in a captive, pedigreed breeding colony of baboons (*Papio hamadryas*) housed at the Southwest National Primate Research Center. We have analyzed over 200 dental traits in order to identify genetic interrelatedness and independence in the baboon dentition. We find that shape variables, such as cusp orientation and the presence of ancillary cusps, tend to be genetically independent of size. Genetic influences on size variation are not uniform across the dental arcade, but show distinct patterns within and across the various tooth categories. These results provide insight to the genetic basis of morphological integration in the baboon dentition, and provide hypotheses to test as we explore the genetic architecture of other primates.

Phylogenetic relationship of the Platyrrhini inferred from complete mitochondrial genome sequences.

J.A. Hodgson[1,2], K.N. Sterner[1,2], L.J. Matthews[1,2], R. Jani[1], C.B. Stewart[3], T.R. Disotell[1,2]. [1]Center for the Study of Human Origins, Dept. of Anthropology, New York University, [2]New York Consortium in Evolutionary Primatology, [3]Dept. of Biological Sciences, University of Albany, SUNY.

Family-level phylogenetic relationships of the Platyrrhini remain contentious. In contrast to many morphological studies, recent studies utilizing autosomal DNA sequence and *Alu* insertion events have hypothesized an early divergence of the Pitheciidae and a more recent separation of the Cebidae and Atelidae. Here we test this hypothesis using complete mitochondrial genome sequences. We sequenced a complete mitochondrial genome from a single representative of *Saguinus*, *Saimiri*, *Aotus*, *Callicebus* and *Ateles* and aligned them with a *Cebus* mitochondrial genome mined from GenBank. We used long-range PCR to amplify the mitochondrial genomes in two overlapping segments. This method maximizes the chance of obtaining true mitochondrial

sequence rather than pseudogenes or numts in two ways. First, the amplicon length employed exceeds that of most numts. Second, sequencing the large overlaps on the flanks of both amplicons assures the recovery of a circular genome.
Phylogenetic analyses of the mitochondrial genomes reveal broad agreement with the phylogenies recovered in studies using sex and autosomal chromosomal sequences as well as *Alu* insertion markers. Cebidae was found to be monophyletic and sister to Atelidae. The Pitheciidae were found to have diverged earliest amongst Platyrrhini. The increasing congruence of the molecular data suggests that we are converging on the true population history. (Supported by NIH R24-GM65580).

Patterns underlying Retzius period variation in primates and mammals.

R.T. Hogg. Dept. of Anthropology, City University of New York, New York Consortium for Evolutionary Primatology, Hard Tissue Research Unit.

Brain mass and body mass have been increasingly credited as influences on life history in primates, and the brain's importance in regulating biological rhythms has also gained steady appreciation due to research on the physiology of circadian cycles. Nevertheless, possible connections between these two factors have largely gone unanalyzed, especially in studies of longer-term biorhythms such as Retzius periodicity in tooth enamel formation. The physiology behind and the variability within the formation of striae of Retzius by ameloblasts (as well as the secretion their of dentine counterparts) has been a mysterious, speculative "black box," based on limited pertinent data. This study attempts to redress this problem by cataloguing Retzius variation across the primates to determine if this variation is tied in some way to the two factors mentioned above. Periodicities were assessed from the sum of cross-striations between adjacent Retzius lines on nineteen species of platyrrhine and were regressed against body and brain mass estimates from the literature for each species. Retzius and mass data for twenty-nine other primate species (catarrhine and strepsirhine) taken from the literature were combined with the platyrrhine data to allow a broader primate perspective. Standard correlation tests show that Retzius periodicity does have a linear relationship with body mass in the primates, but is much more closely correlated with brain mass. Thus, Retzius period may be a function of metabolic rates, and there may be a close linkage between metabolic rate and non-circadian biorhythms for mammals in general.

Similarity of dental microwear between late Neolithic (Jomon) and Yayoi age following Jomon in the west seacoast of Kyushu-Japan

T. Hojo, University of. Sangyoidai, Dept. of Anatomy and Anthropology, Yahatanisi Mitusada 3-19-5, Kitakyushu City 807-0805 JAPAN

SEM (Scanning Electron Microscope) micrographs of dental microwear of the canines and the premolars of late Neolithic (Jomon) and Yayoi age following Jomon in the west seacoast of Kyushu-Japan were taken at x500 from their high-resolution casts (Hojo, 1989, 2005; Teaford, 1988, 1994). The results of Jomon investigated by Microwear Image Analyzing Software (Ungar, 1996) were as follows (in microns): Canine 1: the striations: n = 43, the mean length = 60.1, the mean breadth = 3.7; the pits: n = 23, the mean length = 18.6, the mean width = 7.8; and Canine 2: the striations: n = 28, the mean length = 52.2, the mean breadth = 3.2; the pits: n = 3, the mean length = 33.4, the mean width = 13.9. The mean breadth of the striation of Yayoi age was more than 3 microns. The striations of dental microwear of Jomon showed almost the same breadth as those of Yayoi age, and about twice as broad as that of early modern Japanese (Hojo, 2007). Jomon skeletons were buried in the pits with many seashells, and bones of boars and deer. Their food might contain these animals, and hard dried sardines. Yayoi skeletons were buried in big red clay potteries. Dental microwear patterns of Yayoi showed similarity to those of Jomon, and may highlight the similarity of food between both ages.

Developmental integration in the primate sphenoid and ethmomaxillary complex.

M.A. Holmes[1], R.C. McCarthy[1], M.P. Mooney[2], M.I. Siegel[2]. [1]Department of Anthropology, Florida Atlantic University, [2]Department of Anthropology, University of Pittsburgh.

The sphenoid bone occupies a central location in the cranium, forming the keystone around which several other bones attach. While previous research suggests that the sphenoid influences craniofacial configuration in primates including humans, little is known about developmental integration in this region. Since facial growth continues long after the sphenoid is finished growing, any integration between the sphenoid and face must be established early. Therefore we hypothesize that covariation between the sphenoid and face is stronger early during ontogeny than later, and that humans and non-human primates exhibit different patterns of covariation.
To test these hypotheses, we collected 2-D landmark coordinate data from mixed longitudinal radiographs of 40 modern *Homo sapiens* and 11 rhesus macaques (*Macaca mulatta*). Growth patterns for linear dimensions of the sphenoid and face were assessed using percent growth curves, and for shape change using comparisons of Procrustes distances between successive age intervals. "Two-block" partial least squares (PLS) analyses were used to test for covariation between the sphenoid and midface throughout ontogeny.
Surprisingly, shape of the sphenoid continues to change well after it is finished growing, suggesting that continuous remodeling may be necessary to tie the sphenoid to the basioccipital and face. PLS results indicate different levels of covariation throughout ontogeny in humans and macaques, which may be related to changes in developmental timing that affect spatial relationships in the cranium. These different patterns of developmental integration have important implications for the evolution of modern human craniofacial form.
This research was supported by a Morrow Thesis Research Award from the Department of Anthropology at Florida Atlantic University.

Effects of sexual selection and sperm competition on transcriptional regulation of seminal proteins in hominoids.

K.A. Hooper-Boyd, M.I. Jensen-Seaman. Department of Biological Sciences, Duquesne University.

Hominoids vary widely in their mating systems. Presumed levels of sperm competition vary accordingly, with little sperm competition expected in the monogamous gibbons and polygynous gorillas, and high sperm competition in chimpanzees and bonobos. These differences are reflected in several anatomical and physiological adaptations. Several seminal protein genes show evidence of rapid adaptive evolution of their coding sequence in chimpanzees, and relaxed selection in gorillas and gibbons, consistent with their evolution being driven by sexual selection—specifically sperm competition. However, little is known about the differences among species in the regulation of male reproductive genes and whether selection is acting predominantly on the coding sequence, or on regulatory elements.
We sequenced the putative promoter regions (~3kb) of semenogelins 1 and 2 (*SEMG1*, *SEMG2*), prostatic acid phosphatase (*ACPP*), and prostate-specific transglutaminase (*TGM4*) in human, chimpanzee, bonobo, gorilla, orangutan, gibbon, and macaque. We analyzed these sequences to predict shared, as well as species-specific, transcription factor binding sites.
We cloned the promoters of *ACPP* and *TGM4* from the above species into luciferase reporter vectors and transiently transfected them into a human prostate cancer cell line, to measure in vitro expression levels. Hominoid species were found to differ in their basal transcription levels. These results are interpreted and discussed in light of the evolution of hominoid mating systems and varying strengths of sperm competition, as well as under the hypothesis that most

significant phenotypic adaptation in humans is a result of regulatory evolution.

Pay the boatman: green stained teeth and jaws in medieval and post-medieval Spanish skeletons.

K. A. Hopkinson, S. M. Yeats, J. Shearer, G.R. Scott. Departments of Anthropology and Chemistry, University of Nevada Reno.

While observing dental characteristics in Spanish and Basque skeletons from the Cathedral of Santa Maria in Vitoria, Spain, an unusual pattern of staining was evident in 19 of 219 individuals. The stain, which permeated bone, dentine, calculus, and/or enamel, varied in color from bright green to turquoise. Males and females, all age categories, and medieval and post-medieval skeletons were equally affected.
The green stain was the result of an ancient practice going back to at least Greek times that involved placing a bronze coin (obol) in the mouth of the deceased prior to burial for the purpose of paying the boatman (Charon) for passage across the river of woe (Acheron). Somehow this seemingly 'pagan' ritual was preserved long after Christianity spread throughout Spain.
There are two possible chemical causes for the green stain. Explanations begin with the premise that the copper component (Cu^0) in the bronze coins reacts with H+ ions created by the acidic environment resulting from normal body decomposition, leading to the formation of Cu^{2+}. Cu^{2+} then reacts with water and carbon dioxide to create basic copper carbonate, commonly known as patina. The basic copper carbonate, in an aqueous instead of solid form, may have seeped into the spaces in the bone and teeth. Alternatively, the copper may have replaced the calcium in the bone and teeth, turning the mineral portion of bone, hydroxyapatite, into pseudomalachite.

Living with the dead: burial patterns at the site of Kenan Tepe, Turkey.

D.E. Hopwood. Dept. of Anthropology, Binghamton University (SUNY)

The site of Kenan Tepe is located in the Diyarbakir province of southeastern Turkey. Members of the Upper Tigris Archaeological Research Project (UTARP) have been conducting excavations at the site since 2000. This work has revealed that Kenan Tepe is a multi-period mound with occupation phases ranging from the Late Ubaid period, to the Early Iron Age. UTARP team members have uncovered several burials throughout the site, seventeen of which were analysed during the 2006 season. These burials came from three separate occupation phases: the Late Ubaid period (circa 4600 BCE), Phase 5 of the Late Chalcolithic period (3360-3020 BCE), and the transition between the Late Chalcolithic period and the Early Bronze Age. The span of this temporal sequence provides an opportunity to examine and understand how the practice of burial changed over time at Kenan Tepe. Further, it is possible to examine how members of the Kenan Tepe community negotiated their relationship with the dead by taking a close look at the changing burial patterns. By shifting the placement of the dead within the site the inhabitants of Kenan Tepe would have altered the perception of their own social geography and how they defined their own social world. During the time of occupation at Kenan Tepe at least three different methods of interment were practiced. Further, changing burial patterns indicate a shift from a close personal relationship with the dead towards a more distant, less intimate one.

What to do with something new. Food presentation affects food sharing in owl monkeys.

R.M. Hores[1,2], C.K. Wolovich[2,3], S. Evans[2]. [1]Department of Anthropology, Southern Illinois University, [2]DuMond Conservancy for Primates and Tropical Forests, [3]Biology Department, Bucknell University.

Owl monkeys (*Aotus* spp.) are nocturnal Neotropical primates that reside in socially monogamous family groups, consisting of an adult pair and its dependent offspring. These groups are marked by high levels of paternal care. We tested whether males and females responded differently to potentially 'risky' feeding situations. We examined behavioral responses to food presentation in nine social groups of captive *Aotus*. There were three experimental conditions: control, ground treatment, and a novel opaque container. We examined the latency to approach the food and latency to begin eating food during each trial. We also recorded all social interactions involving food. For all statistical comparisons, we used Wilcoxon's Matched Pairs Signed Ranks tests with a significance level of $p \leq 0.05$. We found no significant sex differences in response to the novel feeding conditions. However, the latencies to approach and the latencies to begin eating during the opaque container treatment were significantly longer than during the control for both males and females. Additionally, the latency for females to approach and to begin eating was longer when food was presented near the ground than when it was presented in its normal location. There were more social interactions involving food and more begs when food was presented near the ground than when it was presented in its normal location. Because owl monkeys are arboreal and typically do not go to the ground to forage, these data may offer insight into their motivation to share food during potentially 'risky' situations.

Mid-palatal suture complexity in African papionins.

J.L. Hotzman. Department of Anthropology, University of Florida.

Current investigations support the idea that sutural complexity reflects the mechanical environment. The rationale is that higher loads produce more complex sutures. Stress in the palate is primarily generated by mastication; however, there is a paucity of research concerning the nature and magnitude of palatal stress. This study examines midpalatal suture complexity of African papionins using fractal analysis as a means of quantifying complexity. The goal is to explore whether or not midpalatal suture complexity yields information concerning the mechanical environment of the palate that can be potentially linked to dietary and feeding differences.
Five species were chosen (*Cercocebus agilis* (n=15), *Lophocebus albigena* (n=19), *Cercocebus torquatus* (n=9), *Papio anubis* (n=12), and *Mandrillus sphinx* (n=8)) based on known dietary, feeding, and morphological differences. The mid-palatal sutures of each specimen were photographed and then digitized. Sutures were quantified using fractal analysis because recent investigations suggest this is one method for quantifying sutural complexity.
Analysis of variance indicates no significant difference among the fractal dimensions of the species tested. Three alternative explanations for the non-significant results are: 1) fractal analysis is not an accurate means of capturing sutural complexity, 2) stress may vary in the vicinity of the suture but is relatively low in all taxa and therefore has no effect on the complexity of the mid-palatal suture, or 3) irrespective of dietary differences, masticatory stresses are broadly similar in the papionins sampled.

Death, disease and unhealthy living conditions in 1880-1920 Los Angeles: Paleopathology of the historic Los Angeles Cemetery.

K.M. Houck. Department of Anthropology, California State University, Los Angeles.

In 2005, a construction project in Boyle Heights, California discovered a portion of the historic Los Angeles Cemetery. This public city cemetery operated between 1878 to 1922, primarily functioning as an indigent cemetery. However, due to discriminatory laws, Chinese residents were also buried at the city cemetery. During this time, the completion of the transcontinental railroads ignited immigration and industrialization, transforming the modest pueblo town into an urban metropolis. Osteological analysis of the burials excavated offers a unique opportunity to explore the health status of two disadvantaged populations inhabiting Los Angeles. The indigents, largely composed of immigrants with a variety of ethnic backgrounds, endured economic hardship. The Chinese, defined by homogenous ethnicity, experienced discrimination and segregation by the Euro-American majority. Health status is evaluated using the prevalence of generalized periosteal reaction, porotic hyperostosis, cribra orbitalia, linear

enamel hypoplasia and carious lesions as indicators of infectious diseases and nutritional deficiencies. The high incidence of all the pathological conditions corroborate the unhealthy living conditions of an industrial time period characterized by rapid growth, overcrowded housing, and poor sanitation. The frequencies are comparable to other 19th century lower-class cemetery samples in the United States. Significant distinctions between the indigents and Chinese are attributed to variations in access to food resources and health care. Data collected from the burial records suggest a dominance of infectious related deaths among the entire cemetery, which is analogous to the cause of death distribution of the entire Los Angeles populace during that time.

Assessing the duration of physiological stress episodes represented by linear enamel hypoplasias: Implications for health

Ameila R. Hubbard, Debbie Guatelli-Steinberg. Department of Anthroplogy, Ohio State University.

Bioarchaeologists have traditionally used the prevalence of linear enamel hypoplasia (LEH), an enamel defect reflecting non-specific physiological stress, to assess population health. Initially, measurements of defect widths were used to estimate the duration of stress episodes that LEH defects represent. More recently, because of questions regarding the accuracy of defect widths in estimating stress episode duration, bioarchaeologists have attempted to infer duration using perikymata (enamel layers that grow in regular increments). Unfortunately, perikymata are often not fully visible within defects, while widths can usually be measured. Using 47 defects in teeth from the Irene Mound, this paper investigates the relationship between perikymata within defects and defect widths to determine if widths can be used to predict perikymata within those defects. Perikymata numbers were regressed on defect widths, first as a combined sample and then separately by tooth type and crown region. The combined-regression analysis indicates a strong relationship between defect widths and perikymata numbers; only minimal improvements were seen in separate regression analyses. Using the combined-regression equation, prediction intervals were determined for individual defect widths and confidence intervals were generated for hypothetical mean population widths. Wide prediction intervals indicate that a defect's width cannot be used to meaningfully determine the number of perikymata within it. However, the narrower confidence intervals associated with hypothetical mean population widths, suggest that mean defect widths may be used to rank populations in terms of *relative* average stress episode duration. Doing so will require that perikymata spacing varies only minimally across all compared populations.

Postmarital residence practices change in prehistoric south Brazil coastal groups.

M. Hubbe[1], W. A. Neves[2], E. C. Oliveira[2]. [1]Instituto de Investigaciones Arqueológicas y Museo, Universidad Católica del Norte, [2]Departamento de Genética e Biologia Evolutiva, Instituto de Biociências, Universidade de São Paulo.

South Brazilian coast was first settled around 6 kyr BP by shellmound builders, a successful fisher-gatherer population that inhabited the coastal lowlands practically unchanged for at least 4 thousand years. Shellmidden were typically occupied as residential sites as well as cemeteries, and are usually associated to rich alimentary zones, such as mangroves. Around 1.2 kyr BP the first evidence of ceramic, brought from the interior, is found in coastal areas, and together with it there is a progressive abandonment of shellmidden construction in favor of shallower sites. Here we analyze if these changes were reflected in the postmarital residence practice of coastal groups, i.e. if the arrival or intensification of the contact with interior groups resulted in changes of this aspect of the social structure of coastal groups. To test the postmarital residence practice we analyzed correlations between Mahalanobis distances and geographic distances of each sex using Mantel's test for matrix correlation. In the pre-ceramic shellmidden samples, there were significant correlations found only for females, suggesting that males migrated more, which is in accordance with matrilocal practices. In the ceramic groups the results are the opposite: only males show a significant correlation with geographic distance, suggesting that patrilocality was the adopted strategy in the latter period. These results favors the hypothesis that the changes experimented by coastal groups after 1.2 kyr BP affected not only their material culture, but aspects of their social organization as well.
FAPESP (99/00670-7 and 04/01321-6). CNPq (301526-04.6).

Strontium isotope ratio determination in enamel and dentin of individuals of the excavation site Thunau/Kamp (Austria) (~900-1000 AD) by MC-ICP-MS

C. Huemer[1], M. Teschler-Nicola[2], S. Boulyga[1], T. Prohaska[1]. [1]Institute of Analytical Chemistry, University of Natural Resources and Applied Life Sciences, Vienna, [2]Department of Anthropology, Natural History Museum Vienna, Austria.

Strontium isotope analysis of prehistoric teeth is a frequently used technique for characterizing human mobility and identifying immigrants in ancient populations, although particular aspects concerning background signals and diagenetic phenomena are still insufficiently investigated and corresponding uncertainties should be taken into account.
By means of MC-ICP-MS we analyzed the $^{87}Sr/^{86}Sr$ ratio of tooth enamel and dentin from 73 human skeletal remains from the Thunau/Kamp burial ground, dated to the early Middle Ages (~900-1000 AD). Archaeological and textual information indicate that this cemetery belonged to a princely court whose importance results from his location in the borderland between two dominions (Slavs and Franks). Different hypotheses about the foundation as well as about the demise of the settlement are in discussion.
To receive information about the local signal of the region we examined recent samples of water, soil, plants and animals and teeth from faunal remains recovered from the Thunau/Kamp site (horse, bear, beef, dog, pig and sheep).
The $^{87}Sr/^{86}Sr$ ratio signals obtained by using digestion of the complete soil are typically for areas where gneiss is the geological main component. In contrast, the values of the extracted soils are consistent with the values of local water, plants and recent animal samples and share similarities with the human dentin results. The $^{87}Sr/^{86}Sr$ ratios of the ancient animal teeth exhibit a broad range ("import" of animals?).
Referring to the ratios obtained from human teeth, a few outliers could be identified, which are endorsed by their burial manner or their morphological features.

History and demographic profile of the George S. Huntington Collection at the Smithsonian Institution.

D.R. Hunt[1], B. Spatola[2]. [1]Department of Anthropology, National Museum of Natural History, Smithsonian Institution, [2]National Museum of Health and Medicine, Armed Forces Institute of Pathology.

The National Museum of Natural History curates a documented collection of over 3600 human skeletons amassed by anatomist George S. Huntington (1861-1927) of the College of Physician and Surgeons, New York City. The collection consists of immigrants and U.S. citizens dying in NYC from1893 to1921. The preservation quality, level of documentation and breadth of ethnic representation makes this collection invaluable for studying human skeletal biology, anatomical variation, demography and pathology. Most individuals have documented sex, age, nationality, cause of death, and in some cases occupation and postmortem anthropometrics. There are numerous excellent examples of trauma, occupational stress as well as infectious and congenital diseases.
Demographically, the collection consists primarily of European or U.S. males (approx. 75%). U.S. Blacks are represented in this collection at around 10%. The collection reflects the influx of immigrant groups of the time: Irish (15%), German (10%), Italian (8%), and other groups including Scottish, English

and Swedish. Tuberculosis, pneumonia and nephritis, the leading causes of death of the time, are well represented.
Since the re-organization of the collection back into individuals from separated elements, inventorying has identified commingling in approximately 16% of the individuals, due to decades old cataloging errors. Ongoing collections management and analysis has enabled much of this collection to be made viable for research. A relational database now provides easy access to individual data and access to a death certificate index. The Huntington Collection is now serviceable for research as long as the researcher is aware of the aforementioned commingling issue.

Age at weaning predictors among foragers in the Standard Cross-Cultural Sample.

K.R.Hurlahe. Department of Anthropology, Florida State University.

The early age at weaning among humans compared to chimpanzees is an important life history trait that shortens interbirth intervals. This study examines how this is accomplished using the sample of 36 hunter-gatherers in the Standard Cross Cultural Sample that acquire 90% or more of their diet from foraging. The median age at weaning among these foragers is 2.5 years.
The less work and traveling the mother has to do, the more energy she has available to devote to the child, and the earlier the child can be weaned. The earliest possible weaning age should be selected for to maximize fertility, but not at the expense of survivorship. Because breast milk provides increased protection, women in environments with increased risk of disease may nurse longer. The following variables were used to predict age at weaning: male contribution to subsistence, pathogen load, sexual division of labor, and home range size. This study found that pathogen load and sexual division of labor significantly affected age at weaning among foragers when controlled for net primary productivity.

Transition analysis: forensic application of a new symphyseal aging technique.

C.V. Hurst. Department of Anthropology, Michigan State University.

Determining the age at death in medico-legal investigations is a major component of the identification process. The pubic symphysis is often used for age estimations because it undergoes predictable developmental and degenerative changes that correlate well with age. There are a number of aging methods that have been established based on these transformations. A new technique is Milner and Boldsen's Transition Analysis (2002), a statistically based age estimation that utilizes a prior age-at-death distribution from a target population to inform its estimates based on the observable characteristics of the pubic symphysis. This method was originally developed for bioarchaeological investigations and in this study its forensic applicability is tested against methods that are commonly used in forensic anthropology, including: Todd (1921), McKern and Stewart (1957), and Suchey-Brooks (1990). In the male sample, the percentages of correct estimations were as follows: Suchey-Brooks 76.32%, Milner and Boldsen 63.16%, McKern and Stewart 31.58%, and Todd 26.32%. In the female sample the two methods tested, Suchey-Brooks and Milner and Boldsen, performed equally accurately aging 75.00% of the sample. Beyond a high estimation accuracy, the ease of learning and use of a technique help determine its value in forensic applications. Being a novice in the forensic field, I had the unique opportunity to learn and employ each of these methods. In my experience, the Suchey-Brooks method was the most easily understood and applied. The quality performance of transition analysis in this study demonstrates the promise that this technique has for application in the forensic context.

Dental defects in the deciduous dentition of two late Mississippian period subadults with arguable treponemal disease: cases of possible congenital transmission.

D.L. Hutchinson[1], E.A. DiGangi[2], M.O. Smith[3], T.K. Betsinger[4]. [1]Department of Anthropology, University of North Carolina, Chapel Hill, [2]Department of Anthropology, University of Tennessee, Knoxville, [3]Department of Anthropology, Loyola University of Chicago, [4]Department of Anthropology, The Ohio State University

Although non-venereal treponemal infection (yaws and/or bejel) is epidemiologically a childhood disease, transplacental transmission of yaws is possible when maternal infection occurs during early pregnancy. Non-venereal treponemal disease is aboriginal to North America and arguably endemic in late prehistory. Paleopathological evidence suggesting congenital transmission would alter the perception of general endemicity in favor of a geographically variable contagion tempered by population concentration, relative population isolation, community pathogen load, and nutritional status. To date, congenital dental defects of the permanent dentition specific to syphilis (e.g., Hutchinson's incisors, Moon's molars) are not evident in pre-Columbian osteoarchaeological samples. However, a suite of gross dental enamel defects of the deciduous incisor and molar dentition associated heretofore with transplacental transmission of syphilis (Ortner 2003) has been arguably identified in two subadults from the late prehistoric (AD 1200-1600) sites of Hiwassee Island (age 2-3 years) and Hampton (age 4-5 years) from lower East Tennessee. The single rooted teeth display gross linear hypoplastic defects. The Hampton case additionally displays central-notched mandibular central incisors and a pulp-exposing craterous defect originating on the occlusal surface in the mandibular molars. These individuals, identified during a four site survey for treponemal disease (N = 630), display postcranial periostitis which would independently argue a diagnosis of treponematosis. The co-association of these dental defects with arguable treponemal cases has an important impact on our understanding of pre-Columbian treponemal syndrome(s) epidemiology.

Synchronizing behavior: the use of gestural communication in a captive group of white-cheeked gibbons (*Hylobates concolor*).

E.J. Ingmanson. Department of Anthropology, Bridgewater State College.

Communication studies with gibbons have focused extensively on vocalizations, especially long-distance calls and duets. Less well known is the extent to which gibbons utilize gestures in their communicative repertoire. During the summers of 2006 and 2007, observations were conducted on the use of gestures in a group of white-cheeked gibbons at the Roger Williams Zoo in Providence, RI. The group consists of one adult male, one adult female, and one infant female. The adults have a well-established pair-bond and are experienced parents. Based on these observations, it is clear that these gibbons utilize a variety of gestures, including facial expressions, body postures, and hand/arm movements. Gestures occurred most frequently during affiliative behaviors and to coordinate movement. Many gestures served to initiate behaviors, especially contact, between two individuals. Aggressive gestures were rare and generally directed from the adult female towards the male. Developmental differences in gesture use were observed for the infant. Though still nursing, in 2007 she spent increasing periods of time interacting with the father, predominantly in play. Both individuals utilized an open-mouth face to initiate play, which was not observed the first year. Individual differences in gesture use were observed between the adults. Some observed gestures may be group-specific, such as one observed to initiate grooming. Because of the long-term bonds in gibbons, group-specific gestures might be expected to occur, requiring comparative data from other groups. A complete phylogenetic understanding of gesture use is important to elucidate the role of gesture in the evolution of human communication.
This research was funded by the Center for the Advancement of Research and Teaching, Bridgewater State College.

A Magdalenian perinatal skeleton from Wilcyzce, Poland.

J.D. Irish,[1] B. Bratlund,[2] R. Schild,[3] E. Kolstrup,[4] H. Królik,[3]D. Mańka,[3] T. Boroń[3]. [1]Department of Anthropology, University of

Alaska Fairbanks, [2]Rissnavägen 57, Spånga, Sweden, [3]Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw, Poland, [4]Department of Earth Sciences, Uppsala University, Sweden.

A repeated-use, late Magdalenian hunting camp was discovered near Wilczyce, in southern Poland. Ongoing excavations at the open-air site revealed a wealth of organic and cultural remains embedded in the cast of an ancient ice wedge. Recovered faunal remains include large and small game and a variety of fur animals; although most bones are fragmented and root-marked, all are generally well preserved. The artifacts clearly emulate those from other late Magdalenian sites across Europe. However, the focus of this presentation is on a partial human infant skeleton discovered in 2005. Apparently deposited under a house floor, its bones are in a similar state of preservation as those of the fauna; a necklace of *Canis* sp. teeth may have been associated with the infant. Basic osteological observations and genetic assessments of sex tentatively characterize the remains as having belonged to a perinatal female of European descent. A radiocarbon collagen assay of an infant bone returned a date of 12,870±60 BP (uncal), which closely corresponds to an average age of 13,000 BP (uncal) for the site.
Upper Paleolithic human skeletal remains from Europe are rare; those of children and, particularly, infants are almost non-existent. The Wilczyce perinate is evidently just the fourth of its kind from this time, and first from the Magdalenian period. Such remains not only serve to expand the existing European Upper Paleolithic skeletal sample, but are useful for providing additional details on mortuary behavior in the region, as well as early modern human ontogeny.
We thank the Radiocarbon Accelerator Unit of the Research Laboratory for Archaeology and the History of Art, Oxford University; the Institute of Archaeology and Ethnology, Polish Academy of Sciences; the Ministry of Science and Higher Education of Poland (Grant 1H01H 021 27 to R. Schild); and the Office of Monument Protection at Sandomierz, Poland.

Spatial and temporal variability in predation by *Cryptoprocta ferox* on sifakas in continuous and fragmented rainforest in Madagascar: Do forest fragmentation and predation act synergistically?

M.T. Irwin[1], J.-L. Raharison[2], P.C. Wright[3,4]. [1] Department of Biology, McGill University, [2] Department de Biologie Animale, Université d'Antananarivo, [3] Department of Anthropology, Stony Brook University, [4] Centre ValBio, Ranomafana, Madagascar.

Predation is a constant risk for most primates, and is known to affect demography, population dynamics, activity patterns and social behaviour. Yet, data are limited on both the rates of predation, and its spatial and temporal variability. We present long-term observations of *Cryptoprocta ferox* predation on rainforest sifakas, *Propithecus diadema* at Tsinjoarivo (25 group-years) and *P. edwardsi* at Ranomafana (74 group-years), derived from intensive observations as part of ongoing behavioral studies. Average offtake rates are relatively low, but temporal variability is high (kills are clumped in time). This is consistent with *Cryptoprocta* ecology; individual home ranges are much larger than sifaka ranges, and individuals may hunt in a subsection of their range until prey density is decreased, then move on.
These results have broad implications. First, in terms of the evolution of anti-predator strategies, it now becomes important to ask: (1) how the relationship between perceived and actual predation risk changes through time, and (2) whether antipredator strategies (e.g., vigiliance, sleeping site selection) fluctuate, reflecting recent experience. Second, in terms of population ecology, *Cryptoprocta* may have proportionately large impacts on the (small) sifaka groups, or even drive groups to extinction (as observed at both sites). Third, the disappearance of groups has important implications for conservation. When this happens in continuous forest (as at Ranomafana), territories will likely be re-filled over time, whereas in isolated forest fragments (as at Tsinjoarivo), recolonization is less likely. Thus, conservation planners should consider predation as a potentially important proximate cause of extirpation in fragmented landscapes.
Supported by: Margot Marsh Biodiversity Foundation, NSERC, PCI, Stony Brook University, Wenner-Gren Foundation, NSF, Earthwatch Institute.

Dental diseases of human skeletal remains of the early-modern period from Kumejima Island, Okinawa, Japan

H. Ishida[1], K. Irei[1],T. Hanihara[2], M. Yoneda[3] [1]Dept. of Anatomy, University of the Ryukyus, [2]Dept. of Anatomy and Biological Anthropology, Saga Medical School, [3]Dept. of Intergrated Biosciences, University of Tokyo, Japan.

Dental diseases, such as dental caries, linear enamel hypoplasia (LEH), antemortem tooth loss (AMTL) and dental calculus were examined, using the human skeletal remains of the early-modern period (17th to 19th century AD) from the Kumejima Island, one of the Ryukyu Islands. The materials used in this study consisted of 105 male, 89 female and 192 sex-unknown adult individuals. Older females had the highest prevalence of dental caries among adult females and males. Not only female physiological events, such as pregnancy and menopause, but also food preference differences may have led to this sex difference, as suggested by the isotope analysis (Yoneda et al., 2004). The higher rate of AMTL in older females indicated that their estimated rate of dental caries must be even higher. There were no significant differences in the dental caries rate between prehistoric foraging and early-modern farming Ryukyu Islanders, probably because of the similar composition of C3 plant and fish ingestion. Younger adult females tended to be more affected by LEH, indicating that they experienced greater physiological stress during their early childhood.

Variation among subspecies of *Pan troglodytes* in limb bone metrics.

R.S. Jabbour. Ph.D. Program in Anthropology, City University of New York Graduate Center, New York Consortium in Evolutionary Primatology.

Studies of skeletal variation in *Pan* provide an important foundation for taxonomic interpretations of variation among hominoid fossils. Traditionally, fossil-oriented studies of *Pan* variation focused on species-level differences, but researchers increasingly recognize the value of characterizing geographic variation below the species level. While steady progress has been made in describing such variation in skulls and teeth, study of geographic variation in postcrania lags behind, despite some valuable contributions. This study, part of a larger study of geographic variation in African ape limb bones, offers a preliminary characterization of differences among subspecies of *Pan troglodytes* in limb bone metrics, based on larger samples of poorly-represented taxa and more variables than were included in previous studies.
Forty-three linear measurements were analyzed from the humerus, radius, third metacarpal, third proximal hand phalanx, femur, tibia, calcaneus, first metatarsal, third metatarsal, and third proximal foot phalanx of 274 *Pan* adults. Most measurements are greater in *P.t. troglodytes* than in *P.t. schweinfurthii* and *P.t. verus*, but only phalangeal measurements are significantly greater in *P.t. troglodytes* than in both of the other subspecies. PCAs demonstrate patterns of geographic variation in shape similar to those observed in studies of craniodental variation: *P.t. verus* is the most distinctive subspecies, and *P. paniscus* differs more from the *P. troglodytes* subspecies than the subspecies differ from one another.
Through increasing knowledge of limb bone differences among chimpanzee subspecies, this study enhances researchers' ability to refer to a modern analog in assessing the taxonomic significance of variation among hominoid fossils.
Supported by NYCEP, CUNY, Sigma Xi, The Leakey Foundation, and The Wenner-Gren Foundation.

Fossil Cercopithecoidea from the Kapthurin Formation, Baringo, Kenya.

N.G. Jablonski[1], S. McBrearty[2], [1]Department of Anthropology, The Pennsylvania State University, [2]Department of Anthropology, University of Connecticut.

Fossils representing modern species of African monkeys are mostly missing from the fossil record, and little is known of the timing of the evolution of the modern Cercopithecoidea on the continent. The Middle Pleistocene Kapthurin Formation of Kenya is best known for its hominid fossils, Acheulean stone tools, and the first record of the modern chimpanzee in the fossil record. Kapthurin has also yielded fossil remains of four cercopithecoid species, *Colobus guereza*, *Chlorocebus aethiops*, *Papio hamadryas*, and *Theropithecus oswaldi*, of which only the last is extinct. The Kapthurin *Colobus* is represented by a well-preserved partial cranium, a partially dentate maxilla, and two partial mandibles, which together greatly increase the known fossil record for the genus. The modern vervet, *Chlorocebus aethiops*, is represented by a partial cranium and some isolated teeth. The modern savannah baboon, *Papio hamadryas* subsp. indet., is represented by some isolated teeth, and *Theropithecus oswaldi* is represented by a hyper-robust male partial cranium and a mandible, which are among the largest and most recent known remains of the species. Most of the fossil Cercopithecoidea from the Kapthurin Formation derive from level K3, below the Grey Tuff, dated to about 500 ka. The Kapthurin fossil monkeys are significant because they demonstrate that the medium- to large-bodied colobines and theropiths, which dominated the East African Plio-Pleistocene, had been succeeded by mostly modern species of small to medium body mass (8-15 kg) by the later Middle Pleistocene. Although *Theropithecus oswaldi* persisted at Kapthurin, it appears to have become extinct soon thereafter.

Does a large peroneal process on the first metatarsal reflect leaping behavior in prosimian primates?

R.L. Jacobs[1], B.A. Patel[1,2], D.M. Boyer[3]. [1]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University, [2]Department of Biomedical Science, Ohio University College of Osteopathic Medicine, [3]Department of Anatomical Sciences, Stony Brook University Medical Center.

The first metatarsal of euprimates is characterized by a well-developed peroneal process, which appears proportionally larger in prosimians than in anthropoids. A large peroneal process has been hypothesized to: 1) reflect powerful hallucal grasping, and/or 2) act as a buttress to reduce strain from loads acting on the entocuneiform-first metatarsal joint during landing after a leap. The first hypothesis was recently refuted using electromyography (Boyer et al., 2007). This study addresses the second hypothesis by comparing the morphology of the peroneal process among prosimians that engage in leaping and/or quadrupedal locomotion.
We took five linear measurements on the first metatarsal and used them to compute variables that capture relative peroneal process size. Results show significant differences in relative process thickness and length among the extant lorisiforms (i.e., lorises and galagos), with leaping galagos having relatively larger processes. However, inclusion of other prosimians revealed that leaping tarsiers and indriids do not have relatively large peroneal processes, leading to the conclusion that there is no consistent relationship between these two measures and degree of leaping behavior among prosimians as a whole.
The hypothesis that peroneal process size is correlated with leaping behavior among primates is supported only by data from extant lorisiforms. It follows that peroneal process size should not be used to assess leaping behavior in non-lorisiform fossil euprimates.
Funded in part by NSF grant BCS-0622544.

The consistency of ethnic differences in diurnal heart rate variation in employed women.

G.D. James, Decker School of Nursing and Department of Anthropology, Binghamton University.

Previous studies have shown that African-American (AA) women maintain a higher heart rate (HR) over the course of the day (while awake and overnight) than European-American (EA) women. There is little information as to whether this difference is reproducible. The purposed of this study was to compare the consistency of HR measured at work (approx. 11AM-3PM) home (approx. 6PM-10PM) and overnight (10PM-6AM) between AA (N=55, age=38.3$\pm$8.1) and EA (N=90, age=37.9$\pm$9.6) women over three monthly assessments. Subjects were employed as secretaries or technicians at either of two medical centers in NYC. HR over the day was measured every 15 minutes using an ambulatory monitor. An average HR was calculated for each setting for each monthly assessment. Ethnic differences in the pattern of HR variation across these settings were assessed using a MANCOVA-repeated measures analysis with ethnicity as a fixed factor and age and BMI as covariates. The results showed that overall HR at work and home are substantially higher than HR overnight for both AA and EA women over the three months ($p<.001$). BMI was also positively associated with HR overall ($p<.001$). On average, AA maintained a higher HR than EA women over the three months ($p<.044$), however, the ethnic differences by setting were less consistent, with the difference at home being most reproducible. These results suggest that the overall ethnic difference in HR over the day persists over time; however, there is less consistency when the evaluation is limited to particular settings.
Supported by NIH Grant CA72457

Determinants of variation in human female ovarian function: genetic polymorphism, developmental conditions and adult lifestyle.

G. Jasienska. Dept. of Epidemiology and Population Studies, Jagiellonian University, Krakow, Poland.

Availability of metabolic energy constitutes a limiting factor for successful reproduction, especially for women. Variation in ovarian function (i.e. levels of estradiol and progesterone) observed among populations, among individual women and among cycles of a single woman can, in part, be explained by variation in lifestyle conditions that determine the levels of physical activity or energy balance. However, relative importance and interactive impact of different energetic factors on ovarian function is not well understood. In addition, reproductive function is, to some extent, programmed *in utero*: nutritional conditions experienced by the fetus during development predict ovarian sensitivity to energetic stress at adulthood. Conditions during childhood growth and development also influence adult ovarian function. Finally, ovarian function varies in relation to genetic factors. Polymorphism in genetic loci involved in the synthesis and metabolism of reproductive hormones is associated with variation in the levels of these hormones produced by women during menstrual cycles.

Genetics of Type 2 Diabetes and the Metabolic Syndrome in Mexican Americans.

C.P Jenkinson[1,2,3], R. Arya[1,3], R. Duggirala[2,3]. [1]Department of Medicine, University of Texas Health Science Center, [2]South Texas Veterans Health Care System, [3]Southwest Foundation for Biomedical Research.

Mexican Americans (MAs) represent a genetically admixed population deriving primarily from Amerindian and European ancestry. Multiple ongoing longitudinal studies have shown that this population has a relatively high incidence and prevalence of type 2 diabetes mellitus (T2DM) and of various related disorders including the metabolic syndrome (MS). The MS is a constellation of metabolic abnormalities such as insulin resistance, impaired glucose tolerance, hypertension, central obesity and dyslipidemia (high triglycerides and low High Density Lipoprotein-cholesterol). In addition to these well known risk factors recent research has highlighted the central roles of lipotoxicity (including abnormal deposition of fat in non-adipose tissue) and low grade chronic inflammation. The increased occurrence of such metabolic diseases is mostly in line with Neels “thrifty genotype” hypothesis.
In this presentation, recent data will be presented from several genetic epidemiological studies based in San Antonio (the San Antonio Family Heart Study, the San Antonio Family Diabetes/Gallbladder Disease Study, and the Veterans

Administration Genetic Epidemiology Study) involving MAs. These and other studies seek to determine the genetic architecture of T2DM and its related disorders by localizing the underlying quantitative trait loci (QTLs). To date, we have localized several loci influencing a variety of disease phenotypes including major loci for T2DM and MS on chromosomes 10q, 6q, and 7q. Currently, we are employing high throughput genomic scanning approaches to identify the specific genetic variants within these regions which contribute to disease pathophysiology. We will present some recent findings from our ongoing susceptibility gene discovery activities.

Feasibility of histological aging on Bronze Age Albanian skeletons: a comparison of methods and observers.

L.L. Jenny[1], K.E. Skorpinski[2], T.W. Fenton[1]. [1]Department of Anthropology, Michigan State University, [2] Department of Anthropology, University of Florida.

Taphonomic processes on archaeological skeletal material can present difficulties when using traditional morphological aging methods. Such circumstances require alternate aging methods, most commonly dental attrition rates. Histological aging is well accepted in forensic anthropology but has rarely been applied to archaeological material. Our research investigates the feasibility of histological aging of skeletons of great antiquity by comparing the Miles (1963) method for dental attrition age estimation, and the Kerley (1965) method for histological age estimation using 30 individuals from the Albanian Bronze Age site of Kamenica. Intra- and inter- observer error is investigated for the histological analysis in order to understand how observer error may affect the results of the overall comparison. Previous research found that osteon fragments and secondary osteons correlate most strongly with chronological age. This study replicates these results, as these factors are better preserved and therefore could be reliably observed histologically. Our results indicate that age estimates based on histology and dental wear can produce strong positive correlations. In this study, histological age estimations tend to overage the sample in comparison with dental attrition age estimates. Inter-observer error is problematic and higher than previously reported using Kerley (1965) and intra-observer error is not significant for either observer. These results suggest that when analyzing large samples, inter-observer error should be monitored or only one observer should be used. The results of our study suggest that histological aging is a feasible alternative in the absence of traditional morphological age indicators.

The Michigan State University Collaborative Intramural Research Grants Program provided the funding for this research project.

Gene duplication, loss, and conversion in the hominoid relaxin gene cluster.

M.I. Jensen-Seaman, J.J. Garcia, H.M. Brockway. Department of Biological Sciences, Duquesne University.

The peptide hormone relaxin is essential for birth, inducing degradation of connective tissue at the pubic symphysis and ripening of the cervix. We hypothesize that positive natural selection has acted on relaxin in the human lineage to facilitate the birth of a large-brained infant through a pelvis remodeled for bipedal locomotion. Previous work has reported various episodes of positive selection on relaxin in primates, although with limited species sampling. Humans and the great apes are known to possess two relaxin genes (*RLN1* and *RLN2*) located in tandem on chromosome 9, the result of a relatively recent gene duplication.
We isolated and mapped genomic BAC clones containing this relaxin gene cluster from human, chimp, gorilla, orangutan, gibbon, and macaque. We also performed cross-species PCR and sequencing of the entire coding sequence of both genes and of the ~1.5kb upstream promoter region in these same species in order to characterize the genomic evolution and to test for evidence of recent positive selection. Among our results, we identified two relaxin genes in gibbons, pinpointing the duplication event to the stem hominoid. We have deduced the evolutionary history of the promoter regions of the two relaxins during hominoid evolution. We demonstrate that gorilla and orangutan have independently lost function of *RLN1*. Finally, we will present evidence of recent gene conversion between *RLN1* and *RLN2*, including parts of the exon 1 coding sequence, in human and chimpanzee. This gene conversion invalidates the use of most common models for detecting positive selection.
This work was supported by a grant from the Wenner-Gren Foundation for Anthropological Research.

Effects of development on the evolution of primate dentition.

J. Jernvall[1], S.J. King[2], A.R. Evans[1], K.D. Kavanagh[1]. [1]Institute of Biotechnology, University of Helsinki, Finland, [2]Dept. of Anthropology, Stony Brook University, NY.

While developmental biology studies are uncovering details about molecular signaling and morphogenesis, present day knowledge about development is often too crude to address questions about how development matters in explaining the evolution of phenotypes. Mammalian dentition is a functionally highly integrated system where details of occluding cusp patterns are critical for function. Furthermore, the overall complexity of molar tooth features closely reflects species specific diets. In addition to functional integration, teeth are also developmentally integrated. For example, molar teeth develop sequentially along the distally elongating dental lamina. Recent experimental evidence on mouse molar development shows that the initiation and size of distal molars depends on previous molars through a dynamic balance between intermolar inhibition and mesenchymal activation. Small species specific differences in the intermolar inhibition can have ratcheting effects on size and number of distal molars. This 'inhibitory cascade' model predicts that primate molar proportions should evolve in a specific manner where the second molar makes up one-third of total molar area. We test this in extant and extint primate species and show the extent to which developmental and functional integration have determined dental diversity of primates. The ability to identify how development and function interact in shaping phenotypes may allow new tools for various questions in physical anthropology, including to the task of determining the identity of extinct taxa.

Isotopic signals of the petrous bone may reflect the diet the early years of life.

M.L.S. Jørkov[1], N. Lynnerup[1], J. Heinemeier[2].[1]Laboratory of Biological Anthropology, University of Copenhagen, [2]AMS C-14 Dating Centre, Aarhus University.

Stable isotope analyses of archaeological human bone samples are used for reconstructing dietary history. This project focuses on intra skeletal variability of the stable isotopic compositions ($\delta^{13}C$ and $\delta^{15}N$) of human bone collagen and teeth. A set of samples from the femoral diaphysis, rib, petrous part of the temporal bone and the 1st molar of was taken from 16 well preserved skeletons of both adults and juveniles from a medieval cemetery in Denmark. Well-documented archaeological and historical records indicate that these individuals belonged to a homogeneous population, consuming a similar diet throughout their lives.
We show that the petrous bone has an isotopic signal that differs significantly from both femur and rib values within the single skeleton (there was only minor variation between femur and rib). On the other hand, there was no significant difference between the petrous bone and 1st molar, although the petrous bone nitrogen values were elevated compared to the 1st molar.
The intra skeletal variations may reflect differences in turnover rates among the skeletal elements. The inner periosteal layer of the petrous bone is formed in uterous and does not undergo remodelling after the age of two, whereas the rib and femur have a continuous turnover rate of 5 and 10-20 years respectively. We find that the petrous bone may be a new useful bone element and a supplement or a proxy for teeth in the analysis of migration patterns as it may reflect the diet in foetal stage and early years of life.

Career or Family?: Maternal Style and Status-Seeking Behavior in Captive Bonobos (*Pan paniscus*).

E.M. Johnson. Department of Biological Anthropology & Anatomy, Duke University

This is the first study to show a trade-off between primate maternal style and status-seeking behavior. Maternal styles in non-human primates fall along two orthogonal dimensions: protectiveness and rejection, with protectiveness positively correlated with approaching, restraining, grooming and contact-making the infant and rejection positively correlated with breaking contact, leaving and rejecting the infant. These personality styles are comparable to styles identified in research on human psychology. Maternal behavior and status-seeking activities are not mutually exclusive and status-seeking mothers provide direct benefits to their offspring through intergenerational transfer of rank. High-ranking bonobo females have the highest frequencies of social grooming and grooming competition is positively correlated with dominance rank as well as with rank-related competition among lower ranking individuals. This study investigated two dominant bonobo females with nursing infants of the same age at separate captive facilities. A previous study at one of the facilities (Johnson 2007) determined that alliance formation among females was reduced as the result of matrilineal housing that included three full sisters. It was predicted that a more protective maternal style would be observed due to the reduced activity budget devoted to rank-related social grooming. 60 hours of video footage was analyzed detailing all mother-infant interactions and all social grooming bouts at each facility. The matrilineally-housed mother showed significantly higher levels of protective infant care while the second mother demonstrated significantly higher levels of grooming time with conspecifics. This suggests that maternal style and status-seeking behavior involve shifting strategies for maximizing female fitness that are context-dependent.

Biological continuity, cultural discontinuity and the collapse of the Meroitic state: Intra-cemetery biodistance analysis of ancient Nubians at Semna South.

K.M. Johnson. School of Human Evolution and Social Change, Arizona State University.

The collapse of the ancient Nubian state of Meroe was followed by a period of political and cultural transition (Edwards 2004). Differences in the material cultures associated with the Meroitic and post-Meroitic periods have been attributed to the displacement of Meroitic populations by X-Group populations from a different cultural tradition (Adams 1977). There are two problems with this account. First, biological data suggest population continuity between the Meroitic and post-Meroitic periods (Greene 1966, 1972; Irish 1993, 2005; Sandy-Karkoutli 1989; Van Gerven et al. 1976; Van Gerven 1982). Second, changes in material culture cannot automatically be equated with changes in socio-political organization (Edwards 2004). Following Stojanowski and Schillaci (2006), the current study uses biodistance analysis of a Nubian cemetery sample from Semna South to investigate possible changes in social organization following the collapse of the Meroitic state. The current study consists of a reanalysis of previously published craniometric data (Sandy-Karkoutli 1989) from a cemetery sample at Semna South. A total of 250 crania are analyzed: 224 Meroitic (127 males, 97 females) and 26 X-Group (14 males, 12 females). Intra-cemetery biodistance analysis is used to identify kin groups and assess post-marital residence patterns within Meroitic and post-Meroitic sub-samples at Semna South. Data for each period is compared in order to evaluate possible changes in social organization during the Meroitic/post-Meroitic transition, and the results are used to contextualize the seeming contradiction between different lines of evidence: the discontinuity of the archaeological record and the overall biological continuity between the Meroitic and post-Meroitic periods.

Risk factors for the metabolic syndrome in South Asian migrants in the UK.

W.O. Johnson, N. Cameron. Centre for Human Development, Department of Human Sciences, Loughborough University.

The metabolic syndrome (MetS) is a term used to describe the clustering within an individual of risk factors for Obesity, Coronary Heart Disease (CHD), and Type II Diabetes (NIDDM). In the UK, individuals of South Asian origin have a 50% greater risk of dying from CHD with much of this excess believed to be due to a 40% increased risk of NIDDM.
Early postnatal growth and nutrition have been found to be important predictors of the MetS. Growth patterns characterised by relatively low birth weights followed by periods of rapid weight gain, observed in many South Asian populations, have been identified as risk factors for childhood obesity, insulin resistance, and glucose intolerance. Combined with this a migration related nutritional transition to diets high in fat and low in fibre, coupled with a sedentary lifestyle, also increases risk for the MetS. All of these factors are likely to be associated with the health profile of South Asian migrants in the UK. However, there are few details about the actual relationship between migration and the growth and health of South Asian groups in the UK.
The population of the industrial northern city of Bradford is 20% of South Asian origin and almost 50% of the 6,000 annual births are to South Asian parents. The Born in Bradford (BiB) birth-cohort study will utilize routine data on 10,000 babies born between June 2007 and May 2009. These data are being augmented by specific parental questionnaires and detailed sub-studies in a core sample 3,500 infants.

Menstrual cycle characteristics in Blackfeet women.

S.L. Johnston. Department of Anthropology and Sociology, West Chester University.

Evidence exists for some interpopulation variability in menstrual cycle characteristics, including cycle length and duration of menses. Such differences may reflect hormone levels and have implications for reproductive as well as other health outcomes. Yet there is a paucity of published data describing menstrual cycles in North American native peoples. Data on characteristics of the reproductive span were gathered in 1995-1996 as part of a larger study of health and lifestyle change among Blackfeet women; menstrual cycle data are reported here.
An age-stratified sample of 150 women ages 18-93 was surveyed in person by three female Blackfeet interviewers or by the researcher. Complete reproductive histories and sociodemographic information were obtained, among other data. Cohorts were constructed to examine secular trends. Descriptive statistics were performed; chi-square (Kruskal-Wallis) tests were used to examine group differences. Bivariate analyses utilized ANOVA or regression.
Mean cycle length for the entire sample was 27.6 ± 7.1 days (median 28, n=142). Cycle length was positively associated with the duration, as a proportion of the reproductive span, of oral contraceptive (OC) use ($p=0.03$). Women who had never used OCs (n=60) had a cycle length of 28.8 ± 10.3 (median 28) days. Age approached significance in a negative association with cycle length only in these women ($p=0.07$). No clear secular trend emerged in cohort analyses.
Blackfeet menstrual cycle lengths are comparable generally to data obtained longitudinally among US women but are shorter than those found in some non-Western populations. Additional analyses are reported and implications drawn for reproductive health and future research needs.
Supported by an American Lung Association Grant.

Exploring sleep and obesity in English primary school children.

C.H.D. Jones, E.J. Henderson, T.M. Pollard, H.L. Ball. Department of Anthropology, Durham University, UK.

Conditions of Western lifestyles have resulted in changing health trends, particularly for obesity and associated diseases. A currently understudied area is the health consequences of sleep deprivation. Habitual sleep duration has decreased dramatically over recent

decades, particularly among children and adolescents. Recently, an association between short sleep duration and elevated risk of obesity has been established.
For this study it was hypothesised that sleep duration would be significantly negatively associated with obesity. Participants were 236 children (48% male) aged 7-11 years, at two primary schools in Middlesbrough, England. Anthropometric measurements were taken at school, and background information and sleep duration estimates were obtained using parent questionnaires. ANOVAs were used to assess relationships. 71% of children were normal weight, 22% were overweight, and 7% were obese. Sleep duration was significantly negatively associated with BMI, waist circumference, triceps skinfold and subscapular skinfold, independently of age, gender, ethnicity and socioeconomic status ($p<.001$, $p=.001$, $p=.04$ and $p=.03$ respectively).
The mechanisms behind the sleep and childhood obesity link remain unknown, and future research will focus on assessing the contributions of diet, physical activity and parent-child interaction to the correlation. Previous studies have found that sleep duration in young children can influence risk of obesity later in childhood; hence sleep duration in preschool children may be an important target for obesity interventions. This anthropological research may help to identify where a simple, behavioural intervention, such as emphasising regular sleep habits, or guidance regarding food intake following sleep, may be effective in preventing and treating obesity.

Sexual dimorphism of maxillary molars: an odontometric analysis of cusp dimensions in the context of evolutionary and ontogenetic development.

L.T. Jones[1], J.H. Langdon[2], C.W. Schmidt [2]. [1]Department of Anthropology, Indiana University Bloomington, [2]Human Biology Program, University of Indianapolis.

Most investigations of dental size sexual dimorphism examine mesiodistal and/or buccolingual diameters. While crown diameters are not problematic in single cusped teeth, molars consist of multiple cuspal units. Each cusp is independently initiated during dental ontogeny and autonomously affects the overall molar diameter. Both the evolution and ontogeny of molars suggest linear measurements of multi-cusp tooth crowns are actually composite dimensions, reflecting diameters of at least two individual cusps. Sexing techniques that use whole crown dimensions ignore the contribution of individual cusps.
We compared sexual dimorphism in maxillary molar crown and individual cusp diameters and evaluated the level of sexual dimorphism in first, second, and third molars. A sex prediction equation was then developed. Measurements included mesiodistal and buccolingual crown diameters and the diameters of the four main maxillary molar cusps: paracone, protocone, metacone, and hypocone.
The results suggest buccolingual crown dimensions reflect sexual dimorphism, but mesiodistal diameters do not. Mesial cusps were significantly more dimorphic in M1 and M2 while distal cusps were less influenced by sex. The level of sexual dimorphism was greatest in M1 and M2 and least in M3. Distal cusps consistently indicate an overall decrease in size in both sexes over the molar series. Protocone cusp diameters, however, decreased in females and increased in males from M1 to M2. In general, it appears that although BL diameters are good indicators of maxillary molar dimorphism, individual cusp measurements add information not provided by standard tooth measurements.

Effects of habitat characteristics on the behavioral ecology and habitat use patterns of mantled howler monkeys, *Alouatta palliata*.

C.A. Jost. Department of Sociology and Anthropology, Purdue University.

The conversion of primary forests into human dominated landscapes throughout the Neotropics has resulted in a reduction of suitable habitat for arboreal primates. Given their flexible foraging strategy, the mantled howler monkey (*Alouatta palliata*) provides an interesting focal species for examining adaptive flexibility in a dynamic environment. Previous research on the effects of habitat fragmentation on howler monkeys has focused on the particular characteristics of fragments necessary to maintain the presence of howler groups. More recently, studies have examined the specific impacts of habitat alterations on the behavioral ecology of groups of howlers within forest fragments. Fragmentation and habitat degradation have been found to result in changes in range size, population density and overall habitat quality. This brief study uses ecological and behavioral data to explore how habitat availability with a single forest fragment affects the habitat usage and activity patterns of three groups of mantled howler monkeys at La Suerte Biological Field Station, Costa Rica. Findings indicate that the differences observed in the behavior and habitat use patterns of study groups were attributable to size of home range, availability of habitat types within each group's home range, and high population density. The results of this study demonstrate that site-specific studies examining the behavioral responses of howler species to fragmentation should enable researchers to better predict their long-term viability in mature and degraded forests of Central America.

Hobbit bipedalism: functional anatomy of the foot of *Homo floresiensis*.

W.L. Jungers[1], W.E.H. Harcourt-Smith[2], S.G. Larson[1], M.J. Morwood[3], T. Djubiantono[4]. [1]Department of Anatomical Sciences, Stony Brook University, [2]Department of Paleontology, American Museum of Natural History, [3]School of Earth and Environmental Sciences, University of Wollongong, [4]National Research and Development Centre for Archeology (Jakarta).

The postcranial remains of the type specimen (LB1) of *Homo floresiensis* include a relatively complete left foot and a partial right foot. There is no calcaneus but all other tarsals and metatarsals are represented, as are some proximal, intermediate and distal phalanges. These bones permit us to reconstruct the length of the left foot and to document both extrinsic and intrinsic pedal proportions. Overall pedal design and function can also be assessed.
Using a large reference sample of articulated human feet, we use regression analysis to estimate total foot length from the length of the talus to the tip of the second digit. Reconstructed foot length is within the observed range of modern human feet, but relative foot length (scaled to either hind-limb length or estimated stature) is extremely long and far above the observed human range. The hallux is robust and fully adducted but is very short relative to all other metatarsals. Although the neck angle of the talus is within the human range, torsion of the talar head is remarkably low and ape-like. The navicular is strongly wedge-shaped and sports an expanded medial tuberosity similar to that of African apes and australopithecines.
We doubt that LB1 possessed a medial longitudinal arch. We also suspect that the medial aspect of the navicular was weight-bearing, and that the toe-off mechanism was not identical to that characteristic of modern humans. The long foot contributed to stride length in walking, but its relative length suggests that hobbits were not built for speed.
(Supported by Wenner-Gren, NGS and the Leakey Foundation)

Genetic structure of Bering populations using anthropometrics.

A. Justice, R. Rubicz, G. Chittoor, M.H. Crawford. Department of Anthropology, University of Kansas.

Recent research indicates that anthropometrics can be used to study microevolutionary forces acting on humans. This study examined the efficacy of anthropometrics in inferring population history of Aleuts and Eskimos of the Bering Sea. WS Laughlin measured St. Lawrence Island Eskimos and Pribilof Island Aleuts from 1979-1981. These analyses included adult participants from the Pribilofs: St. George (N= 165), and St. Paul (N=65); and from St. Lawrence, Gambell (N= 61), and Savoonga (N=108). Blood group and protein markers were compiled from the literature for comparison. The Relethford-Blangero method was employed to examine the phylogenetic relationship between Aleuts and Eskimos. Nei's genetic distance matrix was constructed

using classical genetic markers. The R-matrix from the Relethford-Blangero method clusters Aleuts and Eskimos separately on the first axis (75.5% of variation), while the second axis clusters St. Paul with Gambell and St. George with Savoonga (22.3% of variation). There was minimal phenotypic variation within the population, resulting in low values for minimum F_{st} (0.015). Genetic distances were then compared to an Euclidean distance matrix of anthropometric measurements using a Mantel test, giving a high but not significant correlation (r= 0.770, p= 0.129); likely attributable to sampling differences among comparative populations and few populations being considered. This study supports a close phylogenetic relationship between Aleut and Eskimo populations in this region. Anthropometric and genetic variation reflect the history of these populations except St. George, which shows conflicting patterns between the two markers. These differences highlight the opposing forces of genetic drift and gene flow on St. George.
This research was supported by NSF grant OPP-0327676.

Niche diversity and evolution of Malagasy primates.

J.M. Kamilar[1], S.L. Lehman[2], and K.M. Muldoon[3]. [1]Department of Anthropology, Washington University, [2]Department of Anthropology, University of Toronto, [3]Department of Anatomy, Dartmouth Medical School.

With the development of advanced quantitative tools, there is renewed interest in examining ecological variation within an explicitly evolutionary context. These studies have yielded mixed results. Some researchers have found that niche conservatism exists in many clades, where closely related species exhibit similar ecological niches. Other studies have shown a relatively high degree of ecological divergence among related taxa. In this paper, we examined niche conservatism in an ecologically diverse group of mammals, the Malagasy primates. Our dataset is drawn from the literature and supplemented by systematic field surveys. Variables collected for more than 27 extant species represented in the dataset include: 1) known species occurrences, 2) GIS based climate data for those sites, and 3) the phylogenetic relationships of the taxa. We calculated the niche space of each taxon by summarizing the climatic variation where they are known to occur. Climate data from species occurrences at all sites were entered into a principal components analysis. The mean value of each principal component was calculated for each species. We then utilized Mesquite to optimize the first principal component onto a phylogenetic tree. We found that the first principal component was correlated with temperature seasonality, temperature range, annual precipitation and isothermality. When this niche component was reconstructed on the phylogeny, a high degree of within-genus variation existed. In addition, several taxa from different genera converged on a similar ecological niche. These results have implications for interspecific competition, the evolution of diversity, and the long-term survival of these endangered species.

Using camera-traps and traditional knowledge to estimate population parameters and movements of carnivores in southeastern Madagascar: tools towards better understanding lemur predation risk from a predator's perspective.

S.M. Karpanty, C. Crawford, B. Gerber, M. Kotshwar. Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University.

The largest extant endemic Malagasy carnivore, *Cryptoprocta ferox*, and the mesocarnivores, *Fossa fossana* and *Galidia elegans*, are known to prey on lemurs, many of which are threatened or endangered. No ecological study has quantitatively examined population parameters and diet of *C. ferox* or the mesocarnivores in the eastern rainforests of Madagascar. We conducted a pilot study from June-August 2007 in Ranomafana National Park, Madagascar to assess the usefulness of camera-traps and surveys of traditional knowledge to assess population parameters and movement dynamics of carnivores. We established 22 camera-trap stations for 3 weeks in the primary forest and 22 stations for 3 weeks in secondary forest within RNP to sample predators. Two cameras were placed at each station to allow individuals to be identified by pelage patterns. We conducted interviews with 5 villages adjacent to our study areas. Preliminary analyses have verified the presence of multiple individuals of *C. ferox*, *F. fossana*, *G. elegans*. We will present data on the densities, habitat occupancy, distances moved, and times of activity for each of these predators from this pilot study and relate these findings to known instances of carnivore predation on rainforest lemurs. We will compare these estimates of population densities with those from the western dry forests. Finally, we will report on traditional knowledge of carnivore populations and their interactions with lemur prey. For example, villages adjacent to the primary forest area observed *C. ferox* in their villages only during the months of June-August annually during periods of nocturnal lemur torpor.

Do primates see ecotourists as potential predators?

L. Kauffman, S. Boinski. Department of Anthropology, University of Florida

Ecotourism is touted as a panacea for wildlife conservation. Yet, on reflection, ecotourism can be framed as treating threatened communities with small doses of the same invasive agents (humans) responsible for ever-expanding environmental degradation. Just how benign is ecotourism? Unfortunately, current knowledge is scant, especially for primates.
To answer this timely question we studied ecotourist-primate interactions within the renowned primate community of the Central Suriname Nature Reserve (CSNR). Until the surge of ecotourism consequent to inscription as a World Heritage Biodiversity Site in 2000, human activity in the park has been negligible for hundreds of years. Thus, the CSNR allows assessment of reactivity to humans among primate populations lacking exposure to hunting.
Over five months, 48 ecotour groups were accompanied on a 14-kilometer hike, with all primate encounters documented. Feeding time was the operational definition of a benign interaction, whereas as an adverse reaction was patent predator avoidance, i.e. alarm calls and fleeing.
The seven primate species investigated did not exhibit a unitary response to ecotourists. Instead, *Ateles paniscus, Cebus olivaceus,* and *Saguinas midas* consistently exhibited adverse reactions to ecotourists while *Cebus apella, Saimiri sciureus, Chiropotes satanus* and *Alouatta seniculus* tolerated close proximity. We conclude that primate species subject to ecotourism must be managed separately. This will not be onerous. Monitoring local primate and plausibly other animal populations can be executed reliably by non-specialists using the single variable of feeding time.

Reality bites: monastic dentition refutes historical claims for a vegetarian diet.

K. Keegan, S.G. Sheridan, Dept. of Anthropology, University of Notre Dame.

This study examined the diet and dental health of a monastic community from the Byzantine monastery of St. Stephen's in Jerusalem (5th-7th century CE) by analyzing dental calculus deposition, interproximal grooving, and carious lesion frequency. Comparative data were obtained from the Bronze Age sites of Bab edh-Dhra' (Jordan) and Tell Dothan (West Bank). Results from the monastic teeth indicate 78.2% (129/165) had some degree of calculus deposition, while 75.2% of the molars (82/109) and 83.98% of the incisors (47/56) had calculus present. Of the 129 teeth with calculus deposition, most had only minor calculus (75.4%). There was no statistically significant relationship between the degree of calculus present on the lingual (p=0.3) or buccal (p=0.4) sides of molars or incisors. There was no statistically significant difference for the frequency of calculus on first versus second molars (p=0.9) and lateral versus central incisors (p=0.3). In addition, there was a complete lack of interproximal grooves in the collection of teeth (n=399). Carious lesion frequency was comparably low (22.3%) with the first molars showing the highest lesion frequency. Although historical texts from this time indicate monastic communities traditionally consumed carbohydrate-rich diets, the

condition of the teeth as well as previous bone chemistry studies (Cooper et al. 2005, Gregoricka et al, 2005) indicate a diet high in animal protein.
* This research was supported by the NSF (SES 0649088).

Dietary changes during the development of Nasca social complexity (AD 1-750).

C.M. Kellner, M.J. Schoeninger. Department of Anthropology, University of California, San Diego.

Archaeological and geological evidence indicate the Nasca of arid south coastal Peru (AD 1-750) experienced great environmental and social challenges during their history. Stable carbon and nitrogen isotope analyses of human bone collagen show significant increase in maize consumption after a drought and the construction of underground water filtration galleries (*puquios*). In Late Nasca, some individuals of high social status apparently had greater access to meat, and overall there was greater variation in diet than in earlier periods. Only one individual has nitrogen isotope values indicating a marine-rich diet, even though middens include these items.
Funded by the Regents of the University of California (MJS) and NSF #0409891 (CMK and MJS).

Biological and Cultural Discontinuity from Wari Imperial Rule to Wari Collapse in the Former Imperial Heartland, Ayacucho, Peru

Brian M. Kemp[1], Tiffiny Tung[2], Marshall Summar[3]. [1]Department of Anthropology, Washington State University, [2]Department of Anthropology, Vanderbilt University, [3]Center for Human Genetic Research, Vanderbilt University

We report on the genetic composition of populations that once occupied the Wari era site of Conchapata (AD600–1000) and post-Wari sectors at the former capital site of Huari (AD1000–1400), both located in Ayacucho, Peru. Conchopata is located 12 km south of the capital, and after Wari imperial collapse, the site was abandoned. Much of Huari was also abandoned, but ceremonial sectors were reused for interring the dead in this post-imperial era. Do those burial populations represent descendants of Wari imperial heartland communities? Or did non-local populations move in to replace the peoples and power void left by the defunct Wari empire?
Our success rate in extracting analyzable DNA varied between the two communities, probably as a result of burial practices. Conchapata burials were interred in the ground; mtDNA was analyzable from 14/47 (30%) bone samples. At Huari, bodies were buried in stone lined galleries; mtDNA was analyzable from 18/19 (95%) samples. Although sample sizes are small, frequencies of mtDNA haplogroups greatly differed. As a further test of genetic relations, HVRI of the mtDNA genome was sequenced from 10 Conchapata samples and 17 Hauri samples. This revealed that only two of the 24 haplotypes identified were shared across Conchapata and Huari. These two shared-types represent very ancient mtDNA lineages that are distributed throughout the Americas. Overall, these mtDNA data strongly suggest that those buried at the two sites were biologically distinct, a finding that coincides with cranial modification data that has suggested different ethnic groups at the neighboring sites.

Sexual dimorphism in long bone midshaft cross-sectional properties of *Papio cynocephalus*.

M.A. Kilberger. Department of Anthropology. University of Texas at Austin.

In cercopithecoids, long bone cross-sectional properties often scale isometrically with body mass. Thus, more stressful loadings would be found in the larger members of this group if they did not compensate behaviorally. More extended limbs and muscle mechanics compensate for the relatively weaker cross-sectional properties in the larger individuals. In the highly body size dimorphic species, *Papio cynocephalus*, males and females should have more exaggerated differences in their limb bone midshaft cross-sectional morphology, revealing these general loading patterns. Independent to body size scaling, sexual dimorphism in the long bone cross-sectional morphology can also be discerned. This study uses high resolution X-ray CT scans acquired on specimens from the Bramblett Savanna Baboon Collection. I hypothesize 1) that aspects of scaling in long bone midshaft cross-sectional morphology may be sex specific and 2) that within one species, sexual dimorphism may be seen in some aspects of long bone cross sectional morphology**.** The slopes of midshaft ***J*** compared to body mass are significantly different between that of females and the pooled sample. Sexual dimorphism is present in the relative shape of the femoral and humeral midshafts in this species. In previous studies on modern humans, relatively greater mediolateral strength in female femoral midshafts has been argued to correspond with greater moment arms due to pelvic dimorphism; a similar trend is observed in these baboons. This finding reveals that the dual selection for parturition and locomotor behavior may cause significant biomechanical differences between the sexes of this species.

Slums or suburbs? Health status of a population from Imperial Rome.

K. Killgrove. University of North Carolina, Chapel Hill.

Both ancient historians and modern bioarchaeologists attribute high rates of morbidity and mortality to poor living conditions among the lower classes of Imperial Rome (1st-3rd c. AD). Preliminary analysis of skeletons from an Imperial-period cemetery near the city, however, seems to contradict these ideas.
The site of Casal Bertone, 1.5km from the city walls of Rome, included both a necropolis (N=100) and a mausoleum (N=38) and was adjacent to a large industrial complex. Rates of disease at Casal Bertone are dramatically lower than reported at other Imperial Roman sites. Cribra orbitalia and porotic hyperostosis affect 14% and 1.4% of the population respectively, while dental evidence yields only 2.9% of teeth with linear enamel hypoplasias and 4.9% of teeth with carious lesions. For comparison, the Imperial site of Vallerano, 12km from Rome, yielded rates of 69.2% and 26.8% respectively for cribra orbitalia and porotic hyperostosis, 63.5% of teeth affected by linear enamel hypoplasia, and 2.9% of teeth with carious lesions.
This paper will explore possible reasons for the seemingly good health of the people from Casal Bertone. Dietary and environmental differences, as well as higher social status, are likely factors in making the Casal Bertone population unique among Imperial cemeteries published to date. Stable carbon and nitrogen isotope analyses will further contribute to the understanding of dietary practices of the Imperial Romans.
This research was supported by grants from the NSF (BCS-0622452) and the Center for Global Initiatives at UNC.

Paleodietary change among pre-state metal age societies in northeast Thailand.

Christopher A. King, University of Hawaii, Department of Anthropology

It is hypothesized that in northeast Thailand during the pre-state Metal Age (2000 B.C. to A.D. 500) there are distinct differences among the populations during this time period which coincide with human induced environmental changes and developments of alternative subsistence technologies. It is further hypothesized that female and male diets differed, possibly from social circumstances, such as sex related food accessibility. The archaeological skeletal series is from Ban Chiang, Ban Na Di, Ban Lum Khao, and Noen U-Loke.
Temporal variation (sexes combined) in isotopic results demonstrate a positive shift in $\delta^{13}C_{collagen}$, $\delta^{15}N_{collagen}$, and $\delta^{13}C_{apatite}$ values. Individuals from both the second and first millennium B.C. have varied diets consisting principally of C_3 plants, C_3 terrestrial animals, and freshwater fish.
During the second millennium B.C., the $\delta^{15}N_{collagen}$ values suggest consumption of a wider array of protein sources for females than for males. During the first millennium B.C., $\delta^{15}N_{collagen}$ and $\delta^{13}C_{apatite}$ values in females suggest an increase in open field carbohydrate foods and a shift to a greater consumption of either fish and/or carnivorous

animals. For males, evidence suggests the consumption of more domesticated animals and less emphasis on wild game.
These stable isotope data substantiate archaeological and paleoenvironmental evidence, and corroborate bioarchaeological information from paleodemography and dental pathological conditions that suggest changes in dietary patterns over time and between the sexes. The use of stable isotopes from human remains from northeast Thailand has provided a direct indication for diet change from pre-state Metal Age societies.

Biological and social relatedness in Woodland Period mounds in Illinois.

Jason L. King. Department of Anthropology, University of New Mexico.

Kinship is often an important set of structural relationships within societies; however, it is not solely a network of biological relationships. It is also a set of socially constructed relations created, transmitted and manipulated across generations. Relatedness lies at the intersection of biology and culture, and it must be reproduced both biologically and culturally. One manner in which kinship may be (re)produced and transmitted is the creation of ancestorhood via mortuary rituals, through which distinction is made between those culturally constructed as ancestors and those who are not.
During the lower Illinois valley Middle (50 B.C. – A.D. 400) and Late (A.D. 400 – 1000) Woodland periods, earthen tumuli served as highly visible statements about social life and community. Funerary rituals recorded within these mounds materialized interactions of biological and social relatedness via different burial programs for subsets of the community. This study tests the hypothesis that ancestorhood was generated via differential mortuary treatment, primarily through extended ritual and secondary burial, by measuring biological distance between subsets of cemetery samples. Data are drawn from 22 Middle and Late Woodland mound groups. Mortuary variables are used to partition cemetery samples. Nonmetric cranial traits are employed to characterize sample genetic variation and measure distance between cemetery subsets. Variation in interments and its correlation to genetic relationships are traced over time. Results indicate that funerary practice was one means through which ancestorhood was generated by emphasizing male biological connections to community social and biological reproduction while minimizing those of females.
Supported by National Science Foundation Grant BCS-0654011.

Burial location and variation in long bone morphology at the Toqua site (40MR6), Tennessee.

K. A. King, University of Tennessee.

In chiefdom level societies, status is often reflected in burial practices. At the Late Mississippian site of Toqua in southeastern Tennessee, individuals interred in the mounds at the site were of higher status than those interred in the village areas as judged by the amount and quality of grave goods and the construction of the burial pits (Scott and Polhemus 1987). This study examines if these differences in social status are associated with differential nutritional status, as reflected by increased adult body size. Seventeen postcranial measurements of bone length, diaphyseal size, and epiphyseal size were taken on 33 adults. The sample was subdivided by mound or village burial location. The measurements from the two subsamples were compared to determine if significant differences in these dimensions existed between the two groups. Of the 17 measurements examined, maximum femur length and maximum tibia length were significantly longer among the mound burials. When the sexes are examined separately, these differences are significant only among males, suggesting that high status is correlated primarily with increased size in males. Possible explanations for this include increased biological plasticity among males, only males receiving increased nutritional access as a corollary of increased social status, or greater fluidity in female status compared with males.

Senescence in wild lemurs: does it happen?

S.J. King[1], S. Zohdy[2], A.R. Evans[2], L.R. Godfrey[3], J. Jernvall[2], P.C. Wright[1]. [1]Dept. of Anthropology, Stony Brook University, [2] Institute of Biotechnology, University of Helsinki, Finland, [3]Dept. of Anthropology, University of Massachusetts, Amherst.

Even though primates can be long-lived in the wild, it remains to be determined to what extent they manifest senescence. We have previously documented dental senescence accompanied by decreased reproductive success in wild Milne Edwards' sifaka (*Propithecus edwardsi*), a largely folivorous rainforest lemur. To place the dental senescence of sifakas into a broader functional context, we have applied an additional analytical tool to measure dental function across mammalian orders. For a diverse array of Rodentia and Carnivora, Evans et al. (2007) found that dental complexity, a measure of a tooth's available 'tools', is high in herbivorous species and low in carnivorous species. We determined that tooth complexity in young sifakas is high, increases slightly in early adulthood, but in old individuals rapidly falls below the herbivory threshold of rodents and carnivores. This occurs at the same age (~18 years) that the teeth lose functional surface features, including shearing crests. Because the different measures of dental function point to an abrupt onset of dental senescence, we next examined apparent age-related changes in body composition. The results show that whereas aging sifakas are able to maintain typical body mass through time, their limb muscles exhibit incipient size reduction, perhaps indicating an age-induced decrease in locomotor competence. Therefore, senescence in lemurs appears not to be limited to a single measure, however the temporal order in which different body systems age remains to be determined.
This research was supported by NSF BCS-0721233 (PCW, LRG, JJ).

Hallucal grasping in *Nycticebus coucang*: further implications for the functional significance of a large peroneal process

A.K. Kingston[1], D.M. Boyer[2], B.A. Patel[1,3], S.G. Larson[2], J.T. Stern Jr[2].
[1]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University, [2]Department of Anatomical Sciences, Stony Brook University Medical Center, [3]Department of Biomedical Sciences, Ohio University College of Osteopathic Medicine.

Euprimate grasping feet are characterized by a suite of morphological traits, including an enlarged peroneal process on the base of metatarsal I. The process serves as the insertion site of the peroneus longus muscle. A large process has been linked to a powerful hallucal grasp via the contraction of the peroneus longus muscle and resulting adduction of the hallux. Recent electromyographic (EMG) studies of lemurids show that peroneus longus does not contribute substantially to hallucal grasping in these prosimians. However, non-lemurid prosimians display a morphologically different and phylogentically more primitive grasp complex. It is possible that peroneus longus did function in grasping in early euprimates, but lost this function in large bodied lemurids to favor the intrinsic adductor musculature. This study tests the hypothesis that a large peroneal process is related to powerful grasping ability in primates displaying this more primitive grasp. EMG is used to evaluate the recruitment of peroneus longus and other crural muscles in grasping activities of *Nycticebus coucang*. Results show that the flexor digitorum tibialis and the intrinsic hallucal adductor are strongly active during grasping activities, and less active during non-grasping activities. Peroneus longus shows similar activity during grasping and non-grasping activities. Data are consistent with and strengthen confidence in patterns observed in lemurids, suggesting that muscle function has been maintained, despite morphological changes from a more primitive I-V grasp to a derived I-IV grasp. Consequently, we reject the hypothesis that a large peroneal process is as an adaptation for powerful grasping in basal euprimates.
Funded by NSF BCS 050 9190.

Interpreting enamel isotopic variability in East African fossil assemblages

J.D. Kingston. Department of Anthropology, Emory University.

An integral component of ongoing paleoenvironmental studies of early hominid sites is the dietary reconstruction of associated herbivore species based on isotopic analyses of enamel. Assuming that food preferences of a species are linked to physical and ecological characteristics of its habitats, this approach seeks to record relative proportions of C_4 grazing in dietary patterns and by inference, the extent of grassland or 'open' components in these paleoecosystems. Isotopic profiles of herbivore enamel have now been developed at multiple stratigraphic levels at over 10 hominid sites and in modern equatorial and South African ecosystems, involving thousands of individual analyses. To date, systematic evaluations of isotopic profiles at sites are not typically developed in the context of regional data sets, despite the abundance of comparative data. Presented here is such a compilation of relevant data from multiple fossil localities, including new fossil and modern data from Tanzania. Cumulatively, these data reveal that ancestral forms in many African herbivore lineages were more primitively more eclectic mixed C_3/C_4 feeders or occupied different niches than modern representatives. Isotopic ranges of ancestral taxa also tend to be significantly greater than modern counterparts. Explored here is the extent to which this variability reflects time/ecological averaging in discrete fossil assemblages, fundamentally different types of habitats in the past, variable selective pressures associated within and between feeding guilds in the past, impoverishment in disturbed modern habitats, variable patterns of habitat heterogeneity, and/or simply different foraging strategies.

The influence of habitat acoustics on alarm calls of sifaka (*Propithecus* spp.).

E.C. Kirk. Dept. of Anthropology, University of Texas at Austin.

In response to terrestrial predators, sifaka (*Propithecus* spp.) produce an alarm call with 2 syllables. In the western dry forest of Kirindy Mitea National Park, the alarm call of *P. verreauxi* ("tchi-fak") has a peak acoustic power that occurs near 1000 Hz in the second syllable. In the eastern rainforest of Ranomafana National Park, the alarm call of *P. edwardsi* ("zzeuss") has a peak acoustic power that occurs near 500 Hz in the first syllable. This project examines the effects of habitat acoustics on the alarm calls of both species. Excess attenuation (a loss of sound intensity due to scattering and absorption) and ambient noise were quantified in May 2006 in primary forest at Kirindy Mitea and Ranomafana. Excess attenuation was measured using pure tone playbacks over 80 meter transects at a height of 7 meters. In the dry forest, excess attenuation was minimal at 1000 Hz, above which it increased steadily with increasing frequency. In the rainforest, excess attenuation was slightly higher for most frequencies below 1000 Hz, but also increased steadily above 2500 Hz. At both sites, background noise increased exponentially with decreasing frequency. These data indicate that the maximum power of both alarm calls occurs at frequencies above substantial background noise but below frequencies subject to the greatest excess attenuation. These results suggest that the alarm calls of different sifaka species are adapted to maximize transmission distance and minimize the potential for masking by noise within their respective habitats.

A three-stage model for the peopling of the Americas

A. Kitchen*, M.M. Miyamoto†, C.J. Mulligan*
*Department of Anthropology, University of Florida; and †Department of Zoology, University of Florida

We evaluate the process by which the Americas were originally colonized and propose a three-stage model that integrates current genetic, archaeological, geological, and paleoecological data. Specifically, we analyze mitochondrial and nuclear genetic data by using complementary coalescent models of demographic history and incorporating non-genetic data to enhance the anthropological relevance of the analysis. Bayesian skyline plots, which provide dynamic representations of population size changes over time, indicate that Amerinds went through two stages of growth ~40,000 and ~15,000 years ago separated by a long period of population stability. Isolation-with-migration coalescent analyses, which utilize data from sister populations to estimate a divergence date and founder population sizes, suggest an Amerind population expansion starting ~15,000 years ago. These results support a model for the peopling of the New World in which Amerind ancestors diverged from the Asian gene pool prior to 40,000 years ago and experienced a gradual population expansion as they moved into northern Siberia and Beringia. After a long period of little to no change in population size in greater Beringia, Amerinds rapidly expanded into the Americas ~15,000 years ago either through an interior ice-free corridor or along the coast. This rapid colonization of the New World was achieved by a founder group with an effective population size of ~1,000-5,400 individuals. Our model presents a detailed scenario for the timing and scale of the initial migration to the Americas, substantially refines the estimate of New World founders, and provides a unified theory for testing with future datasets and analytic methods.

Comparing responses to novel objects in wild baboons and geladas.

D.M. Kitchen[1], T.J. Bergman[2,3]. [1]Department of Anthropology, The Ohio State University, [2]Department of Psychology, University of Michigan, [3]Department of Ecology & Evolutionary Biology, University of Michigan.

Behavioral flexibility is considered by some to be one hallmark of intelligence. One measure of behavioral flexibility is how subjects respond to novel objects; seeking out novel stimuli (neophilia) might relate to exploring a novel resource or expanding social relationships. Despite growing interest in comparative cognition, no comparative research on neophilia in wild primates has been conducted. Here, we compare responses to novel objects in wild chacma baboons (*Papio ursinus*) and geladas (*Theropithecus gelada*). Baboons and geladas are closely related taxa, yet they differ in their ecology and degree of social tolerance: (1) baboons are habitat and dietary generalists, while geladas have one of the most specialized primate diets (90% grass) and live only in the Ethiopian highlands; (2) baboons exhibit an aversion toward extra-group individuals, while geladas exhibit an attraction toward them. Using subjects of all age and sex classes, we examined responses to three different objects: a plastic doll, a rubber ball, and a red metal can. Baboon subjects exhibited stronger responses to objects (greater neophilia and exploration) than gelada subjects. Furthermore, baboons interacted with objects in the same way they might interact with a potential food item. Responses were unrelated to sex, but immature geladas showed more object exploration than adults. Results suggest that baboons and geladas have differences in behavioral flexibility that have been shaped by ecological (rather than social) differences. This may be one explanation for the relative success of baboons throughout Sub-Saharan Africa. However, whether neophilia indicates cognitive differences remains to be determined.
Funding for the Ethiopia research was provided by the Wildlife Conservation Society and the University of Michigan. Funding for the Botswana research was provided by The Ohio State University.

Ontogeny of the hominoid carpus: Did we evolve from a knuckle-walking ancestor?

T.L. Kivell. Dept. of Anthropology, University of Toronto, Dept. of Biological Anthropology and Anatomy, Duke University.

There are several stabilising morphological features of the African ape carpus that are shared, sometimes exclusively, with humans and have been posited as evidence that bipedalism evolved from a knuckle-walking ancestor (e.g. see Richmond et al., 2001 for review). This study investigated growth allometry and heterochrony in the ontogeny of the midcarpal joint in extant hominoids and some cercopithecoids to elucidate the functional or phylogenetic significance of these morphological similarities shared among hominines. Linear measurements of over 450 subadult and adult carpal specimens, including the scaphoid, lunate,

capitate and hamate were analysed. Bivariate and multivariate allometry revealed that morphological differences among adults were largely the result of significantly different developmental patterns. Growth allometry and heterochrony did not reveal a clear functional or phylogenetic pattern in the degree of ontogenetic variation among taxa for any carpal. However, African apes were consistently more distinct in their ontogenetic patterns, varying more among each other than with other catarrhines, while humans, in contrast, more often developed in a manner more similar to orangutans. Several carpal characters purported to be functionally advantageous for knuckle-walking were not consistently found in adult African apes, their development was not always correlated with increased knuckle-walking behaviour and several features were absent in humans and fossil hominins. Based on these results and the extreme variation in development patterns within African apes to the exclusion of humans, it is more likely from an ontogenetic perspective to assume that knuckle-walking evolved independently in chimpanzees and gorilla.
This research was supported by *NSERC* and the University of Toronto.

Demographic collapse, and microevolutionary change, and ethnogenesis: a population history of the late pre-Hispanic and postcontact Lambayeque Valley.

H.D. Klaus[1], P. Sciulli[1], and M. Tam[2]. [1]Ohio State University, [2]Universidad Nacional de Trujillo, Peru

European conquest and colonization of the New World forever altered Native American biology. On the north coast of Peru, an unprecedented upsurge in morbidity was an inescapable outcome for the native Mochica of the colonial Lambayeque Valley Complex. While catastrophic depopulation is at least circumstantially associated with postcontact biocultural stress, ethnohistoric sources indicate Lambayeque endured only a moderate indigenous population collapse followed by slow recovery in the seventeenth century. To empirically test the hypothesis of postcontact Lambayeque Valley depopulation, phenotypic dental pattering among five late pre-Hispanic (AD 900-1100) and two Early-Middle/Middle-Late Colonial skeletal samples (AD 1536-1750) were examined via R matrix analysis.
Late pre-Hispanic Mochica samples demonstrated a modest degree of both genetic microdifferentiation (F_{ST}= 0.041) and external gene flow –a possible correlate of the long-lived, endogamous *parcialidad* system of sociopolitical organization. Following European contact, the magnitude of external gene flow initially increased, but then fell precipitously as historically documented population aggregation and changes to Mochica social organization and traditional mating networks unfolded. A dramatically lower degree of genetic variability among the Colonial Mochica (F_{ST}= 0.0091) likely stems from a complex interplay between genetic drift (disease and economically-driven loss of alleles), selection, and social transformations. We accept the hypothesis. However moderate the postcontact Lambayeque demographic collapse, its impacts on population structures were phenetically indelible. We then discuss these results in terms of archaeological evidence documenting the ethnogenesis of a hybrid Euro-Andean Mochica culture and colonial Spanish economic policies that altered indigenous health. and microevolutionary trajectories in the Central Andes.
This research was generously funded by the Wenner-Gren Foundation for Anthropological Research, The Ohio State University of International Affairs, The Tinker Foundation, The Ohio State University Center for Latin American Studies, and The Ohio State University Department of Anthropology.

Maternal sleep and tiredness after scheduled non-labour caesarean section delivery.

K.P. Klingaman, H.L. Ball. Department of Anthropology, Durham University.

Evolved biological characteristics of human infants necessitate that parental care continues through the night. However, the disabling effects of operative delivery disrupt the balance between infant care and postpartum recovery. This obligatory redistribution of effort may lead to maternal frustration as she tries to prioritise her infant's needs over her own in accordance with the concept of 'good mothering' in Western societies (Knaak 2007). Suboptimal health outcomes may also result from women compromising recovery and care practices under these circumstances. The objective of this poster is to explore how maternal sleep in the immediate postpartum period following scheduled non-labour caesarean delivery mediates breastfeeding and maternal well-being and how, in turn, feeding method and maternal satisfaction contribute to postnatal ward tiredness.
Data obtained via semi-structured postnatal interviews with forty-five British mothers who prenatally intended to breastfeed suggest discontent with their limited independent caregiving capacities. Maternal tiredness was spontaneously offered as a specific link to formula feeds in the hospital. Nighttime care had the biggest impact on maternal dissatisfaction - described as being more difficult due to visiting hours and restricted mobility. Consideration of these impediments after caesarean section can help to inform birth mode discussions.
This research was funded by the Parkes Foundation and the International Society for Human Ethology Owen F. Aldis Fund.

Teeth as tools in an early Neolithic population from Central Germany.

S. Klingner[1,2], W.-R. Teegen[2], M. Schultz[3]. [1]Leipzig School of Human Origins – IMPRS, Germany, [2]Institute of Prehistory, University of Leipzig, Germany, [3]Department of Anatomy, University of Goettingen, Germany.

In the early 1980s a linear pottery culture (Linearbandkeramik, *LBK*) cemetery was excavated at Wandersleben (Thuringia, Central Germany). Even though the LBK-people were mainly buried in inhumation graves, cremation was also well known. The grave goods indicate a hardly stratified society, but with clear social differences between males and females. Analyses of degenerative joint diseases showed slight differences between the sexes, indicating the beginning of sex-differentiated work loads (Teegen/Schultz 2000).
One hundred and eleven adult skeletons were investigated in the course of this study. The material was studied macroscopically, by low power microscopy, radiologically and by scanning electron microscopy. Three females of advanced age showed artificial tooth modifications, four other individuals showed significant evidence for this also.
The use of teeth as tools in Neolithic individuals from Germany can mainly be observed in females. These results indicate sex-differentiated labour where teeth played an important role as "third hand". In contrast to other known single cases, which are range from the early to the late neolithic (end of 3rd millenium BC) (Kaiser/Pichler 2001; Teegen et al. 2003; Teegen 2006; 2007), the Wandersleben cases showed that most traces were bucco-lingual/palatinal. This implies that different tasks were probably performed using teeth as tools.

Female-female competition and ranging in Bornean orangutans.

C.D. Knott[1], L. Beaudrot[1], T. Snaith[2]. [1]Department of Anthropology, Harvard University, [2]Department of Anthropology, McGill University.

Female orangutans, because of their semi-solitary existence, have few dominance interactions amongst themselves. However, observations of contest competition as well as scramble competition exist and both are expected to be important for this species. Using 9 years of data and nearly 47,000 hours of observation of orangutans from Gunung Palung National Park, Indonesian Borneo, we examined both types of competition. We determined home range and core area size and overlap for the 6 most frequently encountered female orangutans by digitizing over 3700 range maps and then performing GIS and post-GIS analysis.
Mean home range size was 595 ha using the polygon method. Mean 50% core area was 65 ha, representing 13.4% of an individual's home range. Thus females spent a majority of their time in a small sub-area of their range, yet had large home ranges in which to search for food. Female home ranges overlapped 65.1% for non-relatives, 75.6% for

sisters, and 80.2% for mother-daughter pairs. Despite this high overlap, female day ranges overlapped by only 1.7% and the daily encounter rate was only 0.06. Compared to expected values, we found that females other than close relatives actively avoided each other. We also found evidence for agonistic interactions between females in areas of core area overlap. These results indicate that female-female competition does exist in orangutans despite the low rates of female-female association at this site.
Principle supporters: the National Geographic Society; Leakey Foundation; US Fish and Wildlife; Orangutan Conservancy; Milton Fund; Conservation, Food and Health Foundation; and NSF.

Geographic origins and residential mobility at the Pilgrimage Center of Pachacamac, Peru.

K.J. Knudson[1], M. Palma Málaga[1], I. Shimada[2], R. Segura Llanos[2]. [1] Center for Bioarchaeological Research, School of Human Evolution and Social Change, Arizona State University, [2] Department of Anthropology, Southern Illinois University.

The famed site of Pachacamac, located in the Lurín Valley of central Peru, is considered the most important prehispanic, pan-Andean religious center. Ethnohistoric accounts describe the power of the oracle and temples at Pachacamac, where pilgrims from all over the Andes worshipped and, in some cases, were buried. However, until now, little bioarchaeological and archaeological work at the site has been used to elucidate the lives of the individuals who were interred at Pachacamac.
Here, we combine archaeological chemistry and bioarchaeology to test the hypothesis that the individuals buried in front of the highly venerated Pachacamac, or Painted, Temple were originally from diverse parts of the Andes, including the neighboring highlands. We determine the strontium isotope signatures in dental and skeletal elements that formed at different times in an individual's life; if local strontium sources are consumed, these data can identify the geologic zone or zones in which an individual lived during enamel and bone formation. Preliminary strontium isotope analysis of archaeological human tooth enamel from 26 individuals buried in and next to a largely intact double-chambered tomb in the cemetery at the north base of the aforementioned Temple shows the geographic origins of these individuals. While work on characterizing the biologically available strontium isotope signatures of the region continues, these data demonstrate that the strontium isotope signatures ($^{87}Sr/^{86}Sr$) in these individuals are heterogeneous, and may represent a mortuary population who spent the first years of their lives in a variety of different locales.
This project was supported by the National Geographic Society (CRE grants 7472-03 and 7668-04), National Science Foundation (grants CS-0313964 and BCS-0411625) and the School of Human Evolution and Social Change and the Institute for Social Science Research at Arizona State University.

Sleep predicts chronic disease: Evidence from laboratory and field studies.

K.L. Knutson. Department of Health Studies, University of Chicago.

Sleep is a biological imperative with important implications for health. Laboratory experiments have demonstrated that sleep restriction is associated with multiple negative health consequences, including impairments in immune function, neurobehavioral performance, cardiovascular health and metabolism. Epidemiologic studies have also observed associations between shorter sleep durations and increased risk of chronic disease such as obesity and diabetes in population-based studies. Sleep, however, is also a behavior that can be affected by cultural norms and practices. Therefore, anthropologists can play an important role in the field of sleep research by identifying the social or cultural attributes that predict impaired sleep. Knowledge of these predictors is essential because individuals or populations who experience greater sleep loss or impairment will also be at a greater risk of the associated health consequences. This presentation will review the evidence for a causal link between impaired or restricted sleep and health. In addition, I will present data from studies on sleep that I have conducted in diverse populations, including in the U.S. and Haiti. These data suggest an increased risk of impaired sleep among those of lower socioeconomic status, which may partly explain inequalities in health. Finally, this presentation will discuss the contributions biological anthropologists can make to the field of sleep research. The overall goal of this presentation is to convey the message to other biological anthropologists that they can bring a very valuable perspective to research on sleep and health, a perspective that is currently underrepresented in the field.

Patch depletion, satiation, and patch occupancy: ecological constraints in Phayre's leaf monkeys (*Trachypithecus phayrei*).

A. Koenig[1], E. McCullough[2], C. Borries[1]. [1]Department of Anthropology, Stony Brook University, [2]Department of Biology, University of Puget Sound.

Optimal foraging theory assumes that animals leave patches when the costs of obtaining food become too high and that patches will be depleted more quickly the larger the party size. Folivorous primates, however, are often considered to feed on superabundant food lacking patch depletion and hence, scramble competition. We investigated residency in and depletion of 519 patches (September 2006 through June 2007) used by Phayre's leaf monkeys (*Trachypithecus phayrei*) at Phu Khieo Wildlife Sanctuary, Thailand. We recorded food intake and movement rates (3-min focal sampling), patch size (DBH), amount of food (log-scale), number of individuals feeding (scan sampling), and patch feeding time. Food intake rates significantly declined ($P<0.05$; paired T-test) from the first to last third of patch occupancy, but movement rates did not differ. However, during low food availability (October through February) intake rates significantly decreased and movement rates increased in fruit and flower patches indicating depletion. During high food availability and in all leaf patches, intake rates decreased while movement rates remained stable or decreased, possibly suggesting satiation. Patch feeding time in relation to party size controlled for DBH either followed an inverted U-shape indicative of a size constraint or increased with party size. These results suggest that the leaf monkeys depleted fruit and flower patches during low food availability, but otherwise fed until satiation or left before movement costs increased. Results on party size and patch occupancy support these conclusions. Hence, although folivores might feed until satiation in some patches, scramble competition seems to occur as well.
Supported by the National Science Foundation (BCS-0542035).

Maximum likelihood estimation of perinatal mortality in paleodemography.

L.W. Konigsberg[1], D.W. Owsley[2], R.L. Jantz[3]. [1]Department of Anthropology, University of Illinois, Urbana-Champaign, [2]Department of Anthropology, National Museum of Natural History, [3]Department of Anthropology, University of Tennessee, Knoxville.

It has become fairly commonplace to estimate perinatal mortality using long bone lengths from archaeological sites (Owsley and Jantz, 1985, Mays, 1993, 2003, Gowland and Chamberlain, 2002, Lewis and Gowland, 2007). In some instances this had led to confusion over what constitutes a Bayesian analysis and whether such an analysis would be desirable in paleodemography. In this presentation we use data on 496 proto- and prehistoric Arikara Indian perinatal deaths and 118 British Medieval deaths (Lewis and Gowland) to show why maximum likelihood estimation is preferred over Bayesian estimation in paleodemography.
To estimate the age-at-death structure separately for both samples we use published regression equations that predict long bone lengths given gestational age (Chitty and Altman, 2002) and combine these with a Weibull mortality model to write the likelihood of the Weibull parameters conditional on observed (long bone) data. After maximizing the likelihood it is possible to generate a predicted distribution of long bone lengths and compare this to the observed distribution. For the Arikara data

the match between predicted and observed long bone lengths is quite good. For the British data the match is quite poor because the sample includes some individuals who are clearly too old to be included in an analysis of mortality below 50 gestational weeks. Given the problems with the British data we focus our comparison of Bayesian and maximum likelihood methods on the Arikara data.

Limiting inter-observer error in determination of sex and age at death of human skeletal remains.

M.E. Kovacik, J.J. Cray. Department of Anthropology, University of Pittsburgh.

A key tenant of paleodemographic research, bioarchaeology, and basic skeletal analysis is to implement reproducible methodology within and across populations to assess sexual dimorphism and age-related change in bone morphology. Twenty non-metric, sexually dimorphic traits (Acsádi and Nemeskéri, 1970) and three methods for age determination, including the auricular surface (Lovejoy et al., 1985) and the pubic symphysis (Brooks and Suchey, 1990; Meindl et al., 1985), were assessed for an index of reproducibility. Two trained osteologists determined probable sex and age at death of a group of Monongahelans (Campbell Farm, 36FA26, n=46), part of a homogenous pre-contact Pennsylvania population. The index of reproducibility was assessed by inter-observer error using chi-square for each dimorphic trait (M/F/I) and aging method by respective stages of bony change. Four sexually dimorphic traits exhibited consistency ratios above 75%: superciliary arches, mental trigon, sciatic notch, and linea aspera; two were below 50%: frontal eminences and mastoid processes. Features of the mandible were significantly more consistent ($p=.045$) than utilizing the cranium alone, yet no difference was seen between the skull and pelvis. There were no significant differences in aging methods; both os pubis methods were equally reproducible, and when compared ($p>0.05$) or culled to the auricular surface ($p>0.05$) exhibited no significant differences. Overall, systematic application of multiple features for the determination of sex (Acsádi and Nemeskéri, 1970) increases reproducibility, decreasing inter-observer error. Aging methods of the os pubis and auricular surface exhibited comparable reproducibility and limited inter-observer error suggesting dependability.

Reproductive competition and ambush behaviors in black and gold howler monkeys

M. Kowalewski[1,2], P. A. Garber[1], S. M. Peker[2], G. E. Zunino[2]. [1]Dept. of Anthropology, University of Illinois, Urbana-Champaign, [2]Estación Biológica de Usos Múltiples, MACN, Argentina.

For most howlers species the maximum number of adult males and adult females residing in the same social group appears to be phylogenetically constrained. This constraint in howler sociality and social intolerance is likely related to reproductive competition. In this study we report 8 cases of ambush behavior in wild groups of *Alouatta caraya*. This behavior was expressed when lone nonresident males or females attempted to enter an established group. During each of these episodes males and females were observed to chase, surprise and attack aggressively intruder individuals of the same sex. The study focused on social and mating behavior in two groups of black and gold howlers that live in a continuous flooded forest on Brasilera Island (27º 20' S and 58º 40' W), in northern Argentina. These two multimale groups were followed from May 2003 to November 2004 and from September 2005 to September 2006, for 5 day per month from sunrise to sunset. In 6 out of the 8 cases, the defenders acted in a coordinated way to expel intruders. Ambush behavior may reflect a behavioral tactic used by males and females to reduce same-sex reproductive competition with extragroup individuals through within-group co-operative behavior and social bonding. In howlers, reproductive competition between resident and extragroup individuals may result in co-operative behavior between same-sex individuals that promote stability in multimale-multifemale social groups.

Funded by The Leakey Foundation, The Wenner- Gren Foundation, American Association of Primatologists, University of Illinois, and Ideawild Inc.

The Darwin Day Teachers' Workshop at the University of Tennessee: scientists aiding teachers who confront challenges to teaching evolution in public schools.

A. Kramer. Department of Anthropology, University of Tennessee.

For each of the last three years, Dr. Gary McCracken (of the Department of Ecology and Evolutionary Biology) and I have presented teachers' workshops in conjunction with the University of Tennessee's Darwin Day celebration. These workshops are intelligently designed to aid local secondary school science teachers who are literally manning the front-lines in today's anti-evolution wars. Our intent is to provide these teachers with knowledge, teaching materials and classroom activities that can help to demystify science, and particularly evolution, for their students. In this presentation, I will summarize the structure of the workshops, and discuss the interactive exercise intended to convey the nature of science ("CONPTT") that we share with the teachers. I will also report on the effectiveness of examples derived from physical anthropology in explicating evolutionary ideas and debunking anti-evolutionary misconceptions. Finally, I will share with you the participants' evaluations of the workshops, and their suggestions for future events, derived from the last three years of post-event comment sheets completed and submitted by the teachers themselves.

Humans, geometric similarity and the Froude number: Is "reasonably close" really close enough?.

P.A. Kramer[1] and A.D. Sylvester[2] [1]Department of Anthropology, University of Washington, [2]Center for Functional Anatomy and Evolution, Johns Hopkins University, School of Medicine

Because energy expended during locomotion, a ubiquitous feature of primate subsistence, is lost to reproduction, understanding locomotor energetics is imperative. Although metabolic energy expenditure (EE) can only be measured in extant species, using the equations of motion to calculate mechanical EE offers unlimited opportunities to explore EE. Unfortunately, the relationship between metabolic and mechanical EE remains obscure.

Critical to understanding this relationship is establishing the consequences of deviations from geometric similarity, because geometric dissimilarity (GS) violates the requirements for use of the Froude number (Fr), which is the standard scaling factor for locomotor comparisons. To do this, we developed a mechanical model with properties that mimic human population-level variation. Our goal was to understand if the level of geometric dissimilarity present in human populations could explain the known discrepancies between mechanical and metabolic EE. Specifically, do humans violate GS to a degree that significantly affects the use of the Fr and, consequently, our understanding of the metabolic/mechanical relationship.

The degree of geometric dissimilarity seen in humans produces differences in internal and external mechanical energy of 4-6% and 15-17%, respectively, at Fr=0.25, which could account for one-third to one-half of the known variation in metabolic EE. At equal Fr, our model shows that size does not effect mass-specific mechanical cost of transport. Mass-specific power was, however, affected, with larger individuals requiring more power. At the same velocity (1.35 m/s), larger individuals had a lower power requirement than smaller ones. This reversal highlights the underlying imperative of comparing individuals while accomplishing equivalent tasks.

Isotopic assessment of subannual diet and ecology through serial sampling of human molars.

J.S. Krigbaum[1], B.D. Tucker[1], and I.R. Quitmeyer[2]. [1]Department of Anthropology, University of Florida, [2] Florida Museum of Natural History, University of Florida.

Sampling advances continue to be made in stable isotope analysis, particularly with respect to improving spatial and temporal resolution of analysis. This project builds upon improvements in the isotopic sampling

of teeth to provide a subannual, seasonal record of diet and ecology using light stable isotopes of carbon and nitrogen. Incremental growth lines of tooth enamel form in the human dentition and isotopic ratios sampled at a given time during tooth enamel deposition reflect the diet and ecology of that individual during the time of that tooth's formation. Similar to sclerochronology work conducted on invertebrate shellfish, incremental analysis of dental enamel tissues allow correlation to paleoenvironmental proxy records that may reflect variability in seasonality and paleoclimate.
This project examines intratooth variation of $\delta^{13}C$ and $\delta^{18}O$ values in human molars from two Holocene archaeological sites: Niah Cave (Sarawak, Malaysia) and Harris Creek/Tick Island (Florida, United States). To minimize attenuation of isotopic results, a New Wave Research-Merchantek MicroMill system is used to sample tooth enamel from sectioned molar teeth. Through the analysis and sampling of tooth enamel in thin section, a more accurate isotopic record is produced that permits seasonal ecological and cultural conditions to be inferred for each sample population. To date our analyses have produced up to 10 discrete samples per tooth, with significant isotopic variation evident for both $\delta^{13}C$ and $\delta^{18}O$. Results are discussed with respect to paleoclimate records and site locale.

Comparisons of dental microwear texture attributes between facets in three primate taxa

K.L. Krueger[1], J.R. Scott[1], P.S. Ungar[1], R.F. Kay[2]. [1] Department of Anthropology, University of Arkansas, [2] Department of Biological Anthropology and Anatomy, Duke University.

Recent biomechanics research on chewing suggests that most work is done during what has been called "Phase I". Nevertheless, most dental microwear studies focus on "Phase II" facets, as these have been thought to better separate taxa by diet. This presentation reports comparisons of microwear between facets in species with differing diets to assess effects of facet location on texture attributes and diet discrimination.
A series of *Cebus apella* (*n*=13), *Alouatta palliata* (*n*=10), and *Lophocebus albigena* (*n*=13) M2s were analyzed. Point clouds were generated for "Phase I" (5 and 7n) and "Phase II" (9, 10n, and x) facets of each individual using white-light confocal profilometry. Data were collected at a lateral sampling interval of 0.18 µm (resolution = 0.05 µm) over an area of 276 x 204 µm. Seven microwear texture attributes known to separate extant primates with differing diets were then calculated. A two-factor ANOVA was used to assess affects of species, facet type, and interaction between the two.
There was significant variation for most attributes between taxa and between facet types. In some cases there was no interaction between the factors, indicating consistent differences between facets for all taxa. In other cases, there was a significant interaction, suggesting species differ in variation between facets. For example, "Phase II" facets of *Cebus* and *Lophocebus* have higher fill volumes than "Phase I" facets, whereas *Alouatta* does not evince this difference. Perhaps then, differences in microwear between facets may themselves be of value for distinguishing primates by diet.
This study was funded by the US National Science Foundation.

Stress Markers in Tooth Cementum caused by Pregnancy.

M. Kuenzie, Prof. Dr. U. Wittwer-Backofen. Institut für Humangenetik und Anthropologie, Freiburg University.

This study investigates stress markers in tooth cementum of women with known child birth history. Kagerer and Grupe (2000) found out that pregnancy has an important influence on tooth cementum formation in contrast to other factors such as malnutrition, physical or mental stress. Physical injuries, however, show similar patterns in tooth cementum as can be caused by pregnancy which may be due to an increased mineral need to repair such lesions.
As there is proof already for the influences of pregnancy on tooth cementum formation, this study scrutinizes how age of women at giving birth, birth spacing, and quantity of births correlate with stress markers in tooth cementum. To quantify different signals in tooth cementum new pattern categories are established.
The sample comprises 39 teeth of 24 women with a total number of 52 nativities. Results show that age of women at birth is a criterion that effects tooth cementum formation. Here stress lessens with increasing age at giving birth to a child. Regarding birth spacing, the study shows that extremely short time periods of birth spacing always produce signals. With increased spacing the signal decreases. Considering the quantity of birth, stress is least in the second and third childbearing period. All cases of misscarriage and stillbirth in this sample are visible in the tooth cementum of the corresponding women.

Backbreaking business? An analysis of osteopathic vertebral lesions from the working-class cemetery at Hierakonpolis, Egypt.

A. Kumar. Department of Anthropology, University of Arkansas.

Individuals from the working-class cemetery (HK-43) at Hierakonpolis, a late Predynastic Egyptian site were analyzed for vertebral lesions. Literature on contemporary populations was reviewed in order to derive models of traumatic and degenerative processes in vertebrae caused by specific activity patterns. Based on hypothetical expectations of work-related tasks performed, a functional analysis of the HK-43 skeletal material was then done using these models and possible causative mechanisms for the various lesions were proposed.
A comparison of the severity and pattern of distribution between different age groups revealed significant differences. Moreover, differences in prevalence of osteophytosis, arthritis and osteoporosis were found between the sexes contradicting the idea of gender equality during this period based on mortuary evidence (e.g. Savage 2000). Schmorl's nodes that may be related to herniation of the intervertebral disc were most frequent in the lumbar vertebrae in which differences between the sexes were significant. Atlas fractures that may be related to vertical loading were found in 2/250 individuals. A low prevalence of spondylolysis, spondylolisthesis and ankylosis was found. Two individuals each suffered from scoliosis and kyphosis and one each from ankylosis of the cervical and lumbar vertebrae. The results suggest that the population was not physically overburdened despite the central role played by Hierakonpolis in the rise of the ancient Egyptian state.
Research funded by NSF grant BCS-0119754.

The sacral auricular surface and its significance in age estimation.

A.K. Kutyla. Department of Biology, Middle Tennessee State University.

The iliac auricular surface aging technique as described by Lovejoy et al. (1985) remains one of few means for estimating age beyond the fifth decade. Despite the iliac auricular surface having been shown by various independent studies to be a valid method of age estimation, the opposing sacral auricular surface has yet to be investigated. A new method of age estimation using the sacral auricular surface will be presented.
This new approach to aging was developed using a representative sample (n=410) from the Terry Collection at the Smithsonian Institution National Museum of Natural History. The sacral and iliac auricular surfaces were observed. Preliminary results indicate that the sacral and iliac auricular surfaces do not undergo the same degenerative progression, therefore the characters and phases as described by Lovejoy et al. are not applicable to the sacral auricular surface. For example, the sacral auricular surface is lacking true billows as they do not exhibit transverse organization. This character is exhibited as primary subchondral bone with an irregular undulating surface topography and a raised surface beyond the border. Additionally, these undulations do not progress into striae and striae have not been exhibited on any of the sacral auricular surfaces observed. This method will be tested using a representative sample (n=150) from the William M. Bass Donated Collection housed at the University of Tennessee Knoxville. In the presentation of the validity of this new method of age estimation the influence of sex, race and secular change will also be addressed.

This research was supported by the Smithsonian Institution's Graduate Student Fellowship and the Department of Biology, Middle Tennessee State University.

The social and reproductive health implications of independent north-south child migration in Ghana.

S.O. Kwankye. Regional Institute for Population Studies (RIPS), University of Ghana, Legon.

Independent north-south migration of children is fast developing as a strategy in response to widespread poverty in the northern savannah regions of Ghana. Children migrate independent of their parents and other relations to southern cities, cocoa producing areas and mining towns. The majority of these migrants are females often with little or no education and in the cities they work mainly as "*kayayei*" or head porters at the main market centres and lorry parks. With some of them living virtually on the streets and in kiosks, in front of shops and in uncompleted buildings, the migrant "*kayayei*" are exposed to physical, environmental, sexual and reproductive health risks notwithstanding the valuable services they provide from which they make a living.
This study examines this emerging phenomenon using a 2005 survey of 451 north-south independent child migrants in Accra and Kumasi funded under the Migration Development Research Centre. The study's objective is to examine the social and reproductive health implications of the movement of these youngsters to southern Ghanaian cities and towns as to what extent such movements constitute a welcome strategy in response to parents' inability to financially take care of their children particularly their education in the northern sending regions. Using quantitative and qualitative analytical techniques, the study finds among other things that while some of the child migrants reduce their poverty by migrating to southern cities and towns, others return home with unplanned pregnancies and sometimes with terminal illnesses which render their migration socio-economically unproductive.

An examination of osteoarthritis in a medieval skeletal population from Sudanese Nubia.

B. Kyle. Department of Anthropology, The Ohio State University.

This study investigates osteoarthritis in skeletal remains from two cemeteries in Kulubnarti, Nubia, dating to the early and late Christian periods (550-750 AD and 1100-1450 AD, respectively). All vertebral elements, as well as eight articular joints (shoulders, elbows, wrists, hands, hip, knees, ankles, and feet), from 170 individuals were examined for presence and severity of osteoarthritis. Associations between joints were tested for significance by sex and age using chi-square and Kolmogorov-Smirnov statistical analyses.
The research revealed that osteoarthritis remained relatively constant at Kulubnarti throughout the Christian period. As expected, osteoarthritis was significantly correlated with age in this series. However, an atypical pattern of osteoarthritis arose between the sexes. In past studies, males have commonly shown greater levels of osteoarthritis in prevalence, severity, and age-at-onset. Kulubnarti females, however, demonstrate higher prevalence and greater severity than males for most articular joints. Sexual labor division may have produced Kulubnarti's sex difference in osteoarthritis. Historical records and other evidence indicate that women at Kulubnarti were responsible for a variety of demanding tasks, including cooking, cleaning, hauling water through rocky terrain, and producing pottery. They may also have been responsible for herding animals, plastering floors, and gathering firewood.

Optimization of method for compound specific isotope analysis of lipids extracted from archaeological bone.

A. Laffey[1], A.R. Zimmerman[2], M-Y Ahn[2], J.S. Krigbaum[1]. [1]Department of Anthropology, University of Florida, [2]Department of Geological Sciences, University of Florida.

Because of their distinct isotopic signature, lipids should be removed prior to isotopic analysis of archaeological bone for paleodietary analysis. However, with tools available for compound specific isotopic analysis, lipids, themselves, provide complimentary sources of dietary information. While soxhlet apparatus and ultrasonification are generally used, pressurized liquid extraction (PLE) provides a more efficient method for lipid extraction from bone. Using modern bovine and ancient human bone, we examine variables of sample size, grain size, organic solvent, temperature and pressure in combination with PLE to determine the optimal conditions for PLE lipid extraction. Further, we examine light stable isotopes of different fractions to assess heterogeneity of the sample.
Following extraction using a Dionex 300 Accelerated Solvent Extraction system, saponification, derivitization and quantification by gas chromatography, cholesterol was determined to be the single dominant lipid compound in modern bone. Optimum extraction efficiency was achieved (for a standard lipid compound: 98%) with PLE settings of 75°C, 1500 psi, and three cycles of solvent methylene chloride/methanol (2:1 v:v). For small sample sizes (<0.75 g), fine grain material (<250 □m) was extracted with greatest efficiency; however, extraction of larger sample amounts had no dependency on grain size. PLE extracts of only 0.25 g of bone yielded sufficient lipid for reliable quantification and isotopic analysis. Variation in cholesterol isotope signature among these sample materials will be discussed with respect to extraction variables and the potential of lipid isotopic analysis in paleodietary research.

Comparing the results of trace element analysis of human tissues using ICP-MS versus LA-ICP-MS.

J.E. Laffoon[1], L.A. Curet[2], P.R. Williams[2], W. Pestle[1], L. Dussubieux[2]. [1]Department of Anthropology, University of Illinois at Chicago, [2]Department of Anthropology, Field Museum of Natural History.

The analysis of concentrations of the trace elements Strontium and Barium relative to Calcium in human tissues (bone and teeth) is useful for inferences concerning paleo-dietary patterns and perhaps geographic origins. Trace element analysis of human remains using ICP-MS and traditional methods of sample preparation involving wet chemistry produce reliable results but require the destruction of samples.
This study presents the results of a pilot project assessing whether comparable results of trace element concentrations in human tissues could be attained utilizing LA-ICP-MS. Laser Ablation- Inductively Coupled Plasma- Mass Spectrometry offers the potential for performing trace element analysis in a minimally destructive manner, whereby the alteration of the surface of the material is not detectable by the unaided human eye.
Trace element analysis of human dental enamel from archaeological contexts from several sites in Puerto Rico was performed using both aforementioned approaches, 1) ICP-MS with traditional sample preparation protocols (wet chemistry) & 2) LA-ICP-MS with direct ablation of solid-state enamel. Interestingly, bone and dentine concentrations were quite similar for the same individual with either method. Ba/Sr concentrations of enamel varied significantly for some but not all individuals when comparing the results of one method versus the other. This may be the result of a tendency for wet chemistry to produce a more 'homogenized' signal compared to the micro-sampling inherent to laser ablation. In order to obtain results from LA-ICP-MS that are more comparable to that obtained through ICP-MS, more systematic micro-sampling of individual enamel crowns may need to be performed.

***In Vitro* Fermentation of Dietary Carbohydrates in African Monkeys and Apes.**

J.E. Lambert[1], V. Fellner[2]. [1]Department of Anthropology, University of Wisconsin – Madison, [2]Department of Animal Science, North Carolina State University.

Fermentation in vertebrate herbivore guts produces short chain fatty acids (SCFA) and microbial biomass that provide energy and protein to the host, however fermentation site alters contribution to animal requirements.

Among Primates, only Colobinae are foregut fermenters, all other species are hindgut fermenters. In forestomach fermentation, substrate energy is channeled from microbe to host metabolism, while in hindgut fermentation microbial protein is excreted. Thus, hindgut fermentation is often viewed as most adaptive for mammals relying on lower-fiber diets, and forestomach fermentation most efficient for consuming diets high in structural carbohydrates. However, these predictions remain largely untested for Primates. We measured SCFA profiles of 4 hindgut (*Gorilla gorilla, Pan troglodytes, Papio hamadryas*, *Cercopithecus neglectus*) and 1 foregut (*Colobus guereza*) fermenting species to determine whether differences in SCFA profiles exist between the two systems, whether colobines are advantaged in SCFA uptake, and whether captive-born and wild-caught primates differ in SCFA profiles as a function of gut inoculation circumstances. Fecal samples were collected at the North Carolina Zoological Park (2007). Samples were homogenized with buffer solution to prepare inoculum, added to culture bottles containing dietary substrates, and incubated at 37°C under strict anaerobic conditions. At five intervals, samples were analyzed for methane, pH, and SFA. Results indicate that at 48h, SCFA concentration was similar among species. However, *Colobus guereza* had comparatively greater acetate, lower butyrate, and substantially lower methane. Total SCFA did not differ between captive-born and wild-caught animals, although captive-born animals had lower acetate and significantly greater butyrate and methane.

The Social Underpinnings of Economic Decisions and Health Outcomes in the Age of Agriculture.

P. Lambert, Utah State University.

One of the most common explanations for declining health with the transition to agriculture is a change in the relative size and density of the population: as people shift to food production, they settle into permanent villages, their numbers increase, and health declines. Bioarchaeological research over the last thirty years has commonly documented this trend in both Old and New World contexts, and demonstrated the importance to human health of these demographic correlates of agriculture. There are, however, a number of studies reporting results at odds with this model, where health does not appear to parallel population-based predictions. These exceptions raise important questions about the other factors that may be influencing health in agricultural societies and those in transition.

In this paper, the skeletal remains of late prehistoric agriculturalists from two North American regions provide a basis for exploring the role of the social landscape in mediating economic behavior and thereby influencing health outcomes. Both population samples derive from small agricultural villages and both exhibit poorer health than skeletal samples from larger population centers in their respective regions. These data strongly suggest that population size and density do not explain poor health in these cases, at least directly. Rather, it is hypothesized that the subsistence strategies practiced by inhabitants of these villages were suboptimal for local conditions, and that social factors may have been responsible for decisions to pursue a riskier economy.

Historical patterns of birth seasonality in the United States.

J.H. Langdon, Human Biology Program, University of Indianapolis.

Seasonality of birth has been examined is a wide range of cultures. It is influenced by a variety of environmental and cultural variables, but their relative roles are not well understood. In this study the changing patterns of birth seasonality among samples from 1636 to 2004 in New England and the Midwest are examined. During this time period, an initial strong winter peak of births gradually disappears, while a late summer peak diminishes but persists into the 20th century. These patterns are examined in light of changes in seasonality of marriage, population health, urbanization, and the demographic transition; but none of these factors explain the shifts of seasonality. More elusive factors such as changing economic cycles and more effective contraception have probably been more important.

Functional gene polymorphisms in Canadian Aboriginal populations with high rates of tuberculosis

L. Larcombe. Department of Medical Microbiology, University of Manitoba

Canadian Aboriginal populations experience a high incidence of tuberculosis disease that has primarily been attributed to socioeconomic and environmental factors. However, the role of genetic polymorphisms which can affect the quality of the host immune response to infectious pathogens has not been explored in this context. Using a candidate gene approach, functional vitamin D receptor (VDR) and cytokine single nucleotide polymorphisms (SNPs) were examined in Aboriginal (Dené and Cree) and Caucasian cohorts. The Dené and Cree maintain a high frequency of the SNPs associated with low VDR function, low production of IFNγ (+874) and TNFα (-308), and high production of IL-6 (-174) as compared to the Caucasian cohort. Moreover, the Dené, who experience a very high rate of tuberculosis in Manitoba, maintain a SNP profile that is even more skewed than the Cree cohort. Given the important role of TNFα, IFNγ and vitamin D as key mediators facilitating macrophage containment of *M. tuberculosis,* and the opposing role IL-6 plays, then the observed cluster of ethnic allele variation may contribute to the high rate of tuberculosis observed in this population.

Ontogeny of locomotion in western lowland gorillas (*Gorilla gorilla gorilla*) I. Positional behavior and habitat use in captive environments.

R.M. LaRocque. Department of Anthropology, Northern Illinois University.

The African apes are important models in our interpretation of hominoid locomotor evolution. Locomotor features associated with terrestrial knuckle-walking are fundamental to our understanding of the origin of hominid bipedalism. This paper presents a detailed analysis of lowland gorilla positional behavior throughout ontogeny and in a variety of behavioral contexts by utilizing standardized positional mode descriptions of Hunt et al. (1996). One hundred and seventy-four hours of positional, social, and maintenance behaviors were collected at the Bronx (NY), Brookfield (IL), and Lincoln Park (IL) zoos using a continuous time sampling and instantaneous point sampling technique. Half of the data were collected on infants and juveniles and half on adults. Infants and juveniles unexpectedly exhibited two new locomotor and two new postural behaviors. This is the first quantitative study to examine the development of locomotion in western lowland gorillas and the terrestrial nature of these hominoids. *Gorilla gorilla gorilla* positional repertoire was primarily dominated by terrestrial pronograde quadrupedalism. This study reveals the ontogeny of locomotion in western lowland gorillas differs from that of mountain gorillas, chimpanzees, and bonobos. These findings have implications to our understanding of hominoid evolutionary history and the nature of terrestrial knuckle-walking adaptations in the African ape-human clade.

The role of primate hip extensors in diminishing forelimb forces during quadrupedalism.

S.G. Larson, J.T. Stern, Jr. Dept. of Anatomical Sciences, School of Medicine, Stony Brook University Medical Center.

Unlike most mammals, primates are known to support more weight on their hind limbs than on their forelimbs. While this has been attributed to a more posteriorly positioned center of gravity, mass distribution studies have shown that the center of mass of a quadrupedal monkey is located in about the same position as that of similarly sized nonprimate mammals. Reynolds (1985) has proposed that the greater degree of hind limb weight support seen in quadrupedal primates, especially those adapted to climbing/suspension, is due to an active weight shift toward their hind limbs by use of hip extensors. To test this hypothesis, electromyographic recordings were collected from the hip extensor muscles of chimpanzees, orangutans, patas and vervet

monkeys, and brown, ring-tailed, red-bellied and red-ruffed lemurs.
Like most nonprimate mammalian quadrupeds, the primates typically used their hip extensors through about the first two-thirds of the stance phase of quadrupedal walking. However, there was considerable variation in the amplitude of the muscle activity in the different primate species. By far the highest recruitment levels were observed in the orangutan. Though not as high as the orangutan, chimpanzee hip extensor recruitment was also significant. On the other hand, hip extensor activity levels in the monkeys and lemurs were more modest. We take this as evidence in support of the proposal by Reynolds that climbing/suspensory adapted primates use their hip extensors to actively shift weight to their hind limbs during quadrupedal walking as a means of sparing their forelimbs from disruptive locomotor forces. Research supported by NSF Grant BCS-0509190.

Testing for historical population bottlenecks in a wild lemur population (*Propithecus verreauxi verreauxi*).

R.R. Lawler[1], J.A. Parga[2], 1Department of Anthropology, Boston University, [2]Department of Anthropology, University of Toronto, Scarborough.

Population bottlenecks are of particular importance to issues in both conservation biology and adaptive evolution because they often reduce standing levels of genetic variation within a population. One way to estimate the impact of a population bottleneck is to calculate the effective population size of a population using the harmonic mean from a series of census points that span a crash-recovery period. However, this method only works if there are adequate historical census data for the time period in question. In the absence of historical data, an indirect means of detecting population bottlenecks is to compare allelic diversity against the average heterozygosity expected under mutation-drift equilibrium within a population. This comparison allows one to infer whether a population has undergone a recent population bottleneck (i.e., up to 2000 years ago). In this study, we test whether a wild population of sifaka residing in southwest Madagascar has undergone a population bottleneck in the last 2000 years. Our motivation stems from the widespread idea that the arrival of humans to Madagascar (in the last 1000 years or so) has likely shaped lemur population dynamics and potentially reduced genetic variation for some lemur populations via hunting and habitat disturbance. We use over 100 individuals, genotyped at seven microsatellite loci, in order to examine the potential for a recent population bottleneck under three different mutation models: stepwise, infinite alleles, and two-phase. All tests show that the sifaka population has not experienced a detectable population bottleneck. While this test does not negate that humans have impacted lemur populations upon arrival to Madagascar, it does show that for our population the signature of any potential disturbance is not recorded in the genetic diversity of this evolving lineage.

Examining natural selection in primate non-coding DNA.

H.A. Lawson[1,2], H. Akashi[3], K.M. Weiss[1], R.C. Hardison[2,4]. [1]Department of Anthropology, [2]Center for Comparative Genomics and Bioinformatics, [3]Department of Biology, and [4]Department of Biochemistry and Molecular Biology, The Pennsylvania State University.

It has long been speculated that adaptive changes in non-coding gene regulatory sequence, rather than in coding sequence, underlie many of the phenotypic differences between humans and other primates. Therefore, identification of non-coding regions bearing the signature of either positive or negative selection is an important step toward understanding the evolutionary history of humans and of other primate species.
To this end we have modified the McDonald-Kreitman test (1991) to examine molecular evolution in non-coding regions of DNA using a stringently filtered set of repeat sequences ancestral to catarrhines to represent neutrally evolving DNA. We use human polymorphism information and reckon divergence with both the chimpanzee (diverging about 6 mya) and the rhesus macaque (diverging about 23 mya) whole genome sequences. Analyses to date reveal that most regions significantly violating neutral expectations are, or have been, under strong negative selection. However, we find more significant regions suggestive of positive selection when divergence is reckoned with chimp (28%) than with rhesus (11%). Thus we are picking up different signatures of selection on different evolutionary time scales; this presumably reflects different adaptive histories among these lineages. Notably, these non-neutral regions span the entire genome. Preliminary investigations indicate some of these regions contain regulatory elements that are strong candidates for further experimental consideration.
Results from this study will contribute to our understanding of the role of gene regulation in human evolution, stimulating hypotheses that can be tested comparatively among primates and perhaps extrapolated to the fossil record.
This study was supported in part by NSF dissertation improvement grant BCS0550863 and by a Penn State RGSO dissertation support grant to HAL.

A comparative 3D micro-CT study of trabecular architecture in the second metacarpal of *Homo* and *Pan*.

R.A. Lazenby[1], M.M. Skinner[2,3], J.-J. Hublin[3], D.M.L. Cooper[4], B. Hallgrímsson[5]. [1]Anthropology Program, University of Northern British Columbia, [2]Hominid Paleobiology Doctoral Program, Department of Anthropology, The George Washington University, [3]Department of Human Evolution, Max-Planck-Institute for Evolutionary Anthropology, [4]Department of Anatomy and Cell Biology, University of Saskatchewan, [5]Department of Anatomy and Cell Biology, University of Calgary.

The discovery of the *Homo habilis* holotype (OH 7) associated with both Oldowan tools and *Paranthropus boisei* has spurred curiosity regarding the relationship of hand morphology to stone tool manufacture. Controlled flaking of stone demands the ability to firmly manipulate a core in one hand while striking it forcefully, yet safely, with a hammerstone in the other, a behavior not possessed by chimpanzees. This study asks whether trabecular microarchitecture in hand bones might suggest the presence of an appropriate manipulative capability for stone tool production. Micro-CT data were collected from 4.5 mm spherical VOIs in the head and base of 29 human and 10 chimpanzee (*Pan t. verus*) second metacarpals. K-W ANOVA and the coefficient of variation were used to assess taxonomic differences and variability in measures of mass and architecture.
In *Homo* the metacarpal head is characterized by significantly higher bone volume fraction; trabecular number; reduced separation; and greater isotropy (all $p < 0.000$). In the base, *Pan* possesses significantly greater connectivity ($p < 0.000$), thicker and more plate-like trabeculae ($p = 0.013$ and $p = 0.025$, respectively), as well as greater anisotropy ($P < 0.000$). Trabecular strength in the *Pan* distal epiphysis is augmented by hypertrophy of the cortical shell, not seen in *Homo*. In almost all instances, *Homo* exhibits 2x to 4x higher variances than *Pan*. These patterns are explicable with reference to the primary obligations of manipulation (*Homo*) and locomotion (*Pan*) and suggest criteria for the non-destructive study of lithic manufacturing capacity in fossil hominins.

Temporally related morphological trends in East African "robust" australopithecines.

J.A. Ledogar[1], F.E. Grine[2]. [1]Department of Anthropology Master's Program, Stony Brook University, [2]Departments of Anthropology and Anatomical Sciences, Stony Brook University.

Reconstructing the phyletic relationships among fossil hominin taxa has been a vexing task for paleoanthropologists. One particular source of disagreement involves the evolutionary relationships of the three species of "robust" australopithecines. Although many researchers agree that this group represents a monophyletic clade, others have argued that this group is paraphyletic or even polyphyletic. Specifically, there has been considerable debate over the relationships between the two species from East Africa,

namely *Paranthropus aethiopicus* and *P. boisei*. This study examined the dental, mandibular and cranial morphology of "robust" australopithecine fossils from a sequence of time-successive geological horizons in East Africa in order to assess if this group constitutes an anagenetic species lineage.
Although most characters used in this study were randomly variable throughout the lineage, five out of the 14 traits revealed anagenetic changes. These results support *P. aethiopicus* as the ancestral taxon to *P. boisei*. There is substantial evidence for punctuated equilibrium and stasis. However, *P. boisei* may not have been as static as previously thought. The results of this study suggest that several traits did, in fact, change anagenetically, but that the predominant mode of evolution between *P. aethiopicus* and *P. boisei* was punctuated equilibrium.
This research was supported by a Stony Brook University URECA summer fellowship.

Complicating the genetic histories of the Amazon: insights from the Yekuana.

E.J. Lee, D.A. Merriwether. Department of Anthropology, State University of New York, Binghamton.

The Amazonian rainforest has long been depicted as a homogenous pristine environment and its inhabitants were conceptualized as primitive people living in a manner of the past. The debates surrounding Amazonian ecology continue and many scholars now recognize that the indigenous people have shaped their environment through active engagement in historical events, rather than being simply influenced by external forces. While early demographic events in the region are poorly understood, it is possible to gain insights on more recent population history from the genetics of the region's inhabitants. This study examines the genetic history of the Yekuana who are located in the tributaries of the Rio Orinoco in southern Venezuela. Approximately 700 individuals from 13 villages are represented by 114 mitochondrial DNA lineages based on the control region. Twenty-eight haplotypes are identified, all of them assigned to New World haplogroups A, B, C, and D. These results are utilized to examine variation within the group and between villages and compared to past studies using lower resolution genetic data associated with historical events as well as other ethnographic information. This study shows the complexity of Amazonian demography and the dynamic historical processes that have shaped indigenous people today.

Evolution and development of the hominin brain

S.R. Leigh. Department of Anthropology, University of Illinois, Urbana-Champaign.

Recent genetic and fossil analyses have shed considerable light on the evolution of the hominin brain. However, the developmental bases of evolutionary changes in hominin brain size (cranial capacity) remain uncertain. This study investigates patterns of cranial capacity growth in selected fossil species, concentrating on *Homo erectus* and Neandertals.
Cranial capacities for fossil hominins are compared to a range of primate species. Regressions of cranial capacities against age enable assessment of size growth patterns. Proportional cranial capacities, measured by dividing juvenile sizes by the average adult values, are compared.
Absolute cranial capacity growth in *Australopithecus* cannot be distinguished from chimpanzees. However, absolute growth in *Homo erectus* resembles growth in *Homo sapiens* during the first year of life. Neandertals may show early attainment of adult cranial capacity relative to modern humans. Proportional measures of cranial capacity fail to show major differences among taxa.
These results illustrate complex patterns of cranial capacity size growth across hominins. Growth patterns may differ most within the genus *Homo* after the first post-natal year. These results may reflect significant changes in the distribution of the metabolic costs of brain growth and concomitant changes in maternal investment. Moreover, cognitive evolution may be most closely linked to later periods of human development.

Contributions of A. Roberto Frisancho to human population biology: An Introduction.

W.R. Leonard. Department of Anthropology, Northwestern University.

Over the span of his career, A. Roberto Frisancho has been one of the prime architects of the development and expansion of human population biology. His research and scholarly publications have helped to move the field beyond simple descriptions of human variation to address the nature and evolutionary origins of human biological diversity. Frisancho's early work in the Peruvian Andes elegantly demonstrated the importance of developmental acclimatization for promoting adaptive responses to the multiple stressors of high altitude environments. Since mid 1970s, he has played a major role in developing and expanding the use of anthropometric techniques for assessing physical growth and nutritional status. Frisancho's influential publications have helped to make the use of anthropometric methods commonplace in the fields of nutritional science and public health. Throughout his career, Frisancho's work has examined how environmental, genetic, and developmental factors interact to influence human health and nutritional status. His research has addressed topics ranging from the determinants of low birth weight infants in teenage mothers to the origins of obesity and associated metabolic diseases in Hispanic Americans. Both the breadth and impact of Frisancho's work have been truly remarkable. The field of human population biology owes much to the tremendous contributions of A. Roberto Frisancho.

Hominoid facial position variation within a phylogenetic context.

E.R. Leslie, B.T. Shea. Department of Cell and Molecular Biology, Northwestern University.

This is the first study to comprehensively test the hypothesis that the African hominoids (*Pan* and *Gorilla*) share a derived, ventrally positioned midface relative to the presumed primitive hominoid condition of a dorsally positioned midface seen in both *Pongo* and the lesser apes. Midfacial orientation is quantified in *Pan*, *Gorilla*, *Pongo*, *Symphalangus*, *Nomascus* and *Hylobates* by measuring the angles formed between the hard palate and four "vertical" registration planes: a perpendicular to the orbital axis, a perpendicular to the Frankfort horizontal, the posterior maxillary plane, and the posterior cranial base. Raw, interspecific adult mean angular values are contrasted using one-tailed *t* tests. Size-controlled comparisons are made between *Pan* and *Gorilla* using qualitative assessments of Lowess-smoothed ontogenetic trajectories of angular change relative to body size.
Pan and *Gorilla* exhibit significantly more ventrally positioned midfaces than *Pongo* or the hylobatids for all four midfacial angles with limited exceptions. The data provide very strong support for the African hominoid synapomorphy of a ventrally repositioned midface. Within the African apes, *Pan* midfaces are significantly more ventrally rotated than G*orilla* midfaces, but the growth trajectories for these taxa are roughly coincident for each angle and suggest the taxa follow similar trajectories for age-related changes in midfacial orientation. The size-controlled data do not support a fundamental divergence between *Pan* and *Gorilla* midfacial orientation.
These results have implications for the homology and polarity of facial position as a central feature of hominoid skull form and for evaluating alternative phylogenetic and evolutionary scenarios of hominoid evolution.

Issues of allometry in the scaling of the human brain.

K.P. Lewis[1], R.J. Smith[2]. [1]Department of Anthropology, Texas State University – San Marcos, [2]Department of Anthropology, Washington University in St. Louis.

The question of whether the human brain is simply a large primate brain has garnered some interest in recent years. One line of research in this area concerns the relative size of regions of interest (ROI) in the brains of primates, and tends to focus on inter-specific analyses. For the interpretation of inter-specific scaling, it is useful to understand patterns of intra-specific scaling.

Using published datasets, we have analyzed several ROIs in the brains of healthy human adults to examine both [1] relative scaling in the human brain and [2] variability in human brains. Allometric equations (OLS and RMA), correlation coefficients, and measures of variation are calculated for twenty-three ROIs in the human brain. For a few ROIs there appears to be consistency across studies (e.g., RMA slopes of lateral geniculate body against brain volume are 1.429 and 1.435 for two independent data sets with correlation coefficients of 0.83 in both cases), but more often there is a high level of variability in results among datasets that measure the same ROI. For example, RMA slopes for vermis against brain volume are 1.516 and 1.957, with correlation coefficients of 0.33 and 0.82. Similarly, RMA slopes of corpus callosum against brain volume are: 1.269, 1.833, and 1.593, with correlation coefficients of 0.20, 0.70 and 0.38. We address a number of these inconsistencies in the framework of measurement error and statistical bias.

Female dominance and monomorphism: are patterns of intersexual dominance influenced by sexual dimorphism?

R.J. Lewis, E.C. Kirk. Department of Anthropology, University of Texas-Austin.

Female dominance is hypothesized to be a lemuriform synapomorphy. Because "dominance" is a characteristic of a relationship between two individuals, it cannot be inherited directly. However, heritable traits such as body size and canine size may strongly influence dominance relationships. We examined the effect of sexual dimorphism (male size/female size) on sex-dependent dominance in primates. Our analysis of 73 species found that female dominant (median=0.994) and codominant (median=1.067) taxa exhibit significantly less body mass dimorphism than male dominant taxa (median=1.325; $p<0.001$). Our analysis of canine size dimorphism in 54 species also showed a similar pattern (medians=1.038, 1.174, 1.739; $p<0.001$). These results support the hypothesis that intersexual dominance follows patterns of sexual dimorphism in primates. Female dominance and codominance are probably influenced by intrasexual competition. When males do not have an advantage over females in body size or canine size, male dominance is less likely to occur and leverage (power based on inalienable resources rather than force) may play an important role in intersexual relationships. We conclude that (1) low body mass dimorphism is compatible with all 3 types of intersexual power, (2) reduced dimorphism is necessary but not sufficient for female power or codominance to occur, (3) high dimorphism is not compatible with female power or codominance, and (4) leverage may explain intersexual power relationships in species with low dimorphism. Accordingly, we argue that female power in lemurs is not anomalous because it evolves in the context of monomorphism.

In vitro bone strain in a macaque pelvis during hindlimb loading.

In vitro bone strain in a macaque pelvis during hindlimb loading.

K.L. Lewton[1], M.A. Spencer[1], N.R. Crawford[2]. [1]School of Human Evolution and Social Change, Institute of Human Origins, Arizona State University, [2]Spinal Biomechanics Research Laboratory, Barrow Neurological Institute, Phoenix, Arizona.

The bony pelvis is the major conduit for force transmission from the hindlimb to the vertebral column and its shape is expected to reflect the stresses it experiences during locomotion. However, the nature of stresses that occur in the non-human primate pelvis is unclear, and previous efforts to identify the functional significance of pelvic morphology have been limited by a lack of a theoretical framework of general principles of pelvic stress resistance.
To address this problem, strain patterns and magnitudes were determined in a defleshed adult *Macaca mulatta* pelvis during cycles of applied loading. Rosette strain gauges were affixed unilaterally to the os coxa, and load was applied via the femora using a servohydraulic materials testing system. Bone strains were recorded from full hindlimb flexion to full extension. Average maximum and minimum principal strains and peak shear strains were compared to identify 1) overall patterns of strain and load transmission and 2) regions that experience high strain.
Peak shear strains indicate that dorsoventral bending of the ilium and mediolateral compression of the pubic rami occur during unilateral loading. Contrary to previous suggestions that the pubis does not resist stress due to loading, the pubic rami consistently experience high magnitude strains and indicate this region plays an important role in stress resistance during loading. These data form the basis of a general biomechanical model of pelvic stress resistance that will inform hypotheses of pelvic adaptation.
This project was supported in part by a Sigma Xi Grant-in-Aid of Research awarded to KLL.

Admixture mapping genes for facial features in African Americans.

D.K. Liberton[1], K.A. Matthes[1], X. Mao[1], M. Thomas[2], T. Frudakis[2], M.D. Shriver[1]. [1]Department of Anthropology, Pennsylvania State University, [2]DNAPrint Genomics, Inc.

We are using a combination of morphological and genetic data to better understand the genes which determine normal variation in human facial features using population admixture as a source of genetic variation. Admixed populations are specifically well-suited to genetic analyses of traits that are different between the parental populations which gave rise to the admixed groups.

The study sample consists of 140 African Americans, aged 18-35. Three-dimensional photographs of faces were acquired using the 3dMDface imaging system (Atlanta, GA) and 22 standard anthropometric landmarks were placed on each image. Three-dimensional landmark coordinate data were collected using the 3dMD Patient software and analysed using Euclidean Distance Matrix Analysis. Significant differences were found in facial morphology between African-American males (N=53) and females (N=87), as well as between African-American and European individuals of the same sex. Maximum likelihood genetic ancestry estimates were obtained for each person using 176 ancestry informative markers, which allow for the proportional estimation of West African and European ancestry. Results from linear regressions indicate that ancestry estimates significantly correlate with principal coordinate axes one ($p<0.001$) and two ($p<0.001$) of morphological variation among facial features in African Americans. Seven candidate genes known to be involved in craniofacial disorders, which show high frequency differences between West African and European parental groups, were also genotyped. After controlling for the effects of variables such as sex, height and ancestry, admixture mapping was used to test for significant effects of genes on facial morphology.
Supported by grants: none

Functional, developmental and morphological integration: the case of the head and forelimb in bipedal hominins.

D.E. Lieberman[1], D.M. Bramble[2], D.A Raichlen[2], K.W. Whitcome[1]. [1]Department of Anthropology, Harvard University, [2]Department of Biology, University of Utah, [2]Department of Anthropology, University of Arizona.

Integration, a fundamental property of organisms, occurs via multiple mechanisms and for diverse reasons. Although there has been substantial work on the genetic and epigenetic mechanisms by which developmental integration occurs, we have less of an understanding of the evolutionary relationships between functional and developmental integration. In this respect, human evolution provides an interesting test case. In quadrupedal mammals, there is considerable functional integration among and between the limbs, but less integration between the limbs and the head. The evolution of bipedalism in hominins, however, provided a new opportunities for novel forms of integration by emancipating the forelimbs from any major role in locomotion. Here we consider how the forelimb and head become increasingly integrated in the genus *Homo* because of the biomechanical challenges of running. While the arm and the head interact little during walking, we have found that, during running, the stance side arm acts as a counterbalance to the head, stabilizing it

against impulsive pitching forces generated by the heel strike transient. Moreover, the functional properties of this linkage may have driven several developmental changes in the proportions of the arm and the anatomy of the shoulder girdle during human evolution. Thus, evolutionary changes in arm and head morphology during human evolution may be more integrated than previously considered. This work was supported by funding from NSF.

Cortical bone remodeling and trabecular architecture in Japanese macaques with degenerative joint disease

A.N. Lipps[1], S.C.Agarwal[1], P. Beauchesne[1], and Y.Hamada[2]. [1]Department of Anthropology, University of California, Berkeley, [2]Primate Research Institute, Kyoto University.

Degenerative joint diseases (DJD), specifically osteoarthritis and osteophytosis, have been observed to be inversely correlated with osteoporosis and have low incidence with fragility fracture. Further changes in trabecular architecture, such as increase in bone volume and connectivity, have been observed in subchondral bone regions underlying sclerotic joint surfaces in appendicular bones. However, little or no study has been made of trabecular architecture in pathological bones of the axial skeleton, such as the vertebrae. This study investigates the age and sex-related patterns of DJD alongside changes in trabecular architecture and cortical bone remodeling in the 7th lumbar vertebra and 4th rib of Japanese macaques. A total of 157 vertebrae (f= 99 m=58) were selected for study from adult *Macaca fuscata* with known age, sex, and reproductive history housed at the Primate Research Institute, Kyoto University, Japan. Cortical bone thickness and classic histomorphometry was performed on rib samples; vertebral bodies were scored for osteophytosis (VO) and apophyseal facets were scored for developmental severity of the characteristics associated with true osteoarthritis (OA). Trabecular microarchitecture was examined using High Resolution Peripheral Quantitative Computed Tomography (HR-pQCT) to investigate bone mineral density, bone structure, and connectivity. While there is an overall age-related decrease of bone structure and connectivity, old age monkeys show high levels of DJD and a consequent increase in bone volume, density and connectivity. Changes in trabecular architecture in pathological bones are not limited to the cortical endplates and are seen throughout the entire vertebral body. Observations of cortical bone remodeling in the rib of individuals with vertebral DJD are also presented. The implications of local or systemic bone remodeling with DJD is discussed.

Quantifying fetal spinal growth in a digital environment: A nonhuman primate study focused on reliability and reproducibility of employed methods.

R.M. Lisjak[1], G.E. Wilding[2], J.E. Sirianni[3]. [1,3]Department of Anthropology, University at Buffalo, [2]Department of Biostatistics, University at Buffalo.

Quantifying fetal spinal growth in a digital environment, via computed tomography (CT), is tested for reliability and reproducibility. The sample is comprised of 25 *Macaca nemestrina* (pig-tailed macaque) fetal specimens, ranging in age from 134 – 151 (+/- 1) gestational days. Vertebral bodies and intervertebral disc spaces of spinal levels C3 - L7 are measured using a digital measuring tool which is integrated within the imaging software program. All measurements are taken on the sagittal view and registration techniques are used on coronal and axial images to ascertain midvertebral body height (MVH). Relationships among vertebral body data are assessed by spinal region using Spearman's correlation coefficient. Analyses of each region of the spine (i.e. cervical, thoracic and lumbar) produced significant results with $P < 0.0001$. Mean intervertebral disc space height (IVD), as it relates to age, is not statistically significant ($P > 0.05$). Results are consistent with current research regarding adolescent human spinal growth. Summary statistics of interobserver error produce a mean interclass correlation (ICC) of 0.96 with 3 of the 150 variables failing to exceed 0.70. This pilot study demonstrates an effective method of obtaining reliable measurements for assessing spinal growth using digital CT reconstructions.
Supported in part by National Institutes of Health grants DE02918 and RR00166.

Patterns in head and forearm removal traumata during the Late Archaic in southern Indiana

R.A. Lockhart, C.W. Schmidt, Indiana Prehistory Laboratory, University of Indianapolis.

A single individual from each of three Late Archaic cemeteries in southern Indiana shows evidence of intentional removal of the head and/or a single forearm. This condition is not only compelling because of the nature of the mortuary treatment, but because there appears to be a specific means by which each element was removed. The eastern- and western-most cemeteries are over 50 miles apart and represent a time span of over 1,000 years. The three individuals (two males and one female) have decapitation cut marks on their cervical vertebrae. The manner in which these marks were made is similar in all three skeletons. The cuts are on the lateral aspects of the vertebrae and show evidence of both incisive and percussive strokes. The damage is usually greatest near the third cervical vertebra, but can extend to C4 and even C5. Likewise, the cutmarks on the distal humeri are remarkably similar. They only appear on the anterior aspect of the distal shaft just above the coronoid fossa and just above each epicondyle. These strokes apparently were meant to cut the biceps brachii tendon as well as the origins of the forearm flexors and extensors. Evidence is mounting that head and forearm removal was significantly ritualized and that the tradition of 'proper' bone removal persisted for nearly all of the Late Archaic period.

Female social relationships in *Gorilla gorilla* at Mondika.

J.L. Lodwick[1], D.M. Doran-Sheehy[2]. [1]Interdepartmental Doctoral Program in Anthropological Sciences, [2]Department of Anthropology, Stony Brook University.

Socioecological theory predicts that when females face strong within-group contest (WGC) competition, aggression over food will be selected for and related females will form alliances to defend resources. As a result, differences in female power will give rise to decided dominance relationships that are stable over time, due to life-long support from kin. In contrast, when WGC is weak, there is little aggression over food, females should not form alliances, and rank differences, if present, are not stable through time. The question we examine here is how intermediate levels of WGC, as seen in western gorillas, impact female social relationships. We recorded all aggression observed during all or half-day focal follows of adults in one gorilla group from 2003 to 2006. Results indicate that females were aggressive over food, particularly fruit, in contrast to mountain gorillas that face little WGC. More frequent aggression over food was associated with consistent dominance relations in the majority of female dyads, and these remained stable for at least 3 years. However, female coalitions occurred infrequently. Thus stable rank can be achieved and maintained in the absence of frequent coalitions, and in taxa that exhibit female natal and secondary dispersal in contrast to current theory. These results expand our understanding of socioecological theory by showing which behaviors decouple during moderate WGC, to produce unique patterns of female sociality. This research was funded by U.S. Fish and Wildlife Service and The Leakey Foundation.

Functional linkages and the independence of characters in cladistic analysis.

N. Lonergan. Center for the Advanced Study of Hominid Paleobiology, The George Washington University.

Cladistic methodology relies on the independent association of characters. A shared inheritance of morphological or molecular traits should indicate a relationship based on shared ancestry. If characters are inherited in sets, either as a consequence of an evolutionary constraint or the demands of function, the results of

cladistic analysis based on these characters may be inaccurate.
Several recent publications (i.e., Strait and Grine, 2004, Skelton and McHenry, 1998) have addressed the question of functional linkages in craniofacial characters, particularly those related to mastication, in the hominid lineage. This study evaluates the question of functional linkage in masticatory traits by comparing durophagous and non-durophagous taxa in two groups of catarrhine and platyrrhine monkeys. Co-occurring traits in the durophagous, but not the non-durophagous taxa would provide support for proposed functional linkages. The results of this study suggest that the proposed functional linkages in masticatory traits for hominids are not universally present outside of the hominid lineage, and that masticatory features have evolved in multiple ways in the different primate lineages, suggesting current cladistic analysis are not being hampered by dependent traits. Further investigation into functional linkages, including mechanical models for mastication, is suggested.

Allelic variability and tests for natural selection at the human *ALDH2* locus.

J.C. Long[1], C. Lewis[4], J. Li[1], R. Malhi[2], K. Hunley[3]. [1]Dept Human Genetics, Univ Michigan Medical Sch, Ann Arbor, MI; [2]Dept Anthropology, University of Illinois, Urbana, IL; [3]Dept Anthropology, University of New Mexico, Albuquerque, NM. [4]Dept Anthropology, Oklahoma, Norman, OK.

This research tests the hypothesis that natural selection has shaped variation at the human *ALDH2* gene locus. The enzyme product of this locus catalyzes aldehyde oxidation and is important in alcohol metabolism. *ALDH2* shows unusually high allelic differentiation among human populations. A deficiency variant, *ALDH2-2*, is common in Asians but absent in other populations. This observation implicates the action of natural selection. To test the neutral null hypothesis, we compare the *ALDH2-2* allele frequency to the extent of intraallelic variability.
We have sequenced 5 kb of DNA flanking the functional *ALDH2-2* substitution in a total of 123 people. These people represent sixteen populations, including four indigenous populations from each of four continental regions: Africa, Europe, Asia, and the Americas. We see *ALDH2-2* allele only Asians, and not on any other continent. We observe a common background substitution on *ALDH2-2*. This suggests an old age for *ALDH2-2*. An old age for the allele is consistent with its high frequency in Asians. However, it is important to examine variability at the locus in the context of the geographic structure of our species. To do this, we established neutral baselines for *ALDH2* sequence diversity in our world-wide sample by fitting nested population structure models to the CEPH microsatellite diversity data. In this light, the presence of intraallelic variability and a high allele frequency is inconsistent with the restriction of *ALDH2-2* to the Asian continent. Neutral evolution for *ALDH2-2* is unlikely.
Supported by NSF 0321610, all interpretations and conclusions are those of the authors.

Lemurs eating isotopes: a stable isotope analysis of ring-tailed lemurs (*Lemur catta*) and their menu at the Beza Mahafaly Special Reserve.

J.E. Loudon[1], D.C. Whitelaw[1], M. Sponheimer[1], M.L. Sauther[1], F.P. Cuozzo[2]. [1]Department of Anthropology, University of Colorado-Boulder, [2]Department of Anthropology, University of North Dakota.

This study examines the interplay between the isotopic values of ring-tailed lemurs (*Lemur catta*) and their diet at the Beza Mahafaly Special Reserve (BSMR) in southwest Madagascar. We analyzed $\delta^{13}C$ and $\delta^{15}N$ values of tail hair from 40 known individuals, all of whom are part of a longitudinal study and about which sex, health status, and group membership are known. The individuals came from groups with distinct habitats that differed with regard to canopy cover, extent of anthropogenic disturbance, and plant species composition. We also obtained C and N isotope ratio data for foods known to be consumed by *Lemur catta* comprising 175 plants samples representing 66 species in 34 families. The mean $\delta^{13}C$ and $\delta^{15}N$ values of the four lemur groups differed significantly ($P < 0.01$) and revealed differences between those that occupy habitats with closed vs. open canopies, among individuals that recently emigrated from their previous group, and in lemurs with compromised health status. We also examined the connection between traditional feeding ecology and isotope ecology studies by incorporating behavioral observations with isotope values.
Funding from Primate Conservation Incorporated, Margot Marsh Biodiversity Foundation, Association for Women in Science, National Science Foundation BCS 0621019 and 0525109, and the University of Colorado at Boulder's Museum is gratefully acknowledged.

Ontogeny of cranial features associated with wide jaw gapes in common marmosets (*Callithrix jacchus*).

A.L. Mork and C.J. Vinyard. Department of Anatomy and Skeletal Biology Research Focus Area, NEOUCOM.

Marmosets are unique among platyrrhines in habitually gouging trees with their anterior teeth to stimulate exudate flow. Furthermore, the jaw muscles and skulls of adult marmosets exhibit morphological features that facilitate biting at wide jaw gapes during gouging. Here we investigate the ontogeny of these features in marmoset skulls. Specifically, we hypothesize that because juvenile and subadult marmosets gouge trees, cranial features associated with wide gapes will be present early in ontogeny, as compared to skulls of non-gouging tamarins.
To better understand the ontogeny of cranial features in tree gouging marmosets, we measured four cranial dimensions associated with wide gapes and compared them to three dimensions related to load resistance in ontogenetic series of common marmosets (*Callithrix jacchus*, N=87*)* and saddle-backed tamarins (*Saguinus fuscicollis*, N=90). Ontogenetic series ranged from neonates to adults. All specimens were captive individuals housed at Oak Ridge Associated Universities' Colony.
Marmosets exhibit significant relative differences in cranial features linked to wide gape throughout ontogeny, relative to tamarins. Marmoset AP glenoid and condylar lengths grow faster than tamarins for a given jaw length (ANCOVA, $p<.005$). Marmoset condylar height is transposed below that for tamarins, whereas, AP mandibular length is transposed above (ANCOVA, $p<.001$). Conversely in tamarins, features associated with load resistance, such as corporal and symphyseal dimensions, either grow faster or are transposed above marmosets at a given jaw length during ontogeny (ANCOVA, $p<.001$).
These results support a hypothesis that, throughout ontogeny, marmosets exhibit cranial features that facilitate the generation of wide jaw gapes.
Supported by NSF (BCS-0412153, BCS-0094666).

Structural Constraints on Temporalis Size and Shape in Primates and Hominins.

L. Lucas[1], R. McCarthy[2]. [1]School of Human Evolution and Social Change, Arizona State University, [2]Department of Anthropology, Florida Atlantic University.

It has been argued that changing craniofacial proportions affect size and shape of the hominin masticatory system, including the temporalis muscle. Previous research has focused on the effect craniofacial form has on chewing biomechanics (and *vice versa*), but very little research has investigated structural or developmental integration in this region. Here we test whether changes in vault, brain and face size affect size of the temporalis muscle by reconfiguring the area available for muscle attachment.
To test these hypotheses, we collected 3-D landmark data from the vault, face, basicranium and inner perimeters of the temporal and infratemporal fossae of chimpanzees, gorillas, orangutans and modern humans, in addition to specimens of *Homo erectus*, archaic *Homo*, Neanderthals and Pleistocene *Homo sapiens*. We used multivariate regression analyses to determine the scaling relationships between sizes and shapes of the vault, face and temporal and

infratemporal fossae, and between these regions and cranial capacity.
In extant species, the temporal fossa exhibits a moderate but significant negative correlation with cranial capacity, but a strong isometric relationship with the face. In other words, in extant species the size of the temporalis muscle "keeps pace" with size of the face. However, Neanderthals and archaic *Homo* have smaller, and *H. erectus* larger, temporal fossae than expected, contradicting conclusions drawn from extant species. New evidence suggests that increases in encephalization have downstream effects on facial morphology (and consequently temporalis size and shape) because the brain, basicranium and face are tightly integrated with one another.
This research was made possible by the Ann Adams Graduate Fellowship awarded by the Department of Anthropology at Florida Atlantic University.

How enamel form may provide key information on the properties of fallback foods

P.W. Lucas[1], P. Constantino[1], B.A. Wood[1], B.R. Lawn[2]. [1]Department of Anthropology, George Washington University, [2]Materials Division, NIST.

A fracture mechanics argument is presented here to explain how the shape, size and structure of the enamel cap of a primate tooth is adapted so as to promote the fracture of food objects, while protecting the tooth from damage to itself. Fallback foods of primates often seem harder than items in the regular diet and it seems reasonable to suppose that they will have influenced the evolution of the dentition. It is suggested that an unevenly thick enamel cap, which possesses decussating rods deep to the tooth surface, represents an adaptation to a diet of hard abrasive food particles, since this form will minimize yielding and surface damage on the one hand, yet help prevent wholesale failure of the enamel on the other. We show here that foods such as seeds and dry fruits, which generally have hard outer casings, have evolved structures very similar to those seen in enamel. Thus, it appears that the same mechanical arguments can be applied to both the tooth and to the food particle that it contacts. Under certain circumstances, the forces involved in these collisions can be estimated and the likely sites of damage predicted. Some experimental evidence seems to support aspects of the theory, which if substantiated, would allow dietary interpretations of fossils from examination of the enamel.
We acknowledge funding from the GWU Strategic Plan for Academic Excellence. PC is supported by an NSF/IGERT grant no. 9987590.

Possible Macrocephaly in a Ptolemaic Child Mummy

T. M. Lucio[1], A. Nagy[2], S. L. Olsen[3], J.D. Towers, MD[4]. [1] University of Pittsburgh School of Medicine, [2] University of Pittsburgh Anthropology Dept., [3] Carnegie Museum of Natural History, [4] University of Pittsburgh Medical Center.

In May 2007, CT scanning of a Ptolemaic mummy from Abydos revealed that the young boy probably suffered from macrocephaly. The child was a member of a family burial in a chamber excavated at the Cemetery of Abydos, Egypt, in 1911-12 by T. Eric Peet, and dates to between 332-250BC. Age estimation based on dental growth and eruption placed the boy at about 3 years of age at the time of death.
Examination of 3-D CT scan images of the child's cranium indicated a large anterior fontanelle, delayed closure of the other fontanelles and metopic suture, as well as possible frontal bossing. On the basis of the cranial circumference, conditions of the fontanelles, and estimated age, it is proposed that the child suffered from some form of congenital cranial growth deformity. This particular type of craniofacial development is typical of hydrocephalus, as well as other congenital pathologies, and is a possible cause of death. Interpretation of the CT scan images was facilitated by the application of the software analysis program Stensor, which allows manipulation of extremely large data sets.
This research was made possible through a grant provided by the University of Pittsburgh School of Medicine.

The viability of mtDNA and STR analysis following chemical and heat maceration of human bone.

J.G. Luedtke, E.J. Lee, D.A. Merriwether, D.W. Steadman. Department of Anthropology, Binghamton University, SUNY.

Forensic anthropologists routinely macerate human bone for the purposes of identity and trauma analysis, yet genetic evidence could be destroyed by the heat and chemical treatments most commonly used. This project acts to quantify the effects of bone preparation techniques on both mtDNA and nuclear DNA of human skeletal remains. Twenty-four skeletal samples from six human amputated lower legs were subjected to eight chemical and heat maceration techniques. A control sample was maintained by mechanically removing the soft tissue. All bone samples were drilled and DNA was extracted within the Merriwether ancient DNA lab using a modified version of the FBI bone extraction protocol outlined in Isenberg (2005). Preliminary PCR data suggest the maceration techniques had little to no effect on mtDNA amplification, which is consistent with the findings following the preparation of 12 pig ribs (*Sus scrofa*) by Steadman et al. (2006). We will present the results of the STR analysis using the standard FBI STR protocol COfiler and PROfiler kits (Applied Biosystems) and mtDNA sequence analysis that that show both nuclear DNA and mtDNA viability and detect any possible contamination.

Use of logistic regression in population comparisons of health.

D J Lybarger[1], R J Wilson[2], [1]Department of Statistics, University of Tennessee, [2]Department of Anthropology, University of Tennessee.

Previous studies using the patterns of skeletal markers of stress have suggested an urban rural dichotomy in African American skeletal samples. These analyses used skeletal markers such as osteoarthritis, infection, porotic hyperostosis, and enamel hypoplasias to make paleopathological comparisons using methods such as Fisher's Exact test to differentiate populations based on locality. Looking at location without understanding the interaction of other variables such as height, age, and sex tends to mislead the researcher in concluding inaccurate trends. In order to avoid this, logistic regression was utilized to allow for a fuller understanding of the population dynamics and the interplay of the factors involved. Logistic regression's utility comes from its ability to regress several factors onto categorical/qualitative variables, such as most skeletal stress markers. We demonstrate the value of logistic regression for allowing more robust comparisons between populations using data derived from the Western Hemisphere Database for the Cedar Grove and the Freedman's cemetery samples and the Providence Baptist Church Cemetery sample gathered by the University of Tennessee. In doing so, we are able to discern that unlike the conventional percentages suggesting differences between the urban and rural environments, there is no significant difference between populations when accounting for other variables beyond the stress markers. An increase in methods that account for categorical data in bioarchaeological analyses can improve interpretations regarding African American health.

Phylogenetic analyses of behavior support existence of culture among wild chimpanzees.

S.J. Lycett[1], M. Collard[2], W.C. McGrew[3]. [1]British Academy Centenary Research Centre, SACE, University of Liverpool, UK, [2]Department of Archaeology, Simon Fraser University, Canada, and AHRC Centre for the Evolution of Cultural Diversity, University College, UK, [3]Leverhulme Centre for Human Evolutionary Studies, University of Cambridge, UK.

It has been suggested that variations in numerous behaviors among wild chimpanzee (*Pan troglodytes*) populations are the product of social learning mechanisms and, as such, represent culture. However, this claim has

been criticized on the grounds that the method used to support it—the method of exclusion—is incapable of satisfactorily excluding the possibility that genetic mechanisms are responsible for the behavioral differences. Here, we present the results of a study designed to test the hypothesis that the behaviors are genetically determined in such a way as to avoid the criticism leveled at the method of exclusion. We carried out two cladistic analyses of the major cross-site behavioral dataset (Whiten et al., 1999), one employing data from two subspecies, *P.t. verus* and *P.t. schweinfurthii*, and one utilizing data from just *P.t. schweinfurthii*. We then compared the resulting cladograms with published data on genetic diversity in *P. troglodytes*. We predicted that, if the behavioral patterns are the product of genetic differences, the behavioral data should exhibit a similar pattern to the genetic data. Specifically, the two subspecies dataset should be more highly structured than the one species dataset. The results of our analyses are inconsistent with the null hypothesis that the behavioral patterns in wild chimpanzee populations can be explained solely by genetic differences between subspecies. Rather, our results support suggestions that group-level behavioral patterns are the product of cultural evolutionary processes.

How lawyers and theologians can help save evolution without wearing a lab coat.

Rev. B.W. Lynn, Executive Director, Americans United for Separation of Church and State.

The interminable debate over human evolution has found fertile ground in our nation's public school science classrooms. Tension between those who believe in biblical creationism (or its cousin, "intelligent design") and those who accept evolution is not new, but it is becoming increasingly confusing and contentious. As religious objectors to teaching evolution become more adroit at hiding their true motives, lawyers and theologians can help clear the minefield currently standing between public school students and quality science education. Theologians, particularly of the Christian religion, need to help students, parents, and teachers understand why creationism is a religious belief. Sadly, it will not suffice for scientists to explain why creationism is not a scientific theory because too few people understand the method that renders faith unfalsifiable. Lawyers can simultaneously explain to these groups why teaching religion in public schools is unconstitutional. Lawyers must make clear that creationists do not have a "free speech," "equal access" or "academic freedom" right to teach religion as science. Creationism is *not* evolution's "equal;" thus, academics are not obligated to entertain junk science in the name of "academic freedom." Many scientists are understandably reluctant to debate creationists for fear it may legitimize a non-scientific "alternative" to evolution. Many lawyers and theologians are similarly hesitant to come to evolution's aid, lest they be faced with scientific-sounding arguments they cannot address. But it needn't be this way. By explaining creationism's religious foundation and its legal implications in public schools, theologians and lawyers can help save evolution without even wearing a lab coat.

Age evaluation of the living: using the Greulich and Pyle method

N. Lynnerup, E. Belart, K. Buch-Olsen, B. Sejrsen, Laboratory of Biological Anthropology, University of Copenhagen

We carry out age evaluations of the living requested by the police. The established procedure in these cases involves: 1) a physical examination; 2) odontological examination; and 3) carpal X-ray examination using the Greulich and Pyle (GP) method. We have made a retrospective study of all cases in 2000 - 2002, and carried out intra- and inter-observer tests of carpal X-rays in blind trials. The total retrospective study included 159 carpal X-rays. The age scores covered ages 11 years to 19 years.
Thirty randomly selected X-rays were first scored by us using the GP method. We scored the X-rays almost identically in intra-observer tests (overall 1-3 cases differing, each by 1 year). We then scored all the 159 carpal X-rays and compared the age score with the age score previously determined. There was complete agreement in 126/159 cases; the mean difference was 0.053 years (equivalent to approximately half a month). The cases pertained to individuals from the Middle East (48%), Sub-Saharan Africa (19%) and Eastern Europe (14%) and Asia (13%). The disagreement rate was highest for Sub-Saharan Africa and Central and East Europe. The mean difference was overall low, at the most 0.152 years for Asian cases.
Finally, we compared our age scores with the odontological age scores. Overall, it seems that age determination by the GP method tends to underage the individual as compared to the odontological examination, and this tendency is most pronounced of older juveniles, although the differences are not statistically significant..

Genetics of cardiovascular disease in minority populations.

J.W. MacCluer[1], S.A. Cole[1], A.G. Comuzzie[1], J. Blangero[1], B.V. Howard[2]. [1]Department of Genetics, Southwest Foundation for Biomedical Research, [2]MedStar Research Institute.

Cardiovascular disease (CVD) is a growing health problem in many minority populations, including Mexican Americans, American Indians, and Alaskan Eskimos. In studies of extended families in these three populations, we are working to identify genetic factors that influence risk of CVD and related traits and to understand the interactions of genes with environmental factors. The San Antonio Family Heart Study (SAFHS) is examining risk of CVD, diabetes, and obesity in >1400 members of 42 large Mexican American families in San Antonio; the Strong Heart Family Study involves >3800 individuals in 13 American Indian tribes in Arizona, Oklahoma, and the Dakotas, members of 96 families; and the study entitled Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN) includes >1200 Alaskan Eskimos in the Norton Sound region of Alaska, who are primarily members of a single extended family. For each family member in these three populations, risk factors have been measured, information on lifestyle and environmental variables has been collected, and DNA has been extracted from lymphocytes. >400 microsatellite markers have been genotyped for each individual and linkage analyses have identified numerous chromosomal regions that harbor quantitative trait loci (QTLs) influencing CVD risk factors. Fine mapping using single nucleotide polymorphisms (SNPs) is being done in regions with high LOD scores for specific disease risk factors, and efforts are underway to identify the relevant functional genes. Microarray expression phenotypes have been generated for >1200 SAFHS participants. Results of heritability and linkage analyses from these three studies will be briefly reviewed.

The effect of male presence on female chimpanzee feeding efficiency.

Z.P. Machanda. Department of Anthropology, Harvard University.

In many primate species, male dominance over females is known to negatively affect female feeding success and reproduction. Although such effects are expected in chimpanzees, previous studies present conflicting data with regards to this prediction. This study examines whether the effects of males on female feeding efficiency were positive, negative or neutral. Over the course of 13 months, adult females of the Sonso community in the Budongo Forest Reserve, Uganda were followed and detailed observations were taken of their feeding behavior. Matched samples of females feeding in the same fruit trees with or without adult males were compared for measurements of contest competition including displacements and aggression as well as feeding efficiency measurements such as intake rates. Results indicate that females experienced reduced feeding efficiency in the presence of males although there was no significant difference in the number of displacements or aggressive events. Interestingly, it appears that individual females varied in how they experience the cost of feeding with males and utilized different strategies for alleviating these costs.

Quantitative analysis of the primate first caudal vertebra.

A.E. MacKenzie. Department of Anthropology, University of Toronto.

Only a limited number of studies have been performed on the primate caudal region, despite the importance of the tail in primate behaviour and taxonomy. Six measurements of the first caudal vertebra were recorded from a sample of 32 primates, including strepsirrhines, platyrrhines, and catarrhines. These data were analysed using both univariate and multivariate statistical methods, and were compared to estimations of tail length for the purposes of predicting the length of the tail from primate skeletal remains.
It was determined that by using discriminant function analysis it is possible to discriminate among three categories of primate tail length (short, intermediate and long) using only six linear measurements of the first caudal vertebra. In addition, measurements of the inferior surface of the first caudal vertebral body were determined to be the most influential variables in estimating the length of the primate tail. These preliminary analyses are meant to build a frame of reference from which to help clarify our knowledge of the evolution of tail loss and reduction among the catarrhines, particularly the hominoids, and in general may contribute to a greater understanding of the morphology and positional behaviour of fossil primate species.

Which anthropometric measures best predict body fat percent measured by electrical bio-impedance?

L. Madrigal[1], E. Ruiz[1], M. Blell[2]. [1]University of South Florida, [2]University of Durham

Anthropometric measures are a favorite means to collect data in field studies, since electrical bio-impedance apparatus may be costly or may simply not be available because of logistic reasons (no electrical output or exhausted batteries). Therefore, it is of use to determine which anthropometric measures best predict fat content, as measured by bio-electrical impedance analysis (BIA). Here we report data on a study with a small group of adult male and female Indo-Costa Ricans, on whom we took standard anthropometric measures. Also, we collected data with a bioelectrical bioimpedance machine, which gave us measures of body fat percent, body water percent and lean body mass. The purpose of this paper is to determine which set of anthropometric variables best predicts body fat percent. Our results show that there is a significant positive correlation between BMI and the percent body fat (r_s=0.83370, df = 18, p< 0.001). The best model to predict body fat percent has five variables: -26.67 +0.20 (weight) + 0.28 (waist circumference)+0.28(hip circumference)+ 0.39(hip circumference)-1.44(mid-upper arm circumference)+0.62(triceps). This model is significant (F=18.71, def = 5, 18, p<0.001) and it has an adjusted R^2 of 0.83. The best six-variable model adds to these five variables height, but it has a lower adjusted R^2. Subscapular skinfolds were not entered in the best models. This study shows that a combination of traditional antropometric measures can approximate fat percent measures taken with a bioelectrical impedance apparatus. This project was funded by a University of South Florida Globalization Research Center.

Harris lines in the first metatarsal bones

B. Mafart. Antenne de l'Institut de Paléontologie humaine, Dpt Préhistoire, Muséum national d'histoire naturelle, UMR 5198, Technopole de l'Arbois, Aix-en-Provence, France.

Harris lines (HLs) are observed in the first metatarsal bones (FMBs) that are often better preserved than the tibias in archeological samples. We aimed to analyze the variability of HLs in FMBs, compare HLs in the FMBs and tibias, and determine the possible use of HLs in the FMB as stress markers.
We first studied 274 FMBs from the historic burial site at Notre-Dame-du-Bourg in Digne, France, selected within two archeological periods to highlight variations over time (11th-13thcenturies: 110; 16 th -17 th centuries: 164). Sex was determined by studying pelvic features (Bruzek's method). Samples were classified into three age groups by using Lovejoy's modified method: under 30, between 30 and 60, and more than 60 years. Further, 53 tibias from the same cemetery, 264 FMBs from 4 historical and 2 Neolithic sites were compared.
The bones were X-rayed using constant values of X-ray tube distance and radiographic parameters. HLs were defined as all narrow and dense lines extending across a quarter or more of the shaft width. The intraobserver, interobserver, side, and age-at-death variations were not significant. The prevalence of HLs was higher in the 16th-17th centuries sample, but no significant diachronic variations were observed between male and female samples. HLs in the tibias and FMBs were not statistically correlated. Comparison of the prevalence of HLs revealed significant differences between several samples, compatible witharcheological data. HLs in the FMBs exhibit significant intra- and interpopulation variations. However, further investigations are required to precisely determine their association with nonspecific stress.

Taking a closer look at the institutionalized: the late 19th century Colorado Insane Asylum.

A.L. Magennis[1] and M.G. Lacy[2], [1]Dept. of Anthropology, [2]Dept. of Sociology, Colorado State University.

In late 1879, Colorado opened it's State mental hospital. During the first 20 years of operation, nearly 2000 individuals were admitted. Slightly more than half were discharged after varying amounts of time, while about 500 died at the institution. A brief medical record kept by the asylum superintendent reveals key information about each individual including name, age, marital status, occupation, nativity, and mental illness diagnosis, or cause for admission. Using US census data as a control, we show that the patient population is not a direct reflection of the Colorado population. The medical records reveal that the vast majority of the men were laborers, miners, and farmers, while the women were domestics or housewives. For men, intemperance was an important cause for admission. Syphilis was an epidemic at this time, and it has been estimated that nearly 20% of admissions to mental institutions in the late 19th century would be due to the disease. We find, however, that only about 10-14% of patients at the asylum may have suffered from syphilis. Being single or widowed increased the risk of being admitted by nearly 1.3-2 times compared to those who were married, while males were at far greater risk of being admitted to the institution than females. Finally, immigrants, particularly female Irish immigrants, were at much higher risk of being institutionalized than were the native-born.

Identification of a distinct histomorphological feature of long bones: Potential applications in paleopathology and bioarchaeology.

C.M. Maggiano[1], I.S. Maggiano[2], H. Kierdorf[2], V. Tiesler Blos[3], S. Stout[1], M. Schultz[4]. [1]Dept. for Anthropology, Ohio State University, [2]Dept. for Biology, University of Hildesheim, [3]Dept. for Anthropology, Autonomous University of Yucatan, [4]Dept. for Anatomy, Georg-August-University Göttingen.

Regional variations in microarchitecture are known to affect local strength properties but are often difficult to observe or quantify. Specifically, the endosteal lamellar pocket (ELP) represents an example of easily distinguished micro-structural variation in the endocortex of long bones. In general, the ELP consists of one or several generations of dense endosteal lamellar growth. ELPs are notably devoid of Haversian systems in comparison to surrounding tissue and, instead, are vascularly organized by radially oriented Volkmann's canals. Preliminary observations have identified ELPs in mid-diaphyseal thin-ground sections of adult femora and humeri from Xcambó, Mexico, as well as the humeri and an ulna from the Dakhleh Oasis, Egypt. The ELP forms sometime during the second decade of life in roughly the same anatomical position in each individual. These observations suggest the ELP results from normal processes of long bone growth, specifically, modelling drift. As such, the ELP could provide evidence for periods of rapid change in long bone size and position during growth spurts. Should further investigations corroborate this

formation model, the ELP could also provide a record of rotational and transverse drift. Although ELP formation is likely governed by hormonal control, other ELP characteristics such as shape, exact position, osteon density, and the number or orientation of growth generations could provide information on mechanical demand augmenting occupational analyses. Further research is necessary to quantitatively measure the morphology of ELPs, determine their presence in other skeletal elements, and identify any co-variance between ELP characteristics and age, sex, or indicators of mechanical loading.

Two perspectives on occupational activity patterns: do examinations of entheses and cross-sectional data result in similar physical activity reconstructions?

I.S. Maggiano[1], C.M. Maggiano[2], V. Tiesler[3], H. Kierdorf[1], M. Schultz[4]. [1]Dept. for Biology, University of Hildesheim, [2]Dept. for Anthropology, Ohio State University, [3]Dept. for Anthropology, Autonomous University of Yucatan, [4]Dept. for Anatomy, Georg-August-University Göttingen.

It is uncommon for cross-sectional and muscle insertion analyses to be used on the same population. However, data obtained by these techniques should suggest similar general activity patterns (degree of sexual dimorphism and degree of bilateral asymmetry). We conducted both techniques independently in order to compare results. Two population samples were investigated, one from the Classic Maya site of Xcambó (Yucatán, Mexico, 350-700 AD) and one from the early medieval site Barbing-Kreuzberg (Bavaria, Germany, 300-500 AD). Data obtained by these two methods suggested distinct differences in the degree of sexual dimorphism and the degree of bilateral asymmetry and therefore support two different sets of conclusions regarding the same populations.
We suggest the following explanations as possible single or combined factors for the discrepancies found: 1) morphological analyses of muscle insertions is less objective than cross-sectional geometry; 2) muscle insertion expression is sometimes more difficult to interpret due to the influence of localized trauma; 3) enthesial characteristics are determined by repetitive contraction of one specific muscle, inducing local modification, while diaphyseal shape is determined by general bending conditions and overall effect of muscular systems; 4) occupational stress indicators investigated in this study may be affected differently by biological age. Until further research evaluates these possibilities, the study of physical activity patterns in archaeological contexts will be most benefited by simultaneous application of both techniques.

Ecological and life course effects on mid upper arm somatic muscle allocation and skeletal stature among Bangladeshi male migrants to the UK.

K.S. Magid[1], F.U. Ahamed[2], G.R. Bentley[3]. [1]Department of Anthropology, University College London, UK, [2]Department of Anthropology, University of Chittagong, Bangladesh [3]Department of Anthropology, Durham University, UK.

Life history theory predicts that selection will favour physiological mechanisms that efficiently regulate the allocation of energy and time between competing functions: reproduction, maintenance, storage and growth. Environmental conditions that lead to increased energetic availability will result in enhanced testosterone levels and anabolic muscle tissue in human males. While apportionment of somatic muscle tissue remains plastic throughout the human male life course, the effects of increased energy availability on muscle allocation are expected to be more pronounced in younger males compared with older males.
In our previous study, we demonstrated increased free testosterone among young male migrants from Bangladesh to the UK. In the present study we assess the effects of changes in energetic availability on morphology through measures of mid-upper arm muscle tissue in human males. Anthropometric measures of bone stature (standing height and arm length) and proxies of soft tissue somatic allocation (BMI, mid-upper arm area, mid upper arm muscle + bone area) were collected on adults aged >40 (n=28) and <40 (n=29) who migrated from Bangladesh to the UK aged 1 to 57 years. A group of sedentee males who have remained in Sylhet, Bangladesh all their lives (n=76) were used as a reference.
In line with our hypothesis, our results show that age at migration significantly predicted an increase in mid upper arm muscle tissue for males under the age of 40 years, but was not a significant predictor for males over the age of 40. These findings suggest the allocation of male anabolic muscle tissue is responsive to changes in energetic availability subject to age at migration.
Supported by the Prostate Research Campaign (UK), and ESRC (UK).

Genetics of cardiovascular disease in non-human primates.

M.C. Mahaney, A.G. Comuzzie. Department of Genetics and Southwest National Primate Research Center, Southwest Foundation for Biomedical Research, San Antonio, Texas USA.

While their relatively short life spans and ease of experimental manipulation have made small, inbred animals (e.g., rodents) popular model species for cardiovascular disease (CVD) genetics research, direct extrapolation of results from them to humans is frequently difficult. In contrast, the relevance to our own species of knowledge gained from the study of non-human primates – particularly macaques and baboons – is much more readily appreciated, given the greater genetic, anatomical and physiological similarity between them and humans.
We and our colleagues have investigated the genetics of CVD risk factors in captive, pedigreed baboons for nearly 25 years. We summarize our more salient results to date. Developed from studies of arterial pathology in response to dietary fat in a few animals, our research during the past 3 decades has used data from over 2000 baboons to detect and characterize the effects of genes and diet on dozens of biomarkers of lipid and lipoprotein cholesterol metabolism; inflammation and oxidative stress; hematological function; and CVD co-morbidities: e.g., obesity and diabetes. Using the first whole genome linkage map for a non-human primate (developed in these same animals), we have localized genes influencing variation in many of these traits to specific chromosomal regions with known human orthology. Now focusing on identification and functional analyses of detected genes, we are using many of the new tools that have become available since the completion of the human genome sequence project: e.g., whole-genome transcriptional profiling to prioritize candidate loci and identify networks of co-expressed genes in multiple tissues.
Research reported in this paper supported by grants from the National Institutes of Health, including: P51 RR0138986, P01 HL028972, R01 RR008781, R01 HL068922.

Anomalous enamel growth in a modern human molar.

P. Mahoney[1], C.A. Deter[2]. [1]Department of Archaeology, University of Sheffield, [2]Institute of Archaeology, University College London.

Histological studies of enamel growth rates in modern human molars usually subdivide the cusp into inner, mid, and outer regions, and then calculate average values for each region. Reports of these values have led to an emerging pattern, whereby growth begins slowly in the innermost region and is gradually accelerated towards the outer region. In general, this trajectory is also seen in other extant and fossil hominoids. Here, we calculate average growth rates in a permanent modern human molar cusp using more regions and show a different trajectory of enamel growth.
The unworn erupted molar was prepared and sectioned using standard methods. The sections were examined at 40x and 60x, digital images were taken, and short-period incremental lines were recorded within successive 60μm regions of enamel, beginning at the neonatal line and continuing to the outer enamel surface of the cusp tip, using image analysis software. The short-period lines were used to calculate an average daily rate of enamel secretion (DSR) for each region.
The DSR commenced at 2.51μm ±0.23, and gradually increased through the regions to

3.81µm ±0.27 over a period of 176 days. Following this, the DSR dropped sharply to 2.91µm ±0.21 over a period of 39 days. The DSR then gradually returned to 3.81um ±0.13 over a period of 121 days.
The gradual increase, sharp reduction, and slow recovery of enamel growth rates in this one individual do not follow the emerging trend reported for modern humans. While it is difficult to draw a firm conclusion about the cause of the anomalous enamel growth, similarities with non-dental skeletal responses to illness are explored.

Vertebral heights in the anatomical method for stature estimation.

H. Maijanen, University of Oulu, Finland.

There are different interpretations on how Fully (1956) measured vertebral heights in his original anatomical method for stature estimation. Thus researchers have taken various measurements, usually anterior midline height or maximum midline height (e.g. Lundy 1988; Formicola 1993). Most recently Raxter et al. (2006) introduced a new measurement: maximum height anywhere anterior to pedicles. The anterior and maximum height anywhere anterior to pedicles are subject to many visible changes: osteophytes, compressing and taphonomic factors that can make measuring difficult or inaccurate.
In this study on the W.M. Bass Donated Skeletal Collection different vertebral measurements (anterior, posterior, maximum and maximum height anywhere anterior to pedicles) are compared and their correlation to stature is studied. Preliminary results show that the posterior height, protected by the vertebral arch, is usually best preserved (39 of 93 white males have total spine length with intact heights, whereas the same number for anterior height is only 9). The sum of the posterior heights has the lowest correlation to stature for white males (r= .646 compared to the highest one, Raxter height, r= .742) but the highest for white females (r= .720, the lowest anterior height r= .635) with considerably smaller sample size.
Even though high correlation is important, other factors should also be taken into consideration. Should we simply use statistically most accurate method even if it includes measurements that are more often subject to measuring errors or less available and need more reconstruction than other measurements? This poster discusses these measurement options and their applicability in stature estimation.

Comparative analysis of the endocasts of fossil and modern strepsirhines using microtomography and 3D geometric morphometrics.

J.A. Makedonska[1,2]. [1]Department of Anthropology, University at Albany, [2] Laboratoire de Géobiologie, Biochronologie et Paléontologie Humaine, Université de Poitiers, France.

All extant primates share derived similarities in brain morphology relative to non-primate mammals. These traits can be reasonably interpreted as synapomorphies that evolved in the last common ancestor (LCA) of primates. This hypothesis can be tested in part by examining brain morphology in Eocene primates. Virtual endocasts constructed from CT scans of five fossil adapines attributed to *Adapis* and *Paleolemur* were compared to those of fourteen strepsirhine species, *Tarsius,* an insectivore and a didelphid. Geometric morphometric analysis of 22 landmarks confirms the Eocene onset of differential occipital area and neocortical expansion, characteristic of modern primates. These endocranial features along with medulla oblongata peculiarities place the Adapinae near extant lemuriformes. Temporal lobe and paleocortical morphologies, however, clearly separate fossil from modern taxa, thus suggesting cortical reorganizations during primate evolution. Given that adapines are likely to represent basal strepsirhines, parsimony analysis suggests the possibility that not all of the derived brain characteristics shared by living primates are synapomorphies that evolved in the primate LCA. Rather, some of these features may have evolved in parallel in haplorhines and living strepsirhines. This pattern of character evolution may have implications for hypotheses concerning primate origins. Among other variables, floccular size variation in adapines appears intriguing as flocculi are involved in gaze coordination during smooth pursuit eye movement and large floccular size may be adaptive in a fine branch environment. Further investigations on a larger mammalian sample are needed to elucidate the epoch-related shift in brain shape and test the importance of flocculi in primate evolution.

A predictive model for hominid lower limb length based on mean annual temperature, day range and body mass.

J. Maki, H. Pontzer. Department of Anthropology, Washington University in Saint Louis.

Body proportions of Late Pleistocene hominids have been argued to reflect trade-offs between climatic adaptations and locomotor efficiency. It has been shown that heat loss varies inversely with surface area to body mass ratio after taking into account body fat, and limb length is the primary predictor of cost of locomotion. Here we develop a predictive model for leg length in which the energy cost of longer legs, in terms of lost body heat, are traded off against the benefits of increased locomotor efficiency. This quantitative model is based on experimentally tested relationships between body proportions, heat loss, and locomotor cost. We find that evolutionarily optimal leg lengths are greatly affected by mean annual temperature, day range, and body mass. Intriguingly, this model accurately predicts reconstructed leg lengths for specific Neandertal and Early Modern Human populations given estimations of mean annual temperature, day range and body mass. This model may be useful for assessing selection pressures in earlier hominins as well.

Insight into the peopling of the Americas from whole-mtDNA genome analysis.

R.S. Malhi. Department of Anthropology, University of Illinois Urbana-Champaign

To investigate the pioneering phase in the Americas we analyzed a total of 623 complete mtDNAs from the Americas and Asia, including 20 new complete mtDNAs from the Americas and seven from Asia. This sequence data was used to direct high-resolution genotyping from 20 American and 26 Asian populations. Here we describe more genetic diversity within the founder population than was previously reported. The newly resolved phylogenetic structure suggests that ancestors of Native Americans paused when they reached Beringia, during which time New World founder lineages differentiated from their Asian sister-clades. This pause in movement was followed by a swift migration southward that distributed the founder types all the way to South America. The data also suggest more recent bi-directional gene flow between Siberia and the North American Arctic (Tamm et al., 2007).
Tamm E, Kivisild T, Reidla M, Metspalu M, Smith DG, et al. (2007) Beringian Standstill and Spread of Native American Founders. PLoS ONE 2(9): e829.

Characterization of primate head accelerations during locomotion: a novel application of 3D motion analysis with comparative implications.

M. Malinzak[1], R.F. Kay[1], E.L. Sims[2], and R. Queen[2]. [1]Department of Biological Anthropology and Anatomy, [2]Michael W. Krzyzewski Human Performance Lab, Duke University.

The inner ear functions as a biological accelerometer and participates in reflexes governing balance and gaze stabilization during movement. Accordingly, semicircular canal morphology may reflect locomotor demands. Several studies have sought to correlate semicircular canal shape with perceived locomotor agility: for their body size, seemingly more “agile” primates tend to have certain larger inner ear dimensions. So far, interpreting the adaptive significance of these morphological parameters has been limited by the qualitative nature of the locomotor assessments. To fill this gap, a novel approach has been developed to quantitatively determine linear and rotational head accelerations during locomotion.
This method employs six high-speed (120 Hz) infrared cameras to triangulate the 3D locations of reflective spheres. *Hapalemur*

griseus, *Eulemur fulvus*, *Lemur catta*, and *Varecia variegata* were selected to span a wide range of apparent agilities, locomotor preferences, and body masses available at the Duke Lemur Center. Each animal's head and back were fitted with reflective markers, and diverse locomotor behaviors were elicited. Analyses were performed using EvaRT5.0 and Visual3D software packages.
Employing these methods, this study provides the first measurement of 3D linear and rotational head accelerations during naturalistic primate locomotion. Digital tracking of the markers revealed complex patterns of head accelerations associated with movement on both raised supports and the ground. Results stemming from this technique will speak to the debated underpinnings of allometric scaling of the semicircular canal and the attendant validity of reconstructing locomotion in extinct primates.
This research was supported by Duke University.

The socioecology of Javan gibbons (*Hylobates moloch*): tests of competing hypotheses.

N.M. Malone, F.J. White. Department of Anthropology, University of Oregon.

We present data based on the systematic observation of Javan gibbons (*Hylobates moloch*) in the Cagar Alam Leuweung Sancang, West Java. Intragroup behavioral data from a cohesive group consisting of two adult males and a single reproductive female are contrasted with those from a neighboring uni-male/uni-female group. Behavioral profiles and intragroup social relationships are discerned from 202.5 hours of focal group scan data. A three-way ANOVA with multiple comparisons showed no significant differences in time spent feeding, foraging, and resting between 'groups' and 'sexes'. Within the multi-male/uni-female group, differences between males in the frequency of foraging and resting were significant ($F_{12,12}$=17.217, p=0.001, and $F_{12,12}$=13.15, p=0.001, respectively), attributable to a main effect of 'hours', or the scheduling of these activities in the daily program. Proximity maintenance data and intergroup interactions indicate important differences in social and ecological relationships among group members. Testing the hypotheses advanced for the evolution of pair bonding in gibbons demonstrates a nuanced pattern of social relationships in these hylobatid groups. The central tenets of hypotheses focused on the ecological constraints of group size are challenged by the presence (and acceptance) of an additional male in one group, and lack of significant differences in the basic behavioral allotments between females in multi-male and uni-male groups. Proximity maintenance data within the uni-male/uni-female group support a hypothesis that predicts male responsibility (i.e., mate guarding), while data from the multi-male/uni-female group are equivocal with respect to central hypotheses, which alternatively predict either female or male responsibility (i.e., infanticide protection or mate guarding, respectively).
We acknowledge the support of the Indonesian Institute of Science (LIPI), Konservasi Alam Nusantara (KONUS), Balai Konservasi Sumber Daya Alam (BKSDA), the Endangered Species Fund of the Chicago Zoological Society, Sigma Xi, the American Society of Primatologists, and the Center for Asian and Pacific Studies at the University of Oregon.

Thermoregulatory selection pressures and savanna chimpanzees: climatological data from Assirik, Senegal.

L.F. Marchant[1], W.C. McGrew[1,2], C.E.G. Tutin[3], P.J. Baldwin. [1]Department of Anthropology, Miami University, [2]Leverhulme Centre for Human Evolutionary Studies, Department of Biological Anthropology, University of Cambridge, [3]Centre for Ecology and Conservation, University of Exeter.

One prominent evolutionary model for human origins in the Pliocene involves thermoregulation, that is, adaptive response to heat stress. Hominins ranging over tropical landscapes dominated by grasses and deciduous, open woodlands faced strong solar radiation. Proposed adaptive responses to these evolutionary selection pressures include bipedality, hairlessness, sweating, etc. (Wheeler, 1994). Detailed climatological data for sites with other large-bodied hominoids living in similar environments are lacking. Here, we present 13 data-sets: maximum and minimum daily temperatures in gallery forest, open woodland, and short grassland; hourly average temperatures (07.00-19.00 hr) and humidity in forest, woodland, grassland, and unshaded grassland. These were collected over four annual cycles at Mt. Assirik, Niokolo-Koba National Park, Republic of Senegal, during a field study of wild chimpanzees (*Pan troglodytes verus*). (McGrew et al., 1981, presented data on only four of these 13 data-sets.)
Daily maximum temperatures averaged monthly never fell below 30°C, and average daily minimum temperatures rarely fell below 20°C. Mean daily maximum temperatures were highest in grassland, lowest in forest, and intermediate in woodland, but mean daily minimum temperatures did not differ across habitat-types. Hour-by-hour daytime temperatures differed similarly across habitat-types, with unshaded grassland being even hotter, especially in dry months after annual bushfires. Average humidity showed a reverse pattern, being consistently higher in forest vs. woodland vs. grassland, at all hours of sunlight over the annual cycle. In sum, hairy, large-bodied quadrupedal apes cope with heat stresses comparable to those likely to have been faced by Pliocene hominins.
Research funded by American Philosophical Society, Carnegie Trust for the Universities of Scotland, L.S.B. Leakey Foundation, Science Research Council (U.K.), Wenner-Gren Foundation of Anthropological Research.

Diaphyseal and joint properties of metacarpals and metatarsals of Hominoidea and their relationships with locomotor behavior.

D. Marchi. Dept. Biol. Anthrop. & Anatomy, Duke University.

In a previous study conducted on humerus, radius, ulna, femur, and tibia,Ruff (2002) found that great apes have larger joints surface areas relative to diaphyseal cross-sectional size than monkeys, and that associations between these structural proportions and locomotion can be demonstrated across hominoids. Here I want to determine if structural proportions of metacarpals and metatarsals are useful to distinguish locomotor modes within hominoids. To that purpose I compare distal joint surface areas and mid-diaphyseal cross-sectional properties (section modulus) of metacarpals and metatarsals in a sample of 85 hominoids (chimpanzee, gorilla, orangutan, and human). Both joint to shaft and metacarpal to metatarsal of the same ray proportions were calculated and compared between species.
Results show that orangutans have the greatest distal articular surfaces relative to mid-diaphyseal section modulus for both metacarpals and metatarsals, followed by African great apes. Humans show the lowest values. Differences among species are statistically significant. This is probably a consequence of the greater amount of mobility in the proximal phalanx/distal metacarpal or metatarsal articulations in great apes as compared to humans. Interlimb comparisons show the relatively greatest metacarpal distal joint in African great apes. This may be a consequence of the greater dorsiflexion of the fingers in African great apes during knuckle-walking locomotion.
These results are in agreement with results obtained using limb long bones and can be applicable to fossil material which is often fragmentary and requires that inferences on locomotion of extinct species be obtained from a single bone or a few bones.

Postmortem dismemberment and fire exposure: the identification of saw mark characteristics on burned bone.

S. Marciniak. Department of Anthropology, Trent University.

Previous cremation studies within the forensic literature have established that exposure to heat can distort the signatures of trauma. Research on the morphology of saw marks has not been integrated into studies of fire exposure. This is the first study to assess the degree to which skeletal elements dismembered with a saw will retain

diagnostic features of the particular saw when exposed to fire. It is an examination of the effect of burning on saw marks and the potential for class identification.
The sample consists of 36 adult pig hind limbs which were dismembered fleshed to approximate the condition of remains in a forensic context. Six handsaws and six power saws were used, with three limbs dismembered and burned for each of the saw types. Outdoor fires were created using hardwood and softwood for the limbs dismembered by each saw type. The temperature of the fires ranged from 384°C to 397°C and the duration of burning was between 27 and 44 minutes.
Results indicate that fire exposure affects the visibility and identifiability of saw mark striae, which is dependent on the nature of the striae pattern and the sawing action. The striae contour is observed as pronounced, visible, or faint depending upon the degree of burning and the colouration of the bone. Given the parameters of this study, however, it is possible to identify the class of saw based on the diagnostic characteristics present on the cremated bones. Future research should focus on the effect of burning at higher temperatures and longer duration on saw mark identification from bone.

Risks and odds ratios of becoming at-risk-of-overweight and overweight among migrant children in New Jersey.

D.L. Markowitz[1] and S. Cosminsky[2]. [1]Dept. of Geography and Anthropology, Rowan University, [2]Dept. of Sociology, Anthropology and Criminal Justice, Rutgers University, Camden.

A previous cross-sectional growth study (Markowitz and Cosminsky, 2005) has demonstrated that the prevalence of at-risk-of-overweight (22.3%) and overweight (20.1%) among children of migrant Mexican-American agricultural workers in New Jersey is extremely high (Markowitz and Cosminsky, 2005). To identify the subsamples most vulnerable to becoming at-risk-of-overweight and overweight, risk and odds ratios were calculated in a mixed, longitudinal growth study of 104 children, aged 2-17 drawn from the same sample.
While the risks were 10.3% for becoming at-risk-of-overweight and 9.1% for becoming overweight in the full sample, boys were 1.75 times more likely to become at-risk-of-overweight and over 2.5 times more likely to become overweight than girls. The odds of 2-5 year old boys and girls becoming at-risk-of-overweight were approximately equal, but boys were nearly 3 times as likely as girls to become overweight during that period. Among 6-11 year olds, boys were nearly twice as likely to become at-risk-of-overweight as girls but girls were 2.3 times more likely to become overweight than boys. Among 11-17-year-olds, the risks were approximately equal among boys and girls. From these results, it appears that overweight in boys is most likely to appear in the 2-5 year-old range, but for girls, the highest risk is between the ages of 6 and 11.
Identifying which subgroups of children are at greatest risk of becoming at-risk-of-overweight and overweight may guide future preventive interventions. Identifying those subgroups may also help in focusing future research on the cultural and behavioral factors that increase that risk.

On the value of anthropology for teaching about religion and science.

J.Marks. Department of Anthropology, UNC-Charlotte.

There is only one thing worse than teaching about evolution poorly; namely, teaching about religion poorly. As anthropologists since Malinowski have appreciated, religion is an integral part of people's existence, and is not readily segregated or compartmentalized apart from other facets of their lives and thoughts, as modern science has nevertheless come to insist. In this paper I will explore the bracketing of science (as the study of nature) apart from two neighboring intellectual realms on either side: the spiritual or supernatural realm, and the cultural or moral realm. On one side, the boundary between science and the spiritual order has come under periodic assault, sometimes by religious zealots hoping to find scientific support for their views, but more often by scientific zealots seeking to disprove supernatural ideas scientifically (in spite of the paradox thereby entailed). On the other side, the boundary between science and the moral order has come under periodic assault as well, sometimes by "anti-science" zealots, but more often, once again, as the result of insensitive actions on the part of scientific zealots, such as Josef Mengele, the notorious Auschwitz camp doctor, with a doctorate in physical anthropology. The training of scientists rarely explores the relations between science and its neighboring intellectual arenas, but the breadth of the field of anthropology affords a unique opportunity for doing so.

The impact of seasonality and fallback foods on Hadza hunter-gatherers.

F.W. Marlowe, J.C. Berbesque, Department of Anthropology, Florida State University.

The Hadza diet can be conveniently categorized into five main categories: tubers, berries, meat, baobab, and honey. Using photos of these foods, Hadza adults (28 women, 22 men) ranked them in order of preference. Honey, the most energy-dense food in nature, is ranked highest by both sexes. Tubers, as expected from their low caloric value, are ranked lowest by both sexes. We used kilograms of preferred foods arriving in camp across each of four seasons (early wet, late wet, early dry, late dry), as a minimum estimate of their availability. We show that more tubers are taken when more preferred foods are least available and that tubers fit the definition of fallback foods because they are the most continuously available but least preferred. We examined the impact of fallback foods by assessing variation in Body Mass Index and Percent Body Fat in relation to amount of tubers arriving in camp, as well as the proportion of tubers to more preferred foods. We found no significant variation in physical condition in men or women across season and argue that tubers are a reliable fallback food of sufficient quality to compensate for decreases in more preferred foods.
This research was supported by NSF grants 0544751, 0242455 to F.W. Marlowe.

Defining fallback foods and considering their importance in primate ecology and evolution.

A.J. Marshall. Department of Anthropology and Graduate Group in Ecology, University of California at Davis

Physical anthropologists use the term "fallback foods" to denote resources of relatively poor nutritional quality that become particularly important dietary components during periods when preferred foods are scarce. Fallback foods are becoming increasingly invoked as key selective forces that determine masticatory and digestive anatomy, influence grouping and ranging behavior, and underlie fundamental evolutionary processes such as speciation, extinction, and adaptation. The goals of this talk are to operationally define fallback foods; characterize their nutritional quality, availability in space and time, and patterns of usage; and consider whether and how they exert selective pressures that are distinct from preferred or commonly-eaten foods. In addition, I will discuss how the concept of fallback foods might inform our understanding of primate population ecology, social behavior, and life history. Finally, I will consider some potential future avenues of research which may improve our understanding of the evolutionary significance of fallback foods.

Analysis of secular change in the mandible.

D.C. Martin, M.E. Danforth. Dept. of Anthropology and Sociology, University of Southern Mississippi.

Several recent investigations have focused on secular changes in cranial size and morphology over the last century (eg, Wescott and Jantz 2005). In general, the vault was found to have become higher and narrower. Changes in the face were of smaller magnitude, but included an increase in height and a decrease in breadth. The present study addresses the effects of secular change in the mandible, particularly as they relate to those seen in the skull. Standard measurements were taken of 407 mandibles from the Terry and Hamann-Todd Collections, and measurements for an additional 656

mandibles were obtained from the University of Tennessee-Knoxville Forensic Collection database. The sample included both Blacks and Whites of both sexes. Dates of birth spanned from the mid 19th century to the latter half of the 20th century.
T-testing between collections by age/sex groupings showed statistically significant decreases in mandibular body width and bigonial breadth as well as significant increases in mandibular body length in nearly all comparisons. White males showed the greatest amount of change, and Black females, the least. Following Jantz and Jantz (2000), the measurements were also regressed on year of birth with a similar pattern of change emerging, particularly concerning body length. Overall, these findings support the conclusion that the mandible is transforming into a longer, narrower bone, paralleling many of the morphological shifts seen in the cranium. Potential effects of aging on mandibular metrics will be addressed.

Enamel defects in the deciduous dentition of the SunWatch (33 MY 57) skeletal sample.

S.A. Martin, P.W. Sciulli. Department of Anthropology, The Ohio State University.

Excavations at the SunWatch site, a 13th century Fort Ancient village located on the Miami River near Dayton, Ohio, have yielded the well preserved and virtually complete skeletal remains of 165 individuals. The present study concerns the analysis of enamel defects, linear enamel hypoplasia (LEH) and hypocalcification (HYCAL) in the deciduous dentition of 73 subadult individuals from the SunWatch site.
Each tooth in each individual was scored for the presence or absence of LEH and HYCAL. LEH was considered present if a linear area of interrupted matrix formation wider than the surrounding perikymata was present. HYCAL was scored as present if 'chalky' areas or bands of normal matrix thickness were present which could be scratched with a steel probe. The location of all defects was noted from either the cemento-enamel junction or the occlusal edge of the tooth. Generally, the incidence per individual of HYCAL (28.8%) is much greater than that of LEH (9.6%) with incisors (23.0%) and anterior premolars (m1, 22.9%) affected more commonly than canines (12.3%) or posterior premolars (m2, 14.0%). Defects occur overwhelmingly (83.7%) in dental development stage 1 (Sciulli, 2007) corresponding approximately to an age range of late prenatal to about 4 months. Differential selection is suggested in the analysis of the distribution of affected a normal individuals.

Detecting natural selection in modern human skulls.

N. Martínez-Abadías[1], M. Esparza[1], T. Sjøvold[2], R. González-José[3], M. Santos[4], M. Hernández[1] and C.P. Klingenberg[5]. [1]Unitat d'Antropologia, Dept. de Biologia Animal, Universitat de Barcelona,[2]Osteologiska enheten, Stockholms Universitet, [3]Centro Nacional Patagónico, Consejo Nacional de Investigaciones Científicas y Técnicas, [4]Dept. de Genètica i Microbiologia, Universitat Autònoma de Barcelona, [5]Faculty of Life Sciences, University of Manchester.

In human evolution selection is implicitly assumed to be one of the main forces driving evolutionary change and adaptation, but direct evidence of this is rarely available, especially for morphological traits such as skull shape. The main goal of this study is to assess how life-history and fitness measures relate to skull morphological variation, which is the most direct evidence of natural selection. To do this, we use a unique large collection of modern human skulls with genealogical associated data from Hallstatt (Austria). We combine morphological and demographical data and apply multivariate quantitative genetic methods to estimate selection on a three dimensional reconstruction of the skull morphology. Then, we compare the obtained selected pattern with the secular changes observed in this population over a period of almost 200 years. Our results show that selection significantly acted on the evolutionary changes observed in the skull morphology of the Hallstatt's population during the 18th and the 19th centuries. Indeed, we detect relatively strong directional selection on skull shape and weak stabilizing selection on skull size. However, we find that the expected responses to these selection regimes do not correspond to the actual evolutionary patterns of skull morphology. Therefore, these results emphasize the major role of selective forces both in human skull size and shape, but suggests that microevolutionary factors other than natural selection are also contributing to the evolution of the skull in the Hallstatt's population and these are obscuring the effects of natural selection.

Evaluating the stress response of black howler monkeys (*Alouatta pigra*) through fecal glucocorticoid metabolite measurements.

R. Martínez-Mota[1,2], C. Valdespino[2], R. Palme[3]. [1]Department of Anthropology, University of Illinois at Urbana-Champaign, [2]Instituto de Ecología, A.C., Xalapa, Mexico, [3]Institute of Biochemistry and Department of Natural Sciences, University of Veterinary Medicine, Vienna, Austria.

Studies focusing on the evaluation of the stress response of either human or non-human primates are of particular importance, because they help understand how stressors impact the health of individuals. Because metabolites of glucocorticoid hormones can be excreted in feces, researchers have used fecal hormone metabolites for assessing the stress response of free-ranging non human primates non-invasively. However, before applying this technique to a particular species, a crucial step is the validation of fecal glucocorticoid metabolite (FGCM) analyses to ensure their sensitivity to meaningful changes of adrenocortical activity. The purpose of this study was to validate the use of FGCM to assess the stress response of black howler monkeys, *Alouatta pigra*. Fecal samples of three males and one female housed at Chapultepec Zoo, Mexico DF, were collected before and after a stressful event (i.e. anesthesia). FGCM were determined with two group-specific 11-oxoetiocholanolone enzyme immunoassays (EIA's) which measure cortisol metabolites (one measures 11,17-dioxoandrostanes; the other corticoid metabolites with 5ß-3α-one structure). We found that both EIA's measured similar amounts of excreted FGCM (r_s=0.88, n=33, P<0.001). All individuals increased their FGCM after the stressful event with an initial rise at 24 hr, reaching peak concentrations at 72-96 hr post-stressor. In both basal and stress-induced concentrations there was individual variation. Our results suggest that FGCM, measured with group-specific immunoassays, can be used to monitor the stress response of black howler monkeys. However, the existence of differences in time to excretion, and the fact that the excreted amount of FGCM varies among individuals, highlight the importance of taking these factors into consideration for future studies on stress response in this species.

Effects of nickel and zinc administration on rabbit's compact bone: an experimental animal model.

M. Martiniaková[1], R. Omelka[2], B. Grosskopf[3], H. Chovancová[1], P. Massányi[4], P. Chrenek[1,5]. [1]Department of Zoology and Anthropology, [2]Department of Botany and Genetics, Constantine the Philosopher University in Nitra, Slovakia, [3]Institute of Zoology and Anthropology, Georg-August University in Göttingen, Germany, [4]Department of Animal Physiology, Slovak University of Agriculture in Nitra, Slovakia, [5]Slovak Agricultural Research Center in Nitra, Slovakia.

Pollution of the environment and contamination of humans and animals with trace elements represent serious problem in most countries. Nickel is naturally occurring element with oxidative effects on bone marrow. Zinc is an essential trace element required for normal bone metabolism. In our study we used rabbits as an animal model to investigate effects of Ni and Zn administration on compact bone.
Experimental animals were divided into three groups. In the first group rabbits were fed by 35g $NiCl_2$ per kg of body mass (group 1, n=5). In the second group 35g $NiCl_2$ per kg of body mass in combination with 30g $ZnCl_2$ per kg of the mass (group 2, n=5) were included into feedstuff. The group without administration of Ni and Zn was the control (group 3, n=5). Our results indicate there are no statistically significant differences in bone length and

bone weight between experimental groups (1, 2) and control group (3). Also, we did not identify changes in qualitative histological characteristics of the femora between rabbits from various groups, except for lower number of secondary osteons found in animals from experimental groups. On the other hand, some changes in quantitative histological characteristics of the compact bone were observed between experimental and control groups. Measured values for vascular canals of primary osteons and secondary osteons were significantly higher ($P<0.05$) in the second group as compared to the control group. Our results suggest that administration of Ni and Zn could cause changes in rabbit's compact bone structure.
Acknowledgment: This study was supported by the grants VEGA 1/2417/05 and KEGA 3/4032/06.

Morphological variation in the eye orbit among modern human populations

M.P. Masters. Department of Anthropology, The Ohio State University

This study examines variation in size, shape, and orientation of the eye orbit among major geographic populations of modern humans through the application of univariate and multivariate statistical procedures. Craniofacial measurements were taken on skulls of individuals from Western Europe, The Far East, and South Africa and analyzed to test a null hypothesis of no difference among groups in orbital morphology using ANOVA. Discriminant function analysis and Mahalanobis' distance (D^2) were used to examine the effectiveness of delineating groups using orbital variables, and to understand the pattern of dissimilarity between populations when multiple variables of the orbit are considered simultaneously. The results of this analysis indicate that significant differences exist among geographic populations in the volume ($p < 0.001$), depth ($p < 0.001$), and height to width ratio of the eye orbit ($p < 0.001$), as well as in its vertical orientation relative to the Frankfurt Horizontal Plane ($p = 0.018$). Discriminant analysis further illustrates these differences with an average True Group Classification of 70.3% using orbital measures, of which orbital volume is found to contribute most to group separation. The Mahalanobis' distance matrix reveals that characteristics of the eye orbit are most similar between the Asian and African groups ($D^2= 1.80745$), and most dissimilar between the Asian and European samples ($D^2= 3.70921$). However, the lowest D^2 value is between the Asian and European groups when cranial or facial variables are used, indicating that the eye orbit can differ markedly among populations that otherwise share a similar craniofacial morphology.
This research was funded in part by a Grant In Aid of Research from National Academy of Sciences, Administered by Sigma Xi.

Ranging behavior of white-fronted capuchins (*Cebus albifrons*) in the Ecuadorian Amazon: effects of resource use and intergroup interactions.

L.J. Matthews. Department of Anthropology, New York University, New York Consortium in Evolutionary Primatology.

This report is on the ranging behavior of white-fronted capuchin monkeys (*Cebus albifrons*) in Ecuador at the Tiputini Biodiversity Station, one location of Proyecto Primates headed by A. Di Fiore. I collected over 800 hours of ranging and feeding tree data on one group of *C. albifrons* from September 2005 to Sept. 2006. Using ArcGIS, I calculated travel distances from ranging points collected at 20 minute intervals. By employing models of linear and random movement, I test whether the degree of linearity of capuchin movements at Tiputini best can be accounted for by directed moves between fruit trees or avoidance of insect resource depletion.
I also incorporate ad lib data from intergroup encounters to estimate the degree of homerange overlap between *Cebus* groups at Tiputini, and to study the effect that intergroup encounters had on the group's ranging behavior generally. One clear pattern appears to be that avoidance of other groups is an overriding factor on ranging behaviors for the study group on any day that an intergroup encounter occurred. This may suggest that, for capuchin monkeys, selection from negative effects of intergroup conflict exceeded selection from the fitness consequences of maintaining efficient movement through and between foraging resources.
Fieldwork for this project was supported by an NYU MacCracken stipend. NYCEP grant NSF 0333415 (NYCEP IGERT) supported my time writing.

The effects and identification of diabetes mellitus in skeletal material

S.E. May. Department of Anthropology, University of Tennessee

The increasing prevalence of diabetes mellitus in the US population suggests greater representation of diabetic individuals in modern forensic contexts. This study proposes to examine manifestations of diabetes in bone, and to establish a suite of diagnostic characteristics which may be used to differentiate diabetes in post-mortem skeletal material. Two sample-groups were sourced from the William M. Bass Skeletal Collection, one with diagnosed diabetes and another with no history of the disease, and examined for four types of diabetic pathology: porosity, osteophytosis, osteomyelitis, and fractures. Applying univariate analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA), seven of twelve possible variables determined a significance difference between the diabetic and non-diabetic groups (at an $\alpha=0.05$ level). Logistic variable selection generated a five-variable model with optimal predictive value. This model includes variables: foot porosity, osteophytosis in the knee-joint and ankle, osteomyelitis, and foot fractures.
When used in logistic regression, the five-variable model produced a correct classification rate of 86%, with misclassifications of 14% (jack-knife justified). High levels of classification may be partially dependant upon the form of diabetes (type II) suffered by the adult sample population. False-positive violations occurred slightly more frequently, and may result from collinearity between diabetic indicators and unrelated skeletal markers. Results demonstrate the ability to identify diabetes in skeletal material; applicable to both forensic identification of unknown remains, and anthropological understanding of a modern pathological condition.

Dental evidence for subsistence strategies at the Mississippian site of Spiro Mounds, Oklahoma.

A.T. Mayes. Department of Anthropology, San Diego State University

Spiro Mounds has caught the imagination of generations of researchers and the general populace alike. Located on the Arkansas River in eastern Oklahoma, Spiro Mounds is an archaeological site of the Mississippian culture (1000 – 1450 AD). This paper addresses from a biological perspective previously proposed hypothesis that the use of maize as a primary means of subsistence was delayed in eastern Oklahoma and specifically at Spiro. Analysis of the dental pathology revealed an assorted pattern of moderate changes indicative of a population with a mixed subsistence economy and in transition to maize agriculture. Hypoplasias rates more closely resemble Late Woodland populations at 49%, caries rates are high at 57%, however the majority are small occlusal pits (75%). Eighteen percent of the population suffered antemortem tooth loss, but only 5% of the overall dentition was affected, followed by 10% of the population having periapical abscesses. Dental attrition was not severe, with the majority of dentition falling into the slight to moderate category (61%), however, there was posterior loading suggestive of agriculture. Comparisons to dental evidence from other contemporaneous eastern Oklahoma sites (Brues 1957, 1958, 1959; Buikstra 1973), as well as stable isotope analysis (Rogers 2007), add further support to an alternate sociocultural evolution on the periphery of the Mississippian sphere.

Voices out of the past: synthesizing Neanderthal speech.

R. McCarthy[1], A. Hammond[1], F. Yates[2], P. Lieberman[3]. [1]Department of Anthropology, Florida Atlantic University, [2]Temple University School of Medicine, [3]Department of Cognitive and Linguistic Sciences, Brown University.

Whether or not Neanderthals possessed a human-like capacity for speech is a contentious topic, not least because one of the primary determinants of voice quality, the vocal tract, does not fossilize. New reconstructions show that Neanderthals had vocal tracts in which the horizontal component (SVT_H, measured along the base of the cranium) was 30-70% longer than the vertical component (SVT_V, from the palate to the vocal folds of the larynx). While research on the acoustics of speech production indicates that a vocal tract with this shape is insufficient for producing quantal speech sounds resistant to articulatory error and perceptual confusion, other modeling studies suggest that Neanderthals could have possessed fully-articulate speech capabilities. To test these ideas we used formant and articulatory methods of speech synthesis to model speech for vocal tracts with human (1:1), Neanderthal (1.3:1, 1.7:1) and chimpanzee (2.3:1) proportions. In addition, we modeled the effect of a Neanderthal's large nasal cavity on voice intelligibility. Not surprisingly, a Neanderthal's voice is deep, countering previous claims that it would have been high-pitched. A large nasal cavity would have decreased the intelligibility of vowel-like sounds, and the combination of a long face, short neck, unequally-proportioned vocal tract and large nose make it highly unlikely that Neanderthals would have been able to produce quantal speech. Although Neanderthals undoubtedly spoke, the origin of quantal speech in our species sometime between 100,000 and 50,000 years ago provided a clear advantage in support of spoken language.
This research was supported in part by a grant from the Leakey Foundation to R.M.

Identification of an entepicondylar foramen on the humerus of an East African Miocene catarrhine.

M.L. McCrossin, B.R. Benefit, L. Gonzales. New Mexico State University.

We newly identify the presence of an entepicondylar foramen on a left distal humerus (KNM-MB 37427) from the middle Miocene of Maboko Island (Kenya). The size and anatomy of KNM-MB 37427 indicate that it represents the small-bodied "ape" once referred to *Micropithecus leakeyorum*.
The entepicondylar foramen is a bridge of bone on the medial portion of the distal humerus. Loss of this foramen is a synapomorphy uniting modern catarrhines (Cercopithecoidea and Hominoidea). All known East African Miocene catarrhines lack the entepicondylar foramen. In contrast, Propliopithecidae of the Egyptian Oligocene retain this primitive feature (as do platyrrhines). The only Miocene African catarrhine previously identified as retaining an entepicondylar foramen is an enigmatic form from the early-middle Miocene site of Moghara (Egypt).
Although there have been repeated suggestions that the Pliopithecidae derive from an African ancestor, there has been little or no fossil evidence in support of this model. Recently, a candidate African pliopithecid, *Lomorupithecus*, has been named from the early Miocene site of Napak (Uganda). *Lomorupithecus* is claimed to exhibit pliopithecid-like dental traits, but these are equivocal. The most distinctive characteristics of the pliopithecids (such as an incompletely ossified annular ectotympanic, pliopithecid triangles on lower molars, and an entepicondylar foramen) are not known for *Lomorupithecus*.
The retention of an entepicondylar foramen by the Maboko small-bodied "ape" demonstrates that it is new genus. While the primitive nature of the entepicondylar foramen on the Maboko small-bodied "ape" does not ally this genus with pliopithecids, its retention does not disbar it from pliopithecid affinity.

Evidence of eagle predation in fossil cercopithecids from the Humpata Plateau, southern Angola.

W.S. McGraw[1], C.C. Gilbert[2], E. Delson[3, 4, 5]. [1]Dept. of Anthropology, Ohio State University, [2]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University, [3]Dept. of Anthropology, Lehman College/CUNY, [4]Dept. of Vertebrate Paleontology, American Museum of Natural History, [5] New York Consortium in Evolutionary Primatology (NYCEP).

Several recent studies suggest a large raptor was responsible for collecting at least a portion of the primates from the South African fossil site of Taung, including its lone hominin, *Australopithecus africanus*. If raptors have been a strong selective force throughout primate evolution, the activities of large, carnivorous birds should also be detectable at other primate fossil localities in Africa. Over the last sixty years, a collection of extinct cercopithecids has been assembled from several cave breccias on the Humpata Plateau in southern Angola. The material, dated near the Plio-Pleistocene boundary, includes an assortment of cranio-dental and postcranial remains variably assigned to *Papio (Dinopithecus)* cf. *quadratirostris, Parapapio, Cercopithecoides* and/or *Theropithecus* We compare the Angolan and Taung material to remains of extant primates killed by crowned hawk eagles (*Stephanaoetus coronatus*) in the Ivory Coast's Tai National Park. Our analysis indicates that the size distribution and composition of fauna from the localities is quite similar and that there are striking consistencies in damage to the crania from each site. The absence of large bodied (> 20 kg) primates and other mammalian taxa at Taung and Tai and their rarity in Angola, combined with the strong likelihood that raptor nests were positioned near fissure openings at both fossil localities provides additional support for eagle involvement. Based on this evidence, we conclude that some of the Angolan cercopithecids were most likely raptor prey and that raptor predation has been a strong and underappreciated selective force during the course of primate evolution.

Lifetime reproductive output in a female common marmoset (*Callithrix jacchus*): a case study.

W.C. McGrew[1, 2], J. Barnett[1], [1]Department of Psychology, University of Stirling, [2]Leverhulme Centre for Human Evolutionary Studies, Department of Biological Anthropology, University of Cambridge.

The Callitrichidae (marmosets and tamarins) are the only litter-producing simian primates, so their fecundity is of special interest. Here we report on the reproduction of a female common marmoset who lived 13 years and gave birth 25 times, producing 64 offspring. She and her sole lifelong mate lived in the Primate Unit of the University of Stirling, Scotland. They had seven sets of twins, 16 sets of triplets, and 1 set of quadruplets. Despite triplets being the norm, 91% of offspring were live-born and full-term. Inter-birth intervals were remarkably constant, with the majority (yielding full-term pregnancies) lasting 154 (±2) days' length. Sex ratio of offspring was exactly 50:50. Infant survivorship dropped dramatically in the last quartile of births; the four known or suspected miscarriages occurred in each of the four quartiles. Despite triplet birth being the norm, only one set of triplets was successfully parentally reared; in all other cases neonatal mortality or removal reduced litter size to two. Even under optimal conditions, with a fertile female and a caregiving mate, the common marmoset is a obligate twinner; further complete life history data are needed to see if this generalises to other callitrichid species.

Backpedaling in human evolution – adaptive values of bipedalism in reverse.

J.K. McKee, A. Kolatorowicz, L. Reitsema, A. Ruth, S. Schlecht, O. Ulvi, T. Weston. Department of Anthropology, The Ohio State University.

Bipedalism and associated orthograde posture offer a number of selective advantages. One adaptive benefit that has eluded the literature is the unique way in which bipealism allows hominins to move in reverse. Whereas most mammals backpedal, few if any can do so with comparable quickness and agility. We hypothesize that rapid reverse motion may have provided a small but significant advantage for *Homo erectus* and later hominins.
Backward running today is relevant in many sports, particularly soccer, as one can move quickly across the field while keeping the eyes focused on play action. It is used in training, as it uses most of the same muscles as forward running, yet has less impact on the skeletal system. Vastus lateralis and vastus medialis are used more in backward

running. We hypothesize that fossil evidence will show these muscles to have evolved their full biomechanical advantage with the attainment of modern body size in *Homo erectus*. Moreover, it is at that stage that the vestibular system allowed for backpedaling with adequate agility.
In hunting and scavenging niches, the advantage of backpedaling is that one can retreat rapidly while still facing a predator or dangerous prey, before turning one's back and allowing attack. It has also been observed that running backward confuses animals, and thus would be significant in allowing greater distance for retreat or repositioning.
Thus, rapid backpedaling would not provide a selective advantage at the origins of bipedalism, but the morphological exaptations that allow such behavior would have had adaptive value.

Crop-raiding of mango fruits, *Mangifera indica*, by mantled howlers (*Alouatta palliata*) in the Refugio de Vida Silvestre Curú, Costa Rica.

T. McKinney[1] and C. Orozco Zamora[2]; [1]Department of Anthropology, The Ohio State University, [2]Instituto Internacional en Manejo y Conservación de Vida Silvstre (ICOMVIS), Universidad Nacional de Costa Rica.

The expansion of agriculture in many areas of the neotropics presents both obstacles and opportunities for primates living in increasingly deforested environments. Although there are relatively few reports of crop-raiding by neotropical primates, it is reasonable to expect that some platyrrhines are more likely candidates for crop exploitation than others. Howler monkeys, with their dietary flexibility, wide distributions, and ability to tolerate multiple habitats are good candidates for commensal living.
Here we report results from an eighteen-month study of *Alouatta palliata* at the Refugio de Vida Silvestre Curú in western Costa Rica. Howlers at Curú consume fruit in proportions similar to other *palliata* groups (39.86% of their total diet), however the vast majority of their fruit intake (77.24%) derives from the domestic mango, *Mangifera indica*. Mangos are by far the most important food source for these monkeys, comprising 22.76% of their total diet during the study period. The balance of the howler diet consists of naturally-occurring resources including *Anacardium excelsum* (9.19%), *Samanea saman* (8.27%), *Ficus* spp. (6.91%), and *Inga* spp. (5.67%). The availability of mango crop is limited to May through July, leading to a higher reliance on fruit in rainy season (53.17%) than dry season (24.55%). These data support the notion that howlers are ¨as frugiverous as possible and as foliverous as necessary¨ (Silver *et al*., 1998:273), and suggest that their use of agroecosystems be widely explored.

This study is supported by research grants from Earthwatch Institute, Conservation International, and The Ohio State University.

Sex assessment from metacarpals using the William M. Bass Skeletal Collection.

S.E. McManus[1], M.K. Spradley[2], J. Bennett Devlin[1]. [1]Department of Anthropology, The University of Tennessee, [2]Deparment of Anthropology, University of West Florida.

The assessment of sex is an important component in constructing a biological profile. Arguably techniques involving the pelvis and long bones are the best methods of determining sex, however in many cases these may not be available or suitable for analysis. As such, assessment of the reliability of other methods for accurately discerning sex is a necessary endeavor. The metacarpals have been examined towards the creation of both regression equations and discriminant functions for assigning sex with accuracy ranging from 74% to 94% (Scheuer and Elkington 1993; Smith 1996; Case and Ross 2007; Falsetti 1995; Stojanowski 1999). The present study sought to evaluate the utility of the metacarpal as an indicator of sex using a modern sample. A total of 74 individuals from the William M. Bass Donated Skeletal Collection were examined (32 white females and 42 white males). Eight measurements were collected on each element generating a total of 5,824 values. The measurements used were adapted from Smith (1996) and consisted of maximum and interarticular length, mediolateral and dorsopalmar base width, mediolateral and dorsopalmar head width, and mediolateral and dorsopalmar midshaft width. Discriminant functions were then generated. The 4th metacarpal was found to provide the highest accuracy when combining left and right sides, while the right 1st metacarpal produced the highest accuracy when considering left and right sides separately.

The human ecology of sleep: cross-cultural co-sleeping and childcare patterns.

P. McNamara, A. Kookoolis, N. Warwick, & V. Van Doren. Department of Neurology, Boston University.

McNamara (2002) hypothesized that maternal-infant co-sleeping facilitated mother-infant attachment and predicted ongoing maternal investment in offspring. To test this hypothesis, we studied patterns of co-sleeping and caretaking in the 186 human cultures represented in the Standard Cross Cultural Sample (SCCS). To measure ongoing maternal investment, we used 'age at weaning' and Rohner et al.'s (1982) 'parental care-taker and acceptance' ratings. After controlling for community size, inheritance pattern (patrilineal, matrilineal), and the presence or absence of polygyny, regression analysis (predicting years investment) revealed significant relationships between years investment and both maternal and paternal-infant co-sleeping patterns. Future analyses will involve tests of vertical descent and correlated evolution using phylogenetic analyses for co-sleeping and parental investment.
This work was supported by NIMH grant number 1R01MH070415-01A1 to P. McNamara, P.I.

Bringing up baby: Developmental simulation of adult cranial shape in *Rungwecebus kipunji*.

K.P. McNulty[1], M. Singleton[2], S.R. Frost[3], [1]Department of Anthropology, University of Minnesota, [2]Department of Anatomy, Chicago College of Osteopathic Medicine, Midwestern University, [3]Department of Anthropology, University of Oregon.

The highland mangabey, *Rungwecebus kipunji*, is currently represented by a single physical specimen, an M1-stage juvenile male. Analyses of the juvenile skull suggest the kipunji is morphologically distinct from other papionins; however, its immaturity prevents assessment of key taxonomic characters that are expressed only later in development. This study examines the kipunji's phenetic affinities using developmental simulation to estimate its adult cranial morphology. 3D craniometric landmarks and contours were collected on species of all papionin genera excluding *Theropithecus*. Species developmental vectors were calculated by multivariate regression of Procrustes-aligned coordinates against dental stage. Differences in developmental patterns were computed as the angles between pairs of species vectors and were tested for significance by permutation. The kipunji's adult cranial shape was estimated by applying vectors of developmental change to its juvenile landmark configuration. These adult models were subsequently compared to actual adult papionins using the Procrustes-distance metric. Comparisons of papionin developmental trajectories found differences between species to be small, indicating similar patterns of shape change during later stages of ontogeny. None of the angular differences between species vectors was significant. Consequently, estimates of the adult kipunji morphology using different species vectors were very similar. Compared to actual adult papionins, the kipunji simulations were most similar to *Cercocebus agilis* but very near other *Cercocebus* and *Lophocebus* species. This finding is consistent with analyses of the juvenile skull and suggests the kipunji preserves morphology present in the last common ancestor of African papionins. Taxonomic and phylogenetic implications will be discussed.
Financial and logistical support provided by NSF Research and Training Grant #BIR 9602234 (NYCEP), NSF Special Program Grant #ACI-9982351 (AMNH), Midwestern University, and the Field Museum.

Do Tana River mangabeys (*Cercocebus galeritus*) exhibit age differences in the diet that relate to diet item puncture and crushing resistance values?

R. Medeiros, J. Wieczkowski. Department of Anthropology, University of West Georgia.

Cercocebus mangabeys have powerful jaws that allow them access to hard fruit and seeds. The critically endangered Tana River mangabey (*C. galeritus*) consumes diet items with high puncture and crushing resistance values. To continue investigation of the role physical properties of diet items play in the feeding ecology of mangabeys, we asked if mangabeys exhibit age differences in the diet that relate to differences in resistance values. Three mangabey groups were followed for a year. Ten-minute scan samples every half-hour were used to collect data on age and diet. We used mean resistance values of diet items from an earlier study. Comparisons were made between infants and juveniles (juveniles) and sub-adults and adults (adults) to test if adults spend more time eating hard items, but not softer items, and if mean resistance is higher for items in the adult diet. Adults spent more time (20.6%) than juveniles (16.5%) eating hard seeds, although the difference was not significant, while they spent the same amount of time eating softer items. Adults had a higher mean resistance for diet items (10.2) than juveniles (9.4) although the difference was not significant. Several possible reasons exist for the lack of significant differences. Many diet items, even those with large means, had minimum resistance values of zero; for those diet items, younger individuals may preferentially eat softer fruits and seeds. In addition, because there is little information on mangabey skeletal and muscular development, large age categories may not be appropriate. Future studies should take both of these into account.
Funded by Wildlife Conservation Society, Margot Marsh Biodiversity Foundation, Conservation International's Primate Action Fund, Primate Conservation, Inc., and a University of West Georgia Sponsored Operations Faculty Research Enhancement Award.

The hallucal metatarsal in the evolution of the modern human foot.

D.J. Meldrum[1], R.E. Chapman[2]. [1]Dept. of Biological Sciences, Idaho State University, [2]Idaho Virtualization Laboratory, Idaho State University.

Among the few pedal remains of Pleistocene hominins is a hallucal metatarsal (KNM BK 63) attributed to *Homo ergaster* from Baringo District, Kenya (ca. 500 kya). It is most remarkable in its slender shape, in contrast to the modern human homolog, which is distinguished by its robustness. Primitive aspects of KNM BK 63 raise questions about the modernity of this hominin's gait, i.e. whether weight was transmitted differentially through the hallucal metatarsophalangeal joint in a distinct toe-off. Comparative morphometric analyses addressed the mosaic of primitive and derived features functionally correlated with either a flat flexible foot, or an arched foot associated with a push-off through the ball and first toe. Ten linear measurements of a sample of hallucal metatarsals for chimp, bonobo, lowland and mountain gorilla, and human were analyzed using PCA. Outline shapes of the distal articular surface of a small sample of hominids and KNM BK 63 were also digitized. Individual files were extracted using equally-spaced pseudolandmarks extracted between a set of true landmarks along the outline of the metatarsal head. Procustes analysis was conducted using both the Least Squares and Resistance Fit algorithms to generate average outlines and perform selected pair-wise comparisons. These confirm the intermediate aspects of KNM BK 63, especially in its robustness and distal articular morphology. These data have implications for the prevailing notions regarding the temporal pattern of the evolution of the modern human striding gait, and may indicate that this was a much more recent locomotor innovation than previously recognized.

Cemetery age distributions and modern fertility: estimating mortality, age structure, and annual growth from the paleodemographic record.

R.S. Meindl[1], R.P. Mensforth[2], C.O. Lovejoy[1]. [1]Depts. of Anthropology and Biomedical Sciences, Kent State U., [2]Dept. of Anthropology, Cleveland State U.

One problem in paleodemography is *osteological*, and involves bias in the estimation of skeletal age. Whenever traditional bony sites play a role in aging there is a tendency to under-estimate the age of the oldest decedents. However, there is a far more serious *demographic* issue. Each of a continuum of stable populations could have filled any given prehistoric cemetery with the same age proportions. When the assumption of stationarity (*i.e.*, when the Malthusian parameter r = 0) is imposed on an extinct population which in fact had been growing during the occupation of the site, life expectancy is systematically underestimated, sometimes by a spectacular margin. An analysis of the Late Woodland hunting-gathering-fishing population of the Libben site of Ottawa County, Ohio, is an attempt to address these two biases. Traditional methods of age estimation are used to establish the base of the cemetery age pyramid. However, to address the tendency for underaging adults, all mature skeletons were aged using only the auricular surface of the ilium. Ethnographic surveys provide total fertility performances of women in "colonizing" populations, particularly in Neotropical South America. To address the issue of unknown growth rate, these total fertilities are used to complete the paleodemographic reconstruction of the Libben people, providing estimates of average age structure and annual intrinsic growth similar to those of the Ache and the Yanomamo, but with mortality profiles wholly unlike those currently calculated for populations of similar economic status, geography, and age.

Loaded and spaced out: plasticity and function of the palate in rabbits, with implications for australopith facial form

R.A. Menegaz[1], S.V. Sublett[2], S.D. Figueroa[2], T.J. Hoffman[2,3], and M.J. Ravosa[1]. [1]Department of Pathology and Anatomical Sciences, University of Missouri School of Medicine, [2]VA Biomolecular Imaging Center, Harry S. Truman Memorial Veterans Hospital, [3]Department of Internal Medicine, University of Missouri School of Medicine.

Paranthropines possess a number of derived cranial features explained as adaptations for producing and countering increased masticatory stresses. Among these is a thickened hard palate, theorized to resist increased forces during unilateral biting and chewing. In addition to this mechanical model, 'spatial' hypotheses relate thickness to the developmental integration of the palate within the skull. This research utilizes genetically similar white rabbits (*Oryctolagus cuniculus*) to model the effects of diets of differing mechanical properties on palatal morphology. Ten weanlings were raised on an 'over-use' diet of rabbit pellets and hay blocks for 3.5 months, while an 'under-use' cohort of 10 weanlings was raised on powdered pellets for 3.5 months. In addition to a series of external dimensions, microcomputed tomography was used to quantify palate dimensions in the coronal plane at the level of the mesial, central, and distal postcanine dentition. Non-parametric statistics were used to characterize anatomical variation between treatment groups. Results indicate that, while there are subtle but nonsignificant ($p>0.05$) differences in palatal architecture between dietary cohorts, rabbits subjected to elevated masticatory loading develop hard palates with significantly increased bone volume (and thus decreased sinus volume). Over-use rabbits also tend to exhibit corresponding increases in cortical bone thickness. Contrary to prior assertions by McCollum, we cannot dismiss the role of mechanical loading in the determination of palatal form. Indeed, it is likely that spatial *and* functional factors underlie variation in palatal morphology. In sum, this study emphasizes the consideration of internal geometry when evaluating both mechanical and spatial models.

To be or not to be eaten: social behavior and interactions of a predated infant *Lemur catta* compared to her peers.

S.L. Meredith. School of Human Evolution and Social Change, Arizona State University.

Predation risk is influenced by both ecological and social factors, which may be especially important for older infants making the dietary and social transition to juvenility. Documented predation on known individuals of any age is rare, but one 3-month old infant *Lemur catta* was predated during a pilot study conducted on the free-ranging, provisioned population at St. Catherines Island, GA in summer 2006. Though the actual predation event was not witnessed, the behavior of the group upon observers' early morning contact with them and condition of the infant's recovered carcass led two experienced researchers to conclude that a predation event had occurred immediately prior to their arrival. Here, I compare the pre-mortem activity budget and social interactions of the predated infant to those of six others in her cohort. The predated infant was surprisingly similar to her peers: her nearest neighbor was usually her mother, she was approached by other group members at similar rates, and she did not spend either more time at greater distances from other group members or less time nursing than other infants. In contrast to the infant, the mother's behavior differed dramatically from all other mothers in her failure to show a strong bias toward maintaining her infant as her nearest neighbor. Although more detailed measures social interaction and ecological competence cannot be confidently derived from the limited data available, the broad behavioral measures presented here suggest that, ultimately, the infant's demise was likely related to deficits in the mother-infant relationship.

Species identification using ancient DNA.

D.A. Merriwether[1] and Jason A. Hodgson[2]. [1]Dept. Anthropology, Binghamton University SUNY, [2]Department of Anthropology, New York University

We have devised and optimized three sets of primers that work with a wide range of species that are ideal for species identification, as well as software to pick the closest published or available species to the sequences detected. These primers are designed to work with poor quality ancient DNA and forensic samples. We conducted double blind testing to see how accurately our method would work, and successfully identified all of the test samples. We believe this will be a very useful tool for archaeologists to identify faunal remains (including human remains).

Habitat fragmentation: valid conservation concern or misguided effort.

E.M. Mertz, D.C. Whitelaw. Department of Anthropology, University of Colorado at Boulder.

The processes of habitat loss and fragmentation are serious threats to the continued existence of regional and global biodiversity. As such, there is a massive research effort and body of literature targeted at evaluating the effects of habitat fragmentation on biodiversity. The extensiveness of this literature is only rivaled by its diversity. Various researchers measure and evaluate the process of fragmentation in many different ways resulting in different conclusions regarding both the magnitude and response (positive or negative) of biodiversity. Because of the diverse and vague use of the concept of 'fragmentation' within the ecological literature, the value of this term has recently been called into question. 'Forest fragmentation' is frequently used synonymously with 'habitat loss' thereby making these two terms inseparable and conceptually ambiguous. An important area of recent ecological research focuses on disentangling the effects of habitat composition (the amount of habitat) and landscape configuration (the spatial arrangement of the habitat) emphasizing that these two terms are not synonymous. Based on a recent review of the current uses of the term/concept of 'fragmentation' in the primatological literature, we argue that the focus of much primate research has been on habitat loss and not fragmentation *per se.* We present results suggesting that the effects of different spatial configurations of habitat across the landscape and its effects on primate species persistence remain largely unknown. This has important implications for the direction of future conservation endeavors.

Skeletal indications for distance locomotion in early *Homo erectus*.

M.R. Meyer. Department of Anthropology, Chaffey College

The recent discovery of several axial elements attributed to the D2700 hominid from Dmanisi offers an opportunity to compare locomotor patterns in early *Homo erectus* with other hominids. Cervical, thoracic and lumbar vertebral elements from D2700 were compared with those from 91 modern humans, 26 fossil hominids, 27 chimpanzees, and 22 gorillas.
Comparative analyses reveal systematic differences between D2700 and its evolutionary predecessors, suggesting the development of a new locomotor regime that included extended episodes of running. First, increased ventral cervical loading in the Dmanisi fossils matches the load pattern incurred by human runners, where the cranium forms an inverse pendulum relative to the thorax, producing anterior head acceleration and mandating posterior cervicomuscular counteraction at heel strike. Second, uncovertebral morphology in the D2700 indicates the uncoupling of the head and torso, releasing a constraint on efficient bipedal running seen in earlier species. Third, the ratio of estimated stature and bi-iliac breadth in D2700 reveals a shift to a linear somatotype well suited to efficient distance running in humans. Fourth, functional aspects of the D2700 axial skeleton reveal an aggregate morphology better suited to resist vertical compression, load bearing and distance travel than australopithecines. The Dmanisi axial skeleton reflects a distinct suite of human synapomorphisms that can only be compared to humans in functional terms, and may indicate the advent of efficient bipedal distance running. This study supports observations from other aspects of erectine postcrania, such as long legs and large femoral heads that reflect a greater commitment to long-range bipedalism.

The effects of deforestation on stress and reproductive hormone levels in red colobus monkeys (*Piliocolobus tephrosceles*).

K. M. Milich, R.M. Stumpf. Department of Anthropology, University of Illinois at Urbana-Champaign.

Ecological stressors are correlated with changes in hormone concentrations. These include both stress hormones (cortisol in primates) and reproductive hormones (e.g. progesterone in females and testosterone in males). This study examines the impacts of anthropogenic disturbances on hormone concentrations of wild red colobus monkeys (*Piliocolobus tephrosceles*) in and around Kibale National Park, Uganda. There are three main objectives to this study: 1) determine whether fecal or urine samples are a more reliable and practical way to collect hormone samples from wild primates; 2) explore how hormone concentrations change on a daily basis; 3) document how hormone concentrations correspond to habitat quality. The study includes six populations of red colobus including three from inside the park and three outside the park and resulted in the collection of 200 sets of urine and fecal samples from identified individuals. Concentrations of cortisol, testosterone (for males), and progesterone (for females) were analyzed for each sample. Additionally, the location of each group was recorded using Global Positioning Systems data points and later categorized using measures of location, size, and amount of disturbance from previously published data on the area (Gillespie and Chapman 2006) and remote sensing information. Hormone concentrations were compared for disturbed and undisturbed groups using pairwise analyses and stepwise multiple regressions. Additionally, within group and between group variation were compared. The results of this study have far reaching implications for primate conservation by providing a system in which hormones can be used to identify vulnerable populations of wild primates and assess future conservation needs.

A comparison of age estimations and burial records from a late nineteenth and early twentieth century almshouse cemetery.

C.F. Milligan[1], L.A. Devitt[2], and N.C. Sullivan[3]. [1]Department of Anthropology, Michigan State University, [2]Department of Anthropology, Southern Illinois University-Carbondale, [3]Department of Social and Cultural Sciences, Marquette University.

Between 1991 and 1992, a portion of the Milwaukee County Indigent Grounds (MCIG) cemetery was excavated. The cemetery was in use from 1882 until 1925. Those interred at the cemetery included residents from Milwaukee's various institutions, members of society unable to afford burial fees, as well as, unidentified remains from the coroner's office. The excavation yielded a total of 1,649 burials, 1,061 adult remains and 588 classified as subadult burials.
Of the adult remains, approximately half could be aged according to those methods outlined in *Standards for Data Collection from Human Skeleton Remains*. Secondary age indicators, such as dental wear patterns and the presence and degree of osteoarthritic changes, were also considered in the overall determination of age. This study looks at each of the age indicators and their relation to both preservation levels and the age-structure discerned from the burial records associated with the cemetery.
Differences in skeletal preservation determined, to a large extent, the applicability of aging methods. The biological analysis of the adult remains yields some differences based on sex among the number of individuals estimated as young (20-34), middle (35-49), and old (50+) adults. Male and female age estimations are compared with the burial record. Similarities can be found between the mean age at death for those interred at the MCIG cemetery and the mean age determined from the biological analysis. The relation of each of these comparisons to the variations in preservation and the trends of those interred in the cemetery are discussed.

Long-chain polyunsaturated fatty acid composition of milk from wild and captive living anthropoids: is human milk composition unique?

L.A. Milligan[1], R.P. Bazinet[2]. [1]Department of Anthropology, University of California, Santa Cruz, [2] Department of Nutritional Sciences, Faculty of Medicine, University of Toronto

Brain growth in mammals is associated with increased accretion of long-chain polyunsaturated fatty acids (LCPUFA) in cerebral cortex phospholipids. The period of maximum accumulation is during the brain growth spurt. Humans have a perinatal brain growth spurt, selectively accumulating 22:6n-3 and other LCPUFA from the third trimester through the second year of life. The emphasis on rapid postnatal brain growth and LCPUFA transfer during lactation has led to the suggestion that human milk LCPUFA composition may be unique. This study tests this hypothesis by determining LCPUFA composition for 14 anthropoid species [wild living (n = 28): *Alouatta paliatta, Callithrix jacchus, Gorilla beringei, Leontopithecus rosalia, Macaca sinica*; captive living (n = 58): *Callithrix jacchus, Cebus apella, Gorilla gorilla, Hylobates lar, Leontopithecus rosalia, Macaca mulatta, Pan troglodytes, Pan paniscus, Pongo pygmaeus, Saimiri boliviensis, Symphalangus syndactylus*].
LCPUFA in human and nonhuman anthropoid milk are intimately tied to dietary supply of these fatty acids. Milk LCPUFA profiles of captive living anthropoids (consuming diets with a preformed source of 22:6n-3) are similar to milk from women on a Western diet and those of wild living anthropoids are similar to milk from vegan women. The range of 22:6n-3 percent composition values from nonhuman anthropoid milks (0.03 – 1.1) is nearly identical to that from a cross-cultural analysis of human milk (0.06 – 1.4). Humans do not appear to be unique in their ability to secrete LCPUFA in milk but may be unique in their access to LCPUFA.
This project was funded by Wenner Gren Foundation Dissertation Fieldwork Grant 7360 and LSB Leakey Foundation Grant 1965.

Up a hill, down a mountain: change in ankle joint stability at Early Bronze Age Bab edh-Dhra', Jordan

S. Mimnaugh[1], J. Ullinger[2], D. Ortner[3], S.G. Sheridan[1]. [1]Dept. of Anthropology, University of Notre Dame; [2]Dept. of Anthropology, The Ohio State University; [3]National Museum of Natural History, Smithsonian Institution

Studying the biomechanics of the ankle joint can provide evidence of occupational and habitual stress in archaeological groups. Facet formation and enthesopathies of the calcaneus (n=358), talus (n=403), and distal tibia (n=67) were compared between the occupants of Early Bronze Age I (3600-3000 BC) and Early Bronze Age II-III (2950-2350 BC) Bab edh-Dhra' in Jordan. In comparing the first and second half of the EB I period, EB IA had significant male/female variation in the degree of stability at the talocalcaneal articular surfaces ($p=0.01$). EB IB showed higher joint stability reflected in the frequency of class III calcaneal facets ($p<0.005$) and significant left/right difference in extensions of the superior talar articular surfaces ($p=0.02$). Comparison of the combined EB I material to their EB II-III counterparts demonstrated a significant decrease in the frequency of right facets at the tibiotalar joint ($p<0.005$).
Since facets and enthesopathies are bony responses to the overuse of muscles that support foot stability, observed differences may demonstrate a shift in activity patterns associated with the transformation in terrain and occupation that accompanied a shift from to a semi-nomadic way of life to living in a fortified town. The Bab edh-Dhra' results were compared to other groups, such as the St. Stephen's Byzantine monastery collection (5th-7th C AD Jerusalem), hunter-gatherers from Chin-Tafidet (7000-6000 BP), a group from Iron Age Majorca, Spain (2430 BP), and a 9th-10th C AD early Slavic sample.
This research was supported by the University of Notre Dame/Smithsonian Institution Summer Internship in Anthropology program, the NSF-REU (SES 0649088) Summer Research in Biocultural Anthropology at Notre Dame, and the University's Institute for Scholarship in the Liberal Arts Undergraduate Research Opportunities Program.

Migration from medieval Europe to the Middle East with the crusades.

P.D. Mitchell[1], A.R. Millard[2]. [1]Faculty of Medicine, Imperial College London, UK, [2]Department of Archaeology, Durham University, UK.

During the 12th and 13th centuries thousands of people moved from Europe to the Middle East to fight, undertake pilgrimage, or settle and make a new life. We investigated three populations from the crusader kingdom of Jerusalem, to determine who was born in Europe and who came from the Middle East. Oxygen and strontium stable isotope analysis was performed on tooth enamel from skeletal remains excavated from crusader contexts. Twenty individuals from the coastal city of Caesarea (10 high status and 10 low status), three soldiers from the castle of Jacob's Ford, and two local Syrian Christian farmers from the village of Parvum Gerinum were analysed. Results were compared with known geographic values for oxygen and strontium isotopes.
Unexpectedly, the crusader city of Caesarea appears to have been almost entirely populated by people born in Europe (19/20), with very few born locally (1/20). Historians have presumed that geographic origin would have affected social status, but this was not the case. The soldiers from Jacob's Ford Castle included one from Europe, and two probably from the Middle East. Both controls from the farming village of Parvum Gerinum had spent their childhood in the area of the village, which matches our understanding of limited mobility among poor medieval farmers.
This is the first time that stable isotope analysis has been applied to the study the migration of peoples between medieval Europe and the Middle East at the time of the crusades.
This research was funded by the British Academy (Grant SG-39159)

The use of binocular cues in feline locomotion - consequences for primate evolution.

T.R.T. Mitchell[1], KL Bishop[2]. [1]Department of Biological Anthropology and Anatomy, Duke University, Durham, N.C. [2]Section of Evolution and Ecology, University of California, Davis, CA.

Binocular vision has played a prominent role in theories of primate origins. To date there is no comparative data on the utility of binocular vision for specific behaviors. Previous research demonstrated that binocular cues are important for *Lemur catta* during locomotion on uneven substrates (Mitchell et al. 2006). While this might be a strategy unique to primates, it could also be a general strategy employed by many mammals to traverse complex terrain.
To test this, three domestic cats were videotaped walking on flat boards and a series of unevenly spaced planks under monocular and binocular conditions. Like lemurs, cats do not exhibit any differences during walking on boards, but display a significant change in speed and alteration of wrist trajectory on uneven substrates. During monocular trials subjects decrease speed, lengthen the period of low vertical wrist velocity near the apex of the wrist's movement, and increase the period of low horizontal wrist velocity as the wrist descends.
The strikingly similar results for cats and lemurs suggest that the use of binocular cues to guide placement of the hands is not a uniquely primate ability. These additional cues could be useful to any animal moving through a complex environment, and might help explain why most mammals have moderate binocular vision. The fact that binocular cues are useful during locomotion on narrow substrates suggests the possibility that a large binocular field could be used by primates to guide the placement of long mobile forelimbs to the small discontinuous handholds in arboreal environments.

Mitochondrial DNA polymorphism and the evolution of human host defense

K.P. Mooder, Velda Consulting, Vancouver, BC, Canada

A complex dance between pathogen virulence and host response has existed since time began. While pathogens have adapted to produce virulence factors that serve to thwart destruction by the host, selective benefit is achieved by the host if the effects of pathogen virulence can be curtailed. There is strong evidence that many human genes playing roles in infection and immunity have evolved in response to pathogen exposure and many of these genes converge on cell-programmed death (*i.e.,* apoptosis) pathways. Given the role that the mitochondrion is observed to play in apoptosis, it is feasible that variation in the mitochondrial proteome, induced by polymorphism in both the nuclear and mitochondrial genomes, has also evolved in response to pathogen-induced selective pressures.
This study explores the hypothesis that historical differences in pathogen exposure between human populations has shaped the polymorphic variation observed today in genes encoding mitochondrial activity. This hypothesis will be tested by comparing signatures of mitochondrial polymorphism between human populations and overlaying these signatures on predicted differences in historical and present-day pathogen loads. In doing so, it may be possible to gain insight into the relationship of the mitochondrion to human host defense mechanisms. Furthermore, this study provides a biological framework to explore the role that DNA polymorphism may have played in the mass mortality observed to have occurred as a result of 'virgin soil' epidemics.

Functional adaptation: a view from in utero.

L.G. Moore, Wake Forest University and Univ.of Colorado at Denver/Health Sciences Center.

A major focus within biological anthropology has been to elucidate the processes of evolutionary adaptation. Roberto Frisancho drew attention to the importance of the functional relevance of human variation, thus helping to move anthropology to more mechanistic explanations of human adaptation. Using the natural laboratory of high altitude, he and others asked whether indigenous high-altitude residents exhibited unique adaptive capacities. Several such evolutionary adaptations have been proposed; the case is presented here that a particularly good example is indigenous population's resistance to hypoxia-associated reductions in birth weight. Carefully-controlled, recent studies of nearly 200 Andean vs. European residents of high and low altitudes in Bolivia demonstrate that pregnancy raises ventilation and arterial O_2 saturation similarly in Andean and European groups at high altitude. While subtle differences exist, the Andeans' protection from hypoxia-associated reductions in birth weight is not due to greater arterial O_2 content but rather to higher levels of uterine artery blood flow, the major determinant of O_2 delivery to the uteroplacental circulation. Specifically, Andean *vs.* European women had greater UA diameter, cross-sectional area and blood flow at week 36 (dia = 0.65$\pm$0.01 *vs.* 0.56$\pm$0.01 cm, area = 33.1$\pm$1.0 *vs.* 24.7$\pm$1.2 mm^2, flow = 743$\pm$87 *vs.* 474$\pm$36 mL/min respectively; all $p<0.05$) and thus 1.6-fold greater uteroplacental O_2 delivery near term (126.8 ± 18.5 *vs.* 80.3 ± 8.7 mL O_2/L blood/min, $p<0.05$). After adjusting for variation in gestational age, maternal height and parity, Andean babies weighed 209 gm more than the Europeans. Greater UA cross-sectional area at week 30 related positively to birth weight in Andeans but negatively in Europeans (Andeans' r = +0.39 and Europeans' r = -0.37, both $p<0.01$). We concluded that a greater pregnancy-associated increase in UA diameter raised UA blood flow and uteroplacental O_2 delivery in the Andeans that, in turn, helps maintain normal fetal growth under conditions of high-altitude hypoxia. These data implicate the existence of genetic factors in protecting multigenerational populations from hypoxia-associated reductions in fetal growth. Current studies are seeking to identify the specific genes involved.

Body mass estimation from the human skeleton in terms of paleopathology of the vertebrae, proximal tibia and heel spurs.

M.K. Moore, Doctoral Candidate, Department of Anthropology, University of Tennessee

The ability to estimate body mass from the human skeleton has received considerable attention, but previous research has failed to take into account extremes of body mass due to the restraints of research collections. The Bass Donated Skeletal Collection at the University of Tennessee in Knoxville offers a unique opportunity to study individuals of known age, height and weight. This study considers a subset of 128 white individuals normally distributed for age (mean age=55 years) and body mass index (mean BMI=28.4) for 83 males and 45 females. The variables chosen are bi-iliac breadth, heel spurs, diffuse idiopathic skeletal hyperostosis (DISH), width/breadth of the proximal tibia, osteoarthritic (OA) lipping and eburnation of the femoral head as well as for the proximal tibia for both the medial and lateral sides. Principal component analysis was used initially to check for outliers and for variable selection. Multivariate regression was run using the data for the right side only. The best multivariate model includes heel spurs, DISH, OA of the proximal right tibia m-l breadth and right medial lipping. Bi-iliac breadth was not selected within the top 10 variables for a multivariate equation. Using three variables to create a Multiple Regression Model, the R-squared value of 0.35 ($p<0.00$). (-14.163+ 5.803*DISH+ 3.205*Heel_Spur_R+4.980* Prox_RTib_m_L_breadth) These pathological indicators combined are less effective than univariate correlations of BMI with cross-sectional area of the femoral midshaft (R-squared=.67) and bone mineral density at the proximal femur (R-squared=.53) performed by the author in previous studies. The ability to estimate body mass from the skeleton is relevant to the sub-disciplines of forensic anthropology, bioarchaeology and paleoanthropology.

Walkers vs. non-walkers: a comparison of femoral neck cortical bone in humans.

M.M. Moran, Department of Anthropology, School of Biomedical Sciences, Kent State University.

The shape and distribution of cortical bone at the inferior and superior borders of the femoral neck are putative indications of bipedal locomotion. Their distribution differs in bipedal humans and quadrupedal primates, possibly reflecting these two different gait patterns. The distribution of inferior and superior borders of the femoral neck cortical bone differs in bipedal humans and quadrupedal primates, possibly reflecting

these two different gait patterns. We compared radiographs of normal individuals (Age 16-85; n=21) and non-walking individuals due to cerebral palsy or spina bifida (Age 16-42; n=8). The inferior femoral neck cortical bone and superior femoral neck cortical bone widths were recorded. Inferior and superior femoral neck cortex was measured with digital calipers. A ratio of superior cortical bone width to inferior cortical bone width x 100 was used to compare putative cortex in the femoral neck. We hypothesized that normals would exhibit thicker inferior femoral neck cortical bone. Normal walkers had a 47.2% difference in ratio of superior to inferior cortical bone; less than the 57.8% displayed in non-walkers. That non-walkers exhibit superior and inferior femoral neck cortices more similar in thickness than normal walkers was significant at 0.05 *(p*-value= .0345). This research adds to our understanding of the origins of bipedalism in the hominid fossil record.

Why do males remain and females stay faithful? The mating system and population dynamics of the Milne-Edward's sifaka.

T.L. Morelli, P.C. Wright. Department of Ecology and Evolution, Stony Brook University.

Patricia Wright and colleagues have been continuously following the endangered Milne-Edward's sifaka at Ranomafana National Park for over 20 years, leading to an abundance of information on its ecology, behavior, and conservation status. This presentation will, for the first time, present a synthesis of the information that has been gathered on the genetic relationships of the *Propithecus edwardsi* population. T. L. Morelli has analyzed DNA samples from over 50 individuals using 19 nuclear microsatellite markers and parentage analysis programs *CERVUS* and Kinship. She also sequenced many of these animals at the Major Histocompatibility Complex (MHC) exon 2. The extreme polymorphism of the MHC, hypothesized to increase immune function, is used as a comparison with neutral microsatellite variation.
The analyses in this study allow for an in-depth view of the population dynamics and mating system of *Propithecus edwardsi*. Despite groups with as many as eight individuals, results show that dominant males are siring all of the offspring in this population. T. L. Morelli will discuss the implications of these data, including why subordinate males stay in groups given the extreme male reproductive skew.
This study is supported by Edward Louis and the Henry Doorly Zoo, as well as Conservation International, The Leakey Foundation, Margot Marsh, NSF, and Primate Conservation, Inc.

Periosteal reaction in medieval populations from England: issues of sex and gender.

B.M. Morgan, A. L. Grauer. Department of Anthropology, Loyola University Chicago

As an indicator of systemic or localized infection, inflammation, or hemorrhagic processes, periosteal reaction on long bones have often been used to infer the presence of stress within populations. Collecting reported incidences of periosteal reaction from 46 medieval archaeological populations in England, the goal of this study was to determine if lesion frequency differed between women and men, and if the data could be used to make inferences about the social roles and lives of women. The results indicate that out of 17,217 individuals included in skeletal reports 1910 (9%) were recorded as displaying periosteal reaction. Of the 362 individuals displaying periosteal reaction for whom sex could be determined (and was reported), 141 (39%) were female and 221 (61%) were male (statistically significant p=<.0001). Within each sex it appears that 15.8% (141/892) of all females displayed periosteal reaction, while 17% (221/1296) of all males displayed the lesion. Although sample sizes decrease appreciably when both age and sex of the skeletons are assessed alongside lesion frequency, it appears that the greatest difference between frequency rates occurs within the age-at-death category 18-25 years old, with 10% of all females in that age group, and 32% of all males in that age group displaying periosteal lesions. These data along with historical and archaeological records are used to infer the potential sources of stress within the populations, with emphasis placed upon the possible roles that gender, environment and social conditions might play.

Emerging role of menstrual fluid as health indicator.

L.A. Morrison[1], S.G. Brown[2], [1]Department of Anthropology, [2]Department of Psychology,University of Hawaii at Hilo

Highlighted in this presentation are the various applications using menstrual fluid to assess women's immunological well-being. As part of a larger study investigating the adaptive significance of menstruation in women, we developed several methodologies to examine leukocytes and immunoglobulin A and M in menstrual fluid. Our methods of menstrual fluid collection are non-invasive and have potential for field applicability. We found a day effect in number of leukocytes with increasing leukocytes across Days 1, 2, and 3 of menstruation ($F(2,43) = 9.31$; $p < .0001$). We also found a statistically greater number of leukocytes in the menstrual fluid of oral contraceptive users versus women with natural hormone profiles. We developed a dilution process to conduct enzyme-linked immunosorbent assays (ELISAs) to test for IgA and IgM in menstrual fluid. In comparing menstrual fluid to venous blood, we found a significant positive correlation for IgA ($r = .74$; $p = 004$) and no relationship between the 2 fluids for IgM ($r = .12$; $p = .709$). This underscores the functional differences between menstrual and venous blood. The applications of these techniques to analyze menstrual fluid are unique, non-invasive, non-clinical, and informative regarding women's health. We are continuing this work by analyzing levels of oxytocin and ß-endorphins in menstrual fluid.
NIH grant #S06–GM0873-33.

Vibrissae, the infraorbital foramen, and maxillary mechanoreception: Exactly how special are primates?

M.N. Muchlinski. Department of Anthropology, University of Texas at Austin.

Vibrissae are specialized sensory "hairs" that respond to mechanical stimuli such as tension, pressure, and displacement. Sensory information from maxillary vibrissae is transmitted to the brain via the infraorbital nerve (ION), which passes through the infraorbital foramen (IOF). It is often assumed that IOF size is correlated with the number of maxillary vibrissae and (by proxy) with maxillary mechanoreceptive abilities. Previous analyses of IOF size have been interpreted as indicating that primates have fewer vibrissae than other mammals, and that haplorhines have fewer vibrissae than strepsirrhines. These assumptions have also been applied to phylogenetic and paleoecological studies of fossil crania. Although cross-sectional areas of the IOF and ION are indeed correlated, variation among mammals in the number of maxillary vibrissae has not been systematically studied. In this analysis, vibrissa counts and IOF areas were calculated for 239 mammalian species, including 75 primates. Results of a Spearman's Rho correlation indicate a significant ($p<0.0001$) relationship between size-corrected total number of vibrissae and size-corrected IOF area. However, there is a significant amount of scatter in the data, suggesting that vibrissa counts cannot be predicted from IOF area. Furthermore, although IOF area varies among mammalian groups, the results of this study show that there is no significant difference in vibrissa counts between primate suborders or between primates and other mammals.
This projected was funded by a by NSF DDIG 0622422, a Visiting Scholar Grant from the Field Museum of Natural History, and a PEO Scholar Award.

Human immune functions are energetically costly.

M. Muehlenbein. Department of Anthropology, Indiana University, Bloomington.

Immunological research has traditionally focused on clinical and molecular studies to characterize the structure and function of

various immune responses used for allostasis. More recently, immune functions have been analyzed using evolutionary and life history theories in an attempt to incorporate our understanding of immunology within contemporary human evolutionary anthropology. Such advances are not unexpected in light of the important roles that immune responses play in shaping evolutionary fitness. One resultant perspective hypothesizes that immune responses are likely involved in physiological trade-offs with other functions (i.e., reproduction), and therefore play central deterministic roles in life history evolution. A large body of research now concludes that development and activation of immune responses generates a substantial energetic burden, and from this we may conclude that such energetic burdens, like those generated from growth and reproduction, are subject to allocation mechanisms. Surprisingly, there is a paucity of data on the energetic demands of human immune functions relative to other species like rodents and birds. The present paper provides a critical review of the available comparative literature, specifically focusing on in vivo analyses of humans. Recent data illustrates how metabolic rates substantially increase in men during mild, acute upper respiratory tract infection. Data like this and others are consistent with the supposition that 'starving a fever' may not be in the best interest of our immune system.

The frequency and etiology of rib fractures in the skeletal remains of Washington DC's African American poor.

J.L. Muller. Dept. of Anthropology, Queens College (CUNY).

In both archaeological and modern contexts, ribs are frequently fractured, due to both repetitive stress and direct trauma. When adequate preservation allows, the application of a thorough understanding of rib fracture mechanics to skeletal samples may reveal significant information on the amount and direction of the force applied and the ultimate etiology of injury. The position of rib fractures speaks volumes to the mechanisms that produced them - relationships among ribs, sternum, and vertebrae create unique patterns in fracture location. Research on multiple rib fractures is critical to interpreting biological health since such fractures cause severe pain and can compromise respiratory mechanisms, predisposing individuals with pre-existing respiratory disease to respiratory failure. This study focuses on the frequency, distribution, and etiology of rib fractures in African American skeletal remains from the W. Montague Cobb skeletal collection. This collection provides both biological and archival records on the poorest of Washingtonians, living from the mid-19th century to the 1960's. Analysis reveals a relatively high frequency of rib fractures in the sample, with 7.91% (302/3,818) of all ribs fractured. One or more rib fractures are present in 38.05% of all individuals. The number of rib fractures per individual differs little between males and females, with mean frequencies of 4.05 and 3.43 respectively. In addition to reviewing the importance of rib fracture interpretation in skeletal samples, this study explores the possible contributions of both occupation and violence to rib fracture frequency in the sample.

Molecular genetic diversity of Yemeni populations and implications for global expansions.

C.J. Mulligan[1], R.L. Raaum[1], A. Al-Meeri[2], L. Sanchez[1], C. Blommel[1]. [1]Department of Anthropology, University of Florida, [2]Faculty of Medicine, Sana'a University

Yemen occupies a key position along the proposed southern migration route taken by anatomically modern humans out of Africa. Yemen has also been an important center of trade and scholarship throughout the Indian Basin with a record of continuous occupation from the Neolithic to the present day. Thus, many populations in East Africa and Southeast Asia may derive, in some part, from Yemeni sources. However, very few studies have focused on the molecular genetics of Yemeni populations and the relationship between Yemeni and other populations throughout the world. During spring, 2007, we collected over 550 saliva and dried blood spot samples throughout Yemen, representing the best collection of biological samples from southern Arabia. We have begun an analysis of these samples, including mitochondrial control region DNA sequence, Y chromosome single nucleotide polymorphisms and microsatellites, and nuclear *Alu* polymorphisms. Our initial research focuses on a sub-set of 50 samples distributed throughout Yemen that are being analyzed for all markers to enable a multi-genomic comparison of patterns of genetic diversity. We are also analyzing DNAs from the governates of eastern Mahra and northern Marib/al-Jawf (n ~ 70 and 30, respectively) to provide the first molecular genetic data from these isolated regions that occupy strategic locations, both ancient and historically, in the expansion events out of southern Arabia.

Genetic analyses of *Mcyobacterium tuberculosis* strains in Kansas.

J.F. Munger[1], P. Griffin[2], M.H. Crawford[1], A.J. Redd[1]. [1]Department of Anthropology, University of Kansas, [2]Kansas Department of Health and Environment.

In this study we analyze genetic data from *Mycobacterium tuberculosis* (Mtb) strains in Kansas, which have been genotyped for the Kansas Department of Health and Environment, to provide insight into their genetic diversity and evolutionary origins. In the United States all active Mtb infections are DNA typed for two systems: spoligotypes, and mycobacterial interspersed repetitive units (MIRU). Spoligotyping targets 43 locations in the direct repeat region of Mtb. MIRUs assay variability in 12 minisatellite loci. Our sample includes 143 individuals from 2004-2006, in the state of Kansas. Strain families were determined using the international SpolDB4 database and "Spotclust". The most abundant spoligotype families were as follows: X family 25%, T superfamily 19%, Latin-America & Mediterranean (LAM) 13%, East-African Indian (EAI) 12%, Haarlem (H) 11%, and Beijing 8%. Less frequent families include: S family 4%, Family36 3%, *M. bovis* (BOV) 2%, and Central Asian (CAS) 1%. This frequency distribution of spoligotypes is very similar to a pooled United States sample except that there is a higher frequency of X in Kansas. Interestingly, the MIRU data show that 39% of Kansas X strains are novel and specific to the Kansas City region, that is, there is a unique MIRU mutation in these strains. Furthermore, patients infected with this Kansas City X-strain take longer to treat with antibiotics. These results highlight Kansas as a melting pot of Mtb strains and a birth place of a unique Mtb strain.

Cranial nonmetric study of archaeological populations from different historical periods of Mongolia

E. Myagmar. Department of Anthropology and Archaeology, National University of Mongolia.

A cranial sample consisting of 300 skulls from Mongolia, ranging from the Neolithic period to modern era, was investigated using nonmetric traits. Nonmetric trait frequencies were calculated using the "individual count" method, and 19 traits were selected to calculate biological distances. Cranial nonmetric trait frequencies of pooled-sex and skull incidences for each population were arcsine-transformed and subsequently used to calculate the mean measure of divergence (MMD). Cluster analysis was used to obtain a dendrogram of phylogenetic relationship between the populations compared. Cluster analysis show two distinct clusters for archaeological and modern populations from Mongolia. The first cluster consisted of the Xiongnu (2nd BC to 2nd AD) and medieval age populations from Central Mongolia. The second cluster is divided further into three subclusters. Bronze age populations from the Central and Eastern Mongolia form the first subcluster with the Iron age samples from the Western Mongolia. The second subcluster is formed by the Bronze age and modern populations from Western Mongolia. Medieval age population from Eastern Mongolia joins to this subcluster. Xiongnu populations from Western Mongolia and modern populations from Central Mongolia are found to be the closest among the studied groups. The next closest groups are Neolithic and Xiongnu samples from Eastern Mongolia. These populations form the third subcluster in the second cluster.

Biological affinities of the studied populations are confirmed in the results of the archaeological investigations conducted in the different territories of Mongolia.

Grandmothers getting it done: Somatic durability in walking tasks.

M.J. Myers [1], C.M. Wall-Scheffler[2]. [1]Department of Biology, College of St. Catherine, [2]Department of Biology, Seattle Pacific University.

A corollary of the grandmother hypothesis is that *Homo* has been shaped by selection for slower senescence in somatic capabilities (non-reproductive physiological performance) relative to traits determining fecundity (Hawkes 2003). To determine whether older females show somatic durability in relevant walking tasks, we measured metabolic cost in 10 young females (mean=20.9yr) and 10 older females (mean=51.4yr) as they walked on a treadmill unloaded and front-loaded (two loads, 8% and 16% of body mass) at four speeds (self-selected from eight options) centered around optimal walking speeds. For each individual, we developed cost of transport (CoT) equations (cost vs speed) for each of the three loading conditions and then determined the minimum CoT (minCoT) and the speed of minCoT (SPminCoT) at each loading condition. Both age cohorts showed the same pattern of significantly higher minCoT and lower SPminCoT as front load increased. Young and old cohorts did not differ significantly (independent t-test) in body mass ($p=0.44$), body mass index ($p=0.93$), stature ($p=0.13$), lower limb length ($p=0.21$), or waist circumference ($p=0.89$). When load level was accounted for (general linear model), we found the two age cohorts did not differ significantly in minCoT ($p=0.96$) but the SPminCoT showed a statistically significant small drop in the older group ($p<0.001$). Thus, the two age cohorts were very similar physically and physiologically and only showed a small difference in the speed at which the minimum cost of transport occurs. This latter result implies that pregnant/lactating females and older unloaded females could form an economical travelling cohort.
This research was funded by the National Institutes of Health (#G11HD039786) and the Center of Excellence for Women, Science, and Technology at the College of St. Catherine (3M Faculty/Student Collaborative Grant #271408-800707 and the Assistant Mentoring Program).

Morphological study of the Moroto vertebral specimens.

M. Nakatsukasa. Laboratory of Physical Anthropology, Kyoto University.

The hypodigm of *Morotopithecus bishopi* includes several vertebral specimens from Moroto II in addition to a scapular fragment, and femoral and craniodental specimens. The Moroto vertebral specimens include UMP 67.28, which is a well-preserved penultimate lumbar vertebra. Based on the derived morphological traits in UMP 67.28 together with evidence from other postcranial elements, it has been claimed that certain aspects of the modern hominoid body plan appeared in the hominoid lineage by as old as 20 Ma. Other vertebral specimens from the site are not well preserved and have not been described in detail. This presentation provides the first detailed description of these specimens with an emphasis on a lumbar vertebral body UMP 68.06, which comes from a more cranial level than UMP 67.28. Results confirmed the existing interpretations that *M. bishopi* had a more dorsostable lumbar column compared to other African Miocene hominoids such as *Proconsul nyanzae/heseloni* and *Nacholapithecus kerioi*. The vertebral body is craniocaudally short and the median ventral keel is absent through the lumbar column. However, the number of the lumbar vertebra in *M. bishopi* might be similar to *P. nyanzae* (6-7) if UMP 68.06 and UMP 67.28 are associated. Likewise, the ventral wedging of UMP 68.06 may suggest that *M. bishopi* had more lumbars than extant great apes. The transverse process origin is variable by level in *M. bishopi*. Thus, careful treatment is necessary when this trait is used for a character analysis.
Supported by JSPS core-to-core program HOPE.

Does predator risk influence when and where *Lepilemur leucopus* gives loud calls and how fast the travel? – Interaction of Moon Phase and Height in Canopy.

L. T. Nash. School of Human Evolution and Social Change, Arizona State University.

Moonlight effects on behavior may relate to changes in predation risk at by moonlight levels. For animals subject to raptor predation, e.g. *Lepilemur*, the upper canopy may also be risky. Sportive lemurs at Beza show no activity difference or calling incidence by moon but spend less time in the highest parts of the canopy (15+ m high) when moon was light compared to dark. Neither the distance covered nor possibility of an interaction of moon phase and height in calling was previously addressed. If calling exposes animals to increased risk, there might be less calling from the upper canopy during light moon compared to dark moon. Adults (1 female, 6 males) were focal radio-tracked in riverine forest. Substrate height was assessed at 5 min point samples, Distance traveled and calling as 1/0 scores was measured within those 5 min intervals. Moonlight level was measured relative to both moon phase and moon rise/set times. Moonlight effects were tested using the individual, the point sample, or the animal-night as the unit of analysis. Overall, animals did not differ in distance covered by moon phase. For intervals with and without calls, the heights used did not differ. However, for all analyses, when animals were in the highest part of the canopy, they were more likely to call during light moon conditions than during dark moon conditions -- opposite to expectatios. Perhaps when going to the upper canopy during light moon, animals 'make the most of' the limited time they spend there and then.

Evidence from finger length ratios (2D:4D) of prenatal androgen effects associated with selection for canine size, but not body size in anthropoids.

E.C. Nelson[1], S. Shultz[2]. [1]Department of Archaeology, University of Liverpool, [2]School of Biological Sciences, University of Liverpool.

The second to fourth digit length ratio (2D:4D) is a sexually dimorphic biomarker reflecting prenatal androgen effect (PAE) across a number of vertebrate taxa. In humans 2D:4D has been used to investigate programming of sex-linked androgenic traits in a variety of behaviors including sexual selection and competitive ability. We have previously shown that across 39 anthropoid species 2D:4D varies according to grade, social system and intra-sexual competition, with higher levels of sexual selection and competition associated with lower 2D:4D and high PAE. In this study we explore the relationship between 2D:4D and two conventional measures of sexual selection; body size and canine size dimorphism. Controlling for substrate and phylogenetic effects, 2D:4D was significantly related to canine size dimorphism ($r= 0.412$, $F=5.273$, $p=0.030$) with 2D:4D decreasing (and PAE increasing) as dimorphism increased. There was no relationship between 2D:4D and body size dimorphism ($r=0.191$, $F=1.104$, $p=0.315$). Absence of a link between these variables is unsurprising as 2D:4D is set early in prenatal development and does not correlate with human body size measures (i.e. height, weight). Despite close correlations between body and canine size in anthropoids, results from a recent study indicate that, in highly competitive species, selection for male weaponry may be subjected to stronger selection pressure than body size (Thorén *et al.* 2006). Our results support this theory showing that, on the evidence of 2D:4D, canine size in anthropoids appears to be more closely linked to early programming of androgenic traits associated with intra-sexual competition than body size.

A light microscopy study of the effect of betel nut chewing on enamel microstructure.

G.C. Nelson. Department of Anthropology, University of Oregon.

The nut of the Areca palm (*Areca catechu*) has been chewed throughout South Asia, Southeast Asia, and western Oceania for several thousand years largely for its mild narcotic effects. Thought to have cariostatic and apatite suppressant qualities, betel

chewing is known for the reddish-brown stain left on the teeth of habitual users. In general, the darkness of the stain correlates with length of use and, within individuals, grades from dark to light from the anterior teeth through the molars where, frequently, there is little or no discoloration. Previous research into betel staining has primarily focused on 1) whether the stain was the result of purposeful application or a byproduct of chewing or 2) the chemical composition of the stain. Because slaked lime (calcium hydroxide) is combined with the betel nut, acting both as the agent that activates its psychoactive properties and as a catalyst that releases the red dye, it has been speculated that the surface enamel structure is actually altered by the lime, causing the stain to fix to the tooth surface.
To investigate the mechanism by which the betel stain penetrates the enamel and explore whether prism morphology is actually altered by the betel solution, betel stained teeth from the site of Chelechol-ra-Orrak (2000-3000 BP, Republic of Palau) were sectioned and examined under a light microscope. It was found that the betel stain invades the enamel along the interprismatic spaces possibly via ion exchange. It does not appear that surface enamel structure is altered.

Adult health outcomes and their implications for childhood nutritional stress in Jamaica.

R.G. Nelson. Department of Anthropology, University of Michigan

Inspired by the research and theoretical developments of A. Roberto Frisancho, this paper explores the relationship between measured adult health outcomes and retrospective ethnographic information on childhood nutritional environments in Jamaica. It is based on original research with adult Jamaican participants who vary in age, socio-economic status, education, and familial backgrounds. Adult health outcomes were determined using self-reports, and anthropometric and immunological analyses. The ethnographic and biometric measurements were collected at one time point. I will address the advantages and limitations of using available data on adult health to recreate childhood conditions of nutritional stress and discuss the potential relationship between these developmental stages. Preliminary analyses reveal that negative adult health outcomes in this population including overweight and obesity, diabetes and high blood pressure may be related to the socio-economic status and dietary conditions experienced in childhood. These analyses, based on both retrospective and current health measures could provide the necessary links to understanding the impact of specific nutritional deficiencies on disease prevalence and susceptibility in adult life. This study illuminates the theoretical strengths of this method, and the potential limitations of subject recall and general childhood population health data. This paper has implications for developmental adaptation studies when subject-specific longitudinal data are not available.
This research was funded by a Rackham Merit Fellowship, University of Michigan, Ann Arbor, MI.

Endocranial ontogenetic trajectories in humans: a 3D geometric morphometrics analysis.

S. Neubauer, P. Gunz, J.-J. Hublin. Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany.

Because until very recently it was not possible to quantify endocranial shape in any detail, shape changes in the developing brain have largely been neglected in many studies of primate growth. Instead, these studies have focused on cranial regions that are easy to measure with traditional landmarks, like the face and the cranial base. We provide a detailed account of shape changes during human postnatal ontogeny in the endocranium and the internal cranial base. Our aim is to establish an empirical framework in which brain-endocasts of hominid fossils can be studied by quantifying ontogenetic patterns of endocranial shape change and its correlates in the cranial base. Our cross-sectional sample comprises 90 modern human crania, ranging in age from newborns to adults. 3D coordinates of 28 endocranial landmarks and 277 semilandmarks on curves and the endocranial surface were digitized on CT scans; endocranial volume was measured from virtual endocasts. Furthermore, 305 facial and neurocranial landmarks and semilandmarks were digitized. Data were analyzed using geometric morphometrics. When compared to facial ontogeny, endocranial shape change after birth is much more subtle and does not result in well-defined growth trajectories. Individual shape features, such as the overall neurocranial shape, are already established at birth. Because these differences between individuals are of a larger scale than shape changes during ontogeny, these data do not lend themselves to simple principal component analysis. We study allometric effects using regressions and also account for the overall neurocranial shape by unwarping using the thin-plate-spline algorithm.
Supported by EU FP6 Marie Curie Actions grant MRTN-CT-2005-019564 'EVAN' and by the Max Planck Society.

Hominin cranial base evolution.

L. Nevell and B. Wood. Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University.

A cladistic hypothesis was generated based on parsimony analysis of published craniodental data and basicranial character optimization was performed. We aim to A) predict the cranial base morphology of a hypothetical last common ancestor (LCA) of the *Pan-Homo* clade, B) predict the cranial base morphology of the stem hominin and compare it with that of the *Pan-Homo* LCA, and C) investigate evolutionary trends in cranial base morphology within the hominin clade. Basicranial morphology of the *Pan-Homo* LCA and the stem hominin may differ with respect to foramen magnum position, external cranial base flexion, nuchal plane inclination, *longus capitis* insertion size, posterior skull length, opisthion to infratemporal subtense, cranial base length, mastoid length, width across foramina ovale, bijugal width, bimastoid width, bicarotid width, biporionic width, petrous orientation and tympanic morphology. An increase in posterior skull length has unambiguous support. Many traits support the node including *Homo* and high levels of homoplasy are noted between *Paranthropus* and *Homo.* According to these data the putative hominin *S. tchadensis* is the sister taxon to all other hominins. This relationship is supported in 82% of the most parsimonious trees. In a data partition analysis *S. tchadensis,* and *K. platyops* form unresolved polychotomies with *H. sapiens*; these taxa lack derived hominin cranial base traits. *Ar. ramidus, Au. anamensis,* and *Au. afarensis* each possess hominin cranial base synapomorphies and form sister taxa relationships with *H sapiens* in a data partition analysis where cranial base data for each fossil was included with cranial base data for extant taxa.
This research was supported by the George Washington University Academic Excellence Program (L.N., B.W.), National Science Foundation IGERT 9987590 (L.N.), and a GWU University Professorship (B.W.).

Morphological affinities of South and Mesoamerican Early skeletons: evidence of a widespread Paleoamerican morphology in the New World.

W. A. Neves[1], M. Hubbe[2]. [1]Departamento de Genética e Biologia Evolutiva, Instituto de Biociências, Universidade de São Paulo, [2] Instituto de Investigaciones Arqueológicas y Museo, Universidad Católica del Norte.

During most of the 19th and 20th centuries, the best accepted paradigm for the settlement of the New World suggested that all Native American populations, past and present, derived from only one biological population coming from Northeast Asia. However, craniometric analyses of early South and Mesoamerican skulls questioned this model by showing that the oldest populations known in the New World did not share the same morphological pattern with late Amerindians. The morphological pattern of these early populations is now known as Paleoamerican and has been found widespread across South and Meso America, in population samples as well as in isolated specimens. Here we analyze for the morphological affinities of all known Early American skulls from South and Meso America. Morphological affinities were

assessed through Principal Components Analysis, and two tests were carried out. In the first the Early Americans were separated according to their geographic region and were compared to worldwide reference samples. In the second they were considered as one same population and their morphological dispersion was compared to the dispersion of Amerindians, East Asians and Australo-Melanesians. The results confirm previous analyses done by Neves and collaborators, showing high morphological affinities among the Early Americans and remarkable similarity with the Australo-Melanesian dispersion. Late Amerindians always appear opposite from Early Americans. These results indicate that groups presenting the Paleoamerican morphology were widespread across South and Meso America, suggesting a relatively high population density, which facilitated gene flow among regional groups.
FAPESP (99/00670-7 and 04/01321-6). CNPq (301526-04.6).

Linking behavior and estrus cycling: Premenstrual syndrome in common chimpanzees (*Pan troglodytes*).

A.D. Newman[1], E.N. Videan[2], J. Fritz[3]. [1]Department of Anthropology, San Diego State University, [2]Alamogordo Primate Facility, [3]Primate Foundation of Arizona.

Nearly 80 percent of all human females experience some form of premenstrual syndrome. Despite the fact that this is a widely recognized phenomenon, its causes and evolutionary significance, are poorly understood. Our close phylogenetic relationship to the common chimpanzee (*Pan troglodytes*) suggests that researchers should begin by endeavoring to comprehend the association between chimpanzee behavior and reproductive cycling. In so doing, chimpanzees may represent a model to better understand the evolution of premenstrual syndrome as well as the loss of sexual swellings in modern humans. This study examined the relationship of individual rates of female aggressive and affiliative social interactions, as well as instances of rest, with specific phases of the female chimpanzee reproductive cycle (i.e., tumescence, maximal tumescence, detumescence). Subjects included 12 adult female chimpanzees (12-33 years of age) housed in single-sex (all-female) groups. Behavioral observations were conducted via scan sampling and cycle phase was determined by visual inspections of sexual swellings. Results indicated that females are more affiliative ($p=0.05$) and less aggressive ($p=0.04$) during maximal tumescence, compared to periods of complete detumescence. There was also a trend towards increased affiliation and decreased aggression during tumescence. There was no significant relationship between cycle phase and the rate of inactivity (or rest). Results indicate that cycle characteristics affect female-female relationships, even in the absence of adult male presence.

The relationship between initial bone development and age estimation.

J.A. Newnam. Department of Anthropology, University of Arkansas.

Fetal and neonatal skeletal remains are important to anthropological and medicolegal studies, particularly in archaeological and forensic contexts. Yet these remains also represent the complexity of growth and development in the human skeleton. Prior research using bones of the pectoral and pelvic girdles, which all develop initially by perichondral intramembranous ossification, revealed that these components are very accurate indicators of age. The purpose of this research project is to determine if the type of initial ossification in a bone is related to accuracy of age estimation. Measurements for age estimation were collected from the mandible because it forms through both dermal intramembranous and endochondral ossification. Measurements for age estimation were also collected from the zygomatic because it forms completely through dermal intramembranous ossification. The age estimates obtained from the mandibular and zygomatic dimensions were then compared with age estimates from the pectoral girdle. Analysis showed that the bones developing first though perichondral ossification were more reliable for use in age estimation than those that initially develop through intramembranous and endochondral ossification. The results suggest that primary bone formation may affect the dimensions used for age estimation and that environmental factors may differentially affect skeletal components depending on how they initially ossify. Thus, growth and developmental factors should be considered in osteometric analysis of subadults.

A Novel Transgenic Mouse Model for Primate Fetal Encephalization and Craniofacial Development.

E.K. Nicholson[1], S.R. Stock[2], A. Chenn[3], M.J. Ravosa[4]
[1]Cell & Molecular Biology, [2]Molecular Pharmacology & Biological Chemistry, [3]Pathology, Northwestern University Feinberg School of Medicine; [4]Pathology & Anatomical Sciences, University of Missouri School of Medicine.

There are surprisingly few experimental models of human neural growth and evolution. This and the dearth of information regarding fetal brain development detract from our understanding of cranial integration vis-à-vis the ontogenetic and interspecific patterning of skull form. To isolate the effects of encephalization on basi- and neurocranial development, we examined transgenic mice expressing a stabilized form of ß-catenin. These transgenic mice develop highly encephalized brains due to an increase in neural precursor cells. As the transgene is expressed only in neuroepithelial precursors, craniological differences between transgenic and wild-type littermates are predicted to result solely from variation in relative brain size. By focusing on a prenatal stage characterized by remarkable brain growth, we investigate a critical period when major structural and functional inter-relationships are established within the skull. Comparisons of wild-type and transgenic mice employed microCT, MRI, and histology. Results indicate that the larger brain of ß-catenin mice is associated with a rounded neurocranium and more flexed basicranium. Contra expectations, transgenic mice develop shorter anterior and longer posterior basicrania, and their faces are positioned more posteriorly. Comparisons of the rates of postcranial and cranial ossification point to a surprising, unexpected effect of neural growth on skull development – increased fetal encephalization results in a compensatory decrease in cranial ossification levels. Therefore, if other life history parameters are held constant, the ontogeny of a metabolically costly structure such as a brain may occur at the expense of other adjacent structures. These analyses indicate the benefits of a multifaceted approach to craniofacial integration.
Supported by NSF dissertation improvement grant BCS-0725338.

Cranial suture complexity in marmosets and tamarins.

C.W. Nicolay, M.A. Hutchings. Department of Biology, University of North Carolina Asheville.

Cranial sutures are the sites of postnatal skull growth and are thought to absorb biomechanical stresses on the skull, with more complex (interdigitated) sutures occurring when stresses are greater. We compared skulls of marmosets (*Callathrix jacchus,* n=24; *Cebuella pygmaea* n=18) and tamarins (*Leontopithecus rosalia,* n=26; *Saguinus fuscicollis,* n=22) to examine the relationship between suture complexity and tree gouging. Marmosets gouge trees, forcefully scraping bark to obtain exudates, which likely generates large mechanical forces on the skull. Tamarins opportunistically feed on exudates, but do not actively gouge trees. Suture complexity was quantified from digital photographs as the Length Ratio (LR) of actual length of the suture divided by the minimum straight-line distance between its starting and ending landmarks. The sagittal, zygomaxillary, and frontozygomatic sutures were examined. Marmosets did not appear to have more complex sutures than tamarins. The three sutures examined differed in patterns of complexity among species. Sagittal suture LR appears to increase with skull size in these species. The frontozygomatic suture had the greatest LR of those examined, but did not significantly differ among species. Zygomaxillary suture LR was significantly higher in the smallest species, *C. pygmaea.* The two most similar sized species (*C. jacchus* and *S. fuscicollis*) were always statistically

equivalent in suture complexity. Cranial suture complexity does not appear increased in marmosets relative to tamarins, nor does it appear to be a useful phylogenetic indicator in these species.

Social classification, skin color, and genetic ancestry: a bio-cultural analysis of health disparities.

A.L. Non, C.C. Gravlee, C.J. Mulligan. Dept. of Anthropology, University of Florida.

Consistent disparities in health are well documented across racially defined groups for many complex diseases. Researchers have proposed both genetic and socio-cultural hypotheses to explain these disparities, but few studies combine both genetic and socio-cultural data to test competing hypotheses directly. Here we address this problem in the context of debate about hypertension in populations of African descent. Some researchers suggest that people of greater African ancestry are genetically predisposed to develop high blood pressure. In support of this hypothesis, some researchers point to preliminary evidence of a modest association between blood pressure and genetic estimates of African ancestry. However, the association between ancestry and disease phenotypes may be due to residual confounding with environmental stressors such as discrimination and poverty. Our study, based on fieldwork in southeastern Puerto Rico, is the first to test these alternatives. We incorporate genetic measures of ancestry, genotyping of candidate genes, and an ethnographically derived measure of social classification that estimates how individuals' color is perceived in everyday social interactions. We find that social classification of color, but not genetic ancestry, is associated with both systolic and diastolic blood pressure through an interaction with socioeconomic status. These findings emphasize the importance of gathering socio-cultural data in studies on health and disease, rather than relying on skin color or genetic ancestry as a proxy for potential disease status.

Developmental patterns in the secretion of testosterone in white-faced sakis.

M.A. Norconk[1], P. Whitten[2], D. Winkler[3], K. Vacco[4]. [1]Department of Anthropology and School of Biomedical Sciences, Kent State University, [2]Department of Anthropology, Emory University, [3]Cleveland Metroparks Zoo, [4]Pittsburgh Zoo and PPG Aquarium.

White-faced sakis (*Pithecia pithecia*) exhibit several derived traits related to body size, locomotion and especially sexual dichromatism. Females (and young males) exhibit cryptic coloration; adult males have white faces with contrasting black body pelage. Even though the color change is gradual, a white ring around the face is often discernable in neonates (preliminary analysis found abundant testosterone (T) receptors in the facial skin of a neonatal male). We examined the developmental pattern of T secretion as a preliminary step to understanding the evolution of sexual dichromatism.
Longitudinal fecal samples were collected from seven captive males aged 2 to 44 months. Samples were assayed for fecal testosterone (fT) at the Laboratory of Reproductive Ecology and Environmental Toxicology, Emory University. Tests of assay accuracy, parallelism and precision indicated that T radioimmmunoassay provided reliable results.
We found that the youngest males produce the highest fT values (> 150 ng/gm); average fT values declined by 6 months of age and remained low (averaging < 50 ng/gm) until approximately 25 months of age; and date-specific fT values from two pairs of brothers housed together were significantly correlated. These data suggest that 1) sakis follow a general mammalian pattern of T reduction shortly after birth with an increase near puberty; 2) the early infusion of T may have a priming effect in the facial skin of infant saki males; and 3) it is possible that the correlation of fT values among group males is related to male social cooperation which may characterize all pitheciins.

CSI, forensic science and anthropology: rewriting history.

M. J. Norton. Bellevue Community College.

Is the past changing? Physical anthropologists have always gleaned information from hominid/human remains. The recent focus on forensic science as a tool in both physical anthropology and archaeology challenges traditional interpretations of history. This methodology has both positive and negative affects on the scientific interpretation of paleoanthropological and archaeological remains. The application of forensic methods is explored within the context of a general scientific paradigm and their relevance in understanding the past.

Histological assessment of age at death in long bones of mature and senile individuals of known age.

J. Nováček[1,2], E. Drozdová[2], M. Schultz[1]. [1]Institute of Anatomy, University of Göttingen, Germany, [2]Institute of Anthropology, Faculty of Science, Masaryk University Brno, Czech Republic.

For this investigation histological ground sections of 34 individuals with known age of death were prepared. The samples for the ground sections were taken from the femora of 20 individuals (40 – 93 years of age, 10 males, 10 females) from the Institute of Pathology in Bochum and from the left femurs of 14 individuals (56 - 101 years of age, 8 males, 6 females) from the Department of Anatomy of the University of Göttingen. Two ground sections were prepared from amputated ends of femurs (both males, age 67 and 85), as well as two ground sections from femurs with artificial hip joint replacement (both males, age 73 and 75), with the aim of investigation of the difference in the microscopical structure of the compact bone due to different physical load.
The investigation was aimed at the assessment of the age at death with the use of an as wide as possible range of histomorphometrical, as well as, histomorphological methods. The exactness of histomorphometrical methods decreases at higher age. The methods depend on equations from the special lamellae observed, whose amounts increase during life, until approximately 50-60 years of age. At higher ages, the amount of these traits decreases, resulting in growing divergence, as the individual is assessed as having been younger. In comparison, histomorphological methods use assessment of typical structures and the degree of their development. These methods are not loaded with error in computations, but the result of estimation depends on subjective assessment of the observer. The aim of the investigation is to offer a comparison between different aging methods and to try to assess the usability of these methods.

New data on the positional behavior of wild white-handed gibbons (*Hylobates lar*) at Khao Yai National Park, Thailand.

M.G. Nowak, U.H. Reichard. Department of Anthropology, Southern Illinois University, Carbondale.

Hunt *et al.* ([1996] Primates 37:363-387) identified a need for a more detailed and standardized approach to the study of primate positional behavior in order to enhance inter- and intra-specific comparisons as well as further extending the application of primate positional behavior to other arenas of primatological research, particularly the analysis of morphological form and function. While studies of great ape positional behavior have greatly aided our understanding of hominoid positional adaptations, contributions from small apes to the topic have remained limited due to small sample size and conflated positional modes. Building upon past studies, we used the standardized positional modes identified in Hunt *et al.* to study locomotion and posture in a large population of habituated wild *Hylobates lar*, collecting instantaneous focal animal data on 24 individuals (13 males, 11 females) during approximately 400 hours of observation at Khao Yai National Park, Thailand. It was found that positional behaviors encompassed a vast array of locomotor and postural modes that also frequently required hindlimb compression, tension, and flexibility, whereas forelimb dominated locomotion and posture were less prominent than previously reported. In particular, gibbons used greater amounts of forelimb/hindlimb suspension, vertical climbing, bipedal walking, leaping, and torso-

orthograde clamber/transfer. Most importantly, while gibbons have evolutionarily become highly specialized brachiators and forelimb suspensors, we found that their overall positional repertoire was remarkably versatile and complex, a similarity that allies them well with the other hominoids.

Determinants of variation in ovarian function: A comparison of progesterone and estradiol data

A. Núñez-de la Mora[1], R.T. Chatterton[2],G.R. Bentley[1]. [1]Department of Anthropology, Durham University, [2]Department of Obstetrics and Gynecology, Northwestern University.

Due to historical problems of establishing viable salivary estradiol assays, most research on ovarian function until recently has focused on salivary progesterone. As a result, much less is known about how estradiol responds to ecological variables, or how it compares to progesterone in this respect. Nevertheless, the few studies where comprehensive salivary profiles for both hormones have been obtained throughout the menstrual cycle provide some evidence that the two steroids do somehow behave differently and sometimes contrast with each other. In particular, results indicate that estradiol and progesterone appear to differ in their sensitivity and response to short-term energetic conditions. We discuss possible explanations for differences in response between progesterone and estradiol, as well as potential implications for human reproductive ecology and its study.

Diet inference based on dental microwear analysis of an early LKB cemetery site in Moravia, the Czeck Republic.

P. Nystrom, Department of Archaeology, University of Sheffield, Sheffield, U.K.

How and when the practice of agriculture spread through out Europe is a fundamental question and reflects one of the most significant transitions undergone by human societies. In this study, the diet adaptation of a population from the early LBK site of Vedrovice, located in southern Moravia in the Czech Republic, is examined. It is estimated that the cemetery was in use between 5290-5220BC. Of the 85 individuals available, 32 yielded tooth replicas of sufficient quality to be analysed with a high resolution scanning electron microscope. High resolution replicas were made of facet 9 on the second molar, and were examined at a magnification of 500x. The results suggest that the Vedrovice people had a very 'soft' diet, with little evidence of exogenous abrasives, such as grit, ingested with the food. All the examined individuals showed a preponderance of striations, and a significant number of the pits are less than 4 microns in width, which is commensurate with a highly processed diet. In many individuals the occlusal enamel showed a curious etched appearance, where sharp dental microwear features could not be observed. This appearance may be explained by the teeth having been exposed to post-mortem modifications, or alternatively these individuals consumed a highly acidic diet, possibly a fermented food staple.

Habitat structure variation: implications for understanding the feeding ecology of black-shanked douc in Cat Tien National Park, Vietnam.

J.A. O'Brien[1], T.V. Thanh[2], P.H. Khanh[2], T.H. Nguyen[2], H.H. Covert[1]. [1]Department of Anthropology, University of Colorado at Boulder, [2]Cat Tien National Park, Vietnam.

Here we report on preliminary research on the feeding ecology of black-shanked doucs (*Pygathrix nigripes*), an endangered primate, in Cat Tien National Park, Vietnam. We have established three phenology transects in the park with their locations randomly selected and they pass through a number of forest types including evergreen, semi-evergreen, and bamboo forests. They also appear to sample both young and old forests. Standard habitat structure data were collected including DBH, height, crown volume, species identification, and phenology. Interesting variation exists across these transects in a number of these characters and these differences suggest interesting variation of plant productivity. During the upcoming year we will study the ranging and feeding behavior of the black-shanked doucs across these transects and should be able to document if this species is selective in feeding and habitat use at Cat Tien NP. *P. nigripes* is presently found in a range of habitats across southern Vietnam and Cambodia including dry forests (<0.75m of annual rainfall) and very wet forest (>3.0m of annual rainfall). A better understanding of the feeding ecology of this species at Cat Tien NP should enable us to contribute to long-term conservation planning. Finally, this is an excellent location to conduct this research both because it appears to have a substantial population of this species and because this is one of the best protected parks in Vietnam, and the park administration and scientific staff have made conservation a priority.
Funded in part by the Department of Anthropology and the University Museum of Natural History of the University of Colorado at Boulder

The epidemiology of spina bifida in Ireland: an anthropological approach.

K.A. O'Donnell. Department of Anthropology, Florida State University.

A sample of 97 human skeletal remains from Ireland were examined to investigate the etiology of spina bifida, a form of neural tube defect. The causes of spina bifida are poorly understood. Some evidence suggests environmental factors play a role in its prevalence, while other evidence implies genetic causes. To address this issue, I focus on Ireland because of the high rate of spina bifida in its present-day population.
A preliminary study by Patricia Saluja in 1986 suggested that ancient rates of spina bifida were lower, raising the question of what caused the increase observed today. I chose to investigate collections of human remains from nineteenth century Ireland in an attempt to identify the period during which the prehistoric rates of spina bifida rose to modern levels. I examined skeletal collections from three sites: Church Street (n=91), County Kerry (n=2), and County Kildare (n=4). In these collections, I documented spina bifida rates higher than *either* prehistoric *or* modern rates. Thus, the populations suffered from peak rates of spina bifida.
The nineteenth century was a time of extreme famine and malnutrition in Ireland. Nutrition in modern day Ireland is vastly improved and the frequency of spina bifida has decreased; however, the frequency of neural tube defects has not diminished to rates found in the United States or England. Inquiry into Ireland's connection with spina bifida will increase understanding of the persistence of high rates in modern times.

New light on brachycephalization based on juvenile crania from Japan.

K. Okazaki. Laboratory of Anthropology, Research Center for Chinese Frontier Archaeology of Jilin University.

As significant population replacement did not occur after the Yayoi period (300 B.C.-300 A.D.) in Japan, samples of Japanese skeletal groups are suitable for detecting the cause of historical brachycephalization, because brachycephalization at the onset of the medieval period (1300-1600 A.D.) may be attributed to microevolution. Using juvenile skeletal materials from the Jomon, the Yayoi, the Medieval and the early Modern periods, this study aims to demonstrate how neurocranial shape forms and group differences appear with age. Results indicate that infant cranial index is more variable than is the case for adults. Early Modern Japanese, most brachycephalic as adults, were characterized by a dramatic decrease in cranial index during infancy, also common among living Japanese. On the other hand, Medieval Japanese, the most dolicocephalic as adults, did not show this change with age and remained dolicocephalic from the age of at least 2 years and thereafter. Therefore, our discussion of the causation of brachycephalization focuses on factors affecting neurocranial growth patterns during infancy. In comparing patterns of neurocranial growth for Medieval Japanese with those of a Roman period population from Palmyra, Syria, we have found that similar adult cranial indices in these two samples resulted from different growth processes.

Scaling primate molar enamel thickness: implications for hominin evolution.

A.J. Olejniczak[1], M.M. Skinner[1, 2], J.-J. Hublin[1]. [1] Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. [2] Hominid Paleobiology Doctoral Program, CASHP, Department of Anthropology, George Washington University.

The relative thickness of molar enamel is among the few diagnostic characters of hominins, which have "thick" enamel relative to the "thin" enamel of African apes based on cross-sectional measurements. Advances in imaging techniques facilitate a transition from cross-sectional estimates of whole-crown measurements to actual whole-crown data. Whole-crown thickness data are useful because they elucidate the pattern of enamel thickness across the tooth crown, which is known to differ between taxa of varying dietary proclivity. Despite methodological advances in enamel quantification, the scaling relationship between body size, tooth size, and enamel thickness has not been explored in 3D. The study presented here attempts to assess the scaling relationships of dental tissues in 3D studies. More than 350 unworn primate molars from taxa spanning all major primate radiations were microCT scanned and quantified. Data on body size were culled from the literature. 3D dental measurements (volumes and surface areas) are significantly correlated with one another; the coronal volume of dentine has the strongest relationship with body size. Regression equations describing extant primates were employed in an analysis of over 50 fossil hominin molars; the thick enamel of some, but not all, hominins is probably related to megadontia. Relationships among dental tissues show that thick enamel may be achieved through a variety of tissue conformations and is sometimes the result of reduced dentine volume per unit tooth size rather than an increase in the quantity of enamel. Thick enamel is not necessarily homologous within the hominin lineage.
This study was supported by the Max Planck Society.

Phylogenetic and biogeographic implications of the Dmanisi hominids.

K. Oliver. Department of Anthropology, University at Albany

Rightmire *et al.* (2006) describe the fossil crania from Dmanisi as sharing primitive traits with *Homo habilis* and *H. rudolfensis,* while also sharing some derived features with African and other Eurasian *H. ergaster/erectus* populations. These observations may have phylogenetic and biogeographic implications insofar as Rightmire *et al.* (2006) suggest that the Dmanisi assemblage may be close to the stem from which other *H. ergaster/erectus* evolved. This, in turn, may imply that hominids dispersed out of or, possibly, into Africa more than once at the beginning of the Pleistocene. These hypotheses were tested using cladistic analysis. Forty-one qualitative and quantitative characters derived from Rightmire *et al.* (2006) were subjected to maximum parsimony analysis. *Australopithecus africanus* was used as an outgroup. Ingroup taxa included *H. habilis, H. rudolfensis, H. ergaster* (from Africa), and *H. erectus* (from Asia). In addition, the Dmanisi sample was treated as a distinct operational taxonomic unit (OTU). Results show that the Dmanisi OTU is the sister taxon of an *H. ergaster* + *H. erectus* clade. When geography is used as a cladistic character, parsimony suggests that more than one dispersal event out of or into Africa must have taken place. These results are fully consistent with the phylogenetic and biogeographic hypotheses of Rightmire *et al.* (2006).

The Boy from Abydos: CT Scanning of a Ptolemaic Dynasty Egyptian Mummy Elucidates His Physical Condition and Mortuary Treatment

S. L. Olsen[1], T.M. Lucio[2], A. Nagy[3], J.D. Towers, MD[4]. [1]Carnegie Museum of Natural History, [2]University of Pittsburgh School of Medicine, [3]University of Pittsburgh Anthropology Dept., [4] University of Pittsburgh Medical Center.

CT scanning conducted on a child from the Cemetery of Abydos, excavated in 1911-12, by T. Eric Peet, and dating to between 332-250 BC, has enabled detailed noninvasive examination without removal of the mummy's cartonnage or wrappings. Insight was gained on the health, sex, age, stature, and mortuary preparation of this individual. The analytical software program Stensor allowed manipulation of extremely large data sets derived from CT scanning.
Age estimation based on dental growth and eruption placed the child at 3 years, and preservation of soft tissue indicates that the mummy was a boy. Long bone diaphyseal measurements were compared to modern growth charts to reconstruct stature. Examination of 3-D CT scan images of the child's cranium reveal delayed closure of the fontanelles and metopic suture, as well as possible frontal bossing, possibly indicating macrocephaly.
Insight was acquired about Ptolemaic mortuary practices for elite, non-royal children from this boy's corpse. After the ancient mortician attempted to excise the brain through the right nostril, the foramen magnum was enlarged, removing the condyles. The resulting lack of articulation with C1 necessitated introduction of a papyrus support rod, positioned inside the cranium and wedged down inside the neural canals of the cervicals. Given the rarity of intact child mummies from this period, this study provides significant comparative data for other researchers.
This research was made possible through a grant provided by the University of Pittsburgh School of Medicine.

The influence of habitat quality on juvenile ring-tailed lemur (*Lemur catta*) feeding ecology and glucocorticoid levels.

M. Teague O'Mara, Arizona State University

Low habitat quality and anthropogenic habitat degradation have negative and lasting impacts on adult primates, but their effects on primate development are unknown. Degraded habitats with low food availability may place increased nutritional strain on developing juveniles, forcing them to respond by modifying their foraging strategies and by making physiological adjustments. Both behavioral and physiological adjustments are likely to incur costs. For example, elevating glucocorticoids will mobilize stored energy reserves in response to both nutritional and psycho-social stressors but chronic elevations of glucocorticoids are immunosuppressive, retard growth, and delay sexual maturation. Similarly, behavioral strategies that increase distance among group members to decrease feeding competition increase predation risk. To assess how habitat degradation affects juvenile stress levels (measured via fecal glucocorticoids) and feeding ecology, data were collected from May-July, 2007 at the Beza Mahafaly Special Reserve, Madagascar. Behavioral observations and fecal samples were collected from juveniles from three social groups living in the gallery forest, drier seasonal forest, and anthropogenically degraded habitats surrounding the reserve, respectively. Juvenile lemurs in degraded areas have lower foraging efficiency, spend more time resting, and are within three meters of a conspecific less often than are juveniles in more profitable reserve habitats, suggesting an elevation of feeding competition and behavioral compensation through increased spacing. The impact that habitat degradation has on physiological stress through its action on feeding ecology will also be discussed.
This research was supported in part by grants from Primate Conservation, Inc., Sigma Xi, ASU's School of Human Evolution and Social Change, and a National Science Foundation Graduate Research Fellowship.

Effects of load carrying on the metabolic cost of locomotion in *Lemur catta*.

M. C. O'Neill, Department of Anatomical Sciences, Stony Brook University.

Many primates have to travel while supporting mass in addition to their own body weight. It has been argued that primates that carry infants pay a steep metabolic price for load carriage, but this effect has not been directly measured. The purpose of this study was to determine the effect of added trunk mass on the energetic cost of locomotion in a nonhuman primate.

Two ring-tailed lemurs (*Lemur catta*) were trained to walk and run on a level treadmill with and without trunk loads of ~16% and ~26% of their unloaded body mass. Oxygen consumption (VO_2) was measured while lemurs moved in an enclosed metabolic chamber at speeds ranging from 0.25 – 1.5ms^{-1}. Trials were filmed in lateral view at 250Hz and used to determine limb kinematic parameters.
Results show that the effect of load carrying on metabolic cost is substantial. The VO_2 loaded-to-unloaded ratio was consistently greater than the mass loaded-to-unloaded ratio during walking, for both ~16% and ~26% conditions. However, there was a marked decrease in the VO_2 loaded-to-unloaded ratio with the onset of a running gait. These results confirm that the metabolic cost of load carrying in *Lemur catta* is significant, but suggest that their energetic economy may be gait dependent.
This research was supported by NSF-0525034 and Wenner-Gren.

Fiber architecture of *mm. intertransversarii caudae* in the prehensile and nonprehensile tail.

J.M. Organ[1,2], M.F. Teaford[1], A.B. Taylor[3,4]. [1]Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine, [2]Department of Physical Medicine and Rehabilitation, Johns Hopkins University School of Medicine, [3]Department of Community and Family Medicine, Duke University School of Medicine, [4]Department of Biological Anthropology and Anatomy, Duke University.

Prehensile tails have vertebrae that can resist relatively higher torsional/bending moments than those of nonprehensile tails. These structural differences are observed among tails of primates (atelines and *Cebus*) and procyonid carnivorans living in similar Neotropical habitats. Given these differences, we predicted that prehensile tail muscles would be architecturally well suited for maximizing force production to maintain tail suspensory postures for extended periods.
To test this prediction, we analyzed the fiber architecture of *mm. intertransversarii caudae* (*ITC*), the prime tail lateral flexors/rotators, in 40 individuals distributed across 8 platyrrhine and 2 procyonid genera. Functionally analogous *ITC* muscles were excised from three distinct tail regions. We measured whole muscle mass and surface pinnation angle, then chemically digested the muscles. After digestion, fiber lengths were measured. From these data, we calculated physiologic cross-sectional area (PCSA). Each individual was assigned to a tail-type group (prehensile or nonprehensile) and group data were compared using t-tests.
Results generally support predictions: In all tail regions, prehensile tail *ITC*s have relatively higher PCSAs, indicating the capacity to generate relatively greater maximum muscle forces. Much of the difference in PCSA is driven by muscle mass, as pinnation angles do not differ between tail types in any region. Maximizing force production comes at some expense of excursion/contraction velocity, as prehensile tail *ITC*s have shorter fibers in the proximal tail. In the middle and distal regions, however, prehensile tail *ITC*s have higher mass to maximum tetanic tension ratios, suggesting they may be suited for generating higher contraction forces at higher-than-predicted velocities.
Supported by the National Science Foundation (BCS-0550676) and the National Skeletal Muscle Research Center at the University of California, San Diego (NIH grant R24 HD050837).

Is primate-like grasping needed for fine branch feeding? Terminal branch use in eastern gray squirrels, *Sciurus carolinensis*.

J.D. Orkin, H. Pontzer. Department of Anthropology, Washington University in St. Louis.

A number of hypotheses for primate origins propose that nails and primate-like grasping hands and feet were important early adaptations for feeding in fine branches. Comparative research in this area has focused on instances of convergence in extant animals, showing that species with primate-like morphology feed predominantly from terminal branches. Relatively little has been done to test whether animals without primate-like morphology engage in similar behavior. We tested these hypotheses for primate origins by observing branch use in eastern gray squirrels, a remarkably understudied species that lacks primate adaptations for grasping small branches. We hypothesized that due to their lack of primate-like grasping adaptations, squirrels would avoid feeding and foraging in terminal branches. Instantaneous focal animal sampling was used to examine the locomotor and postural behavior of *Sciurus carolinensis* while feeding and foraging. Contrary to fine branch niche models of primate origins, our results indicate heavy usage of terminal branches while feeding and foraging, primarily on acorns and other tree seeds. Such results question the necessity for a relationship between terminal branch feeding and the primate morphological package, and they challenge current adaptive models of primate origins.

Kinematics of the os centrale in *Pongo pygmaeus*: implications for the knuckle-walking hominin ancestor hypothesis.

C.M. Orr[1], E.L. Leventhal[2], F.S. Chivers[3], J.J. Crisco[2]
[1]School of Human Evolution and Social Change and Institute of Human Origins, Arizona State University; [2]Department of Orthopaedics, Brown Medical School/Rhode Island Hospital; [3]Mayo School of Medicine, Mayo Clinic in Arizona.

Early fusion of the os centrale to the scaphoid is a synapomorphy of African apes and hominins. The use of centrale-scaphoid fusion in arguments for a knuckle-walking hominin ancestor relies on the assumption that fusion has functional significance for knuckle-walking such as limiting shear or reducing midcarpal mobility. However, orangutan dissections suggest that no motion occurs between the free centrale and scaphoid; if true, then such functional explanations have difficulty accounting for centrale-scaphoid fusion. Here we present three-dimensional kinematic data to test the hypothesis that a free centrale exhibits independent mobility.
Kinematic data were derived from computed tomography (CT) images of two *Pongo pygmaeus* cadaver forelimbs. The wrists were scanned at 10° intervals of flexion/extension and radial/ulnar deviation, 3D models were generated from segmented CT scans using Materialise's Mimics software and each model was registered from position to position to obtain transformation matrices. Parameters of helical axes of motion were used to describe and quantify the kinematics of the carpals relative to one another and to a radius-based coordinate system.
Centrale motion is partially independent of the scaphoid in all anatomical planes. Relative to the scaphoid, the largest centrale rotations (up to 12°) occurred around disto-ulnarly oriented helical axes during wrist extension and ulnar deviation. This is consistent with the hypothesis that a fused centrale functions to reduce shear by reducing the number of joints in motion in these planes and possibly limits midcarpal mobility by providing a stable attachment for ligaments spanning the scaphoid and distal carpal row.
Supported by NSF Doctoral Dissertation Improvement Grant BCS-622515, The Wenner-Gren Foundation, Sigma Xi, The School of Human Evolution and Social Change and the Graduate and Professional Students Association of Arizona State University

Intra- and Inter regional dental morphological variation in South American populations.

A. Ortiz[1]. S.E. Bailey[2], [1]Department of Archaeology, Pontificia Universidad Catolica del Peru. [2]Department of Anthropology, New York University.

Dental morphology has been shown to provide important information on the origins and dispersals of peoples in the New World. Most of this work has focused on North America; less study has been devoted to variation within South America. This study examines the biological affinities of four South American populations, and places them in a global context.
Twenty-four non-metric dental traits were examined in 261 individuals from five pre-Hispanic groups (Bolivia, Chile, Venezuela, Northern Peru and Southern Peru) using the

ASU dental anthropology system. Inter-regional comparisons were based on published data. Intra- and inter- regional affinities were assessed using the Mean Measure of Divergence statistic and Multidimensional Scaling was used to visualize differences among groups.
This analysis revealed considerable homogeneity among the five samples studied – all intra-regional MMD values were low (0.0-0.082). All samples are characterized by relatively high frequencies of UI1 shoveling, UM1 Carabelli´s trait, LM2 Y-groove pattern and LM1 deflecting wrinkle. In the multidimensional scaling analysis samples from Venezuela and Chile clustered together. Northern and Southern Peru were more distant and occupied different areas of 2D and 3D space, while Bolivia was most divergent to other samples. Interestingly, Venezuela and Chile are from low altitude regions, while the more divergent samples are from high altitude regions.
Although our sample was somewhat limited, the results suggest that South Americans follow a Sinodont dental pattern and that dental variation within South America is somewhat less than that found within North America.

Assessing the relationship between skin pigmentation and measures of bone strength in adolescent females living in Hawaii.

D.L. Osborne[1], C.M. Weaver[2], L.D. McCabe[3], G.M. McCabe[3], R. Novotony[4] C. Boushey[2], D.A. Savaiano[2]. [1]Department of Anthropology and Geography, University of Nebraska, [2]Department of Foods and Nutrition, Purdue University, [3]Department of Statistics, Purdue University, [4]Department of Human Nutrition, University of Hawaii.

Our understanding of bone growth as it pertains to adult skeletal integrity remains limited. Lifestyle factors associated with contemporary Western society may increase susceptibility to skeletal fragility. One potential contributor to inadequate bone growth is lack of vitamin D. Vitamin D aids in the formation and regulation of bone, with exposure to ultraviolet radiation being a major contributor to this relationship. However, little has been done to quantify this relationship. To this end we investigated the link between skin pigmentation and two measures of bone strength: section modulus (Z) and bone mineral content (BMC) at the proximal femur. All things being equal, increased skin pigmentation reduces vitamin D synthesis. Therefore we tested the hypothesis that individuals with darker skin would have lower measures of bone strength than those with lighter skin. Our sample was composed of adolescent females (n = 100) living in Hawaii who self-identified as either white or Asian. Skin pigmentation was measured at the forehead and inner arm using a Chroma Meter CR-200b colorimeter. Multiple regression was used to investigate the influence of skin pigmentation, physical activity, age, ethnicity, developmental age, calcium intake, and lean body mass on Z and BMC. Results suggest that skin pigmentation in this sample from Hawaii is not a significant predictor of either Z or BMC ($p>.05$). Skin pigmentation, as measured by colorimeter, does not predict bone strength. This may be due to our inability to control for dietary intake of vitamin D and/or long term exposure to ultraviolet radiation.
This project was supported by the IFAFS of the USDA Cooperative State Research, Education
and Extension Service, grant number 00-52102-9696.

The Long and the Short of It: A Case of Diminutive Stature in Prehistoric Ridges Basin.

A.J. Osterholtz, SWCA Environmental Consultants

In this poster presentation I examine one of two individuals recovered
during the Animas-La Plata project that exhibit unusually short stature. The long bones from Burial 294, an adult female, were complete enough to compare with several female burials. Despite this short stature, the long bone ratios are very similar to other females recovered from the project. Moreover, morphological changes consistent with endocrine disorders are not present and no overt signs of malnutrition or other pathological changes are present. Visual and statistical data comparing Burial 294 to other female burials recovered from the ALP project area are presented.

Handedness and the percent of time spent feeding unimanually or bimanually in captive siamangs (*Hylobates syndactylus*) at the Rosamond Gifford Zoo (Syracuse, N.Y.).

L.M. Paciulli, K. Sabbi, G.E. Montanez. Department of Anthropology, Ithaca College.

Handedness has been studied in a variety of nonhuman primates in both wild and captive settings. It appears that population-level handedness is evident in some primates for some behavioral measures. Of the many different tasks for which handedness can be tested, coordinated bimanual tasks seem to provide good measures of hemispheric specialization in human and arguably, nonhuman primates. Therefore, in this study, unimanual and bimanual feeding were examined in three captive siamangs at the Rosamond Gifford Zoo in Syracuse, N.Y. The siamang group consisted of an adult male, an adult female, and their five-year-old female offspring. Individual siamangs were videotaped eating the following food items – an apple, a stalk of celery, lettuce, or jelly in a PVC tube. The videotapes of the feeding bouts were coded for 1. the hand(s) used (right, left, or right and left) and 2. the number of hands used to feed (unimanual or bimanual). Although there were individual differences in the levels of handedness, the adult male exhibited a clear right-hand bias when feeding. In addition, overall, the siamangs fed unimanually significantly more than they fed bimanually (70% vs. 30%, respectively) for certain food items (*e.g.*, celery stalk). However, they spent more time feeding bimanually than unimanually when extracting jelly from PVC tubes. It appears that examining hand preferences when both hands are free and engaged in coordinated bimanual tasks may be advantageous in revealing significant lateral biases.

The frequency of cranial trauma among the Iron Age Vestini of Abruzzi, Italy

R.R. Paine[1], D. Mancinelli[2], V. d'Ercole[3], and A. Coppa[4]. [1]Department of Sociology and Anthropology, Texas Tech University, [2]Dipartimento di Scienze Ambientali, Universitàde L'Aquila, Italy, [3]Museo di Preistoria, Soprintendenza Archeologica dell'Abruzzo, Celeno, Italy, [4]Dipartimento di Biologia animale e dell'Uomo, Università La Sapienza di Roma, Italy.

We examined burials recovered from the Fossa site for evidence of cranial trauma. The Vestini necropolis is located in the mountains of Abruzzi, Italy. These Iron Age burials are from the 10^{th} – 1^{st} centuries BC. Of the 135 adults with cranial elements, 10 them (13.5%) exhibited trauma. Our findings continue to under-score the violent circumstances experienced during the Italian Iron Age. A time characterized by population growth and improved agricultural practices. The Vestini are a distinct cultural group living in Abruzzi. Our results are compared to the Samnites of Alfedena (n= 209), another culturally distinct Iron Age Abruzzi community. Initially, we assumed that Vestini males would exhibit considerably more trauma than females (as did the Alfedena males). The difference in the frequency of trauma by sex for the Vestini sample is not significant; their rate of trauma by sex clearly does not follow the pattern exhibited by the Samnites. This suggests that the social pressures on these groups differed and that Italian Iron Age history is complex. Additionally, there is a significant difference in the frequency of trauma among Vestini by cultural stage. Eight of the 10-trauma cases occurred among individuals from the last cultural stage (350-1 BC), while trauma was not found among individuals from the earliest cultural period (1000-750 BC). Explanations for this include; more stressors experienced in the later cultural period than the earlier periods accounting for conflict between communities and more trauma or differential preservation has limited the presence of trauma for the earlier burials.

Analysis of musculoskeletal stress markers and joint disease on the early medieval skeletons from Thunau

(Austria) and the evaluation of a new methodological approach

Pany, D.[1], Viola, TB.[2] & Teschler-Nicola, M.[1].[1] Natural History Museum Vienna, Department of Anthropology, Burgring 7, 1010 Wien, Austria, [2] University of Vienna, Department of Anthropology, Althanstrasse 14, 1090 Wien, Austria

The very well preserved skeletons from the early medieval fortification of Thunau/Gars am Kamp, Austria, were analysed for musculoskeletal stress markers (MSM) and joint disease. The fortification is located on a plateau about 400m above sea level, reaching approximately 600m west-east and 140m north-south, and excellently overlooking the river valley. Several different burial areas have been found within and at the foot of this fortification. Of special interest in the study were probable social differences between the individuals. This assumption had been deduced from the different amount and value of grave goods and special burial places for some individuals within the area. The skeletons were investigated without knowing their burial place at the site, in order to detect possible different activity levels and maybe also differences in joint alterations within the presumable social groups. For the reconstruction of activity in a population the visual scoring of entheses is now widely accepted. However, one main purpose of the study was also an attempt in using a new, observer independent and reproducible method for quantifying the muscle marks. For a selected sample part covering the MSM range from faint to strong, high resolution optotopometrical surface scanning (using a Breuckmann TriTOS L39/60 scanner) of the M. pectoralis major site was performed. For cortical thickness is affected by exercise, for this selected sample CT scans were carried out supplementary. First results of the visual entheses and joint investigation combined with the new method will be presented and discussed.

Food availability affects male deference behavior in a female dominant primate, the ring-tailed lemur (*Lemur catta*).

J. A. Parga, University of Toronto at Scarborough, Department of Social Sciences.

Adult female *Lemur catta* dominate males in all social contexts. However, the extent to which males show submission in the absence of female aggression (Kappeler, 1993) differs by study location. For example, *L. catta* males in captivity show more spontaneous submission (Pereira et al., 1990) than do wild males in Madagascar, where most female-male feeding agonism involves female aggression (Sauther, 1993). Such differences may be caused by provisioning in captivity (Sauther, 1993). To further explore the relationship between food availability and male submission, the present study measured: 1) approach-withdraw interactions and spontaneous male submissive vocalizations, and 2) female-to-male aggression (e.g., chase, cuff, lunge) in *L. catta* on St. Catherines Island (SCI), USA. SCI lemurs are provisioned, but free-range and forage on natural flora. Data were collected across five mating seasons (2000-2004) on two troops per season using focal and all-occurrences of agonism sampling. In the first two study years, 35-40% of female-male agonism involved female aggression, which is intermediate between previously-recorded values for captive and wild *L. catta*. In 2002, the mode of provisioning on SCI was altered to include feeding platforms (as opposed to ground-scattering provisions). Platforms increased food clumping, but greatly lengthened food depletion time. Following platform introduction, the proportion of female-male agonism composed of spontaneous male submission was markedly higher than before platform introduction (Mann-Whitney: $p < 0.05$). These findings suggest that male *L. catta* are more deferential to females in situations of greater food availability, which has implications for the evolution of female dominance in lemurs.

The perception of primate facial expressions with regard to component movements.

L.A. Parr[1], B.M. Waller[2]. [1]Division of Psychiatry and Behavioral Sciences and Yerkes National Primate Research Center, Emory University, Atlanta GA, and [2]Department of Psychology, University of Portsmouth, Portsmouth UK.

The ability to recognize and accurately interpret facial expressions are critical social cognition skills in primates, yet very few studies have examined how primates discriminate these social signals and which features are the most salient. Three experiments examined chimpanzee facial expression processing using a set of standardized, prototypical stimuli created using the new ChimpFACS coding system. First, chimpanzees were found to accurately discriminate between these expressions using a computerized matching-to-sample task. Second, a multidimensional scaling analysis examined the perceived dissimilarity among these facial expressions revealing two main dimensions, the degree of mouth closure and extent of lip-puckering and retraction. Finally, subjects were asked to match each facial expression category using only individual component features. For each expression category, at least one component movement was more salient, or representative of that expression, than the others. However, these were not necessarily the only movements implicated in subject's overall error patterns. Therefore, similar to humans, both configuration and component movements are important during chimpanzee facial expression processing.

Current bioarchaeological investigations at the Castro del Chao Samartín, Asturias, Spain.

N.V. Passalacqua[1], L.L. Cabo[2] and Á. Villa Valdés[3]. [1]Deptartment of Anthropology, Michigan State University, [2]Deptartment of Applied Forensic Sciences, Mercyhurst College, [3]Servicio de Patrimonio Histórico, Consejería de Cultura, Gobierno del Principado de Asturias, Spain.

The present contribution examines a set of human remains from an Early Medieval Necropolis recently uncovered at the Chao Samartín site, in Asturias, Spain. The set of remains under study were recovered during the 2006-2007 seasons, being part of a larger sample still under excavation, but, according to the demographics obtained, it seems to be an already representative cross-cut sample of the original population.
The first fortifications of the Chao Samartín hillfort were erected during the Bronze Age (circa 800 BC). Construction, expansion and fortification continued through the Iron Age, and the settlement was eventually transformed into an administrative capital under Roman control, until it was partially destroyed by an earthquake and abandoned in the Second Century AD. No subsequent activity is noted in the site until the construction of the Medieval Necropolis, dated in the 9th-10th centuries AD.
The demographic characteristics of the sample are consistent with an attritional pattern, with higher representation of infant and elderly individuals, more likely representing a stable population than travelling pilgrims which would have been common in this time period due to the establishment of St. James' Way in close proximity. Health and stress indicators depict a rather wealthy and healthy population, with moderate levels of dental attrition, low developmental stress indicators and minor to moderate osteoarthritis/degenerative joint disease. There is no evidence for interpersonal violence (perimortem trauma) and very few healed injuries (antemortem trauma).

Speed effects on palmar pressure in digitigrade baboons (*Papio anubis*).

B.A. Patel[1], R.E. Wunderlich[2]. [1]Department of Biomedical Sciences, College of Osteopathic Medicine, Ohio University. [2]Department of Biology, James Madison University.

Terrestrial monkeys may improve locomotor efficiency at relatively slow speeds by increasing forelimb length with digitigrade hand postures. As these primates move faster, however, their hands transition to a more palmigrade posture, which is likely associated with the inability of wrist and hand joints to resist higher ground reaction forces associated with faster speeds. Palmigrady may confer several benefits over digitigrady at high speeds including: 1) distributing forces over a larger surface area to reduce stresses in hand bones; 2) translating the center of pressure proximally

towards the carpus to moderate wrist joint moments.
To test these possibilities, dynamic palmar pressure data were collected on two baboons walking and galloping across a runway integrated with a pressure mat (velocity range: 0.46-4.0m/s). Contact area and peak pressure were evaluated in two regions of the hand: distal phalanges and palms (including metacarpal heads). Direction and length of center of pressure movement were tracked between touchdown and time of maximum force.
Baboons use digitigrade hand postures at slower speeds resulting in absolutely smaller palmar contact area (largely across the metacarpal heads) and higher pressure in the metacarpals heads (primarily digits III and IV). As speed increases, baboons adopt palmigrady resulting in greater palmar contact area and lower pressure in the palms and metacarpal heads. Additionally, center of pressure translates proximally from the metacarpal heads towards the carpus, and this translation is larger at faster speeds. It appears that both digitigrade and palmigrade hand postures are beneficial for terrestrial monkeys under different loading conditions.
Funded by NSF Grant BCS 0524988.

Reconciling Biological Sex and Gender Construction on the Great Hungarian Plain during the Middle Copper Age.

I. Pawn. Department of Anthropology, Florida State University.

The Gyula 114 cemetery (ca. 4000 BC) of the Bodrogkeresztur Middle Copper Age culture is located on the Great Hungarian Plain. Previous studies assigned gender to individuals based on traditional regionally established patterns of body position and grave goods. This procedure for construction of gender groups was practical for Gyula 114 as the fragmentary nature of the remains made nonmetric sexing techniques difficult to apply. Without estimations of biological sex, only the genders of individuals were determined.
Contemporaneous sites display significant variation in mortuary treatment. For example, at the Tiszapolgar-Basatanya cemetery during the Early Copper Age, biological males were buried on their right side and females were buried on their left. However, during the Middle Copper Age, 21% of biological males were buried on their left side, and grave goods varied with side placement rather than biological sex. This illustrates the magnitude of bias that can be introduced when gender assignments are used as proxies for biological sex.
This study evaluates biological sex for the Gyula 114 burials (n=18). Based on nonmetric sexing criteria and metric measurements of the best preserved elements, tarsals and long bone midshafts, sexual dimorphism within the population is determined and biological sex is estimated. These data are used to assess variability in sex and gender at Gyula 114 and related to patterns of muscular development and physical activity. The site is then placed within a regional context, examining intersite variability in sex and gender on the Great Hungarian Plain during the Middle Copper Age

World-wide variation in the body-size-adjusted torsional strength of major long bones.

O.M. Pearson, T.R. Petersen. Department of Anthropology, University of New Mexico.

Second moments of area (SMAs), including torsional SMA (J) can be predicted reasonably accurately from external dimensions of long bones. Given this fact, we produced estimated values of J from the external dimensions (AP & ML or maximum & minimum) at midshaft of the femur, tibia, humerus, radius, and ulna for each sex of 11 Holocene and 5 Late Pleistocene populations. The sample comprises Australian Aborigines, Chinese, Tierra del Fuego, Inuit, Khoisan, European Mesolithic, Pygmies, Sami, African and European Americans, and Zulu; fossil samples include Gravettians, Magdalenians, Epigravettian Italians, Ganges Mesolithic, and Jebel Sahaba. Estimated values of J were adjusted for body size by dividing by the product of body mass (estimated from femoral head diameter) and bone length.
In the lower limb, the correlation between femoral and tibial adjusted-J is r=0.59. Males in each group tend to have higher values of adjusted-J than females; a result that applies more clearly in the tibia, especially in hunter-gathers. Interesting exceptions from the expected patterns include Khoisan and Australians, who have dimorphic but low values from femoral adjusted-J and Zulu males, who have an impressively high value for adjusted tibial J. Correlations in adjusted-J among upper limb bones range from r= 0.67-0.71, suggesting both whole-limb and bone-specific influences. The upper limb results allow few generalizations; probably many group-specific factors operate. Most Late Pleistocene groups and Khoisan have low values for upper limb adjusted-J while Australian males and recent forager males from cold areas have high values.

An investigation of internal midsagittal cranial morphology in African papionins.

T.A. Peburn[1], M. Singleton[2]. [1]Department of Anthropology, CUNY Graduate School and University Center, NYCEP, [2]Department of Anatomy, Chicago College of Osteopathic Medicine, Midwestern University.

Recent studies of African papionins have shown that external basicranial morphology, particularly the relative position of the nuchal lines (inion), is concurrent with their molecular phylogeny. However, the cranium's complex three-dimensional (3D) architecture comprises internal and external components which are differentially influenced by associated soft tissue structures, for example, the brain and nuchal musculature. Therefore, this study investigates the structural relationships between these internal and external cranial components to better understand taxonomic differences in basicranial morphology.
Midsagittal cranial morphology of adult African papionins was examined using internal and external 3D landmarks. Landmarks were chosen to register internal basicranial morphology, the degree of basicranial flexion/extension, and the relative position of specific external structures, such as the palate, basiocciput, foramen magnum, glabella, and inion. Landmarks were collected from reconstructed spiral computer tomography (CT) scans (slice thickness, 1mm; reconstructed increment, 0.5mm) and subjected to generalized Procrustes analysis and principal components analysis (PCA) using Morphologika.
Separate analyses performed on the complete midsagittal landmark dataset, the internal basicranium, and each internal cranial fossa reveal different patterns of taxonomic shape variation. Regional analyses, e.g., the anterior and posterior cranial fossae and occipital landmarks, consistently separate *Cercocebus* and *Lophocebus*; only the analysis of the complete dataset yields a pattern that is wholly concordant with the molecular phylogeny. Results demonstrate that in African papionins, internal and external basicranial morphologies differ in taxonomic patterning; these differences must be taken into account when interpreting cranial architecture.
Supported by: LSB Leakey Foundation; Sigma Xi; Wenner-Gren Foundation (Grant 7172).

The impact of Roman imperialism: skeletal evidence of physiological stress and deprivation in Britain.

J.J. Peck. Department of Anthropology, The Ohio State University.

The biological impact of imperialist expansion and cultural contact has emerged as an important focus in bioarchaeological research. This study contributes to our understanding of this phenomenon by addressing the biological impact of Roman imperialism in Britain. Biological responses to changes associated with the integration of Britain into the Roman Empire should be evident in skeletal and dental markers of physiological stress and deprivation. Through analysis of cribra orbitalia and enamel hypoplasia frequencies in pre- and postcontact populations, this study tests the hypothesis that Roman imperialism in Britain caused increased physiological stress and deprivation.
Data were collected on cribra orbitalia from four precontact (N=269) and one postcontact cemetery (N=228) from the Yorkshire region of northeast Britain, represented by skeletal remains from the Iron Age and Romano-British period, respectively. Results indicate a

significant increase in the frequency of cribra orbitalia (chi-square; p≤0.05) and enamel hypoplasia (chi-square; p≤0.05) during the postcontact period. The increase in lesion prevalence in the postcontact sample is argued to be indicative of poorer health. This temporal trend is consistent with socio-economic transformations reported for the Romano-British period. In particular, the emergence of large urban settlements and an increased reliance on cereal agriculture resulted in high pathogen and parasitic loads, possible lead poisoning, and a relatively iron deficient diet. These findings support the hypothesis that populations in Britain experienced increased physiological stress and deprivation and an associated decline in health with the advent of Roman contact.

Geometric Morphometrics Craniofacial Analysis of early Bronze Age Austrian Populations

A. Pellegrini[1,2], M. Teschler-Nicola[1], P. Mitteröcker[2,3], F. Bookstein[2,4].[1]Department of Anthropology, Natural History Museum Vienna, Austria, [2]Department of Anthropology, University of Vienna, [3]Konrad Lorenz Institute for Evolution & Cognition Research, Altenberg, Austria, [4]Department of Psychiatry & Behavioral Sciences, University of Washington, USA.

Archeological data indicate that early Bronze Age populations in lower Austrian do not present a cultural unity, they differ in three regional manifestations: North of the Danube was the area of the Aunjetitz culture, south of the Danube the Unterwölbling (west of Vienna wood) and the Wieselburg culture (east of Vienna wood).
In this study the craniofacial morphology of these populations was analyzed with Geometric Morphometrics methods. 58 three-dimensional landmarks were measured in 171 adult individuals. We carried out a permutation test MANOVA of the Procrustes coordinates, which yields highly significant differences between the culturally separated populations; moreover a Principal Component Analysis in size-shape space has been carried out, which shows conspicuous differences between the Wieselburg and the Aunjetitz groups, while the (heterogenous) Unterwölblig group overlapps with both of them. A PCA of our sample divided by males and females provided evidence for a more heterogenous cranial morphology in males (length and breath) due to a prolonged cranial growth of males as indicated by an allometric analysis. In contrast, females of the three cultural groups differ in some morphological details (e.g., occipital region) substantiating a partial or total isolation.
However, further analysis (e.g., TPS) have been carried out as well, which contribute considerably to our knowledge on mobility and population dynamics in early Bronze Age Austria. As the populations investigated are contemporary, inhabited a small geographic area and share a similar ecological environment, their phenotypic differences will be discussed in terms of genetic differences due to partial or total endogamy.

Phenotypic variation within and between 'genetically homogeneous' mouse litters.

C. Percival[1], CA Hill[1], M Sun [2], Y Wang[2], EW Jabs[2], JT Richtsmeier[1], [1]Department of Anthropology, Pennsylvania State University, [2]The Johns Hopkins University School of Medicine.

Mouse models are critical to studies of human disease, development, and evolution, because of the biological parallels among mammals. For these models to be effective, the assumptions made in designing these mice should be continuously evaluated.
Researchers often rely on the assumption that a comparison between affected mice and unaffected mice is a comparison of two homogenous populations. The routine focus on small samples and point estimates (e.g., mean, sd) in analysis means that we may be overlooking important information about the very processes we seek to study. More subtle patterns of phenotypic variation within and between litters of 'homogenous' individuals can help identify the functions of specific developmental processes. Hallgrímsson (*et al.*, 2003) suggested that morphological variance decreases as animals age. We therefore expect young mice to show the greatest variation and to better reflect differences in maternal effects and related factors than older mice.
A qualitative investigation of two litters of newborn mice (FGFR252+/-) bred to study Apert syndrome suggested that the mice designated 'normal' in these litters showed distinct patterns of cranial asymmetry and variation in ossification patterns.
Quantitative measures of bone volume and density verified these patterns within and between litters. This analysis revealed evidence of variation and directional asymmetry within one of the litters, a phenotypic pattern thought to have a genetic basis. Since these mice all come from the same inbred line, we propose additional genetic and developmental mechanisms that might explain the basis for this phenotypic variation.

Using proximity to understand association patterns among adult mantled howler monkeys (*Alouatta palliata*).

E.M. Perrin, D.M. Kitchen. Department of Anthropology, The Ohio State University.

In bisexually dispersing animals, bonds among individuals are unlikely to be based on kinship. Yet in species such as mantled howler monkeys (*Alouatta palliata*), groups of adults remain relatively cohesive, despite the fact that social interactions typically count for only 2-4% of the activity budget. Rather than focusing on social interactions, we hypothesized that more subtle forms of association might reveal something about the nature of relationships among individual howlers. For example, we predicted that due to intrasexual competition for mates, males would preferentially spend more time near females than males. Additionally, we predicted that patterns of association would be different for females with and without dependent offspring. To examine this, we used scan samples to measure proximity among 31 individuals in two habituated groups of mantled howlers at the Ometepe Biological Field station in Nicaragua. Based on 1440 minutes of observation, we found that male subjects associated with females more frequently and with males less frequently than expected by chance. We also found that lactating females avoided associating with other lactating females, and that in one study group lactating females were less likely than non-lactating females to spend time near adult males. These results might reflect infanticide avoidance or resource competition due to the energetic demands of lactation.
Overall, this preliminary study suggests that mantled howlers display preferences for the individuals they associate with, despite the fact that social interactions are rare. In the future, we will apply this method to individual subjects rather than to coarse age/sex classifications.

Chewing muscle size and diet in Eocene adapines.

J.M.G. Perry[1] and A. Hartstone-Rose [2]. [1]Department of Anatomical Sciences, Stony Brook University, [2]Department of Biological Anthropology and Anatomy, Duke University.

The skull morphology of Eocene European adapines suggests they ate very resistant foods, but the specific nature of these foods remains a mystery. The molars closely resemble those of extant strepsirrhine folivores. However the configuration of the masticatory system is very different and the chewing muscles appear to have been extremely large. To understand the masticatory system of these early primates, we examined the chewing muscles and skulls of modern analogs: extant strepsirrhines. Fiber length is predicted poorly from osteological dimensions because of the confounding effects of pinnation and tendinous fiber attachment. However, several craniomandibular dimensions accurately predict chewing muscle mass and cross-sectional area in extant strepsirrhines. These were used to infer muscle mass and cross-sectional area for all sufficiently complete adapines. Based on these inferences, adapines indeed possessed significantly larger and more powerful chewing muscles than do extant strepsirrhines of similar body size. The leverage of the chewing muscles is similar in adapines and extant strepsirrhines. This suggests that adapines were capable of generating much more chewing force than even the largest lemurs. One interpretation is that adapine chewing muscles had both

considerable cross-sectional area and long fibers (and thus were capable of generating high bite forces at large gapes) and that these features were adaptations for processing very resistant and large foods. This interpretation suggests that adapines fed on woody stems, mature leaves, and large fruits or nuts with tough casings. Further work to refine estimates of fiber length is necessary to evaluate this interpretation.
This study was supported by Sigma Xi, by the Duke Lemur Center's Director's Fund, and by Duke University (the Graduate School and the Department of Biological Anthropology and Anatomy).

Kin biased social behavior in wild white-faced capuchin monkeys, *Cebus capucinus*.

S.E. Perry[1], L. Muniz[3], J.H. Manson[1], J. Gros-Louis[2], & L. Vigilant[3]. [1]Dept. of Anthropology, University of California-Los Angeles, [2]Dept. of Psychology, Indiana University, [3]Max Planck Institute for Evolutionary Anthropology-Leipzig.

It has long been known that kinship biases individuals' choices of social partners in a variety of species. However, the fine details of how individuals balance the importance of kinship against other variables such as dominance rank is less clear. It is also uncertain how kinship recognition mechanisms function in primates. In this paper, we present data from wild capuchin monkeys living in or near Lomas Barbudal Biological Reserve, Costa Rica. Analysis of genetic data for three groups of monkeys revealed a strong tendency to avoid father-daughter inbreeding ($P<0.0001$, Muniz et al. 2006), though it was not clear whether fathers, daughters, or both, were responsible for the aversion. Adult females' partner choice preferences for grooming and proximity were monitored for a single group over a decade. The amount of grooming and proximity time allocated to paternal half-siblings was far more similar to that of non-kin than to that of maternal half siblings or full siblings. This suggests that females do not recognize shared paternity with other females. There were interesting fluctuations in the extent to which rank distance vs. kinship was important in the structuring of social relationships. When group size was small and the average coefficient of relatedness was high with low variance, kinship was less important than rank in determining proximity and grooming rates. When group size increased to include approximately 10 adult females, and mean matrilineal relatedness was lower with higher variance, kinship became an important determining variable and rank became less important.

Correspondence and divergence among seven measures of long bone robusticity.

T.R. Petersen, O.M. Pearson. Department of Anthropology, University of New Mexico

A large number of robusticity measures of long bones have been used in the literature. The best use second moments of area such as *J* and adjust for the effects of body size. Correlations among measures have been under-explored. We calculated correlations among seven measures of femoral, tibial, and humeral mid-shaft robusticity: *J* divided by bone length^4 and length^5.33, *J* divided by bone length times femoral head diameter or by bone length times estimated body mass, 'residual robusticity,' 'residual strength,' and the sum of orthogonal bone diameters divided by bone length. We used a pooled-sex sample of Australians, Chinese, Inuit, Khoesan, Sami, African-Americans, European-Americans, Zulu, Neanderthals, and Gravettians (total n=414).
Correlations among these robusticity indices sort them into families. Indices in which *J* or summed external diameters are divided by a function of length tend to correlate with one another (r = 0.898-0.986), as do indices involving *J* or multiplied diameters divided by functions that include joint size (r = 0.906-0.990). Correlations between these families vary by bone and are particularly low in the tibia. Residual strength (summed external diameters divided by joint size) correlates poorly (r = 0.112-0.838) with the other indices. Adjustment by length^5.33 performs less well than expected. All correlations tend to be higher in the humerus than in the tibia and femur. Ecogeographic differences leave clear traces in most of the indices; as Ruff has noted, adjustment by body mass and bone length best controls for this effect.

Full genome comparisons of *Mycobacterium:* Insight into the origin of tuberculosis and leprosy.

L.A. Pfister, M.S.Rosenberg, A.C. Stone. Arizona State University.

Resolving the origins and antiquity of the two major mycobacterial diseases, tuberculosis and leprosy, provides a framework for the study of the co-evolution of humans and the ancient obligate pathogens *Mycobacterium tuberculosis* and *Mycobacterium leprae*. Elucidating the relationships of pathogenic and nonpathogenic mycobacteria has been limited due to the lack of resolution obtained with single- or multi-locus analyses. The purpose of this study is to determine robust phylogenetic relationships and divergence times within the pathogenic mycobacteria and the genus as a whole using a genome-scale analysis.
Complete genomes of nine species/strains of pathogenic and nonpathogenic mycobacteria were obtained from Genbank and the Sanger Institute, along with their predicted protein sequences. We then identified 497 protein coding genes (~540,000 base pairs) shared by all nine genomes. Phylogenetic analyses of these data using three different methods yielded identical topologies with 100% bootstrap values for all branches. *M. leprae* is situated basal to the *M. tuberculosis* complex (MTBC), in contrast with previous studies. Pairwise genome divergence times were obtained using the number of synonymous substitutions per site and applying the mutation rate of enterobacteria. Our results indicate that *M. leprae* and the MTBC diverged some 36 million years ago, a much deeper timescale for the origins of these pathogens than previously presumed, which suggests a coevolutionary history that begins around the time of anthropoid-prosimian divergence. Further, members of the MTBC included in this study diverged approximately 115 thousand years ago and this expansion corresponds in time with modern human evolution.

Femoral head articular surface area in different human populations.

T. Pfisterer[1], T.B. Viola[1], F.L. Bookstein[1, 2], H. Seidler[1]. [1]Department of Anthropology, University of Vienna, Austria, [2]Department of Statistics, University of Washington, Seattle.

The articular surface area of the femoral head is a frequently used proxy measure for human body mass. In general, this area has been estimated by measuring linear dimensions, and applying these to formulas that give an approximation of the areal dimension. Here, we explore an alternative to this approach, the direct measurement of the surface area on virtual models derived from 3D surface scanning of femora.
We used a tri*TOS* optotopometric surface scanner (Breuckmann GmbH) to digitize proximal femora of a geographically diverse sample of *Homo sapiens*. 3D models of the femora were imported into the software Rapidform™ (INUS Technology) for post-processing and taking of measurements. After delimiting the articular surface manually, we measured its area, and fitted a sphere to it by least-squares. Additionally, we located landmarks on the proximal femur and produced "classical" measurements (distances and angles).
Our preliminary results indicate that there are clear differences in the femoral head between small-sized Khoisan and large-sized Europeans. Relative to antero-posterior and supero-inferior femoral head diameters, Khoisan have relatively bigger and more spherical articular surface areas than Europeans. Thus in this particular case, intergroup allometry is inconsistent with within-group allometry, so that femoral articular surface area cannot serve as proxy for body weight in studies combining these populations. Algebraically, the cause of the paradox is the systematic difference of the ratio between the total sphere area and the actual articular surface area between the two populations.
We discuss possible reasons for this, including varying activity levels or allometric scaling.
The study was supported by the grant GZ200.093/1-VI/2004 from the Austrian Council for Science and Technology to the Department of Anthropology, University of Vienna, Austria.

Vertical position of the superior nasal aperture in *Homo sapiens* and *H. neanderthalensis*.

B.E. Pierson and T.W. Holliday, Tulane University, New Orleans, LA 70118 USA.

The nasal aperture of modern humans (*Homo sapiens*) is said to be apomorphic relative to that of Neandertals (*H. neanderthalensis*), in that it is much narrower and less projecting. What is less well appreciated is the fact that, relative to the orbits, the cranial margin of the Neandertal nasal aperture lies in a more inferior position than it does in modern humans.
To quantify this feature, we took 8 craniofacial measurements on 15 recent human adult crania, and whenever possible, we took the same measurements on scaled photographs or casts of 10 adult Neandertal crania (and 1 pre-Neandertal cranium). The measurements included 6 standard craniometrics, and 2 measurements of our own design: the first is the horizontal chord distance from the frontomalare orbitale to the inferior-most point of the nasomaxillary suture (reflecting nasal projection). The second is the vertical chord distance from the plane between the left and right frontomalare orbitale to the inferior most-point of the nasomaxillary suture. This measurement reflects the vertical position of the superior piriform aperture.
The Neandertals in our study have absolutely more inferiorly positioned nasal apertures than do any of the recent humans from our collection. This pattern also persists relative to orbital area (arguably a measure of overall size – Kappelman, 1996). Computation of log-shape data (Darroch and Mosimann, 1985) suggest that the position of the nasal aperture in the sample is positively allometric, with the large-faced Neandertals lying on the continuation of the recent human static adult allometric trajectory.

The potential discriminant of femur, tibia and the fibula for sex determination. Discriminant functions for Mexican population.

[1]M. Pimienta, [2] A. Gallardo and [3] H. Cisneros. [1] Centro Peninsular en Humanidades y Ciencias Sociales y en Mérida., UNAM, [2]Centro INAH Yucatán/ Escuela Nacional de Antropología e Historia, [3]Instituto de Investigaciones Antropológicas., UNAM

The purpose of this study is to present the discriminant analysis of twenty metric variables from femur, tibia and fibula of 87 individuals of known age and sex from the Mexican skeletal collection housed at the Medical School of the National University of México. All of the bodies came from cadavers used in the dissection room of the Medical School of the National University, and all of them are from several hospitals and the Forensic Medical Service of Mexico City. The results show that all of the 31 measurements were found to have significant differences by sex, and some measurements were different by side as well. It was possible to obtain 22 discriminant functions composed of one variable with 84.3% to 92.4%. certain of correct classification.

Ties to the land: An example of a strategic secondary interment at the Elizabeth Mound Group in West-Central Illinois.

C.M. Pink[1], J.E. Buikstra[2], L.W. Konigsberg[3]. [1]Department of Anthropology, University of Tennessee-Knoxville, [2]School of Human Evolution and Social Change, Arizona State University, [3]Department of Anthropology, University of Illinois, Urbana-Champaign.

The placement of a group's ancestors can be a highly political negotiation. In an archaeological context, the convention is that disposal of the dead in bounded areas often indicates the rights of a particular social group to the resources in that territory. This case study examines the biological relationship of six crania from a secondary interment at the Elizabeth Mound Group in West-Central Illinois to the greater regional population. The crania were placed in a trench feature in Mound 3, which was the first mound constructed upon the reoccupation of the site during the Middle Woodland Period. The Mound 3 crania are all male and were interred in differing taphonomic conditions varying from crania only to complete skulls with mandibles and cervical vertebrae. This suggests that the individuals did not perish at the same time and may not have been selected from a primary interment at the same locale.
A multivariate distance analysis of non-metric cranial traits was used to investigate the biological affinity of the Mound 3 crania. The six crania were compared to the male Middle Woodland components of the Elizabeth (n=15), Gibson (n=35), Pete Klunk (n=74), and Ray (n=25) sites. Results indicate biological continuity between the Mound 3 crania and the larger Elizabeth population. This is consistent with the hypothesis that upon colonization Middle Woodland people at the Elizabeth site carefully placed their ancestors to legitimate occupation of the space.

Understanding variation in maternal energetics during lactation among subsistence farmers in the eastern Amazon.

B.A. Piperata, The Ohio State University, Columbus, OH 43210

The energetic cost of human lactation is high. The strategies women use to meet these energetic demands are influenced by their local ecological and social environment and may include: a reliance on energy stores, increased dietary intake (DI) and reductions in energy expenditure (EE). Studies of lactational energetics have been conducted in a range of ecological, economic and social settings in effort to understand how women living under different conditions meet these additional energy demands. Less attention has been given to within-population variation. The goal of this paper is to present data on variation in weight loss, DI and EE among a sample of lactating women living in rural Amazonian communities and explore some of the factors that influenced their strategies. Anthropometric, dietary and energy expenditure data were collected during early (e), peak (p) and late (l) lactation from a sample of 23 women. Demographic data on household composition and observational data on social support were also collected. Despite similar ecological and economic conditions, the women exhibited a high degree of variation in weight loss (range=0.0-6.4 kg, CV=56%), DI_e (range=1055-1885 kcal, CV=19%), DI_p (range=982-3204 kcal, CV=33%), DI_l (995-2973 kcal, CV=30%) and EE_e (0.86-1.73 kcal/min, CV=16.3), EE_p (1.22-2.01 kcal/min, CV=14.0), EE_l (range=1.16-2.11, CV=16.1). Women in more mature households had better DI in terms of both calories ($p<0.01$) and protein ($p<0.01$) and lower levels of EE ($p<0.01$), especially in energetically demanding, subsistence-based activities. These data demonstrate how household-level conditions can affect the strategies lactating women use to meet their additional energy needs. Ethnographic data on cultural beliefs regarding women's work and the sexual division of labor also enrich our understanding of the differences observed over time.
Research was supported by the Wenner Gren Foundation for Anthropological Research Inc. (Grant # 6861) and NSF (BCS 0201936).

Analysis of mtDNA in Mongolian Populations

L. Pipes[1], A.A. Pai[2], D. Labuda[3], T.G. Schurr[2]. [1]Department of Sociology and Anthropology, Swarthmore College, [2]Department of Anthropology, University of Pennsylvania, [3]Department of Pediatrics, University of Montreal.

The genetic landscape of Mongolia is quite complicated, and reflects the population dynamics of East Asia over the past 10-20 millennia. Archaeological evidence has shown that both West and East Eurasian cultures were present in the region from at least the end of the Neolithic Period to the Early Iron Age. The later emergence of the Mongolian Empire (1206 A.D.) resulted in tribal fragmentation and resettlement of people within and outside of Mongolia. Similarly, Manchu domination (1796-1911) led to the destruction of the majority of the Western Mongols, while other tribes were partially or wholly resettled to specific areas. As a result, the primary ethnic group, the Khalkha, is dispersed throughout the entire territory of Mongolia, while 20 other groups live mainly in the marginal areas of the country. To clarify the complex population

history of Mongolia, we analyzed variation in the mtDNAs of ~200 individuals from several Mongolian ethnic groups. We used RT-PCR TaqMan assays to type coding region SNPs and HVS1 sequencing to assess control region variation in these groups. The resulting data provide insights into the origins and affinities of these populations with East Asian groups, their relationships to neighboring Turkic speaking groups, including indigenous Altaians, and their possible role in the peopling of the Americas.
The authors would like to thank all of the Mongolian individuals for their involvement in this project. This study was supported by funds from the University of Pennsylvania and the Social Sciences and Humanities Research Council of Canada (T.G.S.), and the Department of Sociology and Anthropology at Swarthmore College (L.P.).

Comparison of hominin dimorphism using different methods, and their impact on behavioral reconstructions.

J.M. Plavcan. Department of Anthropology, University of Arkansas.

Dimorphism in fossil hominins is of enormous interest because of its association with behavior. Several methods for assessing dimorphism in fossils have been advocated, yet direct comparisons of their effectiveness using hominin data have been irregular, in spite of recent debate about the magnitude of hominin dimorphism. Moreover, no study has evaluated correlations between behavioral measures and dimorphism in extant reference species estimated using the same methods applied to the fossils.
This study uses standard Monte Carlo methods to compare craniofacial dimorphism in *Australopithecus afarensis*, *A. africanus*, and *A. boisei* using 6 separate methods for estimating the magnitude of dimorphism, and three for incorporating data from separate elements. The results are compared to estimates of dimorphism in a series of 102 extant primates using the same methods, and then compared to measures of male competition, operational sex ratio, and breeding system.
With few exceptions, all methods yield similar results for hominins considered here. Methods incorporating information from multiple elements yield more stable results. Comparisons to extant taxa show that these hominins were characterized by craniofacial dimorphism somewhat less than that of *Gorilla*, but similar to many strongly dimorphic catarrhines, as suggested by a number of other studies. There is little evidence that these hominins showed human-like dimorphism. Estimates of craniofacial dimorphism among extant taxa are strongly correlated with behavioral measures. Hominin dimorphism suggests intense male competition, polygyny, and strongly skewed operational sex ratios. Debates centering on methods are to some degree a red herring.
Supported by NSF SBR 9616671

The effects of exercise and age on diaphyseal modeling of the femoral midshaft.

J.H. Plochocki, M. DeLisser, T. Cruz, A. Obafemi. Department of Biology, The Pennsylvania State University, Altoona.

It is well established that bone modeling is an adaptive mechanism responsive to changes in mechanical loading. Understanding the modeling process is important because physical behavior patterns and phylogenetic relationships are often inferred from bone. However, the effect of age on the rate and location of modeling is not clearly understood. We examine the interactions among these variables at the femoral midshaft using subadult mice of the strain C57BL6/J (N=40). Mice were separated into four groups: sedentary and exercise groups aged 7 weeks, and sedentary and exercise groups aged 11 weeks. Exercised mice were treated with unlimited voluntary access to activity wheels. The results suggest that the osteogenic response to alterations in the mechanical environment differ by age and location. Mice aged 7 weeks showed no statistical difference in bone formation variables between treatment groups ($P > 0.05$), although the 7-week-old exercised mice had 21.4% more endosteal growth and 21.3% more periosteal growth than controls on average. Exercised mice aged 11 weeks had significantly greater endosteal and periosteal growth than mice in the control group ($P < 0.01$). Exercised mice exhibited 41.7% more endosteal growth and 128.6% more periosteal growth than controls. Our data supports the hypothesis that the addition of greater amounts of periosteal bone relative to endosteal bone may be an important adaptation to loading that increases the bending strength of bone later in skeletal development.
This research was funded by a grant from The Pennsylvania State University.

Sexual dimorphism, body size and joint posture in primates.

J.D. Polk, J. Peterson. Dept. of Anthropology, University of Illinois at Urbana-Champaign.

Body size affects many aspects of primate life, including their locomotor behavior. Among quadrupedal primates, interspecific studies have demonstrated that larger individuals use more extended joint postures than smaller individuals, presumably because extended postures will moderate bone bending moments and joint torques. Within species, primate sexes show considerable variation in sexual size dimorphism, and this study investigates the consequences of dimorphism for habitual limb posture in a broad sample of primate species. More specifically, we test whether interspecific scaling patterns can be applied within species, with males of the most dimorphic taxa exhibiting more extended postures than females. Monomorphic taxa were not expected to differ in habitual postures. Femora from adult males and females for 20 species were included in the analysis. Ratios of male/female body mass ranged from 1.02 to 2.45. Postures were inferred by spatial analysis of subchondral bone density on the distal femur. Density data were obtained by computed tomographic scans, and spatial analyses conducted in AMIRA software. Joint postures were regressed against geometric mean size estimates and dimorphism ratios. For a pooled-sex sample, larger primates used more extended postures than smaller primates. However in sex-specific analyses, male posture was not significantly correlated with dimorphism, while female posture showed a weak but significant correlation. In the least dimorphic species, females appeared to use more flexed postures than conspecific males, however sexes of the most size-dimorphic taxa did not differ. Thus, females of the less dimorphic species may retain greater maneuverability and capability for acceleration relative to their conspecific males.

Endurance versus efficiency in humans and chimpanzees: a new look at the old problem of becoming bipedal

H. Pontzer[1], D.A. Raichlen[2], M.D. Sockol[3], [1]Department of Anthropology, Washington University, [2]Department of Anthropology, University of Arizona, [3]Department of Anthropology, University of California, Berkeley.

Biomechanical investigations of hominin locomotion often focus on locomotor efficiency, but what if endurance is a more evolutionarily salient aspect of locomotor performance? It has long been argued that hominin bipedalism evolved in the context of expanding day ranges under selection for lower walking costs, but the implied evolutionary link between increased daily travel and improved locomotor efficiency is unsupported by ecological and morphological comparisons of living mammals. Instead, the available evidence suggests increased ranging leads to selection for improved endurance. In this study, we investigated locomotor endurance and efficiency during treadmill exercise in humans and chimpanzees in order to test the hypothesis that bipedalism decreases endurance, but not efficiency, for a habitual quadruped. As expected, in contrast to the similarity in locomotor costs of bipedal and quadrupedal walking for chimpanzees, endurance, measured as maximum sustainable speed, was substantially higher during quadrupedal trials. Further, human endurance greatly exceeded that of quadrupedal chimpanzees, a difference which could not be accounted for solely by humans' greater efficiency. These results challenge the hypothesis that bipedalism in early hominins was linked to increased ranging, and indicate strong selection on both efficiency and endurance in the hominin lineage.

Elements of obesity in Orangutans (*Pongo* sp.)

A. Porpora, L.L. Taylor, Department Anthropology, University of Miami.

Obesity is a serious problem in captive great apes, especially orangs (*Pongo* sp). The mast fruiting cycle may have selected for fat storage in this genus, and thus a predisposition to weight gain. We assessed weight, pedigree, lifestyle in 31 captive orangs (15:16) to identify additional contributory variables. The few data available from the wild suggest a normal weight of 77.9 kg for adult males in Sumatra (*P. abelii.)* and 77.9 kg in Borneo (*P. pygmaeus)*; captive males averaged 53.8 kg and 115.2 kg. Wild adult females weigh 35.8 kg and 35.6 kg respectively, whereas captive females were heavier at 49.8 kg and 57.2 kg. Hybrid orangs (*P. abelii* x *P. pygmaeus*) of both sexes were significantly heavier: 129 kg for males and 77.7 kg for females. Two were morbidly obese (121.8 kg male: 159 kg female). Inactivity and poor diet were constants in their lives as pets, until they were moved to the Center for Great Apes (Wauchula, FL). Dramatic weight loss resulted from a change in these two variables. Castration may also contribute to captive hybrid males being so much heavier, since these males are often castrated prior to puberty to prevent them from siring offspring. Orang populations have been isolated from each other long enough to be classed as two genetically-distinct species, but clearly, not so long as to prevent successful interbreeding. So, we suggest that hybrid vigor may also help explain why crossbred orangs in this sample are consistently larger.
This research was supported in part by a CGA Internship (AP) and an Innovative Teaching Grant (LT) from the University of Miami.

Dental decoration and residential mobility in 8th century Pamplona, northern Spain.

E.A. Prevedorou[1], M. Diaz-Zorita Bonilla[2], J.E. Buikstra[1], M.P. de Miguel Ibáñez[3], K.J. Knudson[1]. [1]School of Human Evolution and Social Change, Arizona State University, [2]Dept. of Prehistory and Archaeology, University of Seville, [3]University of Alicante.

Excavations at the 8th century AD necropolis at Plaza del Castillo, in the city of Pamplona, northern Spain, revealed the skeleton of an adult female (PLA-0159) showing dental decoration. While the practice of intentional dental modification was absent in Medieval Spain, it is common in Africa and may suggest that the individual was born in Africa and brought to Spain later in life. The presence of Islamic grave goods and rituals in the cemetery and the historically documented invasion of Pamplona by Muslim groups from North Africa between 715-799 AD also support an African origin for the woman. The hypothesis of a non-local biological origin of the individual was tested via strontium and oxygen isotope analyses on hydroxyapatite in tooth enamel. The isotopic ($^{87}Sr/^{86}Sr$ =0.70817 and $\delta^{18}O_{c(V\text{-}PDB)}$ = -5.64%) signatures of the enamel were measured following established methodologies and compared to the geochemical composition of the local region and to the local modern precipitation values. These data showed a non-local isotopic signature, suggesting that PLA-0159 was a first-generation immigrant. The isotopic values are in general consistent with the geochemical and environmental setting of North Africa. The carbon stable isotope analysis on tooth enamel revealed a diet heavily based on C_3 terrestrial plants ($\delta^{13}C_{c(V\text{-}PDB)}$= -13.57%), like cereals, which is consistent with an inland agricultural population. The use of biogeochemical analyses on archaeological human skeletal material, previously unexplored in Spain, provides a new perspective in the biorchaeological study of the region.
Funded by the Center for Bioarchaeological Research and the School of Human Evolution and Social Change, Arizona State University.

Modern European population affinities: a dental study.

S.T. Price. Dept. of Anthropology, New York University, New York Consortium in Evolutionary Primatology (NYCEP).

European population history has been investigated largely through genetics and archaeological research, and has revealed a complex history for this region. Dental morphology is genetically controlled and only marginally influenced by environment. In addition, dental remains are the most common and often best-preserved remains from past populations, and have been shown to be good indicators of biological affinity. For these reasons, dental analyses will add important evidence to debates regarding European population history. Metric and nonmetric data were collected on 160 modern human individuals curated in the Natural History Museum, London and the American Museum of Natural History. Dental morphology was scored according to the Arizona State University Dental Anthropology System (ASUDAS). Statistical analyses including mean measure of divergence indicate important population differences as well as affinities between some groups. The current study is a pilot project as part of a larger investigation into European population history, but preliminary analyses of dental morphology indicate at least one division in Europe. This division seems to correspond to geographic location, and can broadly be categorized as an east-west separation of populations. More eastern populations not only have higher frequencies of certain dental traits, such as shoveling and double shoveling, but also show a tendency toward higher levels of expression of those traits as well. Overall, these analyses indicate different recent population histories for Eastern and Western Europe. Future research will examine more individuals over more time periods to understand this complex history.
Funding was provided by a NYCEP summer research grant.

Indirect paternal investment in white-handed gibbons.

J.M. Prime, U.H. Reichard. Department of Anthropology, Southern Illinois University, Carbondale.

With the exception of the siamang, direct paternal care is absent in gibbons and females do not seem to need males to successfully rear offspring. Uni-parental female care is widespread among mammals, which releases males from interacting with immatures. In primates, however, long-term observations have revealed surprisingly frequent contact between males and immatures in the form of grooming and playing, even in species where direct male care is absent. This raises the question of how males may benefit from intimate contacts with immatures. In this study, we analyze data collected on male-offspring interactions in seven white-handed gibbon social units over a 6-month period and on male-female sexual relationships from the Khao Yai gibbon long-term database. Data on the type, frequency and duration of male-immature activities, male-immature proximity, mother's proximity and mother's responses to male-immature interactions were recorded. Males engaged more in play and grooming activities with juveniles than females and were highly tolerant of unweaned infants particularly during close male-female interactions. In addition, females did not show signs of distress when immatures and males engaged in activities. We suggest that proximity and involvement with young may be a useful social tool for males, allowing them to establish/strengthen relationships with an infant's mother and perhaps gain sexual access with her and/or neighbouring females. This is of particular interest in light of recently documented gibbon female sexual polyandry and male replacement, and may indicate that males use interactions with immatures as a mating strategy to increase their sexual appeal as partners for females.

Quantitative Shape Analysis of the Proximal Metatarsal Articular Surfaces in *Homo* and *Pan*: A Pilot Study.

D. Proctor. Department of Anthropology, University of Iowa.

This study uses 3D morphometrics to quantify the proximal metatarsal articular surface of m2, m3, m4, and m5. Methodology follows a study by Proctor et al. (in press) that quantified the surface shape of m1. The following hypotheses are tested: (H_1) Human joint surfaces are flatter than chimpanzee joint surfaces; (H_2) The greatest differences are in the metatarsals most responsible for

human weight transference up to and including toe off. These are m4 and m5 (m1 is discussed in Proctor et. al., in press), as evidenced by the typically higher robusticity of these metatarsals, and transfer of weight before toe off (Archibald et al., 1972; Day and Napier, 1964; Elftman and Manter, 1935a). Significant differences were found in the articular surface shape of *Homo* and *Pan*. In *Homo*, the m2 surface is narrower and flatter, while *Pan* exhibits a wider surface with medio-lateral curvature and elevation in the central region. The m3 surface in *Homo* is wider at the central region. The *Pan* articular surface is narrower in the central region, and shows surface convexity. The m4 surface in *Homo* is flat and narrow, and the *Pan* surface is wider with extreme convexity relative to *Homo*. The m5 surface in *Pan* is narrower in the dorso-plantar aspect compared to *Homo*. *Pan* has a tendency toward a slightly concave surface, and in *Homo* the surface is slightly convex. This study is a pilot for a larger study that will compare these joint surfaces in *Homo*, *Pan*, *Gorilla*, and fossil hominins.

Lead in the human femoral head.

J.J. Prutsman-Pfeiffer. Department of Anthropology, State University of New York at Buffalo, Anatomic Pathology, University of Rochester Medical Center.

This study investigated lead concentrations in the proximal femur of 60 patients having hip replacement surgery in Rochester, NY. Femoral head and neck specimens removed for indications of fracture and osteoarthritis were analyzed. The bone specimens were obtained after all diagnostic procedures by the pathology department and intercepted for the study prior to specimen discard. The overall lead concentration of trabecular and cortical bone of 30 fracture and 30 osteoarthritis specimens was determined by portable X-Ray fluorescence (pXRF) and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS). Lead isotope ratios were plotted for each cortical bone sample to determine the source of the environmental exposure.
Lead becomes sequestered in the skeleton and reflects the long-term environmental exposure from a variety of sources ranging from past leaded gasoline emissions to household dust containing lead from degraded painted surfaces. Lead continues to be a major health problem despite measures to curb exposure. High levels of lead have been clinically associated with hypertension, renal failure, and neurologic deficits in humans, and may be a risk factor for osteoporosis. Endogenous skeletal release of lead into the circulation may accelerate the deterioration of already compromised bone. Lead interferes with normal bone healing after fracture in mice. Much is known about the hazards of lead, yet studies are lacking as to the effect lead has on the skeleton. This investigation correlated the amount of lead in bone with patient demographics, medical history and diagnoses, bone pathology, and sociocultural habits of tobacco smoking and alcohol use.
Grant support for this project was received from the Morris E and Lucille R Opler Anthropology Department Dissertation Research Scholarship at the University at Buffalo.

Interaction in pigmentation genes creates variation in brown irises.

E.E. Quillen[1], S. Beleza[2], E.J. Parra[3], R.W. Pereira[4], M.D. Shriver[1]. [1]Department of Anthropology, Pennsylvania State University, [2]Institute of Molecular Pathology and Immunology, University of Porto, [3]Department of Anthropology, University of Toronto, [4]Department of Genomics and Biotechnology, Catholic University of Brasília

Iris pigmentation varies substantially in humans and may have been under either natural or sexual selection at different times during our evolutionary history. While less than 10% of the people today have blue eyes, previous analyses have focused on the genetic basis of the differences between blue and brown iris pigmentation or between blue and green as light eyes and brown as dark eyes while neglecting the variation within brown eyes. In a heterogeneous brown-eyed Brazilian population, both iris and skin pigmentation vary widely and are significantly correlated (r^2=0.39), suggesting that the same or linked genes are determining these two traits. However, an alternate explanation for this correlation between skin and eye pigmentation is admixture stratification which can lead to similarly high correlations among unlinked markers or traits. The history of tripartite admixture (European, West African, and Indigenous American) investigated using Ancestry Informative Markers, makes Brazil the ideal population to study the interaction between genes related to pigmentation of the eye and skin. Polymorphism previously associated with skin pigmentation differences in the parental populations, including *SLC24A5, KITLG, MATP, OCA2,* and *TYRP1*, were investigated to uncover the magnitude of their influence on pigmentation variation in brown irises.

Adult male-juvenile interactions in captive hamadryas baboons (Papio hamadryas).

C.E. Quinn Baker, L.D. Wolfe. Department of Anthropology, East Carolina University.

This study of the interaction between adult male and juvenile hamadryas baboons was carried out at the North Carolina Zoological Park in Asheboro, North Carolina. The study group was composed of twenty captive born hamadryas baboons, of which eleven were adult females, five were juveniles, and four were adult and subadult males. Focal animal observations were conducted for twenty-minute increments for a total of 455 observations periods between May 29 and July 31, 2007. The study focused on agonistic buffering and the kidnapping of juvenile females by adult/subadult males, behaviors typical of hamadryas baboons. The results of this study confirm that both of these behaviors are present in this captive group of baboons. In addition, adult males were also observed carrying and playing with juveniles in situations that were not part of either agonistic buffering or knapping, behaviors not reported for free-ranging baboons.

New diagnostic frontiers in imaging bone anatomy and pathology by synchrotron light, confocal laser scanning microscopy and clinical MRI.

F. Rühli[1], G. Kuhn[1], H. von Waldburg[1], P. Speier[2], S. Nielles-Vallespin[2], C. Papageorgopoulou[1].[1] Institute of Anatomy, University of Zurich, Switzerland, [2] Siemens Medical Solutions, Erlangen, Germany

Diagnostic imaging of bone anatomy and pathology is full of pitfalls, this is particularly true for historic specimen e.g. due to the lack of contemporary clinical information and post mortem tissue alteration. New emerging techniques representing the current methodological advances in bone research may contribute for an improved reconstruction of ancient health and disease in future. The aim of this presentation is to show exemplary the impact of three new state-of-the-art methods with particular diagnostic validity in anthropological-paleopathological research project as done by us. Exemplary, synchotron light allows extremely high-resolution diagnostic imaging of small specimen. We used this technique e.g. to qualitatively assess a bone biopsy of the Iceman (South Tyrol Museum of Archaeology Bolzano, Italy; ca. 3'300 BC) in comparison with contemporary samples of normal and ostoeporotic adult individuals. Unlike in classical light microscopy, confocal scanning laser microscopy (CSLM) allows serial optical sections from thick specimens, multiple wavelength images, three-dimensional reconstruction and computing of length, surface or volume. The study of bone microdamage on archaeological skeletal material (n=12; Tomil Graubünden Switzerland) and for 3D imaging of macerated bones (Galler pathological reference series, Insitute of Anatomy, University of Zurich) revealed the specific advantage of CSLM for such unique specimen. Finally, the diagnostic impact of clinical magnetic resonance imaging (by using 3D ultra-short TE sequence; MRI) on imaging historic dry specimen such as dry bone and mummies will be shown. Spatial tissue discrimination by MRI is now possible for such specimen without rehydration of the sample.

Do new *Alu* polymorphism data distinguish the Northern vs. Southern routes out of Africa?

R.L. Raaum[1], W. An[1], A.B. Wang[1], A. Al-Meeri[2], T. Kivisild[3,4], C.J. Mulligan[1]. [1]Department of Anthropology, University of Florida, [2]Faculty of Medicine, Sana'a University, [3]Department of Evolutionary Biology, University of Tartu, Estonian Biocentre, [4]Leverhulme Centre for Human Evolutionary Studies, University of Cambridge.

Support for an initial migration of anatomically modern *Homo sapiens* through the Levant rests primarily on fossil evidence from this region (e.g., Skhul and Qafzeh). Recent publications documenting many basal Eurasian mitochondrial haplogroups in Southeast Asia and Oceania has led to the alternate hypothesis that modern humans initially dispersed from Africa following a coastal route from the Horn of Africa, along the coast of present day Yemen and Oman, and proceeding quickly to Southeast Asia and Oceania. In order to better evaluate the most likely route taken out of Africa, we collected *Alu* polymorphism data for Yemeni, Bedouin, Palestinian, and Ethiopian population samples. These populations were chosen to cover the putative paths of the Northern and Southern dispersal routes. A principal components analysis of these data shows that these Middle Eastern populations are genetically intermediate between African and non-African populations. In order to further investigate population history in these groups, we used structure to infer African ancestry. Interestingly, the Yemeni, Bedouin, and Palestinian samples show differing patterns of inferred African ancestry, suggesting that these groups may have distinct histories. A genetically intermediate position between African and non-African populations could result from quite different histories, of which the two extreme possibilities are (1) populations founded in the midst of the initial out of Africa migration, or (2) a recent admixture of non-African and African groups. We performed coalescent simulations in order to better understand the expected pattern of inferred ancestry under these two scenarios.

Differences in Cortical Dopaminergic Innervation Among Humans, Chimpanzees, and Macaque Monkeys: A Comparative Study

M.A. Raghanti[1*], C.D. Stimpson[2], J.L. Marcinkiewicz[3], J.M. Erwin[4], P.R. Hof[5,6], C.C. Sherwood[2]. [1]Department of Anthropology and School of Biomedical Sciences, Kent State University, [2]Department of Anthropology, The George Washington University, [3]Biological Sciences, Kent State University, [4]Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, [5]Department of Neuroscience, Mount Sinai School of Medicine, [6]New York Consortium in Evolutionary Primatology.

In this study, we assessed the possibility that humans differ from other primate species in the supply of dopamine to the frontal cortex. To this end, quantitative comparative analyses were performed among humans, chimpanzees, and macaques. Immunohistochemical methods were used to visualize tyrosine hydroxylase-immunoreactive axons within the cerebral cortex. Axon densities and neuron densities were quantified using computer-assisted stereology. Areas 9 and 32 were chosen for evaluation due to their roles in higher cognitive functions. Primary motor cortex was also evaluated because it is not associated with cognition. We did not find an overt quantitative increase in cortical dopaminergic innervation in humans relative to chimpanzees. However, several differences in cortical dopaminergic innervation were observed among species which may have functional implications. Specifically, humans exhibited a sublaminar pattern of innervation in layer I of areas 9 and 32 that differed from that of macaques and chimpanzees. Among-species analysis of axon length density to neuron density revealed that humans and chimpanzees together deviated from macaques in having increased dopaminergic afferents in layers III and V/VI of areas 9 and 32, but not in area 4. Finally, morphological specializations that may be indicative of cortical plasticity events were observed in humans and chimpanzees, but not macaques. Our findings suggest significant modifications of dopamine's role in cortical organization occurred in the evolution of the apes, with further changes in the descent of humans.
This work was supported by the National Science Foundation (BCS-0515484 and BCS-0549117), the Wenner-Gren Foundation for Anthropological Research, and the James S. McDonnell Foundation (22002078). Brain material used in this study was loaned by the Great Ape Aging Project (USPHS/NIH grant AG14308, "A Comparative Neurobiology of Aging Resource," J. Erwin, PI), the Foundation for Comparative and Conservation Biology, and the Northwestern University Alzheimer's Disease Center Brain Bank (NADC grant P30 AG13854).

The effects of human encroachment and seasonality on the risk of mantled howler monkey (*Alouatta palliata*) predation by dogs on Ometepe Island, Nicaragua.

M. Raguet-Schofield. Department of Anthropology, University of Illinois (Urbana-Champaign)

Human encroachment on primate habitats is a major factor threatening primate populations. In addition to deforestation, other aspects of human proximity can compromise the health and viability of primate populations. This paper reports a witnessed account of dog predation that resulted in the deaths of an adult female mantled howler (*Alouatta palliata*) and her 4-month old infant. These events took place during a year long study (August 2006 through August 2007) of *A. palliata* on Ometepe Island, Nicaragua. The attack occurred in a degraded forest edge during the height of the dry season, when food was scarce and howlers spent less time per day feeding. Monkeys frequented this location to access unripe mangoes, one of the few resources available during this period. In addition to the observed dog attack, another adult howler carcass was found at this location, and 3 other infants/juveniles died or disappeared from the group during the dry season. It is unknown whether dogs were directly responsible for all deaths/disappearances, but it is likely that increased anthropogenic activity and seasonal food scarcity contributed to howler mortality. The results of this study indicate that human encroachment poses severe threats, including predation by dogs, to primate populations. Furthermore, these risks are exacerbated during seasonal periods of food scarcity, when howlers venture into hazardous locations to acquire resources. The evolutionary consequences of seasonally differential predation risks and mortality rates are discussed, in terms of the selective forces acting on infants/juveniles to survive this risky period and fulfill their reproductive potential.
This research was supported by the National Science Foundation (Dissertation Improvement Grant 0622411), the Graduate College of the University of Illinois, Sigma Xi Grant-in-Aid of Research, and the Beckman Institute.

Wired to run? The evolution of novel locomotor behaviors in hominins.

D. A. Raichlen[1], B.K. Keeney[2], G. Gerdeman[1], T.H. Meek[2], R.S. Wijeratne[2], T. Jr. Garland[2]. [1]University of Arizona, [2]University of California, Riverside.

Hominin evolution appears marked by two locomotor transitions: first, the evolution of bipedal walking and later, the possible development of endurance running (ER). The former explains many anatomical differences between early hominins and other apes, while the latter may explain morphological innovations in the genus *Homo*. Here, we present preliminary data from a novel test of selection for ER in humans and other mammals. Humans experience neurobiological rewards for ER (e.g. euphoria and stress-reduction) that may represent a mechanism used by selection to generate a behavior that is both energetically costly and increases risk of injury. Some suggest these rewards are due to a reported increase in endocannabinoid (eCB) signaling to brain reward centers during running, although this hypothesis remains untested. We tested the eCB hypothesis by examining the locomotor response to Rimonabant, a cannabinoid receptor antagonist, in a sample of mice that have been selectively bred for high voluntary wheel-running behavior (ER). A sample of ER mice and controls received two dose levels of Rimonabant and a sham over 9 days. Female ER mice significantly reduced

voluntary running (wheel revolutions 10-70 minutes post-injection of high-dose Rimonabant) to a greater extent than controls, although there was no significant difference in the response in males. These results indicate a complex relationship between eCB signaling and ER, but suggest that selection can act on the eCB system to increase the motivation to run. Since humans experience exercise-induced eCB signaling, we propose that this mechanism may have generated novel locomotor behaviors in hominins.
Supported by NSF IOB-0543429 to T.G.

Teaching the controversy – properly: Lessons from the intelligent design challenge.

W. M. Ramsey, University of Nevada, Las Vegas

Proponents of intelligent design have endorsed the seemingly innocuous position that educators should teach that evolutionary theory is not fully accepted by scientists and, moreover, faces significant challenges in explaining certain aspects of complex organisms. In response, most biologists have rejected "teaching the controversy", claiming that doing so would create the false impression that evolutionary theory is less widely accepted than it is. Although this position is correct, it unfortunately makes biologists look as though they are avoiding criticism.

I will argue that some dimensions of the controversy actually should be taught in public schools because they provide a helpful opportunity to explain important dimensions of evolutionary processes. Specifically, Michael Behe has argued that evolutionary theory cannot account for the development of certain complex bio-chemical systems with intricate parts, since these parts would apparently have no utility during intermediary stages of development. Many biologists would agree that this is an interesting *prima facie* challenge to evolutionary theory. Consequently, they have presented compelling and convincing answers to this challenge that reveal precisely how complexity can and does result from the evolutionary processes. Thus, the so-called "irreducible complexity" controversy provides a unique teaching opportunity that not only could help clarify key aspects of evolution, but also serves to expose the theory's explanatory power and durability. I will suggest that teachers of evolutionary biology should embrace this opportunity.

The efficacy of the auditory brainstem response (ABR) in the assessment of auditory sensitivity in primates.

M.A. Ramsier[1], J.D. McGee[2,3], N.J. Dominy[1], D.L. Armstrong[3], E.J. Walsh[2,3]. [1]Department of Anthropology, University of California, Santa Cruz, [2]Developmental Auditory Physiology Laboratory, Boys Town National Research Hospital, Omaha, NE, [3]Grewcock Center for Conservation and Research, Henry Doorly Zoo, Omaha, NE.

Behavioral testing has been used for over 75 years to assess the auditory sensitivity of many mammalian species. Currently, only 26 primate species have been tested using this strategy. As a result, our understanding of primate auditory ecology is largely devoid of comparative data, particularly among the platyrrhines. Although the behavioral audiogram (i.e., threshold vs. stimulus frequency curve) is still an important bioacoustical tool, logistical challenges limit its utility, including the necessity of training and conditioning subjects.
Here, we review the efficacy of the auditory brainstem response (ABR) as a supplemental, safe and efficient procedure to estimate auditory sensitivity of primates across the audible frequency range. The ABR is a noninvasive procedure commonly used to test hearing in a wide range of species, including humans. The aim of this presentation is to consider the utility of the ABR in evolutionary anthropology and to discuss the physiological basis of the response as well as the relationship between ABR-derived and behaviorally-derived audiograms. We also consider the widespread use of the procedure and demonstrate its utility in the investigation of acoustic parameters of ecological interest.
ABR-derived audiograms from the cotton-top tamarin (*Saguinus oedipus*), the brown-headed spider monkey (*Ateles fusciceps robustus*), and the Peruvian squirrel monkey (*Saimiri sciureus peruviensis*) are presented to demonstrate the value of the ABR as a tool to compare the audible limits and variability of hearing sensitivity among primate species. Because hearing is critical to survival, these data have significant implications for understanding auditory form-function relationships in primate evolution.

Full field noncontacting strain measurements in the colobine mandibular symphysis.

A.J. Rapoff[1], R.B. Bucinell[1], W.S. McGraw[2], D.J. Daegling[3]. [1]Department of Mechanical Engineering, Union College, [2]Department of Anthropology, Ohio State University, [3]Department of Anthropology, University of Florida.

Lateral transverse bending ("wishboning") is the most important source of masticatory stress in cercopithecoid symphyseal bone. Characterization of the associated strain gradients has relied on analytical models of simplistic geometries and material composition, despite recognition that the reality of symphyseal morphology makes such inferences prone to unknown errors. We used a speckle image photogrammetry technique to determine surface strains on the labial and lingual aspects of the symphyseal regions of a set of colobine mandibles under wishboning loads. We first air-brushed the mandibles with a black stochastic dot pattern; dot size and density permitted submillimeter spatial resolutions on strain. Mandibles were then wishboned in a materials testing machine to create a maximum internal bending moment at the symphysis of 7 N·m. Two cameras captured images as specimens were progressively loaded, and commercial software was used to track the positions of the dots, determine their displacements and, through spatial differentiation, the surface strains. We found magnitudes of maximum strains of about 0.003 (labial compression, lingual tension) and gradients exceeding 30% over distances as little as 1 mm.
These results indicate that experimental studies using even densely packed strain gages cannot capture functionally meaningful strain gradients. Similarly, accurate computational (finite element) models will require detailed mappings of material constitutive properties with finer spatial resolution than is currently used to reproduce actual strain states. Since photogrammetry allows a more or less exact solution to the question of the strain concentrating effects of mandibular curvature, error magnitudes of various models can be specified.

The effect of vertebral numerical variation on anatomical stature estimates.

M.H. Raxter[1], C.B. Ruff[2]. [1]Department of Anthropology, University of South Florida, [2]Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine.

Most humans possess 24 presacral vertebrae composed of seven cervicals, 12 thoracics and five lumbars; however variation from this standard exists, with some individuals possessing 23 or 25 presacral vertebrae, intercalation and excalation usually occurring in the thoracolumbar and lumbosacral junctions. Fully's (1956) technique for estimating living stature involves measurement of skeletal elements from the skull through the foot, including the maximum heights of the vertebrae, but Fully did not address the issue of vertebral numerical variation. The purpose of this study was to test the effect of vertebral numerical variation on anatomical stature estimates.
The sample consisted of 25 adults from the Terry Collection that possessed varying counts of vertebrae. Living stature was derived from known cadaveric stature. Using a revised Fully anatomical method (Raxter et al., 2006), two statures were calculated – one included the height of the first sacral segment for all individuals, and another excluded it for individuals that possessed a sixth lumbar vertebra. Our analyses revealed that when the first sacral segment is excluded from skeletal height, mean directional (-0.54 cm) and median absolute (1.69 cm) differences between Fully estimated and living statures are smaller compared to when the first sacral

segment is included. Paired t-tests also showed a significant difference between Fully estimates including S1 and living statures ($p = 0.013$), while differences excluding S1 were non-significant ($p = 0.772$). These results suggest that when a sixth lumbar vertebra is present, exclusion of the first sacral segment from calculations yields a more accurate stature estimate.

The dental morphology of modern and prehistoric Sri Lanka and its implications for the peopling of Australasia.

D.R.T.Rayner. School of Archaeology and Anthropology, Australian National University.

The Veddas are an Indigenous people of Sri Lanka and are considered to be descendents of the island's first inhabitants. A commonly accepted opinion is that the Veddas share a (poorly defined) relationship with Andaman Islanders, 'Negrito' populations from Southeast Asia and Australia's Indigenous peoples based primarily upon stature and skin and hair type.
Dental comparisons to test these relationships, of both metric and non-metric traits, have not, until this study, been adequately performed between South Asian, Southeast Asian and Australian material. Non-metric morphological analyses of Sri Lankan dentition was prepared using the Arizona State University System (Scott & Turner, 1997) as morphological traits of dentition appear to be under strong hereditary and polygenic control and are considered to be independent of natural selection.
26 dental traits were recorded on 65 modern Sri Lankan crania and loose teeth from prehistoric sites in Sri Lanka using the ASU standard plaques. Mesio-distal and bucco-lingual diameters were also recorded at the maximum crown width and at the cemento-enamel junction following techniques outlined by Hillson (1996).
Comparisons were made between the Sri Lankan populations (Vedda, Sinhalese and Tamil) and previously published data from the Andaman Islanders, Malaysia and Australia (Hawkey, 1998; Lauer 2002; Rayner and Bulbeck, 2001) and Mean Measures of Divergence were calculated. Tentative results indicate the relationships between modern populations (Sinhalese, Tamil and Vedda) are closer than previously thought and there may be little evidence in the dentition to support a 'Negrito' type.

Tests of association between Y chromosomal and autosomal short-tandem-repeats.

A.J. Redd[1,3], B. Walsh[2], and M.F. Hammer[1]. [1]Division of Biotechnology, University of Arizona, [2]Department of Ecology and Evolutionary Biology, University of Arizona, [3]Department of Anthropology, University of Kansas.

We carried out exact tests of linkage disequilibrium between Y chromosomal haplotypes and autosomal genotypes in 16 US populations to test the appropriateness of combining evidence from both systems. In some forensic case settings, such as a fingernail scraping from a sexual assault, results are obtained from both a limited number of autosomal short-tandem-repeat (STR) loci and from a set of Y-STR loci. The autosomal STR match probabilities may not be satisfactory by themselves and could be improved if the Y chromosome haplotype frequency could be combined by multiplication; the product rule requires independence. Statistical tests of association were performed in 16 US populations between autosomal genotypes (the standard 13 CODIS loci include: CSF1PO, FGA, THO1, TPOX, VWA, D3S1358, D5S818, D7S820, D8S1179, D13S317, D16S539, D18S51, D21S11) and Y chromosome haplotypes (the 11 US core loci include: DYS19, DYS385ab, DYS389I, DYS389II, DYS390, DYS391, DYS392, DYS393, DYS438, and DYS439). The populations include 917 individuals of European-American, African-American, Hispanic-American, Native-American, and Asian-American ancestry. The results are consistent with independence of the US core Y-STRs and and the autosomal CODIS-STRs, although small amounts of dependence would likely have escaped our tests. Given the data in hand, we suggest that it is appropriate to compute joint match probabilities by multiplying the Y haplotype frequency with the appropriately corrected autosomal frequency (Walsh et al. in press).
This research was supported by a National Institute of Justice grant to M.F.H.

The applicability of cladistic methods in biodistance analysis.

J.C. Reed. Biomedical Sciences Department, Grand Valley State University.

Phenetics, adopted from systematics, is the methodological basis for biodistance analysis. Biodistance analysis uses statistical analyses of the variance of the appearance of genetic and epigenetic characters in skeletal samples – samples that have been defined by spatial, cultural and/or linguistic boundaries. Phenetic analyses are also a measure of the similarities of samples, but similarity does not necessarily reflect ancestry. A hypotheticodeductive, cladistically-based approach that specifies morphs – groups that share a suite of unique characters – can delineate groups by testing for differences in the observable biology/morphology of sample specimens, demonstrating biological relationships and eliminating the reliance on cultural or spatial groupings. A skeletal sample of historically documented individuals of known familial relationships was used to test the possibility and practicality of delineating morphs in samples of human remains. A sample of 277 adult crania from the Spitalfields collection at the Natural History Museum, London were analyzed for unique nonmetric traits or unique forms of known nonmetric traits that could possibly delineate a morph. Crania from three other samples were included in the study for out-group comparison: a total of 101 from two prehistoric samples, one from the Southeast U. S. and one from the Northeast; and 60 crania from the Terry Collection at the National Museum of Natural History. Morphs were not delineated at any level of relationship, indicating that while it may be possible to distinguish morphs at a level lower than the species, it is at a higher level than the small populations that are the usual focus of biodistance analysis.

Mio-Pliocene African habitats: local and regional contexts for the earliest bipeds.

K.E. Reed, C.J. Campisano, Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University.

Early scholars of human evolution suggested that habitats of early hominins differed markedly from forest habitats of African Miocene apes. Open grasslands interspersed among shrinking forests was the background for theories on why humans became bipedal. Recently, however, reconstructed habitats for earlier and geographically dispersed hominin fossil sites suggest that hominins were bipedal in forests, closed woodlands, and open habitats, while middle Miocene apes occupied woodlands (Andrews and Kelly, 2007). Thus, with the recovery of new hominin species, the habitats associated with them appear to be decoupled from bipedalism.
We provide habitat reconstructions for hominid fossil localities ranging from the late Miocene through the mid-Pliocene based on ecological diversity analyses of mammalian fossils recovered from each locality, limited to single horizons as best as possible. If we did not have species lists for particular sites, we used published accounts of the reconstructed habitat for comparisons. Late Miocene sites tend to fall in the range of closed to open woodlands, although in many sites, mosaic environments are indicated. The 6 Ma site from the Lukieno Formation is purported to be a forested environment from which not only colobines, but also tragulids and arboreal civets have been recovered (Senut, 2006). *Ardipithecus* sites are closed and mesic in comparison to some later *Australopithecus* sites, but sites from which the latter derive range from closed woodland to shrubland. We note that collection practices and subsequent analyses of fauna may bias reconstructions toward mosaic habitats rather than identifying actual vegetation physiognomies associated with hominins.

Testing the lateral angle method in chimpanzee petrous bones.

S.C. Reedy. Department of Anthropology, University of Massachusetts, Amherst.

The lateral angle refers to the angle at which the inner auditory canal opens in relation to the endocranium. This method has shown to be accurate in determining the sex of adult humans and could potentially be used to identify sex in human juveniles. A common problem in paleoanthropology is determining the sex of early hominins, in particular with respect to craniodental remains not associated with postcranial elements. The objective of this project is to determine if there is sexual dimorphism of the lateral angle in chimpanzees as has previously been demonstrated in adult humans. Positive results may indicate that this method could be used for sex determination in fossil hominids. Casts were taken of both right and left inner auditory canals through the foramen magnum in 81 chimpanzees. The casts were cut in half and the angle was read using a protractor. Preliminary results indicate that there is no significant difference between male and female chimpanzees. However, due to the small sample size, another collection of chimpanzees will be analyzed for more conclusive results.

Dental development and enamel thickness in northwestern African modern humans.

D. J. Reid[1], T. M. Smith[2], J.-J. Hublin[2]. [1] Department of Oral Biology, Newcastle University, UK, [2] Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Germany

Recent histological studies have revealed developmental variation between northern European and southern African modern human dentitions, particularly for anterior teeth and premolars, which take longer to form in northern Europeans. In contrast, studies of enamel thickness in these two groups have reported few consistent trends. This study examined crown formation times and enamel thickness in a sample of unworn or lightly worn teeth from modern northwestern Africans in order to assess the degree of variation among human populations. Histological development was quantified from thin sections according to standard procedures (counts of long- and short-period incremental features), and average enamel thickness was measured from photographic overviews of sections and calculated as the area of the enamel cap divided by the length of the enamel-dentine junction. The results revealed that northwestern African crown formation times for anterior and premolar teeth were either intermediate between northern European and southern Africans, or were most similar to northern European values, depending on the tooth type. Molar crown formation times showed few consistent interpopulation differences. Average enamel thickness was found to be fairly similar among populations, with highly overlapping ranges. Developmental similarities between northern European and northwestern African dentitions may reflect recent population histories; studies of discrete dental traits and genetic structure also indicate strong affinities between northwestern Africa and Europe.

Supported by the Max Planck Society.

Microanatomical assessment of fusion in facial sutures of bushbabies.

L.E. Reinholt[1], A.M. Burrows[2], E.R. Dumont[3], T.D. Smith[1]
[1]School of Physical Therapy, Slippery Rock University; [2]Department of Physical Therapy, Duquesne University; [3]Department of Biological Sciences, University of Massachusetts, Amherst

The extent of fusion in facial sutures has implications for topics ranging from biomechanics to phylogeny reconstruction. An unfortunate limitation of studying sutural fusion in skeletal specimens is that it is difficult to assess whether apparently patent sutures are in fact fused internally. To explore this question, we examined microanatomical aspects of facial sutures in adult cadaveric samples from captive primates. Premaxillary and nasopremaxillary sutures were examined in serially sectioned snouts of three Greater bushbabies (*Otolemur garnettii*) and three lesser bushbabies (*Galago moholi*). A single adult G. moholi was also studied by micro CT. Sections containing sutures with osseous bridging were rated as "fused", and the presence/absence of groove on the external side was recorded. We found age- and species-related patterns in suture fusion. As expected, sutural fusion was lowest within the youngest individuals of both species. However, *O. garnettii* of all ages had a greater extent of fusion in both sutures compared to *G. moholi*. The youngest *O. garnettii* exhibited much greater sutural fusion (~90% in both sutures) compared to a *G. moholi* of similar age (both sutures 100% patent). However, sutural fusion in *O. garnettii* was limited to the internal surface in as many as 31% of sections, resulting in an external notch. The presence of such notches suggests that external examination can underestimate the degree of suture fusion. Microanatomical evidence may be needed to fully assess biomechanical correlates or phylogenetic interpretations based on fusion of facial sutures.

Stable carbon and nitrogen analysis of diet from the medieval cemetery at Giecz, Poland.

L.J. Reitsema, D.E. Crews, H.M. Justus, A.M. Agnew. Department of Anthropology, The Ohio State University.

Stable isotope analysis of archaeological bone collagen is a powerful tool for interpreting the diets of past populations. The value of this approach is its directness: while historical documents and *in situ* archaeological flora and fauna are unreliable indicators of diet, human tissues may be interpreted under the assumption that consumer ratios are representative of their food source ratios. Direct approaches such as this are crucial toward understanding the "Dark Ages," a period in European history when written documents and other visible accomplishments in material culture were infrequent. There is an increasing desire to know more about these medieval cultures as countries with Slavic heritage seek admittance into the European Union, receiving global attention. This study applies stable carbon and nitrogen analyses to skeletal elements from the medieval cemetery in Giecz, Poland. The site was in use during the 11th and 12th centuries, a period of emerging sociopolitical and ideological complexity. The project investigates local diet and nutrition during this transitional period, and presents baseline data for both the human population and local fauna. Twelve females and 12 males between the ages of 20 and 59 were selected for analysis, along with archaeological remains of local suids, bovids, and freshwater fish. Results from isotopic studies such as these, when used in tandem with available individual information regarding sex, skeletal indicators of health, and archaeological context, have implications for overall social structure in addition to diet.

An osteobiography of an African diasporic skeletal sample: integrating skeletal and historical information.

E.S. Renschler. Department of Anthropology, University of Pennsylvania.

This study presents an osteobiography of a sample of crania (N=51) representing individuals who died shortly after arrival in Havana from Africa during the era of the Cuban slave trade. The crania are now a part of the Samuel G. Morton Collection housed at the University of Pennsylvania Museum of Archaeology and Anthropology.
As part of an osteobiographical approach to the individual crania, skeletal information is synthesized with historical information. To achieve this synthesis, this study analyzes skeletal data from the sample in light of several research questions posed by the historical record of the Cuban slave trade. Issues such as demography, ancestry, and life conditions of the individuals represented are illuminated by analysis of data on age, sex, cranial measurements, ritual dental modification, and paleopathology.
The results of this examination are generally consistent with historical information. First, skeletal age data indicate that the majority of the individuals in the sample were adolescents and "prime-age" adults. This finding correlates well with the historical record. Second, as to the ancestry of the individuals represented, craniometric data supports an African origin as well as a high degree of individual heterogeneity within the sample. Evidence for ritual dental modification in a number of crania of the individuals in the sample further supports

their African origin. Finally, paleopathological analysis of the sample suggests that these African born individuals faced less physiological stress than comparable individuals born into slavery in the New World.

What does the proximal femur tell us about the evolution of bipedalism over the past six million years?

Brian G. Richmond[1], William L. Jungers[2]. [1]Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University, [2]Department of Anatomical Sciences, Stony Brook University.

Decades of discoveries and research have demonstrated that modern human proximal femora are distinct from those of early *Homo*, and those are distinct from the morphology of the australopiths. These morphological differences have biomechanical correlates, and probably reflect fundamental differences in bipedal gait. This study examines the femora of *Orrorin tugenensis* (BAR 1002'00) and *H. floresiensis* (LB1) in order to assess if 1) the *Orrorin* femur provides any evidence of a difference in bipedal gait from that of the later australopiths, and 2) the morphology of the *H. floresiensis* is consistent with that of a small-bodied modern human or *H. erectus*. We compared these fossil femora to those of a large sample of adult humans, chimpanzees, bonobos, gorillas, orangutans, and most of the available early hominin taxa. The modern human sample includes individuals from large- and small-bodied populations. Scaling and shape were examined by comparing individual measurements to proximal femur size (geometric mean of all femoral measurements).
Multivariate analyses reveal that the *Orrorin* femur most closely resembles femora attributed to *Australopithecus afarensis* (A.L. 288-1, A.L. 333-3), *Paranthropus robustus* (SK82, SK97), and *?P. boisei* (KNM-ER 1503), in having a long and anteroposteriorly narrow neck and broad shaft. The external morphology of the *Orrorin* femur therefore provides no evidence of changes in hip structure or bipedal gait between 6-2 Ma. The femoral anatomy of *H. floresiensis* also closely resembles early hominins and differs from both modern humans and *H. erectus*, suggesting that it evolved from a taxon more primitive than *H. erectus*.
Supported by The George Washington University, Stony Brook University, Wenner-Gren Foundation, the Leakey Foundation and the National Geographic Society.

Ecological flexibility at the edge: ranging patterns and habitat use of tonkean macaques (*Macaca tonkeana*) in a human-modified habitat.

E.P. Riley. Department of Anthropology, San Diego State University

My objective is to explain variability in ranging patterns and habitat use of Sulawesi tonkean macaques (*Macaca tonkeana*) with regard to anthropogenic habitat alteration and group size. I observed movement patterns, forest strata use, microhabitat use, and home range use in two tonkean macaque groups that occupied habitats with different levels of human alteration and habitat quality in Lore Lindu National Park, Sulawesi, Indonesia. I defined anthropogenic habitat alteration as the clearing of forest for agriculture and small-scale forest product collection. The group occupying the heavily-altered habitat (Anca) spent a significantly greater proportion of time traveling on the ground than the group in minimally-altered habitat (CH), and significantly more time than expected in microhabitats within their range that were characterized by greater alteration (e.g., agroforestry areas). There was no significant difference between the two groups in daily path length, despite differences in group size. The Anca group exhibited a greater home range area per individual than the CH group, and utilized a more limited area within their home range with greater intensity, relative to the CH group. Tonkean macaques therefore show considerable flexibility in response to environmental changes by adjusting their use of forest strata to facilitate travel and increase foraging opportunities, by intensively using particular areas within their home range where known resources are present and predictably available, but also by increasing their home range area per individual to cover more area and extending their overall search effort on a daily basis.

Abdominal depth as a principal determinant of human female attractiveness.

J.K. Rilling[1,2,3,4], T.L. Kaufman[1], E.O. Smith[1], R. Patel[5] and C.M. Worthman[1]. [1]Depart. of Anthropology, [2]Depart. of Psychiatry and Behavioral Sciences, [3]Center for Behavioral Neuroscience, [4]Div. of Psychobiology, Yerkes National Primate Research Center, and [5]Depart. of Biostatistics, Emory University.

Previous research based largely on two-dimensional (2D) line drawings and picture stimuli has established that both body mass index (BMI) and waist to hip ratio (WHR) influence the perceived attractiveness of human female bodies. Here, we extend these studies by 1) creating a more ecologically valid stimulus set consisting of 3D videos and 2D still shots from real female "models" rotating in space, and 2) measuring and examining the influence of several additional anthropometric variables that previously have not been considered. Multiple linear regression analysis revealed that the depth of the lower torso at the umbilicus, or abdominal depth, was the strongest predictor of attractiveness, stronger than either BMI or WHR, and that its impact was significantly greater for video and side view stimuli in which it was clearly visible compared with front and back view stimuli. Women with shallow abdominal depth are more likely to be healthy, fertile and non-pregnant, suggesting that this may be an adaptive male preference that has been shaped by natural selection. Our results show that conclusions regarding anthropometric predictors of attractiveness are influenced by the visual perspective of the perceiver, as well as the anthropometric variables considered for analysis.
Supported by an Emory College Seed Fund grant.

The Evolution of Throwing: Improving Performance through Kinematic Optimization

Neil Thomas Roach, Phillip Roebuck, Daniel E. Lieberman. Department of Anthropology, Harvard University

How do humans throw with such power and accuracy? Chimpanzees, our closest living relatives, occasionally throw using a windmill-type motion, rather than the overarm "baseball" style throw that allows humans to achieve both tremendous power and accuracy. At some point in our evolutionary history, hominins developed the necessary anatomical morphology to produce high performance throws. What these morphological preconditions are, when they appeared, and whether they represent a unique adaptation or are merely exapted, have not previously been investigated.
This study experimentally investigates the effects of certain aspects of shoulder and humeral morphology on the kinematics and muscle activation timing necessary to maximize the kinetic energy imparted to a projectile. We collected both three dimensional, whole body kinematics and electromyography data (from the pectoralis major, deltoid, biceps, triceps) from human volunteers. These data are then related to differences in collected performance measures, namely accuracy and velocity. Subjects performed a number of both overarm and windmill style throws, showing statistically different performance output and muscle activation patterns. Preliminary results suggest glenoid orientation and the degree of humeral torsion play important roles in determining optimized throwing kinetics. The implications for understanding early hominin forelimb anatomy and the emergence timing of high performance throwing behavior are addressed.

The unique paleoepidemiology of treponemal disease in Late Woodland/Early Mississippian samples from southern Appalachia and its implications.

A.M. Robbins[1], M.O. Smith[1]. [1]Loyola University of Chicago.

In light of changing models for interpreting the transition between Woodland and Mississippian cultures and the inadequacy of

archaeological data with which geographical and temporal change can be marshaled in east Tennessee, burial mound inhumations are critical for understanding the major social, economic, and cultural developments marking the Woodland-Mississippian socio-economic transition (600-1000 A.D). Straddling this time period is the Hamilton Mortuary Complex (HMC), a culture geographically confined to lower east Tennessee and exclusively identified by large accretion burial mounds. Economically, the HMC is unequivocally food producing but it pre-dates the maize intensification which characterizes later (AD 1200-1550) east Tennessee prehistory. Treponemal disease, unequivocally present in one or more syndromes in Tennessee as elsewhere, is acknowledgedly sensitive to population sedentism, density, and basic community health. In a five site HMC sample (N=302), three percent exhibit pathological changes pathognomonic for treponemal disease. This contrasts with a seven percent frequency from a three site late Mississippian sample (N=349) also from lower east Tennessee and a published frequency of ten percent from a west-central Tennessee (and only) early Woodland (500 BC - 100AD) sample. Besides simple raw frequency differences, the HMC differs from both comparative samples with the absence of subadult cases, no cranial lesions and only one case of, rather than a predominance of, saber tibia. Various socio-economic variables may be affecting the HMC endemicity, epidemiology and/or the skeletal visibility. These include a dispersed hamlet settlement pattern, lower areal population density, and better overall community health.

Resolving stressful relationships in prehistory: macroscopic and histological indicators of growth disruption in subadult long bones.

G. Robbins. Department of Anthropology, Appalachian State University.

Previous research at Inamgaon, India (3500-2700 B.P.) has documented the effects of climate and culture change on the demographic profile (Robbins, 2006, 2007), dental development (Lukacs and Walimbe 1998, 2000, 2005), and long bone growth profiles (Walimbe and Gambhir, 1994; Robbins, 2007). Comparison of growth profiles for a contemporary reference population (Denver Longitudinal Study) with individuals from Inamgaon (n = 75) has demonstrated significant differences in indices of cortical bone mass (CA/TA) and cross section properties (J and Zp) (Robbins, 2006, 2007). These differences are related to suppression in diameter and growth at the periosteal surface in the first and second year of life for the humerus and femur. Research on subadult cortical bone properties has demonstrated that activity plays a significant role in long bone diameter, section modulus, and other estimates of torsional and bending strength (Ruff, 2003a, 2003b, 2005; Sumner and Andriacchi, 1996). However, declining Z-scores for long bone length in the first 5 years, long bone growth suppression in transverse dimensions, Harris Lines, hyperostosis, and prevalence of LHPC indicate a synergistic relationship between nutritional stress, reduction in body mass, and activity levels. This poster examines long bone growth suppression at Inamgaon on a histological scale. Results from Micro-CT and SEM analyses indicate disruption of bone remodeling at the Haversian and periosteal surfaces, growth arrest lines (or defective cement lines), incomplete mineralization, and osteopenia. Both macroscopic and histological manifestations of growth disruption are most frequent in individuals who died during the first 2 years of life.

Hominine mandibular molar identification using 3D geometric morphometrics.

C. Robinson[1,2], M. Singleton[3], A. Rosenberger[4,2], R. O'Neill[5]. [1]Dept. of Biology & Medical Lab Technology, Bronx Community College, City University of New York, [2]New York Consortium in Evolutionary Primatology, [3]Dept. of Anatomy, Chicago College of Osteopathic Medicine, Midwestern University, [4]Dept. of Anthropology & Archaeology, Brooklyn College, City University of New York, [5]Dept. of Digital Arts, Digital Arts Research Lab, Pratt Institute.

Isolated molars compose a large proportion of the hominin fossil record; their accurate identification, particularly challenging in mixed-species samples, is a crucial first step in analysis of hominin assemblages. This pilot study tests a geometric morphometric approach to molar identification. The study sample comprised first and second mandibular molars of both species of *Pan* and a test sample of known *Homo* molars. Research-quality epoxy casts were scanned using a LDI Surveyor AM-66RR laser scanner at 0.025mm resolution. Scan data yielded high-resolution virtual molar crowns. 3D landmarks collected from occlusal and non-occlusal surfaces using Landmark Editor were aligned by Procrustes superimposition. Discriminant analysis of principal shape component (PC) scores tested the ability of molar shape to discriminate M1s and M2s in mixed-species samples; species of *Pan* in mixed-element samples; and to accurately sort *Homo* molars using a *Pan* metameric variation model. For all *Pan* analyses, ≥90% discrimination was achieved with 2–3 PCs. Discrimination of species of *Pan* was excellent (95%) with 10 occlusal landmarks and improved to 100% with addition of non-occlusal landmarks and/or more PCs. Element identification rates averaged 90% across analyses, with M1s more frequently misclassified than M2s, and did not improve with additional landmarks. Discrimination of *Homo* molars was poor (<50%) in analyses limited to occlusal groove landmarks and/or 2–3 PCs but excellent (up to 100%) for analyses including cuspal landmarks and 5 PCS. Results suggest GM methods significantly improve molar identification; application to early hominin molars will be tested.

Financial support provided by the Leakey Foundation, Midwestern University and a PSC-CUNY grant from the City University of New York.

The emergence of sex-segregated association patterns in juvenile spider monkeys (*Ateles geoffroyi*).

M.A. Rodrigues. Department of Anthropology, Ohio State University

Spider monkey societies have been characterized as sex-segregated, in which adult males frequently range together, while females, particularly those with offspring, tend to be more solitary. These subgrouping patterns are shaped by both social and ecological factors; whereas females should optimize foraging success, males should optimize reproductive opportunities. However, this social organization presents a particular challenge to juveniles because the social experiences most valuable to their development may be limited by their mothers' foraging needs and social preferences. Here I report on sex differences in the interactions, proximity patterns, and subgrouping patterns of individually recognized juvenile spider monkeys at El Zota Biological Field Station, Costa Rica. A total of 71 hours of focal sampling data were collected on nine individuals. Male and female juveniles demonstrated patterns similar to those reported for adult spider monkeys, despite the fact that many of the pressures hypothesized to explain adult patterns are not applicable to juveniles. Juvenile females interacted predominantly with female conspecifics, particularly mothers and other juvenile females, while male juveniles interacted with a wider variety of age/sex classes, particularly adult and other juvenile males. Male juveniles also spent more time than females in proximity to adult and juvenile males. Juvenile males were found in significantly larger parties than juvenile females, and were in parties containing adult males significantly more than were juvenile females. These results suggest that patterns of sex-segregation begin early in life, and are better explained by social factors than by the ecological variables that determine adult association patterns.

Sequencing the genomes of nonhuman primates: Progress and future.

J. Rogers[1,2]. [1]Southwest Foundation for Biomedical Research, [2]Southwest National Primate Research Center.

The fields of primate genetics and genomics are currently in the midst of an overwhelming transformation. With the recent improvements in technologies for the large-scale sequencing and re-sequencing of mammalian genomes, we have entered a

period in which the amount of new genomic information concerning nonhuman primates is increasing rapidly, and the pace of this process will likely continue to accelerate for some period of time. Not long ago the research community debated whether it was appropriate and useful to sequence the genomes of two or three primate species beyond the chimpanzee, but it is now probable that within a short time investigators will have access to full draft quality (6x coverage) sequences for fifteen or more nonhuman primates.
This presentation will review the current status of genomic sequencing in nonhuman primates. Comparisons among the human, chimpanzee and rhesus macaque genomes show that evolutionary differences among species involve much more than simple basepair substitution. Gene families undergo rapid and biologically meaningful expansion and contraction. Repetitive elements and structural rearrangements introduce additional inter-species complexity. Whole genome sequencing projects are now underway for several more species, along with cDNA sequencing and targeted re-sequencing for identification in intra-species variation. The implications of this expanded effort in primate genomics include much more detailed information concerning laboratory primates used in biomedical research, deeper and wider analyses of the evolutionary dynamics of the primate genome and unanticipated discoveries concerning the genetic mechanisms involved in morphological, physiological and behavioral adaptation across various primate lineages.

Morphological integration and the role of pleiotropy in the evolution of primate hands and feet

C. Rolian, Harvard University.

The digits of vertebrate hands and feet are serially homologous elements that share most of their developmental architecture in common. Accordingly, these skeletal elements may be more prone to the effects of pleiotropy, and should covary more strongly than other skeletal traits. This also suggests that pleiotropy plays potentially conflicting roles in the evolution of hand and foot digit morphology. When hand and foot digits evolve to perform similar functions, as in arboreal quadrupeds, pleiotropy should facilitate correlated changes in morphology. However, when hands and feet are selected for different functions, as in humans, then pleiotropy may impose a constraint on their independent morphological evolution. This hypothesis was tested by comparing patterns of phenotypic covariation in the autopods of 9 haplorhine primates representing a broad range of locomotor specializations and phylogenetic relatedness. Linear distance data were collected in the autopods and proximal limb bones using standard morphometric techniques, and covariation patterns were compared using matrix correlations, random skewers, eigenanalysis and partial correlations. Results indicate that some aspects of autopod morphology, including the length and proportion of homologous digits in the hand and foot, covary more strongly than other traits in the appendicular skeleton. However, the comparative data also suggest that selection for independent functional specialization in each autopod leads to reduced levels of covariation between them. Thus, although pleiotropy may cause homologous digits to covary, its effects do not significantly impact on the capacity for independent evolution of digital morphology in primates.

Parasite survey of guinea baboons, rhesus macaques, and pigtail macaques in an outdoor breeding colony in Louisiana: implications for paleoparasitology.

A. Rollins[1, 2], K.Snook[2], P. Dorn[3], M. McNeese[4], R.Lundquist[5], and F.B. Cogswell[2].
[1]Anthropology Department, Indiana University, [2]Department of Bacteriology and Parasitology, Tulane National Primate Research Center, [3]Department of Biology, Loyola University, [4]Ross University School of Medicine, [5]College of Veterinary Medicine, Michigan State University.

Parasitic infestations in prehistoric populations are studied using analysis of skeletons, mummies, coprolites, and latrine soils. A primate model supports a wider ranged investigation of pathological parasite species endemic in southern United States. We conducted a fecal and blood survey of over 4000 baboons (*Papio papio*), rhesus macaques (*Macaca mulatta*), and pigtail macaques (*Macaca nemestrina*) housed in an outdoor breeding colony at Tulane National Primate Research Center in Covington, Louisiana. The endemic pathogenic intestinal parasites found were *Trichuris trichiura*, in 35% of sampled primates, *Strongyloides fülleborni*, in 34%, *Balantium coli* in 21%, and *Giardia lamblia*, in 0.3%. The endemic pathogenic blood parasite found was *Trypanosoma cruzi*, found in 0.8% of samples. This presentation will examine the implications of a similarly diverse community of pathological parasites that is expected in pre-Columbian humans in this subtropical region of North America.
Research support for parasite survey of primates provided by NIH.

Comparative morphology and morphometric assessment of the occipitals from the El Sidrón Neanderthals (Asturias, Northern Spain)

A. Rosas[1], M. Bastir[1], A. García-Tabernero[1], M. de la Rasilla[2], and J. Fortea[2]. [1]Department of Paleobiology, Museo Nacional de Ciencias Naturales, CSIC, Madrid, Spain [2]Area of Prehistory, University of Oviedo; Spain

This paper analyses two occipital bones SD-1149 and SD-1219 of the El Sidrón Neanderthal sample. Descriptive morphology, traditional metrics, 3D geometric morphometrics and virtual anthropological methods were employed to address the morphological and phylogenetic position of these fossils and their role in human evolution. Both fossils reveal clear morphological traits typical of Neanderthals, such as occipital bunning, a suprainiac fossa and bilaterally protruding transverse occipital torus. Additionally, SD-1219 also preserves further Neanderthal features, such as a strongly projecting juxtamastoid eminence and marked neck muscle insertions. In linear distances both fossils are similar to each other and generally close to the Neanderthal mean. Comparative evidence in aged and sexed modern humans (N=120) suggests that sexual dimorphism of occipital plane shape is not statistically significant, while size is highly significantly different ($P<0.001$). Centroid size of SD-1219 is larger than the Neanderthal average. Thus, all evidence taken together, points to the hypothesis that SD-1219 is a smaller (young) male. Shape analysis of a virtual 3D reconstruction of SD-1219 CT-data reveals a broad and low occipital plane, which is primitive in *Homo*. Also, within the European Pleistocene lineage the fossil falls closer to primitive than to derived conditions. This is related to its increased width, flatter curvature and lower inion position relative to the biasterionic axis. The combination of clearly discernible Neanderthal traits together with primitive shape configuration converts SD-1219 into a key fossil for the investigation of intraspecific variability in Neanderthal populations.
Funding: Convenio Universidad de Oviedo-CSIC: 060501040023; CGL-2006-02131, and MRTN-CT-2005-019564 (EVAN).

The quantitative genetic basis of phenotypic integration in the mouse mandible with anthropological applications.

C.C. Roseman[1], J.P. Kenny-Hunt[2], J.M. Cheverud[3]. [1]Department of Anthropology, University of Illinois at Urbana-Champaign, [2] Department of Biology, University of South Carolina, [3]Department of Anatomy and Neurobiology, Washington University in St. Louis School of Medicine.

One of Darwin's fundamental contributions to the study of the diversity of life was his observation that if there is no variation, or no possibility of variation arising, there can be no evolution. Thus an accurate picture of the patterns and causes of phenotypic integration – the correlation and covariance among aspects of a complex phenotype – is critical for testing hypotheses about the evolutionary forces that have led to the observed diversity of life. We report results of an investigation into the genetic basis of phenotypic integration in the mouse mandible and illustrate some applications of these results to anthropological questions. Using 23 measurements collected on 1,243 mouse hemimandibles from individuals typed for 1,407 single nucleotide polymorphisms from

the F_{10} generation of an advanced intercross experimental population, we test hypotheses about the genetic contribution of variation in individual traits and the relationship between traits. A minimum of 65 loci were identified as having significant effects on individual traits at the genome-wide significance level, pleiotropy is commonplace, and the variance of the slopes of the relationships between four traits and mandible length against different genetic backgrounds show suggestive signs of being influenced by genetic factors. We conclude by examining anthropological questions using theoretical models informed by the results presented here and presenting a framework for testing hypotheses about the mode and tempo of the evolution of phenotypic integration.
This work is funded through NSF BCS-0523637 and NIH RR015116.

Developmental anatomy of the hominoid lumbar transverse process: a comparative anatomical framework for examining lumbar natural history in early hominids.

B.A. Rosenman, C.O. Lovejoy. Department of Anthropology and Division of Biomedical Sciences, Kent State University.

The long lumbar spine plays a pivotal role in hominid bipedality by permitting lordosis, which locates the center of mass over a lower limb even when fully extended at the hip and knee. A stiff lower spine is the most important factor inducing the bent-knee, bent-hip gait of African apes. That the long lumbar spine of hominids evolved from a short-backed common ancestor with *Pan* has long been considered axiomatic. Two means of assessment of this presumption are available: the fossil record (*Australopithecus* has a long lumbar column of six mobile vertebrae), and a close examination of hominoid lumbar morphology and number.
We examine serial homology of the lumbar transverse process (LTP). African apes have a high incidence of intermediate first LTPs, which confirms their dual embryonic origin: a dorsal part derived from the external process of the last thoracic transverse process, and a rib-derived ventral part joined to a diminutive rib head and neck. *Pongo*, however, lacks the derived state of the African apes, even though its LTP is of dual origin.
Therefore, African apes and *Pongo* likely have evolved short backs independently through distinctive developmental mechanisms: the former altered *Hox* expression at the thoracolumbar border while the latter terminated the somite segmentation clock earlier in development, thereby reapportioning *Hox* expression patterns over a smaller domain. Given the degree of homoplasy in lumbar vertebral number, likely achieved by different developmental mechanisms, six lumbar vertebrae in early hominids is feasibly plesiomorphic, and is not derived from a short-backed common ancestor.
This work is supported in part by a Dissertation Improvement Grant (NSF-BCS 0352170).

Maternal investment in *Callimico goeldii* and *Callithrix jacchus*.

A.C. Ross. Department of Anthropology, Northern Illinois University.

Within the callitrichids, *Callimico goeldii* is the only species that produces singleton births while the other species, including *Callithrix jacchus*, give birth to twins. Despite different litter sizes, group members in both species show cooperative care of infants. This project tests whether *C. goeldi,* has increased maternal investment relative to *C. jacchus* and how overall infant care compares between the two species. I observed infants over 7 weeks after birth, in two groups of *C. jacchus* at the Wisconsin National Primate Research Center (WNPRC), and two groups of *C. goeldii* at Brookfield and Lincoln Park Zoos for 31.5 hours of observation time per group. Maternal investment was measured by nursing frequency, infant rejections, infant carriage, infant transfers, age at which the infants were independently locomotive, and age of solid food consumption. All-occurrence sampling was used to measure nursing frequency and duration, infant rejections, transfers, and solid food sharing. Point samples at 5-minute intervals measured the percentage of time infants were carried by group members, carrier identity, and infant locomotive independence. Results demonstrate that the frequency of infant rejections, transfers, and the duration infants are carried by non-mother group members is significantly higher in *C. jacchus* than in *C. goeldii*. Examining maternal investment assesses how a reduction in litter size affects maternal care strategies.

Scaling of chewing frequency in Primates

.

C.F. Ross[1], R.L. Washington[2], A. Eckhardt[2], E.R.Vogel[3], N.J. Dominy[3]. [1]Organismal Biology & Anatomy, University of Chicago, [2]The College, University oif Chicago, [3]Department of Anthropology, University of California, Santa Cruz.

Primate feeding systems are expected to evolve in order to maximize food intake rate. One important determinant of food intake rate in mammalian herbivores is intra-oral food processing rate, which in turn is strongly influenced by chew cycle time. Data are presented on the scaling of chew cycle time in primates and compared with the predictions of a forced mass-spring system model of the feeding system. The model predicts that chew cycle time scales to jaw length$^{0.65}$, a prediction confirmed by the data. The model suggests that an important determinant of chew cycle time scaling in anthropoid primates is positive allometry of jaw muscle cross-sectional area which results in increases in bite stress and masticatory power with body size. However, the decreasing nutrient concentrations in the diets of larger primates suggest that these scaling relationships do not allow larger anthropoids to achieve food volume intake rates sufficient to meet metabolic needs. It is hypothesized that larger anthropoids acquire the necessary excess food required by increasing the proportion of the day spent feeding.
A. Eckhardt was supported by a Research Experience for Undergraduates Supplement from NSF Physical Anthropology; C. F. Ross was funded by NSF Physical Anthropology (97006676 and BCS-010913)

Limb strength proportions of OH 62 and locomotion among early African *Homo*.

C.B. Ruff. Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine.

Hindlimb/forelimb skeletal proportions are strongly associated with locomotor mode among modern primates, and have been considered to be key markers of bipedalism among early hominins. However, very few early hominin fossils include relatively well-preserved forelimb and hindlimb elements together with taxonomically diagnostic cranial material. OH 62, assigned to *Homo habilis* (*sensu stricto*) on the basis of its cranial remains, is one such specimen, but its limb bones are still insufficiently complete to accurately estimate inter-limb length proportions. Comparison of mid-diaphyseal strength proportions, however, are not as dependent on precise length estimates. We report here on femoral to humeral strength proportions of OH 62, and compare them to those of modern humans and chimpanzees, as well as two other early *Homo* specimens assigned to *H. erectus/ergaster* – KNM-WT 15000 and KNM-ER 1808.
Cross-sectional contours for OH 62 were obtained from casts of natural break surfaces occurring near midshaft of the femur and humerus, and analyzed using ImageJ and a custom macro to obtain structural properties. Femoral/humeral strength proportions were compared with those determined over a range of locations in the modern samples bracketing the possible break locations in OH 62. OH 62 is intermediate in proportions between modern humans and chimpanzees, but consistently falls within 95% CI's for chimpanzees and outside those for humans. In contrast, KNM-WT 15000 and 1808 fall within (or above) the modern human distributions, and well above those for chimpanzees, and OH 62. These results provide further evidence for a diversity of locomotor patterns among early *Homo*.

Twinning reconsidered: A new math for litter size variation in the callitrichine primates

J.N. Rutherford[1,2] and S.D. Tardif[3]. [1]Institute for Policy Research and [2]Laboratory of Human Biology Research, Department of

Anthropology, Northwestern University, Evanston, IL, [3]Barshop Institute for Longevity and Aging Studies, Department of Cellular and Structural Biology, The University of Texas Health Science Center, San Antonio, TX

Conceiving, gestating, nursing, and communally rearing twin litters comprise the most distinctive pattern of marmoset and tamarin reproductive biology. Although twinning in the marmosets and tamarins is commonly viewed as a monolithic phenomenon of optimality, evidence from captive studies suggests that producing twins from ovulation to weaning is only one point along a reproductive continuum. In fact, triplet litters make up approximately one third of all births in captive marmoset colonies. In captivity, maternal mass is correlated with ovulation number, indicating a primary role for maternal energetic status in initially determining prenatal litter size. However, maintaining litter size throughout gestation results from a complex interplay between the mother and the fetuses.
In this presentation, we argue that the mechanisms that allow for triplet litters represent a robust and redundant system of flexible reproductive investment, one that is likely to play out in some form in the wild, rather than being merely an artifact of captivity. We review the processes before and during gestation in marmosets that shape ultimate litter size at birth. In particular, we present microscopic analyses of 28 common marmoset placentas indicating that triplet litters exploit distinctive developmental strategies to increase efficiency of placental nutrient transfer. The fetuses themselves may engage in resource solicitation when per capita resources are restricted, a situation likely to occur in larger litters, by restructuring the organ that is the direct conduit of maternal resources. Higher individual phenotypic and genotypic quality of the surviving offspring may be the "goal" of such a system.
Is three more or less than two?

A reconstruction of the Vienna skull of *Hadropithecus stenognathus.*

T.M. Ryan[1], D.A. Burney[2], L.R. Godfrey[3], U. Göhlich[4], W.L. Jungers[5], N. Vasey[6], Ramilisonina[7], A. Walker[1], G. Weber[8].

[1]Department of Anthropology, Penn State University, [2]National Tropical Botanical Garden, Kalaheo, [3]Department of Anthropology, University of Massachusetts-Amherst, [4]Vienna Museum of Natural History, Austria, [5]Department of Anatomical Sciences, Stony Brook University, [6]Department of Anthropology, Portland State University, [7]Musée d'Art et d'Archéologie, Madagascar, [8]University of Vienna, Austria.

The first *Hadropithecus* specimen was found in Andrahomana cave in Madagascar in 1899 and sent to von Liburnau of the Austrian Imperial Academy who named it the type of *H. stenognathus*. Only one other *Hadropithecus* skull has been found since, by Charles Lamberton in 1931, from the site of Tsiravé.
In 2003 many more specimens belonging to this species, including much of a sub-adult skeleton were recovered (Godfrey et al., (2006) *J. Hum. Evol.* 51:395-410). Two frontal fragments were found and these, together with most of the postcranial bones, belong to the skull described in 1902. CT scans of the skull and other jaw fragments were made in Vienna and those of the frontal fragments at Penn State University. The two fragments have been reunited with the skull *in silico* and broken parts from one side of the skull have been replaced virtually by mirror-imaged complete parts from the other side. The parts of the jaw of this individual have also been reconstructed virtually from CT scans using the maxillary teeth and temporomandibular joints as a guide.
Using the anterior part of an endocast of the closely related *Archaeolemur majori* as a guide, we reconstructed the endocast. The measured volume is 115 ml. Regression slopes for brain against body mass with and without the extinct subfossil lemurs are different, but whichever is chosen, *Hadropithecus* and *Archaeolemur* seem to have had relatively large brains.
This research was supported by NSF, NSERC, The Leakey Foundation, and Penn State and Portland State Universities.

An examination of the association between thoracolumbar mobility and thoracolumbar osteoarthritis patterns in cercopithecines.

M.G. Sala. Department of Anthropology, Hunter College, City University of New York.

Among primates, cercopithecines possess a relatively long spine that is active during locomotion. Based on studies of spinal biomechanics and cercopithecine vertebral morphology, lumbar vertebrae and vertebrae at the thoracolumbar junction are expected to be the most active elements in the thoracolumbar spine during locomotion, and thus most positively associated with osteoarthritis. An analysis of 73 cercopithecine thoracolumbar spines was conducted to test the hypothesis that spinal mobility during locomotion is associated with thoracolumbar osteoarthritis patterns in Cercopithecinae. The specimens were sampled from the American Museum of Natural History's collection.
A test of association was made between thoracolumbar vertebral position and osteoarthritis incidence. In addition, tests of association between osteoarthritis incidence and other potential variables of osteoarthritis were conducted: Three degrees of relative skeletal maturity, female versus male sex, and captive versus wild status. Variable frequency data were analyzed in contingency tables (R X C or 2 X 2), and the G-test was employed. Significant and positive associations were found between osteoarthritis and vertebrae at the thoracolumbar junction. These results suggest that vertebrae at the junction, relative to the rest of the thoracolumbar region, must deal with both high mobility and stress resistance during cercopithecine quadrupedal locomotion. Therefore, such spinal biomechanics may contribute to degenerative patterns at the cercopithecine thoracolumbar spine. Male sex, captive status, and an advanced degree of skeletal maturity were also positively associated with osteoarthritis incidence, confirming the complexity of osteoarthritis etiology in mammals.

Biogeochemical evidence of human mobility in medieval Nubia.

P. Sandberg[1], V. Grimes[2], C. Smith[2], M. Richards[2], M. Sponheimer[1], D. Van Gerven[1]. [1]Department of Anthropology, University of Colorado at Boulder, [2]Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology.

Oxygen and strontium isotope analyses are used to test hypotheses concerning human mobility at the medieval site of Kulubnarti in Sudanese Nubia. Paleopathological and demographic analyses indicate an increase in health conditions from the early Christian period (AD 550-750) to the late Christian period (AD 750-1400). One hypothesis holds that this improvement in health was the result of increased political and economic autonomy in the region as the centralized Nubian polity declined during late Christian times. Alternatively, increased human mobility into the region could be responsible for this health pattern. Preliminary oxygen isotope data from human tooth enamel suggests a difference in population histories between early and late Christian Kulubnarti. Oxygen isotope ratios in tooth enamel primarily reflect the isotopic composition of drinking water consumed during enamel formation, and are thus useful in identifying individuals who consumed water from isotopically distinct sources during their childhood or adolescent years. Most of the early Christians analyzed appear to fall within a range expected for a local population, while two-thirds of the late Christians analyzed were outside this range, suggesting that they may have originated elsewhere. While these data are consistent with the interpretation that late Christian Kulubnarti experienced an influx of migrants, they are not conclusive. To address the issue of human mobility at Kulubnarti more directly, strontium isotopes analysis of dental tissues is employed. Marked geological variation in Lower Nubia makes Kulubnarti particularly well suited for strontium isotope analysis.
Systematic and functional significance of the OH 8 foot. Esteban E. Sarmiento The Human Evolution foundation, East Brunswick NJ

Systematic and functional significance of the OH 8 foot.

E.E. Sarmiento The Human Evolution Foundation, East Brunswick NJ

In spite its 1.8 million year geologic age, OH 8 is remarkably similar to the modern human foot, leading most workers to refer it to *Homo* and assume it is from a habitual biped. There are, however, no associated remains that can conclusively establish to which Olduvai hominoid the OH 8 foot belongs to, and whether OH8 exclusively weighed its hind limbs. Differences to humans in talo-crural and subtalar joints reflect different joint loading and movement capabilities and a more dorsiflexed foot, suggesting this individual did not stand or move in a human-like manner. OH 8 lacks a human-like longitudinal arch. Its talar head and calcaneocuboid joint have a dorsiflexed set and its plantar processes demonstrate a direct distal tarsus to substrate weight transfer. The continuation of the plantaris longus tendon groove on the ectocuneiform plantar surface reflects a non-fixed transverse arch or one that is much lower than in humans. Two distally divergent grooves on the sustentaculum tali plantar surface indicate that the flexor fibularis m. (the human f. hallucis m.) may have also contributed long flexor tendons to the lateral digits. All these characters and relatively longer metatarsals further suggest a propulsive lever that is relatively weaker than in modern humans, one in line with quadrupedality, but not arboreality. Significantly, the Kromdrai talus (TM 1517) is roughly contemporaneous with and strikingly similar to that of OH 8, suggesting that a *Homo*-like foot could be associated with a genus other than *Homo* and a behavior other than habitual bipedality.

Fallback foods within an anthropogenically disturbed habitat: Effects on patterns of mortality, demography, and biology among wild ring-tailed lemurs.

M. L. Sauther[1], F. P. Cuozzo[2]. [1]Department of Anthropology, University of Colorado-Boulder, [2]Department of Anthropology, University of North Dakota.

Long-term ecological studies of wild primates have revealed many cases where fallback resources are especially informative for understanding morphological and biological patterns.
In this paper we present such results from a five-year study of ring-tailed lemurs (*Lemur catta*) at the Beza Mahafaly Special Reserve, a mosaic of habitats including both intact, and anthropogenically-altered landscapes. At this site, an extremely seasonal habitat in terms of food abundance, ring-tailed lemurs depend on tamarind fruit (*Tamarindus indica*) during the period of low food availability. Dependence on this fallback food has important, identifiable effects on their biology. Among lemurs, molar morphology reflects the mechanical properties (i.e., hardness) of dominant foods in their diets (e.g.,Yamashita, 1998). However, among the ring-tailed lemurs at Beza Mahafaly, many display a dramatically high level of molar attrition, which likely relates to an over-emphasis on tamarind fruit. Use of this fallback food has also had demographic consequences. In 2005 a cyclone disrupted the flowering cycle of tamarind trees, leading to a failure of the tamarind crop. This resulted in a very high percentage of infant, sub-adult and female mortality, as well as an atypically low birth rate. Growth and development patterns were also affected, as individuals weaned during the period of low tamarind availability were significantly shorter in body lengths, fat stores and body weight than subadults weaned during a non-cyclone year. These results are discussed within the context of anthropogenic effects, e.g. the lack of alternative resources during periods of low availability of fallback foods.

Lucayan burials from Preacher's Cave, Eleuthera, The Bahamas.

W.C. Schaffer[1], R.S. Carr[2]. [1]Department of Anthropology, University of Arkansas, [2]Archaeological and Historical Conservancy (AHC), Inc., Davie, Florida.

Archaeolgical investigations at Preacher's Cave, located on the northern part of Eleuthera, The Bahamas, yielded the most complete *in situ* Ostionoid period (AD 600-1500) Lucayan burials (n=5) documented to date by archaeologists in the archipelago. The paucity of whole Lucayan postcranial and axial skeletal elements, coupled with lack of contextual evidence from the inventoried skeletal assemblages (i.e., Yale Peabody Museum and National Museum of The Bahamas; MNI=71; Pateman, in prep), has inhibited our knowledge of the first people who encountered Columbus and his crew in the New World. This study aims to discuss factors such as diet, physiological stressors, skeletal biology, personal injury, and developmental defects, in order to gauge their impact on overall health and well-being. Three males and two females were recovered representing age ranges from the late adolescent phase to the fourth decade of life. Partially intact crania (n=2) exhibit clear evidence of artificial deformation. Pathologies include carious lesions (20%), marked periodontal disease, possible sharp force trauma to the glenoid-humeral joint and blunt force trauma to the right parietal, Schmorl's nodes, osteoarthritis of vertebral facets (4%), osteophytosis of centra (4%), evidence for traumatic arthritis at the dorsal aspect of the hand, as well as healed rib and vertebral fractures. Developmental defects include lumbarization of S1, a bifurcated nueral arch, and non- and partial union of sternbrae. Albeit the sample size is small, this study provides rare insight to Lucayan lifestyle and a comparative sample for future research.

This study was supported by the Archaeological and Historical Conservancy, as well as The Bahamas Ministry of Tourism and National Museum of The Bahamas.

Proportional dwarfism in foxes, mice, and humans: implications for relative brain size in *Homo floresiensis*.

A.D. Schauber, D. Falk. Department of Anthropology, Florida State University.

Proportional dwarfism in foxes, mice, and humans may be relevant for understanding relative brain size (RBS) in *Homo floresiensis*. Dwarf island gray foxes (*Urocyon littoralis*) from the California Channel Islands have the same RBS as their larger-sized closest mainland relatives, gray foxes (*U. cinereoargenteus*), which is contrary to the allometric expectation that RBS should be larger in smaller-bodied relatives. With respect to RBS, the island foxes are proportional dwarfs. The dwarf *little* mouse is a proportional dwarf with a genetic mutation that is the homolog of that which appears in proportionally-dwarfed humans (e.g., Dwarfism of Sindh). Dwarfism of Sindh is caused by a genetically controlled growth hormone deficiency, in which brain and body sizes are reduced proportionally compared to average-sized individuals. Affected individuals have normal RBS, normal intellects, and successful reproduction. Mutations that cause proportional dwarfism may therefore be adaptive in resource-limited insular environments because of the reproductive advantage gained by individuals in whom overall energy requirements are reduced without risk of mental retardation or infertility. Brain size and RBS of LB1 are small and australopithecine-like. One possible explanation is that *Homo floresiensis* is descended from an ancestor whose brain and body sizes were similarly small. A second possibility that is consistent with the findings for mice and foxes, is that *Homo floresiensis* could be a proportionally-dwarfed descendant (with respect to RBS) of a larger-bodied ancestor that had a similar RBS. In either case, RBS in LB1 is not pathological.

The pathology reference series "Galler collection" (part 2): Paleopathological significance and digital recording

R. Schiess[1], G. Kuhn[1], M. I. Hofmann[1], F. J. Rühli[1, 2]. [1]Institute of Anatomy, University Zurich, CH-8057 Zürich, [2]Institute for the History of Medicine, University Zurich, CH-8006 Zürich

In paleopathology it is often hard to achieve an evidence-based diagnosis. Historic pathology reference series are of high value for paleopathological research, even more as they are rare. Such reference material shall be from times before modern surgical and antibiotic treatments were invented, yet the diagnosis has to be reliable.
The Galler Collection – a collection of mostly dry bone specimens built up at the Institute

of Pathology, University of Zurich, in the late 19th and the 20th centuries – represents one of these rare collections. Part 1 of the Galler collection has been documented earlier (Rühli et al. 2003), while the second part, consisting of specimens of about 1700 patients, has not been recorded, yet.
Of nearly all patients autopsy protocols including clinical background information are available. There are for example cases of hyper- & hypoparathyroidism, tumor metastases, osteoporosis, tuberculosis, Paget's disease, or fractures with osteosynthesis material.
The aim of our project is the digital recording of the specimens and of the patient information in a database (FileMaker Pro 7.0v1a ©, FileMaker, Inc., Santa Clara, CA, 95054, USA). Next to general information about the patient (e.g. sex and age) it will contain the main diagnosis concerning the bone specimens (classified according to Ortner 2003) and further medical information (side diagnoses, cause of death if available). Furthermore for each specimen anatomical location, condition and storage location are recorded.
We plan to offer a web-based access to the database for any potential paleopathology researcher.
At present, the Galler Collection (part 2) is stored at the Institute of Anatomy, University of Zurich.

Entheses: are they reliable indicators of activity?

S. Schlecht, The Ohio State University, Department of Anthropology

Over the past two decades, several studies have used qualitative data of muscle insertion development to reconstruct past human activities. The use of enthesial morphology and the reliability of employed methods have increasingly come into question with the expansion of behavioral research in physical anthropology. Few studies have successfully demonstrated a significant correlation between entheses and the cross-sectional geometric properties of associated long bones. In addition, much of the previous work within this area has failed to account for an individual's age, sex and body mass.
This study examines the femoral linea aspera, observing how the diaphyseal midshaft, body mass, sex and age, individually influence the degree of enthesial expression. The analysis includes 62 individuals from an Anglo-Saxon and Norman cemetery located in Newcastle upon Tyne, England. Correlations are explored within the sample using composite quantitative measures of diaphyseal cross-sectional properties, linea aspera length/width, and body mass; in addition to age and sex variables.
The composite diaphyseal data correlates best with the enthesis variable, although body mass and sex also yield significant correlations in relation to the insertion site. Age is not an influential factor within this study, with correlation coefficients generated well below the significance level. This is surprising since previous research focused on muscle site etiology found age to be the largest contributor in enthesial development. This discrepancy between studies may be a result of sample size, linea aspera expression, or methodology. Further research is recommended to explore these inconsistencies.

What moves Hanuman langurs? Temperature and leafy foods as predictors of daily path length.

P.E. Schlichting, C. Borries, A. Koenig. Department of Anthropology, Stony Brook University.

The distance traveled or daily path length (DPL) is often used as a crude estimate of energy expenditure in primates though many different factors are likely to be influential. Availability and distribution of food (especially fruits) as well as demography and mating strategies (number of receptive females, intergroup encounters) are suggested as most important factors. Multivariate approaches incorporating a wide variety of these factors are, however, rare. In this study we analyzed data collected on two Hanuman langur (*Semnopithecus entellus*) groups from Ramnagar, Nepal. We performed stepwise multiple regressions for wet and dry seasons using both daily and averaged monthly measures of DPL as dependent variables. Predictor variables included behavioral (feeding time, diet, drinking), ecological (temperature, rainfall), and social variables (number of receptive female, intergroup encounters). For both dry and wet season temperature was the strongest predictor of DPL on a daily scale (positive correlation; 12.4-63.7% of variance). Drinking (both seasons) as well as intergroup encounters (dry) and number of receptive females (wet) explained another 7.5 to 1.2% of the variance. The monthly analysis revealed that the type of vegetation being utilized drove variation in DPL with young (positive correlation) or mature leaves (negative correlation) being most decisive. These results support the idea that, indeed, ecological, behavioral, and social factors are all important and should be considered simultaneously. In contrast to previous findings on folivores, fruits turned out to be less important predictors than leaves. Young leaves may have the same effect on DPL as fruits, because of a similar distribution.
Data collection supported by the Alexander-von-Humboldt Foundation (AvH), the German Academic Exchange Service (DAAD), and the German Research Council (DFG).

Movement Analysis of Two Facial Social Signals in Humans.

K.L. Schmidt. Department of Psychiatry, University of Pittsburgh.

Human facial expressions are communicative signals that can be used to convey information about emotional state or willingness to interact with a social partner. Spontaneous facial signals such as smiles and brow raises produced in the context of conversation are adaptations for communication. Several specific signal characteristics have been proposed for these types of facial expression: they are relatively small in amplitude, they occur over brief intervals of time, and they exhibit stereotypical patterns of movement. Recent research has identified timing parameters for smiling that differentiate spontaneous social smiles from deliberately produced smiles. In the current study, differences in timing between deliberately produced and spontaneous facial signals were measured within individuals (N = 55). Differences between deliberately and spontaneously produced brow raises, both cross-culturally relevant social signals, were investigated. Both smiles and brow raises fit the predicted pattern; in both cases spontaneous social signals were smaller in amplitude and quicker in onset than those that were deliberately produced. Although brow raises are produced by muscles that are more bilaterally innervated than those used to produce smiles, it was hypothesized that both spontaneous smiles and spontaneous brow raises produced in the social context would be relatively symmetrical. Asymmetry in spontaneous signals tended to be low. Results of the study are interpreted in support of the hypothesis of general adaptations for timing and amplitude of movement in facial signaling.
This research was supported by a grant to KL Schmidt from the National Institutes of Health (MN-067976).

Walking on small branches: convergent solutions in chameleons, marsupials, and primates.

M. Schmidt, K. E. Lilje, M. S. Fischer. Institut für Spezielle Zoologie und Evolutionsbiologie, Friedrich Schiller Universität Jena, Germany.

Many tetrapod vertebrates are able to move on trees so long as the support diameter is large, but only a few groups have developed the specialized adaptations to foraging on small branches. Quadrupeds that climb and walk on such narrow supports face two key problems: controlling the gravity-induced momentum imposed on the body axis (balance) and reducing the gravity-induced forces imposed on the limbs (compliance). The combination of prehensile extremities and simultaneous footfalls of diagonally opposite limbs increasing the balancing abilities of primates, arboreal marsupials, and chameleons over those of other arboreal vertebrates by allowing them to shift their weight dynamically sideward, or backward and forward. The convergent evolution of weight shift mechanisms in combination with grasping extremities in arboreal vertebrates

offers more insights into the biomechanics of the dynamic weight shift.
Chameleons, arboreal quadruped primates and marsupials use a crouched limb posture and relatively large limb excursions. Thereby step lengths and contact times are long, and peak substrate reaction forces are low. However, arboreal quadrupedalism does not necessarily demand three-dimensional limb excursions. Cineradiographic analyses show that forelimb abduction generally results from constraints in shoulder morphology. But, because the shoulder morphology differs in chameleons and mammals, each had to find different solutions to overcome these constraints. Chameleons support their parasagittal limb excursions by possessing the most mobile scapulocoracoid among sauropsida. In primates, by contrast, the "emancipation" of the arm from the scapula was the pre-requisite for developing locomotor modes reliant on shoulder joint mobility rather than on scapular excursions.

Craniometric investigation and biological variability of a North American historic Chinese cemetery.

R.W. Schmidt, Department of Anthropology, University of Montana.

This study presents the craniometric analysis of an historic Chinese cemetery from Carlin, Nevada. Cranial measurements and statistical analysis were performed on 10 crania from Carlin located at the University of Nevada, Las Vegas and 61 crania from Kodiak Island, Alaska, a sample obtained from the NMNH at the Smithsonian. Both samples are considered first generation Chinese immigrant groups. All measurements on Carlin and Kodiak were taken by the author. Published data were used for comparison.
Multivariate statistical analyses were performed to ascertain biological variability within and among groups, with special attention paid to variability within the Carlin sample. Multivariate analyses permit the investigation of interrelationships among variables, examine group differences, and make other inferences among the variables and groups selected. In addition, the groups were tested using a Relethford-Blangero (1990) analysis for estimates of gene flow. Results indicate a relative degree of homogeneity within the Carlin sample. Comparisons to known disparate geographic groups place both immigrant samples closer to known East Asian populations. Within-Chinese group variability seems to discriminate Carlin from other known Chinese groups. This may be due to the small sample size or possibly some admixture with other groups, as there is no definitive evidence that all of the individuals buried in the Carlin cemetery were born in China. Biological variability has not been extensively published for Chinese groups residing in North America and this study presents the opportunity for further analyses, with important insights into an immigrant group that has often been overlooked.

Proteomic profiling of the extracellular matrix proteins in ancient bone.

T.H. Schmidt-Schultz[1], M. Schultz[2]. [1]Department of Biochemistry, University of Goettingen, [2]Department of Anatomy, University of Goettingen.

Proteomics is an emerging technology that evaluates normal and abnormal protein expression in tissues. Amplification deficiencies and the complexities of posttranslational modifications, make it necessary to concentrate more and more on the protein pattern of different tissues. Proteomic evaluation involves the detection and characterization of the protein components of cells and tissues by partial sequence analysis and database matching. Bone consists of about 2% cells and more than 90% calcified tissue, the extracellular matrix (ECM). After the death of an individual, the cells and the cellular molecules are relatively quickly degraded. Bone, particularly its compact component, protects the molecules inside the ECM after the death of an individual much better than other organs. The greatest problem to overcome was is how to extract and solubilize these proteins.
We have developed a method to extract the ECM proteins from recent human bones and also from bones many thousands of years old unearthed from archaeological sites (Schmidt-Schultz and Schultz 2004, 2005). After 2-D-electrophoresis, more than 300 different protein spots can be stained by silver (detection range of silver is between 1-10ng). These spots represent biomarkers which play a role in special pathways. We identified among other proteins, for example, growth factors (e.g., IGF-II, TGF-ß, BMP-2), molecules from the immune system (e.g., IgG) and proteins, which are typical for special diseases (e.g., PSA).

Center of mass movements in arboreal and terrestrial prosimians.

D. Schmitt[1], A. K. Pai[1], M. C. O'Neill[2], K[1]. L. Bishop[3]. [1]Dept. of Biological Anthropology and Anatomy, Duke University, [2]Department of Anatomical Sciences, Stony Brook University, [3] University of California, Davis, Department of Ecology and Evolution.

During walking the center of mass (COM) of cursorial quadrupedal mammals oscillates in such a way that reduces muscle work by allowing exchange of gravitational potential (PE) and kinetic energy (KE). However, primates, especially arboreal species, exhibit deep joint yield that may limit oscillations of the COM and reduce the exchange of PE and KE. To date, no data have been collected comparing COM movements in closely related primates that differ in their habitual substrate use. In this study whole-body force plate recordings were collected for five adult *Lemur catta* and two adult *Eulemur fulvus* walking on a runway and simulated arboreal supports across a range of speeds (0.36-1.3 ms^{-1}). Although both lemurs moved more slowly on the pole than on the runway, energy recovery did not differ across substrates. However, *Lemur catta*, the more terrestrial species, showed recoveries that were higher (mean=49%) than that of the *Eulemur fulvus* (mean=34%). These results are surprising in two respects. First, *Lemur catta* is able to exchange energy at levels near that of nonprimate quadrupeds. Second, recovery values did not decrease significantly when animals moved on arboreal substrates. A possible explanation for these results may lie in the fact that, along with high joint yield, primates have relatively long limbs and high limb protraction. The interaction of these three variables could facilitate vertical oscillations of the COM that increase exchange of PE and KE during walking. These results imply a dynamic solution to the challenge of navigating arboreal and terrestrial substrates economically.
Supported by NSF BCS-0452217, BCS-00525034 and Wenner-Gren Foundation

Endocast asymmetry in pongids assessed via non-rigid deformation analysis of high-resolution CT images.

P.T. Schoenemann[12], R.L. Holloway[3], B.B. Avants[4], J.C. Gee[4]. [1]Department of Sociology and Anthropology, James Madison University, [2]Museum of Archaeology and Anthropology, University of Pennsylvania, [3]Department of Anthropology, Columbia University, [4]Department of Radiology, University of Pennsylvania

Human brains are asymmetrical, both in structure and function. The extent and pattern of asymmetries on the endocranial surfaces of pongids and humans, and how they might match expectations from published studies of their actual brains, is ultimately important for understanding what fossil endocasts might be able to tell us about the brains of these creatures, thereby potentially informing us about their behavior. Gross neuroanatomical asymmetries (known as petalias) favoring the right frontal and left occipital regions of the brain are common in humans, and are reasonably common in pongids. However, the combination of right frontal and left occipital petalias in the same specimen appears to be absent (or extremely rare) in pongids. The behavioral significance of this difference is unclear, but it is suggestive of a possible anatomical marker of evolved behavioral abilities in hominids. Published studies of endocranial petalias have typically used only a few measurements to quantify hemispheric differences. We applied a method in which a series of virtual endocasts are morphed into their respective mirror images. The degree to which left and right hemispheres mismatch is then measured at each point on the endocranial surface. Statistical population assessments of left-right asymmetry using this method will be described for analyses of 10 *Pan*

troglodytes, 10 *Pan paniscus*, 10 *Gorilla gorilla*, 10 *Pongo pygmaeus*, and 10 *Homo sapiens* endocasts. The extent and pattern of human endocranial asymmetries consistently differ from pongid endocranial asymmetries will be demonstrated, and functional implications of these differences will be discussed.

Ecological reconstruction using $d^{13}C$ values in the unaltered bone mineral of select primate species.

M.J. Schoeninger. Department of Anthropology, University of California at San Diego.

Hair samples of modern C_3-feeding primate species from ecologically distinct areas of MesoAmerica, South America, Africa and Madagascar vary by 6‰ in $d^{13}C$ in association with canopy cover. The pattern of variation suggests that recent- and paleo-ecological reconstructions should be possible using $d^{13}C$ values in the unaltered mineral fraction of bone from select primate species. Cebus capucinus (capuchin) and Ateles geoffroyi (spider) from La Selva, Costa Rica from a tropical wet forest have identical average $d^{13}C$ values even though the former is omnivorous and the latter is frugivorous. Alouatta palliata (mantled howler) from La Pacifica, Costa Rica, Brachyteles arachnoides (muriquis) from Fazenda Esmeralda, Brazil, a population of chimpanzees from East Africa, and two different Galago species from Gedi, Kenya from mixed evergreen and deciduous forest have $d^{13}C$ values similar to each other but significantly different from capuchin and spider monkeys. The differences are of the same magnitude and in the same direction as that in leaves from open canopies compared with closed canopies, and are independent of specific primate diet. Lepilemur leucopus from Beza Mahafaly Special Reserve, Madagascar and another population of chimpanzees from dry, deciduous forests have $d^{13}C$ values similar to each other even though lepilemur is a folivore and chimpanzees are frugivorous. Both species are significantly less negative than the ones from closed and broken forest canopy habitats. Published data from other C_3-feeding fauna, including primates, largely match the pattern reported here, and indicate the expected level of accuracy in ecological reconstructions.

A Bronze Age woman in an Anglo-Saxon village.

L.C. D. Schoss, S.S. Legge. Dept. of Anthropology, University of Kent, UK,

During the excavation of a late Anglo-Saxon settlement at Bishopstone, Sussex UK, a crouched burial was unearthed. Carbon dating confirmed that this was a late Bronze Age burial (3260 -3000 BP). The burial was found in close proximity to Anglo-Saxon burials that are part of a cemetery. Further, it was located between the trenches of two buildings dating to the Saxo-Norman period. The burial was interred in a crouch position laying on its right side oriented with the head to the north. This orientation clearly distinguishes it from the Saxon burials, which are in a supine position with their heads to the east. Skeletal analysis revealed that these were the remains of a 25-year-old woman. She showed no signs of trauma or disease with the exception of some osteoarthritis in the lower vertebrae. While this particular osteobiography would seem of limited value, this individual raises a variety of questions about not only its possible association with the Anglo-Saxon cemetery, but also with respect to the potential location for an as yet still unknown late Bronze Age settlement and cemetery in the area.

Ranging patterns in wild hamadryas baboons in Ethiopia.

A.L. Schreier. Department of Anthropology, The CUNY Graduate Center and NYCEP.

Hamadryas baboons have large home ranges and long daily path lengths, and they are attributed to the sparse distribution of food and water in their habitats. This study investigated the ranging patterns of a band of 200 hamadryas baboons at the Filoha site in central Ethiopia from March 2005 - February 2006. Unlike other hamadryas sites, a permanent water source and palm forest providing a high availability of doum palm fruit, a preferred food resource, are located in close proximity to a commonly used sleeping cliff. Therefore, I predicted that home range size would be smaller and daily path lengths shorter than those at other hamadryas sites, an inverse relationship between daily path length and time spent feeding on palm fruit, and that daily path lengths would be shorter during the dry season so as to remain closer to permanent water sources.
The baboons' home range size of 38.5 km^2 is larger than reported for other hamadryas populations and their mean daily path length of 8.8 km (N=105) is comparable to that reported elsewhere. Furthermore, monthly mean daily path length and the percentage of feeding time devoted to doum palm fruit were positively correlated. Finally, the mean daily path length in the dry season (8.1 km, N = 43) was not significantly shorter than that of the wet season (8.6 km, N = 15). These results indicate that the ranging patterns of hamadryas baboons at Filoha do not reflect the year-round availability of water and a preferred food resource.

The role of micro-morphological stress markers in the differential diagnosis of infectious bone diseases.

M. Schultz[1], T.H. Schmidt-Schultz[2]. [1]Department of Anatomy, University of Goettingen, [2]Department of Biochemistry, University of Goettingen.

Light microscopy, particularly the use of polarized light, has such a high value for differential diagnosis of diseases in archaeological bones that it can no longer be neglected because a reliable diagnosis is the basis not only of individual case reports but also of the etiology and epidemiology of diseases in ancient populations.
Selected examples of micro-morphological stress markers caused by various pathological processes are presented (e.g., faserfilz-osteons,polster, grenzstreifen). Emphasis is placed on the differential diagnoses of proliferative reactions at the microscopic level, for instance, specific and non-specific periosteal and osteitic reactions. Thus, there are micro-morphological features which are important indicators of particular diseases or groups of diseases. In this context, micro-morphological structures which are characteristic of non-specific hematogenous osteomyelitis, treponematoses, tuberculosis and leprosy are presented and which make a reliable diagnosis relatively easy. Furthermore, the differential diagnosis of porotic orbital roofs called cribra orbitalia and porotic hyperostosis of the skull vault is discussed at the microscopic level and the importance of the microscopic vestiges of meningeal reactions on the endocranial lamina of the skull for assessing morbidity and mortality in ancient populations is demonstrated.

Monoamine oxidase A (*MAOA*) gene promoter variation influences aggressive behavior towards an unfamiliar intruder in rhesus macaques (*Macaca mulatta*)

M.L. Schwandt[1], T.K. Newman[2], S.G. Lindell[1], J.D. Higley[3], D. Goldman[4] and C.S. Barr[1,4]. [1]Laboratory of Clinical and Translational Studies, National Institutes of Health/NIAAA, [2]National Bioinformatics Network, South Africa, [3]Department of Psychology, Brigham Young University, [4]Laboratory of Neurogenetics, National Institutes of Health/NIAAA.

In a variety of species, highly aggressive behavior toward unfamiliar conspecifics may increase reproductive opportunity, social rank, and protection of self and offspring. In the regulatory region for the human monoamine oxidase (*MAOA*) gene, there is a loss-of-function repeat polymorphism (*MAOA*-LPR). The low-activity *MAOA*-LPR allele has been associated with antisocial behavior in humans and, in rhesus macaque males, an orthologous variant has been shown to predict various forms of aggressive behavior. We wanted to examine how macaques would react to an unfamiliar conspecific (or intruder) and whether individual behavioral responses would vary as a function of *MAOA*-LPR genotype. Behavioral responses to an age- and sex-matched intruder were recorded in adolescent and adult rhesus macaques (males, N= 52; females, N= 92). Factor analysis was performed using principle component extraction followed by varimax

rotation, generating 5 factors. Subjects were genotyped for *MAOA*-LPR, and aggression-related behavior factors were used as dependent measures in ANOVA. We found that aggressive behavior towards the intruder was higher in rhesus macaques with the low activity *MAOA*-LPR genotype. This was true among females as well as males. In a social environment, and due to niche-specific and frequency-dependent selection, divergent behavioral responses will be maintained in a population because the benefits and risks of opposing behavioral strategies will balance one another in different contexts. Variation at the *MAOA* locus may be maintained by such a mechanism. Our findings have implications for the selection for traits that increase fitness, but at the same time increase vulnerability to psychopathology.

What happened to evolution after the synthesis?: the stultification of alternative thinking.

J. H. Schwartz, Departments of Anthropology and History and Philosophy of Science, University of Pittsburgh.

Although most academics embrace the reality of evolution, and the version of Darwinism that emerged from the "modern evolutionary synthesis," few actually know the history of how one particular, idiosyncratic view of life came to dominate evolutionary biology. Yet the seminal publications that informed the synthesis make it clear that what is often but incorrectly referred to as neo-Darwinism rests primarily on diatribe and dogma rather than actual data. Nevertheless, the clout of the synthesis' three primary architects – Dobzhansky, Mayr, and Simpson – was sufficient to submerge advocates of non-Darwinian ideas, usually, as with Goldschmidt, through ad hominem attacks. The result was the elimination of the debate and alternative thinking that had characterized evolutionary biology during the late 19th and early 20th centuries. Because of this, beginning in 1941 with Dobzhansky's second edition of *Genetics and the Origin of Species*, most students and professional academics were taught that Darwinian selection coupled with fruit-fly genetics explained all evolutionary phenomena, from adaptation to the origin of new species, and that the "gaps" in the fossil record were merely taphonomic disruptions of a once-continuous stream of ancestors and their descendants. Unfortunately, the squelching of alternative thinking has led to the current situation in which scientists under attack from scientific creationists and intelligent designists have no intellectual defense other than resorting to Darwinism – which is incompatible with evolutionary lessons coming from developmental biology that were anticipated by the non-Darwinian ideas the synthesis sought to destroy.

Hypoplastic dental emamel defects among the Classic Period Belizian Maya.

R. Scopa Kelso. Department of Anthropology, University of Tennessee

Dental hypoplasia frequency provides an index of population health that can serve as an empirical basis for testing models of the rise of Maya kingship in the Early Classic period besides the consequences of the political, social, and environmental policies during the Late and Terminal Classic period. It has been well demonstrated that such changes alter the frequency and severity of all markers of nutrition and health stresses. Fetal, infant and childhood exposure to stress episodes severe enough to cause a disruption in growth, can leave a permanent record in the developing teeth in the form of enamel hypoplasia. The frequency and patterning by age and sex provides an overall paleoepidemiological picture of the population.
There is a slightly higher mean of hypoplasia for individuals living within urban centers than those living in hinterland communities. The mean growth disruption per individual in centers is 1.56, whereas the mean growth disruption per individual in hinterland communities is 1.10. When the frequency of enamel hypoplasia per tooth and half-year development period by hinterland communities and centers are compared there is a slight tendency for a greater number of hypoplasias to occur at a later developmental age in urban centers. This could imply weaning age, health, and sanitation differences between center and hinterland communities.

The pleasures and pitfalls of teaching human evolution in the museum.

M. Scott. The American Museum of Natural History.

What does the public *really* think about human evolution? In the American Museum of Natural History's Hall of Human Origins' Sackler Educational Laboratory, we as physical anthropologists have a unique opportunity to explore this question and, ideally, intervene in the answer. The Sacker Laboratory—a laboratory designed for teaching comparative genomics and human evolution within the permanent human evolution gallery—is more than a space where visitors can explore the latest methodologies and findings in evolutionary science; it is a space where we in the museum can explore the varied preconceptions and interpretive strategies museum visitors bring to the topic of human evolution. In this unique educational forum—neither formal exhibit, classroom or textbook—rich possibilities emerge for productive, if at times idiosyncratic, interactions around the topic of human evolution. Ultimately, we can consider such unique educational spaces in the museum—informal forums for laypersons to engage with evolutionary scientists—as critical resources for confronting and hopefully dispelling popular myths about human evolution.

Significance of biotic controls on hominid paleoenvironments.

R.S. Scott. Department of Anthropology, Rutgers University.

Abiotic factors are frequently invoked as controls on the availability of hominid paleohabitats. In contrast, biotic controls on paleoenvironments and feedback mechanisms are difficult to study and not generally discussed as major paleohabitat determinants. This is despite the fact that ecologists recognize the critical interplay of biotic and abiotic factors in determining habitat structure (e.g., the interaction of precipitation, fire, and grazing in grassland habitats). Have biotic factors such as species immigration played a significant role in shaping habitats available during hominid evolution?
Regional first appearances may represent cases where an immigrant species could act as a new biotic control potentially influencing environmental change. In particular, the Old World "*Hipparion*" Datum is an event where a major new basal herbivore appears to have spread rapidly upon entry into the Old World. Hipparionine horses are thus a potential candidate for a significant biotic control relevant to hominid evolution. Cases where immigrant taxa appear common and can be correlated with some shift in habitat availability would support the significance of biotic controls.
Here early records of hipparionine horses at or immediately following the Old World "Hipparion" Datum (N=59) are surveyed (NOW Database: Fortelius, 2007). These results indicate a patchy record: some sites preserve more specialized hipparions while at others hipparions appear more generalized. In Turkey, hipparions appear both generalized and common at or very near the "Hipparion" Datum. This suggests a model whereby a generalized (mixed feeding, eurytopic) hipparion invaded and rapidly expanded in existing habitats potentially altering them.

Re-analysis of the ainu-samurai hypothesis using population genetic analysis.

N. Seguchi[1, 2], H. Umeda[3]. [1]Department of Anthropology, The University of Montana, Missoula, [2]Museum of Anthropology, University of Michigan, Ann Arbor, [3]Department of Astronomy, The University of Tokyo, Japan.

In 1989, Brace et al. published the paper "Reflections on the Face of Japan" in *The American Journal of Physical Anthropology*, in which the authors analyzed both craniofacial metric and odontometric data of the remains of the victims of the attack on the city of Kamakura in the summer of A.D. 1333, and they suggested that the Ainu made a recognizable genetic contribution to the warrior class of Kamakura.

In the current paper, I report the results of a re-analysis of Brace's data from a series of prehistoric and historic skeletal samples from Japan by utilizing newer population genetic and statistical analysis: the Relethford-Blangero method.
Craniometric analysis shows that the Kamakura falls between the Jomon-Ainu cluster and the ethnic Japanese cluster. Although the total tooth size and the cross-sectional size of each tooth category of the Kamakura are larger than the Ainu and smaller than the other Japanese groups, the genetic distances based on odontometric data indicate that the Kamakura is rather closer to the ethnic Japanese than to the Ainu. Because microevolutionary trends obscure patterns of gene flow and population ancestry, the odontometric data were detrended. The result shows that the Kamakura ties to the Ainu first, before it ties to the other ethnic Japanese. In addition, the Kamakura group shows more variability, indicating that the Kamakura group may have experienced significantly more gene flow. This indicates the Ainu-derived people who lived in East Japan at that time made a genetic contribution to the warrior class of Kamakura.

Primitive anthropoids from the oldest primate-bearing locality in the Fayum Depression, northern Egypt.

E.R. Seiffert[1], E.L. Simons[2]. [1]Dept. of Anatomical Sciences, Stony Brook University, [2]Division of Fossil Primates, Duke Lemur Center.

The ~37 million-year-old (earliest late Eocene) Birket Qarun Locality 2 (or BQ-2) is the oldest primate-bearing fossil locality in Egypt, and has produced a diverse mammalian fauna that includes both anthropoid and strepsirrhine primates. The anthropoid fauna includes two species of the basal parapithecoid genus *Biretia* and at least two other, more generalized, anthropoid species that have not yet been described. The latter taxa lack the derived features of *Biretia* (such as large hypocones on the upper molars and posterior premolars, upper molar conules, large and centrally placed lower molar hypoconulids, and orbitopalatal fusion) and exhibit some surprisingly primitive features, such as paraconids on all lower molars, lower fourth premolars that lack metaconids, and upper third premolars that lack protocones. These features are combined with robust canines, reduced upper and lower second premolars, lower molar premetacristids, and deep maxillae and mandibular corpora, all of which (along with aspects of upper molar morphology) are also seen in slightly older *Bahinia* from Myanmar. The new species share few clearly apomorphic features with younger Fayum anthropoids, but key among them is twinning of lower molar entoconids and hypoconulids, as is also seen in proteopithecids, oligopithecids, and enigmatic *Arsinoea*. The complex of morphological features observable in the new BQ-2 species has important implications for our understanding of early anthropoid phylogeny, dental character evolution, and biogeography, and the new taxa are sure to play a key role in future discussions surrounding early anthropoid evolution.
Supported by the National Science Foundation and the Leakey Foundation.

Can morphometrics be used to identify knuckle walking features of the hominoid wrist?

M.S. Selby, C.O. Lovejoy. Department of Anthropology and School of Biomedical Sciences, Kent State University

Knuckle walking (KW) has long been thought to figure prominently in human ancestry, and numerous studies have identified putative KW traits that might be used to interpret the fossil record. It has been suggested that the proximal and mid-carpal joints are differentially broad in response to KW, and are therefore characterized by a short capitate with a broad head. These and other features are claimed to be related to "close-packing" morphology, which is argued to limit dorsiflexion during KW. The short, broad capitate of African apes is distinct from that of Asian apes in which the capitate head is more spherical. This study tests the hypothesis that a broad wrist with a short, broad capitate is a character associable with KW. Nine metrics for mediolateral breadth and proximodistal length of the principal carpals were evaluated using principal components analysis (PCA). Size normalization was carried out using the geometric mean of the proximal and distal articular surfaces of the humerus and radius. Samples include hominoids, as well as several species of ceboids and cercopithecoids. PCA was performed twice, with and without monkeys. Neither PCA showed any separation of the African apes and humans from other taxa. In each analysis, gorillas show separation in the second component, with short capitates, following prediction, but with mediolaterally narrow distal radii, which was opposite of expectations. The results of our PCA suggest that these traits have limited morphometric usefulness in identifying KW, and caution should be taken in applying them to fossils.

The paleobiology of the robust australopithecines (*Paranthropus*): a test of the durophage model with a morphometric analysis of carnivoran skulls.

A.B. Shabel. Museum of Paleontology, Museum of Vertebrate Zoology, and Dept. of Integrative Biology; University of California, Berkeley.

The problem of the paleoecology of the robust australopithecines (*Paranthropus*) can be rigorously studied through comparative analyses of non-hominin clades. The robust hominins represent a clear and divergent morphological trend in Plio-Pleistocene primate evolution. The craniodental features that distinguish the robusts are well-known and well-enumerated, and they have been the basis for several dietary hypotheses. The durophage model reconstructs the robusts as opportunistic consumers of hard-shelled invertebrates (HSI's), such as molluscs and crabs, suggesting that the inclusion of HSI's in the diet can explain the derived craniodental features of the robusts. Here I provide a morphological test of this hypothesis with an analysis of 950 skulls from 136 extant species (80 genera) from the order Carnivora, including 85% of the carnivoran species from Africa (excluding pinnipeds). This study includes a geometric morphometric analysis of 15 landmarks visible on the mandible in buccal view, as well as traditional (linear) measurements of cranial features related to mastication, and area measurements of the occlusal surfaces of maxillary teeth. Carnivoran species are assigned to trophic categories that reflect the physical properties of their typical food items, and discriminant analysis reveals clear shape differences among these trophic groups. Interestingly, there is some overlap between the bamboo-eating carnivorans and those that rely on hard-shelled invertebrates. However, when all of the morphological evidence is considered, it is evident that the craniodental apparatus of *Paranthropus* is most similar to that of durophagous carnivorans that consume HSI's.

The influence of body size and substrate size on quadrupedalism in *Monodelphis domestica*.

L.J. Shapiro[1], A. Zeininger[1] , J.L. VandeBerg[2]. [1]Department of Anthropology, University of Texas at Austin, [2] Department of Genetics and Southwest National Primate Research Center, Southwest Foundation for Biomedical Research.

Primate quadrupedal kinematics are viewed as a biomechanical complex that gave early primates exclusive access to resources in a "small branch niche." This view is supported by kinematic convergence between primates and arboreal marsupials, and lack of convergence with *Monodelphis domestica*, a terrestrial marsupial. However, branch size is only meaningful in the context of body size. Ancestral primates might have been tiny (10-15g), yet the interaction of substrate size with small body size remains largely unexplored in primates or marsupials. In this study, *Monodelphis domestica* infants were compared to adults to investigate the influence of body size and substrate size on quadrupedalism in the absence of arboreal adaptations.
Infants aged 4-9 weeks (n=10, 3.5-28g) were compared to adults (n=2, 105g) while walking across a flat surface or on dowels of diameter 6.3/7.9/9.5/12.7 mm (n=92 strides). *M. domestica* did not change gait as a function of substrate size; lateral sequence/diagonal couplets walking was used predominantly on

all substrates at all ages. Duty factor and substrate diameter were inversely correlated in adults, but poorly correlated in infants. That is, larger relative size required adults to slow down on smaller dowels to improve stability. In fact, while adults had difficulty balancing on dowels, infants as young as 7 weeks (12.7g) easily navigated a 6.3mm dowel. Small body size alone thus permits successful navigation of small branches, even in the absence of primate-like adaptations. This study highlights the importance of body size relative to substrate size when assessing hypotheses surrounding primate locomotor evolution.
Supported by NIH Grant P51 RR013986 and The Robert J. Kleberg, Jr. and Helen C. Kleberg Foundation.

A Comparison of Menopausal Symptoms among Women in Sylhet, Bangladesh and Sylheti Migrants in London, UK.

T Sharmeen[1], LL Sievert[2], K Begum[1] S Muttukrishna[3] and Gillian R Bentley[4]. [1] Department of Anthropology, University College London, [2] Department of Anthropology, University of Massachusetts Amherst, [3] Institute of Women's Health, University College London [3] Department of Anthropology and Wolfson Research Institute, Durham University.

Our ongoing research aims to assess differences in the frequency and types of menopausal symptoms between Bangladeshi immigrants in London and sedentees in Sylhet, Bangladesh, and whether any differences might reflect developmental ecology. We interviewed 248 women without surgical menopause, hormone based treatments, pregnancy and lactation aged 35 to 59 from migrant (n=91) and sedentee (n=157) populations. Using piloted, standardized, semi structured, open-ended questionnaires, in-depth interviews with respondents focused on demographic and socioeconomic data, migration history, diet, reproductive and general health history, and symptom experience.
Preliminary analysis of the data collected so far indicates most reported symptoms among all women are nervous tension (69.6%), aches/stiffness in joints (65.7%), dizziness (66.4%), backache (64.5%), low energy (64.1%), leg cramps (62.8%), trouble sleeping (62.4%), depression (56.7%), poor concentration (53.9%) and headache (51.8%). Using Chi Square, preliminary data suggest there is no significant difference between migrant and sedentee populations in menopausal vasomotor symptom experiences. However, women in London experience significantly more backache (74.7% vs. 58.6%, $p<.05$). Among other symptoms associated with quality of life during the menopausal transition, women in London report a higher incidence of constipation (58.2% vs. 36.9%, $p<.05$). In contrast, sedentees experience greater loss of appetite (38.2% vs. 23.1%, $p<.05$). Further data collection and analyses, including information from a reference group of white UK women in London, will be enable us to refine this current picture of contrasts and similarities in relation to the many covariates that affect life in London vs. Bangladesh.
Supported by a Commonwealth Scholarship to T. Sharmeen, NSF grant #0548393, and Wolfson Research Institute Durham University.

It's the hard knock life: degenerative joint disease in a post-imperial Andean population

EA Sharp and TA Tung, Department of Anthropology, Vanderbilt University.

Osteoarthritis, or degenerative joint disease, has inflicted populations around the world for thousands of years. Researchers have conducted a variety of studies about osteoarthritis because of the insight the disease provides about an individual's health and physical activity patterns. Human remains from the pre-Hispanic era in the Andes of Peru were examined for evidence of osteoarthritis. Based on recent radiocarbon dates, they date to the Late Intermediate Period (AD 1000 – 1450), a time of political fragmentation that followed the collapse of the Wari empire (AD 600 – 1000). The skeletal remains were excavated from two areas at the former capital site of Huari: Vegachayoq Moqo and Monqachayoq. Because the skeletal remains are commingled, the data are analyzed by skeletal element and specific joint surfaces. At Vegachayoq Moqo, counts of the left humerus indicate an MNI of 70, and at Monqachayoq, counts of the left tibia indicate an MNI of 60. The osteoarthritis data provide information about how a post-imperial time was experienced by those who lived in the former Wari imperial heartland.
Results show that the highest frequency of osteoarthritis is exhibited in the spinal column, particularly the lumbar vertebrae, where severe lipping and several cases of vertebral fusion are observed. The knee and elbow joints also yield higher percentages of osteoarthritis compared to the ankle, wrist, and shoulder. The disease appears to be bilaterally asymmetrical, as evident in the proximal ends of the left ulna and radius from Vegachayoq Moqo that have a higher frequency of osteoarthritis than the right.
This research was funded by the Vanderbilt Undergraduate Summer Research Program (VUSRP), The Vanderbilt Center for the Americas, The Vanderbilt Discovery Grant, and The Center for American Overseas Research Council.

The evolution of aggression: analysis of SLC6A4 variation in *Macaca mulatta*

M.R. Shattuck, R.Y. Tito, and R.S. Malhi. Department of Anthropology, University of Illinois Urbana-Champaign

Serotonin is a hormone produced by the brain that has been shown to play a role in a wide variety of primate behaviors and its effects are mediated in part by the serotonin transporter. Polymorphisms in the gene that codes for the transporter – SLC6A4 – are a source of great interest for their correlations with behavioral variation. In particular, the promoter region of SLC6A4 shows variation in the number of repeats and these polymorphisms (termed "long" and "short" alleles) have been linked with variation in behavior; that is, there tends to be an increase in anxiety and aggression in association with the short allele.
The macaque species represent a key area of research for this gene. They have the widest distribution of any nonhuman primate, are genetically diverse, and exhibit a broad range of behavioral and social systems. Interestingly, the only species that carries the short allele is *Macaca mulatta*, one of the more aggressive of the macaque species. Increased aggression may help a male achieve rank, and may increase tendencies to exploit new habitats. Thus, the presence of the derived short allele in high frequency in *M. mulatta* may be the result of selection favoring aggressive behavior. To address whether selection is acting on this gene, we sequenced a 3kb segment of SLC6A4 in rhesus macaque individuals (N=60) and examined the data for evidence of selection. The results of this research will shed light on the both the evolutionary and genetic underpinnings of primate behavior.

The relationship between lower limb length and midshaft diaphyseal shape of the femur and tibia among modern humans.

Shaw, C.N., Stock, J.T. Leverhulme Centre for Human Evolutionary Studies, University of Cambridge.

Lower limb diaphyseal shapes have been used to interpret patterns of mobility from hominin skeletal remains. A recent study illustrates that longer limbs incur greater bending moments along the lower limb during certain phases of locomotion, which suggests that limb length may influence anteroposterior (A-P) loading and adaptive remodeling of the diaphysis. An understanding of the relationship between human physique and diaphyseal shape is required in order to use variation in diaphyseal morphology to infer behavioural patterns. This study investigates the relationships between osteometric measures of physique and lower limb diaphyseal shape amongst nine geographically and behaviourally diverse late Pleistocene and Holocene populations (n=159). Regression analyses were performed for limb segment length, total limb length, and bi-illiac breadth against femoral and tibial diaphyseal shape indices (Imax/Imin, Ix/Iy). The results demonstrate that there is a weak relationship between limb segment length and both tibial ($r^2 = .0368$, $p = .019$) and femoral ($r^2 = .0484$, $p = .011$) midshaft shape (Imax/Imin), for pooled male and female data. Other comparisons involving bi-

illiac breadth, total limb length, and limb segment length for the male, female, and pooled subsets were non-significant. This suggests that little of the variation in diaphyseal shape is explained by differences in limb segment lengths and associated bending moments. Other aspects of mechanical loading, such as mobility or terrain relief, may explain a greater proportion of variation in lower limb diaphyseal shape.
This research is supported by funding from the Natural Environment Research Council, U.K., to JTS.

The influence of undernutrition on immune response: Public health insights from adaptationist perspectives.

B. Shell-Duncan University of Washington, Seattle, WA.

Roberto Frisancho's seminal text on human adaptation, which was originally published in 1979 and has since appeared in two updated forms, has provided the foundation for the study of human adaptability and functional consequences for countless students of human biology. Subsequent editions continued to focus on topics that became hallmarks of the field, such as thermoregulation, but grew in emphasis on the topic of accommodation to variable energy intake. In doing so, he expanded the study of human adaptation to the major selective factors operating on humans, nutrition and infection, issues that called for the development of more complex models of interacting environmental stressors and innovative field methods. In the preface of the 1993 edition, Dr. Frisancho expressed the hope that some students may be inspired to further explore some of the questions and debates raised in the book – and in his discussion of the synergistic interaction between nutrition and infection, I found such inspiration. My initial field research in northwest Kenya investigated the role of cellular immunocompetence in mediating the relationship between protein-energy malnutrition infectious morbidity among nomadic Turkana children. This study, along with many others at the time, assessed nutritional status only through anthropometry, rather than additionally employing biochemical markers of micronutrients, measures more pertinent to the site of biological action. Consequently, many of us have shared Dr. Frisancho's interest in methodological innovation for assessing nutritional status in field settings. A broader lesson drawn from Dr. Frisancho's work highlights the important contribution that the field of human biology can make to public health and health sciences by offering novel insights gained from evolutionary perspectives, illustrated here through examples of recent research on vitamin A and iron status.

Play behavior by young male chimpanzees at Ngogo, Kibale National Park, Uganda.

H.M. Sherrow. Department of Sociology & Anthropology, Ohio University.

Play behavior is common among young wild primates including young chimpanzees. Previous research has indicated that play is important for behavioral development and that young primates engage in play for multiple reasons including; skill development, testing conspecifics, relaxation of tension. Among chimpanzees play is common among infant and juvenile males and females, with males participating more often than females. Play is less common among females as they mature, but remains common among males well into adolescence. However, the intensity of play behavior by male chimpanzees, based on age has received little attention. I present data on play behavior by young male chimpanzees at Ngogo, Kibale National Park, Uganda that addresses this deficiency. The Ngogo community is unusually large, with over twenty-five adult and fifteen adolescent males. The number of males within the community provides for numerous opportunities for play throughout any given day. Data from over 300 play bouts show that play is common among young males and that males are selective in their play partners. Play frequency and intensity varies negatively with age, with juvenile and early adolescents playing more often and more intensely than middle and late adolescents. These results confirm previous reports that as primates mature they play less often. Males show preferences for play partners, indicating that participation in play may be a social strategy in male chimpanzees.

Variation, genetics, and evolution of the primate craniofacial complex.

R.J. Sherwood[1], M.C. Mahaney[2,3], D.L. Duren[1], , L. M. Havill[2], L.A. Cox[2,3], J. Rogers[2,3], B. Towne[1]. [1]Lifespan Health Research Center, Boonshoft School of Medicine, Wright State University, [2]Dept. of Genetics, Southwest Foundation for Biomedical Research, [3]Southwest National Primate Research Center.

The craniofacial complex holds great interest across diverse fields. Biologically, the cranium presents a unique developmental history and functional constituency. Clinically, craniofacial anomalies are the most common congenital defects. Evolutionarily, cranial traits form the basis for most phylogenetic assessments. Central to the use of craniofacial traits is the detailed characterization of the extent and sources of variation. While numerous studies have examined phenotypic variation, elucidation of the genetic underpinnings of this variation has received less attention.
We have conducted a series of statistical genetic analyses to dissect the genetic architecture of the primate craniofacial complex in baboons (*P. hamadryas spp.*) from the Southwest National Primate Research Center. Using maximum-likelihood variance decomposition procedures we analyzed 47 measures obtained by lateral cephalometry in 830 animals from a single pedigree. Because we detected a significant additive genetic contribution to the variance for all 47 traits (heritability, h^2, range: 0.13 to 0.71, $p<0.001$), we performed whole genome linkage screens to localize quantitative trait loci (QTL) accounting for these genetic effects.
Our linkage analyses identified several chromosomal regions harboring genes influencing craniofacial variation. We found significant evidence (LOD>2.75, genomewide $p<0.05$) for QTL for eleven craniofacial measures on the baboon orthologs of human chromosomes 1, 2p, 3, 6, and 12. Potential positional candidate genes include FGF6, WNT5B, and POMC. Novel regions identified will be investigated for their role in craniofacial variation.
This work forms part of our ongoing comparative genomics research into the genetic architecture of the craniofacial complex in baboons and humans.
Supported by NIH grant P51 RR13986 to the Southwest National Primate Research Center; NIH R21 DE016408; and NIH R01 DE016692.

Hunting pressure and declining monkey populations on Bioko Island, Equatorial Guinea.

I. Shmulenson[1], G.W. Hearn[2], W.A. Morra[3], T.B. Butynski[4]. [1]Department of Anthropology, Hunter College- City University of New York, [2]Department of Bioscience and Biotechnology, Drexyl University, [3]Department of Economics, Arcadia University, [4]Zoo Atlanta, Nairobi, Kenya.

Illegal shotgun hunting of bushmeat in the protected areas of Bioko Island, Equatorial Guinea has continued to diminish the numbers of the island's seven monkey species. For over ten years, representatives of the Bioko Biodiversity Protection Program(BBPP)in conjunction with the National University of Equatorial Guinea (UNGE) have measured the species, sex, approximate age, sale price, method of capture, and town of origin for bushmeat that comes through the Malabo bushmeat market. Approximately 110,000 carcasses have been documented. Animal encounter rates have been recorded during forest census conducted in 1990 and every season from 1996-2007. Since the first census of primates was conducted on Bioko by Butynski in 1986, the estimated population sizes of six of the seven primate species have decreased to below 5,000 individuals. Between 1986 and 2006, Black colobus, *Colobus satanas satanas*, and Bioko Preussi's monkey, *Cercopithecus preussi insularis*, populations have decreased approximately 60 percent. In 1986 both species were abundant in the Pico Basile National Park. In the last five years they have been heavily hunted out of this area. Since 2005, the number of animals shot has steadily increased, while the number of

monkeys as a percentage of that total has declined. Increasingly, monkeys at the bushmeat market are reportedly coming from the Caldera and Southern Highlands Scientific Reserve in the south of Bioko, indicating that monkey populations on Pico Basile have been virtually hunted out.

Age-related changes in the pubic symphysis: a topographical approach.

S. Sholts[1], P.L. Walker[1], S. Warmlander[2]. [1]University of California at Santa Barbara, Department of Anthropology, [2]University of California, Los Angeles, Cotsen Institute of Archaeology.

The morphology of the pubic symphysis shows age-related changes that continue throughout life. These changes involve an early growth phase in which the transverse grooves of the immature symphysis are replaced by a smooth, flat symphyseal surface with a well-delineated periphery; this is followed by the development of marginal lipping and increased symphyseal surface porosity in old age. The multi-stage scoring systems currently used to make age assessments based upon these changes suffer from problems of interobserver error and produce age estimates with broad confidence intervals, especially for elderly individuals. To mitigate these problems with current methods, we used a laser scanner to create 3D models of pubic bones from people of known age. After isolating the symphyseal surface and standardizing its orientation, we extracted coordinate data from transects encompassing various regions of each symphyseal model. The resulting surface topography data were then summarized using standard descriptive statistics. Fourier analysis was also applied to the mean z-values of transects spaced at regular intervals across the symphyseal surface. The resulting coefficients were summarized using principal components analysis. Stepwise regression was used to explore the value of various metrical attributes of the surfaces as age predictors. The results of this analysis suggest that the topographical approach we have developed has considerable promise as an age determination method. The equations we developed based upon the metrical attributes of transects passing vertically through the center of the symphysis resulted in much lower age-estimation errors than currently available from stage-based pubic symphysis scoring systems.

500 years of Ojibwa history: lessons from and insight into using mitochondrial DNA.

B.A.S. Shook, Department of Anthropology, California State University Chico

Over the past 500 years, the Ojibwa have expanded geographically throughout Northeastern North America, becoming one of the most widespread indigenous groups on the continent. This relatively well-documented history includes interactions with Europeans, Americans, and other Native groups, as well as adaptations to various subsistence strategies. This paper uses mtDNA from extant populations to examine the matrilineal genetic relationship between Ojibwa populations and to their neighbors, to determine the extent to which different historic and cultural factors have had an impact on the genetic structure and demography of the Ojibwa.
Ojibwa populations analyzed include the Turtle Mountain Chippewa (N=86), Minnesota Chippewa (N=26), Wisconsin Chippewa (N=77), Manitoulin Island Ojibwa (N=33), and Northern Ontario Ojibwa (N=28). Results suggest that while linguistic and geographic factors have not had a significant affect on the genetic structure of Northeastern populations, genetic patterns in some cases have been significantly influenced by changing demographics and by neighboring populations in a relatively short period of time. Specifically, genetic drift has been a significant force since European contact, resulting from both a severe drop in population size as well as isolation of populations on reserves and reservations established by outside governments. Regional and historic factors, which have previously been underestimated, must be understood before attempting to extrapolate information about events in prehistory.

Association between male testosterone and *friendship* formation with lactating females in wild olive baboons (*Papio hamadryas anubis*).

M.D.Shur[1], R.A. Palombit[1], P.L. Whitten[2]. [1]Department of Anthropology, Rutgers University, [2]Department of Anthropology, Emory University.

Numerous studies reveal a negative correlation between testosterone concentration and paternal care in diverse mammals including nonhuman primates and humans. Several researchers suggest that spousal investment accounts for the lower testosterone of married men compared to unmarried men, but findings that the lowest testosterone levels are observed in married men with children implicate paternal care as particularly relevant. Thus testosterone reduction may reflect a facultative shift in male reproductive strategy from intrasexual competition and copulation to care of young. We tested this hypothesis in wild olive baboons, in which adult males and lactating females maintain cohesive associations, *friendships*, commencing at parturition. We examined the association between male testosterone and the timing of friendship formation. Fecal testosterone, and data on social behavior and spatial relations were collected from 26 adult male and 22 lactating female baboons in two study groups located in Laikipia, Kenya. Testosterone was assessed by radioimmunoassay from field-extracted hormones. Friendships were determined from composite proximity scores (C-scores) calculated for each male-female dyad in the groups.
In contrast to control males, male friends experienced a decrease in testosterone level coinciding with the birth of their female friends' infants. Male friends also maintained a lower basal testosterone level than did control males during the lactation period of their female friends. Testosterone levels in male friends increased gradually corresponding with developing infant independence. These data, suggesting a negative association between male testosterone and heterosexual friendship, indicate support for the paternal care hypothesis for olive baboon friendship.
Supported by Fulbright IIE, The Leakey Foundation, The Wenner-Gren Foundation, and the Center for Human Evolutionary Studies.

Circadian rhythms and levels of concordance between measures of objective and subjective hot flashes in a multiethnic population.

L.L. Sievert[1], A. Reza[2], P. Mills[2], D. Brown[2]. [1]Dept. of Anthropology, UMass Amherst, [2]Dept. of Anthropology, University of Hawaii at Hilo.

Hot flashes at midlife are the result of a heat dissipation response apparently triggered by a core, hypothalamic mechanism within the context of declining estrogen levels. In the laboratory, sternal skin conductance provides the best measure of hot flash experience. Ambulatory hot flash monitors demonstrate lower levels of concordance between objective and subjective hot flashes, but provide a means to examine diurnal patterns in everyday settings. The purpose of this study was to examine circadian patterns of objective and subjective hot flashes in the hot, humid environment of Hilo, Hawaii, using both sternal and nuchal skin conductance measures. While wearing the monitor for 24 hours, women also recorded subjective hot flashes in a diary and by pushing buttons on the monitor. Biolog software was used to identify objective hot flashes based on a 2 micromho rise in SCL within 30 seconds. The number of objective hot flashes experienced on the sternum, on the back of the neck, and the number of subjective hot flashes were recorded for each hour monitored. Among the first 62 participants in the on-going study, the percentage of women demonstrating objective sternal hot flashes was lowest at 05:00 and peaked at 11:00; objective nuchal hot flashes were lowest from 21:00 to 24:00 and highest at 14:00; subjective hot flashes were lowest from 04:00 to 05:00 and highest at 07:00, 12:00 and 14:00. The number of true positive, false positive, and false negative readings was also computed.
Supported by NIH grant No. S06-GM08073-32.

New *Homo erectus* crania from Ethiopia

Simpson, S.W.[1]; Semaw, S.[2]; Quade, J.[3]; Levin, N.E.[4]; Butler, R.[5]; Rogers, M.J.[6]; Holloway, R.L.[7]; Renne, P.R.[8]; Dupont-Nivet, G.[9]; Stout, D.[10]; Everett, M.[2,11]

[1]Department of Anatomy, Case Western Reserve University School of Medicine, [2]CRAFT and Stone Age Institute; [3]Department of Geosciences, University of Arizona; [4]Department of Geology & Geophysics, University of Utah; [5] Department of Physics, University of Portland; [6]Department of Anthropology, Southern Connecticut State University; [7]Department of Anthropology, Columbia University; [8]Berkeley Geochronology Center; [9]Department of Earth Sciences, Utrecht University; [10]Institute of Archaeology, University College London; [11]Department of Anthropology, Indiana University

By the Early Pleistocene, members of the genus *Homo* were distributed throughout Africa and Asia, spreading into Europe by the Middle Pleistocene. As expected from such a widely distributed and long-lived species, variation in anatomical details is marked. This variation has fueled debate about the number of Early Pleistocene *Homo* species that existed and their relationship with modern humans. Here we report on two newly discovered hominid adult crania – one female and one male – dated to 1.5-1.7 My from the Busidima Formation, Gona Paleoanthropological Research Project area, Afar State, Ethiopia. An additional *H. erectus* cranial fragment (~1.24My) is also reported. These crania are near contemporaries of specimens from Kenya, Tanzania, Republic of Georgia, and Southeast Asia and are attributable to *Homo erectus*. These fossils document a greater degree of brain size variation than previously known and allow a better accounting of the magnitude and character of cranial sexual dimorphism in size and shape.

Ontogeny of airorhynchy in male-female orangutans: analysis of palate and frontal bone.

N. Singh[1], S. Senck[2]. [1]Dept. of human evolution, Max Planck Institute for Evolutionary Anthropology, Germany, [2]Dept. of Anthropology, University of Vienna.

Comparative studies on skull form of great apes have shown that orangutans have an upwardly deflected palate relative to the basicranium – a structural condition known as airorhynchy. It has been suggested that the lack of a supraorbital torus in orangutans relative to African apes is related to the airorhynch condition. Several studies have discussed the craniofacial morphology of orangutans in a phylogenetic context, but little work has been done on the ontogenetic relationship of features related to airorhynchy. Taking a 3D geometric morphometric approach, the goal of our investigation is to examine the developmental relationship between the palate and frontal bone in the context of sexual dimorphism in orangutans.
Thirty-three 3D ectocranial landmarks were digitized on the frontal bone and palate of 151 *Pongo pygmaeus pygmaeus* individuals. Age groups were classified from infancy to adulthood according to dental eruption patterns. Specimen landmark configurations were superimposed using generalized Procrustes analysis and analyzed using principal components analysis (PCA) in form space.
The first two PCs account for 75% of the total variance in the sample size; PC1 vs PC2 shows that males and females overlap in their pattern of development in the frontal bone and palate. Preliminary results suggest that associated shape changes in the two regions include a dorsally deflected palate with marked postorbital constriction and a high frontal region. These shape changes are more pronounced in adult males and associated with marked concavity in the mid-face. Implications for co-evolution of hominid craniofacial traits are discussed.
Supported by "EVAN" MRTN-CT-019564

Meet the new kid: Phenetic affinities of the *Rungwecebus kipunji* juvenile.

M. Singleton. Department of Anatomy, Chicago College of Osteopathic Medicine, Midwestern University.

The highland mangabey or kipunji was initially referred to the papionin genus *Lophocebus* but was transferred to a new genus, *Rungwecebus*, when molecular analyses showed it to be more closely related to *Papio*. *Rungwecebus* has met with skepticism among researchers who question both the molecular results and the kipunji's morphological distinctiveness. This situation is exacerbated by the immaturity of the single available specimen, an M1-stage juvenile. Because recent studies have shown that primate cranial shape differences are present early in ontogeny, a geometric morphometric analysis of juvenile cranial shape was used to explore the kipunji's phenetic affinities and evaluate support for its separation from *Lophocebus*. Craniometric landmarks and semi-landmarks were collected on 126 subadult (dp4-M2 stage) cercopithecine crania, and multivariate statistical and shape analyses were conducted. The kipunji juvenile's overall phenetic affinities are with *Macaca* and *Cercocebus*; morphological distances between it and species of *Lophocebus* are comparable to distances between papionin genera. Discriminant analyses do not support the kipunji's classification to other papionin taxa, and it falls between macaques and African papionins in canonical space, suggesting it retains primitive cranial characteristics. In comparisons among M1-stage juveniles, the kipunji skull is distinguished from *Lophocebus* by its less restricted suborbital fossa, sagittally oriented zygomatic arches, and longer auditory tube, and from all papionins by its boxy neurocranium, broad face and cranial base, dished nasal profile, and dorsally oriented rostrum. The kipunji is thus a skeletally diagnosable phenon distinct from classic *Lophocebus* and with a unique mosaic of primitive and derived characters.
Financial and logistical support provided by NSF Research and Training Grant #BIR 9602234 (NYCEP), NSF Special Program Grant #ACI-9982351 (AMNH), Midwestern University, and the Field Museum.

Patterns of disease and death of children in early nineteenth century Rochester, New York.

J.E. Sirianni, R.L. Higgins. Department of Anthropology, SUNY at Buffalo.

Mount Hope Cemetery in Rochester, New York has the distinction of being the first municipal Victorian cemetery in America (Reisem, 1994). The cemetery=s death records include: date of death, name, age, sex, address, location of burial, and cause of death. These valuable resources have been used to report disease specific mortality (Sirianni, 2002) and patterns of gastrointestinal infection (Sirianni and Higgins, 2007) for nineteenth century Rochester. The purpose of this investigation is to examine demographic patterns of disease and death of children during a twenty year period (1837-1856) using the death records from Mt. Hope Cemetery.
A total of 4,842 death records of infants and children were examined. Ages ranged from birth to15 years. The first three years of life appear to be particularly hazardous for children living during the early nineteenth century. Among the various causes of death, gastrointestinal infections accounted for 24% of the recorded deaths, followed by respiratory diseases (13.5%), and childhood diseases (7.8%), e.g. measles, scarlet fever and whooping cough. After the age of three the number of recorded deaths gradually dropped from 257 children aged three to 39 fifteen year olds. From three to fifteen, there is a slight decrease in the number GI infections relative to respiratory ailments, and an increase in the number of deaths due to scarlet fever.
These data are compared to death records for both Monroe County and Erie County Poorhouses, as well as, the skeletal demographic analysis of the Highland Park Cemetery.

Phylogeny and phylogeography of the chacma baboon (*Papio ursinus*); an assessment of evolutionary history and genetic variation.

R. Sithaldeen[1], R.R. Ackermann[1], J.Bishop[2]. [1]Dept Archaeology, University of Cape Town, [2]Dept Molecular and Cell Biology, University of Cape Town,

A high level of external and behavioural variation within *P.ursinus* has been documented. The chacma baboon is widely dispersed and utilizes a wider array of

ecological niches than any other baboon. This degree of variation in characters of pelage and behaviour is not surprising if you assume that chacmas are in fact the oldest lineage within *Papio* (Newman *et al*., 2004). This study continues from a preliminary study, which revealed a deep divergence event within chacma baboons (Babb *et al*., 2005). In the present study we have sought to refine this phylogenetic tree as well as to look at the influence of gene flow on genetic sub structuring within chacma. Samples were collected from South Africa, Namibia and Botswana. All samples were sequenced for the mitochondrial control region, and a subset were sequenced for the mitochondrial Brown region. Sequences were analysed by parsimony, maximum likelihood and Bayesian methods and trees were rooted using yellow baboon (*P.cynocephalus*) sequence data. Brown region data showed that animals from Namibia and the South African coastal belt formed a clade, while individuals from the Caprivi Strip group together in a clade with individuals from the South African interior. The control region data shows that populations tend to group along lines of geographic rather than evolutionary distance. These results suggest that the current pattern of genetic structuring within chacma is a result of the interaction between large-scale landscape changes brought about by climatic fluctuations, as well as more recent gene flow events.

The importance of bipedality/bending in mediating morphological adaptation in the chimpanzee femoral neck might be overstated.

J.G. Skedros, A.B. Beckstrom, C.J. Kiser, R.D. Bloebaum, Bone and Joint Research Laboratory, Veterans Hospital, and Department of Orthopaedic Surgery, Univ. of Utah, Salt Lake City, Utah

Support for the view that the chimpanzee femoral neck receives habitual superior-inferior bending is based, in part, on morphological evidence (elliptical/elongated cross-section; robust cortices). In contrast to the anterior-posterior glutei of chimpanzee hips, the *laterally oriented* human gluteus medius neutralizes bending. Thus, the cross-sectional geometry of the human femoral neck (thin cortices, and more ovoid shape than chimpanzees) seems designed for superior-inferior *compression*, not bending—this idea influences debate with regards to using skeletal morphology to infer bipedalism. However, bone cross-sectional robusticity/circularity can be highly unreliable in this context. We employed a more reliable characteristic for inferring habitual bending [predominant collagen fiber orientation(CFO)] to test the hypothesis that chimpanzee proximal femora receive habitual superior-inferior bending. Four undecalcified/unstained sections from nine adult chimpanzee femora were examined: mid-neck, base-neck, subtrochanteric, proximal diaphysis. Methacrylate-embedded sections (100-micron ultramilled) were quantified for regional CFO variations from mean graylevels (GLs=birefringence) in circularly polarized light (dark GLs= longitudinal collagen in habitual tension; bright GLs= oblique/transverse collagen in habitual compression). In the neck, no significant CFO difference was found between putative 'tension'(superior) and 'compression'(inferior) regions($p=0.51$). Proximal diaphyseal sections showed clear 'compression'(medial)/'tension'(lateral) differences($p=0.03$). As in humans, habitual loading of chimpanzee proximal femora might occur in two 'domains': combined bending/torsion in the femoral neck, and predominant bending across the subtrochanteric region (the complexly loaded intertrochanteric region separates these 'domains'). This conclusion is based on the idea—shown in many other torsionally loaded bones—that the *absence* of regional CFO variations likely reflects adaptation for shear stresses produced by torsion.

Distinct patterns of protostylid expression at the enamel-dentine junction of *Paranthropus robustus* and *Australopithecus africanus* lower molars

M.M. Skinner[1, 2], B.A. Wood[3], J-J. Hublin[1]. [1]Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, [2]Hominid Paleobiology Doctoral Program, CASHP, Department of Anthropology, George Washington University, [3]CASHP, Department of Anthropology, George Washington University.

Distinctive expressions and incidences of discrete dental traits form part of the diagnosis of many early hominin taxa. It has been claimed that one of these discrete dental traits, the protostylid, can be used to discriminate between southern African archaic fossil hominin taxa. However, there is ongoing debate about the extent to which the shape of the enamel-dentine junction (EDJ) determines protostylid morphology, the influence of differential enamel distribution on the expression of such EDJ traits at the outer enamel surface (OES), and whether cingulum-like features across the buccal face of lower molar tooth crowns are developmentally independent.
We compared protostylid expression qualitatively and quantitatively at the EDJ and at the OES of the lower molars of *Paranthropus robustus* (N = 22) and *Australopithecus africanus* (N = 28). The results include evidence A) of statistically significant taxon-specific patterns of protostylid morphology at the EDJ that are not evident at the enamel surface; B) of non-independence of these features across the buccal face; C) that the correspondence between protostylid expression at the EDJ and OES expression is affected by differences in enamel distribution, and D) that the form of the protostylid at the EDJ of worn teeth has taxonomic valence.

The error of midshaft cross-sectional location on human femora.

V. Sladek[1], M. Berner[2], L. Friedl[3]. [1]Dept. Anthropology, University of West Bohemia, Pilsen, [2]Dept. Anthropology, Natural History Museum, Vienna, [3]Dept. Anthropology, Tulane University, New Orleans.

The position of femoral midshaft has to be estimated when biomechanical length is not sufficiently preserved. We compared the amount of error for the position of femoral midshaft in different locations of biomechanical length. Differences are studied from 65% to 35% of biomechanical length. The sample consists of 30 females and 30 males from the Late Eneolithic and the Early Bronze Age in Central Europe. The cross-sections are obtained using CT scans; five parameters are analyzed (CA, Ix, Iy, Imax/Imin, Jp). Maximum 5% deviation from the midshaft cross-sectional parameters is accepted as a limit for the error location. The 5% limit of Mean absolute difference compared to midshaft parameters is within 55% and 45% of biomechanical length. Mean length of this region is about 2 cm above and 2 cm bellow the midshaft cross-section. The femoral CA is the most sensitive parameter for a specific location. Females and males reach similar patterns of difference. However, the great variability was found when each individual was studied separately. For example, for CA there are about 40% of individuals with the error higher than the accepted difference of 5% inside the 55% to 45% interval. Thus, in average the midshaft location can be safely placed within the interval of 4 cm but there is high probability that the deviation will be higher than the accepted 5% level. Therefore, other measures of error are adopted (i.e., difference per 1cm) to identify those individuals who may produce high error inside the 45% - 55% interval.

Does the convergence of multiple inconvenient truths signal the threshold of demographic and societal collapse?

J.K. Smail, Kenyon College

Some five years ago, the *AJPA* published three "sequential essays" on a "Remembering Malthus...." theme, in the *News and Views* format. Simply stated, my goal was to call attention to the growing "disconnect" between reasonably accurate demographic projections of future global population growth (to ca. 9 billion by mid-21st century) and prudent scientific estimates of the Earth's probable long-term sustainable human carrying capacity (perhaps no more than 2 to 3 billion at a "modest" first-world standard of living). This paper provides an opportunity: first, to comment further on global demographic developments; second, to broaden my basic argument to more fully incorporate several other critically important global concerns;

and finally, to speculate about the nature of the profound sociocultural, ecological, and evolutionary challenges that may appear over the next half-century. In essence, I argue that an important "emergent" phenomenon has become increasingly likely, namely the growing potential for a global "synchronous failure," a cascading, political, economic, social, environmental and demographic collapse stimulated by the mutually-reinforcing convergence of multiple "inconvenient truths." Chief among these truths are surely: (1) continued unsustainable population growth; (2) the imminent peaking of fossil energy resources (particularly oil and gas); (3) increasing climatic instability (or "global warming"); (4) broad-scale environmental stresses (on numerous fronts); (5) a pervasive and hyper-consumptive economic "growthmania;" and (6) political destabilization and social disruption by various "non-state" actors. Other such "truths" could undoubtedly be added. This poses a fundamental existential question. Unless significant mitigating steps are soon undertaken, could the future of modern industrial/technological civilization, not to mention the lives of several billion human beings, be at considerable risk?

Determining paleodemographic correlates of settlement patterning using samples from the upper Tennessee River valley.

B.T. Smith[1], L.W. Konigsberg[2], T.K. Betsinger[3]. [1]Department of Anthropology, University of Minnesota, [2]Department of Anthropology, University of Illinois, [3]Department of Anthropology, The Ohio State University.

Community health status, which is density and settlement patterning dependent, is demonstrably subsistence-settlement system co-associated in osteoarchaeological material from several temporal horizons in the eastern Tennessee River valley. Population morbidity, mortality, and fertility co-associations certainly factor into the epidemiology of the contagious disease health background as well as the paleopathological visibility of chronic or endemic disease processes. The large osteological sample available from the eastern Tennessee River valley (N = 2000) enables paleodemographic assessment of skeletal age-at-death data controlled for by settlement pattern type. The ratio of adults (30+ years) to post-weaning age subadults (5+ years) was examined in multiple site samples of seasonal migrants from the Middle (6000-3000 BC) and Late Archaic (2500-500 BC) period, probable dispersed hamlet settlements from the Late Woodland-Early Mississippian (Hamilton Mortuary Complex) (900-1100 AD) period, palisaded mound center sites from the late Mississippian Dallas phase (AD 1200–1550), and large non-palisaded village sites dated to the terminal Mississippian Mouse Creek phase (AD 1400-1600). Noteworthy patterns include the highest fertility rate (within this diachronic sample) in the Middle and Late Archaic (D_{30+}/D_{5+} = .23, N=133), which is consistent with independent archaeological evidence of a population 'boom' associated with the exploitation of riverine resources (i.e., the Interior Shell Mound Archaic) and a lower Late Woodland/Early Mississippian fertility (D_{30+}/D_{5+} = .46, N=197) relative to Late Mississippian fertility (D_{30+}/D_{5+} = .40, N=645), which is consistent with the temporal trend co-associated with increased agriculturalization observed in other Mississippian culture area samples.

New fossils and studies confirm the affinities of the human remains from the Neandertal type site (Kleine Feldhofer Grotte), Germany

F.H. Smith[1], S.E. Bailey[2], S.C. Feine[3], K. F. Hillgruber[3] , R.W. Schmitz[3]. [1]Department of Anthropology, Loyola University Chicago, [2] Department of Anthropology, New York University, [3] Institut für Ur- und Frühgeschichte und Archäologie des Mittelalters, Abteilung Ältere Urgeschichte und Quartärökologie, Universität Tübingen.

Paleolithic artifacts, Pleistocene faunal remains and > 80 human skeletal elements attributed to the cave fill removed from the Kleine Feldhofer Grotte were recovered in excavations by Schmitz and J. Thissen during 1997 and 2000. However, some of these deposits derived from a second cave, the Feldhofer Kirche, located adjacent to the Kleine Feldhofer Grotte in the Neander Valley. Paleolithic artifacts include both Middle Paleolithic (Micoquian) and Upper Paleolithic (Gravettian) elements. Previous assessment of the human remains demonstrates that all elements with diagnostic morphology follow a Neandertal pattern and that at least two adults and one subadult are present in the sample. Here we report more detailed non-metric assessments of the dental elements and analysis of new elements, principally a right ulna, that further confirm this assessment and clarify the attribution of individual skeletal elements to individuals. Further evidence come from the use of three-dimensional modeling of the secondary stratification of the removed cave fills using a specialized computer aided design program. Results of this analysis show a pattern of separation between the Middle and Upper Paleolithic artifacts and show that the human bones concentrate almost exclusively with the Middle Paleolithic elements. This strongly indicates that all skeletal elements represent Neandertals, and the taphonomic nature of these specimens strongly suggest that at least the type specimen was essentially complete at the time of initial recovery in 1856. Finally we discuss the impact on the early history of interpreting the Neandertals if the artifacts had been recovered in 1856.

The phylogenetic signal of the 3D morphology of endochondral *vs.* intramembranous regions of the skull.

H.F. Smith, School of Human Evolution and Social Change, Arizona State University

It has been suggested that regions of the skull ossifying endochondrally should be more phylogenetically informative than regions ossifying intramembraneously, as endochondral regions are less influenced by non-genetic factors during ontogeny than the more externally sensitive intramembranous bones. This hypothesis was tested here for human three-dimensional cranial morphology. Landmarks describing portions of the skull ossifying according to these two processes were digitized on samples of 16 human populations. Procrustes distance matrices derived from these landmarks were compared to molecular distance matrices for the same populations. The morphology of the endochondral regions had a higher correlation with the molecular matrix than the intramembranous regions. However, both sets of landmarks were significantly correlated with genetic distances. Thus, 3D morphology of cranial regions ossifying endochondrally appears to be phylogenetically informative, but intramembranous regions also contain information about genetic relationships. The endochondral and intramembranous ossification matrices were also compared to other subsets of cranial morphology. Only the entire cranium had a higher correlation with genetic distances than the endochondral matrix. The basicranium (excluding temporal bone) had a similar correlation coefficient to the endochondral matrix, which is not surprising as the vast majority of endochondral landmarks occur in this region. The temporal bone, a partially endochondral bone, had a marginally lower correlation than the endochondral matrix, followed by the mandible, face, and palate. These findings are consistent with previous studies suggesting that the temporal bone and basicranium reflect phylogenetically information reliably, and support the idea that ossification type is an important factor in that relationship.
This research was supported by NSF BCS-0622570 and the Wenner-Gren Foundation.

Violent is as violent does: the correlates of political contact, political isolation and agonistic behavior from the Late Woodland to the Late Mississippian periods of east Tennessee.

M.O. Smith. Department of Anthropology, Loyola University, Chicago.

Within the tight geographic confines of riverine lower east Tennessee, there is dramatic temporal change in the pattern and frequency of intergroup and interpersonal violence (e.g., inflicted projectiles, sharp force trauma, cranial blunt force trauma, scalp taking) between the Late Woodland/Early Mississippian (AD 800-1100) and Late Mississippian (AD 1200-1600) horizons. This result has cultural significance as several of the sampled sites demonstrate occupational continuity between the Late Woodland to

Late Mississippian periods. The LW/EM multiple site sample displays a circa 11 percent frequency of deliberate violence (inflicted points and sharp force trauma) with no evidence of scalp taking. However, ritual decapitation as part of mortuary ritual is evident. The primary mound interment is either one or several disembodied crania or is accompanied by one or several. In the Late Mississippian multiple site sample, there is no evidence of mortuary dismemberment, the frequency of the same kinds of violent trauma is less than two percent, there is scalp taking, and there is a pattern of non-lethal ectocranial trauma best interpreted as interpersonal violence. Additionally, the trauma pattern in the Late Mississippian multiple site sample differs qualitatively and quantitatively from contemporary sites of the same (Dallas) phase from adjacent upper east Tennessee. It is hypothesized that the sociopolitical rise and fall of polities from north Georgia (e.g., Etowah) culturally influenced the Mississippianization in east Tennessee.

Mandibular canine and premolar root growth: a mixed-longitudinal radiographic study.

S.L. Smith[1], P.H. Buschang[2]. [1]Dept. of Sociology & Anthropology, University of Texas at Arlington, [2]Dept. of Orthodontics, Baylor College of Dentistry, Texas A&M USHSC.

Despite abundant knowledge of eruption, fewer studies have examined dental development longitudinally, and root development has commonly been assessed via estimation of fractional lengths. We analyze the growth of mandibular canine and premolar roots as a percentage of total tooth lengths and as absolute root lengths in a mixed-longitudinal orthodontic sample (77 girls, 74 boys; 6.25 – 16.10 years). Panorex radiographs (N=227, girls; N=229, boys) were scored for dental age using Demirjian staging. The MLwiN multilevel modeling program was used for analyses of root length and to assess variation at age 11 years.
Growth rates decrease from 7 – 14 years when measured as a percentage of total length. The canine attains a greater percentage of its root length at earlier ages, has a longer absolute root length during growth, and displays a growth pattern different from that of premolars. Using dental age rather than chronological age reduces between-subject variation for both percentage and absolute length models, especially for boys. Root length velocity for girls (absolute length, dental age) reaches c. 2 mm/yr around age 9 for the canine, but this approximate velocity is sustained over four years; peak velocities for premolars are c. 3 mm/yr at 12-12.5 years. Boys' models show linear, decreasing velocities, with the exception of that for P2 for dental age. Refinement of knowledge of root development should lead to more successful growth prediction models for living subadults and enhance paleoanthropological understanding of hominid life history.
This presentation is dedicated to A. Roberto Frisancho.

Horizontal gene transfer events may impair phylogenetic reconstruction of the genus *Mycobacterium*: considerations for human and mycobacterial coevolutionary studies.

S.E. Smith, A.M. Scola, and C.D. Gatenbee. Department of Anthropology, University of Utah.

Tuberculosis (TB) is one of the most prevalent reemerging infectious diseases. It currently affects one third of the world's population and has been documented extensively both skeletally and genetically throughout human prehistory. Although accurate phylogenetic reconstruction of mycobacterial lineages (the causative agents of TB) is essential to understanding the coevolutionary relationship between mycobacteria and their human host, few researchers have accounted for the possibility of non-linear gene acquisition within the genus *Mycobacterium*. This is partially due to the initial characterization of mycobacteria as exclusively clonal organisms. Recent genetic analyses suggest that mycobacterial plasmids and genomes occasionally acquire new genetic variation via horizontal gene transfer (HGT) from both closely or distantly related species. To further characterize the extent of these HGT events, we have searched 10 genes in 50 mycobacterial species for homologous sequences that suggest past gene conversion events. Between 2 and 50 HGT-acquired sequence fragments per gene were identified in our analyses. This finding suggests that it is important to assess how HGT events distort phylogenetic reconstructions. We generated phylogenies that either incorporate or eliminate HGT events to evaluate topological difference and statistical significance between trees. Results show that for genes containing upwards of 20 HGT events, the generated phylogenies were significantly different. We conclude that researchers should evaluate the level of gene conversion events when attempting phylogenetic reconstruction for the genus *Mycobacterium*.

Dental development and enamel thickness in the Neanderthal molar from Lakonis, Greece.

T.M. Smith[1], K. Harvati[1], A.J. Olejniczak[1], D.J. Reid[2], J.-J. Hublin[1], E. Panagopoulou[3]. [1]Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Germany; [2]Department of Oral Biology, Newcastle University, UK; [3]Ephoreia of Paleoanthropology and Speleology, Athens, Greece.

Recent attention has been paid to the topics of developmental and structural affinities between modern human and Neanderthal dental remains, with the aim of informing assessments of life history and taxonomy. Excavation of the Middle Paleolithic site Lakonis in Mani, southern Greece, has recovered a lower third molar, LKH 1, which has been classified as a Neanderthal based on the presence of an anterior fovea and mid-trigonid crest. Here we detail the crown development and enamel thickness of the LKH 1 distal cusps. Crown formation was determined using standard histological techniques, and enamel thickness was determined from a virtual plane of section. Crown formation time in the LKH 1 hypoconid was estimated to be ~2.5 years, which is lower than modern human times. Developmental differences include much thinner cuspal enamel and a lower periodicity than respective modern human averages. The tooth showed developmental stress, including strongly accentuated lines and pit-type hypoplasias, as well as a very scalloped enamel-dentine junction. The relative enamel thickness was approximately half that of a modern human comparative sample; enamel on the distal cusps of modern humans is extremely thick. These findings are consistent with recent studies that demonstrate differences in crown development and enamel thickness between Neanderthals and modern humans. While overlap in some dental characters may be found, the results of this and other studies suggest that Neanderthal molars formed in shorter periods of time than modern humans, partially due to absolutely and relatively thinner enamel.
This study was supported by the Max Planck Society. Fieldwork at Lakonis is supported by the Greek Mististry of Culture, the L.S.B. Leakey Foundation, Wenner-Gren Foundation and Institute for Aegean Prehistory.

Tour of a labyrinth: The nose and nasal fossae of the mouse lemur (*Microcebus murinus*)

T.D. Smith[1], J.B. Rossie[2]
[1]School of Physical Therapy, Slippery Rock University; [2]Department of Anthropology, Stony Brook University, Stony Brook.

Dimensions of the external midface in mammals are sometimes related to olfactory abilities, for example, the so-called "olfactory snouts" of strepsirrhine primates. Such an association hinges on the largely unexplored relationship between the protruding midface and internal topography of the nasal fossae. Serially sectioned heads of mouse lemurs (*Microcebus murinus*; 4 adults, 1 neonate, 4 fetuses) were studied to assess the rostrocaudal distribution of olfactory epithelium (OE) within the nasal fossa. In two (1 adult, 1 infant), the surface area (SA) of olfactory and non-olfactory epithelium was measured using Scion Image software. SA measurements in the adult reveal that 31% of the entire nasal fossa is lined with OE. The majority is sequestered in a caudal recess (70% OE). Rostral to this space, only 28% of the nasal fossa is lined with OE. The most

rostral ethmoturbinal is lined with relatively less OE (35%) compared to more caudal ethmoturbinals (46-57%). An age comparison supports the idea that olfactory epithelium scales differently than other epithelia between ages. Total OE surface area is 3.5-fold greater in adult versus neonate, whereas non-OE is more than 5.4-fold greater. Regionally, results suggest that most growth in SA occurs in turbinals (8 to 16-fold difference in SA between adult and neonate). But in all ethmoturbinals, SA of non-OE differs between ages more than that of OE. This study shows that the rostral part of the nasal fossa is mostly non-olfactory in *M. murinus*. Thus, the term "olfactory snout" may misrepresent the prognathic midface of strepsirrhines.

Expert Witnesses as Science Educators

V.A. Smith, Oak Ridge Associated Universities; B.J. Carroll, Federal Bureau of Investigation, Trace Evidence Unit; A.Christianson, Federal Bureau of Investigation, Forensic Anthropology Program

Scientists interact with and educate the general public about science in a wide variety of settings including school systems and academia, museums, and political venues. An increasingly frequent but perhaps less often considered setting is the courtroom. Here, scientists as expert witnesses must explain their science and their findings to a jury, which is generally comprised of individuals who do not necessarily have sufficient or accurate knowledge of many scientific fields. This paper investigates the role expert witnesses play and challenges they face in educating jurors, judges and attorneys on scientific topics by evaluating responses to a survey administered to forensic scientists. Many scientists surveyed believe that educating the jury (at least minimally) about their science is an important part of their role as an expert. Most, however, have received little or no training specifically aimed at jury education, and many wish they had or expressed an interest in additional or continued training. Some of the more difficult challenges scientific expert witnesses report relate to explaining complex statistics, and addressing jury misconceptions about forensic science as a result of the way forensic science is portrayed in movies and on television.
Teaching science to non-scientists can present interesting challenges, and courtroom testimony often involves the added difficulties of anxiety and misconceptions held by their audience. Most forensic scientists would probably appreciate and benefit from receiving training specifically aimed at effective methods for teaching complex scientific concepts to non-scientists.

Evolutionary oral ecology: how subsistence pattern acts as a selective force in the evolution of cariogenic bacteria (*Streptococcus mutans*) in human populations.

M.J. Soltz[1], J. Bock[2,1] Department of Anthropology, The Ohio State University, [2] Department of Anthropology, California State University, Fullerton.

Epidemiological and bio-archaeological studies have established clear associations between dental caries rates and dietary patterns (Larsen, 1995; Rugg-Gunn and Nunn, 1999). Dental caries is the product of a complex suite of variables with diet and oral bacteria the most significant contributors to the demineralization process (Sheiham, 2001).
An evolutionary approach to dental caries as a disease process requires an understanding of the oral ecology as a dynamic environment where changes may cause a disruption to the ecological balance. Recent research in bio-molecular oral ecology has described the proximate mechanisms by which oral flora demineralize dental enamel through the metabolism of fermentable carbohydrates into organic acids (Marsh, 2003). However, the evolutionary effects of diets rich in fermentable carbohydrates on oral ecology is not well understood. In this study we test the hypothesis that the dietary practices associated with different subsistence patterns create selective environments, which affect the ecological balance of oral flora.
Utilizing meta-analyses, this study compared the prevalence of *S. mutans* in hunter-gatherers (n = 40), agriculturalists (n =1,604), and industrial agriculturalists (n =4,638). Correspondence analysis revealed a significant relationship ($p < 0.001$) with hunter-gatherers closely associated with lower bacterial loads and bacterial loads of agricultural populations congregating on the higher end of the spectrum. However, industrial agricultural populations were associated with medium-low bacterial loads in comparison to agricultural populations, which were closely associated with high bacterial loads. The results provide critical information for understanding how dietary pattern and the resulting social correlates influence oral ecology.

Do monks live longer? Tooth cementum annulation analysis of a Cistercian monastic sample.

J. Somerville[1], H. Schutkowski[2]. [1]RSK Environment, Glasgow, UK; [2]Archaeological Sciences, University of Bradford, UK.

Assessing age-at-death by counting tooth cementum annulations (TCA) is claimed to produce the most accurate skeletal ageing figures currently available. TCA reflect incremental structures that are deposited circa-annually and thus offer the potential to ascertain chronological rather than skeletal age. This study reports on results obtained through TCA analysis from the medieval Cistercian monastic cemetery of Stratford Langthorne, UK. A sample of 37 individuals was available for thin sectioning and subsequent microscopic assessment. Selection of samples focused on older individuals (45+) where conventional ageing methods become less accurate to allow for a comparison of methodological approaches and the resulting age profiles.
Correspondence of TCA and conventional ageing results was found in only 58% of the samples. The number of individuals with TCA ages between 26-45 years was three times higher than initially indicated by conventional methods. This implies advanced skeletal or biological ageing despite lower chronological ages, likely caused by adverse living conditions. Nine individuals (29%) displayed TCA dates beyond the age of 45 (as opposed to 61% aged conventionally), of which three died in their 50s and 60s, respectively. Monastic life may therefore have been conducive to increased longevity, but probably less frequently than expected. These TCA age distributions correspond well with contemporary historic records of monastic age profiles. They suggest that conventional ageing techniques distort actual demographic profiles, which are more realistically reflected by TCA ages. The wider implications of these findings are discussed.

Untangling the effects of terrain and mobility on the cross-sectional geometry of the femur and tibia.

V. S. Sparacello, O. M. Pearson, T. R. Petersen. Department of Anthropology, University of New Mexico.

This study examines the influence of mobilità and terrain on the cross-sectional geometry (CSG) of the midshafts of the femur and tibia. Both factors correlate with robusticity. To separate these influences, we examined a world-wide set of 15 male samples, spanning Neanderthals to Medieval fishermen (n=282). Each sample was scored for terrain (non/rugged, rugged), mobility (mobile or sedentary). J, I_{max}, I_{min}, and I_{max}/I_{min} were computed from midshaft external dimensions and (except I_{max}/I_{min}) standardized by the product of body mass (from femoral head diameter) times bone length. We hypothesized that rugged terrain would primarily increase I_{min} to augment medio-lateral stability.
Results. In a non-rugged terrain, more mobile groups have a higher femoral I_{max}/I_{min} but no significant difference in adjusted-J and, in the tibia, both higher adjusted-J and I_{max}/I_{min}. Among mobile samples, the ones from rugged areas have significantly higher adjusted-J in the femur. In the tibia, rugged terrain primarily enlarges I_{max}, with a consequent increase in I_{max}/I_{min}. Interestingly, the presence of seafaring seems to influence lower limb CSG in a similar way. Among groups from rugged environments, higher mobility increases femoral adjusted-J without a change in shape, while tibial properties do not show changes with mobility, possibly due to small sample size. Thus, terrain interacts with mobility, complicating inferences about

activity based on the lower limb.
Unexpectedly, terrain did not influence tibial $I_{min.}$ It is possible that an high I_{max} also increases medio-lateral bending resistance in platycnemic tibiae.
Data collection was sponsored by grants from Accademia Ligure di Scienze e Lettere – Brian grant, the Wenner-Gren Foundation, Boise Fund, and the University of New Mexico.

The role of long-distance vocalizations in regulating association patterns and social interactions in white-bellied spider monkeys (*Ateles belzebuth*).

S.N. Spehar[1,2,3], A. Di Fiore[1,3,4]. [1]Department of Anthropology, New York University, [2]Department of Religious Studies and Anthropology, University of Wisconsin Oshkosh, [3]New York Consortium in Evolutionary Primatology, [4]Center for the Study of Human Origins, New York University.

Many primates produce "long calls," species-specific acoustic signals that carry over long distances. As long calls advertise the location of individuals relative to each other, they may allow animals to minimize resource competition through avoidance, or, conversely, allow them to maintain or establish contact with other group members. Spider monkeys (*Ateles* spp.) exhibit a fission-fusion social system in which subgroup composition changes frequently, often several times per day. Long calls may be an important way that spider monkeys regulate association patterns within the context of this social system.
We examined calling behavior, vocal and behavioral responses to long calls, and patterns of subgroup change in one community of white-bellied spider monkeys (*Ateles belzebuth*) in northeastern Ecuador. Focal animals were followed continuously; focal location was recorded every five minutes and long calls and social behaviors were recorded as they occurred. Subgroup composition was recorded every 15 minutes. Long calls were not randomly distributed in time but were most often emitted within a short period after hearing a long call by another individual. Furthermore, the emission of long calls within subgroups resulted in increased rates of subgroup fusions, and analyses of ranging patterns demonstrate that spider monkeys move toward distant callers more often than expected by chance. However, sex and dominance rank did affect individual call rate, indicating that individual considerations may affect how often individuals call and invite social interaction. These results suggest that long calls do influence social interactions and association patterns within spider monkey communities.
Support from the L.S.B. Leakey Foundation, Primate Conservation, Inc., the New York Consortium in Evolutionary Primatology, and New York University are gratefully acknowledged.

The ontogeny of masticatory system configuration in humans and its influence on the timing of molar eruption.

M.A. Spencer, G.T. Schwartz, Institute of Human Origins, Arizona State University, Tempe, AZ.

Paleontologists reconstruct an organism's life history from associations with skeletal markers that readily preserve in the fossil record. A key skeletal feature in this regard is the timing of permanent molar eruption, in particular M1 eruption, which is strongly correlated with brain and body size, gestation length, weaning age, etc., across primates. While an extensive, and ever-growing, compendium of primate molar eruption times exists, at present we have little understanding of the processes that regulate these temporal events. The current study tests the hypothesis that the timing of molar eruption is modulated by biomechanical constraints that occur during craniofacial growth.
Three-dimensional coordinate data for a series of 54 craniodental landmarks were collected on a known-age ontogenetic series of archaeological human material from the site of Kulubnarti in Sudanese Nubia (N=91). This 3-D data set was used to calculate ontogenetic changes in moment arm lengths for the masticatory muscles and for bite points located at each deciduous and permanent tooth. Results indicate that, as anterior growth of the face proceeds, the eruption of each molar occurs at a consistent distance from the temporomandibular joint. Additionally, the primary chewing muscles are consistently located less than 75% of the distance from the temporomandibular joint to the most distal tooth. These results are consistent with a constrained model of jaw biomechanics and suggest that the changing architecture of modern human masticatory system during ontogeny may provide a constraint on, and thus help modulate, the timing of molar eruption.

Using Stable Isotope Analysis to Identify Fallback Foods in Fossil Taxa.

M. Sponheimer[1], B.H. Passey[2], T.E. Cerling[3], J.A. Lee-Thorp[4] & D.J. de Ruiter[5]. 1. Department of Anthropology, University of Colorado at Boulder, 2. Department of Geological and Planetary Sciences, Caltech, 3. Departments of Biology and Geology, University of Utah, 4. Department of Archeological Sciences, University of Bradford, 5. Department of Anthropology, Texas A&M University

There has been increasing interest in the idea that the australopith masticatory complex (e.g., large, flat molars with thick enamel, robust mandibles) was the product of selection for the consumption of fallback, rather than preferred, foods. However, identifying the consumption of fallback foods from the size and shape of fossil dentognathic remains is problematic. In this paper we discuss ways in which one can derive high-resolution isotopic records from enamel in an effort to identify the consumption of fallback foods in the fossil record. Additionally, these techniques can provide new insights into climatic change or the seasonal/interannual movements of individuals across ancient landscapes. Lastly, we discuss the isotopic data available for fossil hominins and the degree to which they are consistent with the idea that the australopith masticatory complex represents a set of adaptations for the consumption of fallback foods.

Evaluating Cranial Morphometric Relationships using Discriminant Function Analysis.

M.K. Spradley[1], S.D. Ousley[2], R.L. Jantz[3]. [1] University of West Florida, [2] Mercyhurst College, [3]The University of Tennessee.

Craniofacial morphology represented by craniometrics, have been useful in assessing biological relationships among groups (Howells, 1973; Keita, 2004; Relethford, 1994; Relethford, 2001; Relethford and Blangero, 1990). These biological relationships have been used to trace the geographic origins of population groups or individuals, as in forensic anthropology in general or an Egyptian mummy in particular (Wright 2001). However, critics suggest that attempting to discern the geographic origin of a population group or an individual, using craniometric data perpetuates racial typologies and can only be used among widely separated population groups (Williams et al. 2005).
This presentation will test the hypothesis that craniometric analyses *can* be used to help identify the geographic origins for a group of individuals or a single individual, that craniometric analyses can be used within continental populations to identify groups, and that discriminant function analysis (e.g. FORDISC, SAS) is a useful tool in biological anthropology when the user has a fundamental understanding of how to use the program and interpret the results. Using the FORDISC 3.0 import data set option, a recently rediscovered sample of enslaved Africans at the University of Pennsylvania Museum of Archaeology and Anthropology was compared to the Howells (1973) groups as well as a recently collected West African data set from the AMNH. Based on the morphometric relationship of the enslaved African sample to the African groups and to the Howells world groups, determining geographic origins of a group of individuals or an individual is not dependent on using widely separated population groups.

Factoring in rural demography and land use in GIS-based modeling of Japanese macaque habitat expansion.

D.S. Sprague and N. Iwasaki. National Institute for Agro-Environmental Sciences, Japan

Depopulation in rural areas is a crucial background factor that may lead to wildlife habitat structures permitting increased crop damage by Japanese macaques. Rural depopulation is a multifaceted phenomenon expressed in reduced population, aging, farmland abandonment, and diminished farmer field presence. This paper reports on rural demography within the Japanese monkey habitat in Chiba Prefecture using government agricultural statistics. The villages intersecting the monkey habitat area were extracted from these statistics and compared to villages in the rest of Chiba Prefecture. The monkey habitat area is hilly with the villages clearly more depopulated compared to non-habitat villages. From 1970 to 2000, farmland area diminished, farm population shrank and aged, and the number of days farmers spent in fields decreased. One indicator of farmer presence is the number of active male farmers spending more than 150 days in fields. In the 2000 data, the average farmer presence within monkey habitat was 6.3 men per village, and 12.7 men outside monkey habitat. Furthermore, 34 habitat villages counted 2 men, 26 villages only 1, and 27 villages 0.
To test whether land use and agricultural statistics predicted the direction of monkey habitat expansion, we applied a GIS-based habitat expansion model using cost-distance. Land use data improved the statistical significance of this GIS model. Adding agricultural statistics to the model improves statistical significance only slightly, probably because village level agricultural statistics do not form a steep gradient along the habitat expansion front, and land use is already correlated with agriculture.

Quantitative comparison of midface morphology in Down syndrome individuals and unaffected siblings.

J. Starbuck[1], K. Wilmore[1], R. Reeves[2], J. Richtsmeier[1]. [1]Department of Anthropology, Pennsylvania State University, [2]Department of Physiology, The Johns Hopkins University School of Medicine.

Down syndrome (DS) or trisomy 21 is the most common live-born chromosomal trisomy. Typical DS facial morphology includes ocular abnormalities, reduced ear length, brachycephaly, and reduced maxillary and mandibular growth. The goal of this study is to quantitatively characterize the three-dimensional arrangement of DS facial features and those of their unaffected siblings, focusing on mean difference and variation of midfacial phenotypes. Previous analyses of DS phenotypes have proposed that evolutionarily constant developmental trajectories are destabilized by trisomy through "increased developmental instability", resulting in recognizable and highly variant phenotypes. Alternatively, since the DS face is immediately recognizable to even the untrained observer, it may be that DS faces comprise reduced phenotypic variation. The study sample consists of 20 DS individuals and 15 unaffected siblings aged 4-11 years. Coordinate data representing the midface were analyzed for 6 anthropometric landmarks located on 3D digital photogrammetric images acquired with the 3dMDface system. Shape differences were evaluated using Euclidean Distance Matrix Analysis. Levene's test was used to evaluate shape variation, and morphological integration was measured using the variance of the eigenvalues of the correlation matrix. The shape of the midface is significantly different between DS individuals and their unaffected siblings, but we found no differences in the magnitude of variation, or in patterns of morphological integration. Our results suggest that trisomy disrupts the trajectory of normal facial development, but does not support the hypothesis of increased developmental instability contributing to these developmental anomalies.
Funding: PHS 1R01HD038384-08.

A comparison of inexpensive methods for obtaining DNA from the feces of baboons.

M.E. Steiper[1,3,4], L. Swedell[2,3,4,5], S. Chowdhury[3,4,5], E. Garrett[3,4]. [1]Dept. of Anthropology, Hunter College of the City University of New York (CUNY), [2]Dept. of Anthropology, Queens College of CUNY, [3]Program in Anthropology, The Graduate Center of CUNY, [4]New York Consortuim in Evolutionary Primatology (NYCEP), [5]Filoha Hamadryas Project

Genetic analysis of non-invasively collected samples has yielded numerous important insights into primate evolution and social behavior. Many methods are currently used to obtain primate DNA for these purposes. Here, we compare 5 different methods of non-invasive sample collection on the feces of a zoo population of hamadryas baboons. The 5 methods chosen are relatively inexpensive and easily transferable to field conditions. They included a silica-based drying method, collection in ethanol, collection in isopropanol, and 2 hybrid alcohol/silica methods. An mtDNA locus was targeted to determine if amplifiable DNA was present. Both the quantity and quality of DNA varied between each of the methods, suggesting that optimal collection methods exist for collection of feces from hamadryas baboons. The results of this analysis highlight the value of preliminary studies for the eventual transfer of methods to particular field conditions.

Behavioral indicators of stress in female chacma baboons: social structure, female reproductive state, and human impact.

J.S. Stephenson[1,5], L. Swedell[2,3,4,5], M.J. O'Riain[1,5]. [1]Department of Zoology, University of Cape Town, [2]Department of Archaeology, University of Cape Town, [3]Department of Anthropology, Queens College, City University of New York, [4]New York Consortium in Evolutionary Primatology, [5]Cape Peninsula Baboon Research Unit.

Self-directed behaviors (SDBs) have been shown to be associated with stress or anxiety in macaques and baboons. In this study we measured the occurrence of SDBs in a managed population of free-ranging chacma baboons in the Cape Peninsula of South Africa. The aims of the study were to quantify SDB rates in the study troop, compare them to other available data on female baboons, and investigate the relationship between SDB rates and (a) female dominance rank, (b) reproductive state, and (c) herding by baboon monitors. The study troop, consisting of 13 adult and subadult females and 4 subadult males, is unusual in two ways: (1) it lacks adult males and (2) it is regularly herded away from tourist areas by park staff employed as baboon monitors. Fifteen-minute continuous focal samples were conducted on females, in which the occurrence of SDBs (scratching, self-grooming, yawning, and body-shaking) was recorded. Overall rates of SDBs, rates of scratching and self-grooming, and durations of self-grooming bouts were calculated. Rates of SDBs in this troop were significantly higher than those in olive baboons (Castles et al. 1999). Neither SDB rates nor self-grooming bout duration was related to female dominance rank. Rates of SDBs were significantly higher in pregnant and lactating females than in cycling females. Finally, self-grooming bout duration was significantly shorter when the troop was being herded by baboon monitors compared to when baboon monitors were absent. Results of this study have implications for both baboon social behavior and management of this population.

Evolution of the Toll-like Receptor 7 Gene In Primates.

K.N. Sterner.Department of Anthropology at New York University, New York Consortium in Evolutionary Primatology (NYCEP).

This research explores the evolutionary history of the Toll-like receptor 7 (TLR7) gene in primates in order to understand how some African taxa have adapted to co-exit with Simian Immunodeficiency Virus (SIV). TLR7 encodes a protein that recognizes and binds to viral ssRNA, initiating a signaling cascade that jump-starts the cell's innate immune response. Variation in the effectiveness of this system may contribute to variation in response to viral infection and subsequent disease progression in primate hosts.
The TLR7 translated region and partial 5' and 3' untranslated regions were sequenced in 16 primate species. The gene tree matches the known species relationships, suggesting that evolutionary processes – selection or otherwise – have not produced detectable homoplasy or convergence at this locus. There is evidence of selection on TLR7 in

primates and positively selected sites are confined mainly to the extracellular domain. The extracellular domain also has significantly more variable amino acids than observed in the transmembrane or cytoplasmic (TIR) domains.
The extracellular domain is considered important for recognizing and binding to viral RNA. Therefore, any variation in amino acid sequence and/or selective pressure may influence the ability of the receptor to recognize viral RNA and initiate an immune response. Future work is being conducted to examine if the observed variation may influence the protein structure, making some primates more susceptible than others to developing immunodeficiency disorders post viral (SIV/HIV) infection by altering the function of the pathway.
Supported by NSF BCS 0648457, the Wenner-Gren Foundation, and Sigma Xi.

There is an optimal speed of human running: Implications for the evolution of hominin hunting strategies.

K. L. Steudel-Numbers and C. M. Wall-Scheffler. Department of Zoology, University of Wisconsin

Recent discussion of the selective pressures leading to the evolution of modern human postcranial morphology has focused on the relative importance of walking versus running (Carrier, 1984, Bramble & Lieberman, 2004, Lieberman et al., 2006, Pickering & Bunn, in press). An element of the debate is the widespread belief that quadrupeds are constrained to run at optimally efficient speeds within each gait, whereas humans are equally efficient at all running speeds. Here we present data showing that humans do in fact have speeds at which running is significantly less costly than at other speeds. Using metabolic data on multiple running speeds from 9 human participants, we tested the fit of both linear and curvilinear models to the variation in the cost of running a given distance at different speeds. Fitting a curvilinear model produces consistently higher correlations than does fitting a linear model ($R^2 = 0.94$ as compared to $R^2 = 0.41$). This difference is highly significant ($p = 0.001$). In addition, we demonstrate that the use of persistence hunting methods to gain access to prey at any running speed, even the optima, would be extremely energetically costly; considerably more so than a persistence hunt at optimal walking speed. Thus neither extinct nor extant hominin populations are as flexible in the chosen speeds of running pursuits as other researchers have suggested. The variations in the efficiency of human locomotion appear to be similar to those of terrestrial quadrupeds.

A multidisciplinary approach to analysis of historic cemetery populations.

C.M. Stigler, A.B. Eriksen, S.P. Nawrocki. Department of Human Biology, University of Indianapolis.

Analysis of accidentally discovered skeletal populations can present unique opportunities for both anthropologists and the public in research and reconstructing local history. The availability of archival documents, including historic maps and census records, can be integral in the identification of multiple individuals when compared to biological profiles generated by the anthropologist. The unintentional disinternment of human skeletal remains during December of 1999 in Noble County, Indiana presented such an opportunity. This paper will present how this comparison aided in the analysis of a historic cemetery population, and will describe how DNA analysis could further this investigative study.
Anthropologists from the University of Indianapolis constructed complete biological profiles on the individuals discovered in Noble County and conducted an extensive search for historic documentation. The data generated by osteological analysis and the historic documents suggest that: (1) remains were part of a rural, family cemetery, (2) individuals ranged in age from subadult to middle-late adult, (3) individuals were of European ancestry, and (4) interments were in existence by 1874. A minimum number of 12 individuals was determined from the commingled remains. Utilizing the property maps and census records from 1860 to 1900 a plausible family tree was constructed. Birth, death, will, and marriage records corroborated estimates of familial relationships and possible interments in Noble County. This investigation illustrates the significant contribution archival information provides in the assessment of historic cemeteries. Further studies will explore familial relationships by comparing mitochondrial DNA of living relatives to DNA acquired from the skeletal remains.

Factors influencing relative sitting height at high altitude.

S. Stinson. Department of Anthropology, Queens College, CUNY.

One of the themes of the research of A. Roberto Frisancho is the influence of multiple factors on growth and development. In particular, his work has emphasized nutritional, developmental, and genetic effects on child growth. The present study explores how these factors influence relative sitting height in two groups of high altitude Bolivian children between 8 and 14 years of age: 253 rural Aymara children of very low socio-economic status and 273 upper socioeconomic status children from the capital city of La Paz. As expected, the two groups differ significantly in relative sitting height, with rural Aymara children having longer trunks relative to stature. Although there is a substantial difference in average relative sitting height between the groups, there is also overlap. Some Aymara children have relatively short trunks, and some elite urban children have relatively long trunks. Examination of the 20% of each sample in the region of overlap highlights the multiple factors influencing relative sitting height. Developmental and genetic influences on relative sitting height are suggested by the finding that elite urban children with the largest relative sitting heights are significantly more likely to have lived a large proportion of their lives at high altitude and to have parents who were born in Bolivia. Nutritional effects on relative sitting height are suggested by the finding that Aymara children with relatively long legs are tall for their age.

Small sample aggregation in bioarchaeology: necessary and preferred.

C.M. Stojanowski. School of Human Evolution and Social Change, Arizona State University.

Bioarchaeologists often deal with small and incomplete samples in their analyses and have for decades been aware of the problems associated with equating a sample death assemblage with a population in the statistical and biological sense. Previous work has focused on the temporal or time averaging component of death assemblages, preservation and sampling bias, or epidemiological concerns related to frailty and risk. Here I consider the effects of differential burial catchment areas and use histories on inferences of past population structure, specifically considering the theoretical justifications for small sample aggregation for biological distance analysis.
In this paper I present the results of a simulation comparing 12 samples from the late precontact Georgia coast which include 11 small mound cemeteries and a single large community cemetery (Irene Mound). By artificially dividing Irene Mound into subsamples of a size equivalent to the small mound samples I demonstrate that NOT aggregating small samples for regional comparative purposes significantly affects inferences about past population structure: within-population variability is decreased, between-sample variability is artificially increased, and most importantly, population structure appears stochastic in ordination space. This latter point has previously been interpreted as resulting from weakness in data or methodologies. These results are consistent with expectations from population genetic research on clan- and kin-structured migration in contemporary populations and indicate that small sample aggregation is, under certain limitations, not only necessary for biological distance analysis, but is actually the preferred approach.
Grant sponsor: Wenner-Gren Foudation for Anthropological Research GR-6698.

The combined use of cortical, endosteal, and trabecular bone histomorphometry

to assess health and disease in ancient skeletal remains.

S.D. Stout, L. Peck, D. Pinto, L. McCormick. Department of Anthropology, The Ohio State University

The unique mineralized nature of bone tissue results in its persistence after death, and allows us to observe byproducts of physiological processes – modeling, and remodeling – in its microstructure. Bone can be described in terms of four histomorphological envelopes, periosteal, intracortical (Haversian), endosteal, and trabecular. Each of these envelopes is metabolically unique. Paleohistological studies have focused on the analysis of intracortical bone because of its density and the relative uniformity of its histomorphological structures, e.g., osteons. Intracortical bone reflects long standing metabolic activity, while endosteal and trabecular bone are more dynamic and reflective of metabolic disturbances. The histomorphometry of the different envelopes is well established in clinical research. This paper describes the combined use of intracortical, endosteal, and trabecular histomorphometry at several skeletal sampling sites, e.g., rib, iliac crest, and vertebra, and discusses its potential for paleopathology and bioarchaeology.

Diagenesis scale for bone microstructure.

M. Streeter. Department of Anthropology**,** Boise State University

Histomorphological age at death estimation is increasingly applied to archaeological, paleontological and forensic skeletal material. The various methods are based on the quantification of the age associated accumulation of micromorphological structures (osteons) created through remodeling. Just as the postmortem environment can influence the preservation of gross morphological features, postmortem modification can produce diagenetic alteration that ranges from mild to severe, obstructing the view of bone microstructure to varying degrees. Processes such as fungal encroachment, microcracking and cortical erosion can conceal or obliterate morphological detail compromising the accuracy of osteon counts. This study presents a five stage method of evaluating the influence of taphonomy on bone microstructure. It also provides standardized terminology for describing diagenic changes and assessing the impact of diagenesis on the reliability and accuracy of histological analysis.

Comparison of dietary morphological space among Paleogene primate communities.

L.K. Stroik, L.K. Delezene. Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University.

Suborders of early primates were almost entirely isolated at the continental level: anthropoids dominated primate communities in the Paleogene of Africa, whereas non-anthropoids were the only primates in Europe and North America throughout the Eocene. Previous research has quantified the dietary morphological space (DMS) of Eocene North American and European primate communities using M_1 size and shearing quotient, but similar comparative analyses of DMS have not been performed on Paleogene communities containing anthropoids. This study addresses the following: (1) Did Paleogene primate communities comprising only non-anthropoids (e.g., in Europe and North America) occupy a similar DMS as those that contained anthropoids (e.g., in Africa)? (2) In the latter, how was DMS divided between anthropoids and non-anthropoids? (3) Were prosimian DMSs similar across communities regardless of the presence of anthropoids?
The DMSs of Paleogene primate communities from Africa, North America, and Europe were characterized as two-dimensional polygons created by plotting M_1 areas and shearing quotients obtained from the literature. Mean differences in centroid locations, polygon areas, and point distributions between communities and taxonomic groups were analyzed statistically using resampling techniques. Results indicate that communities that included anthropoids differ in the distribution of taxa within DMSs from communities without anthropoids. In communities containing anthropoids, the anthropoid DMS is different from that of prosimians, although prosimian DMSs are similar across communities. This demonstrates that although niche spaces of Paleogene anthropoids and non-anthropoids overlapped, the way in which these spaces were occupied may have been distinct in these taxa.

Accuracy of metric infant age estimation methods.

K. Stull, BA, K. Frazee, BA, L. Cabo-Perez, MS**,** Mercyhurst College, Erie, PA

While adult age-at-death estimation techniques are usually based on highly variable degenerative patterns, subadult aging relies on the rigidly sequenced processes involved in development. Consequently, infant aging techniques are considered more reliable, rendering much narrower confidence intervals.
Still, most metric infant aging techniques are based on isolated diaphyseal lengths, which poses two major problems: (1) as diaphyseal lengths are highly correlated with body mass, age estimates will be strongly influenced by the body mass distribution of the reference sample. Additionally (2), the statistics associated with some of these methods suggest that the error rates increase with age. This would violate the assumption of homocedasticity of most parametric linear methods, invalidating the attached confidence intervals.
The present study examines the biases associated with classic metric infant aging techniques, developed from populations dating back to the early to mid 1900's, when applied to a modern radiographic sample, and then tests for violations of their parametric assumptions. The study utilized a forensic sample of 185 infants, from birth to 1 year, born between 2000 and 2007, of known age, sex, ancestry, body size, and cause of death. Long bone measurements were recorded from digitalized radiographs and age estimates from different aging techniques were compared with the known ages. Accuracy was recorded for the pooled sample and by age group in terms of percent correct classification. The relationships between diaphyseal lengths and age were tested for linearity and homocedasticity.

Allometry of trabecular thickness in the non-human primate astragalus.

A. Su. Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

The hypothesis that cancellous bone serves a mechanical role in absorbing the energy transmitted to joints leads to a prediction that the trabeculae in animals of increasing body size (whose joints experience greater loads) should follow a geometric scaling rule. However, previous studies of cancellous bone in the femoral and humeral head have found that trabecular strut thickness demonstrates strong negative allometry within mammals (e.g., Swartz et al., 1998). In this study it was hypothesized that a more anatomically distal region, presumably experiencing greater joint loads, would exhibit allometry of trabecular thickness in better accordance to the geometric scaling hypothesis. Micro-CT scan data with voxel resolution of 0.045 mm were collected from the astragalus of one wild-shot individual each of eight primate species that represent a broad range of body sizes. In each specimen, trabecular thickness was quantified in nine spherical volumes of interest (VOIs) using Quant3D. The VOIs were scaled to body size and positioned in homologous regions across the body and head of each astragalus. The results of this study agree with previous studies in finding a strong negatively allometric scaling of trabecular thickness within the astragalus. There seems to be an upper limit on trabecular thickness that may be determined by tissue-level metabolism. Suggested limiting mechanisms include the size of the region that an osteocyte can regulate or through which nutrients can diffuse from the marrow cavity, or the maintainance of adequate bone surface area for calcium homeostasis.

Variation in nutritional intake across the year for Phayre's leaf monkeys (*Trachypithecus phayrei*).

S.A. Suarez, M.A. Reilly, Department of Anthropology, Miami University

Phayre's leaf monkeys primarily eat a diet of young leaves and immature seeds. Seasonal variation in diet influences activity budget, affecting nutritional intake, and therefore diet quality. Diet quality is typically proxied as the contribution of high and low quality food categories to feeding. Direct measures of nutritional intake are difficult to collect, but improve accurate measures of diet quality. We examine the nutritional intake rates for Phayre's leaf monkeys in the Phu Khieo Wildlife Sanctuary, Thailand. Suarez observed feeding behavior in three research groups from June 2004 to May 2005. Five 20-minute focal samples were conducted each month for all adult monkeys in three social groups (N=23), with instantaneous sampling of behavior at one-minute intervals (N=7172 feeding points). During feeding, Suarez measured bite rate and size, and collected plant samples for nutrient analysis. Nutritional data are available for 46% of instantaneous data collected in marked feeding patches. We calculate diet quality as the total feeding time (pooled across three groups) per plant species, times intake rate and bite size, times protein, fat, ash, fiber, and caloric content per bite of those plant species. Nutritional quality varied across months, with a poorer diet associated with dry months. Male and female leaf monkeys did not differ in diet content, bite rate, or diet quality. Females who were pregnant or nursing ate a diet with higher caloric content than that of non-pregnant females without nursing offspring. For Phayre's leaf monkeys, seasonal variation in nutrient intake improves understanding of seasonal variation in behavior. Supported by NSF (BCS-0215542).

New Evidence bearing on the status of *Homo habilis* from Olduvai Gorge.

R.L. Susman, Department of Anatomical Sciences, Stony Brook University.

Radiographic evidence of the foot and taphonomic evidence of identical carnivore damage to both the foot and leg (Njau and Blumenschine, 2007), clarifies the association and taxonomy of hominin postcrania from Middle Bed I at Olduvai. Olduvai hominids 7, 8 and 35 are among the first hominins recovered by Louis Leakey, and among the earliest fossils of the genus Homo. The morphology of the OH 8 foot indicates that it is part of the holotype. Radiographic evidence shows that OH 8 is the same ontogenetic age as the OH 7 mandible, hand, and skull bones. Evidence of morphology, geology and taphonomy suggest further the likelihood that the OH 35 leg also belongs to the OH7/8 individual and should be included in the holotype. The revised type specimen ranks as one of the most complete early hominin skeletons and the most complete skeleton yet of earliest Homo.
These findings do not support the numerous claims over the past forty-seven years that OH 7, 8, or 35 belong to Australopithecus spp. or Paranthropus boisei.

Alternative reproductive strategies in male hamadryas baboons: leaders, followers, and solitary males.

L. Swedell[1,3,5], J. Saunders[4,5], M. Pines[5], A. Schreier[2,3,5], B. Davis[5]. [1]Department of Anthropology, Queens College, City University of New York, [2]PhD Program in Anthropology, City University of New York, [3]New York Consortium in Evolutionary Primatology, [4]Behavioural Ecology Research Group, University of KwaZulu-Natal, [5]Filoha Hamadryas Project.

Hamadryas baboons are unique among primates in having a multi-tiered society in which males aggressively herd females into semi-permanent one-male units (OMUs). As in many other social animals, there are multiple male roles within hamadryas society. One role is that of the *leader male* of an OMU. A second role is that of a *solitary male*, who moves throughout the band, interacting mainly with other solitary males and juveniles. A third role is that of a *follower male* to an OMU, who is tolerated by the leader male and has social (but not sexual) access to OMU females. It has traditionally been thought that follower males are the primary recipients of females and that they are essentially 'leaders in waiting' who inherit the leader's females when he can no longer defend them (Kummer 1968; Kummer et al. 1978; Abegglen 1984; Colmenares 1992a). Here we conduct a preliminary analysis of the success of various male strategies by analyzing patterns of takeovers in Band 1 (formerly 'Group 1') of the Filoha population of hamadryas baboons in central lowland Ethiopia. Observations of takeovers between 1996 and 2007 suggest that over 70% of females are taken over by other leader males, about 20% of females are taken over by solitary males, and only about 10% of females are taken over by the follower male to their OMU. We discuss the implications of this pattern for reproductive strategies of male hamadryas baboons, and, in particular, the role of follower males in hamadryas social organization.

The effective mechanical advantage of the australopithecine knee.

A.D. Sylvester[1], M.R. Mahfouz[2]. [1]Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine, [2]Department of Mechanical, Aerospace and Biomedical Engineering, The University of Tennessee.

In an analysis of three-dimensional shape we have demonstrated that, when functionally aligned, the australopithecine distal femur AL 129-1a had a patellar surface which projects less anteriorly than that of modern humans. A potential functional consequence of the australopithecine morphology is a reduced effective mechanical advantage (EMA) of the quadriceps muscle compared to modern humans, a possibility we investigate herein.
We created a three-dimensional computer model from CT images of a cast of AL 129-1a. Ten human femora (5 male / 5 female) were generated using a statistical shape atlas of the human femur. Each sex was represented by an average form and versions that were +/- 2 standard deviations along the first two shape components. All femora were aligned to their axis of flexion and rotated around this axis in five degree increments (0-50°). The lever arms for the quadriceps muscle and body were measured, and the EMA was calculated as the ratio of these two lever arms. We accounted for the effect of body size using equations relating body mass and knee EMA from published literature.
Initial analyses reveal that, in absolute terms, AL 129-1a had lower EMA at the knee compared to modern humans. The EMA of AL 129-1a is 81% of the average female and 83% of the average male, values that are outside the range of human variation accounted for in this study. After the effect of body size is incorporated, the EMA of AL 129-1a is, however, comparable to that of modern humans.

Long sacrum in human obstetrics.

R.G. Tague. Department of Geography and Anthropology, Louisiana State University.

Females have a larger pelvis than males. This dimorphism is obstetrically advantageous. This study considers sexual dimorphism of sacral angulation and posterior sagittal diameter of the outlet in relation to number of sacral vertebrae. Females and males between ages 20 and 49 from the Hamann-Todd and Terry skeletal collections were studied. Sample sizes were 413 females and 434 males for determination of number of sacral vertebrae, and 169 females and 79 males for pelvimetry. Results show no significant difference between the sexes in number of sacral vertebrae. The combined sample shows 1% with four vertebrae, 61% with five vertebrae, and 38% with six or more vertebrae. A sacrum with six or more vertebrae is due to assimilation of a lumbar or coccygeal vertebra. Among individuals with five sacral vertebrae, females are significantly larger than males in both sacral angulation and posterior sagittal diameter of the outlet; the percentage dimorphisms (female mean x 100%/male mean) are 110% and 113%, respectively. For posterior sagittal diameter of the outlet, comparison of females with sacral assimilation to females and males with five sacral vertebrae shows that the former females are significantly smaller than the latter females and non-significantly different

from males. A short posterior sagittal diameter of the outlet can be obstetrically hazardous. The evolution of sexual dimorphism in sacral angulation is to ensure that females with sacral assimilation have an obstetrically adequate posterior sagittal diameter of the outlet.

Influence of infectious disease on childhood nutritional status and growth.

S. Tanner. University of Georgia, Department of Anthropology, Athens GA 30602

Infectious diseases, such as diarrheal disease, respiratory infections, and parasitic infections, are an important source of nutritional and energetic stress in many populations. Continual exposure to such infections has been shown to negatively impact physical growth in childhood, but the long-term implications of this exposure remain unclear. Research is beginning to illustrate the importance of early exposure to infectious disease on development and lifelong patterns of health. Through methodological innovations, A. Roberto Frisancho pioneered research documenting childhood nutritional status and growth delay resulting from negative environmental conditions. Inspired by this research, this paper will consider the impact of childhood environment and local disease ecology on child health and growth patterns in lowland Bolivia. It aims to examine the relationships between child anthropometry, parental reports of illness, and objective assessments of infection. Specifically, it will consider the impact of both chronic and acute infections on markers of short and long-term nutritional status throughout childhood. The study of human adaptation continues to refine our understanding of normal physiological functioning in diverse environments.

Height, Health and Mortality in 19th Century Youths

N.E. Tatarek, Ohio University

Anthropometric history links health and nutrition estimates via stature and body weight data with societal factors such as occupation and SES. Most data utilized comes from slave manifolds and military muster rolls. Data for juveniles are more rare and have been limited to military academies and schools. Penitentiary records comprise a smaller data subset (Johnson & Nicholas, 1997; Tatarek, 2006), but often contain data on juveniles. This study aims to further complete the understanding of juvenile growth, health and mortality by examining a potentially disadvantaged youth sample. This study focuses on 14,547 individuals, ages 9 to 24 years who were incarcerated in the Ohio Penitentiary between 1834 and 1902. Data collected include sex, age, ancestry, height, nationality, year and place of birth and mortality data. Average height for each sex and age group was calculated and every observation divided by the appropriate average to create a height index.
Average height for African-American youths was 66.61 inches ± 2.9 inches; average height for young Caucasians was 67.31 inches ± 2.75 inches. Regression analyses on height index, birth cohort, ancestry, nationality, and place of birth indicate significant height differences due to each of these variables. Analyses also show that that 3.5% or 529 of the juveniles died while incarcerated. The homicide rate for youths was twice that of adult inmates, while the suicide rate was half. Though the height patterns are not very different from non-incarcerated youths, mortality due to tuberculosis, homicide and suicide hint at a socially and biologically more stressed life.

Evolution in Museums: The Spitzer Hall of Human Origins at the American Museum of Natural History.

I. Tattersall[1], W.E.H. Harcourt-Smith[2]. [1] Division of Anthropology, American Museum of Natural History; [2] Division of Paleontology, American Museum of Natural History.

The Spitzer Hall of Human Origins at the American Museum of Natural History opened in February, 2007. It is unprecedented in attempting to integrate the traditional fossil and comparative biological sources of information on human evolution with the new information being provided by molecular approaches. This approach was taken in the belief that it is no longer possible to understand fully what is known about human emergence without considering genomic and developmental lines of evidence as well as the tangible fossil and archaeological records. The exhibit is also unusual in that a fully-equipped laboratory/classroom is incorporated into the design of the Hall itself, allowing both school classes and groups of adults to enjoy a hands-on experience during their visit. Throughout the Hall, content is delivered by complementary systems, so that, for example, static displays are enhanced by audiovisual and/or interactive elements. The visitor is introduced to fossils, artifacts and their analysis on one hand, and to molecules and genomic systems on the other, before being presented with the physical evidence for human evolution and its interpretation, the story of the spread of *Homo sapiens*, and exhibits encouraging the visitor to ponder on what exactly it means to be human.

A taxonomic and functional examination of the Sangiran 7 *Homo erectus* molars using novel imaging technologies.

J. Tausch[1], O. Kullmer[2]. JWG University of Frankfurt[1] & Senckenberg Museum[2], Germany.

The study of dentition yields information on hominin evolutionary affinities, functional adaptation and ecological context. This project combines two emergent technologies adapted specifically for the purpose of mineralized tissue quantification while using proven methods of morphological analysis as a basis against which the new data can be compared. First, the von Koenigswald (Sangiran 7) *Homo erectus* molar collection are quantified for crown and cusp areas per Wood (1983). This data is used to determine taxonomic affinities within the collection itself as temporal discontinuities exist. Also, the data are compared against published data for all other *H. erectus* to ascertain evolutionary similarities between the v. K material and regional populations. The second phase employs 3D topometry to create virtual reality (VR) models to gain the same data sets as the traditional methods while also generating data on cusp disposition (cusp volume, facet dip and pitch) (Kullmer, 2001). The traditional data sets are then compared with the 3D VR numbers to establish future efficacy of by-passing the traditional route of quantification. Cusp disposition data are employed in generating an occlusal compass (Ulhaas et al., 2004) in preparation for the third stage in which confocal scanning optical microscopy (CSOM) is employed to image microwear direction per selected molar cusp facets. Microwear direction is then digitally mated to the 3D VR models generating approximate mandibular function thus yielding data on diet and thus ecology et al.
This project has been supported by: DAAD (Deutscher Akademisher Austausch Dienst) Scholarship # A/05/13858; CUNY PSC Adjunct Professional Development Fund Grant

Variation in masseter muscle fiber architecture in five strains of inbred mice: implications for heritability of fiber architecture.

A.B. Taylor[1,2], C.J. Vinyard[3], B.A. Payseur[4]. [1]Department of Community and Family Medicine, Duke University School of Medicine, [2]Department of Biological Anthropology and Anatomy, Duke University, [3]Department of Anatomy, Northeastern Ohio Universities Colleges of Medicine, [4]Laboratory of Genetics, University of Wisconsin-Madison.

Muscle fiber architecture plays an important role in determining muscle function in humans and other mammals. Although some research has explored the heritability of fiber types, the heritability of fiber architecture has not been well studied. In a first step towards addressing heritability of muscle fiber architecture, we investigated variation in masseter fiber architecture in five inbred strains of mice. Inbred strains maintained in a similar environment are useful in this regard because morphological differences among strains are due largely to genetic factors.
Ten males and ten females from each of five strains were analyzed (AKR/J, BTBR T(+) tf/J, CAST/EiJ, DBA/2J, NOD/ShiLtJ). Following measurements of whole masseter lengths (0.01 mm) and wet muscle weights (0.0001 g), muscles were chemically digested in 30% HN03 to facilitate separation of

muscle fibers. Manual dissection continued under a stereomicroscope. Forty to 45 fiber bundles from each of three masseter regions – pars superficialis, pars reflexa, and pars profunda -- were dissected and measured to the nearest 0.1 mm using a reticule. Two-way ANOVAs were computed to test for significant sex, strain, and sex*strain effects for each muscle region. A Bonferroni adjustment was applied post-hoc to examine pairwise comparisons (α=0.05).
Post-hoc pairwise comparisons revealed significant strain differences in muscle length and weight, and significant absolute and relative differences in regional fiber lengths. The significant variation in fiber architecture in these inbred strains of mice raises the possibility that variation in masseter fiber architecture among mammal species has an important heritable component.
Supported by NSC (BCS-0452160), Ohio Board of Regents, and the Jackson Laboratories.

Investigating the effects of cooking on $\delta^{13}C$ and $\delta^{15}N$ of bone collagen, percent collagen yield, and $\delta^{18}O$ in bone apatite.

M.A. Teague, B.D. Tucker, J.S. Krigbaum, Department of Anthropology, University of Florida.

The effects of cooking on zooarchaeological bone are poorly understood. Experimental research is used to bridge this gap by correlating isotopic ratios with cooking technique (i.e., boiling or roasting). The isotopic effects of heating and cooking on bone collagen and apatite have been previously investigated by DeNiro et al. (1985) and recently by Munro et al. (2007). Heating bone collagen to temperatures normally encountered in cooking, 170° C to 420° C, has been shown to produce a small shift in $\delta^{13}C$ and $\delta^{15}N$ ratios of around 1‰. However, the effects of heating on the $\delta^{18}O$ values of bone apatite are more pronounced. Temperatures >300° C have been shown to alter $\delta^{18}O$ values of bone apatite by as much as 7‰, suggesting altered, burned bone is not appropriate for dietary reconstruction. Both of these studies use bone samples macerated prior to cooking/heating coupled with cooking times and temperatures which maximize or exceed conditions encountered in normal cooking. In this study *Bos taurus* limb portions with meat intact are cooked for shorter durations and at lower temperatures to better replicate common cooking techniques. This project builds upon previous work and adds to the corpus of experimental evidence using light stable isotopes to assess heated, cooked and burnt bone. The effects of cooking technique on $\delta^{13}C$ and $\delta^{15}N$ values of bone collagen, percent collagen yield, and $\delta^{18}O$ values of bone apatite are discussed.

Adult responses to seasonality and unpredictability: Fecal cortisol levels in the red-bellied lemur, *Eulemur rubriventer*.

S.R. Tecot. Institute for the Conservation of Tropical Environments, Stony Brook University

Unique lemur traits are suggested to have evolved in response to reproductive and/or environmental stress in seasonal, unpredictable environments. This study investigated how lemurs cope with fluctuating resources by measuring stress hormone (cortisol) levels in feces in conjunction with reproductive and phenological data. 18-month cortisol excretion profiles were created for five groups of *E. rubriventer* in two sites; one disturbed (DIS) and one undisturbed (UND). Overall, ripe fruit was more abundant and predictable in UND, while preferred resources were largely random in DIS. Cortisol profiles at each site followed a similar pattern, but with higher peaks in UND and significant differences between groups' weekly means (ANOVA: $F_{4,917}$=3.25, p<.012). Post-hoc analyses indicated that one group had significantly lower cortisol levels (p<.005). Only this group's range was composed almost entirely of the invasive species *Psidium guajava* (present only in DIS). During fruit scarcity this group fed almost entirely upon unripe guava. This resource may provide relief during particularly lean years. Weekly mean cortisol levels differed significantly by month (ANOVA: $F_{16,905}$=10.36, p<.005). Cortisol levels were lowest in March 2004, when no females had infants. Post-hoc tests indicate that March 2004 was significantly lower than March 2005, when each female completed weaning an infant (p=.001). Peak cortisol levels occurred during resource scarcity regardless of infant presence, and at birth. Food availability appears to be a strong selection pressure requiring energy mobilization, which may occur in combination with behavioral changes. This work was supported by NSF # 0424234, PCI, Primate Action Fund, PEO, and AAUW.

New ways in the documentation of human burials using 3D-laser scanning and digital microscopy: Two late Roman sarcophagus burials from Trier-St. Maximin (Germany).

W.-R. Teegen[1] and N. Reifarth[2]. [1]University of Leipzig, [2]Bischoefliches Dom- und Dioezesanmuseum Trier.

Several sarcophagus burials were discovered during archaeological excavations in the Roman cemetery of St. Maximin at Trier (Germany). Most of them can roughly be dated to the 4th cent. AD. Small infants, children and adults were buried. Some sarcophagi contain up to three individuals, e.g. a young adult female and two small infants.
Due to preservation of the archaeological record for future generations, it was decided to keep the contents inside sarcophagi in their original position and to use mostly non-destructive techniques for investigation. This led to the application of 3D-Scanning and Digital Microscopy as a foundation for documenting the distribution and constitution of the different materials and sampling.
In a pilot study the contents of two sarcophagi were scanned by the Fachhochschule Mainz, Institute for Space-oriented Information- and Measuring Technology. Bone measurements can be taken from the 3D scans. The 3D data set was plotted in XY-direction. On these plots, every find or bone fragment is correctly located. and in this way the plots are used as a basis for all further investigations. The two studied sarcophagi contain textiles of exceptional quality and richness. By contrast the preservation of bone is in general extremely poor. Only the enamel cusps are preserved from the teeth. In one third of the burials head hair and sometimes hints for beard hair are still present.
Only small samples of textile fibers, hair, teeth and bone were collected for further analyses (isotopes, AMS-dating) and maped. The larger part of the sarcophagi contents is remaining untouched.
The work is supported by the Studienstiftung des Deutschen Volkes and the Thyssen Foundation.

Variation in stature between Jomon and Yayoi people from prehistoric Japan.

D.H. Temple, Department of Anthropology, The Ohio State University, Columbus.

This study documents and interprets variation in stature between Middle to Final Jomon (5000 to 2300 BP) and Yayoi (2300 to 1700 BP) people from prehistoric Japan. Jomon foragers occupied a large number of ecological niches across the Japanese islands for approximately 10,000 years and are associated with a foraging economy. Yayoi people were the descendents of migrants from continental Asia who bred with Jomon foragers and introduced wet rice agriculture to Japan. It is hypothesized that Jomon ($n_{♂}$=77, $n_{♀}$=61) and Yayoi ($n_{♂}$=46, $n_{♀}$=38) stature will vary in association with differences in systemic stress and ecogeographic variation. Stature was compared using pooled t-tests separately for males and females. Brachial (n_j=46, n_y=62) and crural
(n_j=46, n_y=55) indices were compared using Monte Carlo analysis, while principle components analysis was employed to help explain how limb length contributed to variation in body size.
Yayoi people had significantly greater height than Jomon foragers ($p_{♀}\leq$.001, $p_{♂}\leq$.001). Brachial and crural indices were significantly lower for the Yayoi ($p\leq$.001). Principle components analysis indicates that femoral and humeral length contributed the most to size variation in limb length between Jomon and Yayoi people: Jomon people had shorter femora and humeri. Canalization of homologous limb growth and ecogeographic variation is likely related to this trend. Reduced percentages of femoral length growth in the five to seven year age cohorts

among Jomon compared to Yayoi people suggests that systemic stress also influenced differences in stature between these two groups.
This research was supported by a Dissertation Fieldwork Grant from the Wenner-Gren Foundation for Anthropological Research (#7318).

Environmental and dietary correlates of papionin temporal bone variation.

C.E. Terhune[1], H.F. Smith[1], C.C. Gilbert[2]. [1]School of Human Evolution and Social Change, Arizona State University, [2]Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University.

Recent analyses of human temporal bone variation have shown that temporal bone shape covaries with genetic and geographic variation, and to a lesser extent, environmental variables such as temperature. Here we further investigate these relationships using papionins, another closely related primate group which is known to be highly variable in diet and environment. Twenty three-dimensional landmarks were digitized on the temporal bones of 18 papionin species, and matrices of temporal bone form were generated. These matrices were then compared to matrices describing geographic distance and environmental variables such as latitude, temperature, and rainfall using multiple Mantel tests. In addition, data describing dietary variation within the sample were compiled from the literature, and combined into a matrix describing variation in material properties of the foods utilized.
Significant differences were found in temporal bone shape among all taxa, and a discriminant function analysis showed relatively high rates of correct classification for each taxon, with males, on average, classified correctly more often than females. Results of the Mantel tests indicate that temporal bone shape and temperature are significantly correlated, as are temporal bone size and rainfall. At the genus level, *Papio* and *Macaca* temporal bone shape was patterned geographically. The dietary matrix was found to be correlated both with temporal bone size and TMJ shape. These results suggest that environmental variables covary significantly with temporal bone form, in contrast to findings obtained previously for modern humans. Furthermore, dietary differences among papionin species also appear to be correlated with temporal bone morphology.

Techniques for the identification of missing persons at the FBI Laboratory.

R.M. Thomas, E. O'Donnell, E. Pokorak, J.E.B. Stewart. Laboratory Division. Federal Bureau of Investigation.

One of the goals of the Federal Bureau of Investigation (FBI) Laboratory is to identify missing persons. Several forensic disciplines contribute to this effort. The National Missing Persons DNA Database (NMPDD) program provides profiles of mitochondrial (mtDNA) and nuclear DNA from unidentified human remains as well as from samples submitted by family members of missing persons. A comparison of these profiles may provide information to identify the remains. Additionally, forensic artists work in cooperation with forensic anthropologists to develop facial reproductions from unidentified remains. These reproductions are then provided to law enforcement for public distribution in an attempt to identify remains or locate missing persons. This poster provides examples of these efforts and also provides information on how anthropologists, medical examiners, coroners, and law enforcement can submit samples to the laboratory to assist in this effort.

Bioarchaeology of the early contact period Oliver site (22CO503), Coahoma County, Mississippi.

A. Thompson. Dept. of Anthropology and Sociology, University of Southern Mississippi.

Early European contact had profound consequences for the health and lifestyles of indigenous populations in North America. Most of the information about this period is based on ethnohistorical accounts with some supplementation from archaeological excavation. Bioarchaeological analysis of available skeletal populations, however, provides a source of independent but complementary data by which the effects of culture change can be investigated.
This paper presents results from a bioarchaeological study of the human remains recovered at the Oliver site (22CO503) in Coahoma County, Mississippi. Excavation was completed in 1902 by Charles Peabody. Based on the presence of European burial goods as well as other archaeological and historical evidence, the population at Oliver is thought to be one of the original groups with whom Hernando Desoto made contact in 1541. Field notes from the excavation indicate a bias towards collecting well preserved skeletal remains, thus this is not considered to be a population representative sample. The demographic profile shows a strong presence (n=25/34) of young-middle aged adults with an adult sex ratio of 15 males to 11 females. Rates of linear enamel hypoplasias were high, indicating that childhood health was compromised. Despite this, adult stature was relatively tall, with males averaging 170.2cm (n=10), and females 159.7cm (n=11). Trauma was common, occurring in 26.5% of the sample, including cases of psuedoarthrosis and possible Legg-Calves-Perthes disease. These results demonstrate a mixed response to European contact at the Oliver site. Comparisons will be made with those seen at other contemporary sites from the Lower Mississippi Valley.

Demographic composition and health at Pueblo Grande de Nevada.

J.L. Thompson, D.L. Martin, K.G. Harry. Department of Anthropology and Ethnic Studies, University of Nevada, Las Vegas.

Pueblo Grande de Nevada is a Virgin Anasazi site dating to between AD 500 and 1250. Over 200 human burials were discovered and these, and any associated artifacts, were later dispersed to a number of museums/repositories but approximately 50 of them have been relocated. Data on demographic structure, patterns of morbidity and mortality, and indicators of poor health and trauma were collected and these results were compared against ancestral Pueblo sites from other regions. Demographic analyses indicate a population structure comparable to those of other, larger contemporaneous samples. For example, mean age at death was 26.9 (n= 35) and crude mortality rate was 37.17. The age composition of 10.2% infants under 1, 16.2% children 1-9, 69.4% adults and old adults shows a fairly normally distributed population, although the incidence of teenagers (10-18) was low (4%). Pathologies indicate both sexes experienced endemic, but low level, nutritional anemia while occupational stress markers point to a strenuous lifestyle. For example, one female, aged 45, showed moderate to severe osteochrondritis dessicans, osteoarthritis, and porotic hyperostosis. The same female presented several, healed postcranial fractures while blunt force trauma affected the skull of a 40+ male, perhaps the result of inter-personal violence. Dental wear is consistent with the practice of full-time agriculture. This is important as there has been no consensus on the nature of the economic strategy of people from this site. These results reveal new information about this little studied Virgin Anasazi group and provide important baseline data for health in this region.
Research funded by the National Park Service's Lake Mead National Recreation Area.

Are there significant interpopulational differences in the ratio of salivary to serum progesterone?

J. Thornburg[1], H. Spielvogel[2], V.J. Vitzthum[3,4,5]. [1]School of Mathematics, University of Southampton, [2]Instituto Boliviano de Biología de Altura, [3] Anthropology Dept. and Kinsey Institute, Indiana University, Bloomington [4]Institute for Primary and Preventative Health Care, Binghamton University, [5]Max Planck Institute for Evolutionary Anthropology.

To ascertain whether relatively low salivary progesterone (P) in Bolivian women (Vitzthum et al 2000, 2002, 2004) reflects similarly low serum P, Chatterton et al (2006) compared sample means of salivary and serum P, and each group's (mean salivary P)/(mean serum P) ratio in concurrent saliva

and serum samples, taken on a single day during the putative luteal phase from study participants in La Paz (n=26) and Chicago (n=20). They concluded that there is significant interpopulational variation in the salivary/serum P ratio, and that populational differences in salivary P cannot be assumed to be indicative of comparable variation in serum P.
We present additional analyses of these data that call into question their conclusions. The correlation between individual salivary and serum P is only 0.17 in Chicago (n=15) and 0.45 in La Paz (n=25). Yet, their original description of their new salivary P assay reported r=0.75 for concurrent serum and salivary P "for single luteal phase samples from 48 US women" (Lu, Chatterton et al 1997), which is consistent with the reports of other studies. Furthermore, individual salivary/serum P ratios are 0.62%-70.7% in Chicago and 0.37%-8.4% in La Paz.'s The 115-fold range in the Chicago sample is untenable. These and other analyses cast substantial doubt on the utility of these data, therefore no conclusions regarding populational differences in salivary/serum P ratios can justifiably be inferred. The study should be re-done with stricter controls on sample handling and assay performance.
Funded in part by the National Science Foundation, Binghamton University, and a Fulbright Fellowship.

Bringing the Stone Age into the Information Age: introducing the Paleoanthropology Database.

Z.J. Throckmorton. Department of Anthropology, University of Wisconsin, Madison.

Online databases and datasets have become indispensable tools for modern scientists. A number of such databases relevant to paleoanthropology are currently in development; many of these can be accessed through Paleoanthportal.org. These databases are thus far narrow in their scope and detailed in their content. I present here the Paleoanthropology Database (PADB), the first broad and general database designed to be useful to both researchers and students of human evolution.
The database contains 40 types of basic data categories filled with information culled from the published literature. These data categories include, for example, age of the site, skeletal elements present, taxonomic affinities, archeological and behavioral evidence, and associated faunal remains, all fully referenced to an extensive source list (over 4,000 references in total for Europe). Here I present the first phase of the database, 300 European sites. An additional 900 African and Asian sites, as well as Miocene hominoid sites, will be added in the future. The primary goal of PADB is the facilitation of access to the evidence of human evolution through its open access status (anyone with a computer that is online may use it). Its secondary goal is to be a continuously updated source of paleoanthropological data through a streamlined updating protocol (utilizing the familiar Excel spreadsheet). At the heart of PADB's ease of use and updateability are its straightforward database structure (two MySQL tables) and flexible, simple, yet powerful search functions (written largely in Perl). The database can be accessed through Johnhawks.net.

Testing histological age determination techniques on Prehispanic Maya skeletal populations.

V. Tiesler[1], S. Suzuki[1], S.D. Stout[2], M. Streeter[3]. [1]Facultad de Ciencias Antropológicas, Universidad Autónoma de Yucatán, [2]Department of Anthropology, Ohio State University, [3]Department of Anthropology, Boise State University.

Histological age determination techniques measure age-dependent morphological features in samples taken from bones or teeth. They hold advantages over macroscopic methods when conventional parameters cannot be applied for lack of preservation, as is the case with the Lowland Maya skeletal remains. In this study, we test the potential of histomorphological techniques in Maya research, using three regression formulas derived from rib morphometry of series with known ages: Stout and Paine (1992), Cho et al. (2002) and Valencia Pavón (2007). While the first two formulas were developed from populations of European-American and African-American descent, the latter is founded on a cohort of modern individuals with known ages from the Yucatan peninsula. For the purpose of this study, a series of rib sections were obtained from 35 adults dated to the Classic period, recovered from Palenque, Chiapas, Ek Balam, Yucatán, and Calakmul, Campeche (all in Mexico). Osteon density (OPD), osteon size (On.Ar), and cortical area measures (Ct.Ar/Tt.Ar ratio) were determined in two sections of each individual. The results were then compared with macroscopically determined age ranges, and the influence of diagenesis and interobserver differences noted. Our findings reveal a greater correlation between the macroscopically derived ages and the age estimates from the regression formulas based on OPD developed by Stout and Paine (1992) and Valencia Pavon (2006), while the combined application of osteon size (On.Ar) and the ratio of cortical bone to total area (Ct.Ar/Tt.Ar) employed in the Cho et al.(2002) only provided better correlation with macroscopic age estimates in older individuals.
The study was funded by CONACYT 33743-H grant to Vera Tiesler.

Whale hunting may place individuals at risk for spondylolysis.

M.B. Timm. Department of Anthropology, Western Michigan University.

North American Inuit populations are thought to have the highest prevalence of spondylolysis, which is a unilateral or bilateral separation of both the centrum and neural arch of a vertebral element at the pars interarticularis. Spondylolysis may affect any vertebral unit and is commonly found in lumbar vertebrae. High risk activities hyperflex and hyperextend the back, such as dragging heavy objects and bending at the waist with the legs fully extended. This study compares two Inuit groups from Point Hope, Alaska, the Ipiutak and Tigarak, housed in the American Museum of Natural History, for the presence and absence of spondylolysis. The Ipiutak lived approximately from 2100 – 2500 BP and hunted caribou, seal, and walrus. In contrast, the Tigarak lived from approximately from 800 – 300 BP and hunted whales in addition to other large mammals. Data were collected from both populations noting presence, absence, and location of spondylolysis. A total of 30 Ipiutak individuals were evaluated with 26 % prevalence in males (5/19) and 9 % in females (1/11). A total of 92 Tigarak individuals were evaluated and demonstrated 50 % prevalence in males (21/42) and 60 % in females (30/50). It is likely that both groups acquired spondylolysis from standing or sitting while bending at the waist with legs fully extended. The increase in prevalence among Tigarak may be because of whale hunting. Men towed the dead whale to shore and women dragged the meat to camp, both activities that predispose individuals to spondylolysis.

Extinction of critically endangered West African colobus monkeys will lead to a major loss in molecular diversity.

N. Ting. Anthropology Program, City University of New York (CUNY) Graduate Center, New York Consortium in Evolutionary Primatology (NYCEP)

Red colobus monkeys rank among the most endangered of all living primates with nearly half of the 18 forms threatened with extinction in the near future. Designation of conservation priorities for these animals is hampered by an unresolved phylogeny that remains among the longest-standing problems in African primate taxonomy. Thus, there is no consensus on how many species of red colobus should be recognized, and the assignment of species names to certain forms remains contentious. This is the first study to address the systematics of this group using molecular phylogenetic methods.
An 897 base pair fragment of mitochondrial DNA was amplified and sequenced in nearly all red colobus forms from tissue, fecal, and museum specimen (tooth) samples. A combination of tree-based and distance methods was used to infer evolutionary relationships and divergent mitochondrial lineages. This information was combined with that from previous studies based on morphology, pelage, and vocalizations to

produce a consensus red colobus classification.
Several distinct mitochondrial lineages are discovered, some of which belong to critically endangered West African forms that possess an extremely limited distribution and face a high degree of human hunting pressure. The loss of these taxa would represent the extinction of major molecular lineages that will never be recovered. The consensus classification elevates one of these (*epieni*) to species level, and identifies the presence of at least four other species. Overall conservation priorities for red colobus monkeys are discussed, as well as the importance of systematics to conservation.
This work was funded by the National Science Foundation, the New York Consortium in Evolutionary Primatology, and Primate Conservation Inc.

Effects of food exploitation on activity and group size of Mantled Howlers (*Alouatta palliata*).

A. Tinney [1], M. Bezanson [2]. [1] Department of Anthropology, Univeristy of Arizona, 1009 E. South Campus Drive, Tucson, Arizona 85721-0030 U.S.A. [2] Department of Anthropology, Santa Clara Univ., 500 El Camino Real, Santa Clara, CA 95053, U.S.A..

Studies of feeding ecology in primates have indicated that energy expenditure and group size are related to food type and food availability. Behavioral effects of resource use were analyzed using group size, diet, feeding behavior, activity budget and forest structure data in *Alouatta palliata* at La Suerte Biological Field Station in Northeastern Costa Rica. Focal scan sampling data were collected over a two-month period on three troops of *A. palliata* (each with 4-11 individuals). Howlers concentrated all behaviors in trees that were more than 10 cm dbh. Mean dbh of all trees measured (1,496 trees within 94 plots) was 13.93cm $\pm$ 18.77 (range: 2.5-223) and the mean dbh of trees more than 10 cm dbh was 27.67 cm $\pm$ 24.04 (range: 10-223). Average tree height was 10.18m $\pm$ 6.81 (range: 0.8-53.3) and average height of first branching or bole height was 6.33m $\pm$ 4.86 (range: 5-32). The tallest trees were estimated at 30-50 meters. Howlers were observed consuming leaves at a significantly higher rate (80%) than other food types (20%) during the two month period and five tree species constituted a majority of *A. palliata* diet despite the fact that other tree species exploitable by howlers were available during the study duration. Results confirmed a correlation between low levels of activity and consumption of leaves containing low protein-to-fiber ratios. Groups visited a small number of feeding trees in close proximity to one another and frequently revisited previous feeding sites. Results presented here support the notion that howler groups are able to adjust and survive in small forest patches and despite selective feeding behavior can concentrate on a small number of food types. Additional relationships among feeding behavior, forest structure, and resource availability are discussed.

From hypervariable region to complete mitochondrial DNA analysis in the Americas

R. Y. Tito, S. E. Smith, R. S. Malhi.
Department of Anthropology
University of Illinois Urbana-Champaign

Comprehensive studies of the human mitochondrial DNA (mtDNA) genome have been carried out by analyzing single nucleotide polymorphism (SNPs) determined by RFLP analysis and sequencing the hypervariable (HV) region. Several previous studies assume the same maternal origin of mtDNAs based only on the haplotyping of the hypervariable (HV) region. The present study shows that even with identical HV regions, there might be several differences within the rest of the mitochondrial genome.
We used 44 samples from British Columbia to test how well sequences from the HVI and HVII regions represent variation in the entire mitochondrial genome. To accomplish this we sequenced the HV region of these samples and developed an easy way to sequence the whole mtDNA. Some samples with the same haplotype for HVI/HVII showed differences for the whole mtDNA sequence.
Possible reasons for the differences identified in this study are discussed and we make recommendations for genotyping markers in the mitochondrial genome in the Americas.

Preliminary Evidence of Fission-Fusion Sub-Grouping Behavior in White-Fronted Brown Lemurs (*Eulemur fulvus albifrons*) in Betampona Natural Reserve, Madagascar.

C. Toborowsky, Department of Anthropology, University of Texas at Austin.
Sub-grouping behaviors in primates have been hypothesized to mitigate problems arising from food competition, sexual competition and predation. Permanent group fission has been observed previously in subspecies of the brown lemur complex (*Eulemur fulvus* sspp.), but a fission-fusion social system whereby groups repeatedly split and regroup, *sensu lato Ateles*, has not been documented. One hundred fifty-six hours of behavioral data were collected using scan sampling on one focal group of six adult white-fronted brown lemurs (*Eulemur fulvus albifrons*) from April – July 2005 in the eastern lowland rainforest of Betampona Natural Reserve, Madagascar. Data were collected on other groups opportunistically. Two types of groups were observed: 1) large, migratory groups that moved throughout areas of primary and secondary forest, and 2) small groups that split into sub-groups during foraging. The small groups reconvened during periods of resting and sleeping, and were seen only in secondary forest habitats. Results indicate that the sub-groups typically consisted of two males and one female, and two females and one male. The complete group rested together during the night, as evidenced by sleeping tree observation. Because the focal group lived in areas of secondary forest where resources were less varied and less abundant than primary forest, the sub-grouping behavior may serve to alleviate energetic constraints, such as competition due to feeding or foraging in the same small food patch, endured by larger groups while foraging and traveling.
Funding for this research was provided by the Saint Louis Zoo WildCare Institute and the Sophie Danforth Conservation Biology Fund.

Age at death disparities between African-Americans and Euro-Americans in the Robert J. Terry Anatomical Collection.

D.L. Tompkins, Department of Anthropology, University of Massachusetts-Amherst.

As a reference collection utilized by biological anthropologists to test disease and morphological models, the Robert J. Terry Anatomical Collection has been an invaluable resource. The high level of documentation of age, sex, race, health status, and cause of death for each individual within the collection makes it particularly attractive as a standard for both disease processes and measures of "normal" growth and development. However, despite its use as a standard, little has been written about intra-collection discrepancies. Of the 249 documented deaths from tuberculosis, 107 individuals were under the age of 35 at death. Ninety-six percent of the 107 (n=103) were African-Americans. This preliminary study of 62 individuals with an identified cause of death of tuberculosis examines which stress factors contributed to a lower age at death profile for African-Americans.
Muscle scars, fracture patterning, hypoplasias and caries, degenerative joint disease, and infectious lesions were measured in order to determine if greater stress contributed to increased risk for lower age at death. There is no significant difference in incidence of caries and nasal fractures between African-Americans and Euro-Americans. There is a marked difference between the two groups, however, with respect to linear enamel hypoplasias (LEH). While 29% of the subsample displays at least one LEH, only 9% of Euro-Americans exhibit LEHs as compared with 40% of African-Americans. Occupational skeletal stress markers are currently being analyzed in conjunction with frailty indicators (LEH, stature ratio, body mass) and will be addressed further in the poster.

Parental investment and child growth in Papua New Guinea.

D.P. Tracer. Department of Anthropology, University of Colorado at Denver and Health Sciences Center, Denver, CO 80217-3364.

Among his many contributions to biological anthropology, A. Roberto Frisancho

has conducted numerous influential studies of growth and development in U.S. and non-U.S. populations. Not content to simply describe patterns of growth across populations, his work has paid special attention to the ecological and social setting in which growth occurs and therefore, to understanding growth outcomes using an adaptationist paradigm. In this tradition, this paper uses the adaptive paradigm of "parental investment theory" to examine maternal investment and its correlation with indices of child growth in Papua New Guinea. Parental investment theory predicts that mothers do not allocate resources indiscriminately, but rather, do so taking into account such factors as the gender, age and condition of offspring as well as their own age, condition, and access to resources.

Anthropometric data on 113 mother-infant pairs coupled with 470 hours of observations on parental solicitude (carrying behavior, feeding practices, and responsiveness to cries) towards children shows that aspects of parental investment, such as the temporal patterning of breastfeeding, are significantly correlated with indices of offspring quality. No significant relationship between parental solicitude and indices of maternal condition or resource holdings are seen. The range of conditions under which parental investment theory may be a useful guide to studies of child growth are discussed.

Sexual dimorphism and group variation in orbital aperture shape.

W.R. Trask, P.H. Moore-Jansen. Department of Anthropology, Wichita State University.

Cranial morphology is generally considered useful for estimating sex and group affiliation in human skeletal remains. Yet, fragmentation of cranial remains in various skeletal recovery contexts sometimes invalidates traditional and more comprehensive analyses of vault and facial morphology, calling for alternative measures of study. This paper examines orbital aperture morphology relative to group and sex variation.
Sixteen measurements and several qualitative observations are recorded on a sample of 260 White and Black male and female crania from the Hamann-Todd Collection. Six standard and non-standard landmarks are defined on the periphery of the orbital aperture to characterize orbital shape. Direct linear measurements are recorded between any two landmarks, including two standard and 14 novel chords, thus defining orbital aperture shape. The findings reveal statistically significant ($p<0.05$) differences in orbital aperture shape for chords defining general orbital size and shape for both sex and group. Observations include, but are not limited to, group differences in height and breadth measurements in both males and females and between sexes in a White sample. Statistically significant ($p<0.05$) results among chords, characterizing the somewhat lateral half of the orbit, suggest that this portion of the orbit is also useful in the assessment of group and sex. Results of a quantitative analysis of at least two chords are correlated with a set of qualitative observations describing orbital shape. These results add to the improved quantification and understanding of the morphology of orbital aperture morphology and human cranial shape in general.

Variation in Lemur Genital Anatomy: Implications for taxonomy and functional morphology.

K. Treatman-Clark. IDPAS, Stony Brook University.

Recent research has documented such great penile diversity in galagos that penile anatomy can be used to distinguish galago species (Perkin, 2007). A potential implication of this finding is that penile anatomy in galagos acts as a barrier to inter-specific mating. This study examined variation in lemur genitalia to examine taxonomic influences on genital anatomy. Quantitative measurements of the genitalia and exhaustive descriptions of genital shape were collected for nineteen lemuriform taxa and three lorisiform outgroups at the Duke Primate Center and Ranomafana National Park. Clitoris and penis measurements were analyzed in nested ANOVAs using SPSS 11.0. For males, neither superfamily ($F=2.8$, $p=.161$) nor genus ($F=2.24$, $p=.105$) explain significant variance in penis length, while the taxonomic rank of family explains a significant amount of variance in penis length ($F=4.03$, $p=.038$). Additionally, penis shape is highly consistent within a family, but very different between families. This indicates that penis shape is unlikely to serve as a barrier to interspecific mating in lemurs. Unlike male genitalia, the shape of the female genitalia differ substantially within families and even within genera. While the majority of variation in clitoris length is at the family level, no taxonomic level explains a significant portion of the variance. Clitoris length and genital shape are correlated with two behaviors: female dominance ($X^2=6.67$, $p=.036$) and female promiscuity ($X^2=4.75$, $p=.029$). Previous reports have also linked variation in male genital anatomy to mating behavior, indicating that this is a primary cause of genital variation in lemurs (Treatman-Clark, 2007).
This research was supported by the National Science Foundation (Doctoral Dissertation Improvement Grant #0424166).

Sex, symptoms and daily life during the menopause transition in a sample of North American women.

W.R. Trevathan[1], M.H. Burleson[2]. [1] Department of Sociology and Anthropology, New Mexico State University, [2] Department of Social and Behavioral Sciences, Arizona State University.

The Menopause in Daily Life project is based on data collected prospectively over a 6-year period (1992-1998) from 58 women who kept daily records for 116 to 2,814 days, with a per person average of 1,213 days. Each participant completed a daily checklist, reporting for the previous 24-hour period, of 51 variables including stressful events, illness, exercise, sexual activity, moods, and menopause symptoms (e.g., hot flash, sweats). With this dataset, we can develop a picture of the circumstances in which each participant experienced the menopausal transition and examine selected variables in the context of her daily life experiences. In ongoing analyses we are assessing relationships among behavior patterns and psychosocial events, including stress, sexual activity, exercise, and physical and emotional experiences. In this paper, we report relationships among sexual behaviors and menopause symptoms obtained for the sample as a whole (between-subjects design) and by pooling results for each individual woman (within-subjects design). In contrast to a previous study that found women with more frequent intercourse had fewer hot flashes, we found no relationship comparing between participants and an opposite relationship within participants. Similarly, we found no association between sexual activity and positive or negative mood comparing between subjects, but our within-subject analyses found that positive mood increased the day after sexual activity with a partner, whereas negative mood decreased. Possible explanations for the discrepancies and implications of the findings are discussed.
Funding was provided by the National Science Foundation (BCS #0129922), New Mexico State University, and Arizona State University.

Biocultural approaches to the study of mortuary practices in the Early Byzantine populations from Greece; the cases of Akraiphnio, Boeotia and Maroneia, Thrace.

P. Tritsaroli. Wiener Laboratory, American School of Classical Studies at Athens.

The Early Byzantine period (4th-8th c. AD) is marked by important population movements into Europe including the Balkans. People from different religions and nations coexisted along with Orthodox Christians in the Byzantine Empire. Consequently, much of our understanding of mortuary practices is closely tied to continuous interactions between groups with different cultural backgrounds.
Recent research on skeletal samples from Greek cemeteries confirms reports from archaeology and history that burial customs are the result of cultural choices. The bioarchaeological study presented here includes 82 individuals from single and multiple burials located outside city-walls, as was the custom until the 7th c. The deceased were orientated West-East, in a supine position with the forearms folded on the chest

or abdomen, as was the common Christian custom. In Akraiphnio (7th c.), one individual from the population was buried on its right side in an East-West orientation, suggesting Muslim tradition. In Maroneia (5th-6th c.), a woman displayed circular head shaping; this practice was adopted by the Huns but was unknown in Byzantine customs.
Variations in the orientation and position of the deceased and intentional alteration of the human skeleton may suggest the presence of individuals from different cultures. While the Byzantines used special burial places for the dead who were foreigners, these burials belonged probably to Christianized citizens who had the right to be buried in common Christian cemeteries. Thus, the combination of archaeological and skeletal information contributes substantially to the understanding of the multicultural character of the Early Byzantine society through mortuary practices.

Physical characteristic of archaeological populations of Mongolia

D.Tumen, Ch. Vanchigdash, Department of Anthropology and Archaeology, National University of Mongolia

In the article we have given main results of comparative study of physical stature and physiques of ancient nomads from different historical periods (from Neolithic up to Mongolian Period) of Mongolia. The study shows some difference in body constitution of studied archaeological populations from Mongolia. Differences between archaeological populations were found in shoulder width, torso length, arm and leg length. It was shown that during the historical periods (from Neolithic up to modern era) shoulder width and torso length decreased and in contrary the arm and leg length increased significantly. The interesting phenomenon in physique of Mongolian archaeological populations may show its secular trends observed in some archaeological populations from different regions of the world.

Violence in post-imperial times: cranial trauma among post-Wari burials in the former imperial heartland, Peru

T.A. Tung, Dept. of Anthropology, Vanderbilt University

Post-imperial contexts are often characterized by social instability that can lead to violent conflict. Skeletal analysis can document the physical manifestation of violence, so a bioarchaeological approach is well-suited for evaluating if and to what extent violence emerged. To this end, the frequency and patterning of pre- and peri-mortem cranial fractures are documented among two Late Intermediate Period (LIP, AD1000–1400) burial groups, a time that follows collapse of the Wari empire (AD600-1000). The two burial groups come from the Monqachayoq and VegachayoqMoqo sectors at the site of Huari, the former capital. Seventy-three crania were examined for fractures.
Results: the capital was used as a mortuary complex after the decline of Wari. First-ever AMS dates from these samples prove this, contrasting earlier studies that suggested burials dated to the Wari era. Monqachayoq: 71% of 31 adults show premortem head wounds; 42% of adults (N=31) and 30% of children (N=10) show perimortem cranial fractures. There were no sex-based differences. Pre- and peri-mortem cranial trauma was also common among 28 adults and four juveniles in the VegachayoqMoqo group. While cases of trauma are common, the demographic profiles likely do not represent a once-living population; thus, these trauma frequencies are not wholly representative of LIP communities in the former imperial heartland. Rather, they may represent a select group of persons, either interred by their mourners or disposed of by their attackers. Nonetheless, violence affected many, suggesting that the post-imperial period was a violent time for numerous individuals, regardless of age or sex.

Distal tibial shape and presentation reflect the type of substrate.

K. Turley, E. Henderson, S. Frost. Department of Anthropology, University of Oregon

The talo-crural joint in primates is the interface between the leg (and the rest of the organism) and the foot (and substrate). It can be considered to consist of three elements, proximal presentation (tibial torsion, shape, and plane of the tibial talar facet), distal presentation (talar shape and distal articulation), and the joint articulation (remaining elements of the joint). Geometric morphometric techniques are used to examine the morphological differences among taxa in the distal tibia, and whether similar morphological differences occur between pairs of closely related terrestrial and arboreal taxa.
Tibiae of 147 specimens from several museums representing nine extant catarrhine species including humans, apes, and Old World monkeys were laser scanned using a portable Minolta 910 LSS and edited in Geomagic. Thirty-one landmarks were then placed on the tibial scans using Landmark Editor software. Landmark configurations were then superimposed using Morphologika 2.0 and statistically analyzed in SAS using standard multivariate techniques, including principal component analysis and multivariate regression, to examine the relationship of distal tibial morphology to substrate type across taxa.
Results demonstrate that distal tibial orientation, shape, and plane of the talar facet differed among taxa, but showed similarities within substrate groupings across taxa. Arboreal forms have greater torsion, with medial presentation, while terrestrial forms have an increased antero-posterior length and decreased medio-lateral breath, and a flatter facet plane. These findings are consistent with more inverted foot posture in arboreal forms compared to more stability in terrestrial forms.
NSF (BCS-0452539) and UO provided financial support.

Prisoners of war or victims of raids? Population dynamics and their relationship to dynastic upheaval in southern Mongolia c. 1300-1350 AD.

B.L. Turner[1], M.K. Zuckerman[1, 2], B.A. Carlson[1], J.D. Kingston[1], G.J. Armelagos[1], D.R. Hunt[2], T. Amgalantugs[3], B. Frohlich[2]. [1]Department of Anthropology, Emory University, Atlanta, GA, [2]Department of Physical Anthropology, Smithsonian Institution, National Museum of Natural History, Washington, DC, [3]Institute of Archaeology, Mongolian Academy of Sciences, Ulaanbaatar.

This study presents findings from stable isotope analysis of eleven natural mummies recovered from the Hetz Mountain cave site, southern Mongolia. The assemblage includes both adults and children, who show evidence of violent death. They are radiocarbon dated to the 14th century during the Yuan Dynasty, a period characterized by political and economic turmoil, famine and violence as Mongolian leaders diverted resources to China. However, the historical record leaves the nature and scope of conflict in this hinterland region unclear. As mtDNA indicates a familial relationship between several individuals, these mummies were used to test two different models of warfare in the area: (1) regional warfare involving the transport and execution of prisoners of war, or (2) small-scale, disorganized violence involving the killing of local inhabitants in raids. Strontium, lead and oxygen isotopic ratios in human tooth enamel (N=4) and O isotopic ratios in bone (N=10) were characterized using previously validated methods to assess whether the individuals were local to the Hetz mountain area or if they were transported, antemortem, from elsewhere. These data were compared to isotopic signatures of archaeologically derived tissues from regions throughout Mongolia. Results provide a critical complement to the historical record pertaining to the Yuan Dynasty. They provide insight into the identity of this hinterland group and into the political economy of this historically underrepresented borderland region during a violent and transitional period in Mongolian history.
Funding provided by the National Geographic Society.

Dental health and political instability in early medieval France

E.A. Tyler. Dept. of Anthropology, The Ohio State University.

While little is known about the biological aspect of lifeways in early medieval Europe,

both historical and archaeological evidence demonstrate extensive political instability throughout Western Europe for this period. This study examines dental health during the politically volatile collapse of the Roman Empire (early period), the chaotic time of Merovingian rule (middle period) and the stable period of permanent unification of Gaul under the Carolingean dynasty (late period). Through the parameters of carious lesion, antemortem tooth loss, and abscess frequencies, this research tests the hypothesis that political instability negatively affects human dental health.
There are no significant differences in dental health between the unstable early and middle periods, despite increased incidence of all three measures in the middle period. Dental disease peaked for the three indicators in the middle period with a decline in the later, more politically stable Carolingean period. Carious lesion frequency rose from 0.22 to 0.24 (p=0.47) between the early and middle periods, antemortem tooth loss frequency rose from 0.28 to 0.30 (p=0.67), and dental abscess frequency rose from 0.05 to 0.08 (p=0.058). During the transition from the middle to the late period, carious lesion frequency fell from 0.24 to 0.15 (p=0.001), antemortem tooth loss frequency declined from 0.30 to 0.26 (p=0.086) and dental abscess frequency fell from 0.08 to 0.06 (p=0.12).
These results support the hypothesis that dental health was negatively affected by the politically unstable environment of the late Roman and post-Roman world, and improved after the unification of Gaul.

Museum opportunities for public science education.

D. H. Ubelaker. Department of Anthropology, NMNH, Smithsonian Institution.

Museums offer splendid opportunities for public education regarding evolution and other science topics. Exhibitions represent an obvious and well-known venue for museum science education. Less well known are museum-based initiatives in public lectures, workshops, short courses, television and radio, public writing, and providing opportunities for the interested public to interact directly with museum professionals on specimen-related concerns.
A continual need exists to educate the public on science topics; a public that mostly remains without access to scientific journals and may have skewed impressions of science from the material presented on the popular science oriented television programs. Examples of successful museum based programs in science education include the Smithsonian Institution's Naturalist Center, a variety of public lecture series in forensic anthropology, and "Creativity Institutes" designed to challenge corporate executives with creative problem solving on science topics. Also noteworthy in this regard is "Café Scientifique", a forum initiated in the UK for debating science issues outside of an academic setting which offers opportunities for informal dialogue between scientists and the public.

Distinct genomic signatures of adaptation in pre- and post-natal environments during human evolution.

M. Uddin[1], M. Goodman[1,2], C.C. Sherwood[3], T.E. Starzl[4], L.I. Grossman[1] , R. Romero[5], D.E. Wildman[1,5,6]. [1]Center for Molecular Medicine and Genetics and [2]Department of Anatomy and Cell Biology, Wayne State University School of Medicine, [3]Department of Anthropology, The George Washington University, [4]Thomas E. Starzl Transplantation Institute, University of Pittsburgh School of Medicine, [5]Perinatology Research Branch, National Institute of Child Health and Development, National Institutes of Health, [6]Department of Obstetrics and Gynecology, Wayne State University School of Medicine.

Despite abundant efforts devoted to investigating adaptive evolution in human ancestry, such research has largely overlooked both the deep genetic roots of our modern human phenotype, and the environment in which these genes evolved. Our aim in the present study was to identify those genes that have been the targets of adaptive evolution during human evolutionary history, broadly defined. Using comparative genomic data from 10 taxa, we found a human ancestry-specific (HAS) signature of adaptive evolution in more than 1240 genes since our last common ancestor with rodents. In addition, to determine how these HAS genes have been affected by the environment in which they are expressed, we bioinformatically identified highly expressed HAS genes from tissues (N=11) representing the two primary environments during an individual's lifetime: the prenatal and the postnatal. Functional analyses of all HAS genes indicate that distinct biological processes have been the targets of natural selection during different periods of humankind's evolutionary history. Interestingly, in the adult whole brain, the subset of highly expressed HAS genes show biological processes targeted by natural selection (e.g., oxidative phosphorylation) that differ from processes identified when considering all highly expressed genes in that tissue (e.g., nervous system development). Distinct biological processes are especially evident when comparing HAS genes from fetal and adult stage tissues (e.g., hormone activity in the placenta vs. cellular morphogenesis in the uterus), suggesting that different selective pressures act on the development vs. the maintenance of the human phenotype.
This work was supported in part by the Intramural Research division of the National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services, NSF BCS-0550209, and the Thomas E. Starzl Transplantation Institute.

ADBOU age-at-death estimation in South Africa.

N.M. Uhl. Department of Anthropology, University of Pittsburgh at Titusville.

The ADBOU computer program provides multifactorial age-at-death estimation for both modern and archaeological skeletal populations. Because the ADBOU program was developed using 19th century American cadavers, this study tested the program's applicability to a modern cadaver population from Pretoria, South Africa. The pubic symphysis, auricular surface of the ilium, and cranial suture closure were scored for 202 individuals following the scoring procedures outlined by Boldsen et al. (2002).
Previous studies on American populations have alternately shown this multifactorial method to be very effective (Boldsen et al., 2002) and only moderately effective (Bethard, 2005). Results of the current study indicate that the most effective single indicator of age-at-death is the auricular surface of the ilium ($r = 0.622$) followed by the pubic symphysis ($r = 0.564$). The cranial sutures scored in the ADBOU program proved to be very ineffective as indicators of age-at-death ($r = 0.207$). Overall, the most effective method for estimating age-at-death combined all three indicators ($r = 0.678$). This study suggests that while the ADBOU program shows promise as a multifactorial method for estimating age-at-death, a more diverse reference sample could make it more applicable internationally.

Dental health and settlement change at Early Bronze Age Bab edh-Dhra', Jordan.

J. Ullinger, Department of Anthropology, Ohio State University

This project focuses on the osteological evidence utilized as part of a bioarchaeological analysis of Bab edh-Dhra' and its inhabitants. Archaeological evidence supports the hypothesis that Early Bronze I (EB I; 3600 -3150 BCE) people were agro-pastoralists, living in small, semi-nomadic communities. Sometime during Early Bronze II-III (EB II-III; 2950 – 2350 BCE), they erected a large, walled town, supported by increased agriculture and secondary product use, near the EB I cemetery. Mortuary practices also shifted, and people were buried in large, above-ground charnel houses rather than the shaft tombs of the Early Bronze I. This paper explores the dental changes that accompanied the transition from a more nomadic to an increased sedentary lifestyle. There is biological evidence to suggest that there are some subsistence differences between EB I and EB II-III, although both groups appear to rely upon mixed economies with increasing agricultural emphasis. There is no significant difference between the groups with regards to dental caries,

although chi-square comparisons result in a significant difference in antemortem tooth loss and calculus ($p < .005$). There is also evidence to suggest that dental wear is heavier in the earlier group, although commingled remains preclude any meaningful age reconstruction of the groups at this time. Evidence from the teeth suggests that the group is increasingly relying upon agricultural and processed food products, although it may not have been a striking change from the Early Bronze I way of life.
This project was supported by a Smithsonian Institution Predoctoral Fellowship and Sigma Xi.

Anterior alveolar process curvature and diet in two West African colobine species.

O.S. Ulvi, W.S. McGraw, D. Guatelli-Steinberg. Department of Anthropology, The Ohio State University

Primates with diets requiring greater masticatory forces tend to exhibit increased facial retraction, vertically deeper faces and a more anteriorly placed masseter muscle attachment. Because of the modular nature of maxillo-facial development, modification of a single area could have implications for the rest of the system. This study tests whether a decrease in the curvature of the maxillary anterior alveolar process is associated with decreased palatal length, thus increasing the amount of facial retraction. If cranial changes producing greater facial retraction provide an increased mechanical advantage for obdurate feeding, then we expect the radius of curvature to decrease with increasing hard object feeding.
We examined crania of two African colobine species for which extensive feeding data have been collected. *Procolobus badius* feeds on large amounts of soft fruits and leaves while *Colobus polykomos* feeds predominantly on hard seeds and leaves. The radius of curvature of the anterior alveolar process and several linear measurements on the palat were recorded on fifty three colobine specimens obtained from the Ivory Coast's Tai Forest.
Our analysis indicates that there is a significant difference in the alveolar curvature between colobine species ($p = 0.029$). *C. polykomos* exhibits the least amount of curvature; however we were unable to correlate palatal length with the curvature of alveolar process. We conclude that although curvature differences of the anterior alveolar process may be associated with dietary differences, the geometry of this region is not necessarily linked to elements of facial retraction.

Investigating the importance of fallback foods in early hominins using dental microwear.

P.S. Ungar[1], R.S. Scott[2]. [1]Dept. of Anthropology, University of Arkansas, [2]Dept. of Anthropology, Rutgers University.

Morphological specializations such as craniomandibular robusticity, megadontia and tooth enamel thickness can offer important insights into potentials for early hominins to consume foods with specific fracture properties. They cannot, on the other hand, tell us much about what individuals in the past ate on a daily basis. Do such specialized adaptations reflect specialized diets, or is morphology "weighted" by occasional but still important mechanically challenging foods taken during times of resource stress?
Because dental microwear reflects fracture properties of foods eaten in the days before death, sufficiently large samples should allow us to infer patterns of food preference for a taxon, assuming a random sampling from the fossil record. Extant primates that fallback on hard, brittle foods during "crunch times" may show a distinctive pattern of microwear textures wherein most individuals sampled evince low texture complexity, with a distinct skew toward more complex surfaces.
Here we present new data for *Australopithecus afarensis* ($n = 19$) in light of microwear textures of *Australopithecus africanus* ($n = 10$) and *Paranthropus robustus* ($n = 9$). While *P. robustus* shows microwear texture values expected of a taxon that "fell back" on hard, brittle foods, *A. afarensis* has very little variation in surface complexity, despite marked geographic and temporal variation of the sample. Low complexity values suggest that *A. afarensis* may have avoided hard, brittle foods. These results hint at different foraging strategies for different hominins.
This research was funded by the US National Science Foundation.

Reconciliatory behavior in captive female chimpanzees *(Pan troglodytes)*.

M.E. Upshaw, L.D. Wolfe. Dept. of Anthropology, East Carolina University.

Between May 29th and July 31st I studied the behaviors of the nine adult female chimpanzees at the North Carolina Zoological Park in Asheboro, North Carolina. Data were collected using focal animal observations in which females were observed for 20-minute intervals. A standard ethogram was employed. While resting was generally recorded most often, the females engaged in affiliative behaviors an average of 21.15% of the time, with a range of 8.27% to 37%. The two highest ranking mothers in the group, MG and RT, had the highest levels of affiliation (30.26% and 37%, respectively). During the study period I also recorded four conflicts between eight of the nine females: MG, RB, BA, TM, RT, AM, MK, and TR. In all four conflicts, one of the females was chased by at least one other female, and in two conflicts, a female was struck by BA, the daughter of the highest ranking female, MG. After three out of the four conflicts, I observed reconciliation between those involved. These post-conflict reconciliation behaviors included kissing, grooming, sitting close to one another, and reaching. The data show that there is an association between rank, age, and affiliation in the post-conflict reconciliation.

Reconstruction of the Early Neolithic/Bronze Age Population Diversity of the Lake Baikal Region Using mtDNA Polymorphism from Shamanka II Cemetery

H. Vahdati Nasab[1, 2], T. A. Thomson[1], F. J. Bamforth[2], and V. I. Bazaliiski[3]. [1]Department of Anthropology, University of Alberta, [2]Human Identification Lab for Archaeology, Department of Laboratory Medicine and Pathology, University of Alberta, [3]Department of Archaeology and Ethnography, Irkutsk State University.

This research examines the mtDNA polymorphism among individuals buried at a Neolithic (ca. 5000-4000 BC) hunter-gatherer cemetery, Shamanka II (field season 2002), located on the southwestern tip of Lake Baikal, Siberia. The present study principal research objective aims to compare the mtDNA polymorphism observed at Shamanka II cemetery to the mtDNA results of a previous study (Mooder, 2004), which includes Lokomotiv and Ust'Ida. Like Shamanka II, Lokomotiv is representative of the same culture group (Kitoi) and is contemporaneous in age (5000-4000 BC) while Ust'Ida is representative of a Bronze Age culture group (Serovo-Glazkovo, 1000 BC). There is a pronounced hiatus in radiocarbon dates stretching between the Neolithic and Bronze Age (4900-4200 BC) cultures around Lake Baikal region (Weber, 2002). Mooder's (2004) results revealed disparate mtDNA distribution between pre- and post-hiatus groups.
Our results indicate although the Neolithic Kitoi (Shamanka II and Lokomotiv) share the identical haplogroups with the Bronze Age Serovo-Glazkovo, the frequency distributions between pre- and post-hiatus cemetery groups are very different. Thus the general model for biological discontinuity between the pre- and post-hiatus Cis-Baikal populations is not disputed.

New formulas to estimate age at death in Maya populations using histomorphological changes in the fourth human rib.

M. Valencia Pavón, A. Cucina, V. Tiesler. Facultad de Ciencias Antropológicas Universidad Autónoma de Yucatán.

Anthropological use of histomorphology to estimate age at death of archaeological or forensic human material rests upon a series of algorithms developed mainly from North American samples. Nonetheless, the aging process of human populations living in

different environmental, social and cultural conditions might follow a different pattern that could be reflected in a different OPD (Osteon Population Density), so that the application of generic formulas could result in a bias introduced by the reference sample. With this problem in mind, and considering the tropical environment in which the ancient and modern Maya population evolved, we addressed the specific research question about the validity of some of those algorithms developed for the human ribs. OPD, cortical area and osteon size were recorded from the fourth left rib of thirty-six individuals of known sex and age, who mainly died in road accidents, and spanning from age 20 to 87. They were used to develop a specific algorithm for Maya populations, which was tested on thirteen other individuals forming the control sample, and compare the results to verify the applicability of the published formulas. Results show that the new formulas using the OPD (alone or in conjunction with the other parameters) estimate age at death slightly better than the commonly used one by Stout and Paine (1992). Yet, the difference is not significant, to indicate that the latter can be used also for Mesoamerican samples. The study was funded by CONACYT 33743-H grant to Vera Tiesler.

A Single Lineage Hypothesis for the Habiline to Erectine transition in the Lower Pleistocene Hominin Record

A. Van Arsdale[1], M. Wolpoff[1]. [1]Paleoanthropology Laboratory, Department of Anthropology, University of Michigan

The re-dating of several East African Plio-Pleistocene hominin localities as well as the publication of new fossils has prompted a reappraisal of the evolutionary sequence of early *Homo* from this time period. Differing models for the relationship between *H. habilis* (and *rudolfensis*) and *H. erectus* have been presented. Spoor & Leakey (2007) suggest the two species are distinctive but overlap in aspects of their morphology and exist sympatrically for as much as half a million years. Suwa et al. (2007) suggest that within the Turkana sequence there is no reason to believe any *H. habilis* specimens occur after the earliest appearance of identifiable *H. erectus* fossils. We extend the ideas of Suwa and colleagues to the hypothesis of a single lineage in early *Homo* reflected in crania from all sites including African ones such as Olduvai and the remains from Dmanisi, Georgia. Our hypothesis is that these specimens show an evolutionary trajectory from more habiline-like specimens early in this time period to clear erectine-like specimens later. To differentiate this hypothesis from the predictions of the two-lineage hypothesis, we examine the evolution of putative male and female pairs during this time period. We find evidence for elevated, but consistent levels of sexual dimorphism in the 1.9-1.2 myr *Homo* record as well as consistent trends in the evolution of male and female characters, both of which suggest a single lineage is a more parsimonious model of evolutionary change at this time. We pay special attention to the anatomical similarities and differences between KNM ER-1813 and KNM ER-3733, two fossils of opposite sex that are critical for resolving questions of the relationship between *H. habilis* and *H. erectus*.

To fight or to cooperate? Reproductive dilemmas in male black howler monkeys.

S. Van Belle[1], K.B. Strier[2], A. Estrada[3]. [1]Department of Zoology, University of Wisconsin-Madison, [2]Department of Anthropology, University of Wisconsin-Madison, [3]Instituto de Biología, Universidad Nacional Autónoma de México.

In black howler monkeys (*Alouatta pigra*), females can mate with both the dominant and subordinate males in multi-male groups, but it is not clear whether this is a result of the inability of the dominant male to monopolize females (tug-of-war model), or the dominant male's tolerance toward subordinate males in exchange for their support in taking over and defending female groups (concession model). We suggest that the interactions of black howler monkey males co-residing in the same group may need to reach a balance between cooperation and competition to maximize reproductive success. During a 14-month field study from June 2006 – July 2007 at Palenque National Park, Mexico, five male take-over events involving 11 males were observed in one study group, and a change in two subordinate males was observed in the second study group. In one of the take-overs, a single male aggressively challenged and expelled the resident dominant male, whereas in three of the take-overs two males formed a coalition to aggressively evict the resident males. Other males joined established groups as subordinates, either with (N =1) or without (N = 1) overt aggressive interactions. Based on 1,800 hours of focal observations, we report data on rates of agonistic and affiliative interactions among males that formed or did not form coalitions, male participation in howling bouts, interindividual spacing patterns, and the frequency of male sexual activities. Funding provided by: NSF DDIG 0622386, Leakey Foundation, Department of Zoology, University of Wisconsin-Madison, and Pittsburgh Zoo Conservation Fund.

Influence of maternal and early childhood undernutrition on obesity risks in adulthood.

M.I. Varela-Silva[1], A.R. Frisancho[2], B. Bogin[1], F. Dickinson[3], D. Chatkoff[4], P. Smith[5], D. Winham[6]. [1]Department of Human Sciences, Loughborough University, UK, [2]Department of Anthropology, University of Michigan, [3]Department of Human Ecology, Center for Advanced Studies (CINVESTAV), Mexico, [4]Department of Behavioral Sciences, University of Michigan-Dearborn; [5]Department of Social Sciences, University of Michigan-Dearborn, [6]Arizona State University Polytechnic

The epidemic of childhood overweight/obesity (OW/OB) in the United States is especially strong among the Hispanic/Latino population. In addition to the obesogenic factors common to all ethnicities (low physical activity and excess energy consumption) Hispanic/Latino children also are the descendents of recent immigrants or are themselves migrants. Our research project aims to identify intergenerational components of early life undernutrition, metabolism, and behavior that lead to OW/OB in Hispanic/Latino children. Our sample includes recent immigrants from Central America to Florida, rural-to-urban migrants within Mexico, and sedentes (non-migrants) of rural Mexico. Our previous research found a continuum of variation in stature, relative leg length, and, generally, fatness with the children of migrants to the US being the tallest, longest legged, and fattest followed by children from urban Yucatan, then a coastal village, and finally an interior village of Yucatan. Children and adults from both villages showed clear signs of undernutrition. A novel approach of our new research is estimation of the nutritional status of the mothers when they were children via current relative leg length. Maternal leg length is associated with offspring birth weight, independent of mother's birth weight or mother's final height. Human and animal-model research finds that exposure to undernutrition in fetal life influences fat distribution, metabolic efficiency of dietary carbohydrate and fat utilization, locomotor activity, and appetite. All this suggests that leg length is a sensitive marker of the nutritional and behavioral environment during childhood, and may serve as a marker for intergenerational influences on risks for OW/OB.

The influence of diet and activity pattern on visual acuity: implications for primate evolution.

C.C. Veilleux. Department of Anthropology, University of Texas at Austin.

Diurnal haplorhines are characterized by high visual acuity compared to other primates and non-primate mammals. Although some researchers have suggested that high acuity in haplorhines evolved in the context of diurnal visual predation, there has been little quantitative research on the relationship between visual acuity and ecology. The goal of this project is to explore the effects of diet and activity pattern on visual acuity in a large mammalian sample. Data on mammalian acuity, eye size, diet, and activity pattern were collected from the literature (n=82 species). Least squares regression demonstrated a significant positive relationship between acuity and eye size in non-haplorhine mammals (r^2=0.83, p<0.0001). The higher y-intercept of a separate diurnal haplorhine regression indicates a grade shift from the strepsirrhine and non-primate

condition. In order to compare visual acuity across a wide range of eye sizes, residuals were calculated from the non-haplorhine regression line of acuity on eye size. Activity pattern and diet were both found to influence acuity relative to eye size. Diurnal species had significantly higher residuals than cathemeral (U=85, $p<0.05$) or nocturnal species (U=100, $p<0.05$). Furthermore, faunivorous species had significantly higher residuals than herbivorous species (U=339, $p<0.05$). Together, these results suggest that faunivory and diurnality are critical selective factors favoring increased acuity independent of eye size. This analysis thus provides further support for the hypothesis that the haplorhine last common ancestor was a diurnal visual predator.
Research supported by a National Science Foundation Graduate Research Fellowship.

An introduction to ChimpFACS: Facial measurement in chimpanzees.

S-J. Vick [1], B.M. Waller[2], L.A. Parr[3], M. Smith Pasqualini[4], K.A. Bard[2].[1] Department of Psychology, University of Stirling, Scotland, [2] Department of Psychology, University of Portsmouth, England. [3]Yerkes National Primate Centre, Atlanta, U.S.A, [4] School of Psychology, Avila University, Kansas City, USA

Are facial expressions homologous between primate species? In order to further our understanding of both primate communication and the evolution of human facial expressions, there is a need for detailed and standardised comparisons with other species. Previous research has been impeded by idiosyncrasies in coding systems across studies and a surprising lack of photographic documentation. We have recently developed a modified version of the widely used Facial Action Coding System (FACS; Ekman and Friesen 1978) for use with chimpanzees (*Pan troglodytes: ChimpFACS*). ChimpFACS was developed through the study of the underlying facial musculature of the chimpanzee face and detailed examination of facial movements, taking into account differences in the facial architecture of these two species. We created a manual illustrating the repertoire of facial movement in the chimpanzee; classified in terms of FACS Action Units (AUs). The FACS can now be applied to another species of extant hominoid (chimpanzees) and the benefits are twofold 1) allowing for micro-analysis of chimpanzee facial communication in order to better understand their social interactions and 2) adapting the most commonly used method in human expression research allows for cross-species comparisons and contributes to debates on the homology of expressions and emotions in primates.
The development of the ChimpFACS manual and test was funded by a Research Interchange grant from The Leverhulme Trust, UK (PI: K.A.Bard).

ASPM and the evolution of cortical size in an adaptive radiation of New World Monkeys

F.A. Villanea[1,2], G.H. Perry[3], G. Gutierrez-Espeleta[1], N.J. Dominy[2]. Escuela de Biología, Universidad de Costa Rica, Department of Anthropology, University of California, Santa Cruz, School of Human Evolution and Social Change, Arizona State University.

The primate community of Costa Rica is a model system for examining the underlying genetic mechanisms of encephalization. Mantled howling monkeys (*Alouatta palliata*) and black-handed spider monkeys (*Ateles geoffroyi*) are sympatric, similar in body size, and closely related, yet the relative brain size of *Ateles* is ca. twice that of *Alouatta*. The other members of the primate community; squirrel monkeys (*Saimiri oerstedi*) and white-faced capuchins (*Cebus capucinus*); the brain of *Cebus* is among the largest relative to body mass of any nonhuman primate and it is substantially larger than *Saimiri*. In addition, the neocortex of *Cebus* shares with *Ateles* the most complex pattern of fissures among the platyrrhine primates.
Recently, the abnormal spindle microcephaly related gene, *ASPM*, has been linked to the evolution of human brain size. *ASPM* has experienced significant positive natural selection in the human lineage and has been associated with greater cortical size and cognitive abilities. Here we test the hypothesis that *ASPM* has experienced significant positive selection in *Ateles* and *Cebus* in comparison to *Alouatta* and *Saimiri*, among other species. We purified DNA from each Costa Rican species and amplified exon 18, which codes for the cadmodulin-binding domain. We compared the sequences to those of other species available in GenBank. We calculated lineage specific dN/dS ratios and found that *ASPM* has not experienced significant positive selection in *Ateles* and *Cebus* (dN/dS<1). We conclude that *ASPM* is unlikely to be involved in the evolution of large brain size in these genera.
This research was funded by the Center for Tropical Research, Ecology, Agriculture and Development at UC-Santa Cruz.

Jaw-muscle electromyography during chewing in humans from a primate perspective.

C.J. Vinyard[1], H.M. Wasserman[1] and N.M. Friedman[2].[1] Dept. of Anatomy, NEOUCOM, [2] Akron Neurology, Inc.

While there have been numerous clinically-oriented studies of jaw-muscle activity during chewing in humans, these results are rarely considered in a broader primate perspective. In part, this disjunction relates to methodological differences in EMG data collection and analysis. Here we report on jaw-muscle EMG data collected from a human sample following previous methods used on nonhuman primates to foster consideration of how human jaw-muscle EMG activity fits in this broader primate pattern.
Bipolar indwelling electrodes were inserted in the left and right superficial and deep masseters, anterior and posterior temporalis and medial pterygoid muscles of five males and five females. All volunteers had normal occlusion and no history of dentofacial pathology. EMGs were recorded while subjects chewed several food types. We compared relative activity levels (W/B ratios) and jaw-muscle timing in humans to previous data collected with similar methods from nine non-human primate species.
Like non-human primates, humans tend to fire their working-side temporalis prior to the balancing-side temporalis. Like other anthropoids, the peak activity of the balancing-side deep masseter on average occurs after the working-side superficial masseter. Humans are also similar to other anthropoids in having W/B ratios that tend to be lower than strepsirrhine primates with unfused symphyses. When compared to jaw morphology, humans fit distinct primate-wide patterns linking jaw robusticity to activity patterns of balancing-side jaw muscles particularly those involved in laterally-directed forces and jaw movements.
These results indicate that human jaw-muscle activity patterns are typical of those found in other primates, particularly anthropoids.
Supported by NSF (BCS-0552285).

Postcranial remains from Okladnikov Cave, Siberia.

T.B. Viola[1], M. Teschler-Nicola[2], K. Schaefer[1], A.P. Derevianko[3], H. Seidler[1]. [1]Department of Anthropology, University Vienna, [2]Department of Archaeological Biology and Anthropology, Natural History Museum Vienna, [3]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Novosibirsk.

The fossils from Okladnikov Cave (Altai, Russian Federation) represent one of the very few pre-Upper Paleolithic human remains from Northern and Central Asia. At this site, five teeth and four postcranial fragments were found associated with a so-called "Altai Mousterian". ^{14}C and U/Th dates indicate an age between 45 - 30 kyr BP. Previous studies concentrated on the dental remains, and indicated possible Neandertal affinities.
Here we present the postcranial fragments, a distal humerus and a middle manual phalanx of an adult, and a distal humerus and distal femur fragment of a child.
The morphology of the remains in general is rather archaic. The phalanx is strongly flattened, with a very broad distal end, similar to Neandertals and middle Pleistocene *Homo*. The adult distal humerus is small with low trochlear depth and a small olecranon fossa. The medial epicondyle is small, and does not deviate strongly dorsally. The immature remains are very fragmentary, we estimate an age at death of about 6-8 years. Compared to recent humeri, the medial

pillar limiting the olecranon fossa is relatively thin, while the cortical bone is very thick. The distal shaft is strongly mediolaterally flattened, similar to Neandertals. The femur also shows relatively thick cortical bone, and a marked linea aspera with a slight pilaster. We discuss the anatomical features in relation to their phylogenetic relevance.
This study was supported by the grant GZ200.093/1-VI/2004 from the Austrian Council for Science and Technology (P.I. H. Seidler).

In-utero risk factors for women's reproductive health: Correlates of luteal and placental progesterone levels throughout pregnancy in Bolivian Aymara agropastoralists.

V.J. Vitzthum[1,2,3], H. Spielvogel[4], J. Thornburg[5]. [1]Anthropology Dept. and Kinsey Institute, Indiana University, [2]Institute for Primary and Preventative Health Care, Binghamton University, [3]Max Planck Institute for Evolutionary Anthropology, [4]Instituto Boliviano de Biología de Altura, [5]School of Mathematics, University of Southampton, UK.

The hormonal milieu during pregnancy, characterized by several-fold increases in progesterone and estrogens, appears to be a significant factor in the post-partum health of the mother and her offspring. In a prospective study of singleton pregnancies (Mucci et al. 2003), higher levels of progesterone and estrogens during gestation were associated with higher birth weight, itself a risk factor for breast cancer in the newborn's subsequent adulthood. The mechanism is uncertain, but pregnancy steroids may be affecting undifferentiated fetal mammary gland cells (Trichopoulos 1990). Elevated hormones may also modify the risk of subsequent breast cancer in the pregnant mother, perhaps by a promotional effect on pre-malignant and/or pre-existing malignant cells. Swedish women whose first two pregnancies had placenta weight (a proxy for hormone levels) >700g had twice the risk for subsequent breast cancer as those with placentas weighing <500g (Cnattingius et al. 2005).
Very little is known of interpopulational variation in the levels of pregnancy hormones. By extension from studies of variation among individuals, such hormonal variation could be contributing to populational differences in breast cancer risk. We have previously documented significantly lower mean luteal progesterone during the first 3 weeks after conception in Bolivian compared to U.S. women (Vitzthum et al. 2004). Here we examine changes in progesterone levels throughout gestation, from conception through the luteo-placental transition (as the placenta assumes a dominant role in progesterone production) and up to birth, based on serial saliva samples collected as part of a longitudinal study of reproductive functioning and health in Bolivian agropastoralists.
Funded in part by the National Science Foundation, the University of California, a Fulbright Fellowship, and EPSRC/STFC (UK).

Factors affecting foraging decisions in a wild population of sympatric orangutans (*Pongo pygmaeus wurmbii*) and white-bearded gibbons (*Hylobates albibarbis*): evidence of cognitive maps.

E.R. Vogel[1,2], L. Haag[2], S.A. Wich[3], M.L. Bastian[4], C.P. van Schaik[2]. [1]Department of Anthropology, University of California-Santa Cruz, [2]Anthropologisches Institut & Museum, Universität Zürich, [3]Great Ape Trust of Iowa, [4]Department of Biological Anthropology & Anatomy, Duke University.

Recent research has provided convincing evidence that non-human primates navigate adaptively though their home ranges by utilizing cognitive maps of their key food resources. However, few studies have addressed how morphology, physiological, and sociosexual strategies may constrain these foraging decisions. We examine 1) if ecological and demographic variables can be used to predict revisitation rates to feeding trees for sympatrically living orangutans (*Pongo pygmaeus wurmbii*) and white-bearded gibbons (*Hylobates albibarbis*) in Central Kalimantan, Indonesia and 2) if these variables differ among the two species. For both species, revisitation rates to feeding trees were predicted by tree productivity, feeding bout length, and tree species density. Although 95% of food items consumed by gibbons were also consumed by orangutans during the study period, the availability of habitat-wide, edible fruit predicted revisitation rates for gibbons but not for orangutans. Thus, similar ecological variables can be used to explain foraging decisions for both species, with the exception of habitat wide fruit availability for orangutans. For orangutans, adult females were more likely to revisit feeding trees than adult males. Both species were more likely to revisit tree species with high monthly preference scores, indicating that travel paths are organized around these preferred feeding trees. These data suggest that both species use spatial memory to move between key resources. We explain these findings in terms of the physiological, morphological, and behavioral constraints that characterize these species.
Funding for this research was provided by the L.S.B. Leakey Foundation, The A.H. Schultz Foundation, and the Denver Zoological Society.

Mound vs. Village: A Biocultural Analysis of Status and Health at the Cox Site (40AN19), Anderson County, Tennessee

J.R. Vogel

A good deal of what we know regarding the prehistoric Mississippian period (1000-1600 AD) in the Southeastern United States has been provided for by mortuary studies. Archaeological investigations have uncovered what appears to be differential treatment in burial practices among some subsets of community populations. The argument has been made that those individuals buried in ceremonial mounds or interred with finely crafted or exotic grave goods make up the "elite" sector of a population while those with less spectacular burial treatment are "commoners."
The purpose of this research is to determine if health status differs by burial location at the Late Mississippian Cox site of Anderson County, Tennessee. The site consists of one mound and an associated village. This study does not assume social rank is associated with burial location, but instead adopts a biocultural perspective to ascertain if differences in health status by burial location suggest possible differences in social status. A skeletal sample of 230 individuals was analyzed. Thirty-nine individuals were exhumed from the mound and 191 from the village. Sex, age, and health status were evaluated for each individual. Health status was determined by observing porotic hyperostosis, cribra orbitalia, dental disease, infectious disease, and linear enamel hypoplasias. An overall health score based on these characteristics was then calculated for each individual. Logistic regression as well as chi-square analyses were performed to determine any correlation between health status and burial location.
There was no statistically significant difference between burial locations as they related to overall health status. Porotic hyperostosis was the only pathology to differ significantly by burial location ($p=0.0005$). Dental disease, infection, and linear enamel hypoplasias affected both mound and village samples similarly. Possible evidence for the presence of both tuberculosis and treponematosis among the site's occupants was noted. A logistic regression of health score indicated that at any given age, if an individual exhibits one less pathology, he or she is 1.5 times more likely to be buried in the mound. However, social inequality in this late prehistoric community is not supported by any findings of biological inequality.

Human cranial variation fits iterative founder effect model with African origin.

N. von Cramon-Taubadel[1], S.J. Lycett[2]. [1]Leverhulme Centre for Human Evolutionary Studies, University of Cambridge, UK, [2]British Academy Centenary Research Centre, SACE, University of Liverpool, UK.

A number of studies have compared phenotypic and neutral genetic affinity matrices and have concluded that, on average, modern human cranial variation largely fits a model of neutral expectation. It has been noted that human craniometric and genetic data fit a model of isolation by geographic distance, yet it is not clear whether this is due to geographically

mediated gene flow or dispersal events. Recently, it has also been shown that human genetic data fit an iterative founder effect model of dispersal from Africa, in support of the out-of-Africa replacement model for modern human origins. If craniometric variance patterns are largely governed by non-neutral evolutionary forces, craniometric data can be predicted to fit such a dispersal model, in line with the genetic data. As with the genetic data, the iterative founder effect model is supported if there is a significant inverse relationship between within-group (craniometric) variance and geographic distance from a dispersal origin (Africa). Here we test this prediction by employing Howells' published craniometric dataset. We find support for the model, with up to 26% of global within-population craniometric variation being explained by geographic distance from sub-Saharan Africa. Comparative analyses using non-African origins do not yield a significant result. When potential climatic adaptation and temporal variation are accounted for, the fit with the model increases substantially, with at least 40% of global craniometric variation explained by geographic distance from sub-Saharan Africa.

The Sex of Skulls: A Study of Age and Population Difference in Sexually Dimorphic Cranial Traits.

P.L. Walker. Department of Anthropology, University of California at Santa Barbara.

The accuracy of sex determinations based on visual assessments of the mental eminence, orbital margin, glabellar area, nuchal area, and mastoid process was tested on 304 skulls of known age and sex from people of European American, African American, and English ancestry. Discriminant functions were created using data collected with an ordinal scoring system developed for these sexually dimorphic traits. The performance of these equations was evaluated in terms of their capacity to minimize both the proportion of misclassified individuals and sex biases in classification errors. Of the techniques tested, logistic regression produced the discriminant functions that best met both of these goals: a logistic model containing the scores for all five cranial traits correctly classified 88% of the skulls in the test sample with a negligible sex bias of 0.1%. Adding age at death, birth year, and population affinity to the models did not appreciably decrease these classification errors. Analysis of age-related changes in sexual dimorphism revealed an age-dependent pattern that results in younger males being misclassified at a higher rate than younger females and older females being misclassified at a higher rate than older males. This age dependence of sex determination errors appears to reflect adult growth and mortality-related processes with the potential to distort paleodemographic reconstructions in ways that are of considerable biological interest.

Remodeling variation in human skeletal elements

R.A. Walker[1], C.O. Lovejoy[2], R. Cordes[1]. [1]Dept. of Clinical Anatomy, New York Chiropractic College. [2]Dept. of Anthropology, Kent State University.

Densities of complete and fragmentary haversian systems and bone resorption are examined in the midshafts of the human humerus, radius, ulna, clavicle, femur, tibia and fibula in a sample of 16 males (mean age 68) and 23 females (mean age 80). They range in age from 14 to 107 years. Resorption is assessed as percent of the field of view composed of solid bone, excluding resorption spaces. Osteons and fragment densities are normalized to account for resorption spaces. Remodeling theory predicts that osteons and fragments will increase with age. However, among females past 60 years, osteon densities decrease with age. Normalized osteon fragments increase with age in both sexes and all bones, with the exception of the male radius, which remains unchanged. Rates of remodeling with age vary by bone. ANOVA demonstrates that osteons per sq. mm. vary by age and differ among bones, and that osteon fragments vary by sex and age. The amount of bone resorption is significantly affected by age, sex and bone within the skeleton. Principal components analysis reveals that 60 percent of the variation in the sample is accounted for by bone within the skeleton, the amount of resorption in the bone, and number of fragmentary osteons present. Remodeling behavior in a given bone thus cannot be generalized to the entire skeleton.

Footfall patterns and peak vertical substrate reaction forces in *Cebus apella*.

I.J. Wallace[1], B. Demes[2]. [1] Interdepartmental Doctoral Program in Anthropological Sciences, [2] Department of Anatomical Sciences, Stony Brook University.

Quadrupedal locomotion of primates is distinguished from the quadrupedalism of many other mammals by several features, including differences in footfall patterns during symmetrical gaits and the distribution of peak vertical substrate reaction forces on fore- and hind limbs. Primates predominantly adopt a diagonal sequence footfall pattern and sustain higher peak vertical forces on their hind limbs, while most non-primate mammals adopt a lateral sequence footfall pattern and experience greater peak vertical forces on their forelimbs. These presumably unique features of primate locomotion usually are attributed to an ancestral adaptive functional complex that facilitates cautious arboreal quadrupedalism on thin flexible branches. However, the functional relationship between footfall patterns and peak vertical force distributions remains hypothetical. We tested this hypothesis using kinematic and kinetic data collected from *Cebus apella* symmetrical gaits. *C. apella* use both diagonal and lateral sequence footfall patterns and are therefore ideal subjects for the examination of the effects of gait sequence on peak vertical force distribution. Footfall patterns and peak vertical substrate reaction forces were obtained from simultaneously recorded video and force plate data on both terrestrial and simulated arboreal supports. Our data indicate that there are no differences in peak vertical force distribution when adopting different gaits. This is true for locomotion on both terrestrial and arboreal substrates. Therefore, the relationship between interlimb peak vertical forces and footfall patterns during symmetrical gait remains unclear.
Supported by NSF BCS 0548892.

Intramuscular electrical stimulation of facial muscles in humans, chimpanzees and rhesus macaques.

B.M. Waller[1], L.A. Parr[2], K.M. Gothard[3], S-J. Vick [4], K.A. Bard[1], A.M. Burrows[5] and A.J. Fuglevand, [3] .[1] Centre for the Study of Emotion, Department of Psychology, University of Portsmouth, UK, [2] Yerkes National Primate Centre, Atlanta, USA, [3] Department of Physiology, University of Arizona, USA, [4] Department of Psychology, University of Stirling, UK, [5] Department of Physical Therapy, Duquesne University, USA.

Duchenne (1862) used surface electrical stimulation to document the movement of facial muscles in humans. Despite much scientific interest in the anatomical basis of facial expression, this seminal work had never been replicated. Here, a refined methodology (intramuscular electrical stimulation) was used to replicate these studies and also to extend the investigation to other extant primate species (*Pan troglodytes*: chimpanzees and *Macaca mulatta*: rhesus macaques). Despite early published accounts that chimpanzees and rhesus macaques exhibit less differentiated and less complex facial musculature than humans, the majority of muscles located in humans were stimulated successfully in both species, and caused similar appearance changes. Of the 14 muscles successfully stimulated in humans, 12 were stimulated in rhesus macaques and 10 in chimpanzees. Thus, all three species are capable of producing very similar facial movements. The present results provide objective identification of the muscle substrate of human, chimpanzee and rhesus macaque facial expressions, and can be used to facilitate comparative facial expression research.
This research was supported by grant RR-00165 from NIH/NCRR (to LAP), grant NS-39489 from NIH/NINDS (to AJF), grant MH070836 (to KMG) and a Research Interchange grant from The Leverhulme Trust (to KAB).

Impact of fruit abundance on bonobo party composition and social structure.

M.T. Waller[1], F.J. White[1], A.K. Cobden[2], N.M. Malone[1]. [1]Department of Anthropology and Institute of Cognitive and Decision Sciences, University of Oregon, Eugene, OR 97403, [2]Department of Anthropology, Emory University, Atlanta, GA 30322.

Bonobos and chimpanzees have evolved differences in cohesion among and between the sexes that relate to food patch size but may also reflect habitat-wide variation in fruit availability and diversity. Data from approximately 456 hours of focal animal sampling from 1983 to 2007 and fruit transects at Lomako, Democratic Republic of the Congo, are compared to male and female social strategies in party membership. When only known bonobo foods were considered, fruit abundance and the number of food patches fruiting per transect were correlated ($r=0.664$, $p < 0.02$) as was party size and fruit abundance ($r=0.693$, $p<0.03$). Fruit abundance and number of patches were not correlated with the number of species fruiting ($r=-0.019$, not significant and $r=0.074$, not significant). Regressions showed that monthly average party sizes increased significantly with the fruit abundance ($F=6.47$, $p<0.05$, R-squared 48%) but not with the number of food patches or fruit diversity. The average number of males, but not females, in a party increased with both fruit abundance and the number of food patches ($F=12.04$, $p<0.02$, R-squared 63%). This data suggests that fruit availability and the number of discrete patches of fruit are more important in selecting for bonobo sociality than fruit diversity. Female sociality varies less from month to month, whereas males congregate more in large parties associated with fruit abundance. Because high fruit abundance is associated with high density of food patches, females are able to form cohesive social bonds and males are unable to control females' access to food patches.
This research was supported by NSF grants BNS -8311252, SBR -9600547, and BCS -0610233 to FJW.

Working harder and taking longer: How frontal loads can impact female reproductive costs.

C.M. Wall-Scheffler[1], M.J. Myers[2]. [1]Department of Biology, Seattle Pacific University, [2]Department of Biology, College of St. Catherine.

Wrangham (2000) has hypothesized that loaded females might have slower optimal walking speeds than unloaded females; walking more slowly might be necessary for loaded females to offset some of the energetic costs associated with carrying extra mass. To evaluate this hypothesis, we tested females (N=20) walking unloaded and front-loaded (two loads, of 8% and 16% of body mass) and at four speeds (self-selected from eight options) centered around optimal walking speeds. We developed cost of transport (CoT) equations from each of the four speeds for each of the three loading conditions for each individual and determined the minimum CoT for each individual at each loading condition. We ran paired t-tests to determine that indeed females carrying frontal loads do have a significantly lower optimal walking speed than when they were unloaded ($p<0.04$). This implies that when traveling a given distance to acquire resources or to move to a different site, pregnant/front-sling-carrying females would most likely have to extend their travel time above that of non-pregnant females or incur much greater costs. In addition, pregnant/front-loaded females walking at their 'optimal' walking speed still incur a higher cost than that of non-pregnant/non-loaded females ($p<0.001$). A 16% increase in front loaded mass incurs a 12% increase in cost with a simultaneous 5% decrease in speed. In real terms this means that when a pregnant/lactating female and non-pregnant female (of the same non-loaded mass) both walk 20km, the pregnant/lactating female takes 13 minutes longer and costs 127Cal more than the non-pregnant female.
This research was funded by the National Institutes of Health (#G11HD039786) and the Center of Excellence for Women, Science, and Technology at the College of St. Catherine (3M Faculty/Student Collaborative Grant #271408-800707 and the Assistant Mentoring Program).

Comparing female initiation across the estrous cycle among captive *Pan paniscus* and *Pan troglodytes*.

J.T. Walz, D.E. Crews, D.M. Kitchen. Department of Anthropology, The Ohio State University.

Among sexually dimorphic species of primates, it is hypothesized that females exhibit behavioral strategies, such as copulation initiation, in order to mediate male aggression. However, the frequency and timing of female initiation among various primate species differs, often, in association with social organization and female reproductive physiology. The purpose of this study was to compare frequency of female initiated behavioral interactions across the estrous cycle among captive bonobos and chimpanzees. These two species make suitable study subjects due to shared phylogeny, and differences in social structure and reproductive physiology. Female chimpanzees face higher rates of aggression by males and, as predicted, studies in the wild, have shown that bonobo females initiate copulations less frequently than chimpanzee females. Thus, we predicted that captive female bonobos would also express fewer initiation attempts than captive female chimpanzees. We found little variation between the two species regarding frequency of female initiated non-copulatory interactions (approaches, grooming bouts, leading, touching). However, chimpanzees expressed higher copulation rates with females expressing greater tendency to initiate interactions than among bonobos. Additionally, female chimpanzees responded to male courtship displays by directing their attention to males, presenting to males, and approaching males from greater distances than female bonobos. This study corroborates evidence from wild populations and contributes to our understanding of reproductive behavior of these two species. These results contribute not only to the care and breeding of these primates in captivity, but also may inform evolutionary models of our own life-history.

Modeling the elastic properties of sutures in finite element analysis

Q. Wang[1], D.S. Strait[2], A.L. Smith[2], J. Chalk[3], B.W. Wright[4], P.C. Dechow[5], B.G. Richmond[3], C.F. Ross[6], M.A. Spencer[7], C.D. Byron[8], Peter Lucas[3], Ian Grosse[9], D.E. Slice[10], G. Weber[10]. [1]Division of Basic Medical Sciences, Mercer University School of Medicine; [2]Department of Anthropology, University at Albany; [3]Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, George Washington University; [4] Department of Anatomy, Kansas City University of Medicine and Biosciences; [5]Department of Biomedical Sciences, Baylor College of Dentistry; [6]Department of Organismal Biology & Anatomy, University of Chicago; [7]School of Human Evolution and Social Change, Institute of Human Origins, Arizona State University; [8]Department of Biology, Mercer University; [9]Department of Mechanical and Industrial Engineering, University of Massachusetts at Amherst; [10]Institute for Anthropology, University of Vienna.

Sutures as bone boundaries are important in understanding craniofacial growth and biomechanics. Recent analyses of craniofacial biomechanics have incorporated sutures into Finite Element Models of primates. In these studies, elastic moduli ranging from 1 to 50 MPa (1 MegaPascal=10^6N/M^2) were assigned to parts in FE models that correspond to sutures. However, these values, derived from tests of small sections of sutural material of various animals such as neonate rats, are likely to underestimate sutural stiffness in vertebrates with larger or more complex sutures. Our and other experiments in the literature show that average strain values in patent sutures are an order of magnitude higher than in adjacent regions of cortical bone. Thus, we predict the average elastic modulus of a suture-bone interface complex in larger mammals to be 1.0 -2.5GPa (1 GigaPascal=10^9N/M^2), at least 50 times stiffer than previously assumed. The stiffness of a suture-bone interface complex is likely achieved through the three dimensional complexity of sutural fibers, which are oriented such that they are usually under tension regardless of how adjacent bones are loaded. We present data on how the strain patterns on and across sutures vary with assignment of elastic properties of different

magnitudes to sutures in a monkey skull using Finite Element Analysis, and compare them to existing *in vivo* and *in vitro* data. Supported by National Science Foundation HOMINID grants 0725183 and 0725126.

New partial pelvis of *Dryopithecus brancoi* from Rudabánya, Hungary

C.V. Ward[1], D.R. Begun[2], L. Kordos[3]. [1]Department of Pathology and Anatomical Sciences, University of Missouri; [2]Department of Anthropology, University of Toronto; [3] Geological Institute of Hungary.

In 2006, a partial right hipbone and fragment of left ischium from a single individual were recovered at Rudabánya, Hungary. This fossil preserves the entire acetabulum, the iliac blade to the level of the auricular surface, roughly half of the superior pubic ramus, and most of the ischia excluding tuberosities. This is the only hominoid pelvis known from between 17.9 and 3.0 million years ago except for that of *Oreopithecus*. Because *Dryopithecus* likely is a member of the crown hominoid clade, the pelvis reflects torso shape as well as hip joint function, and because torso form has undergone substantial modification throughout hominoid evolution, this specimen is particularly significant. The *Dryopithecus brancoi* pelvis is small in size, with an acetabulum similar in size to that of siamangs or spider monkeys. Although the ilium is only partly preserved, it is clear from preserved contours that the blade was widely flared, with the iliac portion substantially wider than the sacral portion. The distance between sacroiliac and hip joints was intermediate in length between that of monkeys and great apes, and similar to what is seen in hylobatids. Other parts of the bone, however, such as shape of the lower ilium, appear to display more primitive morphology. Overall, this specimen is more derived and extant ape-like than that of *Proconsul*, suggesting some degree of adaption to below branch arboreality. Differences between *D. branco*i and great apes may be attributable to locomotor adaptation and/or small body size. Research supported by NSF, Leakey Foundation and ***.

Population specific craniofacial variation and its relevance to the clinical application of anthropometry.

R.E. Ward[1], E.S. Moore[2], L. Wetherill[3], T. Foroud[3], and the Collaborative Initiative on Fetal Alcohol Spectrum Disorders Consortium, [1] Department of Anthropology, Indiana University, Indianapolis, [2] St. Vincent Women's Hospital, Indianapolis, [3]Department of Medical and Molecular Genetics, Indiana University School of Medicine.

The usefulness of racial/ethnic categories in clinical research remains a controversial topic. Classic categories of "racial variation" seem to have limited biological utility yet we have previously shown that population differences in facial form complicate the diagnosis of Fetal Alcohol Syndrome (FAS). To assess population-based craniofacial variability we examined 152, 3-D facial images from four populations used in our FAS study but focused on the non FAS controls (North American Caucasians (NAC) n=31;African Americans (AA) n=13; Finnish Caucasians (FC) n=54:, and Cape Town, South Africa, mixed ancestry known as Cape Coloured (CC) n=54.) For each image, 16 craniofacial measurements were analyzed. Discriminant analysis revealed that FC and NAC could be reliably separated (82%) using 6 variables. Classification of AA and CC was only slightly less effective (78%) using just two variables. These findings indicate significant craniofacial variability *within* the "Caucasian" and "African derived" populations.
We conclude that population variability is an important consideration in clinical research, but argue further that this variability is much finer grained than that which is captured in the traditional typologies such as those required for reporting purposes by the National Institutes of Health. These findings suggest that in order to more effectively control for population-based variability, clinical studies employing anthropometry should always ascertain control data from the same populations represented in their study sample.
Support: 5U24 AA014809, U01 AA14834, U01 AA014970, U24 AA014828, U24 AA014815, U24 AA014818, U24 AA014811, Indiana Genomics Initiative

The Late Neolithic Collective Burial of Bolóres (Torres Vedras), Portugal: Preliminary Results.

A.J. Waterman, J.C. Willman, K.T. Lillios. Department of Anthropology, University of Iowa.

The archaeology of the Late Neolithic in the Portuguese Estremadura provides compelling evidence for increasing social stratification. The impact of these social transformations on human health, however, is poorly understood. In order to obtain information about health status, diet, and lifestyle patterns during this time of social change, excavations at the Late Neolithic collective burial of Bolóres (Torres Vedras) were undertaken in the summer of 2007. This poster presents analyses carried out on the skeletal and dental remains from Bolóres (MNI=10) and compares these to other Late Neolithic burials in the Estremadura. More than half of the individuals in the Bolóres sample were children under the age of five. This finding is consistent with the subadult to adult ratios at other Late Neolithic burials in the Estremadura indicating that childhood mortality rates in this region were significant during this time. Pathology rates were lower at Bolóres than the other reviewed sites. The interactions between childhood health, diet, and social organization are discussed in relation to the results of this study, and further research directions are indicated.

Does increased ranging effort lead to fewer wasted menstrual cycles?

M. Watsa, H.D. Pontzer. Department of Anthropology, Washington University in St. Louis

From the standpoint of energetic efficiency, an increased allocation of energy on ranging effort could potentially reduce resources available to other allocation categories such as reproductive effort. Since menstruation itself is energetically expensive, especially in the case of successive cycles that do not result in conception, the number of cycles per interbirth interval that are undergone before conception occurs (wasted cycles) is an energetic cost that could potentially be manipulated under conditions of increased ranging effort. We tested the hypothesis that day range, or daily distance traveled, is traded off against reproductive effort, or number of wasted menstrual cycles at the species level. Despite not holding true for primates alone, we found that in a sample of 61 mammals including primates, day range and the number of wasted menstrual cycles appear to be inversely proportional to each other once the effects of phylogenetic relatedness and body mass are controlled for. The analysis also took into account the effects of gestation and lactation as periods of amenorrhea.

Grooming symmetry in male chimpanzee dyads at Ngogo.

D.P. Watts. Department of Anthropology, Yale University.

Grooming is the most common type of affiliation between male chimpanzees. Previous analyses of male-male social interactions at Ngogo, in Kibale National Park, Uganda, have shown reciprocity group-level reciprocity in grooming and interchange of grooming for agonistic support. However, analyses at group level mask much variation within and among male dyads in the frequency and duration of grooming bouts and in the symmetry of grooming exchanges. I use data from Ngogo to examine the relationship of bout duration and of within-dyad symmetry to male age, dominance rank, rank difference, and frequency of coalition formation. Grooming distribution is highly skewed or even unidirectional in adolescent-adult dyads. Matrix permutation tests show that dyadic grooming asymmetry increases with increasing rank difference between partners, but age differences among males complicate rank difference effects. Subordinate members of some dyads receive more grooming than they give, particularly from allies, and allies generally have symmetrical grooming relationships. These and other results indicate that power differences among males, encompassing both the effects of dominance and the leverage that

individuals have as potential allies, influence grooming frequency and symmetry. They also reaffirm previous results from Ngogo (Mitani et al., 2002) that highlighted the effects of age similarity on variation in male-male social relationships.
Work at Ngogo has been supported by NSF Grants SBR-925 3590 and BCS-0215622 and by the L.S.B. Leakey Foundation, the National Geographic Society, and Yale University.

Morphological Limb Variation in Three Eco-geographically Distinct Native North American Populations

E.B. Waxenbaum, M.A. and A. B. Falsetti, Ph.D. C.A. Pound Human Identification Lab, University of Florida.

It has long been recognized that mammalian morphological variation is affected, in part, by environmental condition. Limb variation is attributed to two complementary "rules" for homeothermic animals and is often attributed to human variability. Allen's rule (1877) asserts that lower latitude populations display longer extremities while those of higher latitudes have shorter limbs stemming from gene flow from warmer geographic regions during the transition to modern *Homo sapiens*. The complementing "rule" is posited by Bergmann (1847): body mass increases as a population inhabits cooler or more polar regions resulting in shorter extremities and an overall decrease in body surface area. This study addresses limb variation among three eco-geographically distinct human groups. This research presents a comparative analysis of six postcranial elements (humeri, ulnae, radii, femora, tibiae, fibulae) drawn from three eco-geographically distinct Native North American populations: Native Alaskan (n=158), South Dakota Arikara (n=199), New Mexico Puebloan (n=116) groups. These populations are temporally conserved and share a common evolutionary history. All skeletal material is housed at the National Museum of Natural History, Smithsonian Institution and the Maxwell Museum of Anthropology, University of New Mexico. Results of analyses demonstrate statistically significant deviation of the group means for postcranial elements with variation manifest in the distal segments of both the upper and lower limbs. Similarly, morphological size variation shows strong evidence for patterning along geographic boundaries and climatic conditions. These morphological differences conform to Bergmann's and Allen's biological "rules" and suggest that temporally and evolutionary conserved groups are highly responsive to environmental condition.

Staggering under the load: biomechanics of carrying as indicated by footprint trail parameters.

D. Webb, H. Ward. Department of Anthropology and Sociology, Kutztown University.

The evolution of bipedalism allowed hominids to carry tools, food and perhaps infants more easily. Now, we all carry suitcases, grocery bags and toolboxes that sometimes comprise a large percentage of our body weight. Even though we have the strength to carry such heavy items, our locomotion can be so severely impaired that we run a significant risk of injury.
A preliminary study (Webb, 1989) suggested that there are two accomodations that humans typically make when carrying a heavy, unilateral load: intoeing on the side opposite the load; and narrowing of step width. This project, with more subjects and better experimental control, was undertaken to test the idea that both of these changes in foot placement are part of our compensation for the imbalance that occurs while carrying a load in one hand. If so, a greater load should produce more marked effects, and the hypothesis might explain the tendency to trip on one's own feet when the load (e.g., suitcase) is particularly heavy, because intoeing and narrowing the step increase the chances of catching the contralateral toes on the heel of the loaded side.
Subjects of both sexes were asked to walk on a paper runner, while wearing paint-soaked socks and carrying a canvas bag with various loads: empty; 7% of body weight; 14%; and 21%. Foot angle, step width and step length were recorded and analyzed.
We found that, as load increased, foot angle decreased (intoeing), but step width did not change significantly. In addition, step length decreased and the variability of all footprint trail parameters increased with increasing load.
Thus, intoeing appears to be a method of bringing the base of support further under the (displaced) center of mass, though narrowing the step may not be. The increased variability in foot placement was taken as an indication of "staggering" and partially explains the shorter steps (to maintain control and stability).

Transfer behavior and association patterns of female spider monkeys (*Ateles belzebuth belzebuth*) in Yasuní National Park, Ecuador.

T.H. Webster[1,2], S.A. Suarez[1]. [1]Department of Anthropology, Miami University, [2]Department of Zoology, Miami University.

It is widely accepted that female spider monkeys leave their natal communities at sexual maturity. However, few studies have supported this claim with observational data. We present data on the transfer of subadult female spider monkeys into a long-term study community, and we discuss the implications of their subsequent behavior.
Suarez studied a community of white-bellied spider monkeys (*Ateles belzebuth belzebuth*) at the Proyecto Primates Research Site in Yasuní National Park, Ecuador from August 1998 to May 2000. During two-week focal follows, he recorded all additional subgroup members at 15-minute intervals. Focal follows rotated between three adult females. Suarez collected 5264 subgroup compositions between March 1999 and May 2000. Four females appeared in the study community and associated consistently with focal subjects for the duration of the research. Transferring females were nulliparous and adult in body length, but small in weight. No males were seen to immigrate into the study group.
We analyzed associations among three of the immigrant females and resident adult females. Each immigrant female differed in their associations with particular resident females (Kruskal Wallis, Chi Squ=17.829, df=2, $p<0.001$; Chi Squ=10.965, df=2, $p=0.004$, Chi Squ=27.446, df=2, $p<0.001$), preferring to associate with two in particular. Until the end of the study, immigrant females were never observed in subgroups without adult females present. Resident females who tolerate the presence of transferring females may aid in their survival by providing information on the location of important feeding patches.
Financial support was provided by grants from the National Science Foundation and the Leakey Foundation.
Vicki L. Wedel, Dept. of Anthropology, Univ. of California, Merced.
Bone remodeling in historical African Americans.

Bone remodeling in historical African Americans.

V.L. Wedel, Dept. of Anthropology, Univ. of California, Merced.

Understanding the health and nutritional status of historical African Americans is complicated by the paucity of material and the inherent historical biases. Few skeletal remains are available for study and firsthand documentation is lacking. Bioarchaeological analyses of three historical African American skeletal series, the New York African Burial Ground (1646-1790) and the two First African Baptist Church cemeteries (1810-1841) from Philadelphia, focused on pathological conditions. In this paper, this paleopathology is considered in concert with histomorphometric data recently collected from the midshaft femur from these three series.
The sample consisted of 110 individuals from the three cemeteries. Variables include cortical width, percent cortical area, number of intact and fragmentary osteons, resorption spaces, and forming osteons. From these variables the density of intact and fragmentary osteons, mean osteon area, mean Haversian canal area, visible osteon creations, total osteon creations, effective age of the adult compacta, mean annual osteonal creation frequency, and average annual Haversian bone formation rate were calculated. The results were compared by sex and age category within and among the study populations and to the histomorphometric data from the Cedar Grove Baptist Church

Cemetery (1878-1925), southwestern Arkansas.
A trend of overall health decline and decreasing bone mass was from oldest to the most recent skeletal populations. During these years, bone mass decreased while bone turnover increased. Simultaneously, osteoarthritis and signs of adult iron deficiency (both active and remodeled) increased in prevalence, while evidence of periostitis decreased. These data suggest complex individual- and population-based responses to the stressors these people faced.

The household food insecurity and health outcomes of U.S.ñMexico border migrant and seasonal farmworkers

M.M. Weigel, D.L. Markowitz

Emerging evidence suggests chronic household food insecurity has an adverse effect on health. This study examined the prevalence, predictors and health outcomes associated with food insecurity in 100 migrant and seasonal farmworker (MSFW) households living on the U.S.-Mexico border. Data were collected using the U.S. Food Security Scale, California Agricultural Worker's Health Survey, and objective anthropometric, clinical and biochemical indicators. Food insecurity affected 82% of households; 49% also had hunger. Household food insecurity was predicted by the presence of minor children in the home and low maternal education. Food insecure households were more likely to have at least one member affected by symptoms of depression (deprimido), nervios (an ethnospecific condition), learning disorders, and symptoms suggestive of gastrointestinal infection. Although not directly associated with food insecurity, adult obesity, central body adiposity, elevated blood pressure, and blood lipid and glucose disturbances were common. These findings highlight the significant food security and health challenges faced by border area MSFW families.

Hadar hominins and cercopithecids: a taphonomic analysis of carnivore damage.

P. Weis. Department of Anthropology, Hunter College, City University of New York.

The present study assesses carnivore damage to the Pliocene hominin *Australopithecus afarensis* and cercopithecid fossils in order to gauge the relationship between carnivores and these large-bodied terrestrial primates. This is the first time that the hominin and non-hominin primate fossils from a single member of the Hadar Formation have been systematically analyzed for evidence of carnivore modification. The hypothesis addressed here is that cercopithecids and hominins each had an equal chance of becoming the prey of Pliocene carnivores. Therefore, as large-bodied terrestrial primates, it is probable that the results will reflect roughly equal proportions of carnivore damage in each group.
A taphonomic analysis was conducted on original cranial and post-cranial specimens of *A. afarensis* (NISP = 34) and cercopithecids (NISP = 79) from the Sidi Hakoma member at Hadar (~3.4 – 3.25 mya). Fossils were examined for evidence of carnivore damage, broadly defined here as "tooth marks," which includes punctures, pits, scores and gross gnaw damage. Preliminary results indicate that contrary to the assumption made in the hypothesis, hominins exhibit a higher proportion of tooth marks than cercopithecids. The difference in proportion between the groups is most pronounced when only post-crania are considered. The results suggest that although hominins and cercopithecids are both large-bodied terrestrial primates, their relationships to the environment were not the same. Possible reasons for this outcome, such as differential prey selection among carnivores or primate occupation of separate niches within the environment, will be discussed.

A comparison of craniofacial secular trends during the 19th and 20th centuries in the U.S. and Portugal.

K.E. Weisensee and R.L. Jantz, Department of Anthropology, University of Tennessee, Knoxville, TN 37996

Craniofacial secular changes over the past two hundred years have been observed in several worldwide populations. This project addresses the question of whether the pattern of change is similar across different populations experiencing the unique 20th century environment. Several studies have documented secular changes in modern populations using anthropometrics on living people, this study, however uses large, well-documented skeletal samples to compare secular trends across different populations experiencing similar environmental conditions. Both American Black and White populations have been shown to be experiencing a similar pattern of change over time. The Portuguese have also been shown to have experienced significant changes in cranial morphology over the past two hundred years. This study seeks to determine if the pattern of change seen in the American population is the same as that observed in the Portuguese sample from the same time period. Lisbon, Portugal experienced typical changing environmental conditions as in much of the U.S. and Europe whereby urban density increased and mortality patterns were dramatically changed. Unlike the American sample, the Portuguese sample is taken from a single urban population which experienced little immigration. Because of the more tightly controlled Portuguese sample, it is possible to determine if these changes in environmental conditions impacted cranial shape in a similar manner across populations or if the American experience is unique compared to other populations which were not impacted by large immigrate populations. The study uses both interlandmark distances and 3d landmark coordinate data to compare changes between populations from 1820 to 1950.

When it rains it pours: Multiple congenital pathologies in single individuals.

E. Weiss, Department of Anthropology, San Jose State University.

This study examined congenital pathologies of 284 prehistoric California Amerinds to determine whether skeletal individuals exhibit multiple pathologies including excessive limb length asymmetries (i.e., greater than average asymmetries calculated from prehistoric populations) as reported in medical literature. Skeletal condition varied from fragmentary to complete (i.e., all major bones present). Pathological individuals were examined twice to ensure pathologies were congenital and avoid including asymmetries related to trauma.
Sixty individuals (21%) have congenital pathologies; half of them exhibit multiple pathologies (29/60). Excluding fragmentary individuals, 60% (28/47) of individuals have multiple pathologies; in complete skeletons, 79% (19/24) of individuals have multiple pathologies. Differences in pathology frequency within individuals compared to skeletal condition are significant (Chi-Square = 19.33; $P < 0.01$). One-third (20/60) of pathological individuals show asymmetry; half of these individuals have asymmetry in multiple sets of limbs. Asymmetries are found mainly in complete skeletons (Chi-Square = 13.79; $P < 0.001$). There is a marginal sex difference in asymmetry with females exhibiting more asymmetry than males (Chi-Square = 5.73, $P = 0.057$).
This hunter-gatherer population has a high rate of congenital pathologies. Pathologies are often minor, such as supernumerary teeth, spina bifida occulta, and bony growths. However, one individual has a cleft palate and four other pathologies. Fused bones, such as ribs and foot phalanges are also present. This study supports that individuals born with a congenital pathology often have other congenital pathologies. Anthropologists are disadvantaged in documenting congenital pathologies due to incomplete remains and the fragility of subadult remains.

Evolution without Dogma.

K.M. Weiss, Dept. of Anthropology, Penn State University, University Park, PA.

It is astounding that so high a fraction of the US population doesn't 'believe' in evolution. However, it is also highly doubtful whether education has much to do with it. We in biology are under siege from some religious groups, and this assault could lead us to box ourselves into a corner if fear of misrepresentation lures us into not acknowledging where knowledge of evolution is uncertain. The danger is that we would be

dragged into advocating a dogma of our own, which would not be healthy for evolutionary science. A close look at the 1925 Scopes trial shows aspects of that kind of duel between dogmas. It is a challenge to decide what aspects of evolutionary biology are so firmly at the core that we can assert them strongly in school classrooms, and where we are making surmises that biological research is aimed at confirming or testing. These areas are easier to name than to solve, and there is often no consensus. But we should resist catering to the false syllogism of creationist critics that the holes in evolutionary knowledge support their claim of truth for the Bible. The latter must be demonstrated on its own merits—and those merits have come up short when put the proper kinds of test. This is a cultural struggle, being waged for a variety of reasons. How it will be won isn't clear, but we must retain control of our own agenda, which includes critically questioning what we know, and don't know, about evolution.

The Growth of Low Altitude Migrants at High Altitude on the Qinghai-Tibetan Plateau: The Effects of Socio-Economic Status and Hypoxia

C.A. Weitz[1], R.M Garruto[2]. [1]Temple University, [2]Binghamton University

The height and weight of Han (Chinese) children and adolescents who migrated to high altitude in Qinghai Provence (western China) after having been born at low altitude seems related to the date of their relocation. Children and adolescents who migrated after 1990 tend to be shorter and lighter than same-age Han born and raised at high altitude, while those who migrated prior to 1990 tend to be taller and heavier. This paper explores the possibility that differences in the sizes of child/adolescent migrants reflect a change in the socio-economic status of migrants. In the early-to-mid-1990's, liberalization of migration policies and attempts to promote the economic development of high altitude areas may have encouraged larger numbers of poorer low altitude Han to move into rural Qinghai. Those who migrated in the early-to-mid-1980's, on the other hand, are likely to have been the children of better-off government workers, who were given incentives to settle at high altitude. At the same time, and independent of stature and weight, migrants who have lived at high altitude for a short period of time show lower lung function values compared to same-aged Han born and raised at high altitude, while migrants who have lived at high altitude for many years show lung function values similar to same-aged Han born and raised at high altitude. This pattern is consistent with expectations based on the existence of developmental adjustments to hypoxia.

The Mark of Ancient Java is on none of them - Replacement without assimilation

M.C. Westaway. School of Archaeology and Anthropology, The Australian National University.

Discussion on the variability of ancient Australian crania has focussed at times on the possible role of more archaic populations from Java, Indonesia, contributing to the Australian genotype. A model favouring assimilation of Javan *Homo erectus* by *Homo sapiens* migrating through the region has been offered as the most parsimonious explanation for cranial robusticity in Australia. Twenty four individual crania (and calottes) from the Willandra Lakes, South East Australia, were compared in a number of phylogenetic analyses (cladistics and splits network) and a principal component analysis to the earliest series of anatomically modern human crania from East Africa and the Levant and the series of *Homo erectus* from Ngandong, Java. The results of the analyses indicate that there is considerable phenetic distance between the Ngandong and Willandra series. The splits network analysis provides a summary of possible relationships between individual specimens and clearly separates Ngandong from the Willandra specimens, providing no support for models arguing for assimilation of archaic populations by modern humans in South East Asia.
The range of cranial variation in the Willandra series most likely reflects some combination of sampling inadequacy, movement of a tropical coloniser population to the rigours of Australia's more arid environments, or local evolution in response to the onset of full glacial conditions.

Dental variation and biological distance of Late Mississippian populations from eastern Tennessee.

T.C. Weston[1], M.C. Griffin[2]. [1]Department of Anthropology, The Ohio State University, [2]Department of Anthropology, San Francisco State University

Biological affinity is an important consideration in developing an understanding of the relationships and patterns of microevolution among prehistoric Native American populations. Previous research indicates a high degree of biological and cultural diversity during the Mississippian period in southeastern Tennessee. In the interpretation of North American prehistory, it is important to include biological relationships in order to fully understand the dynamics of these past populations. In this study, biological distance was assessed between three Native American skeletal samples by a comparison of dental nonmetric trait frequencies.
The samples included here represent three prehistoric populations from the Late Mississippian cultural period (AD 1000-1600). Archaeological data indicates that these populations are temporally successive and correspond to the late Hiwassee Island (AD 1200-1350), Dallas (AD 1350-1450), and Mouse Creek (AD 1400-1600) phases in this region. Previous research has shown that these populations exhibit large changes in settlement patterns and mortuary practices across the three phases. It is not clear if the changes in cultural practices reflect population replacement, acculturation of in situ populations with some admixture, or merely cultural changes within an intact population. This study examines whether these three populations share a close biological affinity, or if they represent distinct biological groups. Thirty-seven dental nonmetric traits were recorded from 100 individuals. Multivariate statistical analyses were used to compare sample groups. Results of this study indicate that while there is significant diversity in terms of dental morphology, the three groups are closely genetically affiliated and represent a continuous population.

Are the alarm calls of tufted capuchin monkeys (*Cebus apella*) functionally referential?

B.C. Wheeler. Interdepartmental Doctoral Program in Anthropological Sciences, Stony Brook University

An animal call is said to be a functionally referential signal (FRS) if it is elicited in reaction to a specific stimulus and if responses to the call are independent of the presence of that stimulus. Using these criteria, the food and alarm calls of a number of avian and mammalian taxa, especially primates, have been argued to be FRS. However, previous studies of primate alarms have shown differences between Old World monkeys and lemurs in the extent of referentiality while no such study has been conducted with any Neotropical primate. This study tests whether or not the aerial and terrestrial predator alarms of the tufted capuchin monkey (*Cebus apella*) in Iguazú National Park, Argentina are functionally referential. Data were collected through focal samples taken in both natural and experimental contexts. Experiments included playbacks of conspecific alarms, predator vocalizations, and controls as well as the use of predator models to mimic natural predator detections. Results indicate that responses to both alarm types are context independent but vary with call intensity and distance to the caller, both of which may indicate the urgency of the threat. In addition, the aerial predator alarm is produced only in response to aerial stimuli and can thus be considered a FRS, while the alarm associated with terrestrial predator detections is produced in multiple contexts and may be best described as a general disturbance call. In conclusion, this study provides evidence that Neotropical primates use FRS, although perhaps to a more limited extent than do catarrhines.
Supported by the American Society of Primatologists, NSF DDIG (BCS-0550971), and the Wenner-Gren Foundation.

Head roll stabilization and muscle mitigation mechanism in human distance running.

K.K. Whitcome[1], D.E. Lieberman[1], D.M. Bramble[2], D.A. Raichlen[3], C. Sloan[1]. [1]Department of Anthropology, Harvard University, [2]Department of Biology, University of Utah, [3]Department of Anthropology, University of Arizona

Humans experience relatively high ground impact forces during running that can destabilize the head, especially at heel strike. Although head pitch is by far the largest challenge, an appreciable degree of roll also occurs (as is evident when a runner's pony-tailed hair swings recurrently from side to side). Here we analyze the kinematic and kinetic forces of head roll and how the body stabilizes angular accelerations in the coronal plane. At endurance running speeds, the head rolls towards the stance side approaching $50^{o}s^{-1}$, reaching peak rates near midstance, well after the time of peak pitching rates. Our analysis identifies a roll mediating mechanism in activation of the swing side sternocleidomastoid muscle (SCM) just before heel strike followed by a peak magnitude burst of the muscle some 40-80ms before the head attains peak roll rate. The SCM fires on the stance side as well but with much shorter duration and lower magnitude, suggesting that the increased activity of the swing side SCM functions in head roll control. There is no apparent correspondence of unilateral activity of the cranial and cervical trapezius muscles with head roll.
This research was supported by funding from NSF.

Lomako bonobo population dynamics, habitat productivity, and the question of tool use.

F.J. White[1,2], M.T. Waller[1], A.K. Cobden[2], N.M. Malone[1]. [1]Department of Anthropology and Institute of Cognitive and Decision Sciences, University of Oregon, Eugene, OR 97403, [2]Department of Anthropology, Emory University, Atlanta, GA 30322.

The study population of Lomako bonobos (Democratic Republic of the Congo) currently contains 18 females, 11 infants, and 8 juveniles and is not significantly different in composition to previous years (G=2.070, not significant). This high level of female reproductive success, infant survival, and short inter-birth interval is consistent with other bonobo populations (Wamba: G=0.11, not significant). High primate productivity is associated with high habitat productivity suggesting that bonobo population dynamics are less limited by food availability, including access to protein. Lomako bonobos use plant protein from vegetation and animal protein from termites and other invertebrates and vertebrates. Forest productivity has also been associated with variation in ape tool use in cases where chimpanzees use alternative, and often hard to access foods, during periods of fruit scarcity. Chimpanzee tool use is also associated with gaining valuable protein resources through harvesting social insects especially termites using fishing wands. Termite fishing is an important component of the tool use repertoire of many chimpanzee populations but has not been well documented for wild bonobos. Surveys of Lomako termite mounds found possible examples of old fishing wands with access to live termites through holes made by giant pangolins (*Manis gigantea*), but no recent activity. Fecal analysis during 2007 field season demonstrated that bonobos supplemented their frugivorous diet with other abundant invertebrates, mostly large caterpillars. We suggest that, while Lomako bonobos occasionally use tools to fish for termites, they focus on other seasonally abundant, more easily obtained and processed, insects as their preferred alternative protein source.
This research was supported by NSF grants BNS-8311252, SBR-9600547, and BCS-0610233 to FJW.

Molecular diagnosis of ancient tuberculosis: Is it really necessary to screen for host DNA?

A.K. Wilbur, T. Campbell, J.E. Buikstra, A.C. Stone. School of Human Evolution and Social Change, Arizona State University.

Molecular diagnosis of ancient diseases is especially interesting to the paleopathological and bioarchaeological communities because of its potential for addressing anthropological, epidemiological, and evolutionary questions. DNA sequences from ancient pathogens may provide opportunities to examine the evolution of an infectious agent, investigate the history of a global disease, and identify the causative agent in cases where paleopathological signals are ambiguous. However, such studies depend upon the amount of pathogen DNA originally present in a sample, and the preservation of ancient DNA in the sample. This study uses absolute quantitative PCR to assess the quantity of host and mycobacterial pathogen DNA from three different New World environments and time periods. Twenty-eight skeletons exhibiting classic tuberculosis lesions were obtained from southern Peru, mid-northern U.S.A., and south-eastern Canada. Human nuclear and mitochondrial, and mycobacterial repetitive and single copy loci were analyzed. Preliminary results indicate that sixty-two percent of samples contain nuclear DNA, 56 percent contain human mitochondrial DNA, and thirty-five percent contain mycobacterial DNA. In no case was mycobacterial DNA recovered in the absence of human DNA. There are significant differences in DNA recovery among the samples: human mitochondrial DNA was obtained from 39% of Peruvian remains, 100% of USA remains, and 63% of Canadian remains. *Mycobacterium tuberculosis* complex DNA was obtained from 31% of Peruvian remains, 20% of USA remains, and 50% of Canadian remains. These results support those of a previous quantitative PCR study that concluded initial assessment of host mtDNA preservation is advisable to avoid needless destruction of ancient remains.

Neutrally evolving intergenic, non-coding DNA markers provide a resolved genus level phylogeny of neotropical primates (Platyrrhini).

D.E. Wildman[1], J.C. Opazo[1,2], S.V. Yi[3]. [1]Center for Molecular Medicine and Genetics, Wayne State University School of Medicine, [2]School of Biological Sciences, University of Nebraska, [3]School of Biology, Georgia Institute of Technology

Advances in genomics enable new approaches for phylogeny reconstruction. The phylogenetic relationships of platyrrhine primates have been extensively studied from a molecular perspective over the past twenty years. These studies have mostly relied on the approach of using a few markers generated from sequences derived from mitochondrial and nuclear DNA. In addition to these sequence-based studies, Alu retroposons have been successful at inferring many of the relationships within the platyrrhines; however, key questions remain. In the current study platyrrhine phylogeny was inferred using novel genomic and computational techniques. A random genomic library was generated from *Aotus lemurinus*. Ten unlinked, non-coding, non-genic, non-repetitive, nuclear DNA markers derived from this library were sequenced in at least one representative species of every platyrrhine genus. Using this approach, we obtained a 6844 bp multiple sequence alignment that includes 19 species. The markers selected had more phylogenetically informative sites than "traditional" genetic markers. Parsimony and Bayesian analysis converged on a single topology for the platyrrhine familial relationships. Pitheciidae is sister to the other families Cebidae and Atelidae. Generic relationships were fully resolved with one exception: in parsimony, *Aotus* is sister to all other cebids; conversely, Bayesian analysis showed a clade that grouped *Aotus* as sister to a clade comprised of *Cebus* and *Saimiri*. Without an accurate New World monkey phylogeny in place, evolutionary reconstructions of anthropoid genomes, phenotypes, and behaviors will be hampered. The current study thus provides a framework for future comparative primate phylogenomic studies.

Physical activity assessment of children from the Jirel ethnic group in eastern Nepal.

K.D. Williams[1], S.A. Czerwinski[1], and J.Subedi[2], B. Jha[3], J. Blangero[4], S. Williams Blangero[4], and B. Towne[1], [1]Wright State Univesity, [2]Miami University, [3]Tribhuvan University Institute of Medicine, [4]Southwest Foundation for Biomedical Research.

Physical activity assessment of children in field settings can be challenging. This study presents pilot data collected from 123 children (62 males, 61 females) aged 5-18 years who currently participate in the Jiri Growth Study, a genetic epidemiologic study of growth and development in Jiri, Nepal. Studying physical activity in this rural population presents an opportunity to quantify daily physical activity, which has important implications for growth and development and skeletal integrity in later life.
Each child wore an Actical tri-axial accelerometer (Mini-Mitter, Bend, OR) continuously for 7 days. Raw activity counts and percentage of time spent in sedentary, light, moderate, and vigorous physical activity were calculated. Few differences in percentage of time spent in these levels of physical activity were observed between males and females of the same age. Younger children of both sexes, however, spent more time in light physical activity compared with older children. And, significant differences in vigorous activity were found between males and females after age 14 years - females spent significantly less time in vigorous activity compared with males (females: 2.7%, males: 5.4%), but prior to this age there were no differences between the sexes for this variable. This later result reflects the change in work responsibility between the sexes as they pass through adolescence - females taking on more household responsibilities and males working more outside the home.
These preliminary results describe the physical activity level of rural Nepali children. Future work will examine associations between physical activity, body composition, and skeletal development.
Supported by NIH grants F32HD053206, R01HD40377, R01AI37091, R01AI44406, and R37MH59490.

Gender and status differences in treponemal disease vulnerability in Late Mississippian Period chiefdom level samples

L.L. Williams[1], M.O. Smith[2], T.K. Betsinger[1]. [1]The Ohio State University, [2]Loyola University of Chicago

The paleopathological evidence of tertiary stage treponemal disease varies epidemiologically across time and space in pre-Columbian North America. Factors that affect disease visibility include sedentism, population density, aggregated settlement patterning, and baseline community health. Treponemal disease is ubiquitous in the Late Mississippian Period Dallas phase (AD 1200-1600) of east Tennessee. Dallas is a two-tiered simple chiefdom level society with documented status associated differences in group health. This anticipates status differences in treponemal disease visibility. Five Dallas sites with elite (mound interment) and non-elite (village interment) inhumations (n=667) were examined for evidence of treponemal disease. Approximately 4% of the total sample displayed evidence pathognomonic of treponemal disease. In comparing the combined mound and combined village samples, there was a greater prevalence of diagnostic treponemal disease in the village (4.5%) than in the mound (1.9%). The village sample also had a greater frequency of indicative but not diagnostic treponemal disease cases (4.9% versus 0%). This status distinction in the prevalence of tertiary stage treponemal infection mirrors published differences in basal community health. Examination of the sex differences revealed that males exhibit a greater prevalence of skeletal manifestations both within the mound and within the village samples. Status and sex differences in treponemal disease morbidity underscore the potential of the disease to reflect basic community health.

Phenotypic integration and evolution of the African ape third manual ray.

S.A. Williams, M.W. Grabowski, J.D. Polk, C.C. Roseman. Department of Anthropology, University of Illinois at Urbana-Champaign.

The evolution of morphological differences between species occurs through the conversion of variation within species into variation between species. As such, an understanding of within-species variation is crucial to testing hypotheses about the evolutionary causes of between-species differences. Comparisons of phenotypic variance-covariance (V/CV) and correlation matrices allow for an examination of that variation in an evolutionary context. This study compares integration and dispersion patterns of the third manual ray in and between two closely-related African apes, *Gorilla gorilla* and *Pan troglodytes*. Twenty-three linear dimensions of the third metacarpal and its associated proximal and intermediate phalanges were measured using Mitutoyo Absolute Digimatic sliding calipers. Data for each species (*G. gorilla*: n = 76, *P. troglodytes*: n = 55) were standardized for sex using a difference of means method. Selection gradients were calculated from V/CV matrices and outlying variables were identified as potential cases of directional natural selection. A matrix correlation yields a significant positive correlation (r = 0.518) and a Mantel test confirms that chimp and gorilla correlation structures are significantly correlated. Metacarpal medio-lateral head diameter and proximal phalanx dorso-palmar trochlear height exhibit extreme selection gradients between chimps and gorillas, suggesting that natural selection has acted upon these traits.

Are the Burusho an indigenous population of the Northern Areas, Pakistan? An odontometric investigation.

C.A. Willis and B.E. Hemphill. Dept. of Sociology and Anthropology, California State University, Bakersfield.

The Burusho figure prominently in the current controversy over the initial appearance of Indo-Aryan languages and the spread of traditional Vedic culture throughout South Asia. This controversy has been stimulated recently by a series of DNA investigations, which identify Indo-European speaking Pakistanis and high-status caste Hindus of North India as possessing West Asian genetic sequences in higher frequencies than either Dravidian speaking South Indian caste Hindus or non-Hindu tribals.
The Burusho are of great interest for two reasons. First, they live in far northern Pakistan the alleged route of entry of Indo-Aryan speakers. Second, although surrounded by speakers of languages assigned to the Dardic branch of Indo-European, the Burusho speak Burushaski, a linguistic isolate whose origins remain unknown. Yet, despite this linguistic distinctiveness, comparisons of mtDNA (Quintana-Murci et al., 2004) and Y-chromosome (Qamar et al., 2002) haplogroups failed to identify the Burusho as genetically unique.
This research provides another investigation of Burusho origins. Maximum mesiodistal and buccolingual diameters were measured for all permanent teeth, except third molars, from 124 Burusho school children from Gilgit, Pakistan. These data were contrasted with 17 samples of prehistoric and living inhabitants of Pakistan, peninsular India, Central Asia and the Iranian Plateau. Results indicate the Burusho share nearly equal affinities to living North Indians and prehistoric Central Asians, but no affinities to prehistoric Pakistanis or South Indians. Such results are consistent with those obtained from DNA analyses and may indicate that the introduction of Indo-Aryan languages was accompanied by gene flow from Central Asia.

Dental morphometrics in Sudanese Dinka and Nuer refugees to the U.S.

M.S. Willis, E.R. Smith. Department of Anthropology and Geography, University of Nebraska Lincoln.

Dental data from contemporary African populations are rare in the anthropological and dental literature. When dental analyses have been conducted, data more often represent populations from Southern Africa and/or from museum collections where provenience is less precise and random sampling unlikely. We assessed dental casts of 32 Sudanese refugees to the U.S., 15 Dinka, all adult males, and 17 Nuer, nine adult males and eight adult females, for tooth size and shape factors denoted as common within Sub-Saharan African populations. Although sample sizes are small, the dental data are from known regions/subtribes. Crown size measures were made for all but the mandibular incisors and canines. Among the Nuer, no measurements could be made of the maxillary canines as well. These anterior teeth had been removed just after permanent eruption during a ritualized extraction

process. Still, given that East Africa populations have rarely been part of comparative dental analyses, we wondered if dental size and morphology data would support placement of the Dinka and Nuer within the "sub-Saharan African dental complex." Thus we assessed trait frequency of the M^1 Carabelli's cusp, M_2 Y pattern, incisor shoveling, and third molar eruption. We also examined lingual features, spacing, and angle of the maxillary incisors. There were no absolute tooth size differences between Dinka/Nuer and male/female. Results are mixed with regard to placement within a Sub-Saharan African dental complex. While 10 (31%) possess a central maxillary distema, interpretation about causal factors is hindered by anterior tooth extraction and subsequent migration of the remaining teeth.

Comparison of phenotypic and genetic integration between mouse and baboon.

K.E. Willmore[1], H.A. Lawson[1], C.C. Roseman[2], J.M. Cheverud[3], J.T. Richtsmeier[1]. [1]Dept of Anthropology, Pennsylvania State University, [2]Dept of Anthropology, University of Illinois in Urbana Champaign, [3]Dept of Anthropology, Washington University in St. Louis.

In this study we use mouse and baboon mandibular data to determine if, and to what degree, morphological homology corresponds with genetic homology. Understanding the association between genetic and morphological homology will help us to determine how the genotype-to-phenotype map corresponds between species. We use morphological integration to establish morphological homology and quantitative trait loci (QTL) analyses to investigate genetic homology. Corresponding landmark data were collected from the hemi-mandibles of an advanced intercross mouse sample (N=1240) and mandibles from a baboon sample from the Southwest Foundation for Biomedical Research (N=350). Both mouse and baboon samples are of known pedigree with known genome-spanning markers, enabling us to conduct QTL analyses. Using several approaches, we calculate the degree of mandibular integration in each species to compare levels and patterns of integration between mouse and baboon. Whole genome QTL analyses were conducted for the baboon and mouse samples, and we discovered several significant and suggestive QTLs. Our results indicate that patterns of mandibular integration are significantly different in these samples; the coronoid process is most tightly integrated in mice, whereas baboon mandibles are most strongly integrated in the molar alveolar region. This suggests differences in the cohesiveness and/or identity of developmental modules in the mandible. We present data on potential candidate genes associated with the QTLs in each sample for homologous morphological traits. Our results provide new findings pertaining to the correspondence between genetic and morphological homologies as well as implications for choosing model organisms in evolutionary research.
This work is funded through NSF BCS-0523637.

A paleodemographic analysis and comparison of ageing methods for a Middle Mississippian skeletal sample from west-central Illinois.

J.J. Wilson, D.W. Steadman. Department of Anthropology, Binghamton University (State University of New York).

Paleodemography has been the subject of criticism and healthy re-examination by scholars within and outside of the field over the past 30 years. The "Rostock Manifesto" (Hoppa & Vaupel, 2002) and related research has renewed interest in ageing techniques and paleodemography while opening new avenues of inquiry. The current study examines the adult mortality pattern for the Middle Mississippian Orendorf skeletal sample (n = 268, AD 1150 to AD 1250) from west-central Illinois. The goal of the study is to explore the variability in mortality patterns between males and females from the Orendorf cemetery (n = 90) using transition and hazard analyses. A secondary goal of the study is a comparison of transition analysis to traditional methods of estimating age-at-death.
Results of the Gompertz and Gompertz-Makeham hazard analyses reveal that the force of mortality was significantly different for males and females at Orendorf. The risk of death was substantially greater amongst females during their early fertile ages. This pattern, also observed in the Dickson Mounds and Norris Farms cemetery samples from the region, raises questions regarding variability in sex-specific mortality patterns over the course of the Holocene. Measures of association show a significant correlation between ageing methods. On average, transition analysis tended to estimate individuals' ages-at-death slightly older than traditional methods. These findings are important as the elderly demographic has been ignored by traditional techniques, which confined skeletons to 50+ age categories.
This research was supported by travel grants from the Max Planck Institute for Demographic Research.

Modeling mortality in the Forensic Anthropology Center's body donation program.

R.J. Wilson, B.F.B. Algee-Hewitt, L. Meadows Jantz. Department of Anthropology, University of Tennessee.

The Body Donation Program at the University of Tennessee provides an unprecedented diversity of modern skeletal materials for the William M. Bass Skeletal Collection. Although Medical Examiner donations of unclaimed individuals once made up the majority of the remains curated, Family and Self-donors now contribute 65% of the 825 donations received to date. Analyses of the age-at-death distribution of this collection suggest that the source of donation differentially affects the age composition of the entire reference population and may indicate that the patterns of mortality are shaped by current socio-economic trends. Through the application of hazard models of mortality, this study examines the differences in the age-at-death distributions for three sub-populations: 240 Medical Examiner, 416 Family, and 104 Self donations. Using a Gompertz-Makeham model to represent adult mortality for individuals of legal donor age (>18 years), preliminary analyses identify sub-population specific age distributions. Average ages-at-death are calculated as 54 years for Medical Examiner, 61 for Family, and 75 for Self donations.
These results are compared to estimates for the Pre-donor population: a sample of 1188 living individuals who have pre-registered for the program. Results suggest that the age distribution of the Self-donors is informative for the estimation of the age-of-transition from Pre to Self-donor. Predicted mortality profiles for living donors are essential to the coordination of the resources necessary to accommodate the anticipated influx of future donations.

Cultural and ecological factors impeding AIDS programs in rural northwestern Tanzania.

L.A. Winkler. Department of Anthropology University of Pittsburgh at Titusville.

Anthropologists are sensitive to cultural and ecological factors which influence the epidemiology of disease. These can be complex, particularly in rural Africa where cultural diversity is broad and communication and medical access limited. The present study examines factors influencing the awareness of AIDS and access to treatment programs in rural northwestern Tanzania. This project is a collaborative effort (since 2002) with Nyakahanga Hospital (Karagwe District) which houses numerous community health programs related to HIV services. HIV testing records were collected and analyzed from blood donors, pregnant women and volunteers. In addition, ethnographic interviews were conducted with staff in AIDS treatment and antiretroviral programs. Compliance to program goals was assessed for participants and staff in the HIV antenatal program. Rates for HIV vary between sentinel groups due to factors related to age and composition of the groups. HIV rates also vary geographically in this district (2.6-18.5%) with 25% of the wards having HIV rates greater than 10%. Individuals near the primary roads are much more likely to seek HIV services including access to testing and AIDS education. Although mobile clinics provide HIV testing to areas proximate to the hospital, access to other HIV services are limited to those unable to travel to the hospital. Geographic distance, access to

transport, impassable roads during the rainy season and subsistence demands (horticulture) are limiting factors for access to hospital services. Additionally, hospital staff shortages and endemic malaria epidemics affect HIV program services with compliance in some programs only at 20%.

Cementum annulations as physiological events: Its potentials and its limits.

U. Wittwer-Backofen. Institute for Human Genetics and Anthropology, University of Freiburg, Germany

Tooth Cementum Annulations (TCA) techniques have faced deep interest during the last decade after its general use as age indicator has been proved. The main question is no longer whether TCA is correlated to age but how good resulting age estimations are correlated to chronological age. It is also far from being clear whether the cementum layers represent years of life, what the underlying trigger mechanisms are, and whether dark and bright cementum layers in transmission light microscopy represent varying density and/or structure of the hard tissue.
Recent projects are dealing with the counting standardization by automatic algorithms. Such efforts have delivered results comparable to manual counting in good quality images. No general applicable solution is available yet showing that semi-automatic procedures might be most helpful in supporting manual counting.
Evaluation studies in age known modern samples do not deliver same error ranges as in soil exposed samples. Some of the assumed factors were tested in detail.
The variability of microscopic image quality is another problem. Defective images cannot be excluded by their histological appearance alone, leading to a considerable degree of uncertainty when applied to unknown samples.
Another area of application is the detection of stress markers in the cementum due to metabolic disorders. Few ideas about causes effecting cementum exist, but we are far from understanding the influencing factors. There is large potential in this application for the analysis of life history variants in prehistory. The contribution summarizes recent findings for all aspects connected with the TCA method.

Night work: sleep, state regulation, and life history

C.M. Worthman. Department of Anthropology, Emory University.

The essential function of sleep remains a biological riddle, although the negative effects of sleep dysfunction are widespread and apparent. Current advances in sleep physiology point toward its functions for memory consolidation and underscore its role in state regulation and resource partitioning. State regulation determines alertness levels, orienting, and attentional focusing under concurrent organic and situational demands. As such, it both is informed by affective processing of ecological demands and directly modulates partitioning of limited valuable resources (attention, energy, time). As an aspect of state regulation, sleep reflects proximal determinants of resource allocation. This paper presents a model of sleep as a dynamic moderator of life history algorithms and applies it to resolving persistent empirical paradoxes involving sleep (why sleep restriction promotes obesity, why sleep disorders are so prevalent in certain settings, and why entire populations do not sleep as they "should"). Linkages to stress emerge from this analysis as a cross-cutting aspect not only of sleep but also of state regulation in general regarding security/threat, acute/long-term demands, and social/material resources. Newly proposed key features of human sleep related to these insights include cue dependency and a sleep restriction reflex. Physical anthropologists have been slow to consider this most common of behaviors, even as they have been slow to attend to the psychosocial aspects of human adaptation indexed by state regulation. Now is the time to close these gaps.
Supported by NIH MH61584, DA011301, and the Emory University Research Committee.

Evaluating alternative scenarios for fallback foods in early hominin evolution.

R. W. Wrangham. Department of Anthropology, Harvard University.

Increasing evidence points to underground storage organs (USOs) as the principal fallback foods for australopithecines, but the nature of the USOs has been little discussed. USOs could have provided two main kinds of fallback foods, either water-associated (e.g. sedge corms and water-lily rhizomes) or dry-country (e.g. various tubers). To evaluate their relative importance I consider (1) the modern distribution of USOs, (2) the use of USOs by baboons, (3) the ecological association of USOs with preferred foods, (4) the inferred habitats of australopithecines, (5) the use of USOs by hunter-gatherers and (6) the problem of australopithecine origins from a *Pan*-like ancestor. While both types of USO may have been important, I conclude that water-associated USOs are likely to have been predominant in the diet, particularly during the early phases of australopithecine evolution. This analysis presents challenges for the dry-country (savanna chimpanzee) scenario of hominin origins.

Methodological considerations: Osteoarthritis and the significance of porosity in the William M. Bass Donated Skeletal Collection.

K.T. Wren. Dept. of Anthropology, University of Tennessee.

The objective of this study was to determine whether a relationship exists between osteoarthritis and porosity severities as a result of the criteria used to identify osteoarthritis. The hips and knees of a total of 231 individuals from the contemporary William M. Bass Donated Skeletal Collection were examined. These individuals included 26 African American males, 87 European American females, and 118 European American males. African American females were excluded from this examination due to their extremely small sample size. These joints were analyzed using ANOVA and Fisher's Exact tests. Results show that the relationship between osteoarthritis and porosity severities did change when different criteria were used to identify osteoarthritis. A relationship also exists between porosity and osteoarthritis severities in the left hips of the two male groups. This suggests that porosity is related to osteoarthritis and consequently should not be excluded as a criterion for osteoarthritis presence.

Fallback foraging as a way of life: dietary variability and skeletal morphology in tufted capuchins

B.W. Wright[1], K.A. Wright[1], J. Chalk[2], M. P. Verderane[3], D. Fragaszy[4], E. Visalberghi[5], P. Izar[3], E.B. Ottoni[3]. [1]Kansas City University of Medicine and Biosciences, [2]Dept. of Anthropology, George Washington University, [3]Dept. of Experimental Psychology, University of São Paulo, [4]Dept. of Psychology, University of Georgia, [5]Institute of Cognitive Sciences and Technologies, National Research Council, Rome

The genus *Cebus* is arguably the best extant model for examining the role of fallback foods in the evolution of living and fossil primates. *Cebus* includes the robust tufted capuchins which exhibit skeletal features that have been termed specializations for the exploitation of hard and tough foods. Paradoxically, these "specialized" taxa belong to the most ubiquitous group of closely related primates in South America and thrive in a range of different habitat types. Their ability to thrive in these habitats appears at some sites to be a consequence of their ability to exploit seasonal and often obdurate fallback foods. In this study we compare the manner in which tufted capuchins exploit palm fruits and the dietary mechanics of exploited palm tissues at Turtle Mountain, Guyana (tropical rainforest) and Boa Vista, Brazil (seasonally dry woodland). Only the mesocarp of palm fruits was ingested at Turtle Mountain, which demanded tearing through extremely tough exocarp (10,909 Jm^{-2}) with the hands and mouth. At Boa Vista exploited palms are extremely hard on average (4+ GPa) and are cracked to gain access to the kernels within. The use of tools to crack palm fruits at Boa Vista circumvents the need to produce and dissipate high masticatory forces, but may be the selective agent responsible for their relatively short hind limbs and relatively massive forelimbs. These initial findings

corroborate the hypothesis that the anatomical specializations identified in tufted capuchins are a suite of niche broadening features permitting exploitation of a range of habitats and food resources.
Research funded by NSF (#9972603 and #6680238), National Geographic Society (#083-0370A-6025525), and the Kansas City University of Medicine and Biosciences.

Is climate change affecting plant phenology and rain forest lemurs in Madagascar?

P.C. Wright[1, 3] B. Greene[2], P. Rakotonirina[3] and J. Scirbona[1, 3]
[1]Department of Anthropology, Stony Brook University, [2] Department of Ecology and Evolution, Stony Brook University, [3] Centre ValBio, Ranomafana

Despite the overwhelming evidence for climate change, there are few data documenting the possible effects of changes in rainfall and temperature on the long-term population dynamics and persistence of primates. Given the many roles that primates play in the functioning of tropical ecosystems, changes in their population dynamics might accelerate ecosystem change in unpredictable ways. For the past 21 years within the moist humid forests of Ranomafana National Park, Madagascar, we have been monitoring both fruit trees and lemurs. Four individual trees of 25 tree species have been monitored once a month for fruits, flowers and new leaves over each annual cycle. *Propithecus edwardsi* (Milne Edwards' sifakas) are captured, weighed and measured at least once a year to assess health. Female lemurs are surveyed once a week in the birth season and once a month over the remaining annual cycle to record birth, migration and death. We have found that although annual rainfall totals are not changing (3000mm/yr), there are more dry months (5 vs. 3mo.) in the last decade on average than in the previous three decades. Finally, we stress the need and importance of long-term monitoring programs for primates and the plants they eat in order to better understand effects of climate change. If we understand the magnitude and effect of changes, we will be better prepared to take appropriate conservation actions for those primates with strategic conservation value and/or endangered primates, such as lemurs.
Supported by: Conservation International, Stony Brook University, and NSF.

Functional models of morphological integration in *Propithecus verreauxi verreauxi*.

R.E. Wunderlich[1], R.R. Lawler[2]. [1]Department of Biology, James Madison University, [2]Department of Anthropology, Boston University.

One explicit component of the theory of morphological integration is that integrated traits serve a common function. Functionally interacting traits are expected to evolve strong phenotypic and genetic correlations via correlational selection. Patterns of morphological integration are commonly assessed inductively, by examining the covariance structure of numerous traits and then developing an *a posteriori* interpretation of the data within a functional or developmental framework. Here we employ a less common approach, developing *a priori* hypotheses of integration based on functional models and then comparing these models to the observed pattern of integration. Using conditional independence graphs, we specify three models of integration among eight linear postcranial measurements (lengths of humerus, radius, hand, femur, tibia, foot, trunk and tail). The three *a priori* models imply different patterns of trait integration corresponding to morphological correlates of thigh-powered leaping, grasping/suspension, and vertical-clinging. We compare these functional models to the observed pattern of integration using data collected from over 100 wild-caught adult *Propithecus verreauxi verreauxi*. We use information theoretic statistics such as Akaike's information criterion and model deviance in order to determine the correspondence between the observed data and the three models. Our results indicate that the observed pattern of integration best resembles the model emphasizing vertical clinging, suggesting strong integration of traits related to vertical clinging, and also implying strong correlational selection on traits related to orthograde postures. We discuss the implications of our results in the context of the evolution locomotor behaviors in indrid primates.

Fallback foods and dietary partitioning among Pan and Gorilla.

J. Yamagiwa, Kyoto University.

Gorillas and chimpanzees are distributed in Equatorial Africa overlapping their range widely. Their digestive physiology is oriented toward frugivory and based on the caeco-colic fermenting system, and dietary overlap in fruits is high between them. These findings predict high levels of competition for foods between gorillas and chimpanzees in the areas where they coexist sympatrically. However, they rarely encounter around the fruiting trees and are lees competitive over foods than expected, probably due to different response to fruit scarcity and fallback foods. Vegetative foods and fruit species with long availability play the role of fallback foods for both apes. While gorillas change the amount of fibrous foods to consume according to fruit availability, chimpanzees persistently seek fruits with supplemental use of animal foods. Such differences may be attributed to the differences in foraging strategies and gregariousness between gorillas and chimpanzees. Chimpanzees show fission-fusion grouping patterns and their ranging are strongly influenced by fruit abundance and distribution. By contrast, community structure may form constraint factors on group cohesion and similar home range size of gorillas. Different features between THV and animal foods as fallback foods may have contributed to formation of contrasting gregariousness and social interactions over foods in gorillas and chimpanzees under sympatric conditions. Their face-to-face interactions, tool use, food sharing may reflect such differences.

A comparison of gastrointestinal tracts of sympatric *Hapalemur* species.

N. Yamashita[1], C.L. Tan[2], C.J. Vinyard[3]. [1] Dept. Anthropology, University of Southern California, [2] Center for Reproduction of Endangered Species, Zoological Society of San Diego, [3] Dept. Anatomy, NEOUCOM.

We compared the gastrointestinal anatomy of *Hapalemur* species to determine if gut morphology was correlated with observed differences in diet. The lemur species primarily fed on two different bamboo species throughout the year but concentrated on parts with different mechanical properties. *Hapalemur simus* and *H.g.griseus* cadavers (n=2 for both) were dissected at a zoo (PBZT) in Madagascar. *H.aureus* cadavers were unavailable. Gastrointestinal tracts were removed from the abdominal cavity, measured following Campbell et al. (2000), and photographed. Specifically, the lengths of the small intestine, cecum, and colon were measured after the tract was dissected. Compared to *H.griseus*, *H.simus* has a longer total intestine length and longer individual segments relative to trunk length. Relative to total intestine length, however, none of the individual segments differs in length between taxa. Individual parts of the *H.griseus* tract relative to total tract length are nearly identical to those reported in Campbell et al. (2000); therefore, their findings for *H.griseus* relative to four other lemur species can be extended to *H.simus*: both *Hapalemurs* have relatively long small intestines and correspondingly short large intestines, short intestines overall, a sacculated colon, and a short, non-differentiated cecum. *H.simus* does not elaborate any part of its tract compared to *H.griseus* despite marked differences in the structure of their diets. Perhaps a specialization on bamboo precipitated a shift toward shorter intestines that emphasize fast gut passage rates in the larger *H.simus* and a reliance of food parts, such as bamboo pith, that require minimal processing in the smaller *H.griseus*.
Supported by NSF BCS 0420133 and the Zoological Society of San Diego.

The isotopic ecology of *Theropithecus* in North Africa: changes in foraging ecology and movement through time.

J.D. Yeakel[1], D. Geraads[2], P.L. Koch[3], N.J. Dominy[1]. [1]Dept. of Anthropology, University of California, Santa Cruz, [2]CNRS, Paris, [3]Dept. of Earth Sciences, University of California, Santa Cruz.

Theropithecus was once widely distributed across Pliocene Africa. Species ranged from the northwest Mediterranean coast to the southern Cape, developing unusually large body sizes across taxa. Prior isotopic analyses of Pliocene *Theropithecus oswaldi* from South Africa support a graminivorous diet. We measured the $d^{13}C$, $d^{18}O$, and Sr^{87}/Sr^{86} of *Theropithecus* in North Africa during two distinct time intervals (2.5 Ma and 0.7 Ma) to determine differences in feeding and behavioral ecology as a function of environmental variables. Using the isotope aridity index developed by Levin et al. (2006), we suggest an increasingly arid North African environment may explain isotopic shifts within *Theropithecus* spp. relative to co-occurring fauna. Our initial results indicate distinct differences in theropith $d^{18}O$ variability from the late Pliocene to Mid-Pleistocene, suggestive of a changing foraging strategy during this time interval. North African theropiths reveal depleted $d^{13}C$ values (-13.4 to -10.6‰), which is not surprising given the Mediterranean Coast is nearly entirely composed of C_3 grasses. Importantly, nutritional differences in C_3 and C_4 grasses, and the indication that different *Theropithecus* populations are partitioned among these resources, suggest possible physiological and socioecological implications. Initial strontium isotope results of North African theropiths suggest landscape utilization that is significantly different from co-occurring grazing animals. Results of this study suggest dietary and behavioral flexibility of North African *Theropithecus* spp.in response to climate change during the Plio-Pleistocene.
Funding was received from the American Philosophical Society, the UC-Santa Cruz Committee on Research, and the Wenner-Gren Foundation.

Diet and health of an antebellum African-American slave population from central Virginia.

C.J. Yoder[1], D.C. Boyd[1], C.C. Boyd[1] and E.J. Bartelink[2]. [1] Department of Sociology and Anthropology, Radford University, [2] Department of Anthropology, California State University, Chico.

The Robinson cemetery is an antebellum African-American cemetery that was found on the Woodstock Plantation in Henrico County, Virginia. A total of 44 individuals have been excavated and analyzed from this site. Basic demographic information such as sex and age-at-death, as well as stature, bony signs of infection, dental health and activity patterns have been examined and presented previously (Boyd and Boyd, 2007). The current study furthers this research by examining the diet of the individuals interred at this cemetery and by exploring the relationship between diet and health in this sample. Stable isotopic analysis of carbon and nitrogen, paleopathological analysis, and ethnohistorical documentation are used in the assessment of diet. As predicted, the Robinson site is characterized by high frequencies of subadult mortality, infection and non-specific stress. Preliminary data indicate that the diet of the individuals interred at the cemetery was highly cariogenic, as 92% of adult individuals from this site have a carious tooth and the overall caries rate for the site is 17.8%. Bony evidence of anemia, as evidenced by cribra orbitalia and porotic hyperostosis, is rarer at this site, as only 7.4% of adults exhibit porotic hyperostosis, and 3.7% of adults show signs of cribra orbitalia. These data will be interpreted in conjunction with the isotopic and ethnohistoric data to provide a more complete understanding of not only diet in an African-American slave population, but also the relationship between dietary and health indicators in bioarchaeological assessments.

Forelimb and hind limb forces in developing squirrel monkeys (*Saimiri boliviensis*)

J.W. Young, Dept. of Anthropology, University of Texas, Austin, TX, 78712.

Primates are unusual among mammals in experiencing higher vertical peak forces (Vpk) on their hind limbs (HL) than their forelimbs (FL). Low FLVpk/HLVpk ratios among primates have been attributed to active reduction of FLVpk via increased FL compliance (e.g., Schmitt, 1999). However, focus on FL mechanics alone may have obscured the importance of HL mechanics in determining FLVpk/HLVpk ratios. In this study, I exploited ontogenetic variation in growing squirrel monkeys to test whether differences in FLVpk/HLVpk ratios resulted primarily from 1) active reductions in FLVpk via greater FL compliance or 2) passive increases in HLVpk caused by placing the HL closer to the center of mass (CM).
I filmed five squirrel monkeys *(Saimiri boliviensis*; age range: 74-302 days, body mass range: 218-535g) weekly as they traversed a three-meter long runway or elevated pole into which two force transducers were incorporated. A total of 400 symmetrical strides (i.e., walking and running) were analyzed. FLVpk/HLVpk ratios declined with increasing body size across substrates, although the pattern was more pronounced for pole strides. FLVpk (in % body weight) decreased only slightly during development and was unrelated to fluctuations in shoulder height, a measure of FL compliance. In contrast, HLVpk increased with body size on both substrates. Moreover, increases in HLVpk were directly associated with decreased horizontal distance between the foot and shoulder. These results suggest that changes in HL mechanics resulting from simple shifts in foot position relative to the trunk and CM may contribute to primates' unique mode of weight distribution.
Supported by L.S.B. Leakey Foundation Grant 38648

The epigenetic effect of activity level on functional integration of the limbs.

N.M. Young[1], B. Hallgrímsson[2], and T. Garland, Jr.[3]. [1]Department of Orthopaedic Surgery, University of California at San Francisco, [2]Department of Cell Biology and Anatomy, University of Calgary, [3]Department of Biology, University of California at Riverside.

Previous analyses indicate significant covariation between homologous limb elements that varies in relationship to presumptive selection for functional integration. It has been proposed that neuromuscular coordination plays an epigenetic role in the functional integration of associated bones, a factor that could help to explain observed variance in limb integration among species. To investigate whether postnatal activity has a significant effect on variance within limbs or covariance between limbs, we compared four groups of mice from a long-term selective breeding experiment investigating activity levels: (1) mice selected for increased voluntary activity and allowed free access to a running wheel, (2) selected mice without access to a running wheel, (3) control mice with free access to a running wheel, and (4) sedentary control mice. Mice originating from selected lines ran significantly more than control mice, but when controlled for variance in body size, our results indicate no statistically significant difference among these groups in either variance or morphological integration of the limbs. A possible explanation for this result is that whereas baseline levels of postnatal activity may contribute to integration, increased levels of activity do not further refine the system. Investigations of earlier timepoints and/or use of models in which neuromuscular coordination is impaired are required to determine when and to what degree epigenetic factors contribute to functional integration of the limbs.
This research was supported by the Alberta Ingenuity Fund (#200300516), the National Science and Engineering Research Council (#238992-02), Alberta Innovation and Science (#URSI-01-103-RI), and the National Science Foundation (IOB-0543429).

Growth and development in medieval Écija (Spain).

S.R. Zakrzewski & A. Di Loreto. Dept of Archaeology, University of Southampton, UK.

Little is known archaeologically about the Islamic conquest of Spain in AD 711. Following complete excavation, and with the support of the local Imam, this is being rectified by skeletal analysis of the large Islamic necropolis from Écija (located east of Sevilla on the Guadalquivir plain). The cemetery contains over 4500 inhumations, including many juveniles.
Stages of dental and skeletal maturation were assessed for a case study series of 28 juveniles deriving from varying periods of the Islamic necropolis. Individuals were selected for skeletal completeness on the basis of

having associated dental and long bone elements. Dental ages were assessed following Gustafson & Koch (1974), Liversidge et al. (1993), Moorees, Fanning & Hunt (1963 and Ubelaker (1978). Long bone ages were assessed following Fazekas & Kosa (1978), Maresh (1970), Scheuer et al. (1980) and Ubelaker (1999). The highest correlations between dental and skeletal ages were found in individuals under 2 years old. After 2 years of age, dentally derived ages were higher than the associated long bone derived age estimates. These results are placed into a broader Medieval context, and are discussed with regard to stunting, health, diet and potential effects of population variation within early Islamic Spain.
Partially funded by the British Academy.

The influence of foot posture on effective mechanical advantage at the knee and ankle during human bipedalism.

A. Zeininger, Department of Anthropology, The University of Texas at Austin

In order to maintain posture during stance, extensor muscles must actively counteract ground reaction force (GRF) moments. Among quadrupedal mammals, including primates, extended limb joint postures have been shown to increase the effective mechanical advantage (EMA) of extensor musculature by reducing the moment arm of the GRF. Although humans walk with extended knees, mass-specific EMA at the knee is unexpectedly low. It has been suggested that low knee EMA is a consequence of plantigrade foot posture. However, because all humans are plantigrade during walking, this hypothesis has not been directly tested. This study tested the hypothesis that, compared to plantigrady, bipedal digitigrady would increase knee EMA by more closely aligning the knee joint with the GRF. Digitigrady was also assessed for its effect on EMA at the ankle.
3D kinematic and force plate data were recorded for 12 human subjects during 60 plantigrade and 60 digitigrade (tip-toe) walking trials. EMA was calculated at midstance. Contrary to predictions, digitigrady increased GRF moment arms and lowered EMA at both the knee and ankle. Subjects adjusted to digitigrade foot postures by flexing their knees, most likely in order to lower the center of mass and increase stability over a small base of support. Results demonstrate that digitigrady does not necessarily decrease GRF moment arms. Thus, with respect to EMA at the knee and ankle during human bipedalism, plantigrady does not appear to be disadvantageous compared to digitigrady.
Supported by an NSF Graduate Research Fellowship.

Mandibular modularity of a rodent model system

M.L. Zelditch. Museum of Paleontology, University of Michigan..

The idea that developmental systems are modular has become a major theme in evolutionary developmental biology. The rodent mandible is currently a favored model system because it forms from six developmental modules that must be tightly regulated, both temporally and spatially, to produce a functioning whole. Additionally, these mandibular modules must be coordinated with developing muscles, a coordination that likely arises early in development but which regulates mandibular morphogenesis later. Whether musculoskeletal interactions integrate or modularize the jaw is an open and obviously fundamentally important question.
According to some models, musculoskeletal interactions integrate the ascending ramus. However, other models propose that they integrate individual processes or act even more locally, integrating only the regions on which the muscles insert. The one clear point of agreement is that the molar and incisor alveoli form an integrated unit separate from the more proximal ramus and processes. Preliminary results on jaws of adult deer mice (*Peromyscus maniculatus bairdii*) show an unexpectedly complex structure of integration between proximal and distal jaw regions: the molar alveolus is as highly correlated with the angular process and part of the condyloid process as it is with the incisor alveolus. Moreover, the angular is as highly correlated with the incisor as it is with the condyloid although the condyloid is not correlated with the incisor. Our results thus indicate a complex pattern of integration between teeth, muscles and bone as well as a structure better represented by a network than a nested hierarchy of semi-autonomous modules.

Genetic Heritage and Native Identity of the Seaconke Wampanoag Tribe of Massachusetts.

S.I. Zhadanov[1,2], M.C. Dulik[1], M. Markey[3], T.G. Schurr[1], The Genographic Project Consortium. [1]Department of Anthropology, University of Pennsylvania, Philadelphia, PA; Institute Cytology and Genetics, Novosibirsk, Russia; [3]Seaconke Wampanoag Tribe, Seekonk, MA.

The name 'Wampanoag' means 'Eastern People' in the local dialect of Algonquian language. Once extensively populating the coastal lands and neighboring islands of the east coast, the Wampanoag Indians now consist of only two federally recognized tribes in present-day Massachusetts, the Gay Head and Mashpee Wampanoags. Because of repeated epidemics and conflicts with English colonists, including King Philip's War of 1675-76, the Wampanoag population size was drastically reduced from as many as 12,000 individuals in the 16th century to less than 400 as recorded in 1677. As a consequence, the history and tribal integrity of the Seaconke Wampanoag has largely been lost. To investigate the influence of the historical past on their biological and native cultural identity, we have collaborated with the Seaconke Wampanoag on a study of genetic variation in its members. Our initial results indicate that the majority of their mtDNA haplotypes belongs to West Eurasian and African lineages, thus reflecting the extent of contact and interaction with people of European and African descent by the remnants of Wampanoag groups on the east coast. On the paternal side, Y-chromosome analysis revealed a mixture of Native American, West Eurasian and African haplogroups. By comparing these genetic data with genealogical and historical information, we are reconstructing the tribal history of the Seaconke Wampanoag back to at least the early 18th century. This analysis provides important evidence about Native American populations in Massachusetts and their genetic affinities with other Indian populations in New England.

Roughing it: what it takes for Hapalemur, bears and rodents to chew bamboo.

S. Zohdy [1], A. Evans, P.C. Wright [1,2]. J. Jernvall [1] . [1]Institute of Biotechnology, University of Helsinki, [2]Department of Anthropology, Stony Brook University, NY.

Bamboos, grasses belonging to the family Poaceae, are highly fibrous, with culms containing close to 50 percent cellulose. This together with phytoliths makes bamboo a challenging food to consume and digest. Specialization for bamboo feeding has evolved several times in mammals. Primates, bears, and muroid rodents all have living species that rely largely on a bamboo diet. While phylogeny, size, and life history are highly divergent among these bamboo specialists, they do share some adaptations to feeding on bamboo. One shared feature is dental morphology, and here we apply a new 3-dimensional method to assess crown feature complexity, or surface roughness, in bamboo eating lemurs, pandas, and rodents. Our analyses of dentitions show that bamboo specialists have highly complex cheek tooth morphology irrespective of the taxon-specific morphological details. The high complexity values can be related to the high number of tooth crown features, or 'tools', required to process fibrous bamboo. In addition to comparable levels of high dental complexity, all the studied taxa have low tooth crowns. This is in stark contrast to the tall teeth of ungulates feeding on grass in open and more seasonally dry environments. A potential consequence of the 'bamboo feeding syndrome' is the susceptibility of low-crowned teeth to wear and early dental senescence, perhaps limiting bamboo feeders to humid environments. Our method of correlating overall high-level dental complexity to diet holds promise for inferring diet and environment of extinct primates, including those implicated with bamboo diets.

Dental Texture Analysis of Late Archaic Amerindians from southern Indiana.

M.S. Zolnierz and C.W. Schmidt. Indiana Prehistory Laboratory, University of Indianapolis.

SEM-based studies of Late Archaic Amerindian dental microwear have indicated that these largely foraging populations had an abrasive diet, which created numerous wide scratches and few pits. Although the SEM-based studies provided important dietary reconstructions, they were limited because they relied upon two-dimensional micrographs. A more recent approach to dental micro-topography, dental texture analysis, employs a white light, confocal imaging profiler to acquire three-dimensional surface coordinates at submicron resolutions with a 100x objective (e.g., Scott, et al., 2005). The coordinates are used to generate digital elevation models that are analyzed via scale-sensitive fractal analysis. The current study applies dental texture analysis to 34 Late Archaic adults from southern Indiana. Data were collected from mandibular second molar Phase II occlusal facets (primarily facet 9) using a profiler housed at the University of Arkansas. The results indicate that the Late Archaic wear was modestly complex (male-female values: 1.88-1.33) yet not particularly anisotropic (male-female values: .0027-.0030). The lack of complexity indicates that the surface was dominated by scratches rather than by pits. The low anisotropy indicates that the scratches, however, were oriented in many directions. Females exhibit less complexity than males, but male and female anisotropic values are similar. The dental texture findings reinforce the SEM-based microwear results, but add necessary detail to our understanding of Late Archaic diet, especially in subtle sex-related differences.
Funding provided by a University of Indianapolis Research Fellowship to C.W.S.

Diet and Disease in Times of War: Analysis of Mummified Human Remains from Southern Mongolia c. 1300-1350 AD.

M.K. Zuckerman[1, 2], B.L. Turner[1], [2], B.A. Carlson[1], J.D. Kingston[1], G.J. Armelagos[1], D.R. Hunt[2], T. Amgalantugs [3] and B. Frohlich[2]. [1]Department of Anthropology, Emory University, Atlanta, GA, [2]Department of Physical Anthropology, Smithsonian Institution, National Museum of Natural History, Washington, DC, [3]Institute of Archaeology, Mongolian Academy of Sciences, Ulaanbaatar.

This study presents the results of stable isotope analysis of eleven southern Mongolian natural mummies. The nine mummies, recovered from the Hetz Mountain cave site, southern Mongolia, show evidence of violent death. They are radiocarbon dated to the 14th century during the Yuan Dynasty, a period characterized by political and economic turmoil as Mongolian leaders diverted resources to China. Historical records document widespread famine and profound malnutrition, as well as a coerced shift in subsistence strategy from traditional pastoralism to sedentary agriculture. However, the historical record does not clearly document whether the southern hinterland region in which these mummies were found was affected by these long-term nutritional changes. Dental examination and radiographs do not indicate chronic malnutrition; but both sets of measures are non-specific in etiology. Consequently, these mummies were analyzed to satisfy three objectives: (1) to identify plant-based agricultural vs. animal-based pastoralist diets (2) examine dietary change across the life course and (3) profile the nutritional status of the study population. This was accomplished in part through characterization of carbon and nitrogen isotopic ratios in preserved tooth enamel (N=4), dentin (N=4), bone (N=10) and hair (N=5), using previously-validated techniques. These analyses were coupled by the examination of pathological conditions known to form at different developmental periods in life. Results provide a more complete picture of subsistence and nutrition in the region and shed light on the effects of dynastic transition on this historically underrepresented borderland.
Funding provided by the National Geographic Society.