

DOLPHIN RESEARCH CENTER

Viruses and Dolphins

Grade Level: 6th-8th

Objectives: Students will be able to explain how viruses operate within cells and how they can be transmitted. Students will be able to apply their knowledge of viruses to a case study involving dolphins.

Florida Sunshine State Standards:

Science

SC.G.1.3.1 The student knows that viruses depend on other living things.

National Science Education Standards:

Content Standard C (5-8) - Structure and Function in Living Systems: Disease is a breakdown in structures of functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.

Background: Viruses often seem to be precariously perched on the line between the living and the nonliving. A virus is a particle made up of nucleic acid (either DNA or RNA, depending on the virus) and a protein coat. The protein coat that encloses a virus's genetic material is called a capsid. Some viruses have an additional layer called an envelope. A virus does not have the cellular structures required for producing proteins, so while a virus may exist outside of a host cell, it can only replicate after infecting a host cell.

A virus is only capable of infecting certain cells. Some types of viruses can infect multiple species and/or types of tissues, while other viruses may be so specific that they can only infect one type of tissue in one species of organism. The virus will enter a cell by binding to a specific protein on the surface of the cell. Once the virus is attached, its genetic material will then gain entry into the cell. The genetic material essentially takes over the cell, reprogramming the host cell so that it copies the virus's genetic material. The virus will also use the host cell's resources (ribosomes, ATP, enzymes, etc.) to produce new viruses. Once the new viruses are assembled they will either exit the host cell without killing it, or they will continue accumulating in the host cell until it bursts. These new viruses can then go on to infect new host cells.

Virus particles are always in the surrounding environment. Viruses can enter the body of an animal (including humans) via the mouth, nose, or breaks in the skin. If a virus finds

Key Terms

- Capsid:** The protein coat that encloses a virus's genetic material
- Disease:** A breakdown in structures or functions of an organism
- Host Cell:** A cell that has been infected by a virus
- Pathogen:** A disease-causing agent such as a virus or bacteria
- Virus:** A particle made up of nucleic acid (DNA or RNA) and a protein coat. Viruses may exist outside of a host cell, but can only replicate after infecting a host cell.



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the type(s) of cells it is designed to attack, an infection will occur. If the virus does not find these cells, the organism will simply carry the virus without becoming infected. However, it is still possible for the carrier to transmit the virus to other organisms that may then become infected.

Vaccines have been developed to prevent viral infections. A vaccine usually contains a harmless variation of a pathogen (virus, bacteria, etc.) and stimulates the immune system to defend the body. After a vaccination, the immune system becomes sensitized to the harmful version of the pathogen, and if the pathogen enters the body the immune system is prepared to ward off infection. Vaccines are able to prevent illnesses caused by certain viruses, but current medical technologies are able to do very little once a virus has invaded the body. Medications may be prescribed to minimize the symptoms of a viral infection, but the virus itself must simply run its course. Antibiotics are able to fight off bacterial infections by inhibiting the bacteria's enzymes or cellular processes, but they are useless if a virus invades, because a virus simply uses the resources of the host cell.

Viruses infect many types of organisms, including bacteria, plants, and animals. Viruses that commonly affect humans include the flu, chicken pox, or even the common cold. Vaccines are widely available for some viruses such as polio, measles, and mumps. As a result, these viral infections are not as widely seen in humans as they once were. There are viruses that affect dolphins and other marine mammals. Morbillivirus is a virus found in cetaceans, and is similar to canine distemper in dogs and measles in humans. More information on this virus can be found in our **Morbillivirus** information file.

Materials:

For the class:

- Bleach
- Medicine dropper

For each student:

- A numbered paper cup containing water (One student will have a cup containing hydrogen peroxide instead)
- A computer with Internet access
(NOTE: If Internet access is not available to your students, this lesson may still be conducted using information printed from the suggested websites or from textbooks.)
- **Viruses and Dolphins** handout

Teacher Prep Notes: Make arrangements for students to use the Internet in your school's computer lab. Make a copy of the **Viruses and Dolphins** handout for each student.

Prepare cups for students to complete the "Fizzies Virus" activity. Set out a paper cup for each student. Number each of the cups on the side. Randomly select one cup and partially fill the cup with hydrogen peroxide. Note which cup contains the hydrogen peroxide. Partially fill the remaining cups with water. The cups should be a little bit less than half full.



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This lesson does not require any prior knowledge of viruses. However, it would be beneficial for students to have a basic understanding of cellular structure and function, as well as the characteristics of living things. Students may also benefit from a basic understanding of bacteria and the types of diseases they cause.

Procedures:

1. Ask students to share their own definitions of the word “disease”.
2. Explain that a disease is a breakdown of structures or functions in an organism.
3. Have the class generate a list of diseases that affect humans, and ask the students to describe ways in which these diseases impair the functioning of the human body. (One example could be cancer, which is a disease that can cause the body’s cells to replicate uncontrollably and form tumors. Another example of a human disease is chicken pox, which results in the formation of itchy red bumps and blisters on the skin.)
4. Ask students to explain how they think these diseases are caused.
5. Discuss the fact that there are many different causes of disease, and that the general term for these disease-causing agents is “pathogen”.
6. Explain that bacteria are single-celled organisms, and some types of bacteria may cause disease in humans or other organisms. Bacteria cause diseases such as pneumonia, salmonella, and strep throat.
7. Discuss that a virus is another type of pathogen. Unlike bacteria, though, viruses are not considered living things. They are unable to reproduce on their own, and must invade a host cell in order to replicate their genetic material.
8. Distribute the **Viruses and Dolphins** handout to students. Direct them to a textbook or to some of the websites below. Ask students to use these resources to respond to the questions in Part I of the handout.
9. Once students have completed Part I, bring the class back together and discuss the information the students have gathered. At this point, they should have an understanding of the general structure of a virus and the ways that viruses invade cells.
10. The students will now complete Part II of the **Viruses and Dolphins** handout to learn more about morbillivirus in dolphins. Students will need to view the Pathologist’s Report found on the website indicated on the handout and respond to the questions provided.
11. Discuss student responses to the questions.
12. Now explain to students that they will be participating in an activity to demonstrate how a virus like morbillivirus might spread among a dolphin population. (This is Part III of the handout.)
13. Provide each student with a cup, and allow the students to exchange the fluid in their cup with three classmates. To do this, one student will need to pour all the liquid from his/her cup into the cup of another student. These two students will then need to carefully pour half of the liquid from the full cup into the empty cup. Each student should exchange fluid with a total of three classmates, and record the names of these classmates on their handout.



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14. Once students have completed this, they will return to their seats. You will need to move around the room and use a medicine dropper to place a few drops of bleach in each student's cup. If the liquid in the cup fizzes, the student's cup is infected with the "Fizzies Virus".
15. Generate a list of students with infected cups on the board. Work with the students to determine the one cup that originally contained the virus.
16. Have students respond to the final question in Part III, and then discuss answers as a class. (NOTE: Part IV of the activity is optional, and is listed below as one of the options for **Taking it Further.**)

Wrap Up: Select students to summarize what they have learned about viruses.

Taking it Further:

- Assign each student (or pair of students) the name of a viral disease that affects humans. Have students use Internet or print resources to complete Part IV of the **Viruses and Dolphins** handout.
- Ask students to research additional marine mammal diseases caused by viruses.
- Compare the pathology and transmission of human viral infections with those in marine mammals. (Morbillivirus and measles would be a good starting point, as the viruses that cause these diseases are closely related.)

Resources:

Find the Pathologist's Report referred to in student handout at the following website:

http://www.tmmsn.org/pathology/path_Hope2.html

Here are some websites you and your students might find useful when learning about viruses.

- **What the Heck is a Virus?** (<http://people.ku.edu/~jbrown/virus.html>): An interesting and very informative description of viruses, their effects, and prevention.
- **How Stuff Works** (<http://science.howstuffworks.com/virus-human.htm>): Great overview of viruses.
- **Encarta Encyclopedia-Viruses** (http://encarta.msn.com/encyclopedia_761575740/article.html): Another good overview.
- **Stalking the Mysterious Microbe** (<http://www.microbe.org/index.html>): Click on "Join Sam in Solving Microbe Mysteries", and this will take you to a page where you can find more information about all kinds of microbes, including a kid-friendly explanation of viruses.
- **American Museum of Natural History Infection Detection Protection** (<http://www.amnh.org/nationalcenter/infection/infectionindex.html>): More kid-friendly information and games pertaining to all types of microbes, including viruses.

The following websites contain information on diseases caused by viruses.



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- **Karolinska Institutet University Library**
(<http://www.mic.ki.se/Diseases/C02.html#C02.256.466.175>)
- **The Big Picture Book of Viruses**
(http://www.virology.net/Big_Virology/BVDiseaseList.html)

The “Fizzies Virus” activity in this lesson is adapted from the following website:

- **KidZone Lesson Plans** (<http://www.kidzone.ws/plans/view.asp?i=100>)

