**Lesson 1: Introduction - The Spread of Germs**

Adapted from Super STEM Sleuths

**Problem statement:**

Imagine you are an epidemiologist--someone who studies the spread and control of diseases. You work for the Centers for Disease Control and Prevention in Atlanta, GA. Reports of middle school students out sick have been pouring in from all over the country at an alarming rate. Few things are known about this mystery disease: victims are experiencing chills and high fever, and the disease is spreading quickly. There are no recorded fatalities, but there are reports of more extreme symptoms such as paralysis. Your team has been tasked with understanding and containing this new infectious disease. Your director has handed you a document with notes to start with, but it is up to you to come up with a plan to prevent, contain, or cure the disease. Time is of the essence, as symptoms are starting to appear in adults and high school students as well.

This lesson helps students begin to understand the prevalence of germs and how they are spread.

**Learning objectives:**

Students will be able to answer the question: What is a microbe and how are they spread?

**Lesson standards (NGSS, CCSS, CTE):**

What standards (content and practices) are you addressing in this unit/lesson(s)?

Ex. NGSS HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

CCSS Math HS N-RN. Extend the properties of exponents to rational exponents.

**Washington State Health Standards**

*Disease Prevention* H7.W2.8a

Analyze how personal choices contribute to communicable and noncommunicable diseases.

*Analyzing Influences* H7.W2.8a

Describe how peers, culture, and family influence health decisions and behaviors.

**Common Core State Standards Connections:**

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| *ELA/Literacy -* | |
| [RI.5.7](http://www.corestandards.org/ELA-Literacy/RI/5) | [Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. *(5-LS2-1)*](http://www.corestandards.org/ELA-Literacy/RI/5) |
| [SL.5.5](http://www.corestandards.org/ELA-Literacy/SL/5) | [Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. *(5-LS2-1)*](http://www.corestandards.org/ELA-Literacy/SL/5) |
| *Mathematics -* | |
| [MP.2](http://www.corestandards.org/Math/Practice/MP2) | [Reason abstractly and quantitatively. *(5-LS2-1)*](http://www.corestandards.org/Math/Practice/MP2) |
| [**MP.4**](http://www.corestandards.org/Math/Practice/MP4) | [Model with mathematics. *(5-LS2-1)*](http://www.corestandards.org/Math/Practice/MP4) |

**Career and Technical Education**

*Career Ready Practices* H2.W3.7

* Attend to personal health and well-being
* Work productively in teams while using cultural/global competence

**Soft skills:**

* 9.B.1 ***Work Effectively with Diverse Teams***

Respect cultural differences and work effectively with people from a range of social and cultural backgrounds.

* 10.B.1g ***Produce Results***

Respect and appreciate team diversity.

* 11.B.1***Be Responsible to Others***

Act responsibly with the interest of the larger community in mind

**Locally and/or personally relevant for students:**

How do students build on their understanding of their school community or on what matters to students? Are there ways to make a strong connection to women or underrepresented minorities in STEM fields – to increase proportionate representation of those groups in STEM?

**Connections to career and educational pathways:**

How will students learn about connections to career and educational pathways into the unit/lessons?

**Materials:**

GloGerm ([www.glogerm.com](http://www.glogerm.com)) powder from science supply stores (available on Amazon for about $19)

Blacklight ($7 on Amazon, price break for 5 ($12))

Access to sink for washing hands

Optional: Pre-moistened towels, Several types of hand soap (bar and liquid), Anti-bacterial cleaner

Colored pencils, crayons or markers

[Observation Sheet](https://drive.google.com/open?id=0B1TkjHrDZ7XMSldEZldWaER6ZzA) (class set)

[Germ Sheet](https://drive.google.com/open?id=0B1TkjHrDZ7XMUGRQVzRHZlBjNTg) (class set)

**Lesson preparation:**

If using a blacklight fixture, set it up for the students to use

**Time required:** 45-50 minutes

**Grouping of students for instruction:**

This activity is intended to be done in partnerships and groups of 4-5.

Protocol that will help groups function smoother:

* Everyone leaning in
* Shared speaking time - equal voice
* No cross talk

**Understanding the Problem**

**Investigative Question:** How can disrupting the environmental conditions stop the spread of infectious disease? How can thorough hand washing limit the spread of infectious diseases?

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| **Time** | **Teacher** | **Student** |
| 3 min | Rub GloGerm powder on your hands and then casually shake hands with all students as they enter the room or as appropriate. | Shake hands with teacher |
| Notes: Transfer was great with 6 people “infected” with GloGerm. Another idea is to secretly employ students as “infected” people. Alternately, sprinkle/spread GloGerm on shared class materials that students will be touching during the course of Lesson 1. Boxes of colored pencils work well as they will be used later in this lesson. | | |
| **THINK PAIR SHARE** | | |
| 2 min | Ask students to **THINK** and make a written list of everything they see in their immediate environment. | Individually on [**OBSERVATION**](https://drive.google.com/open?id=0B1TkjHrDZ7XMSldEZldWaER6ZzA) sheet in “On your Own” column |
| 2 min | Facilitate discussion of **PAIRS**. | For two minutes, have students, working with a partner to exchange lists (✔ beside existing items, and add new ones to the PAIR column of worksheet). |
| 2 min | Facilitate table group discussion and record in SHARE column. | Share their observations, one PAIR with another PAIR repeating the process . (✔ beside existing items, and add new ones to their list). |
| 5 min | Facilitate whole group **SHARING of the Q: “**Come up with one thing one your lists (as a table group) that you believe nobody else has on their list.”  List each observation on a white board. If a team runs out of new things to add to the list they can pass. Continue until all teams run out of observations. | One person from each group shares in a round robin fashion. |
| 5 min | Ask students, “What is missing? What else is in our immediate environment that you may not be able to see? (Things that you cannot see! Germs.) Germ is a generic term for what are considered bad microbes. Microbes are organisms too small to be observed by the naked eye”. Write their guesses on margin of OBSERVATION SHEET | Students write MICROBE definition on the back of their [OBSERVATION SHEET](https://drive.google.com/open?id=0B1TkjHrDZ7XMSldEZldWaER6ZzA) |
|  | Distribute sticky notes to table groups, one per person. Instruct students to work together to write the name of one ( type of) microbe on their post it.Try to have no duplicates at the table group. (Fungi, Algae, bacteria, virus, protozoa) | Students place sticky notes on a “Parking Lot” area (white board/poster paper) for use later in the unit. Make no judgements at this point, Later post-its will be classified into category of microbes or moved from the list. |
|  | Ask students,  “How do you think germs are spread? If one person has a cold, how can you catch it?” Have students examine their hands. Ask, Do you see anything? Why do you wash your hands before eating? (Germs.) | Students participate in discussion (Students will give many answers: “If you sit next to them,” “if you drink out of their cup,” “if they sneeze on you.” Write these down.) |
|  | Distribute [Germ Sketch](https://drive.google.com/open?id=0B1TkjHrDZ7XMUGRQVzRHZlBjNTg) worksheets |  |
| 10 min  (optional) | Ask students to draw an enlarged Germ Sketch on the provided document.  *\*Note: this allows time to use pencils that have been dusted with GloGerm and have students inspect hands in a darkened setting for simulated germ transfer.* | Colored pencils, copies of [GERM SKETCH](https://drive.google.com/open?id=0B1TkjHrDZ7XMUGRQVzRHZlBjNTg), [Cells Alive](http://www.cellsalive.com/) is a great resource for completing this assignment. Use colored pencils to complete the germ sketch [activity](https://drive.google.com/open?id=0B1TkjHrDZ7XMUGRQVzRHZlBjNTg). Helpful resources include: [Alive!](http://www.cellsalive.com/) Or [Live Science](http://www.livescience.com/19060-gallery-microscopic-images-viruses-bacteria-insects.html), [Daily Mail Bacteria](http://www.dailymail.co.uk/sciencetech/article-3549713/You-never-forget-brush-teeth-Horrifying-close-pictures-reveal-bacteria-living-inside-mouths.html), [Daily Mail Viruses](http://www.dailymail.co.uk/sciencetech/article-2197533/As-pretty-picture-lot-deadly--Killer-diseases-youve-seen-before.html) |
| 10 min | (Darkened room & blacklight required) Explain that you’ve used a model germ that you can only see under a blacklight. Invite groups of students to examine their hands, pencils, paper, etc.  \*\*Instruct students to wash hands with soap and water, wipes, antibacterials, etc. after examining hands. | Students examine their hands, pencils, paper, etc. and make observations |
| open | Invite students to return to closet after washing hands. | Continue working on [GERM SKETCH](https://drive.google.com/open?id=0B1TkjHrDZ7XMUGRQVzRHZlBjNTg) and return to darkened closet after washing hands to inspect for residual germ substance. |
| 5 min | Ask, how did the germs spread. Record responses on whiteboard. | Share ideas about how they think the germs spread |
| 2 min | Closure:   * Explain to the students that during the course of the few weeks they will be investigating the way germs spread as they research and model the spread of diseases. |  |

**Extensions/ Additional Resources:**

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| **Time** | **Teacher** | **Student** |
| 15 min | [Powers of Ten Video](https://youtu.be/0fKBhvDjuy0) (exponents- video examines the relative size of things: zooms in to micro level (inside human body viruses, etc.) and out to solar system by adding power of 10. 1977 Cool)  New, HD version of something similar, but not as informative: [Cosmic Eye](https://youtu.be/jfSNxVqprvM) (zoom in zoom out- newer, but not narrated) |  |
| 55 min | [**Hand Wash Extension**](https://www.cdc.gov/bam/teachers/documents/epi_4_hand_wash.pdf) **(CDC Stop Germs Activity)** |  |

**Assessment:**

How will you assess student learning during the problem? Will there be a final product? Will the final product criteria be clear for students from the beginning? Will there be both whole group elements and individual accountability? Attach appropriate rubrics

Exit Ticket

* What is a microbe?
* How are microbes spread?

**References:**

* [Super STEM Sleuths](http://www.bioedonline.org/lessons-and-more/focus-on-stem/super-stem-sleuths1/)
* <https://www.cdc.gov/bam/teachers/documents/epi_4_hand_wash.pdf>