

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?
a. glucose and fructose b. galactose and maltose
c. glucose and galactose d. glucose and maltose

2. Geneticists studying the gene for lactase did not find any differences in the coding region DNA (the section of DNA with instructions to make the protein) between people who could digest lactose and people who could not digest lactose. After they investigated further, they discovered that the difference between lactose tolerant and intolerant individuals was due to a mutation located in
a. the genetic switch for the lactase gene b. an intron of the lactase gene
c. the gene for glucose production d. different genes for different individuals

3. Which statement accurately describes human evolution?
a. Human evolution ended 200,000 years ago when humans (*Homo sapiens*) became a distinct species.
b. Humans continued to evolve until the species adapted to a pastoralist way of life and then stopped evolving.
c. Humans are still evolving and will continue to evolve through natural selection.
d. Human evolution through natural selection ended with the advent of modern medicine.

4. Which discovery supports the hypothesis that evolution of the lactase persistence trait was driven by the use of milk in pastoralist cultures?
a. The lactase gene is present both in humans and in domesticated animals.
b. Ancient pots used to hold milk are about the same age as the lactase persistence mutations.
c. Most human cultures today drink milk and most people worldwide are lactase persistent.
d. Scientists have identified different mutations that cause lactase persistence.

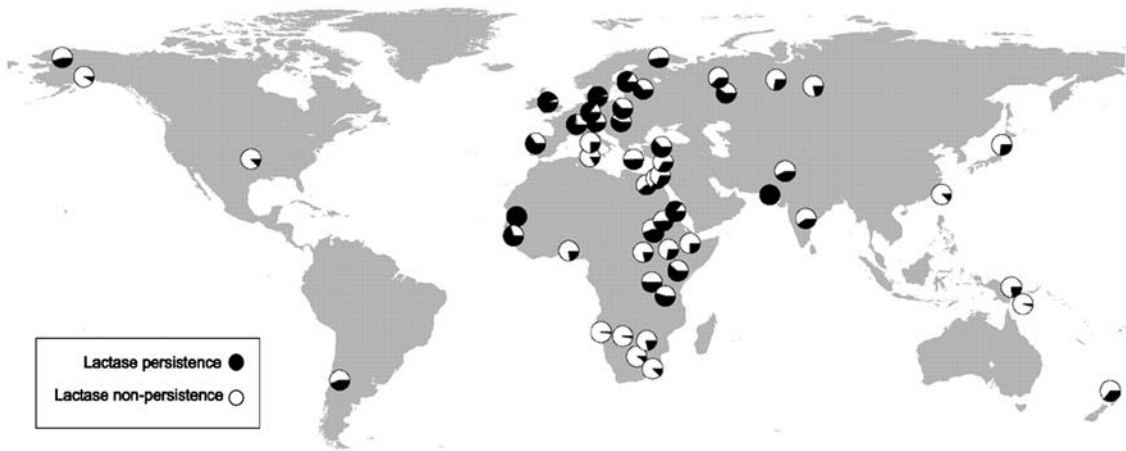
5. Why would measuring blood glucose levels in an individual, 20 to 30 minutes after they drink a liter of milk, indicate whether they are able to digest lactose.
a. When lactose is digested by lactase in the small intestine, different cells in the body start releasing glucose into the bloodstream.
b. When lactose is digested by lactase, the glucose that is produced enters the bloodstream from the small intestine.
c. When lactose enters the large intestine, glucose is digested by bacteria and then enters the bloodstream.
d. The fats and proteins in milk are digested by the body, causing glucose levels in the blood to increase.

6. What would be the effect of a mutation in the coding region of the lactase gene?

7. Why could milk have provided strong favorable selection for lactase persistence?

8. In humans, the AMY1 gene produces the enzyme amylase in cells of the salivary glands. Amylase breaks down starch (a polysaccharide) into the sugar maltose (a disaccharide). People from cultures with diets high in starch produce more amylase than people from cultures with diets low in starch because of a mutation in the AMY1 gene. Explain in two to three sentences why the frequency of this AMY1 mutation would have increased in frequency in populations with a high-starch diet.

9. Study the figure below. Each pie chart represents a distinct population. 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.
