

Lactase Enzyme Activity with Data Analysis

Simulation at jondarkow.com



Pre-Lab

1. Define the following and explain how each relates to the lactase chemical reaction.

→ Enzyme

→ Substrate

→ Active site

→ Rate of reaction

→ Activation Energy

2. What is the chemical reaction that lactase catalyzes?

3. Why would having the enzyme lactase as an adult be an evolutionary advantage?

4. Explain how the structure of an enzyme relates to how well the function catalyzes chemical reactions.

Simulation Option 1: Temperature

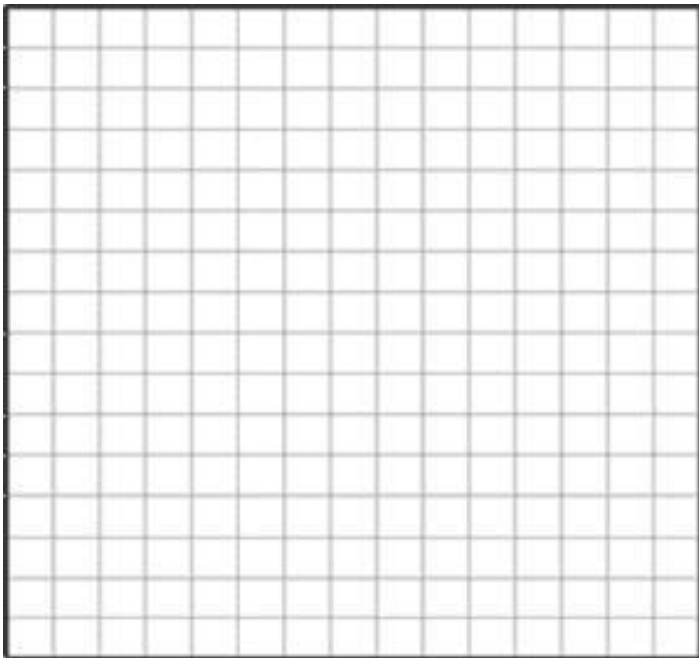
1. Start with the initial lactose at 500 mg/dL and the pH at 7. Do not vary these parameters while testing for temperature, they are environmental controls. The temperature is in degrees Celsius.

Be sure to show the instructor your method for calculating the rate of reaction for the first 3 minutes before going on. The units should be mg/dL glucose per minute.

Vary the temperature by 20°C. Run each experiment 5 times (for reliability in the results.) Record the rate of reaction in the table below. The rate of reaction should be in mg/dL of glucose per minute.

	0°C	20°C	40°C	60°C	80°C
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Mean					
Standard Deviation					
Standard Error of the Mean (SEM)					

2. On the axes provided, *create* an appropriately labeled graph to illustrate the sample means of the five temperatures tested to within 95% confidence (i.e., the sample mean $\pm$ 2 SEM).



3. What are the results of the simulation? What is the optimal temperature? Is there statistical significance? Explain.

4. Explain why your results of the optimal temperature of the lactase enzyme make sense for the human enzyme? Explain the results in terms of the structure and function of proteins.

5. Propose an appropriate control treatment for the experiment, and describe how the control treatment would increase the validity of the results.

6. Predict how milk digestion is affected in individuals that lack functional copies of the gene encoding lactase. Justify your response.

Simulation Option 2: pH

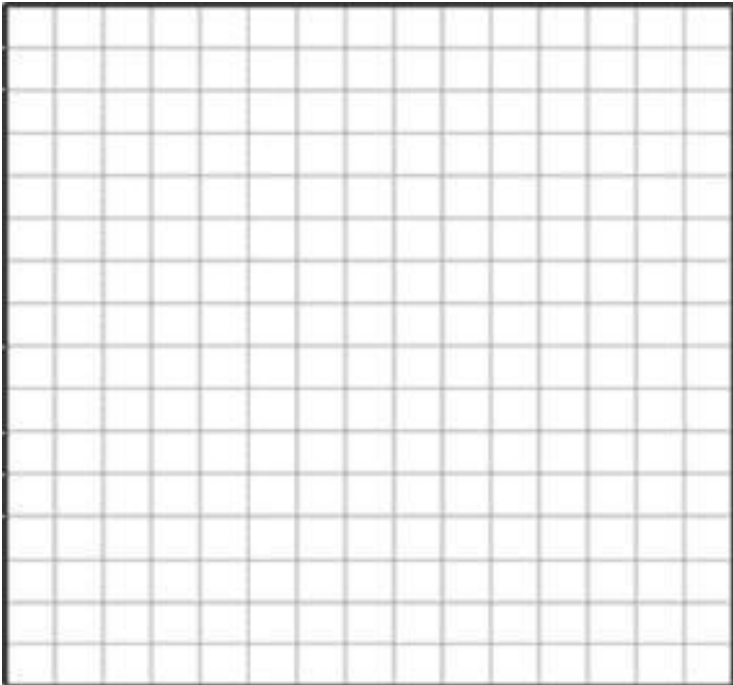
1. Start with the initial lactose at 500 mg/dL and the temperature at 25 degrees Celsius. Do not vary these parameters while testing for pH, they are environmental controls.

Be sure to show the instructor your method for calculating the rate of reaction for the first 3 minutes before going on. The units should be mg/dL glucose per minute.

Vary by a pH of 3. Run each experiment 5 times (for reliability in the results.) Record the rate of reaction in the table below. The rate of reaction should be in mg/dL of glucose per minute.

pH	1	4	7	10	13
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Mean					
Standard Deviation					
Standard Error of the Mean (SEM)					

2. On the axes provide, ***create an appropriately labeled graph to illustrate the sample means of the five pH levels tested to within 95% confidence (i.e., sample mean $\pm$ 2 SEM).***



3. What are the results of the simulation? What is the optimal pH? Is there statistical significance? Explain.

4. Explain why your results of the optimal pH of the lactase enzyme make sense for the human enzyme? Explain the results in terms of the structure and function of proteins.

5. Propose an appropriate control treatment for the experiment, and describe how the control treatment would increase the validity of the results.

6. Predict how the milk digestion is affected in individuals that lack functional copies of the gene encoding lactase. Justify your response.

Yo Teachers:

I have two different simulations for the lactase enzyme:

Lactase with Data Analysis and Lactase with Variable Sample Size.

I started with the Lactase Enzyme Simulation. For this simulation, the units for lactose and glucose are in mg/dL.

For the [Variable Sample Size simulation](#), the units for lactose and glucose are in mM.

For more help and background information, including updates please visit my Patreon page at patreon.com/jondarkow

References

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