

Recent Adaptations in Humans



About This Worksheet

This worksheet complements the Click and Learn “Recent Adaptations in Human” developed in conjunction with the 2011 HHMI Holiday Lectures on Science “Bones, Stones, and Genes: The Origin of Modern Humans.”

Author: Ann Brokaw, Rocky River High School, OH.

Key Concepts

- Humans, like all species, are evolving and adapting to the environment.
- Natural selection is the process by which individuals with traits most suited to their environment produce more offspring and pass on their genes.
- Over time, favorable traits become more common in a population.
- Natural selection acts on traits, but it affects the frequency of alleles in a population.

Instructions

1. Go to BioInteractive.org.
2. On the left, mouse over Topics – Evolution – Interactive.
3. Scroll down and click “Recent Adaptations in Humans.”
4. Proceed through the slides, watch the embedded video clips, and answer the following questions in the space provided.

Questions

1. Give an example of a cultural adaptation.

2. In your own words, define *natural selection*.

3. Not all mutations produce new traits. Give one reason for wanting to identify genetic variations that have an effect on traits.

4. Natural selection favors certain traits. Over many generations, what will happen to those traits?

5. What does it mean that a trait is “adaptive”?

Lactase Persistence

1. Define *lactose intolerance*.

2. What happens to the expression of the lactase gene when a baby is weaned from his or her mother’s milk?

3. What type of carbohydrate is the sugar lactose? Can it be absorbed by cells in the small intestine?

4. Which two simple sugars make up a molecule of lactose? Where in the digestive system are these sugars absorbed?

5. Give two causes of bloating from drinking milk in a person who is lactose intolerant.

6. Define *lactase persistence*.

7. What causes lactase persistence? Be specific.

8. Why is lactase persistence more prevalent in indigenous populations of northern Europe and parts of Africa than in other regions of the world?

9. Explain the connection between the domestication of livestock and the prevalence of lactase persistence.

10. If mutations occur at random, explain why lactase-persistence mutations are found in some populations and not others.

11. Can the same trait arise from different genetic changes? Explain.

12. Is the mutation causing lactase persistence in a person of African descent likely to be different from that in a person of European descent? Explain.

13. What is meant by the concept that a genetic variation can result in increased fitness? Explain.

14. Define *positive selection*. In addition, explain the genetic evidence for positive selection in the case of lactase persistence.

15. Explain how the lactase-persistence trait is a convincing example of gene-culture coevolution.

Sickle Cell Anemia

1. Define *anemia*.

2. What is the function of the hemoglobin protein?

3. How does the mutation that causes sickle cell anemia affect the hemoglobin molecule? How does that change result in blood cells being sickle shaped?

4. Explain the differences between an individual homozygous for the sickle hemoglobin allele (HbS/HbS) and one who is heterozygous (HbA/HbS). Consider the hemoglobin molecule, cells, and disease.

5. What is the probability that two parents who are heterozygous for the HbS allele will have a child with sickle cell disease?

6. Does an individual who is heterozygous for HbS have any sickle-shaped red blood cells? Explain.

7. Sickle cell anemia is caused by a genetic mutation. What is malaria caused by?

8. Why is the sickle cell trait selected for in some populations worldwide?

9. Define *balancing selection*.

10. Explain the concept of *heterozygote advantage* using the HbA and HbS alleles as an example.

11. Do heterozygotes (HbA/HbS) have an advantage in all regions of the world?

12. The malaria parasite is known to infect both liver and blood cells of its human host. Explain in detail how the parasitic infection of liver cells differs from the infection of red blood cells.

13. What are four symptoms of malaria?

14. How might the HbS allele affect infection by the malaria parasite?

15. Explain why there is a correlation between the worldwide distribution of malaria, the sickle cell allele, and G6PD deficiency.
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Bitter Taste Perception

1. How do people perceive taste in general? How do people perceive different tastes?

2. What ultimately controls the presence of different receptors for different tastes?

3. Why is the “tongue taste map” inaccurate?

4. What is PTC?

5. What distinguishes a taste receptor in a person who is a “PTC taster” from one in someone who is a “PTC non-taster”?

6. How are the PTC receptor haplotypes different?

7. What are some environmental factors that can influence the PTC taster phenotypes?

8. Propose one advantage of being able to taste PTC.

9. Propose one advantage of being a non-taster of PTC.

Summary

1. What happens to alleles that are under negative selection?
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