

## SUGGESTED REFERENCES

- **DMBD – Antibiotic Resistance – Home:**  
<http://www.cdc.gov/drugresistance/community/>
- **Alliance for the prudent use of Antibiotics (APUA):**  
<http://www.tufts.edu/med/apua/index.html>
- **Scripps Research Institute**  
[www.scripps.edu](http://www.scripps.edu)
- **21st Century Complete Medical Guide to Antibiotics and Antibiotic Resistance, Drug-Resistant Bacteria, Antimicrobial Susceptibility, Authoritative CDC, NIH, and FDA Documents, Clinical References, and Practical Information for Patients and Physicians** PM Medical Health News
- **The Antibiotic Paradox. How the Misuse of Antibiotics Destroys Their Curative Powers (Second Edition),** Stuart B. Levy, M.D., 2002, Perseus Publishing, Cambridge, MA.
- **Killer Superbugs: The Story of Drug-Resistant Diseases (Issues in Focus)**  
Nancy Day, Enslow Publishers (August 1, 2001)

## NATIONAL SCIENCE EDUCATION STANDARDS

### Grades K-4

#### Life Science

The characteristics of organisms  
Life cycles of organisms  
Organisms and environments

#### Science in Personal and Social Perspectives

Personal health

### Grades 5 - 8

#### Life Science

Structure and Function in Living Systems  
Diversity and Adaptation of Organisms

#### History and Nature of Science

Nature of Science

\*Source: *National Science Education Standards, 1996, National Academy Press*

## CREDITS

### EDUCATOR ADVISORY PANEL

Fred Barch, M.S.  
Rose-Marie Botting, M.S.

Debra A. Murnan, B.A.  
John A. Murnan III, M.S.

### PRODUCTION CREDITS

WRITER/PRODUCER:  
ASSOCIATE PRODUCER:  
EDITOR:  
NARRATORS:

Jon Glassman  
Judi Sitkin  
Jon Glassman  
Cyrilla Baer Pond & Andrew Forman

# SCIENCE SCREEN REPORT FOR KIDS®

*Science Brought To Life In The Classroom*

SCIENCE SCREEN REPORT FOR KIDS is a proud participant in the Presidential Awards for Excellence in Mathematics and Science Teaching. For information visit  
[www.nsf.gov/pa](http://www.nsf.gov/pa)

1000 Clint Moore Road, Suite 211, Boca Raton, FL 33487  
tel: 1.800.232.2133 email: [info@ssrvideo.com](mailto:info@ssrvideo.com)  
[www.ssrvideo.com](http://www.ssrvideo.com)

COPYRIGHT © 2007 Allegro Productions, Inc. All rights reserved.

# SCIENCE SCREEN REPORT FOR KIDS

## VOLUME 17 ISSUE 1 PASSING THE BUG



Accreditation Board  
for Engineering  
and  
Technology



Presidential Awards  
for Excellence in  
Mathematics  
and  
Science Teaching



Junior Engineering  
Technical Society  
[www.jets.org](http://www.jets.org)

## SYNOPSIS

This program explores how we have learned to deal with bacterial disease over time. Humans have attempted to control bacterial diseases through the use of antibiotics, but over time, some of these antibiotics have gradually become less effective. The reasons behind this evolution of antibiotic ineffectiveness are explored.

Students will learn how two major theories in Biology, Germ Theory and Natural Selection play a role in bacterial resistance to antibiotics. The application of these theories provides an opportunity for students to understand how our actions may be doing us as much harm as good.

## CURRICULUM UNITS

- BIOLOGY
- ECOLOGY
- ENVIRONMENTAL SCIENCE
- HEALTH

## RUNNING TIME

14:54

## BACKGROUND

Bacteria are single-celled organisms that contain no membrane bound organelles. As the oldest known life forms on earth, bacteria are capable of living in severe environments better than any other kind of organisms.

Humans suffered up until the 20th century from bacterial diseases such as staph and strep throat. At that time, we had no drugs to treat these diseases and the mortality rate from some, like the Bubonic Plague, was extremely high. In 1928, Alexander Fleming discovered a fungus that effectively killed bacteria and in the 1940's large-scale production of penicillin began. Immediately, the number of people who died from bacterial infections dropped dramatically.

Soon afterwards, scientists began to notice that bacteria were developing a resistance to the antibiotics. Initially the resistance was limited and increasing the dosage of the antibiotic or changing to a different antibiotic was sufficient to eliminate the bacterial infection. However, scientists also noted that the bacteria could eventually develop resistance to all antibiotics. Over the next fifty years, scientists developed new antibiotics and doctors were able to keep the incidence of disease quite low.

Humans are not the only ones using Antibiotics. When livestock or pets get sick, they are given antibiotics as well. This is an appropriate use of antibiotics since some bacterial infections can be passed from animals to humans. Also, farmers began using antibiotics on healthy livestock when it was shown that the animals would gain weight faster with less feed. This lowered the cost of production, increased profits, increased the amount of antibiotics in the environment, and exposed more bacteria to humans.

Natural Selection predicts that in any population some individual organisms will have variations that allow them to survive a change in the environment. These individuals will pass on this variation to following generations. When we expose bacteria to antibiotics, we are changing the environment. When exposed to the antibiotic, most bacteria die, but some do not. The ones that do not are resistant. The more antibiotics used, the more likely the bacteria will become resistant.

When antibiotics are used for purposes other than defeating bacterial infections, they are being misused. Some companies produce consumer products such as antibacterial soap. This soap has little or no effectiveness compared to regular soap. Doctors also routinely give antibiotics to people suffering from viral infections. Although sometimes the viral infection can cause a secondary bacterial infection, doctors usually prescribe the antibiotic to appease the patient.

Overuse of antibiotics is leading to bacteria that are resistant to all antibiotics. VRE is one such bacterial strain. It is resistant to vancomycin, the most powerful antibiotic known. Patients often get infected with these bacteria in the hospital because of poor infection control, and once the infection begins, doctors must quarantine the patient to avoid infecting other patients.

Most students are vaguely aware that bacteria live on their body. These bacteria have colonized their skin and most times are harmless unless they penetrate the skin. Once they have done that, infection begins with an immune response from the body. Most students are aware of the signs of infection (fever, swelling, etc...) but few realize that if an infection progresses far enough that tissue death may occur. If an infection is not controlled, doctors may have no choice but to amputate the infected tissue.

## ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 5: The Living Environment  
Section F - Evolution of Life

Know by Grade 8

- Individual organisms with certain traits are more likely than others to survive and have offspring. Changes in environmental conditions can affect the survival of individual organisms and entire species.

\*Benchmarks can be found at [www.project2061.org/tools/benchol/bolintro.htm](http://www.project2061.org/tools/benchol/bolintro.htm)

## CRITICAL THINKING EXERCISES

1. Explain how bacterial infections begin.
2. Describe how antibiotic resistance can develop in bacteria.
3. Discuss methods that hospitals can take to reduce the number of antibiotic resistant bacteria.
4. Explain how antibiotics are misused.
5. Design an experiment to test the effectiveness of antibacterial soap, compared to hand soap, at killing the bacteria found on the hand.

## VOCABULARY

- Antibiotic** . . . . . A substance produced by or derived from certain fungi, bacteria, and other organisms, that can destroy or inhibit the growth of other microorganisms. Antibiotics are widely used in the prevention and treatment of infectious diseases.
- Quarantine** . . . . . A strict isolation imposed to prevent the spread of disease.
- Colonization** . . . . . The spreading of an infection into a new area.
- Colony** . . . . . A group of organisms of the same kind living or growing in close association.
- Germ Theory** . . . . . The doctrine holding that infectious diseases are caused by the activity of microorganisms within the body.
- Natural Selection** . . . . . The process by which forms of life having traits that better enable them to adapt to specific environmental pressures, as predators, changes in climate, or competition for food or mates, will tend to survive and reproduce in greater numbers than others of their kind, thus ensuring the perpetuation of those favorable traits in succeeding generations.
- Phagocytes** . . . . . A cell, such as a white blood cell, that engulfs and absorbs waste material, harmful microorganisms, or other foreign bodies in the bloodstream and tissues.
- Plasmids** . . . . . A circular, double-stranded unit of DNA that replicates within a cell independently of the chromosomal DNA. Plasmids are most often found in bacteria.
- Sepsis** . . . . . Local or generalized invasion of the body by pathogenic microorganisms or their toxins.

## CAREER POSSIBILITIES

- BIOLOGIST
- BIOTECH RESEARCHER
- PHYSICIAN
- MEDICAL TECHNOLOGIST
- NURSE
- PHYSICAL THERAPIST