



DUCKS, PIGS, YOU AND THE INFLUENZA VIRUS

Subject Matter: Science

Grade Levels: 11-12

Time Allotment: Three 50-minute class sessions

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Overview

How does the influenza virus change? Swine, Russian and the Fujian flus: Where do these names come from and what do they mean? The flu is caused by viruses from the orthomyxoviridae family. Influenza epidemics can cause thousands of deaths each year as well as cause economic losses because of absentee employees. Different vaccines must be developed each year to protect against new strains of the influenza virus. Should you get a vaccination against the flu? This lesson will look at and answer some of these questions.

Learning Objectives

Students will be able to:

- Understand how viral nucleic acid changes result in new strains of influenza.
- Identify the cause of nucleic acid changes in the influenza virus.
- Understand the nomenclature for the “flu shot.”
- Identify the connection between ducks, pigs and people.
- Describe methods of disease infection.

Oregon Standards Available at:

<http://www.ode.state.or.us/cifs>

Science – Life Science

Understand structure, functions and interactions of living organisms and the environment.

Organisms

- Describe, explain and compare the structure and functions of cells in organisms.

Heredity

- Explain laws of heredity and their relationship to the structure and function of DNA.

Media Components

Video

Check the link at <http://www.opb.org/edmedia/trs/> to find access to the video(s) from unitedstreaming™ referenced in this lesson plan.

- “Life Science: Viruses” (20:00)
 - **Clip:** “Vaccines” (02:55)
- “The Body’s Defenses Against Disease” (23:46)
 - **Clip:** “Immunity and Vaccination” (03:06)
- “Understanding: Viruses” (54:00)
 - **Clip:** “Mutations in Viruses (03:04)
- “Biologix: Genes, Mutations and Viruses” (29:00)
 - **Clip:** “Viruses” (02:02)

Web

- **The Blackout Syndrome**

An Interactive Web site where the student tries to solve a mystery about the source of a mysterious illness. A child is rushed to the hospital bleeding uncontrollably from the eyes, hands and mouth and soon another case occurs. The student is asked to select clues and determine where the mysterious disease originated.

<http://www.accessexcellence.org/tbs/>
- **Influenza**

Excellent summary of the influenza virus, laboratory diagnosis, morphology used in identification, life cycle, nomenclature, evolution and treatment.

<http://web.uct.ac.za/depts/mmi/jmoodie/influen2.html>
- **Centers for Disease Control and Prevention**

Home page for the federal agency responsible for protecting the health and safety of people. Provides information about diseases, health and safety issues.

<http://www.cdc.gov/>
- **Communicable Disease Surveillance and Response (CSR)**

Lists recommendations for the composition of the influenza vaccine for both the Southern and Northern hemispheres. Includes recommendations for previous influenza vaccines.

<http://www.who.int/emc/diseases/flu/recommendations.html>

Materials

Per Student:

- Small square of paper
- Pencil or pen
- “Who’s the Source of the Infection?” worksheet available from <http://school.discovery.com/curriculumcenter/viruses/pdf/activity2.pdf>
- Mutations in Viruses Worksheet (located at end of lesson plan)

Per Class and/or Group:

- Cardboard box or similar type of container

Prep for Teachers

When using media, provide students with a **Focus for Media Interaction**, a specific task to complete and/or information to identify during or after viewing of video, Web sites or other multimedia elements.

Prior to teaching this lesson, bookmark the Web sites used in the lesson on each computer or provide a list of the URL addresses that students can type into the address bar. Make sure that each Web site is still available for use before bookmarking.

Download the video clips onto the computer that will be used for the classroom presentation. Be sure each video clip displays appropriately by using appropriate plug-ins and media players. Make sure the screensaver is turned off or is on a long delay.

Contact the local health department for a list of vaccinations that students must acquire before entering school. The local school district office may also have this information. The Oregon requirements are for diphtheria, tetanus, polio, measles, mumps and rubella. Other shots are to be phased in for hepatitis, second dose measles and varicella (chicken pox).

Introductory Activity

Step 1: Have students participate in the activity, “Who’s the Source of the Infection?”, from Discovery Channel School’s Curriculum Center to create interest in learning about the spread of disease: <http://school.discovery.com/curriculumcenter/viruses/pdf/activity2.pdf>

Step 2: Using the students’ infection models that were created as part of “Who’s the Source of the Infection?”, have them identify their methods of preventing disease transmission. *Possible answers include covering your mouth when you cough, washing hands with soap and water frequently, and staying home when ill.* Make sure students include vaccination as an option.

Step 3: Ask students to list vaccinations that they may have had throughout their lives. *Examples would include diphtheria, tetanus, polio, measles, mumps, rubella, hepatitis and varicella (chicken pox).*

Step 4: Explain to students that they are going to focus on the influenza virus, the reason it changes so easily and the resulting need for a new flu vaccine each year.

Learning Activities

Step 1: Explain to students that they will be watching a short video clip about genetic change in viruses. Provide students with a **Focus for Media Interaction** by asking them to identify information about genetic shift, DNA and RNA differences, the need for new influenza vaccines, animal influenza, viral influenza jumping species and what could happen when people live in close proximity to farm animals. Have students record the identified information on the Mutations in Viruses handout that is available at the end of the lesson plan. Preview the handout with the students.

Step 2: Play the video clip, “Mutations in Viruses” (03:04), from the video, “Understanding: Viruses” (54:00). At the end of the video clip, have students share the information they recorded on the Mutations in Viruses handout. (The answer key is available at the end of the lesson plan.) Answer questions about any information that students may not completely understand.

Step 3: Explain to students that they will be watching another video clip about viruses and their nucleic acid. Provide students with a **Focus for Media Interaction** by asking them to record the process by which viral nucleic acid may change. *Viral nucleic acid changes may occur when RNA is spliced into the host cell DNA, causing the host cell DNA to mutate and produce viruses with new genetic information, or when transduction occurs as a result of the virus taking some of the host cell DNA with it and introducing it to a new host cell.* **Play** the video clip, “Viruses” (02:02), from the video, “Biologix: Genes, Mutations, and Viruses” (29:00).

Step 4: Have students work as teams or partners and use the information they just recorded from the video to describe how this new gene combination could manifest itself in a virus. *Student descriptions should include that new viral identifying structures on the surface of the virus would be changed and a person would probably become ill because they do not have antibodies that recognize the foreign invader.*

Step 5: Play the video clip, “Vaccines” (02:55), from the video, “Life Science: Viruses” (29:00). Provide students with a **Focus for Media Interaction** by asking them to identify the world’s first vaccine and the disease the vaccine was created to prevent, as well as the steps the body’s immune system takes to prevent future infections. *First vaccine was made from cow pox and given to individuals to prevent small pox. Virus enters the individual; antibodies rush to virus marking it for destruction; white blood cells move in and destroy the virus; if the body is infected again by the same virus, it will quickly identify the virus and destroy it before it can cause the person to become ill.*

Step 6: Using the information the students just recorded, have them diagram on the chalkboard or whiteboard the process from viral entry into the body through the formation of antibodies for future immunity. *The diagram should include the virus, antibodies, white blood cells and the memory cells that will attack the virus in the future.*

Step 7: Provide students with a **Focus for Media Interaction** by asking them to define immunity and record how a vaccine provides the body with immunity. **Play** the video clip, “Immunity and Vaccination” (03:06), from the video, “The Body’s Defenses Against Disease” (23:46). *Immunity is the body’s ability to recognize the markers on the virus surface and destroy it before it infects the body’s cells. Vaccines work because they contain parts of the viral markers found on the surface of the virus. The immune cells attack these pieces of viral markers and destroy them, then create antibodies to protect the body against future invasions. If there is future exposure, the antibodies will immediately attack and destroy the virus before the person becomes ill.*

Step 8: Have students share their definitions of immunity. *Immunity is the body’s ability to recognize the markers on the virus surface and destroy it before it infects the body’s cells. Immunity is the resistance to a disease.*

Step 9: Students should work in teams and use the information from the video clip to describe how a vaccine works or aids the immune system in the human body in preventing infection. Students should share their results with the class. *Vaccines work because they contain parts of the viral markers found on the surface of the virus. The immune cells attack these pieces of viral markers and destroy them, then create antibodies to protect the body against future invasions. If there is future exposure, the antibodies will immediately attack and destroy the virus before the person becomes ill.*

Step 10: Ask students to recall names of flus or flu vaccines. Create a list on the chalkboard or whiteboard of their contributions. Students will probably remember some flu names, but will struggle with flu vaccine names. *Flus: Swine, Avian, Hong Kong, Russian, Spanish. Vaccines: A/New Caledonia/20/99 (H1N1), A/Moscow/10/99 (H3N2), B/Hong Kong/330/2001.*

Step 11: Have students share their reasons for the different names of the flu or flu vaccines. *Answers may include where the flu came from or where a lot of people got the flu.*

Culminating Activity

Activity 1:

Provide students with a **Focus for Media Interaction** by asking them to identify how flu vaccines are named. Have students explore the following Web site to conclude if their explanations about the flu vaccine names were accurate and explain how the flu vaccines are named: <http://web.uct.ac.za/depts/mmi/jmoodie/influen2.html> *Flu vaccines have five parts to their names: A/New Caledonia/20/99 (H1N1): A is the type of flu; New Caledonia is the town*

where the flu was first isolated; 20 is the number of isolates; and 99 is the year of isolation. H1N1 is the protein type on the surface of the virus: N is neuraminidase protein (9 types) and H is hemagglutinin protein (15 types).

After students have identified how the influenza vaccine is named, provide the students with a **Focus for Media Interaction** by having them identify five influenza vaccines and their compositions. Students may access either the Web site for the Center for Disease Control at <http://www.cdc.gov/> and use their search engine by typing “influenza vaccine composition” or access the Web site for the World Health Organization Communicable Disease Surveillance and Response at <http://www.who.int/emc/diseases/flu/recommendations.html>. Use the students’ results to generate a class list of different influenza vaccines the students identify.

Activity 2:

Use the interactive Web site The Blackout Syndrome, <http://www.accessexcellence.org/tbs/>. Have students complete Episode One of the mystery about the source of a disease that has mysteriously appeared. Students may work as individuals or partners to solve the case. Individuals or partners should be prepared to share their findings and develop a procedure that would prevent the spread or further spread of the mysterious disease.

Cross-Curricular Extensions

Geography

- Have students explore and map the flu pandemic of 1918-19 by using the lesson plan available from the National Geographic Web site: <http://www.nationalgeographic.com/xpeditions/lessons/17/g912/disease.html>

Mathematics

- Have students graph and determine the percentage of the weekly increase in influenza cases. Weekly influenza cases can be found at the Center for Disease Control (CDC) Web site: <http://www.cdc.gov/flu/weekly/fluactivity.htm>

Community Connections

- Contact the local health department and invite a nurse or doctor to talk about local influenza topics or concerns, at-risk populations, influenza shot schedules or the type of influenza shots available.
- Invite a local veterinarian to discuss other types of viruses that could jump species and the precautions that veterinarians take to prevent becoming infected.

Mutations in Viruses

1. What is the result, in respect to humans, of a genetic shift in the influenza virus?
2. What makes double helix DNA viruses less likely to genetically shift?
3. Why do RNA viruses change on an almost yearly basis?
4. Why do we need a new vaccine for the influenza virus each year?
5. What other animals will the influenza virus live in?
6. Can the influenza virus cross from one species to the next?
7. What happens when people live in close proximity to farm animals? Why is this of concern?

Mutations in Viruses Answer Key

1. What is the result, in respect to humans, of a genetic shift in the influenza virus?
The flu virus mutates and changes the way it looks and gets around the immune system and may cause major epidemics.
2. What makes double helix DNA viruses less likely to genetically shift?
DNA has a spelling checker to make sure the double strands of DNA are identical.
3. Why do RNA viruses change on an almost yearly basis?
RNA does not have a spell checker to make sure the code is not changed.
4. Why do we need a new vaccine for the influenza virus each year?
Since the RNA virus can change on a yearly basis, the human body's immune system will not recognize the new viral strain and will become infected.
5. What other animals will the influenza virus live in?
Farm animals, especially swine and chickens
6. Can the influenza virus cross from one species to the next?
Yes.
7. What happens when people live in close proximity to farm animals?
When people live in close proximity to farm animals, they will come in contact with the virus when the animal coughs or sneezes.
8. Why is this of concern?
This is of concern because the virus will have a new combination of RNA and the human immune system will not recognize the new virus. Therefore, a new epidemic may result.