

## STUDENT ACTIVITY

# Disease Detective

## Project Details

### GRADE RANGE

9–12

### TIMING

45–60 minutes

## OVERVIEW

Students will begin with a disease outbreak simulation as they start to explore the impact of disease mutations. After this prompts them to consider how diseases can be tracked and/or stopped, they will be introduced to the field of epidemiology through watching a short video and reading a career profile. Students will then work in small groups to read sections of an article that discusses how epidemiology uses genomics to track disease transmission. Each group will be tasked with creating a short summary of their section, and they will share this summary with the class. The period will conclude with a brief class discussion around how genomics and the field of epidemiology work together to impact public health.

## OBJECTIVE

Through simulating the process of disease mutation and investigating the field of epidemiology, students will develop an understanding of how epidemiology and genomics work together to track disease.

## MATERIALS NEEDED

- Device with the ability to project
- Epidemiology [video](#) (from 0:05–0:56)
- Secret Virus Instructions, one per every six students
- Scrap paper, one per every six students
- Perspectives of an Outbreak handout, one per group of four students
- [Epidemiology](#) article, one per student

## NEXT GENERATION SCIENCE STANDARDS: THREE DIMENSIONS

Asking Questions and Defining Problems	Disciplinary Core Idea	Crosscutting Concepts
Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)	<b>LS1.A: Structure and Function</b> All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.	<b>Cause and Effect</b> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

## STANDARDS FOR TECHNOLOGICAL LITERACY

### Standard 3: The Nature of Technology

- K. The rate of technological development and diffusion is increasing rapidly.
- L. Inventions and innovations are the results of specific, goal-oriented research.

### Standard 14: Medical Technologies

K. Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.

### Common Core State Standards for English Language Arts

CCSS.ELA-LITERACY.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

## PROCEDURE

- 1 **Warm-Up Activity:** Begin by pretending that a disease outbreak has struck your classroom. Over the course of the next several minutes, students will simulate what happens as the virus passes from person to person.

Explain that viruses cause disease by attaching to a human cell and injecting their genetic material into the cell. Within this genetic material are instructions for the cell to make more of the virus, which results in more and more infected cells as the virus gains strength in the human body.

To simulate a disease outbreak, separate the class into groups of approximately six students.

Tell the class that they will play a game similar to telephone, and they must follow these instructions:

- a. Each group will sit in a circle.

- b. One person in every group will be given a written set of secret directions. Explain that these directions represent the instructions that a virus’s DNA contains in order to multiply.
  - c. The first person will read and whisper these instructions to the person next to him/her.
  - d. The second person will then whisper what they remember hearing to the third person, and this will continue until the virus instructions make their way around the circle.
  - e. The last person in the circle should then use the scrap paper to draw a picture based on the instructions they heard.
  - f. No repeating of instructions is allowed!
- 2 Distribute a Secret Virus Instruction sheet as well as one piece of scrap paper to each group. Then instruct groups to get started.
- 3 Once the groups have finished, collect the drawings from every group and display them. Then review the initial secret virus instructions, and reiterate that every group began with the same set of virus instructions. Probe students to analyze how the virus mutated in each group. How did the mutations differ from one another? Were there any similarities?
- 4 Explain that viruses mutate frequently in order to survive. If it can’t attach to a human host cell, it will change in order to trick the cell into letting it attach. With this in mind, lead the class in a discussion around the following questions:
  - a. What impact could a mutation like the one you just simulated have on a disease outbreak in a large population?
  - b. Could it be possible to track or stop the spread of disease? Why or why not?
- 5 Explain that a field of science called epidemiology seeks to answer these questions. Write the word “Epidemiology” on the board and explain that the Greek roots of the word “epidemiology” comes from “epi” which means *on or upon*, “demos” which means *people*, and logos which means *the study of*. When these word parts are put together, epidemiology means the study of what comes upon a population.
- 6 Project and play the “What is Epidemiology?” [video](#) from 0:05–0:56. As students watch, ask them to listen for further explanations of the field, and review this explanation when the video is complete.
- 7 Next, explain that one of the best ways to understand a career or field of study is to learn about it from the perspective of someone in that line of work. Distribute the Perspectives of an Outbreak handout to groups of four students. Invite each student to take on one career role and read their role to the other group members. Ask students to role-play their assigned career and consider, what contributions has this person made to help stop the spread of disease? Guide students to share their perspective with their small group.

- 8 Now that students have a general understanding of epidemiology and careers that work together, it's time to connect it back to the viral mutations that they simulated at the beginning of class. Instruct students to find their group members from the virus game, and distribute one copy of the [Genetics Detective](#) article to each student.
- 9 Assign each group one section of the article. (If there are more than four groups, reorganize the groups as needed.) Instruct groups to read their assigned section and annotate it for key details. The group should then work together to create a three or four sentence summary of their section, which can be written on the back of the article or in the margins.
- 10 After about 10 minutes have passed, instruct each group to designate one student to share their summary with the class. Students should present in the order in which their section appears in the article. As they listen to their classmates, instruct the class to consider how these summaries connect to the virus outbreak simulation.
- 11 **Wrap-Up:** Conclude by posing the question: How can genomics and the field of epidemiology work together to impact the tracking and spread of disease? Encourage students to reference the simulation and their readings as they share their thoughts.

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### SECRET VIRUS INSTRUCTIONS

First, draw a triangle in the middle of the page. To the left of the triangle, draw a circle. Above the circle, draw a square. To the right of the square, draw a rectangle. In the bottom left corner, draw a second triangle. Below this triangle, draw a small star.

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**PERSPECTIVES OF AN OUTBREAK**

<p><b>Epidemiologist</b></p> <p>Investigates patterns and causes of disease and injury in humans. They plan and direct studies of public health problems, collect and analyze data, communicate their findings to health practitioners, and manage public health programs.</p>	<p><b>Reporter/Journalist</b></p> <p>Informs the public about news and events happening. They research topics and stories, investigate and interview people, and communicate their findings.</p>
<p><b>Infectious Disease Doctor</b></p> <p>Trained to be an expert in the diagnosis and treatment of infectious diseases. They help deal with pandemics and emerging disease outbreaks.</p>	<p><b>Center for Disease Control Researcher</b></p> <p>Work to improve health and save lives around the world. They design and analyze information from controlled investigations, experiments, and trials.</p>