

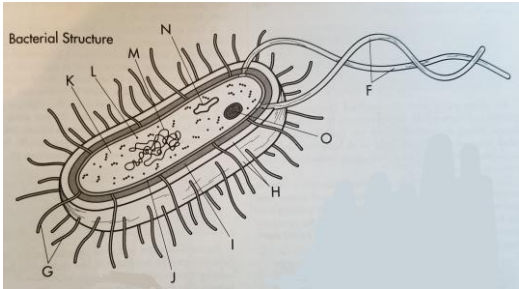
# Spread of Pathogens Video Notes Guide

**Purpose:** Understand the role of microorganisms in disrupting the health of organisms.

**Why we should care:** Plagues caused by infectious diseases have ravaged human populations throughout history. Even today, populations must deal with life-threatening diseases in localized areas or even on a global scale. Understanding what caused the diseases and how they spread has been the key to controlling these outbreaks and saving lives. We are currently dealing with the reality of COVID-19. Understanding the disease and how to control the spread is the key to fighting misinformation and panic.

**Instructions:** As you go through this video color code your reading. Highlight or underline vocab and important information as follows:

- ✓ Highlight (or underline) the vocab and material you already know in green
- ✓ Highlight (or underline) the vocab and material you didn't already know in red

<p><b>Questions and Thoughts</b> Use this area to write down any questions that occur to you as you go. You can also sketch anything that you think might be helpful from the video.</p>	<p><b>Video Notes</b> This is the script from the video to be used as your notes. You don't have to try to copy everything down as you go. Listen to what you hear and highlight and use the space to the side to add to the notes.</p>
	<p><b><u>Introduction</u></b> A pathogen is defined as any microorganism or virus that can cause an infectious disease. Microorganisms are single-celled organisms, such as bacteria, protists, and fungi. Viruses are not included as microorganisms because they are not actually living organisms. An infectious disease is caused by microorganisms or viruses, like the cold virus (which happens to be a type of coronavirus) or strep throat; unlike non-infectious diseases, like diabetes, which is caused by lifestyle, the environment, or gene mutations.</p> <p><b><u>Pathogens can be separated into 4 groups:</u></b></p> <p>Bacteria are prokaryotic organisms do not have a nucleus. The DNA is found in the nucleoid region of the cell. They may or may not have a cell wall around the cell membrane. Bacteria often cause diseases by producing toxins that are secreted by the bacteria or released when the bacteria break apart. When this happens, the toxins damage cells and causes infectious diseases. Examples of bacterial diseases are strep throat, cholera, tetanus, and botulism. You have also probably seen necrotizing fasciitis (flesh-eating bacteria) on some of your favorite medical dramas.</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="text-align: center;">  <p style="font-size: small;">Bacterial Structure</p> </div> <div style="background-color: #f0f0f0; padding: 5px; border: 1px solid #ccc;"> <p style="margin: 0;"><b>Bacterial Structures</b></p> <ul style="list-style-type: none"> <li><input type="radio"/> Flagellum .....F</li> <li><input type="radio"/> Pili (Fimbriae) ....G</li> <li><input type="radio"/> Capsule .....H</li> <li><input type="radio"/> Cell Wall .....I</li> <li><input type="radio"/> Cell Membrane .....J</li> <li><input type="radio"/> Cytoplasm .....K</li> <li><input type="radio"/> Ribosomes .....L</li> <li><input type="radio"/> Chromosome.....M</li> <li><input type="radio"/> Plasmid .....N</li> <li><input type="radio"/> Endospore .....O</li> </ul> </div> </div>

Fungi are eukaryotic organisms that have a nucleus, are heterotrophic, and have a cell wall made of a carbohydrate called chitin. We often think of fungi as the different types of mushrooms we can find on the ground or in the store, but there are also single-celled fungi. Fungi can cause disease in three ways. First, some produce toxins to protect themselves and they are considered poisonous if eaten. Second, some can be parasites; they not only take nutrient from the host but will also invade nearby tissues. Last, some people are allergic to the spores produced by the fungus and these can cause an immune response when inhaled.



Ringworm



Athlete's Foot

### Poisonous or Edible?

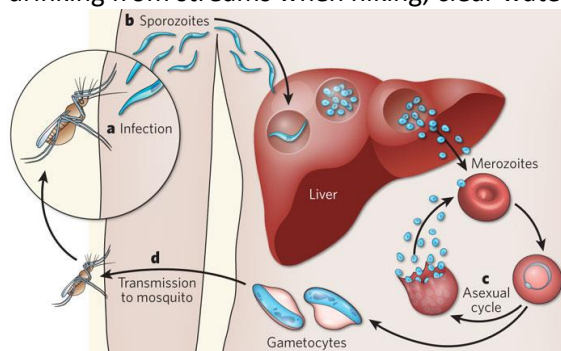


"Destroying Angel"  
Mushrooms

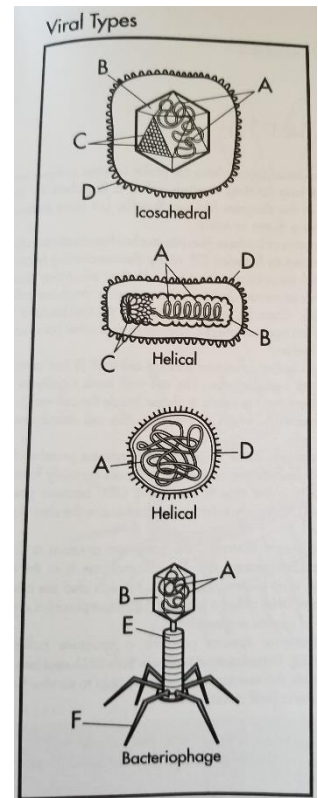
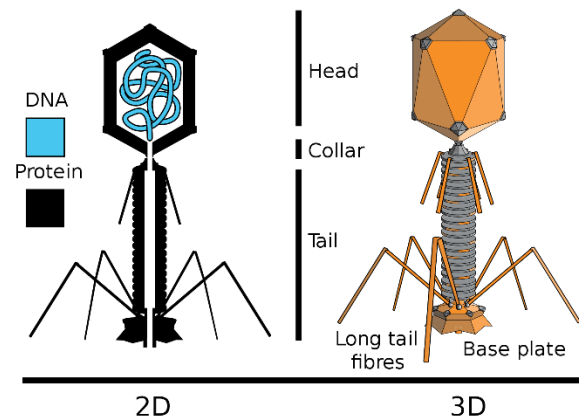


Edible Puffball  
Mushrooms

Protists are also eukaryotic and belong to the Kingdom Protista. Unlike the other kingdoms, some protists have very little in common. Most diseases are caused by protozoa or animal-like protists. These can be spread by a vector, such as a mosquito, or through contaminated food or water. These protozoa become parasites, taking nutrients while harming the host. Medical treatment is generally needed, or people won't recover. Malaria and Chagas disease are spread through insect vectors and the protist enters the host through the insect bites. Giardia is found in food or water contaminated with animal or human feces; the parasite enters the body when people ingest it. This is why hikers are warned against drinking from streams when hiking; clear water does not mean free of parasites.



Viruses are not living cells; but a nucleic acid, either DNA or RNA, surrounded by a protein coat called a capsid. Some viruses may also be surrounded by an envelope made of phospholipids lipids and proteins. The envelope helps protect the virus from the host's immune system. Viruses will infect a host cell and use the host cell to make new viruses. The new viruses will break out of the host cell and go to infect other cells. The fact that viruses cannot reproduce on their own is one reason they are not considered alive. Examples of viruses are HIV, which causes AIDS, chicken pox, influenza, and the coronaviruses that causes the common cold and COVID-19.



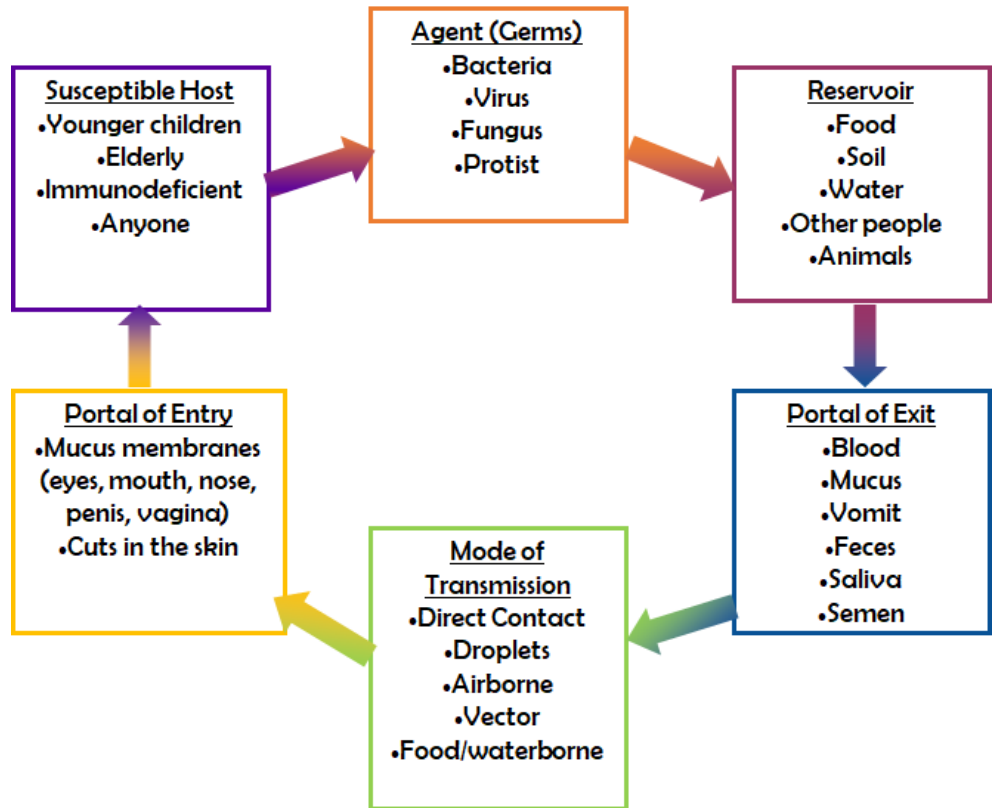
### Chain of Infection

A pathogen starts in a reservoir, which is where the microorganism or virus is multiplying. The reservoir can be in another person, in a vector like a flea, or in contaminated water or food. You have probably heard about some diseases that started in animals and were transferred to humans. This is called zoonosis and happens when humans come in contact with animals that carry the pathogen. It can exist in the animal reservoir with very little effect on the host, but when transferred to humans can make us sick. Despite what we see in the news, consuming wild animals is not the only way this happens. Pathogens can also be transmitted in the saliva through bites, through the air, or contaminated water. Examples of diseases caused by pathogens spread from animals include leprosy, AIDS, SARS, and bubonic plague.

The pathogen must leave the host through an exit and is usually carried in bodily fluids, such as blood, mucus, or saliva. The mode of transmission can be direct or indirect. Direct contact includes diseases spread through physical contact or diseases spread through droplets. Physical contact would include touching infected areas, kissing, sexual intercourse, or even eating or drinking after an infected person. HIV is spread sexual intercourse because it is found in the white blood cells of semen and vaginal fluids. It can also spread through intravenous drug use. Mononucleosis is the "kissing disease," but can also be shared when you share your drinks. Droplets are spread when a sick person, maybe with the flu, coughs or sneezes in your direction and you inhale those pathogen-filled droplets into your lungs. This also happens when you eat or drink after someone; their saliva droplets are now in your mouth!

Indirect contact is when you don't have to make contact with the infected person to get sick. Airborne diseases such as measles hang out in the air after the sick person is no longer in the area. Diseases spread by a vector include malaria and West Nile. Mosquitos spread the pathogens when they bite a person and it is transferred into the blood through the saliva of the mosquito. Some pathogens can also be spread through food or water contaminated pathogens. This is why proper food handling and cooking temperatures are so important. In the late 1800s, cholera was spread quickly when people in cities were drinking from water pumps that had been contaminated with feces.

### Chain of Infection



Pathogens can be spread different ways, but it is important to understand that most diseases are spread one way, not multiple ways. For example, ebola is spread the direct contact with bodily fluids of an infected person. You can't catch it by breathing the same air as them. However it spreads; the pathogen must have a way into the body. Pathogens can enter through any opening into the body. This includes natural openings like the eyes, mouth, nose, penis, or vagina and unnatural opening like breaks in the skin. The mucus produced by the mucus membranes in those natural openings usually do a pretty good job of trapping pathogens, but sometimes they do get through our natural defenses.

### Prevention

It can be pretty scary to start thinking about all the different pathogens and the diseases you could catch. However, we can control the spread of many of these. For example, better waste management help stop cholera outbreaks. For yourself, you can keep yourself healthy by washing your hands after using the restroom and before eating. This helps stop the spread of bacteria from feces and helps keep pathogens out of your mouth when you eat. Covering your mouth, with something other than your hand, when coughing or sneezing helps keep droplets from being inhaled by people close to you. Avoiding the bodily fluids, such as saliva, blood, vomit, sweat, semen, or feces, of other people is also a good

idea; especially if you don't know if they are sick. That did include saliva, as in don't share drinks with each other!

**They Aren't All Bad**

One last important point; bacteria, fungi, protists, and viruses are not all bad! Some of these are actually really helpful to humans. Some are even essential to our survival. For example, some bacteria and some fungi are used in fermentation to give us things like yogurt, cheese, bread, beer, kimchi, kombucha, and other fermented food. Bacteria in your body also aid the digestion and absorption of nutrients; they can also help keep the "bad" bacteria in check. Bacteria, fungi, and some fungus-like protists are essential to our ecosystems because they function as decomposers. Bacteria and plant-like protists carry out photosynthesis, which gives us most of the oxygen on the planet. Even certain viruses live in your body and help destroy certain bacteria. Scientists are also working to genetically engineer viruses to work for us.