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## Identifying Limits to the Growth of Bacteria

In this investigation, you will determine whether an environmental factor such as temperature can control the growth and reproduction of bacteria.

## Problem

Does temperature limit the growth and reproduction of bacteria?

## Materials

- glass-marking pencil
- 3 sterile agar plates
- sterile cotton swabs
- bacterial culture
- transparent tape
- hand lens

Skills Analyzing Data, Drawing Conclusions

## Procedure 国 通

1. Asking Questions Read about the investigation; then, write three questions about how temperature might affect the growth of bacteria.
2. Predicting Predict how temperature will affect the growth rate of bacterial colonies. Record your prediction on the lines below.

Prediction: $\qquad$
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3. Put on your plastic gloves. Use a glass-marking pencil to label the edges of the agar plates " $3^{\circ} \mathrm{C}, " ~ " ~ 20^{\circ} \mathrm{C}$," and " $37^{\circ} \mathrm{C}$." Also, write your name on each plate.
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4. Dip a sterile swab in the bacterial culture and wipe it back and forth in a zigzag pattern over the entire surface of the agar on one plate, as shown in the drawing above. Cover the plate, and seal it with transparent tape. CAUTION: Do not open the plates once they have been exposed to air.
5. Repeat step 4 with each plate, using a new sterile swab for each plate.
6. Place the plate labeled " $3^{\circ} \mathrm{C}$ " in a refrigerator. Leave the plate labeled " $20^{\circ} \mathrm{C}$ " in a place designated by your teacher. Place the plate labeled " $37^{\circ}{ }^{\circ}$ " in an incubator. Be sure to store each plate upside down.
7. After 24 hours, examine each plate with a hand lens. Bacterial colonies look like small white or colored dots on the agar surface. In the data table below, record the number of bacterial colonies on each agar plate. Return each plate to its location.
8. After a second period of 24 hours, record in the data table the number of bacterial colonies on each agar plate. After you have completed your data table, place your agar plates in the container designated by your teacher for safe disposal.

| Data Table—Bacterial Growth |  |  |
| :---: | :---: | :---: |
| Temperature | Number of Colonies |  |
|  | 24 hours | 48 hours |
| $3{ }^{\circ} \mathrm{C}$ |  |  |
| $20^{\circ} \mathrm{C}$ |  |  |
| $37^{\circ} \mathrm{C}$ |  |  |

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9. On a separate sheet of graph paper, make a graph of the results in your data table. Plot time on the $x$-axis and number of bacterial colonies on the $y$-axis. Use a different symbol to represent data from each day. After you have plotted all your data on your graph, draw a straight line or smooth curve as close as possible to all the points that represent observations after 24 hours. Draw a second curve or line through the points that represent observations after 48 hours.

## Analyze and Conclude

1. Analyzing Data At what temperature were most bacterial colonies visible after 24 hours? At what temperature were the fewest bacterial colonies visible after 24 hours?
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2. Analyzing Data Did the same plate have the most bacterial colonies after 48 hours? The fewest?
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3. Analyzing Data Describe the effect of temperature on the growth of bacteria.
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4. Evaluating Do you consider your results reliable? Explain. Did the results of your experiment confirm your prediction?
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