PEER One Health Curriculum	
Leader Guide	**Vaccination and Infectious Disease Case Study: Avian Influenza**

Summary:
The vaccination and infectious disease module covers the concepts of organizing and analyzing data using the topics of vaccination and infectious diseases. Students will learn the causes of infectious disease and discover the role of vaccination in preventing disease spread. Through the One Health in Action case study, students will have the opportunity to investigate the impact of Avian Influenza.
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Keywords: acquired immunity, bacteria, epidemic, infectious disease, natural immunity, pandemic, vaccine, virus

Subject TEKS:

- 7. 13 (A) identify and model the main functions of the systems of the human organism, including: the circulatory, respiratory, skeletal, muscular, digestive, urinary, reproductive, integumentary, nervous, immune, and endocrine systems
- Biology 4 (C) compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza.
- Biology 10 (A) describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals
- Biology 11 (A) summarize the role of microorganisms in both maintaining and disrupting the health of both organisms

Grade Level: 6^{th} - 9^{th}

Learning Objectives:

1. Define infectious disease.
2. List and describe agents of infectious disease.
3. Compare and contrast bacteria and virus.
4. Describe how the immune system and vaccinations work together to fight infectious diseases.
5. Describe avian influenza
6. Develop a plan for addressing an avian influenza outbreak from various one health perspectives.

Time Required: Two to three 45-minute class periods.

Materials:

- Devices with internet access

A product of the Partnership for Environmental Education and Rural Health at
College of Veterinary Medicine & Biomedical Sciences, Texas A&M University
Funding support from the National Center for Research Resources, National Institutes of Health

- **Infectious Disease Spread Activity**
    - Saturated baking soda solution (baking powder dissolved in water until no more can dissolve)
    - Distilled water
    - Vinegar
    - Numbered clear plastic cup for each student
    - Stickers
    - Phenolphthalein indicator solution (water from boiled red (purple) cabbage can be used as a substitution; instructions provided in activity plan)
- **Spread of Infectious Disease Worksheet**
    - Colored pencils and straight edge/ruler for graphs
- **Avian Influenza Case Study**
    - Device with internet connection
    - Avian Influenza slide show

Background and Concepts for Teachers:

Infectious Disease

Several types of microorganisms cause infectious diseases, which can affect different body systems. The microorganisms most commonly responsible for disease include viruses, bacteria, fungi, and parasites. Transmission of pathogens can occur in various ways including physical contact, contaminated food, body fluids, contaminated objects, airborne inhalation, or through vector organisms.

Infectious diseases and their spread are a cause of national attention due to the risk of outbreaks. Many of the recent infectious disease outbreaks are due to viruses. A virus is a tiny, infectious particle that can reproduce only by infecting a host cell. Viruses are not made of cells; in fact, they are much smaller than cells and not visible with light microscopes. Viruses also do not metabolize food for energy. For all of these reasons, many scientists do not classify viruses as living organisms. However, similar to other living organisms, viruses do contain genetic material (DNA or RNA) and can evolve.

When pathogens like viruses infect the body, the immune system fights back! The immune system is made up of special cells, proteins, tissues, and organs which work together to form an immune response. When the immune system encounters foreign substances, or antigens, it begins to produce antibodies to attack and destroy them. Antibodies are specialized proteins created by the immune system to attach to and remove specific antigens. Once antibodies are produced, they remain in the body and, if the same antigens appear again, the antibodies can quickly respond.

Vaccinations boost the immune system by introducing antigens to a specific disease in a way that does not cause illness, but does create an immune response; including the production of antibodies. The antibodies will then protect the individual from a future attack by the microorganism that produces that particular disease.

Avian influenza or bird flu refers to the disease caused by infection with avian (bird) influenza (flu) Type A viruses. These viruses naturally spread among wild aquatic birds worldwide and can infect domestic poultry and other bird and animal species. Bird

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flu viruses do not normally infect humans. However, sporadic human infections with bird flu viruses have occurred. Symptoms of bird flu virus infections in humans have ranged from no symptoms or mild illness [such as eye redness or mild flu-like upper respiratory symptoms], to severe (such as pneumonia requiring hospitalization) and included fever, cough, sore throat, runny or stuffy nose, body aches, headaches, fatigue, and shortness of breath or difficulty breathing. Less common signs and symptoms include diarrhea, nausea, vomiting, or seizures.

Vocabulary / Definitions:

- **Acquired immunity** - immunity developed by exposure to a disease (infection or vaccination)
- **Bacteria -** Microscopic single-celled organisms lacking a distinct nucleus
- **Epidemic -** The occurrence in a community or region of cases of an illness or other health-related events clearly in excess of normal expectancy
- **Infectious Disease -** a disease caused by the invasion of a host by microorganisms whose activities harm the host's tissues and can be transmitted to other individuals
- **Natural immunity –** immunity that is present without prior exposure to a pathogen; gained from the mother in the womb or through antibodies in the mother's milk
- **Pandemic –** a disease that occurs over a wide geographic area and affects an exceptionally high proportion of the population
- **Vaccine –** a substance used to stimulate the production of antibodies and provide immunity against one or several diseases
- **Virus -** A microorganism that is smaller than a bacterium and that cannot grow or reproduce apart from a living cell.

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 have students model the spread of an infectious disease, then collect and analyze related data. (infectious disease spread teacher instructions & student worksheet)

Exploration/Explanation:

Students should next examine the required concepts (standards) of infectious diseases and the immune system through the Essential Knowledge – "Case Study: Influenza" section of the Infectious 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 - 16 – Infectious Disease

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- Slides 5, 9, and 12 are Knowledge Checks (use as whole group activity, or create friendly competition – boys v. girls, etc.)
- Slides 4, 7, 12, 14, and 16 are videos (view as a whole class and discuss)
    - Slide 4 – Microbes Video https://youtu.be/0N3toHfD7K4
    - Slide 7 – The World of Microbes: Viruses Video (watch as a whole class and discuss) https://youtu.be/VQ6aW2apPaY
    - Slide 14 Vaccines Explained https://www.pbs.org/wgbh/nova/video/immunity-and-vaccines-explained/
    - Slide 16 Pandemic vs Epidemic https://youtu.be/WVH8BPDOeb8

Elaborate: Days 2 & 3

- Avian Influenza Case Study – students will research avian influenza from the perspective of a poultry producer, veterinarian, and public health official. They will create a short presentation to explain their response to a hypothetical outbreak in a mock press conference. Each One Health professional icon is linked to information specific to that profession. (Avian Influenza Case Study)

Assessment/Evaluation:

The Vaccination and Infectious Disease Module includes a post-test, which can be used for an overall learning assessment. Other opportunities for assessment include student output at any of the "Elaborate" activities.

Please email us your comments on this lesson: cvmpeer@cvm.tamu.edu
In your email, please include the title of the lesson and the grade level to which the lesson was applied.

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Funding support from the National Center for Research Resources, National Institutes of Health