

Teaching evolution through human examples: Malaria

Grade Levels: 9-12 Duration: 7 class periods

Overview:

Lesson 1, Changes in a Long-term Relationship: In this lesson, students are encouraged to provide their initial ideas about how change over time occurs in living organisms, using the context of malaria parasites evolving resistance to an antimalarial drug. Students then learn about four historical explanations for change over time, and they compare their initial ideas to the historical ideas. Students then investigate the results from six different experiments, and they use the results to build an explanation for change over time based on natural selection.

Lesson 2, Malaria and Human Diversity: Students strengthen their ability to develop explanations with natural selection by using human diversity in response to coevolution with malaria as the context in Lesson 2. The lesson begins with an investigation of why certain individuals react poorly to taking a specific antimalarial drug. Through this investigation, students learn about G6PD deficiency, the most common enzyme deficiency among humans. Students then use evidence from four experiments and data sets to construct an argument that natural selection has shaped patterns of G6PD diversity in humans.

Lesson 3, Malaria and Population Genetics: Students learn how to use the Hardy-Weinberg equilibrium model to make predictions about populations in the future and how biologists use an understanding of the model to better understand how populations are changing over time. Students apply their understanding of the Hardy-Weinberg equilibrium model to problems related to the coevolution of humans and the malaria parasite. Students then use a population genetics simulation to conduct and analyze an investigation on an evolutionary question of their choosing. In the process, students learn about genetic drift, another important evolutionary mechanism.

Lesson 4, Beyond G6PD: In Lesson 4, students apply what they learned about evolution to explain patterns of diversity in other human genes whose allele frequencies have also changed in response to malaria. Students complete a summative assessment as they work in teams to develop a scientific summary report or creative presentation describing how malaria has shaped the frequency of alleles for at least one more gene.

Aims:

Lesson 1. During this lesson, the student will:

- understand the tremendous impact of malaria on human health,
- recognize major explanations that humans have developed for change over time and how their initial explanations fit within these categories,
- use data and evidence to make claims that relate to natural selection,
- revise their initial explanations for change based on their new understandings,
- begin to appreciate the value of understanding evolution.

Lesson 2. During this lesson, the student will:

- understand the tremendous impact of malaria on human health,
- interpret data that helped medical professionals understand a health mystery,

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- use data and evidence to develop an argument that natural selection has shaped human diversity,
- revise their initial explanations for change based on their new understandings,
- better appreciate the value of understanding evolution.

Lesson 3. During this lesson, the student will:

- use their understanding of the Hardy-Weinberg equilibrium model to solve problems related to the coevolution of the malaria parasite and humans,
- be able to use a population genetics simulation to investigate and interpret evolutionary mechanisms such as genetic drift and natural selection,
- reflect on how mathematical models add to the evidence for evolution.

Lesson 4. During this lesson, the student will:

- understand the tremendous impact of malaria on human health,
- use data and evidence to develop an argument that natural selection has shaped human diversity,
- use their understanding of the Hardy-Weinberg equilibrium model to solve problems related to the coevolution of the malaria parasite and humans,
- be able to use a population genetics simulation to investigate and interpret evolutionary mechanisms such as genetic drift and natural selection
- better appreciate the value of understanding evolution.

Materials needed:

handouts, computer with internet access, colored marbles, container for marbles, colored pens/markers; additional optional material detailed in lesson plans

Keywords:

human, malaria, medicine, genetics, DNA, allele, population genetics, Hardy-Weinberg equilibrium, natural selection, genetic drift, evolution

Source:

[Teaching Evolution through Human Examples Project](#), Smithsonian Institution

[LINK TO LESSON](#)

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