

Focused Learning Lesson
Science
Grade Level(s) 9-11
LS-H-G2

Overview:

This lesson can be used to review the organisms that cause disease and to review how disease is transmitted and the process of infection.

Approximate Duration: 45 minute

Benchmark:

LS-H-G2 contrasting how organisms cause disease.

Biology GLE: 38. Discuss mechanism of disease transmission and processes of infection.

Benchmark:

SI-H-A2 designing and conducting scientific investigations

SI GLE: 2. Describe how investigations can be observation, description, literature survey, classification, or experimentation.

Objectives

1. Identify the cause of disease.
2. Explain how infectious diseases are transmitted and the process of infection.
3. Organize concepts into a graphic organizer to show different organisms that spread infectious diseases, the way they transmit those diseases, and examples of the diseases.

Teacher Preparation

- Students need to be in groups of 2-3 before lesson begins.
- Make a transparency of attachments 1-4 to use in discussion of content.
- Refer to Attachment for teacher 5 background.
- Make a transparency of Attachment 6 for review of concept map/graphic organizer skills.
- Make a transparency of Attachment 7 for correct concept map/graphic organizer of assignment.

Materials/Equipment/Resources

- Transparency film
- Overhead projector
- Unlined/construction paper
- Tape

Lesson Procedures:

Opener:

Ask students if they have ever been sick. When they were sick, did they go to the doctor's office? *Yes or no.* What did the doctor say? *You have an infection, a disease, the flu, chicken pox, strep throat, athlete's foot, etc.* What do you think causes these diseases/sicknesses? *Bacteria and viruses are the common responses.* Discuss with

students that not all diseases or illnesses come from bacterial infection. Explain that today they are going to learn about the various organisms that cause diseases/sicknesses.

Body of the Lesson

1. Discuss with students disease and the four main organisms that cause disease.
2. Discuss with students the means of infection by these organisms. See Attachment 5 for teacher background information.
3. Show students Attachment 1, picture of bacteria, when discussing bacteria for visual learners.
4. Show students Attachment 2, picture of virus, when discussing viruses for visual learners.
5. Show students Attachment 3 for examples of diseases caused by bacteria and viruses and the modes of infection.
6. Show students Attachment 4, picture of plasmodium life cycle, when discussing Protists for visual learners.
7. Once the discussion of the organisms and the modes of infection, review concept map (graphic organizer) instructions and skills, on the board, with students using words to organize their school using words like: teachers, classrooms, principal, students, different courses or subjects students take in school. Use example found in Attachment 6.
8. Assign students, in pre-assigned cooperative groups, to create a concept map that shows the relationship between the different organisms that spread infectious diseases, ways of transmission, and examples of diseases caused by these organisms.
9. Allow 10-15 minutes for students to complete the organizers/maps. Walk around the room to check for understanding and student misconceptions.
10. Once time has passed or students have completed the assignment, have one student from each group display and explain their concept map to the class.
11. Hang the concept maps up on the wall to use in future lessons.

Closure

Review with students the correct concept map/graphic organizer, Attachment 7, and explain the flow from organism to organism and the methods of disease transmission. Use assessment items to check for student understanding.

Attachments:

Attachment 1: Structure of Bacteria.

Attachment 2: Structure of Virus.

Attachment 3: Tables of organisms that cause disease, diseases, and methods of transmission.

Attachment 4: Life cycle of Plasmodium

Attachment 5: Teacher Background

Attachment 6: Sample Concept Map/Graphic Organizer

Attachment 7: Concept Map of Diseases: One Solution

Sample Assessment Items:

1. Disease causing agents such as viruses, bacteria, and fungi are known as
 - a. Retroviruses
 - b. Prions
 - c. Pathogens
 - d. Toxins

2. One group of viruses that contain RNA as their genetic information are
 - a. Oncogenic viruses
 - b. Retroviruses
 - c. Prions
 - d. Pathogens

3. Any change, other than an injury, that disrupts the normal function of a person's body is a
 - a. Disease
 - b. Pathogen
 - c. Toxin
 - d. Vector

KEY: 1. – c., 2. – b., 3. – a.

References:

Miller, K. (2002). *Biology* (pp. 479-487, 495-502, 527-539, 1029-1033). Upper Saddle River, NJ: Prentice Hall.

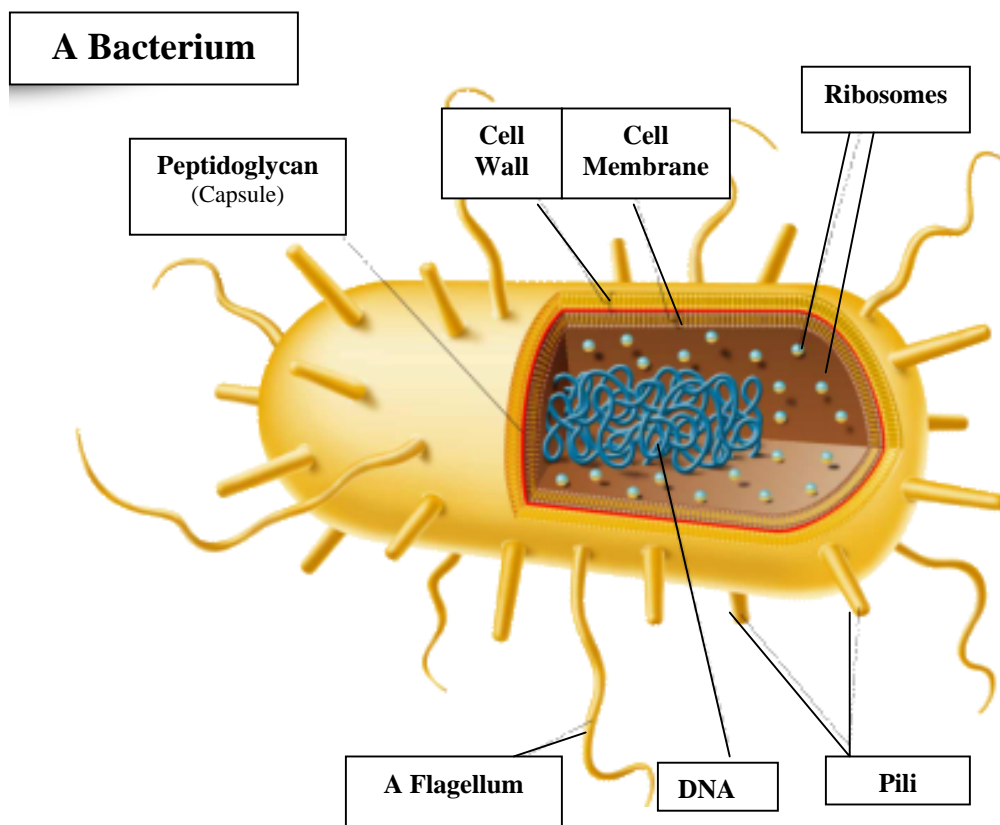
Raven, P., Johnson, G. (1992). *Biology* (pp. 1088-1102). St. Louis, MS: Mosby-Year Book, Inc.

Pictures:

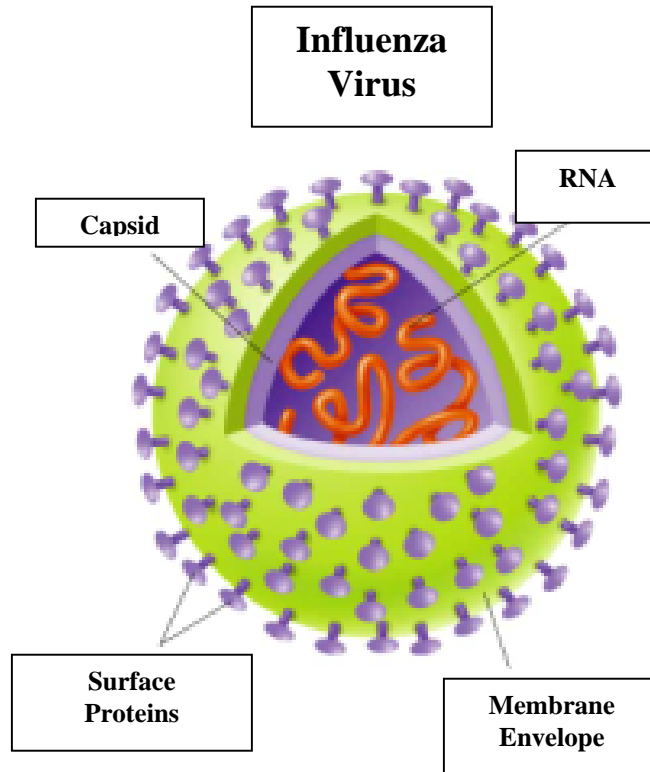
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Sanders, David. *All the Virology on the Web*. (February 2004). Online at <http://www.virology.net/Articles/sars/s2model.html>

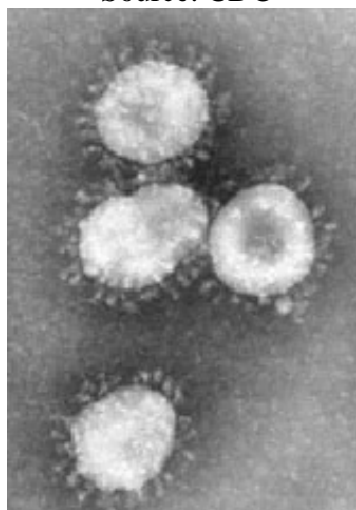
Attachment 1 Structure of Bacteria



Attachment 2 Structure of Virus



SARS Virus
Source: CDC



Attachment 3

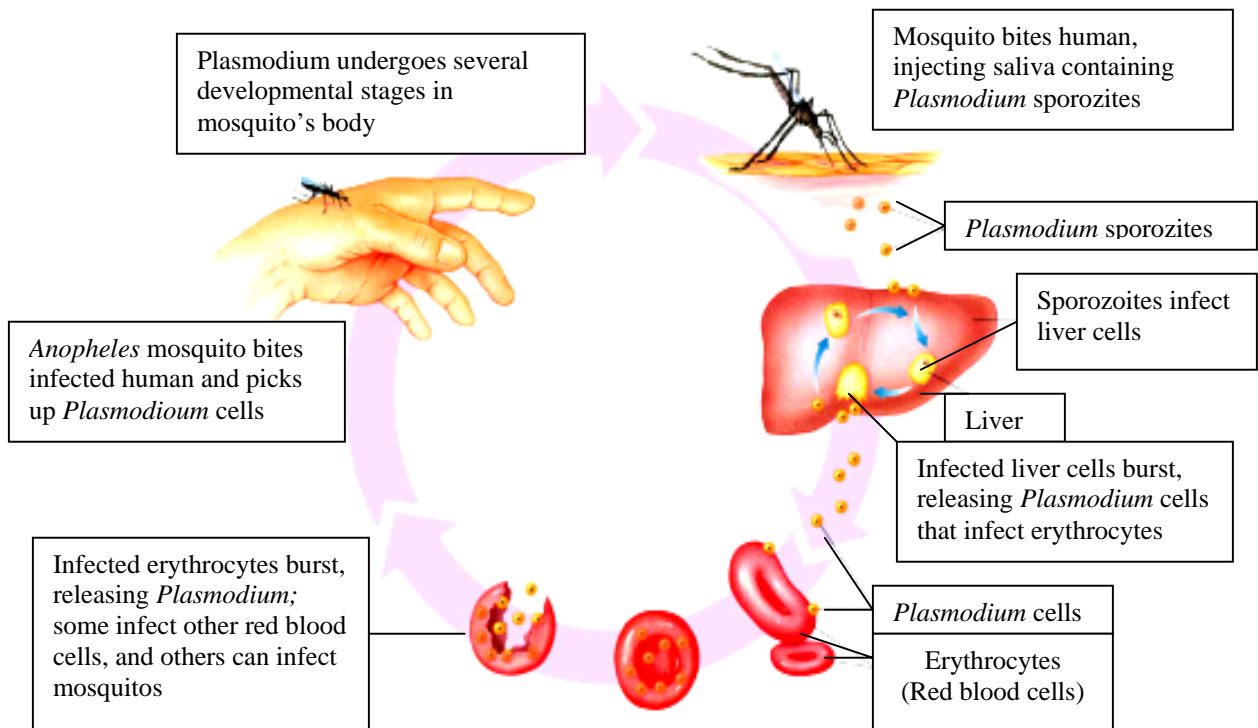
Examples of bacteria/viruses/Protists and the diseases they cause.

Disease	Pathogen	Prevention
Tooth decay	<i>Streptococcus mutans</i>	Regular dental hygiene
Lyme disease	<i>Borrelia buradorferi</i>	Protection from tick bites
Tetanus	<i>Clostridium tetani</i>	Current tetanus vaccination
Tuberculosis	<i>Mycobacterium tuberculosis</i>	Vaccination
Salmonella food poisoning	<i>Salmonella enteritidis</i>	Proper food-handling practices
Pneumonia	<i>Streptococcus pneumoniae</i>	Maintaining good health
Cholera	<i>Vibrio cholerae</i>	Clean water supplies

Type of Virus	Nucleic Acid	Disease
Oncogenic viruses	DNA	Cancer
Retroviruses	RNA	Cancer, AIDS
Adenoviruses	DNA	Respiratory infections
Herpesviruses	DNA	Chickenpox
Poxviruses	DNA	Smallpox

Pathogen types	Disease	Agent that causes disease	Methods of transmission
Viruses	Common cold	Rhinovirus	Airborne, direct contact with infected person
	Influenza	Two types (A,B) plus subtypes	Airborne, droplet infection, direct contact with infected person
	Chicken pox	Varicella	Airborne, direct contact with infected person
	Measles	Paramyxovirus	Droplets in air, direct contact with secretions of infected person
		<i>Mycobacterium tuberculosis</i>	
Bacteria	Tuberculosis	<i>Neisseria meningitides</i>	Droplets in air, contaminated milk and dairy products
	Meningitis	<i>Vibrio cholerae</i>	Direct contact with a carrier
	Cholera	<i>Clostridium tetani</i>	Contaminated drinking water
	Tetanus	<i>Trypanosoma</i>	Contaminated wound, usually puncture wound
Protists	African sleeping sickness	<i>Plasmodium</i>	Spread by tsetse fly
	Malaria	<i>Entamoeba histolytica</i>	Spread by <i>Anopheles</i> mosquitoes
	Amoebic dysentery		Contaminated drinking water

Attachment 4 Life cycle of a Plasmodium



Attachment 5 Teacher Background

Disease

1. Definition: Disease is any change other than an injury that disrupts the normal function of the body.
 2. Examples
 - (a) Examples of inherited diseases: hemophilia, cystic fibrosis, and sickle cell anemia.
 - (b) Example of environmentally caused disease: cigarette smoke and lung cancer.
 - (c) Example of agents that cause infectious disease: bacteria, viruses, protists, and fungi. Each is explained below in number order.
 3. Information
 - Disease causing agents such as bacteria are called pathogens, “sickness makers.”
 - Diseases caused by pathogens are generally infectious diseases because the agents that cause them usually enter or infect the body of the person who gets sick.
 - The human body provides just the right conditions for growth of many microscopic organisms, i.e., right temperature, moist environment, and abundance of nutrients. For example, our large intestine, mouth and throat contain dense colonies of helpful bacteria.
- I. **Bacteria** (Use Attachment 1 to illustrate a bacterium.)
- A. Cause disease in one of two general ways.
 1. Some damage tissues of the infected the organism directly by breaking cells down for food.
 2. Others release toxins (poisons) that harm the body.
 - (a) Example: Tuberculosis bacteria break down lung tissue
 - (b) Example: Bacterial toxins cause many cases of food poisoning.
 - (c) Example: Streptococcus bacteria that cause strep throat release toxins into the blood stream.
 - B. Are single, prokaryotic cells, some of which have slime capsules.
- II. **Viruses** (Use Attachment 2 to illustrate a virus)
- A. Viruses are particles of nucleic acid, protein, and some cases lipids that can reproduce only by infecting living cells.
 - B. A typical virus is composed of a core of either DNA or RNA, surrounded by a protein coat.
 1. A virus’s outer protein coat is called its capsid.
 2. The capsid includes protein that enables a virus to enter a host cell.
 3. The capsid proteins of a typical virus bind to the surface of a cell and “trick” the cell into allowing it inside.
 4. Once inside, the viral genes take over.
 - (a) The cell transcribes the viral genes, putting the genetic program of the virus into effect.
 - (b) Sometimes that genetic program may simply cause the cell to make copies of the virus, but often it destroys the host cell.

- C. Diseases such as polio, measles, AIDS, mumps, influenza, yellow fever, rabies, and the common cold, are caused by viruses.
 - They attack and destroy certain cells in the body, causing the symptoms of the disease.
- D. Oncogenic viruses cause cancer.
 - They carry genes that disrupt the normal controls over cell growth and division.
- E. Retroviruses contain RNA as genetic information.
 - When they infect a cell, it produces a DNA copy of the RNA.
 - This DNA is inserted into the DNA of the host cell.
 - Example: HIV
- F. Similar to viruses, *prions* are protein infectious particles.
 - They contain neither DNA nor RNA, only a protein.
 - Example: Mad cow disease

III. **Protists** (use Attachment 4 for picture of plasmodium cycle)

- A. Definition: any organism that is not a plant, an animal, a fungus, or a prokaryote.
 - They are not members of the Kingdom Plantae.
 - Animal-like protists cause diseases.
 - Most are eukaryotic cells. Some are found in colonies.
- B. Examples
 1. Malaria is caused by a plasmodium (protist) that is transported by a female mosquito.
 - Sporozites (Plasmodium reproductive cells) from mosquito saliva are injected into the bloodstream.
 - Sporozites infect liver cells and then red blood cells.
 - Sporozites multiply rapidly within infected cells.
 - Red blood cells burst, dumping large amounts of toxins into the bloodstream.
 - Toxins produce the chills and fever that are symptoms of malaria.
 2. African sleeping sickness is caused by Trypanosome (protist).
 - Spread from the bite of a tsetse fly.
 - Toxins cause chills and rashes.
 - They can also infect nerve cells.

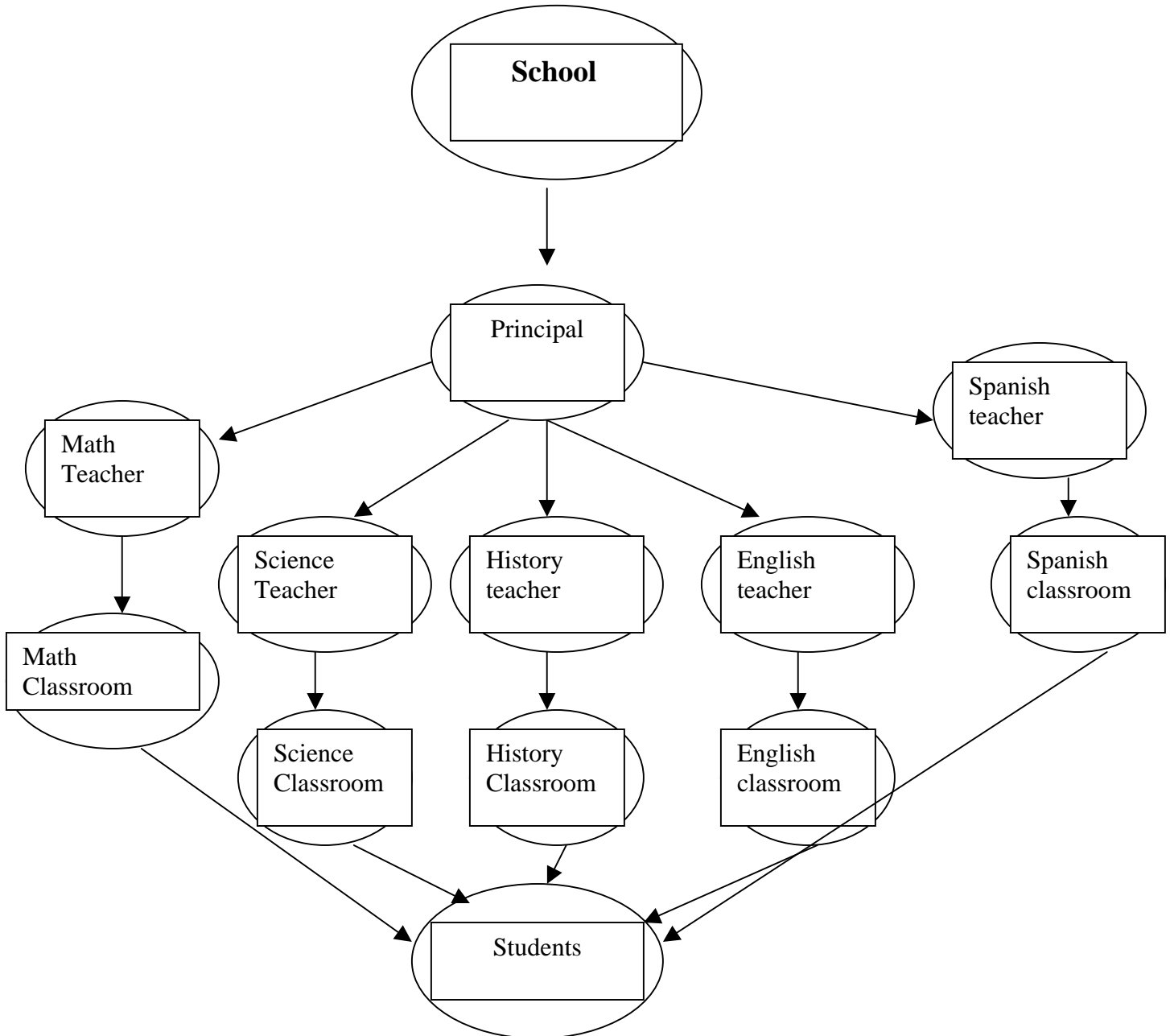
IV. **Fungi**

- A. They are eukaryotic heterotrophs that have cell walls.
- B. Parasitic fungi cause serious plant and animal disease.
- C. Examples:
 1. Athlete's foot – infection in the areas between the toes that produces a red, inflamed sore from which the spores can easily spread.
 2. Ringworm is actually a fungal infection in the skins that appears as a red, bumpy ring.

Use Attachment 3 for summary of organisms and the diseases that they cause.

Attachment 6 Sample Concept Map/Graphic Organizer

Ask students to organize their school using words like: teachers, classrooms, principal, students, different courses or subjects students take in school.



Attachment 7
Concept Map of Disease: One Solution

