Teaching evolution through human examples: What does it mean to be human?

Grade Levels: 9-12 Duration: 7-8 class periods

Overview:

Lesson 1, What Do You Think It Means to Be Human?: The main goal of the lesson is to set a scientific frame of mind for students as they begin to explore the question, “What do you think it means to be human?” This lesson sets an important tone by highlighting that other lines of human inquiry outside of science are important for answering this question on a personal level, but the class will focus on a scientific definition of “humanity.” Students learn to distinguish questions that could be addressed by the methods of science and those that could not, and they practice applying these criteria. Students recognize that the activities in this unit will help them answer the scientific questions posed concerning what it means to be human.

Lesson 2, Our Place in Nature: The goal of this lesson is for students to begin to learn the skills for “tree-thinking,” including how to infer phylogenetic relationships and interpret tree diagrams. Concurrently, students will learn about specific characteristics that are common among all the species on Earth and other characteristics that are specific to major groups in the Tree of Life. After an investigation at the domain and kingdom levels to estimate a phylogeny using morphological characters, students conduct a second investigation of relationships among major groups of vertebrates using both morphology and DNA sequences. Students learn that part of a scientific answer to what it means to be human is that humans are connected by common ancestry to every other living organism and that characteristics found in humans have accumulated at widely varying points throughout evolutionary time.

Lesson 3, Climbing Around Our Family Tree: The goal of this lesson is for students to take on more individual responsibility for generating the data to infer and interpret phylogenetic trees. They begin by working within the context of developing a phylogeny of living primates, first using the Smithsonian Institution’s online skull collection and then with DNA sequences. Students use the phylogeny to interpret the evolution of specific characters. Students use a phylogenetic perspective and fossil evidence to make inferences about the common ancestor of humans and chimpanzees/bonobos. Students then examine how claims about traits that were thought to be unique in humans have changed over time, consistent with a better understanding of other organisms and the nature of science. Students then explore and explain representations of relationships among extinct hominin species, all the while building more tree-thinking skills.

Lesson 4, Explaining Human Characteristics: In the final lesson, students are given the opportunity to demonstrate what they learned about many of the major concepts in the unit for both the nature of science and the science content. From a teacher-supplied list, students choose a characteristic that changed substantially in the human family tree and develop a brochure or other educative display to develop a scientific argument based on evidence for when the character evolved. At the end of the lesson, students reflect once again on the guiding question for the lesson: “What does it mean to be human?”

Aims:

Lesson 1. During this lesson, the student will:

- reflect on their own understanding of what it means to be human,
- compare and contrast scientific versus non-scientific questions,
- determine whether a question is answerable by science by evaluating the question against a set of five criteria,
- identify scientific and nonscientific questions..

Lesson 2 & 3. During this lesson, the student will:

- pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that could extend or improve the phylogenetic tree;
- evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history;
- create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set;
- evaluate evidence provided by data from many scientific disciplines that support biological evolution;
- refine evidence based on data from many scientific disciplines that support biological evolution;
- connect scientific evidence from many scientific disciplines to support the modern concept of evolution;
- describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms;
- reflect on how their understanding of common ancestry affects their understanding of what it means to be human.

Lesson 4. During this lesson, the student will:

- demonstrate what they learned in the unit about the nature of science and scientific questions
- demonstrate what they learned about interpreting phylogenies and explaining character evolution in ways other than traditional tests.

Materials needed:

handouts, scissors, tape, computer with internet access and word processing program, highlighters, chart paper, colored pens/markers

Keywords:

human, chimpanzee, bonobo, vertebrate, fossils, phenology, morphology, DNA, evolution

Source:

Teaching Evolution through Human Examples Project, Smithsonian Institution

LINK TO LESSON

Though the AABA Education Committee compiled this lesson summary, it has not evaluated this lesson for alignment with the Next Generation Science Standards (NGSS). To assess if a lesson aligns with NGSS, we recommend using the EQuIP Rubric for Science, available at nextgenscience.org.

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