Understanding: Viruses: Teacher's Guide

Grade Level: 9-12	**Curriculum Focus:** Microscopic World	**Lesson Duration:** Two class periods

Program Description

Even as you read this, your body may be under attack from a virus. This enemy is patient, adaptable, potentially deadly, and invisible. Viruses range from the common cold to HIV and have caused epidemics more destructive than war. This program includes one feature and four short segments:

- Discovering Viruses (9 min.)
- Pandemic! (9 min.)
- Old Virus, New Virus (19 min.)
- Viruses: Foes and Friends? (6 min.)
- Fighting Disease (7 min.)

Onscreen Questions

- How do viruses reproduce?
- How did World War I contribute to the influenza pandemic of 1918?
- Why is it important for virologists to study life forms in tropical rain forests?
- How might viruses be used to cure some genetic diseases?

Lesson Plan

Student Objectives

- Discover the functions of a virus.
- Research and devise a helpful genetically engineered virus.
- Describe environmental safeguards of the new virus.

Materials

- *Understanding: Viruses* video and VCR, or DVD and DVD player
- Computer with Internet access
- Print and Internet resources on viruses and on local weeds

Procedures

1. Review what students know about viruses. A good way to do this is by viewing the *Understanding: Viruses* video. Be sure they understand that viruses occur in plants as well as animals. You could cite the tobacco mosaic virus, which kills tobacco plants.
2. Tell students their task includes suggesting a useful purpose for a virus. To do that, they need to understand how viruses work.
3. Have students use library and Internet resources to add to their knowledge about viruses. They should understand the following before they continue with the project:
    - A virus is an infectious organism that reproduces within the cells of its host.
    - A virus is not alive until it enters the cells of a living plant or animal.
    - A virus contains genetic information wrapped in a protein coat.
    - A virus that mutates ensures its survival by becoming unrecognizable to immune systems and vaccines.
4. Divide your class into groups. Ask group members to imagine that they are a team of scientists assigned to genetically engineer a virus that will stop a local weed epidemic.
5. Hold a discussion about how such a potentially useful virus could also harm the environment. Challenge students to suggest ways to safeguard against such dangers.
6. Allow students enough classroom time to research the names and characteristics of local weeds. They may find it useful to research viruses that have been used already to control weed epidemics, learning what environmental safeguards scientists used. This will help them devise safeguards for their own viruses.
7. Instruct groups to perform the following tasks to complete their assignment:
    - Make a sketch of the weed.
    - Make a sketch of the genetically engineered virus.
    - Make a series of sketches to show the stages of a virus life cycle and the result of its infection.
    - Clearly describe safeguards required to keep the virus localized, and to make sure it doesn't harm animals or other plants or persist in the environment once the weeds are gone.
    - Make a display of the project for posting in the classroom

8. Review the groups' projects as a class, and ask students the following questions:
    - How does a virus reproduce and cause disease in a host?
    - How did World War I contribute to the flu pandemic of 1918? If the war had not occurred, what probably would have happened to the flu strain? Why?
    - Compare and contrast the work of Edward Jenner to that of Jonas Salk. How can their accomplishments set an example for modern scientists researching new threats?
    - How might viruses help cure genetic diseases?
    - Describe two instances from the program in which disease was used as a weapon. How effective were these weapons? Is this practice in use today? What are the potential consequences of using viruses in this manner?
    - How might the destruction of rain forests help spread new viral diseases?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students carefully drew and labeled all sketches; environmental safeguards were based on research, reasonably realistic, and clearly explained.
- **2 points:** Students adequately drew and labeled their sketches; some environmental safeguards were based on research, reasonably realistic, and somewhat clearly explained.
- **1 point:** Students inadequately drew and labeled their sketches; environmental safeguards were not based on research, were unrealistic, and vaguely explained.

Vocabulary

antibody

Definition: A protein created in blood and body tissue by the immune system to neutralize or destroy sources of disease

Context: Antibodies bind to the surface of viruses, flagging them for death.

pandemic

Definition: Occurring over a wide geographic area and affecting an exceptionally high proportion of the population

Context: The influenza pandemic of 1918 struck every major city in the United States.

vaccine

Definition: A preparation of a weakened or dead pathogen, such as a bacterium or virus, or of a portion of the pathogen's structure, that stimulates immunity

Context: Many people get a flu vaccine every year.

virus

Definition: Infectious organism that reproduces in the cells of an infected host

Context: A virus is not alive until it enters cells of the body, where it grows and reproduces, often causing viral illnesses.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit http://books.nap.edu.

This lesson plan addresses the following science standards:

- Life Science: Interdependence of organisms; Behavior of organisms

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit http://www.mcrel.org/.

This lesson plan addresses the following national standards:

- Science—Life Sciences: Understands relationships among organisms and their physical environment
- Language Arts—Viewing: Uses viewing skills and strategies to understand and interpret visual media

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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- http://school.discovery.com/teachingtools/teachingtools.html

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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

***Play Video*—** This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

***Video Index*—** Here the video is divided into five parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

***Curriculum Units*—** These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

***Standards Link*—** Selecting this option displays a single screen that lists the national academic standards the video addresses.

***Teacher Resources*—** This screen gives the technical support number and Web site address.

Video Index

I. Discovering Viruses (9 min.)

The simplest form of life, a virus attaches itself to living cells in order to replicate and survive. Discover how our understanding of viruses has changed over the years.

II. Pandemic! (9 min.)

The 1918 influenza epidemic was one of the worst pandemics the world has known. Learn about the many different flu strains and the vaccines we use to combat them.

III. Old Virus, New Virus (19 min.)

From polio to AIDS, viruses have been with us since the beginning of time. See how smallpox was wiped out, and investigate some viral diseases still at large today.

IV. Viruses: Foes and Friends? (6 min.)

Historically considered enemies, viruses may one day become medical allies. Explore how researchers hope to use them for the common good.

V. Fighting Disease (7 min.)

Learn about how our immune systems work, the fight to find a cure for the common cold, and the vaccines science has created to help boost our natural immune defenses.

Curriculum Units

1. The Simplest Form of Life

Pre-viewing question
Q: Have you ever had a virus?
A: Answers will vary, but most students will answer yes.

Post-viewing question
Q: What is a virus?
A: Viruses are submicroscopic pieces of genetic code wrapped in a simple protein for protection. A virus can't begin to replicate itself until it finds a living cell to invade.

2. Under the Microscope

Pre-viewing question
Q: What do viruses look like?
A: As seen through an electron microscope, viruses can look like spheres, spindles, or geometric shapes.

Post-viewing question
Q: How do viruses work?
A: A virus uses the proteins on its surface to attach itself to a target cell. The virus then acts as a parasite, using the cellular mechanism of the target cell for its own duplication and survival.

3. Viruses Through the Ages

Pre-viewing question
Q: Where are viruses found?
A: Answers will vary; possible answers include in water, in the air, and in any living cell.

Post-viewing question
Q: How does the T4 virus work?
A: The T4 virus attacks bacteria. Once inside a bacterial cell, it "hijacks" the cell and forces it to make more viruses. Within minutes, the infected cell explodes, releasing hundreds of new T4 viruses to infect other bacterial cells.

4. An Outbreak of Influenza

Pre-viewing question
Q: How do viral illnesses spread?
A: Answers will vary.

Post-viewing question
Q: What do people do to try to protect themselves from illnesses?
A: Answers will vary.

5. Experimenting with Vaccines

Pre-viewing question
Q: What vaccinations have you received?
A: Answers will vary.

Post-viewing question
Q: What are the major functions of the human immune system?
A: To protect and defend against disease, it produces antibodies, proteins that bind to the body of a virus, flagging it for destruction. The body's white cells move in to destroy the viral cells. Once you have had a virus, memory cells within your immune system will recognize it if it ever tries to invade again.

6. Mutating Flu Viruses

Pre-viewing question
Q: Why do some people who receive flu vaccines still get the flu?
A: Answers will vary.

Post-viewing question
Q: How often can a virus change or mutate?
A: The answer depends on how the virus is made. If it has genetic material arranged in the standard double helix DNA, then it is fairly stable from generation to generation. If a virus is an RNA virus, like influenza, then it changes all the time.

7. Surviving Epidemics

Pre-viewing question
Q: What do you think it was like to live through a polio or influenza epidemic?
A: Answers will vary.

Post-viewing question
Q: Should we continue to vaccinate for viruses that are no longer prevalent?
A: Answers will vary.

8. Destroying Rotaviruses

Pre-viewing question
Q: Why does there seem to be a greater risk of viral infections in developing countries?
A: Answers will vary.

Post-viewing question
Q: Why do rotaviruses spread so easily in many developing countries?
A: Lack of potable drinking water, poor sanitation conditions and hygiene, and lack of information all help spread rotaviruses. These conditions are frequently found in developing countries.

9. Death of a Disease

Pre-viewing question
Q: What are the pros and cons of destroying a virus?
A: Answers will vary.

Post-viewing question
Q: How was the spread of smallpox ended?
A: Smallpox can only grow in human beings. Mass vaccinations kept the disease from spreading. When the last human victim recovered, the chain of transmission stopped.

10. Reintroducing Old Viruses

Pre-viewing question
Q: Why are older, dormant viruses reappearing as the world's population spreads?
A: Answers will vary.

Post-viewing question
Q: What do you think will happen if we continue to destroy the world's rainforests?
A: Answers will vary.

11. Our Vulnerability to AIDS

Pre-viewing question
Q: How can we reduce the spread of HIV and AIDS?
A: Answers will vary.

Post-viewing question
Q: How does HIV work?
A: The human immunodeficiency virus (HIV) is a member of a fast-mutating RNA virus family that destroys the immune system. Using retroviral RNA properties, HIV creates DNA copies of itself that hide in the host cell, making it extremely difficult to find.

12. Working With Viruses

Pre-viewing question
Q: Why should the U.S. Army be prepared to fight new viral diseases?
A: Answers will vary.

Post-viewing question
Q: What virus characteristic are researchers trying to use?
A: They are trying to use a virus' ability to break into cells in order to alter genetic defects. For example, experiments are also underway to deliver a missing gene to people with cystic fibrosis.

13. The Immune System

Pre-viewing question
Q: Why is it so difficult to find a cure for the common cold?
A: There are more than 200 varieties of the virus that causes colds.

Post-viewing question
Q: How do vaccines work?
A: They typically contain a weakened or dead pathogen, such as a bacterium or virus. Because these strains contain the virus' unique proteins, they trigger an immune response, building the body's ability to fight the virus.