



uBEATS Teacher's Guide:

Virology-The study of viruses

(Grades 11-12)

This teacher guide is a supplementary text to support the use of the uBEATS “Virology-The study of viruses” module for grades 11-12.

To help students develop the knowledge necessary for an incredible future in health care, we created UNMC Building Excellence in Academics Through STEM (uBEATS), an online health science resource for Nebraska students.

UNMC uBEATS modules are short (15 minutes or less), interactive online health science modules to supplement curriculum taught in grades 6 – 12. These do not replace curriculum, but are a supplement for teachers and students incorporating evidence based information and UNMC expert guided material. Each module is chunked into sections with formative and summative assessments with immediate feedback provided.

Tips on how to utilize uBEATS modules:

- Internet access is required to view uBEATS modules.
- For those who have access to one-to-one technology, modules can be used in or outside of the classroom as a topic introduction, extension, or review.
- For classrooms without individual student devices modules can be used in whole group instruction. Formative assessment questions can use the teacher's preferred call and response method and summative assessment questions can be displayed on the board and answered individually by students or printed and distributed to students after viewing the module.

Objectives

- Classify viruses based on their Baltimore classification and structure.
 - Discuss how viruses cause disease in humans.
 - Explain the prevention of viral diseases
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Introduction

Have you ever stopped to think what a virus actually is? Do you think of something gross and slimy, like how you feel when you get the flu? And why is it your parents make you get the flu shot every year? In this module, we are going to dive in on a microscopic level to explore viruses and why they are so clever.

Prior Knowledge

Before beginning this module, the student should understand the Next Generation Science Standards (NGSS) featuring [Three-Dimensional Learning](#).

Core Idea LS1: From Molecules to Organisms: Structures and Processes [A Framework for K-12 Education](#)

- The life sciences focus on patterns, processes, and relationships of living organisms. Life is self-contained, self-sustaining, self-replicating, and evolving, operating according to laws of the physical world, as well as genetic programming. Life scientists use observations, experiments, hypotheses, tests, models, theory, and technology to explore how life works. The study of life ranges over scales from single molecules, through organisms and ecosystems, to the entire biosphere, that is all life on Earth. It examines processes that occur on time scales from the blink of an eye to those that happen over billions of years. Living systems are interconnected and interacting. Although living organisms respond to the physical environment or geosphere, they have also fundamentally changed Earth over evolutionary time. Rapid advances in life sciences are helping to provide biological solutions to societal problems related to food, energy, health, and environment.
- From viruses and bacteria to plants to fungi to animals, the diversity of the millions of life forms on Earth is astonishing. Without unifying principles, it would be difficult to make sense of the living world and apply those understandings to solving problems. A core principle of the life sciences is that all organisms are related by evolution and that evolutionary processes have led to the tremendous diversity of the biosphere. There is diversity within species as well as between species. Yet what is learned about the function of a gene or a cell or a process in one organism is relevant to other organisms because of their ecological interactions and evolutionary relatedness.

Science and Engineering Practices [NGSS](#)

- Constructing explanations and designing solutions

Crosscutting Concepts [NGSS](#)

- Cause and Effect



Key Terms/Vocabulary

Virus, Baltimore classification, virion, protein capsid, genome, nucleic acid, RNA, DNA, nucleocapsid, glycoprotein, membrane envelope, morphology, icosahedral, filamentous, spherical, complex, transcriptase, infection, host cell, receptor, endocytosis, vacuole, replication, expression, fusion, budding, myxovirus, influenza, pathogen, epidemic, pandemic, hemagglutinin, Ebola, mutagenesis, electrolytes, blood pressure, oxygen therapy.

Science Standards

This module is related to the content of **UNMC High School Alliance: Introduction to Pathology and Microbiology**

Pathology is the study of disease processes. The field lays the foundation for all of clinical medicine and medical research. All diseases begin at the cellular level and changes in the structure and function of tissues ultimately lead to symptoms that health care providers see on a daily basis. This course will introduce students to medical terminology, normal histology and gross/microscopic pathology, allowing students to correlate the findings they see into basic clinical concepts.

Nebraska's College and Career Ready Standards for Science 2024 [Nebraska Science Standards](#)

Engineering in Health Sciences: SC.HSP.17.1.C

- Evaluate a solution to a complex real-world human health problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. Solutions could include the effects on the human body or solutions for environmental public health issues.

Next Generation Science Standards (NGSS) featuring [Three-Dimensional Learning](#)

- LS1: Structure and Function

Nebraska Health Science Standards

- HS.HS.8.1.b Describe common diseases and disorders related to body systems.
- HS.HS.6.4.c Demonstrate methods to control the spread of infection

National Health Science Standards (NCHSE)

- 1.2.1 Describe etiology, pathology, diagnosis, treatment, and prevention of common diseases and disorders
- 7.1.1 Explain principles of infection transmission.
 - a. Identify classifications of pathogens
- 7.1.2 Differentiate methods of controlling the spread and growth of pathogens.
 - a. Asepsis
 - e. Vaccinations



Extensions of the lesson

- To help students become more familiar with the Key Terms of this module, the teacher can use the vocabulary list for a classroom Word Wall, or integrate the vocabulary into classroom word games during review sessions.
- To help the students see personal relevance, suggest that they have a **private** conversation at home regarding flu shots.
- As student misconceptions become apparent, the teacher may need to reinforce these important concepts:
 - The understanding of viruses is controversial and confusing. Some scientists talk about viruses not being living organisms, while other scientists talk about viruses as being alive. The distinction is all about whether or not the virus can carry out its own life cycle and replicate without depending on a host organism. In some ways, a virus is similar to a living heart. A heart cannot replicate on its own, and therefore is not a living organism. However, a heart is certainly a living organ, capable of staying alive even outside of a body.
 - Vaccines designed to instruct a person's immune system to attack a specific virus may actually contain a living virus, or a severely weakened virus, or a dead virus. In all cases, the purpose of the vaccine is to train the immune system without causing the full-blown disease.
 - In extremely rare cases a person can get the disease after being vaccinated, but the vast majority of viral diseases develop in unvaccinated persons.
 - A virus must have two distinct mechanisms: a way to enter a cell's cytoplasm through the cell's defenses, and a way to escape the host cell after replicating.

Enrichment

- For information about Healthcare Career Opportunities, see [UNMC Health Career Book](#).
- Students should be watchful in current events for recent stories about viral infections and vaccinations.
- An example of a classroom activity about the spread of viruses is NOVA's [1918 Flu](#).
- To make connections in your community, contact the American Red Cross, local hospitals, healthcare clinics, nurses, doctors.