1 The Full Course

INVESTIGATION

Sasha has a serious respiratory infection. Her doctor has done tests, which show that the infection is caused by bacteria. Dr. Torres prescribes antibiotics to help fight the infection.

"Sasha, I think you will start to feel better in a few days, but it's important that you keep taking all the medicine even after you feel better. You must finish it all. Don't stop, and don't miss doses," warns Dr. Torres.

"Why?" Sasha asks. "I don't keep taking other medicines after I feel better. Like, once my headache is gone, I don't take any more headache medicine."

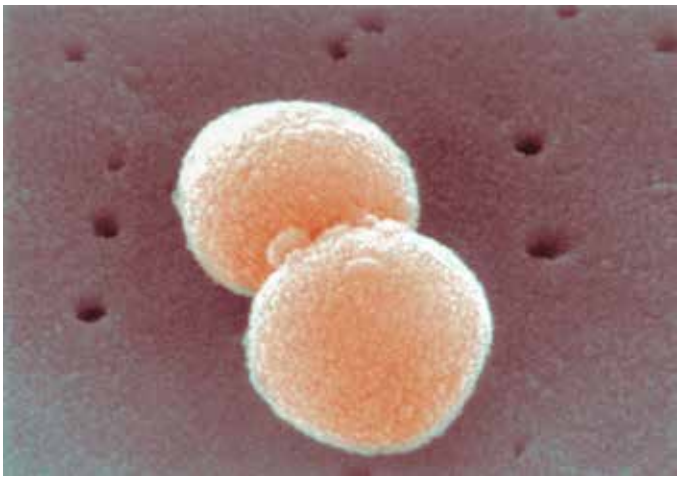
"There's a real crisis developing with antibiotics," Dr. Torres explains. "People take them when they don't need them, or they take them for a while and then stop. This causes bacteria to evolve antibiotic resistance. Doctors and researchers are very worried about this."

"What happens when the bacteria are resistant?" asks Sasha's mother.

"The antibiotics no longer work against the resistant bacteria. Last year, our clinic had four patients with infections that we used to be able to fight easily! Three of those patients had to stay in the hospital and take antibiotics for a very long time before they got better." Dr. Torres sighs. "The other patient didn't make it."

"You know, I just saw a story about that on TV," says Sasha's mother.

"I'm beginning to understand that antibiotics are different from other medicines. I'll be sure to take all the pills!" says Sasha.



Streptococcus *bacteria in its natural environment, the human throat*

Antibiotics are chemical substances that help your body fight off an infection by killing harmful bacteria. A small number of bacteria in any population may not be affected by the antibiotic as quickly as the rest of the population. These bacteria, which are more resistant to the treatment, continue to grow and reproduce if doses of the antibiotic are missed. In this activity, you will use a model to explore how bacteria have changed over time to become resistant to many antibiotics.

GUIDING QUESTION

What happens when a person does not take antibiotics as prescribed?

MATERIALS

For each pair of students

- 1 set of 50 disks: 20 green, 15 blue, 15 orange
- 4 colored pencils (including green, blue, and orange)
- 1 number cube

For each student

- 1 Student Sheet 1.1, "Bacteria Graphs"

A Bacterial Infection

Imagine that you are sick with a bacterial infection. Your doctor prescribes an antibiotic to be taken every day for eight days.

Colored disks represent the harmful bacteria that are in your body:

Disease-Causing Bacteria	Represented by
Least-resistant bacteria	green disks
Resistant bacteria	blue disks
Extremely resistant bacteria	orange disks

Each time you toss the number cube, it is time to take the antibiotic. The number on the number cube tells you what to do.

PROCEDURE

1. You and your partner should begin with 20 disks: 13 green, 6 blue, and 1 orange. These disks represent the harmful bacteria living in your body before you begin to take the antibiotic. Set the extra disks aside for now.
2. Make a data table in your science notebook similar to the following one.

Number of Harmful Bacteria in Your Body

Toss number	*Least-resistant bacteria (green)*	*Resistant bacteria (blue)*	*Extremely resistant bacteria (orange)*	*Total*
Initial	*13*	*6*	*1*	*20*
1				
2				
3				
4				
5				
6				
7				
8				

3. It is time to take your antibiotic. Toss a number cube, and follow the instructions in the following Number Cube Key.

Number Cube Key

YOUR TOSS	WHAT HAPPENED	WHAT TO DO
1, 3, 5, 6	You took the antibiotic on time, so bacteria are being killed!	Remove 5 disks: Start by removing the green disks, then the blue, and then the orange.
2, 4	You forgot to take the antibiotic.	Do nothing.

4. The bacteria are reproducing all the time! If one or more bacteria of a particular type are still alive in your body, add 1 disk of that color to your population.

   For example, if you have resistant (blue) and extremely resistant (orange) bacteria in your body, add 1 blue disk and 1 orange disk to your bacterial population.
5. Record the number of each type of bacteria in your body in the table in your science notebook.

6. Repeat Steps 3–5 until you have completed your table.
7. Use the data in your table to graph the population for each type of bacteria and the total number of bacteria on Student Sheet 1.1, "Bacteria Graph." Use different-colored pencils to represent each type of bacteria.

ANALYSIS

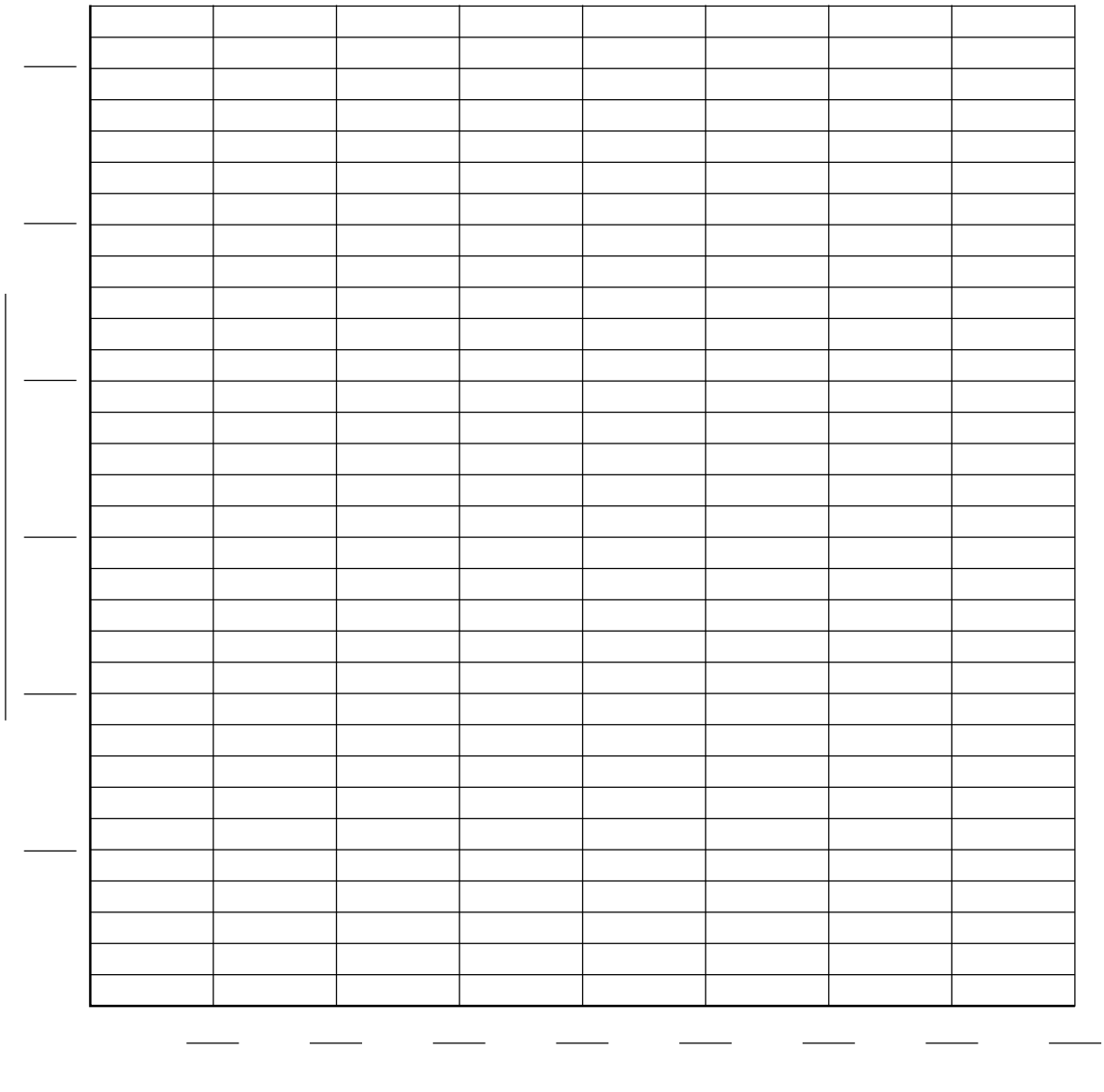
1. Describe what happened when you or a classmate did the following:
   a. Remembered to take the antibiotic according to the instructions
   b. Missed several doses of the antibiotic
2. Provide an explanation for these results.

   Hint: How do bacteria differ, and what is happening to the bacteria when they are exposed to antibiotics in their environment?
3. Explain how people are affecting populations of bacteria when they take an antibiotic.
4. **Revisit the issue:** What questions do you have about other ways that humans affect or are affected by other changing populations?
5. **Reflection:** Have you or any of your family members ever taken an antibiotic? If so, did you follow the instructions? How did this activity affect how you will take antibiotics in the future?

Name_____ Date_____

STUDENT SHEET 1.1

BACTERIA GRAPHS



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