



Collaboration and Problem Solving

OBJECTIVES

Students will:

- Gather data and determine patterns by synthesizing information from a variety of sources
- Organize and represent data to determine a solution
- Communicate findings with similar researchers and develop solutions through effective collaboration

OVERARCHING QUESTION

How can scientists learn from each other to find solutions to tough problems through collaboration?

STANDARDS

Next Generation Science Standards

- From Molecules to Organisms: Structures and Processes
 - 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- Engineering Design
 - MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions

Common Core English Language Arts

- Literacy:
 - RI.3.7: Use information from illustrations and the words in a text to demonstrate understanding of the text.
- Speaking and Listening:
 - SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
 - SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

Instructional Note:

The following activity has been designed so you can tailor it to your current mode of instruction.

- The *Introduce*, *View & Reflect*, and *Conclude* sections can be presented virtually, by video, or through a shared document.
- The *Challenge* section is designed for students to complete independently at home using the accompanying Challenge handout. Students can either print and fill out the handout or answer the questions separately in a format that can be shared with you.

ACTIVITY OVERVIEW

Introduce

1. Begin by determining prior knowledge of viruses. Facilitate a class discussion addressing the concepts below.
 - Ask students to generate a list of viruses that are known to them. (influenza, hepatitis, HPV, rhinovirus, varicella or chickenpox, polio, COVID-19, etc.)
 - Encourage students to note the symptoms of each virus.
2. Play the video [How do Viruses Reproduce?](#)
3. When the video has concluded, explain that students will have 3–5 minutes to write down what they have learned from the video clip.
4. Next, ask students to share what they have learned with a partner, encouraging them to add any new ideas that they heard from sharing.
5. Explain that students are about to watch a short video that features Guy DeBruyn, a scientist who is working directly on COVID-19 clinical development. The video discusses how he is using his STEM skills to collaborate with his team to find a vaccine for COVID-19 while working under a compressed timeframe.

View & Reflect

1. Before the class watches the *Career Profile Video*, instruct students that they will be pretending to write a job description for a new position opening in their research lab.
2. Tell students that as they watch the video, they will be creating a list of skills both scientists possess.
3. Share the *Career Profile Video*. Students may find it helpful to view the video more than once.
4. When the video is complete, instruct students to review the list of skills they identified and categorize them into one of the following STEM categories: creativity, communication, critical thinking, and collaboration.
5. Invite students to discuss why Guy DeBruyn was motivated to use his collaborative problem-solving skills in order to discover a vaccine for COVID-19.

CHALLENGE

1. Explain that the class will now be challenged to take on the role of a virologist and work collaboratively with other virologists to solve a significant health problem.
2. Share the *Challenge* handout and review the instructions. Remind students that good communication skills are vital when sharing knowledge and advice with other public health experts.

CONCLUDE

1. Once the Challenge activity is complete, invite research groups to communicate their findings, including the reasoning behind their conclusions.
2. Wrap up by encouraging students to discuss the following questions and the importance of working collaboratively with others.
 - What are the benefits of having different viral experts work together on the same project?
 - In the 17th century, many scientists kept new findings secret so that others could not claim the results as their own. How would that affect a pandemic today?

Virology is all about understanding viruses. Virologists are medical doctors that oversee the diagnosis, management, and prevention of infection. A virologist may be both a scientist and a physician. They can be found working at a bench in laboratories or managing the care of patients suffering from infections. Virologists are responsible for diagnosing viral infections, investigating how viruses respond to antiviral drugs, and how they develop drug resistance. They give expert advice to health care professionals, veterinarians, as well as government officials

Directions: You will be playing the role of a research virologist working with a small team of scientists to collaboratively identify an unknown virus. Each virologist on the team will share their expertise of the virus they are studying to identify patterns or trends in the newly discovered virus.

Gathering Information

As a virologist, understanding the general structures of viruses and the steps of replication is crucial when tasked with identifying a new virus. In this stage, you are responsible for building your understanding of characteristics all viruses share.

Structures of a Virus

Structures	Description / Function	Model / Diagram
Genome		
Capsid		
Envelope		

How Viruses Replicate

Steps	Description	Model / Diagram
Attachment		
Entry		
Copies of Genome		
Assembly		
Release		

Becoming an Expert

Each virologist on the team will become an expert in one of these viruses, FLU, HIV, POLIO. Use your critical thinking skills to develop a deeper understanding of your assigned virus. You will use the information you have learned in the next step of the challenge.

You will gather information about each topic below and become an expert on your virus.

- Find a picture of your virus and describe its general structure and envelope (if it has one).
- Describe its genome. Is it DNA, RNA, segmented?
- Describe the entry method. Does the entire virus enter the host cell or just its genome?
- Does the virus affect the host cell's DNA? (This is not very common.)
- Does the virus affect the host cell's ribosomes?
- What type of cells or region of the human body does the virus target?
- Describe general symptoms that infected people experience.

Working Collaboratively

A new virus has been discovered and the initial research was shared with your laboratory. Review the characteristics of this unknown virus and work collaboratively with other virologists to compare its characteristics with what we currently know about FLU, HIV, and POLIO. Determine the virus it shares the most features with.

INITIAL RESEARCH FINDINGS

- Genome is RNA
- The entire virus enters the host cell
- Epithelial cells within the nasal cavity, lungs, and intestines are more susceptible to infection
- The host DNA is not affected
- Patients are experiencing a cough, sore throat, runny nose, headache, and diarrhea

