

STUDENT ACTIVITY

Why Bats? Disease Transmission to Humans

Project Details

GRADE RANGE

9–12

TIMING

45–60 minutes

OVERVIEW

In this lesson, students will look at the connection between bats and humans in the transmission of pathogens, such as SARS-CoV-2. They will learn about the mechanism that allows the virus to make the jump between species and explore the idea that bats may have an evolutionary advantage and a “super” immune system that allows them to carry and handle pathogens more effectively than we can. Students will begin by learning that bats have been uniquely identified as transmitters of zoonotic diseases, such as SARS-CoV-2. Then, students will use the CER (claim, evidence, and reasoning) sheet to answer the driving question: “why are bats so often involved in the transmission of diseases to humans?” Students will use sticky notes to brainstorm and compile a list of “need to know” questions that must be answered to help answer the driving question. Next, students will participate in a jigsaw activity where they will work together to read and review articles to find evidence to support their claims. Each group will compile their claim, evidence, and reasoning on their CER sheet and end the activity by choosing a representative from the group to present to the other groups or whole class for feedback and discussion.

Teacher modifications for distance learning or use in virtual classrooms are included throughout the activity.

OBJECTIVE

Students will learn that some diseases, known as zoonotic diseases, jump from animals to infect humans in an event called spillover. They will discover that bats are one species that are responsible for more zoonotic pathogens than most other species on Earth. To determine why this is, students will work together to complete a claim, evidence, and reasoning sheet and participate in a jigsaw activity.

MATERIALS NEEDED

- Device with the ability to project videos or share videos and links virtually with students
- Student devices (laptop, iPad, etc.)
- Video—TED-Ed: “How do viruses jump from animals to humans?”
- Group KWL Capture Sheet (displayed in the front of the classroom)
- Video—TIME: “Bats Are The Number One Carriers Of Disease: How To Prevent The Next Pandemic From Spreading”
- Sticky notes (1 pad per pair of students)
- Capture Sheet: CER - Claim, Evidence, Reasoning, one per student
- Articles #1–4, one set for every group of four students
- Video (optional)—Vice: “Here’s How Scientists Think Coronavirus Spreads From Bats To Humans.”

NEXT GENERATION SCIENCE STANDARDS: THREE DIMENSIONS

Asking Questions and Defining Problems

- Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

Disciplinary Core Ideas

LS1.A: Structure and Function

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.

Crosscutting Concepts

Cause and Effect

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 projecting or displaying the Group KWL (Know, Want to Know, Learned) chart on the front board. (This chart can be digitally displayed or copied onto the front board, butcher block paper, or other large paper or poster board.)

Virtual/Distance Learning adaptation: The KWL chart can be posted as a shared google doc that all students have access to on the google classroom platform, or go to <https://www.groupmap.com/map-templates/kwl-chart/> to create a virtual KWL chart.

- a. Introduce students to the topic: “How Diseases Jump from Animals to Humans.” Ask students to focus on the “K” column of the chart and think about what they already know about this topic. Allow students to share their previous knowledge with the group and the instructor should add their knowledge to the group KWL chart.
- b. Next, ask students to think about what questions they have and what more they want to know about how disease spreads from humans to animals. Ask students to share their questions with the group. The instructor should add these ideas to the “W” column of the chart.
- c. Ask students to get out a scratch piece of paper at their seats to use to take some information notes on as they watch the next video. Show the video “How do viruses jump from animals to humans?” (<https://www.youtube.com/watch?v=xjcsrU-ZmgY&t=72s>).
- d. After viewing the video, ask students to share what they learned and what questions were answered while watching. Add their responses to the “L” section of the group KWL chart.

2. Ask students if they have heard or read theories and evidence on where SARS-CoV-2, or coronavirus, originated from and how it infected people. Show students the first portion of the video “Why Bats Can Fight Off So Many Viruses” (<https://www.youtube.com/watch?v=3HHHP1uEY1I>), stopping at 1:00. The clip explains that bats seem to be the most likely host of SARS-CoV-2 and that they are among the leading causes of zoonotic diseases, pathogens that spread from animals to humans.

Virtual/Remote Learning adaptation: To show videos to students in a virtual lesson, the instructor can use Zoom (<http://zoom.com/>) to record a lesson and use screen sharing to show, pause, and give commentary on an online video. This recorded zoom meeting can then be posted as a link for students to view.

3. Ask students to pair up with a person sitting next to them and give each pair a pad of sticky notes. Write the following driving question on the front board: *“Why are bats so often involved in the transmission of disease to humans?”*

Virtual/Remote Learning adaptation: A virtual sticky note board can be created by using Padlet (<https://padlet.com/>). In this, students can share their ideas by adding their answers and ideas to the driving question by posting virtual sticky notes via a shared link.

4. Explain to students that they will be working together to uncover the answer to this driving question. Before they begin, they should work with their partner to brainstorm what information they need to know in order to answer the driving question. Ask students to discuss their ideas with their partner and write them down on sticky notes.

Virtual/Remote Learning adaptation: If working in pairs is not an option due to distance learning, students do not need to work with a partner for this part of the activity and may formulate ideas on their own.

5. Give student pairs 5–7 minutes to record the information they need or questions that need to be answered on their sticky notes. Allow them to choose their best 2–4 ideas and stick them up on the front board underneath the driving question. The instructor should then read the students’ ideas on the sticky notes to the class, grouping similar ones and removing repeats.
6. Next, explain to students that they will be part of a jigsaw activity that will allow them to work together to uncover information that will help them to answer their “need to know” questions, and ultimately try

to discover why bats are often the transmitters of zoonotic diseases to humans. Ask students to form groups of 4, with each group member being given a letter A, B, C, or D.

7. Give each group member a copy of the Why Bats? CER - Claim, Evidence, and Reasoning capture sheet. Display the following definitions of claim, evidence, and reasoning on the overhead screen:

CER Vocabulary:

- A **CLAIM** is a statement that answers the question
- **EVIDENCE** is data used to support the claim
- **REASONING** is an explanation of how or why the evidence supports the claim

Explain to students that while the claim is first on the CER sheet, they may want to wait until they have evidence to fully formulate their claim.

Virtual/Distance Learning adaptation: The CER—Claim, Evidence, Reasoning capture sheet can be posted as a shared google doc that all students have access to on the google classroom platform, or as a shared document on a preferred online platform.

8. Give each “A” group member the Why Bats? CER Article Link or you may print a hard copy of the article for students to use. Repeat with “B”, “C”, and “D” group members.

Why Bats? CER Article Links

Article A—Immune arms-race in bats may make their viruses deadly to people

<https://www.sciencenewsforstudents.org/article/immune-arms-race-in-bats-may-make-their-viruses-deadly-to-people>

Article B—Why Bats Are Breeding Grounds for Deadly Diseases Like Ebola and SARS

<https://www.discovermagazine.com/health/why-bats-are-breeding-grounds-for-deadly-diseases-like-ebola-and-sars>

Article C—Bat cave solves mystery of deadly SARS virus—and suggests new outbreak could occur

<https://www.nature.com/articles/d41586-017-07766-9>

Article D—How Do Bats Live With So Many Viruses?

<https://www.nytimes.com/2020/01/28/science/bats-coronavirus-Wuhan.html>

9. Ask students to form a new group with everyone who has the same article assignment as they do. (All A article students will group up, all B article students, and so on.) Students should take 10–12 minutes to read through their article and discuss any evidence they find that help to answer the driving question on the CER sheet: *“Why are bats so often involved in the transmission of disease to humans?”* They will add this evidence in bullet point form to their CER sheet under the section for their article.

Virtual/Distance Learning adaptation: The instructor can create breakout groups for each article assignment during a zoom meeting to allow students to discuss and collaborate with each other.

- Once each group has recorded the evidence for their article on the CER sheet, they should rejoin their original group. Each group member should summarize their article and share the evidence they recorded with the rest of the group. Other group members should write down this evidence on their own sheet. Group members should take turns sharing and summarizing until all members have had a turn and all four evidence sections are completed in the CER sheet.

Virtual/Distance Learning adaptation: The instructor can create breakout groups for each original group during a zoom meeting to allow students to discuss and collaborate with each other.

- Groups should then evaluate their evidence and discuss what they think the claim should be or should they modify their original claim (if they have one). They should work to come to a consensus and record their claim at the top of the CER sheet.
- Finally, students should think about how their evidence connects to and supports their claim to complete the reasoning section of the CER.
- When the groups have finished their CER, each group should choose a representative to share their claim, evidence, and reasoning to the whole group. Students can give feedback to each other and determine what additional evidence from other groups may support or refute their claim.
- Wrap-Up:** Conclude by posing the question: “How can humans help to stop the spread of zoonotic diseases, such as viruses thought to be spread by bats?” Engage in a class discussion and allow students to share their thoughts. Ideas may include outlawing the consumption of animals that transmit disease to humans, or ending and monitoring the trade of these types of animals as well. If time permits, the instructor may choose to show the following video that summarizes ideas from the lesson and wrap up question: “Here’s How Scientists Think Coronavirus Spreads from Bats to Humans” at https://www.youtube.com/watch?v=2DsVhaXx8_I&t=8s. Students can compare the information on their CER sheets to the information presented in the video.

Virtual/Remote Learning adaptation: A virtual idea board can be created by using Padlet (<https://padlet.com/>). In this, students can share their ideas by adding their answers and ideas to the driving question by posting via a shared link.

How Diseases Jump From Animals To Humans

K	W	L
What do we already KNOW about this topic?	What do we WANT to know about this topic?	What did we LEARN about this topic?

QUESTION: Why are bats so often involved in the transmission of disease to humans?

CLAIM (Your answer to the question written as a complete sentence):

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EVIDENCE (Data, facts, examples that support the claim and help to answer the question):

Article A	Article B
Article C	Article D

QUESTION: Why are bats so often involved in the transmission of disease to humans?

REASONING (An explanation of evidence—how or why the evidence supports the claim)