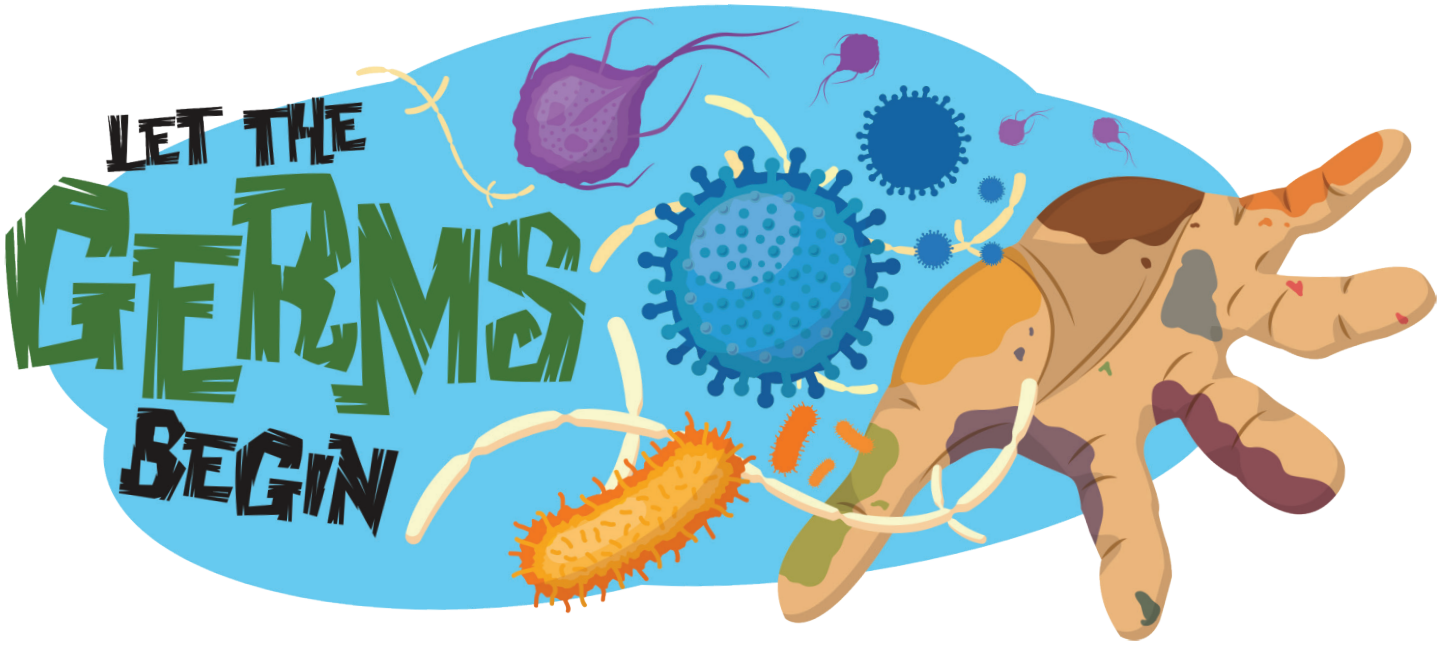

Ask A Biologist activity for classroom and home

By Julie Dunlap, Esmeralda Manzano, Vanessa Vierkoetter, and Satina Sund

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Learn more

This is a companion PDF for this online articles:

Puzzling Pathogens
askabiologist.asu.edu/explore/puzzling-pathogens

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Experiment Overview

Have you ever wondered why you get sick? The answer is germs. Germs are tiny organisms that make you feel sick and cause disease. We are exposed to millions of germs every day. There are different kinds of germs: bacteria, fungi, viruses, and protozoa.

Germs are parasitic, which means they gobble up nutrients and energy from other organisms (like us). This process causes someone who has trouble fighting off the germs to show symptoms of common infections like fevers, sniffles, rashes, coughing, vomiting, and diarrhea, just to name a few.

Now that we know germs cause sickness, how do you think germs are spread? Germs can be spread many ways, including three types of transmission (or passing of germs): direct, indirect, and airborne. Direct transmission means person-to-person contact occurs, and the germs are passed that way. Indirect means that someone spread germs onto an object and when the next person touched that object, the germs spread to the person. Germs can also travel through the air to move from one person to another.

With all these different ways for germs to be passed around, you might wonder if there's a way to avoid germs from getting to you. While we can't really avoid germs altogether, we can take care of ourselves by washing our hands and covering our mouths when sneezing, among other things. This helps reduce the spread of germs.

During this activity you will illustrate the steps germs take during transmission. You will learn about the different types of bacteria, how they are spread, and you will discuss ways to keep from getting sick.

What you need

- Sheet of paper
- Pencil
- Cups of water

Procedure

Welcome to the beginning of a four-day festival of germs! Each day you will learn or do something new and germy.

Day one

Read the Pathogens story and discuss it with the rest of your class.

Day two

Listen to a short presentation and do three activities that will teach you how those jolly germs jump from one person to another (this is called transmission).

Step 1

Direct transmission. Get a cup of water from where your teacher has set them up (don't drink it!). One will have a special chemical in it. You are going to see how just one person with a cold can spread it to many people. You will pour a little bit of your water into three other students' cups. Make sure to write down whose cup you put water into. Your teacher will then tell you who started out infected and from there, you will try to figure out who all should be infected. At the end of the activity, your teacher will come around and put one drop of another chemical into each cup. Those "infected" will end up with red water.

Experiment Overview *(continued)*

Step 2

Indirect transmission. This is a surprise activity that you will have to wait to learn about from your teacher.

Step 3

Airborne transmission. One student in class will get to use the spray bottle. They will point it in one direction and spray. Everyone else should stand around, trying to feel whether water from the spray bottle reached them. If you feel water land on you, raise your hand. Those that didn't get sprayed will use a meter stick to measure the furthest distance the water traveled.

Day three

Work on making a tree map. This will be a chart with bacteria, viruses, fungi, and protozoans listed at the top. Your teacher will prompt you with three or four questions related to these organisms. Then, you will watch a PowerPoint presentation and fill out your charts so they contain the answers to the questions in the appropriate columns.

Day four

Discuss ways to prevent the spread of germs with the rest of your class. You will split into groups and come up with skits that show how you can protect yourself and your classroom from germs. At the end of the day, you will take a quiz to show how much you've learned.

Teaching Tips

This activity introduces students to pathogens or "germs" and how they are transmitted. This is a multi-day activity that integrates Common Core Reading Standards with NextGen Science Standards.

Day 1

Guide students through the **Puzzling Pathogens** story, found here: **askabiologist.asu.edu/explore/puzzling-pathogens**, and the **Cold and Flu Worksheets** provided in this packet.

Students should discuss their first inquiry question, "What are some signs you are sick?" and they should compare the cold and the flu.

Day 2

Start off with these activities:

1. **Direct transmission:** Remember which cup held the clear indicator (dissolved baking soda – as much as possible while keeping the fluid mostly clear). Students record with whom they share water. Reveal who started with the infection so the class can trace the spread. When they've finished, add a drop or two of red indicator (phenolphthalein) to each cup. The fluid will change color for those who have been "infected".
2. **Indirect transmission:** Before class or during lunch, spread "germ juice" on a surface (e.g., door handle). After completing one or both of the other activities, use a black light in the dark on students' hands, seeing who and what objects have been affected. Make sure students wash their hands before they go to lunch or go home.
3. **Airborne transmission:** Ask a student to fake sneeze with the spray bottle from the middle of the room and see who feels the water. Using a meter stick, have students measure the distance the "germs" spread. This can lead to testing of how covering mouths when sneezing affects the spread of germs.
4. Review and clarify concepts using the **Traveling Germs PowerPoint**.

Day 3

Students will create a **Tree Map** (worksheet included) based on the main **Germs PowerPoint**.

A Tree Map is used to classify objects. Have students label the four columns: (1) bacteria, (2) viruses, (3) fungi, (4) protozoa. Before the PowerPoint, write down questions you'd like the students to answer in their tree maps. You can choose your own questions based on information you will add to the presentation, or use the following set questions: "What is it?," "What illnesses might it cause?," and "What is its environment?"

Day 4

Start with the inquiry question "What are some ways we could prevent spreading bacteria and viruses?" Have student groups come up with skits that demonstrate ways they can answer this question.

Teaching Tips *(continued)*

Finally, have your students take the **pathogens test.**

Tips for Classroom Implementation

Time Required

- Day 1: 30 minutes
- Day 2: 90 minutes
- Day 3: 30 minutes
- Day 4: 45 minutes

You will need

- water
- cups (1 per student)
- meter stick or tape measure
- spray bottle
- GermJuice (or equivalent)
- baking soda
- phenolphthalein indicator
- black light
- Cold and Flu worksheets for each student (included)
- Pathogens test for each student (included)
- Tree Map worksheet for each student (included)

Classroom set-up

Day 1: Each student receives a copy of the Cold and Flu worksheets included in this packet.

Day 2: You will need the "Traveling Germs" PowerPoint presentation, as well as: water, cups, clear indicator (dissolved baking soda) in one cup, red indicator (phenolphthalein), germ juice (GermJuice's Jr. Hand Washing Kit is suggested), black light, spray bottle.

Day 3: "Germs" PowerPoint, tree map print outs.

Day 4: Space for students to work on their skits, pathogens test.

Tips

Discussion is essential throughout these lessons. Make sure you allow enough time for students to discuss and process the presented information. Use the two inquiry questions to guide discussion and learning.

Extensions

1. Ask students how they could help prevent the spread of disease in other classrooms.
2. Prompt students to do research and find specific examples of each type of transmission (which infections spread better by which route?).

Objectives

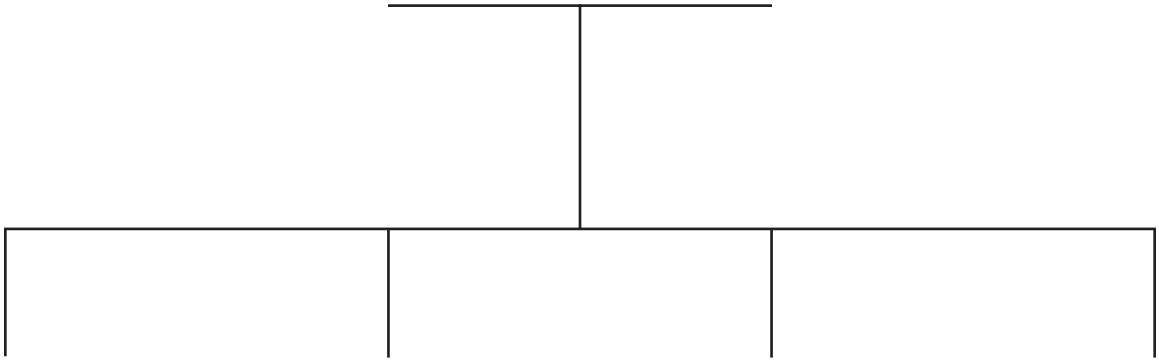
Students will be able to identify how pathogens are transmitted and brainstorm ways to keep their classroom healthy.

Tree Map

Name: _____

Date: _____

Label the four columns: bacteria, viruses, fungi, protozoa. Now, wait for instructions from your teacher.



Cold and Flu Worksheet

Name: _____

Date: _____

A: What Do You Think?

Work alone and answer questions 1 - 3.

1. Which things on the list below are usually signs and symptoms of a cold and which are signs and symptoms of influenza (flu)?

• fever and chills	• sore throat	• stuffy nose	• runny nose
• scratchy throat	• body aches	• upset stomach	

Cold: _____

_____

Flu: _____

_____

2. What kinds of things do you do in your everyday life to try to avoid catching a cold?

_____

_____

_____

_____

_____

3. What do you do if you have a cold? Do you do anything special to try to make it go away faster?

_____

_____

_____

_____

_____

_____

Cold and Flu Worksheet *(continued)*

Name: _____

Date: _____

B: Test Your Medical Knowledge

Now work in pairs and compare your answers for section B.

Decide whether these statements are True or False.
(You will be able to check your answers later when you read the article.)

		True/False
1.	There are vaccines available that can prevent people from catching flus and colds.	_____
2.	There are more than two hundred viruses that can cause the flu.	_____
3.	Washing your hands can lower your chances of catching a cold.	_____
4.	It is easy to tell whether or not a small child has the flu.	_____
5.	Children with the flu usually have higher fevers than adults.	_____

Reading Activities

Finding the Main Idea

Here is the headline of today's article but some of the words have been mixed up. Try to put the words in the headline into the correct order. Write your answer on the line provided. (The first two words are given to you as an example).

Jumbled Headline: Nose Stuffy? Flu if or to Tell it's Cold a How

Your Answer: _____

_____

Read the Puzzling Pathogens article (askabiologist.asu.edu/explore/puzzling-pathogens) before continuing.

Test Your Medical Knowledge and complete the following:t

1. Check to see if your answers are correct according to the article.
2. Change your answers if they are incorrect.
3. If a statement is false, change the false statement to make it true.

Check Your Understanding

Fill the gaps in the sentences with information from the article. Put only one word in each blank.

Cold and flu symptoms are similar but _____ symptoms are more serious and develop faster. If you are able to tell that you have the _____, and see a doctor, you may be treated with an _____ drug which will _____ the length of the symptoms. These medications, however, must be taken within _____ days of the flu starting, so it is important that you try to work out which illness you have and then go and see a _____ if you have the flu.

Pathogens Test

Name: _____

Date: _____

Fill in the blank

Write the answer that best completes the statement.

_____ 1. Microscopic organisms that can make you feel sick and cause disease are called _____.

_____ 2. Germs produce wastes of their own called _____.

_____ 3. Flu is a common name for a _____.

_____ 4. A common eye inflammation caused by a bacteria is known as conjunctivitis or _____.

_____ 5. The flu virus will change or _____ each year which makes it difficult for your body to produce antibodies.

_____ 6. A cold is an infection of the upper _____ system.

Matching

Match the symptoms with the correct ailment.

_____	7. red, itchy, crusty, or gooey irritated eyes	A. Influenza
_____	8. fever, headache, chills, dry cough, tired, loss of appetite	B. Strep throat
_____	9. mucus, red and runny nose, sneezing, hoarseness	C. Common cold
_____	10. red sore throat with white patches, trouble swallowing	D. Conjunctivitis

True or false

If the statement is true, write true. If the statement is false, replace the underlined word(s) with a word or phrase that will make the statement true. **DO NOT WRITE FALSE IN ANY BLANK.**

_____ 11. Once inside a body, <u>germs</u> can spread and make organisms very sick.

_____ 12. Most <u>fungi</u> are not dangerous.

_____ 13. Some <u>fungi</u> live in our intestines and help us use the nutrients in food.

_____ 14. Most flu <u>viruses</u> are very contagious so stay home from school.

_____ 15. A <u>bacteria</u> causes athlete's foot.

_____ 16. A doctor will prescribe antibiotics if you catch <u>strep throat</u>.

_____ 17. Antibiotics <u>will work</u> if you catch the flu.

Pathogens Test *(continued)*

Name: _____

Date: _____

Multiple choice

Write the letter of the correct answer in the blank.

18. _____ depend upon a host to survive, grow, and reproduce.

A. protozoans B. viruses C. bacteria D. fungi

19. The rhinovirus is the most common cold _____.

A. protozoa B. virus C. bacterium D. fungus

20. Some _____ live in our intestines and helps us use the nutrients in food.

A. protozoans B. viruses C. bacteria D. fungi

21. You can catch _____ just by touching an infected person or surface then touching your eyes.

A. strep throat B. a cold C. conjunctivitis D. measles

22. _____ love moisture and spread through contaminated water.

A. protozoans B. viruses C. bacteria D. fungi

23. A multi-celled plant like organism which cannot produce their own food through photosynthesis is a _____.

A. protozoa B. virus C. bacterium D. fungus

24. Chicken pox, measles, and the flu are ailments caused by _____.

A. protozoans B. viruses C. bacteria D. fungi

25. Tiny single-celled creatures that can reproduce outside or within our bodies are _____.

A. protozoans B. viruses C. bacteria D. fungi

Discussion

Write a paragraph describing how you can protect yourself from pathogens. Include at least three examples.

Pathogens Test - Answer Key

Fill in the blank

Write the answer that best completes the statement.

Pathogens
1. Microscopic organisms that can make you feel sick and cause disease are called _____.

Toxins
2. Germs produce wastes of their own called _____.

Virus
3. Flu is a common name for a _____.

Pinkeye
4. A common eye inflammation caused by a bacteria is known as conjunctivitis or _____.

Mutate
5. The flu virus will change or _____ each year which makes it difficult for your body to produce antibodies.

Respiratory
6. A cold is an infection of the upper _____ system.

Matching

Match the symptoms with the correct ailment.

D
7. red, itchy, crusty, or gooey irritated eyes

A
8. fvever, headache, chills, dry cough, tired, loss of appetite

C
9. mucus, red and runny nose, sneezing, hoarseness

B
10. red sore throat with white patches, trouble swallowing

A. Influenza
B. Strep throat
C. Common cold
D. Conjunctivitis

True or false

If the statement is true, write true. If the statement is false, replace the underlined word(s) with a word or phrase that will make the statement true. **DO NOT WRITE FALSE IN ANY BLANK.**

True
11. Once inside a body, <u>germs</u> can spread and make organisms very sick.

Bacteria
12. Most <u>fungi</u> are not dangerous.

Bacteria
13. Some <u>fungi</u> live in our intestines and help us use the nutrients in food.

True
14. Most flu <u>viruses</u> are very contagious so stay home from school.

Fungus
15. A <u>bacteria</u> causes athlete's foot.

True
16. A doctor will prescribe antibiotics if you catch <u>strep throat</u>.

Won't work
17. Antibiotics <u>will work</u> if you catch the flu.

Pathogens Test - Answer Key *(continued)*

Multiple choice

Write the letter of the correct answer in the blank.

18. ___B___ depend upon a host to survive, grow, and reproduce.

A. protozoans B. viruses C. bacteria D. fungi

19. The rhinovirus is the most common cold ___B___.

A. protozoa B. virus C. bacterium D. fungus

20. Some ___C___ live in our intestines and helps us use the nutrients in food.

A. protozoans B. viruses C. bacteria D. fungi

21. You can catch ___C___ just by touching an infected person or surface then touching your eyes.

A. strep throat B. a cold C. conjunctivitis D. measles

22. ___A___ love moisture and spread through contaminated water.

A. protozoans B. viruses C. bacteria D. fungi

23. A multi-celled plant like organism which cannot produce their own food through photosynthesis is a ___D___.

A. protozoa B. virus C. bacterium D. fungus

24. Chicken pox, measles, and the flu are ailments caused by ___B___.

A. protozoans B. viruses C. bacteria D. fungi

25. Tiny single-celled creatures that can reproduce outside or within our bodies are ___C___.

A. protozoans B. viruses C. bacteria D. fungi

Discussion

Write a paragraph describing how you can protect yourself from pathogens. Include at least three examples.

Science Standards

Arizona Science Standards

Strand 1: Inquiry Process (Grades 3-4)

Concept 1: Observations, Questions, and Hypotheses

Observe, ask questions, and make predictions.

- PO 1. Formulate relevant questions about the properties of objects, organisms, and events of the environment using observations and prior knowledge.
- PO 2. Predict the results of an investigation based on observed patterns, not random guessing.

Concept 2: Scientific Testing (Investigating and Modeling)

Design and conduct controlled investigations.

- PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.
- PO 2. Participate in guided investigations in life, physical, and Earth and space sciences.
- PO 3. Conduct simple investigations in life, physical, and Earth and space sciences.
- PO 4. Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary).
- PO 5. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).

Concept 3: Analysis and Conclusions

Analyze and interpret data to explain correlations and results; formulate new questions.

- PO 2. Construct reasonable interpretations of the collected data based on formulated questions.
- PO 3. Evaluate the reasonableness of the outcome of an investigation.

Strand 4: Life Science (Grade 3)

Concept 3: Populations of Organisms in an Ecosystem

Understand the processes acting on the Earth and their interaction with the Earth systems.

- PO 2. Examine an ecosystem to identify microscopic and macroscopic organisms.
- PO 5. Describe how environmental factors in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive.

Science Standards *(continued)*

Common Core Standards

- **RI.5.2:** Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- **RI.5.9**: Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- **RI.6.8**: Integrate information presented in different media or formats as well as in words to develop a coherent understanding of a topic or issue.

Next Generation Science Standards

- **MS-LS1-1**: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-2:** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.