

CLASS SET! Answers and Graph on Separat sheet

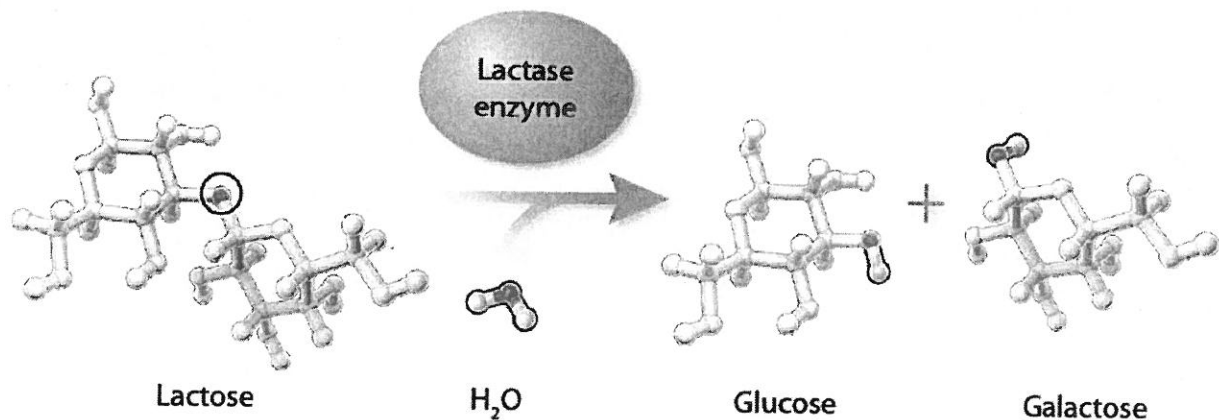
*The Making of the Fittest:
Got Lactase? The Co-evolution of Genes and Culture*

HHMI
BioInteractive.org
LESSON
STUDENT MATERIALS

GOT LACTASE? BLOOD GLUCOSE DATA ANALYSIS

INTRODUCTION

"Mother's milk" is packed with the proteins, fats, and carbohydrates that support the growth, development, and survival of baby mammals. The sugar lactose is the main carbohydrate in milk. Lactose can be cleaved into two simpler sugars, glucose and galactose, by lactase, an enzyme produced in the small intestine. The two smaller sugars are readily absorbed through the intestinal wall into the bloodstream for delivery to the cells of the body, where they are used for energy.



After infant mammals are weaned from their mother's milk, lactase production shuts down, presumably because it is no longer needed. This condition is called lactase nonpersistence—meaning that production of the lactase enzyme does not *persist* into adulthood. The general condition for mammals is not to consume milk after weaning and to be lactase nonpersistent. Some populations of humans are unusual in that adults continue to consume milk from other mammals, such as cows.

If a person who is lactase nonpersistent drinks milk, undigested lactose passes from the small intestine to the large intestine, where it is fermented by bacteria. Fermentation produces various gases in the large intestine, which can cause abdominal pain, bloating, flatulence, and diarrhea—all symptoms of lactose intolerance. Worldwide, most adults are lactase intolerant, although some people may not know because their symptoms are mild. Only a minority of human adults (35% of the global human population) continues to produce lactase into adulthood and can drink milk without any problems. These individuals are said to be lactase persistent or lactose tolerant.

There are several ways to test whether someone is lactase persistent. In the short film, *Got Lactase? The Co-evolution of Genes and Culture*, the narrator, Dr. Spencer Wells, takes a blood glucose test to deduce his lactase status. In this activity you will examine the results of blood glucose tests conducted on six different adults to determine who is lactase persistent (lactose tolerant) or lactase nonpersistent (lactose intolerant).

MATERIALS

- Ruler
- Colored pencils

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PROCEDURE

1. Examine the data in the table below. It shows the blood glucose levels of six individuals tested in Dr. Sarah Tishkoff's laboratory. First, baseline (i.e., time 0 minutes) blood glucose levels were measured and recorded. Then each person drank a liter of milk and blood glucose levels were again measured at 15, 30, 45, and 60 minutes after drinking the milk. Glucose levels were measured using glucose strips and a glucose reader similar to the one Dr. Wells used in the film.

Individual	Blood Glucose (mg/dL)				
	0 minutes	15 minutes	30 minutes	45 minutes	60 minutes
Peter	97	111	135	154	143
Rachel	96	99	105	101	98
Katherine	95	97	99	101	102
Sarah	108	116	129	141	139
Michael	94	109	128	143	140
Arthur	97	96	94	83	88

2. Plot the results from the six individuals in the graph below.

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QUESTIONS

1. Why is measuring blood glucose levels an indicator of someone's lactase activity?

2. Divide these individuals into two groups (A and B), based on their blood glucose test results. Write the names of the individuals in each group, including Dr. Spencer Wells.

Group A:

Group B:

3. Explain your rationale for dividing the individuals into these two groups using data to support your answer.

4. Based on these data, do you predict that individuals in Group A are lactase persistent or nonpersistent? Describe the evidence that supports this claim.

5. Based on these data, do you predict that individuals in Group B are lactase persistent or nonpersistent? Describe the evidence that supports this claim.

6. If you performed the same blood glucose test on a group of people who are from the Maasai population in Kenya, predict whether their results would be more like those of Group A or Group B. Explain your prediction.
(Hint: Remember from the film that the Maasai people are pastoralists.)

7. A person taking a blood glucose test is usually told to fast prior to the test. Why do you think that might be necessary?

