

HOW DID I GET SICK?

DESCRIPTION:

Students will learn about general factors associated with illness and how to determine the cause of an illness based on signs, symptoms, and diagnostic tests.

RATIONALE:

In the Hydroville Mysterious Illness Outbreak Scenario, students will need to understand the route of exposures that cause illness and how to make clinical diagnoses from human and animal signs and symptoms.

PURPOSE/GOALS:

Students will be able to:

- Understand that microbial pathogens and chemicals can cause illness.
- Understand modes of transmission and route of exposure.
- Make a diagnosis relying on signs, symptoms, and diagnostic tests.

PREREQUISITES:

- Background on microbes, such as bacteria and viruses
- Microbe plating

TIME ESTIMATE:

Prep: Part 1: 15 min

Part 2: 30 min

Activity: Part 1: 50 min

Part 2: 2 - 50 min periods

MATERIALS:

- Hydroville Learning Log

Part 1

- A small amount of "GloGerm" powder (or a small box of Tide Powder Laundry Detergent)
- Ultra violet black light
- One tennis ball

MATERIALS (PER GROUP OF 3-4 STUDENTS):

- Student Handout: Illness Puzzle. (Should be laminated or printed out card stock paper to reuse in other classes.)
- Student Worksheet (1/student)

MATERIALS TO PHOTOCOPY:

Part 1

- Transparency 1: Illness Factors
- Illness of the Day 1 - What is it?
- Illness of the Day 2 - What is it?

Part 2

- Student Handout: Illness Puzzle (1/group)
- Student Worksheet: (1/student)

TEAMWORK SKILL:

Basic Team Skills

- Everyone contributes and helps.
- Encourage all in the group to participate.
- Criticize ideas without criticizing people.

Problem Solving Skills

- Integrate a number of different ideas into a single position

BACKGROUND INFORMATION:

Human or animal illness can be caused by microbes (bacteria, fungus, viruses, prions) or chemicals (created artificially by humans or by nature).

Microbes

The cycle of infection by microbes has 5 steps:

1. Reservoir host – most pathogens must gain entrance to a host or die. They reside and multiply in the host until they are released.
2. Means of exit – the pathogen is released into the environment from the reservoir hosts from the mouth, nose, eyes, ears, intestines, urinary tract, reproductive tract, or open wounds.
3. Mode of transmission - the three Mode of transmission of disease are contact, vehicle, and vector.
 - **Contact transmission** is the spread of the agent of disease by direct contact, indirect contact or droplet transmission. Examples of direct contact are touching, kissing or sexual intercourse. Common diseases spread by direct contact are colds, influenza, staphylococcal infections, hepatitis A, infectious mononucleosis, STDs and AIDS. In indirect contact, the agent of disease is transmitted to the host by a non-living object such as a needle or rusty nail. Examples of diseases spread by indirect contact are tetanus, hepatitis B and AIDS. In droplet transmission the agent of disease is transmitted in droplets spread by sneezing, coughing, laughing, or talking. These droplets travel less than one meter. Influenza, pneumonia, and whooping cough are droplet spread diseases.
 - **Vehicle-borne transmission** results when the agent of disease is waterborne, airborne, or foodborne. Examples of vehicle-borne microbial diseases are cholera (waterborne); staphylococci, streptococci, fungal infections (airborne); and food poisoning, botulism, tapeworm (foodborne). Chemical-caused diseases are spread in this way.
 - **Vector-borne transmission** results when agents of disease are carried from one host to another by animals. Examples of vector-borne diseases are malaria (mosquitoes); bubonic plague (fleas); and typhoid fever (houseflies).
4. Means of entry – the microbe must gain entry into a new host through the mouth, nose, eyes, ears, intestines, urinary tract, reproductive tract, or open wounds.
5. Susceptible host – the host must be capable of supporting the growth of the infecting organism. Factors affecting the susceptibility of the host are location of entry, dose of the organism, and the condition of the new host. If conditions are right, the invading organism reaches infectious levels, the susceptible host becomes the reservoir host and the cycle begins again

TERMINOLOGY:

Pathogen	Diagnosis
Mode of Transmission	Route of exposure
Ingestion	Inhalation
Absorption	Symptoms
Signs	Vector

SUGGESTED LESSON PLAN:

Part 1: Contracting Illnesses

Getting Started

1. Roll a tennis ball in a tablespoon of “GloGerm” (or a cup of Tide Powder Laundry detergent.) Rub the powder into the fabric so that it sticks and is not evident to the naked eye. This powder will represent microscopic pathogens.

Safety: If you use Tide rather than GloGerm, make sure students are not highly allergic to such scents and perfumes. If they are sensitive, they should be warned not to touch their faces.

2. While holding the ball, tell the students about a recent illness that you experienced and how and where you think you might have gotten it.
3. Toss the ball to a student and have them share a story about a recent illness. He/she should toss the ball to another student and so on.
4. After a few stories, have the students return the ball to you. Turn on the black light, and observe phosphorescence on the ball and on students’ hands. Discuss that the phosphorescence represents microscopic pathogens that were transmitted by passing a ball and how an illness might be spread in this classroom. The GloGerm could also represent a chemical that students could be exposed to. In both cases, the route of exposure would be ingestion (hand to mouth or nose), inhalation (breathing in dust / powder from tennis ball), or absorption (skin contact).
5. Clean/wash your hands and your infected work area.
6. **Classroom Hint:** another way to use the GloGerm ball is to just set it on a student desk for part of the period. Keep an eye on where it goes. Stop the class and get out the black light. Explain that the tennis ball had been handled by someone with a very contagious disease that had recently sneezed into their hands. Or put some GloGerm on the handouts at the end of the period see where it has gone: hands, clothes, noses, mouth.
7. **Learning Log Prompt:** Have students in small groups and then as a class discuss Transparency 1: *Illness Factors* and answer the following questions that you have put on the board or an overhead.
 - What does the powder represent?
A pathogen (disease causing microorganism) or a chemical.
 - Where did you find evidence of the pathogen?
On everyone’s hands that handled the tennis ball.
 - What is the Mode of transmission and route of exposure?
Mode of transmission is from the person to the ball and then to a person (indirect). Route of exposure could be all three: ingestion, inhalation, and absorption.
 - What organ system could be affected or targeted?
Skin, digestive (If found near mouth), respiratory(if found near nose)
 - How is exposure to the tennis ball being diagnosed?

Observing phosphorescence under an UV light.

8. Hand out Two Mystery Illness of the Day sheets. Have students research this information as homework and try to identify the diseases. Give students 2 days to come up with an answer to get extra credit.

Answers: Illness 1 is Cholera and Illness 2 is lead.

Part 2 (or substitute Activity 3a)

Getting Started

1. Make one classroom set of the Illness Cards (1/group). Students will work in groups of 3-4 so you probably need to make about 10 sets. Copy onto card stock or have them laminated for reuse. Cut apart and store in an envelope.

Doing the Activity

1. Students work in teams of three (or four) to assemble the illness puzzle represented by a data table. There are seven illnesses and the five illness factors: Cause, Signs/Symptoms, Mode of transmission/Route of exposure, Target organ and system, and Diagnostic tests. Students match the factors with the illness.
2. Provide feedback to the correctness of the puzzle. When the group thinks they have the correct answer they will ask you to check their puzzle. Or you can provide each group of students with a complete illness puzzle, which serves as a reference sheet.
3. Discuss the following points: What discoveries did you make in your group? What did you struggle with?
4. Have students answer the following questions in their Learning Log.
 - Can you give one more example of a diagnostic test that you or someone you know has had? What were the symptoms that lead the doctor to order that test?
5. In your groups, describe a process you would go through to determine how you got sick or how these categories happen in "real life."

ASSESSMENT:

- Learning Log entries

EXTENSIONS:

None.

RESOURCES:

- National Institute of Health. National Institute of Allergy and Infectious Diseases. The Common Cold Fact Sheet. <www.niaid.nih.gov/factsheets/cold.htm>.
- Center for Disease Control. Division of Bacterial and Mycotic Diseases. Disease Information. <www.cdc.gov/ncidod/dbmd/diseaseinfo/cholera_g.htm#What%20cholera>.
- Cardiff University. Common Cold Centre. <www.cf.ac.uk/biosi/associates/cold/info.html#1>.
- Agency for Toxic Substances and Disease Registry. ATSDR – Tox FAQs for Chlorpyrifos. <www.atsdr.cdc.gov/tfacts84.html>.
- National Pesticide Information Center. NPIC Fact Sheet: Pyrethrins and Pyrethroids. <npic.orst.edu/npicfact.htm>.
- Lead Poisoning News. <www.lead-poisoning-news.com/html/dangers.html>.

ILLNESS FACTORS

1. What CAUSES illness?

- Bacteria, viruses, fungi, prions, exposure to chemicals

2a. What is MODE OF TRANSMISSION?

- How is an agent of disease passed around
 - Contact: Person to person (direct); object to person (indirect); or person sneezing (droplet)
 - Vehicle-borne – airborne, waterborne, or foodborne
 - Vector-borne – animal to person, insect to person

2b. What is ROUTE OF EXPOSURE?

- How a chemical agent gets into a human body
 - Ingestion (mouth); inhalation (nose); absorption (skin)

3. What ORGAN OR SYSTEM does it target in your body?

- The location in the body most affected. For example:
 - Respiratory system: nose, throat
 - Cardiovascular system: heart
 - Nervous system
 - Digestive system

4. What are SIGNS AND SYMPTOMS?

- SIGNS: indicators that can be measured or observed; for example, temperature, pulse, heart rate, vomiting, skin rash
- SYMPTOMS: things people say they feel; for example, body aches and pains, headache, fatigue, nausea, etc.

5. How are illnesses DIAGNOSED? How can your doctor be sure?

- Investigation or analysis of the cause or nature of a condition, situation, or problem.
- Laboratory diagnostic tests: blood (count white blood cell to look for infection); stool/fecal (bacterial identification)

ILLNESS 1:

ILLNESS OF THE DAY - WHAT IS IT?

1. CAUSE:

- A severe, infectious disease caused by a bacterium, *Vibrio cholerae* that produces a poisonous toxin.

2a. MODE OF TRANSMISSION:

- Vehicle-borne

2b. ROUTE OF EXPOSURE:

- **INGESTING** food or drink - usually water - contaminated with a bacterium found in feces.
- Large epidemics often related to fecal contamination of water supplies or street vended foods.
- Eating raw or undercooked shellfish that are naturally contaminated.
- The disease is not likely to spread directly from one person to another; casual contact with an infected person is not a risk for becoming ill

3. TARGET ORGAN OR SYSTEM:

- After the bacteria are swallowed, they multiply in the **SMALL INTESTINE**, where they set off an infection that interferes with normal intestinal functions resulting in the following signs and symptoms.

4. SIGNS AND SYMPTOMS:

- **SIGNS:** Heavy diarrhea, vomiting, fluid loss (water and essential salts) leads to dehydration, circulatory collapse, and shock
- **SYMPTOMS:** muscle cramps

5. DIAGNOSTIC TESTS:

- **STOOL SPECIMENS** are sent to a clinical laboratory to determine the causal organism.
- **NOTIFIABLE DISEASE** - within 24 hours

ILLNESS 2:

ILLNESS OF THE DAY - GUESS WHAT IT IS

1. CAUSE:

- Chemical found in household paint applied before 1978

2a. MODE OF TRANSMISSION:

- Object to person (indirect) or Vehicle-borne

2b. ROUTE OF EXPOSURE:

- INGESTION - enters your body when you put your hand or another object on dust, paint chips, or soil that is contaminated with it
- INHALATION of contaminated dust

3. TARGET ORGAN OR SYSTEM:

- Nervous system
- Children less than 6 years of age are especially sensitive still have developing brains and nervous systems and toxic substances can negatively affect their development.

4. SIGNS AND SYMPTOMS:

- SIGNS: diarrhea, high blood pressure, dark line around gums, pale skin color
- SYMPTOMS: Fatigue, weakness, headache, aching bones and muscles, abdominal pain, irritability, poor appetite, distractibility, and lethargy. Mood swings, irritability, and loss of motor coordination

5. DIAGNOSTIC TESTS:

- Blood tests are sent to a clinical lab to identify the suspected chemical.

ILLNESS PUZZLE - REFERENCE SHEET

ILLNESS	CAUSE	MODE or ROUTE of EXPOSURE	TARGET ORGAN(S)	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
salmonella	BACTERIA a gram-negative rod-shaped bacilli	INGESTION of contaminated foods: beef, poultry, milk, or eggs; water, or direct contact with infected animals-reptiles	Infection may spread from the INTESTINES to the blood stream	Diarrhea, fever, abdominal cramps 12 to 72 hours after infection	STOOL SAMPLE diagnosed by detecting the bacterium; Notifiable Disease - within one working day
e. coli O157:H7	BACTERIA a gram-negative rod-shaped producing that produces a powerful toxin	INGESTION of undercooked ground beef; eating sprouts, lettuce, salami, unpasteurized milk and juice, and swimming in or drinking sewage-contaminated water.	Most strains are harmless and live in the INTESTINES of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness	Acute bloody diarrhea & abdominal cramps with little or no fever; usually lasts 1 week.	STOOL SAMPLE diagnosed by detecting the bacterium; Notifiable Disease - within one working day
flu	VIRUS Causes contagious disease called influenza	INGESTION & INHALATION Transmitted by coughing, sneezing, or speaking or by touching a surface that has viruses on it and then touching his or her nose or mouth.	Infection of the RESPIRATORY TRACT in humans (nose, throat, and lungs)	Sudden onset of fever, muscle aches & pains, headache, fatigue, dry cough, sore throat, and possibly runny nose	THROAT or OTHER SWAB , nasal wash, bronchial wash, nasal aspirate, sputum cultures
Mono-nucleosis	VIRUS Epstein-Barr virus is one of the most common human viruses found, virus is also found frequently in the saliva of healthy people	INGESTION Intimate contact with the saliva (found in the mouth) of an infected person	EBV remains dormant or latent in a few cells in the THROAT and blood for the rest of the person's life	fever, sore throat, and swollen lymph glands	BLOOD TEST <ul style="list-style-type: none"> • Elevated white blood cell count • Increase in the percentage of certain atypical white blood cells • A positive reaction to a "mono spot" test
Chlorpyrifos (Pronounced klor peer'a-fos)	INSECTICIDE A common organophosphate pesticide used to control cockroaches, fleas, and termites; it is also used in some pet flea and tick collars.	INHALATION, INGESTION & SKIN ABSORPTION Putting food or other contaminated items in your mouth. Inhaling where it was applied to control insects.	Disrupts the NERVOUS SYSTEM by interfering with acetylcholinesterase enzyme. Prevents contracting muscles from relaxing.	Fatigue, headache, nausea, eye tearing, excessive salivation, vomiting, stomach cramps, dizziness, diarrhea, chest tightness, weakness	BLOOD TEST <ul style="list-style-type: none"> • Measure the activity of enzyme acetylcholinesterase, in the blood. • Test for the metabolite, or breakdown product in the urine.
cold	VIRUS Caused by over two hundred different viruses; occurs during the fall and winter	INHALATION & INGESTION Inhaling respiratory secretions from the air and ingestion of secretions from skin and surfaces touching the eyes or nose.	RESPIRATORY SYSTEM The virus enters the nose, a critical stage in infection is the attachment of the virus to nasal cells lining the nose	nasal discharge, obstruction of nasal breathing, swelling of the sinus membranes, sneezing, sore throat, cough, and headache	None

<p>Bubonic Plague</p>	<p>BACTERIA An infectious disease of animals and humans caused by a bacterium named <i>Yersinia pestis</i></p>	<p>INJECTION from bites Flea-borne, from infected rodents to humans; Direct contact with infected tissues or fluids from handling sick or dead animals.</p>	<p>When bacteria invade and multiply in the BLOOD STREAM, they spread rapidly throughout the body and cause a severe and often fatal condition.</p>	<p>Swollen and tender lymph glands (called a "bubo"), fever, chills, headache, and extreme exhaustion.</p>	<p>BLOOD CULTURES of the bacteria and microscopic examination of lymph gland, blood, and sputum samples</p>
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TEACHER KEY

STUDENT WORKSHEET:

1. What are patient's symptoms? What are their signs?
Signs: fever, sore throat, and swollen lymph glands
Symptoms: tired
2. What are the possible routes of exposure?
Ingestion or inhalation
3. Which factor do you think is most important in diagnosing a person's illness?
Answer will vary.
4. What specific questions would you ask this patient?
Answer will vary.
5. What do you think is causing this person's illness?
Mononucleosis
6. When you made your diagnosis, what logic did you use? Write out a step-by-step explanation of the method you used.
Answer will vary.
7. How can you ensure that your diagnosis is correct?
Perform one or two diagnostic tests to confirm the illness.



**STUDENT PAGES
FOR
BACKGROUND ACTIVITY 3:
HOW DID I GET SICK?**

FOLLOW THIS PAGE

STUDENT HANDOUT:

ILLNESS PUZZLE

ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
Salmonella	BACTERIA A gram-negative rod-shaped bacilli.	INGESTION of contaminated foods: beef, poultry, milk, or eggs; water, or direct contact with infected animals like reptiles.	Infection may spread from the INTESTINES to the blood stream	12 to 72 hours after infection: <ul style="list-style-type: none"> • Fever • Diarrhea • abdominal cramps 	<ul style="list-style-type: none"> • STOOL SAMPLE diagnosed by detecting the bacterium • Notifiable Disease - must alert Health Department within one working day
ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
E. coli O157:H7	BACTERIA A gram-negative rod-shaped bacilli that produces a powerful toxin.	INGESTION of undercooked ground beef, sprouts, lettuce, salami, or unpasteurized milk and juice; swimming in or drinking sewage contaminated water.	Most strains are harmless and live in the INTESTINES of healthy humans and animals; this strain produces a powerful toxin and can cause severe illness.	<ul style="list-style-type: none"> • Acute bloody diarrhea • Abdominal cramps • Little or no fever 	Diagnosed by detecting the bacterium from <ul style="list-style-type: none"> • Stool sample
ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
Flu	VIRUS A virus causes this contagious disease called influenza	INGESTION & INHALATION -Transmitted by coughing, sneezing, or speaking. Also transmitted by touching a surface that has viruses on it and then touching his or her nose or	Infection of the RESPIRATORY TRACT in humans (nose, throat, and lungs)	Sudden onset of: <ul style="list-style-type: none"> • Fever • Muscle aches and pains • Headache • Fatigue • dry cough • Sore throat • Runny nose 	SWAB TESTS: <ul style="list-style-type: none"> • NP swab throat swab • Nasal wash • Bronchial wash • Sputum cultures

ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
Mono-nucleosis	VIRUS Epstein-Barr virus is one of most common human viruses, virus is found frequently in the saliva of healthy people	INGESTION - intimate contact with the saliva (found in the mouth) of an infected person	Virus remains dormant or latent in a few cells in the THROAT and blood for the rest of the person's life	<ul style="list-style-type: none"> • Fever • Sore throat • Swollen lymph glands 	BLOOD TESTS: <ul style="list-style-type: none"> • Elevated white blood cell count • Increase in the percentage of certain atypical white blood cells • A positive reaction to a "mono spot" test
ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
Chlorpyrifos (Pronounced klor peer'a-fos)	INSECTICIDE A common organophosphate pesticide used to control cockroaches, fleas, and termites. It is also used in some pet flea and tick collars.	INHALATION, INGESTION & SKIN ABSORPTION Putting food or other contaminated items in your mouth. Inhaling where it was applied to control insects.	Disrupts the NERVOUS SYSTEM by interfering with acetylcholinesterase enzyme. Prevents contracting muscles from relaxing.	<ul style="list-style-type: none"> • Headache • Nausea • Fatigue • Excessive salivation • Vomiting • Stomach cramps • Dizziness • Diarrhea • Weakness 	BLOOD TESTS: <ul style="list-style-type: none"> • Measure the enzyme activity in the blood or other tissues • Test for the metabolite or breakdown product in the urine.
ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
Cold	VIRUS Caused by over two hundred different viruses. This common illness occurs mainly during the fall and winter.	INHALATION & INGESTION Inhaling respiratory secretions from the air and ingestion of secretions from skin and surfaces touching the eyes or nose.	RESPIRATORY SYSTEM the virus enters the nose, a critical stage in infection is the attachment of the virus to nasal cells lining the nose	<ul style="list-style-type: none"> • Nasal discharge • Obstruction of nasal breathing • Swelling of sinus membranes • Sneezing • Sore throat • Cough • Headache 	None

ILLNESS	CAUSE	MODE/ ROUTE of EXPOSURE	TARGET ORGAN/ SYSTEM	SIGNS/ SYMPTOMS	DIAGNOSTIC TESTS
<p>Bubonic Plague</p>	<p>BACTERIA <i>Yersinia pestis</i>, an infectious disease of animals and humans</p>	<p>INJECTION from bites: Flea- borne disease from infected rodents to humans. Direct contact with infected tissues or fluids from handling sick or dead animals.</p>	<p>When bacteria invade and multiply in the BLOOD STREAM, they spread rapidly throughout the body and cause a severe and often fatal condition.</p>	<ul style="list-style-type: none"> • Swollen and tender lymph gland (called a "bubo") • Fever • Chills • Headache • Extreme exhaustion 	<ul style="list-style-type: none"> • BLOOD CULTURES of the bacteria • Microscopic examination of lymph gland, blood, sputum samples

ILLNESS PUZZLE

1. Try to match five factors: ILLNESS, MODE OF TRANSMISSION/ROUTE OF EXPOSURE, SIGN & SYMPTOMS, TARGET ORGAN/SYSTEM, and DIAGNOSTIC TESTS with the appropriate illness.
2. When you think the puzzle is complete, have your teacher check it to see if it is correct.
3. If you need more help, ask for a reference sheet.
4. Once the puzzle is complete, you will use this information to diagnosis a patient that came into your office. Read the patient's case history below.

Patient ID: Brianna Sherwood
Chief complaint: "I'm so tired."

History of the present illness:

Brianna is a 19-year-old, white, female college student with sore throat, swollen lymph glands, and fever for 5 days' duration who was in a usual state of good health. She denies any trauma, recent illnesses, exposures to noxious fumes or gasses, or illicit drug use. Brianna works part-time in the Botany Department's greenhouses tending plants for pesticide efficacy studies. She has not taken any medications recently, and has not had any recent foreign travel.

Past medical history:

Surgery tonsillectomy at age 5
Meds none

Conclusion Questions: (Write answers in Learning Log ☺)

1. What are patient's symptoms? What are their signs?
2. What are the possible routes of exposure?
3. Which factor do you think is most important in diagnosing a person's illness?
4. What specific questions would you ask this patient?
5. What do you think is causing this person's illness?
6. When you made your diagnosis, what logic did you use? Write out a step-by-step explanation of the method you used.
7. How can you ensure that your diagnosis is correct?