

<i>PEER One Health Curriculum</i>	
Leader Guide	Zoonotic Disease – Case Study: West Nile

Summary:

The “Zoonotic Disease” One Health module explores the concepts of taxonomy and symbiotic relationships through the lens of disease-causing agents. Students will learn the definition of zoonotic disease and discover specific diseases of particular importance to humans and animals. Through the One Health in Action case study, students will have the opportunity to investigate the impact of West Nile Virus.

Keywords: asymptomatic, commensalism, host, mutualism, parasite, symbiosis, vector, zoonoses

Subject TEKS:

- Biology (12) Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:
 - (A) interpret relationships, including predation, parasitism, commensalism, mutualism, and competition, among organisms

Grade Level: 6th - 9th

Learning Objectives:

1. Define symbiosis and describe commensalism, mutualism, and parasitism.
2. Determine if organisms have a commensalistic, mutualistic, or parasitic relationship.
3. Define zoonotic disease.
4. Define vector and give examples of three common disease vectors
5. Describe how West Nile Virus is Spread
6. Identify the species affected by West Nile Virus and describe the potential symptoms of each.
7. Develop a plan for determining infection and preventing outbreak of West Nile Virus

Time Required: Three - four, 45-minute class periods

Materials:

- Devices with internet access
- West Nile symptom handouts (can be laminated and reused)
- Colored stickers to indicate symptomatic/asymptomatic infection
- Posters, presentation/butcher paper, etc.
- Markers, sharpies, other art supplies

Background and Concepts for Teachers:

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Symbiotic Relationships

Symbiosis describes a close and long-term relationship between different species in which at least one species benefits. These symbiotic relationships often dictate the survival of one or both organisms. There are three types of symbiotic relationships: mutualism, commensalism, and parasitism.

Mutualism is a symbiotic relationship in which both species benefit. An example of a mutualistic relationship is between herbivores and gut bacteria. The bacteria help the herbivore digest food and utilize the intestines and its content as food and shelter. Since both species benefit, it is a mutualistic relationship. Clownfish and sea anemones also have a mutualistic relationship. The clownfish protects the anemone from anemone-eating fish, and the stinging tentacles of the anemone protect the clownfish from predators; mutual protection! The relationship between the plover bird and the African crocodile is another example of this type of symbiotic relationship. The tiny blackbird helps the crocodile by removing morsels of food that are stuck between the crocodile's teeth. These food remains are the source of food for the bird.

Commensalism is a symbiotic relationship in which one species benefits while the other is not affected. Commensal relationships may involve an organism using another for transportation or housing. For example, spiders build their webs on trees. The spider gets to live in the tree, but the tree is unaffected. Cattle egrets and livestock also have a commensal relationship. Cattle egrets are often found in grasslands near cattle, horses, or other livestock. These birds feed on the insects that are disturbed due to the movement of the animals.

Parasitism is a symbiotic relationship in which the parasitic species benefits while the host species is harmed. Parasites may live either inside or on the surface of their host. An example of a parasite is a hookworm. Hookworms affect the small intestine and lungs of a host organism. They must live inside of a host in order to survive. Some parasites may kill their host but most do not. It's easy to see why; if a parasite kills its host, the parasite is also likely to die. Parasites are found in animals, plants, and fungi.

Zoonotic Disease

Zoonotic disease (plural, zoonoses) is an infectious disease caused by a pathogen (an infectious agent, such as a bacterium, virus, parasite or prion) that has jumped from an animal (usually a vertebrate) to a human. These pathogens can cause many different types of illnesses in people and animals, ranging from mild to serious illness and even death. Zoonoses have different modes of transmission including direct contact or through food, water or the environment.. In direct zoonosis the disease is directly transmitted from animals to humans through media such as air (influenza) or through bites and saliva (rabies). In contrast, transmission can also occur via an intermediate species (referred to as a vector), which carry the disease pathogen without getting sick. When humans infect animals, it is called reverse zoonosis or anthroponosis.

West Nile Virus

West Nile virus is an infectious disease that first appeared in the United States in 1999. Infected mosquitoes spread the virus, and it is the leading cause of mosquito-borne disease in the continental United States. The mosquitoes get the virus when they bite an

infected bird. The West Nile virus can infect humans, birds, mosquitoes, horses, and some other mammals. Infected people usually have no symptoms or mild symptoms which may include a fever, headache, body aches, skin rash, and swollen lymph glands. Symptoms can last a few days to several weeks, and usually go away on their own.

Vocabulary / Definitions:

- **Commensalism** – an association between two organisms in which one benefits and the other derives neither benefit nor harm.
- **Host** - an organism that harbors another organism inside or near their body in a symbiotic relationship
- **Mutualism** - an association between two organisms in which both organisms benefit
- **Parasite** - relationship between two species of plants or animals in which one benefits at the expense of the other
- **Symbiosis** - a close living relationship between organisms from different species, usually with benefits to one or both of the individuals
- **Vector** - An organism or vehicle that transmits the causative agent or disease-causing organism from the reservoir to the host
- **Zoonosis** - diseases caused by germs that spread between animals and people

Lesson Introduction/Motivation:

Begin the lesson by illustrating the concept of One Health with this simple colored water activity:

<https://drive.google.com/file/d/1GgyzUOp0dros2FL7PMELrmTkAzG4mJMs/view?usp=sharing>

Leaders could then introduce the ideas of symbiosis and One Health to their classes by watching the “Zombees” Science Friday video (<https://youtu.be/prtOM9LOz7U>). After watching, have students discuss the relationship witnessed between the flies and bees. How might this relationship impact humans or the environment? Have students brainstorm other relationships between organisms or organisms and the environment. If students are struggling to think of relationships, you can show this video: <https://youtu.be/2vpkOvIZJqs> Categorize the relationships as harmful, beneficial, or neutral.

Students begin by taking the “pre-test” in order to assess their current knowledge and understanding. This may also enable students to recognize concepts about which they would like to learn more or to which they need to pay particular attention.

Exploration/Explanation: Day 1

Students should next examine the required concepts (standards) related to zoonotic disease (taxonomy and symbiosis) through the Essential Knowledge – “Zoonotic Disease” section of the Zoonotic Disease module from the One Health online curriculum. This can be done as a whole group, small group, partner, or individual activity. Slides, videos, and stopping points are listed below.

- Slides 1 – 3 “What are Zoonotic Diseases?”, “Zoonotic Diseases”, “Causes of Zoonotic Disease”
- Zoonotic Disease Knowledge Checks # 1 & # 2 (use as whole group activity, or create friendly competition – boys v. girls, etc.)
- Slide – “Symbiotic Relationships & Zoonotic Disease”
- Video (view as whole group and discuss: “What types of symbiotic relationships did you see?”, “Were the relationships beneficial, harmful, or neutral?”, etc.) - <https://www.youtube.com/watch?v=g09BQes-B7E>
- Slides – “How do Humans get Parasites & Diseases from Animals?”, “Vector-Borne Parasites”, “Trypanosoma Cruzi”
- Video (view as whole group and discuss: “What is this veterinarian studying?”, “What is the vector of the disease?”, “Why is this considered a One Health issue?”) - <https://www.youtube.com/watch?v=QJvLqRTXFc8&t=54s>
- Slides – “Water-Borne Parasites”, “Fecal Transmission”
- Video (view as whole group and discuss: “What is the disease shown in the video?”, “What is the vector of the disease?”, “Why is this considered a One Health issue?”) - <https://www.youtube.com/watch?v=rqno7K2zXi4>
- Slides – “Hookworms and Roundworms”, “Contaminated Foods”
- Knowledge Check – “Think Break” (use as whole group activity, or create friendly competition – boys v. girls, etc.)

Elaborate: Day 2

- West Nile Role Play Activity - https://drive.google.com/file/d/13qzFMJhTu1T6zxwy7p6YEkLsMBxr_V16/view?usp=drive_link

Ask for three volunteers to play the One Health professions – physician, veterinarian, wildlife biologist. These students will leave the room and be given a brief description of West Nile Virus and that there is a suspected West Nile outbreak in the area. They will then be coached by the teacher/mentor on making diagnoses (hypotheses) based on physical exam and observations (abnormal behavior, fever, cough, headache, difficulty doing normal activities, etc.).

Ask for two more volunteers from the students remaining in the room. These will be mosquitoes. The rest of the students should number off 1, 2, or 3 (birds, horses, or humans). Mosquitos will be given red and green stickers and will fly around the room “biting” students by giving them ONE of the two colored stickers (there should NOT be enough stickers for all students, i.e., all students should NOT be infected). Student species groups (birds/horses/humans) will now be provided with handouts describing West Nile virus and how their species might respond to infection. Students should begin acting as their species and presenting any symptoms they might have (birds are flying, singing; horses are grazing, walking/running, etc.).

The One Health professionals will now come back in the room to begin making observations/examining their “patients” and making notes about symptoms and number of individuals infected. Students who have been “bitten” must keep their sticker hidden from the physician/veterinarian/biologist.

Have everyone but the three One Health professionals return to their seats. Ask each individual to report their findings and write the number of individuals they believe to be infected on the board. Separately, ask each group to have infected individuals stand up. Discuss whether the infected individuals matches the number of individuals the scientists thought were infected. Discuss the term asymptomatic and how this can make disease diagnosis difficult. Discuss the importance of diagnostic testing and good health/illness practices (washing hands, isolating new animals, etc.).

Elaborate: Day 3

- Zoonotic Disease Research & Poster Session -
https://drive.google.com/file/d/1etJdhDg0cMRJbXJ0QdN3ZPJmiKgxL1cx/view?usp=drive_link

Students will choose a zoonotic disease to research and report on. They may present using any medium they choose (Google Slides, poster, video, etc.)

- List of zoonoses -
https://docs.google.com/document/d/1fB851uRrMgwwDjPDBRzTF6ge-VM1TAoa5H82pBtm39s/edit?usp=drive_link

Assessment/Evaluation:

The Zoonotic Disease Module includes a post-test, which can be used for an overall learning assessment. Other opportunities for assessment include:

- Zoonotic Disease Trashcan Basketball
https://docs.google.com/presentation/d/15DYaIGC5uG8Bj9KRh8Nf1lCFee_FXD Cs/edit?usp=drive_link&ouid=109252698449386442667&rtpof=true&sd=true .
- Zoonotic Disease Worksheet
https://drive.google.com/file/d/19CCRgRp5NU3XUf9OPI61-zVihQPRmu46/view?usp=drive_link
- Zoonotic Disease True/False
https://drive.google.com/file/d/1CnieL29OGm1K8bbinj4ieKZzbvt_lsFC/view?usp=drive_link