

# Drug Resistant Germs



**Grade Level:** 9-12

**Professions:** Physicians, Pharmacists, Public Health Advisors, Epidemiologists, Microbiologists, and Medical Lab Technologist/Technician

*All HOTT lesson plans are designed with the purpose of increasing students' awareness of the variety of health careers that are available to them. If possible, invite the corresponding health professional into your classroom to discuss his/her occupation. If this is not an option, use the attached sheet(s) to share this/these career(s) with your students.*

**Purpose:**

**Materials needed:**

- *Why Does Evolution Matter Now?*

Video [www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html](http://www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html)

- Ultraviolet Light
- Germ Glow – <http://www.glogerm.com/>
- *The Effectiveness of Antibacterial Soap Lab Handout* (attached to Day 2 Lesson)
  - Prepared Petri dishes
  - Antibacterial Soap (Germ-X)
  - Regular Soap (Dove)
  - Safety Goggles
- *Microbes: What They Do and How Antibiotics Change Them*

[http://www.actionbioscience.org/evolution/meade\\_callahan.html](http://www.actionbioscience.org/evolution/meade_callahan.html)

**Duration:** Two or three days

**Instructions:**

*Explanation/Background Information*

Since the discovery of Penicillin and its medicinal uses by Alexander Fleming in 1928, Penicillin and other antibiotics have saved thousands of lives from several bacterial diseases. Although known to be ineffective on viruses, antibiotics kill or inhibit the growth of bacteria. Due to the bacteria's genetic mutation, misuse of antibiotics, or a combination of both, bacteria have been able to build immunity to several of the antibiotics over the past century.

The ability of bacteria to develop a resistance to an antibiotic allows bacteria to survive doses of antibiotics that would otherwise prove to be lethal. This is particularly true with Penicillin and Erythromycin. Drug resistance not only plays a vital role in the daily lives of the population, but also plays a significant part in terms of bio-terrorism in the event terrorists use some means to infect the population with bacteria such as Anthrax, smallpox, and Botulism.

Antibacterial and antimicrobial agents were created to prevent the spread of infection and were first introduced to doctors and nurses working in large health institutions. Later large companies began marketing these products to everyday consumers. The effectiveness of antibacterial products is in question and being researched to determine if the overuse of the products is a leading factor in drug resistance among bacteria.

Arguments made against antibacterial products include the possibility that although the products kill harmful bacteria, the products also kill bacteria that provide benefits to everyday consumers.

## DAY ONE

### I. Engaging Activity

A. Choose one or combination of the following:

#### Option One:

1. Generously apply GloGerm to your hands. As students enter the room, shake their hands, welcoming them to class. Choose only 10 students.
2. After the students have settled, ask the students that shook your hand, to shake the hand of one other student.
3. Have students put their hands under the ultraviolet light.
4. While doing this, ask the following questions:
  - a. Other than handshaking, what are some other ways in which bacteria/viruses could be spread?
  - b. Look around the room, what do you think are common areas that harbor high concentrations of bacteria?
  - c. What common areas do you think you touch regularly to become "infected"?
  - d. What is the simplest way to prevent spreading of bacteria?
  - e. Is it possible for bacteria to become resistant to antibiotics? How does it occur? Is it something we need to be concerned about?

#### Option Two:

1. Prior to students arriving to school, sprinkle Germ Glow on high use areas of students in your class. For example, locker handle, door handles, pencil sharper, table top, books, etc.
2. Ask students if they have come into contact with germs today. Inform students about the ability of the ultraviolet (black) lights to detect "germs" and walk up and down the aisles with the ultraviolet (black) light, scanning the students' hands. While engaging the students, ask the following questions:
  - a. What common areas harbor the highest concentration of bacteria?
  - b. What common areas do you think you touched to become "infected"?
  - c. What is the simplest way to prevent the spreading of the bacteria?
  - d. Is it possible for bacteria to become resistant to antibiotics? How does it occur? Is it something we need to be concerned about?

### II. Exploration Activities

- A. Students watch Why Does Evolution Matter Now, a video focusing on the transmission of tuberculosis and the evolution of multiple drug-resistant strains of TB in a Russian prison. Students need to consider the following questions while watching the video:
- a. How does the misuse of antibiotics affect the evolution of disease-causing bacteria?

- b. Why is a resistant strain of TB in Russia a concern for citizens of the United States?
  - c. In what other settings would you expect antibiotic resistance exist?
  - d. Why does the prison setting provide a perfect environment for TB to replicate?
- B. Effectiveness of Antibacterial Products Lab

1. Introduction to lab:

Show portions or all of the following Power Point OR tell the story below:

<http://www.cdc.gov/handhygiene/training.html>

*In 1846 Ignaz Semmelweis observed that women whose babies were delivered by students and physicians in the First Clinic at the General Hospital of Vienna consistently had a higher mortality rate than those whose babies were delivered by midwives in the Second Clinic. He noted that physicians who went directly from the autopsy suite to the obstetrics ward had a disagreeable odor on their hands despite washing their hands with soap and water upon entering the obstetrics clinic.*

*His theory: puerperal fever, which was causing the deaths, was caused by "cadaverous particles" transmitted from the autopsy suite to the obstetrics ward via the hands of students and physicians. In May 1847 Semmelweiss insisted that students and physicians clean their hands with a chlorine solution, between each patient in the clinic.*

*After Semmelweis insisted that students and physicians clean their hands with a chlorine solution between each patient the maternal mortality rate in the First Clinic dropped dramatically and remained low for years. This is the first evidence indicating that cleansing heavily contaminated hands with an antiseptic agent between patient contacts may reduce healthcare-associated transmission of contagious diseases more effectively than hand washing with plain soap and water.*

2. Conduct Effectiveness of Antibacterial Products Lab: Day 1 (Attached)

**DAY TWO - THREE**

**I. *Effectiveness of Antibacterial Products Lab, Day 2 and/or 3***

- A. Review with students the purpose of the lab in testing the effectiveness of the antibacterial products. Quickly review the procedures taken in lesson 1 to prepare for today's lesson. Many variables exist with the results and must be pointed out when discussing the outcome of the bacterial growth. As students gather their Petri plates, have students think about the following questions:
  - a. What objects did they come into contact with prior to providing the bacterial sample?
  - b. Based on the growth of bacteria in all three samples, which method of hand washing is the most effective?
  - c. What additional studies can be conducted to determine the effectiveness of antibacterial soaps?
  - d. What disadvantages exists with the use of antibacterial soaps? Should the production of antibacterial products be banned based on the threat they may pose to the health of the public?
- B. Students read the article, Microbes: What They Do and How Antibiotics Change Them. Discuss the following questions:
  - a. How are bacteria beneficial to the environment?

- b. How do antibiotics get into the environment?
- c. How are bacteria beneficial to our health?
- d. Why is it pointless to take antibiotics for the common cold and flu?
- e. What are some ways to reduce the drug resistance problem?
- f. Explain how bacteria develop the ability to become antibiotic resistant?

## II. Elaboration: Health Professions Application

- A. Students, individually, pairs, or groups, research and write a 2-3 page report on the MRSA and health professions.

### Part One: MRSA Research - Consider the following questions:

1. What is MRSA?
2. Why is MRSA considered a “superbug”?
3. What common antibiotic(s) is it resistant to?
4. What areas of the body carry MRSA?
5. How does one become infected with MRSA?
6. What is CA-MRSA as compared to hospital-based MRSA?
7. How is CA-MRSA spread?
8. How long can MRSA survive outside the body?
9. Where is MRSA found in the school, home, health care settings?
10. How can you prevent the spread of MRSA?
11. What is the difference between someone who is colonized with MRSA as compared to a person who is infected with MRSA?

### Resources: Methicillin-resistant Staphylococcus aureus (MRSA)

- *Methicillin-resistant Staphylococcus aureus and vancomycin-resistant enterococci in rural communities, Western United States.* <http://www.thefreelibrary.com/Methicillin-resistant+Staphylococcus+aureus+and+vancomycin-resistant...-a0133284122>
- [http://en.wikipedia.org/wiki/Methicillin-resistant\\_Staphylococcus\\_aureus](http://en.wikipedia.org/wiki/Methicillin-resistant_Staphylococcus_aureus)
- [http://www.cdc.gov/ncidod/dhqp/ar\\_mrsa\\_in\\_schools.html](http://www.cdc.gov/ncidod/dhqp/ar_mrsa_in_schools.html)
- <http://www.easternyork.com/safety/MRSAinSchools.pdf>
- <http://www2.ed.gov/admins/lead/safety/emergencyplan/mrsa.doc>

### Part Two: Health Professions Research

Students choose two of the following health professions. For each chosen profession, write a one paragraph explanation of the “role” each has in the study, treatment, and prevention of MRSA and drug resistance.

*Physicians, Pharmacists, Public Health Advisors, Epidemiologists, Microbiologists, Medical Laboratory Technologist/Technician*

### Resources: Health Professions

- <http://explorehealthcareers.org//en/Index.aspx>
- [http://www.cdc.gov/employment/menu\\_topjobs.html](http://www.cdc.gov/employment/menu_topjobs.html)

## References:

- [http://www.actionbioscience.org/evolution/lessons/meade\\_callahanlessons.pdf](http://www.actionbioscience.org/evolution/lessons/meade_callahanlessons.pdf)
- <http://www.immed.org/illness/bioterrorism.html>
- *Why Does Evolution Matter Now?* Video –  
<http://www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html>
- [http://www.cdc.gov/employment/menu\\_topjobs.html](http://www.cdc.gov/employment/menu_topjobs.html)
- Germ Glow – <http://www.glogerm.com/>
- <http://health.howstuffworks.com/antibacterial-soapoutlawed.htm>
- <http://www.pbs.org/wgbh/evolution/educators/lessons/lesson6/act1notes.html>
- *Microbes: What They Do and How Antibiotics Change Them-*  
[http://www.actionbioscience.org/evolution/meade\\_callahan.html](http://www.actionbioscience.org/evolution/meade_callahan.html)
- [http://www.in.gov/dhs/files/Drug\\_Resistance\\_Day\\_1.pdf](http://www.in.gov/dhs/files/Drug_Resistance_Day_1.pdf)
- [http://www.in.gov/dhs/files/Drug\\_Resistance\\_Day\\_2.pdf](http://www.in.gov/dhs/files/Drug_Resistance_Day_2.pdf)
- <http://www.cdc.gov/handhygiene/training.html>
- Center for Disease Control, <http://www.cdc.gov>