

What Do Your Parents Need To Know About Antibiotics?

A curriculum activity to complement “The Microbes Strike Back” by B. Brett Finlay for the December 1999 HHMI Holiday Lecture “2000 and Beyond: Confronting the Microbe Menace”

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Learning Objectives

1. To learn about antibiotics and how they are used.
2. To understand the dangers of antibiotic use.
3. To learn more about efforts to use vaccines to combat future outbreaks of deadly pathogens.
4. To gain practice using the scientific literature.

Student Exercise

Preparation

1. Watch the lecture “The Microbes Strike Back” by B. Brett Finlay on the HHMI Holiday Lecture DVD “2000 and Beyond: Confronting the Microbe Menace”
2. Begin a discussion about antibiotics with your students using the following questions:
 - What is an antibiotic?
 - Where do antibiotics come from?
 - Have you ever used an antibiotic?
 - Did you experience any side effects?Some of the answers will come from their basic science knowledge, some answers from the Holiday lecture, and some from personal experience.
3. Give the students some background on antibiotics in addition to what is presented in your science textbook and on the HHMI Holiday Lectures DVD. Most texts mention at least the basics of how some antibiotics work. Highlight different types of antibiotics: Penicillin and Amoxicillin that inhibit cell wall formation, Sulfa drugs such as Bactrim that act to inhibit processes in the bacteria that require the vitamin folic acid. (Bactrim does not affect you because you (and other eukaryotes) cannot convert the drug to a form that would inhibit folic acid use). Tetracycline (often used to kill the bacteria that cause acne) inhibits protein translation in bacteria but not eukaryotes. Ask the students what they have learned. Do they have questions? Be honest and let them know that you may not have all of the answers.
4. Discuss the side effects of antibiotic use. Many antibiotics have significant side effects. Most are a result of allergies to the drugs. Some of your students are probably allergic to Penicillin. Sometimes the mechanisms by which antibiotics kill bacteria (prokaryotes) also have negative effects on the mitochondria of eukaryotes. Some antibiotics such as streptomycin and



chloramphenicol can cause serious side effects such as bone marrow crises or deafness. Tetracycline is known to cause birth defects in fetuses. For that reason, doctors will not prescribe tetracycline for acne if the patient is female of childbearing age and not on birth control.

Assignment

Science has changed a lot since your parents were in school. One of the problems that public health officials need to address is antibiotic misuse by an uninformed public. Misuse and overuse of antibiotics has led to the generation of drug-resistant bacteria (“superbugs”). Scientists believe that through enhanced public health education, antibiotics may remain useful for longer periods of time.

Your job will be to develop public health information about antibiotics (how they work, the benefits, the dangers, etc.). The material you generate should be targeted for presentation to your parents. Assume your audience (your parents) have a college education, but remember that any science that they learned is probably prehistoric by now.

The activity can be assigned in a variety of ways:

- Require each student submit two written reports. One copy will be graded and another will be given to their parents (they wouldn’t want to give their parents a report with grading marks on it, would they?).
- Have the students give the reports as a presentation in the manner of a public health presentation. The students can pretend they are doctors, scientists, public health officials, etc. Let them ham it up and be creative. Have the students bring blank videotapes from home and tape it so they can bring a copy to their parents. (The only down side to this method is 30 student presentations would take a lot of time. I would have them do it in groups for that reason).
- Have the students conduct their research in groups. This group research is often most productive, because students share successful search strategies and can try out ideas on each other. The final reports can either be written individually or as a group.

Have the students work during class time to gather information required for the report/presentations. Allow the students to use library and Internet resources for their research.

Issues which need to be addressed in the student presentations/reports:

- How does the antibiotic kill bacteria? Select three different antibiotics. (Bactrim, Penicillin, and Tetracycline are three good ones).
- Will an antibiotic like penicillin or amoxicillin work against the flu? A cold? Strep throat? Why or why not?
- Why do antibiotics work against bacterial and not viral infections?
- Why doesn’t the antibiotic kill you?

- How does your doctor select which antibiotic to prescribe for you?
- How could you test (in a laboratory) whether an antibiotic is effective against a bacterium?
- What are the possible side effects of the antibiotics you have selected? What do you think causes the side effects?
- Why do you need to take all of the antibiotics the doctor gives you, even if the symptoms of your illness have stopped?
- How do bacteria become resistant to antibiotics?