

Got Lactase?
The Co-evolution of Genes and Culture

NAME

DATE

1. What two monosaccharides (simpler sugars) are formed when the lactase enzyme hydrolyzes lactose?
2. True or False. "The genetic mutations that cause lactase persistence only occur in people living in pastoralist populations." Justify your answer in one or two sentences.
3. True or False. "Geneticists studying the gene for lactase did not find any differences in the coding region DNA between people who could digest lactose and people who could not digest lactose." Justify your answer in one or two sentences.
4. True or False. "Human evolution ended 200,000 years ago when humans (*Homo sapiens sapiens*) became a distinct species." Justify your answer in one or two sentences.
5. All known mutations giving rise to lactase persistence occur in the genetic switch that regulates the expression of the lactase gene.
 - a. What is the effect of these genetic switch mutations?
 - b. What would be the effect of a mutation in the coding region of the lactase gene?
6. You are studying the amylase enzyme in humans. Amylase is produced by the *AMY1* gene in cells of the salivary glands. It breaks down starch (a polysaccharide) into the sugar maltose (a disaccharide) as starchy food is initially digested in the mouth. You discover that because of a mutation in the *AMY1* gene, people from cultures with diets high in starch produce more amylase than do people from cultures with diets low in starch. Propose a hypothesis to explain this observation.

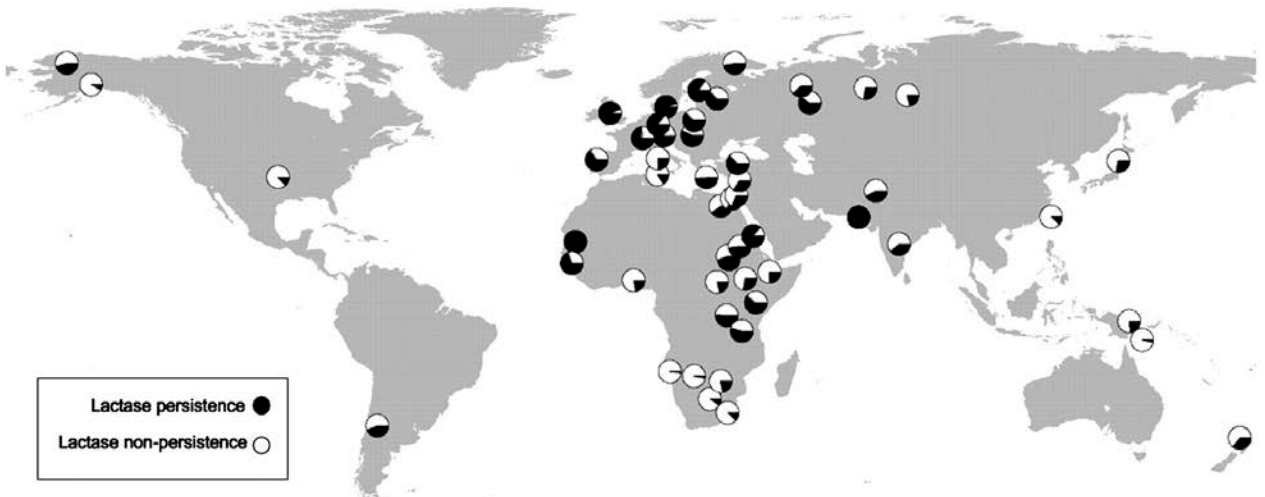
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QUIZ
STUDENT HAND-OUT

- 7. Which discovery supports the hypothesis that the evolution of lactase persistence may have been driven by a dependence on drinking milk for survival? (Circle the letter of the correct answer.)
 - a. The oldest pots that once contained milk date back to 200,000 years ago, the same time that humans became a distinct species.
 - b. The gene for lactase production is found in both humans and cows.
 - c. Ancient pots that were used to hold milk are nearly the same age as the mutations that led to lactase persistence.
 - d. Most human cultures today drink milk and most people are now lactase persistent.
 - e. Scientists have not yet found evidence for this hypothesis, but they are still looking.

- 8. List three possible explanations for why drinking milk could have provided strong favorable selection for lactase persistence.

9. Study the figure below. Each pie chart represents a unique population that was examined. The degree to which the pie chart is filled in illustrates the percentage of individuals in that population who are lactase persistent.



- a. Identify two trends you see in the data. Provide evidence to support each trend.

- b. State one possible hypothesis that can explain the global distribution of lactase persistence (lactose tolerance) and lactase nonpersistence (lactose intolerance). Be sure to include the following key words in your explanation: selection, fitness, survival.