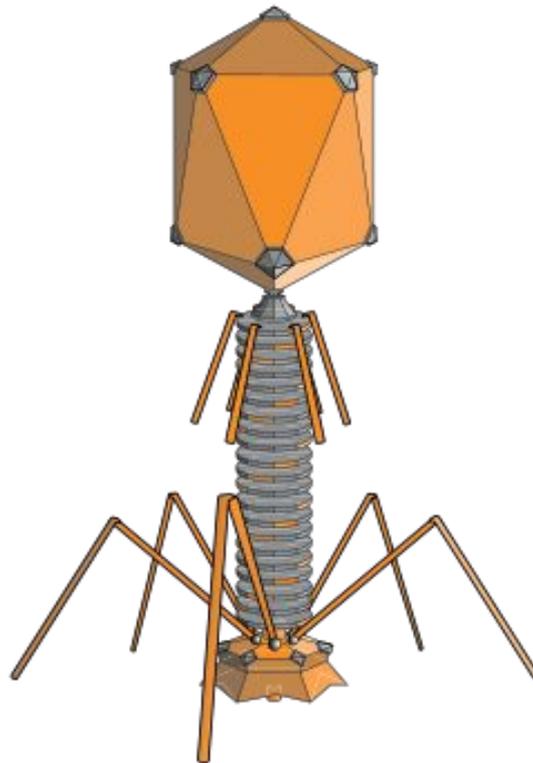


# Viruses, Bacteria, Protists and Fungi

Microbiology is the study of microscopic organisms like microbes

# Viruses

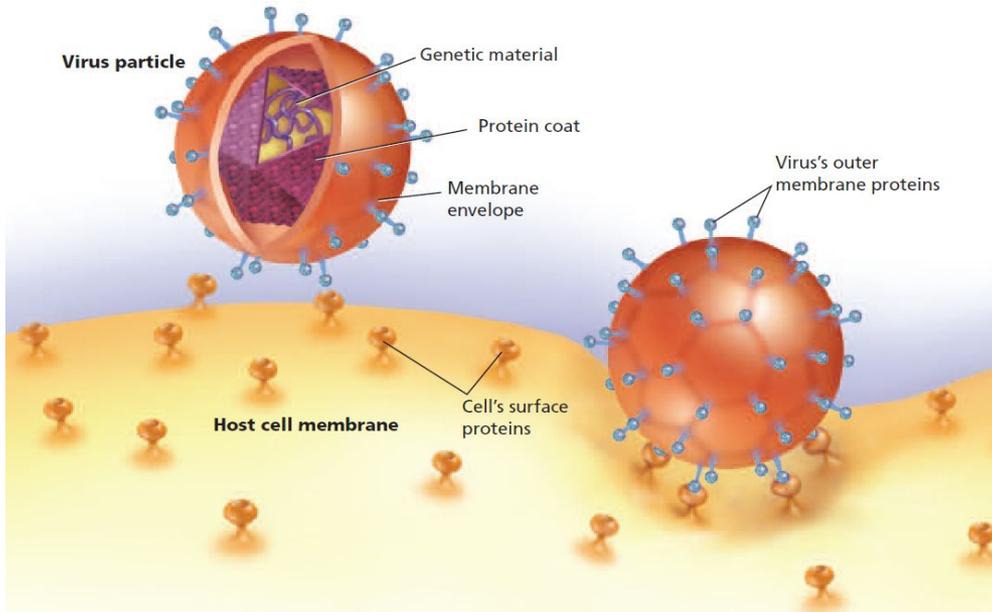
- A **virus** is a tiny NON-LIVING particle that invades and then multiplies inside a living cell.



# Viruses

- Viruses act like **PARASITES**, organisms that live in or on another organism and cause it harm.
- The living organism that a virus attaches to and uses as a source of energy is called the **HOST**.
- Once the **HOST** is carrying and transmitting a virus it is referred to as a **VECTOR**.

# Virus Structure

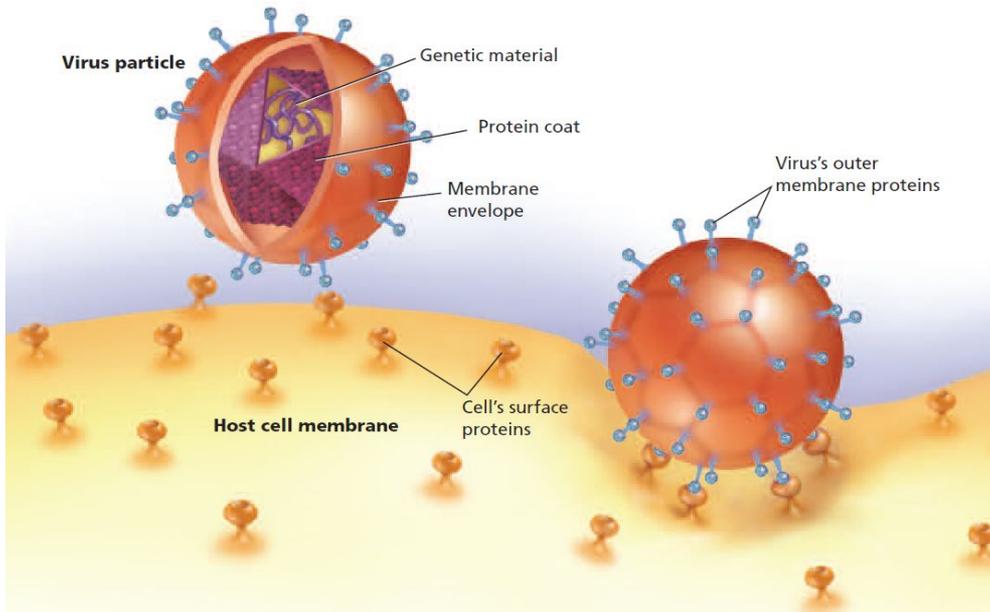


Viruses are smaller than cells, but can vary greatly in size and shape.

**BUT, ALL** viruses have three things in common.

1. A **PROTEIN COAT** that protects them
2. An **INNER CORE** that contains genetic material (direction for making new viruses)
3. **SURFACE PROTEINS** that allow it to attach to certain cells in the host.

# Virus Structure



The proteins on the surface of a virus play an important role during the invasion of a host cell.

The shape of the surface proteins allow the virus to attach to the proteins on the surface of a host's cells.

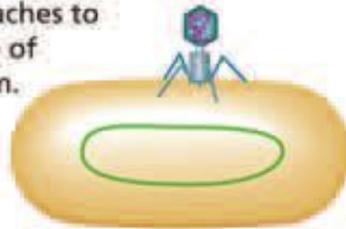


# How Do Viruses Multiply?

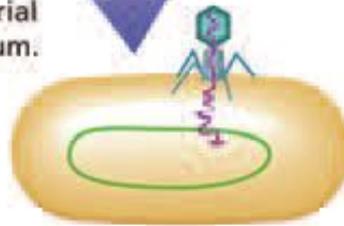
- Once inside a cell, a virus genetic material takes over many of the cells functions.
- It instructs the cell to produce the virus's proteins and genetic material.
- These proteins and genetic material assemble into new viruses which go on to infect more cells.

# Active Virus

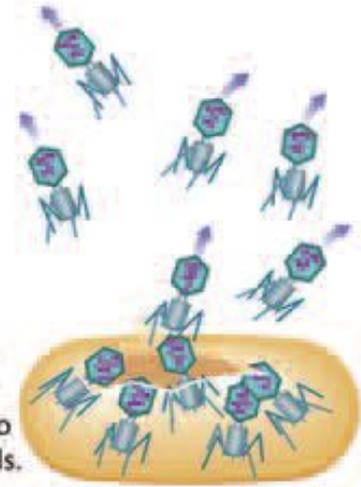
- 1 A virus attaches to the surface of a bacterium.



- 2 The virus injects its genetic material into the bacterium.



- 5 The bacterium bursts open, releasing new viruses. The viruses go on to infect more cells.

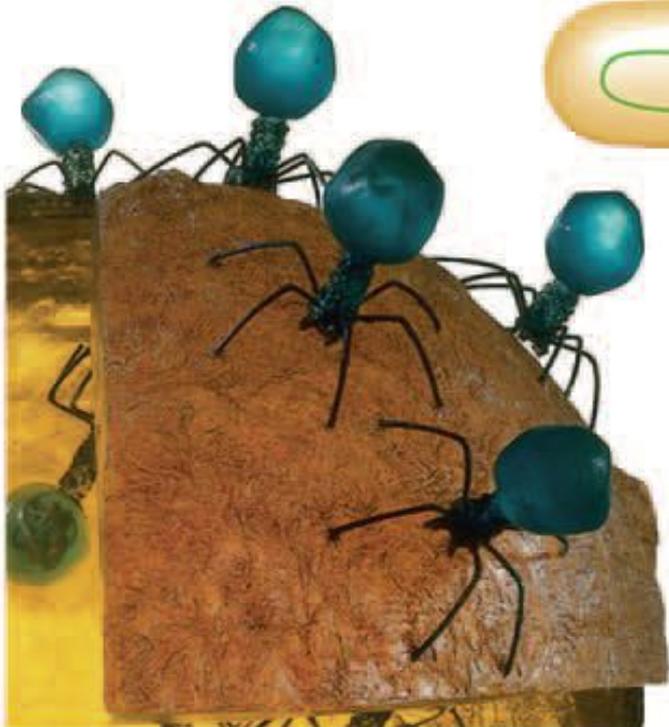
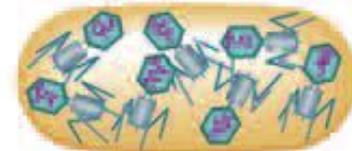


## Active Virus

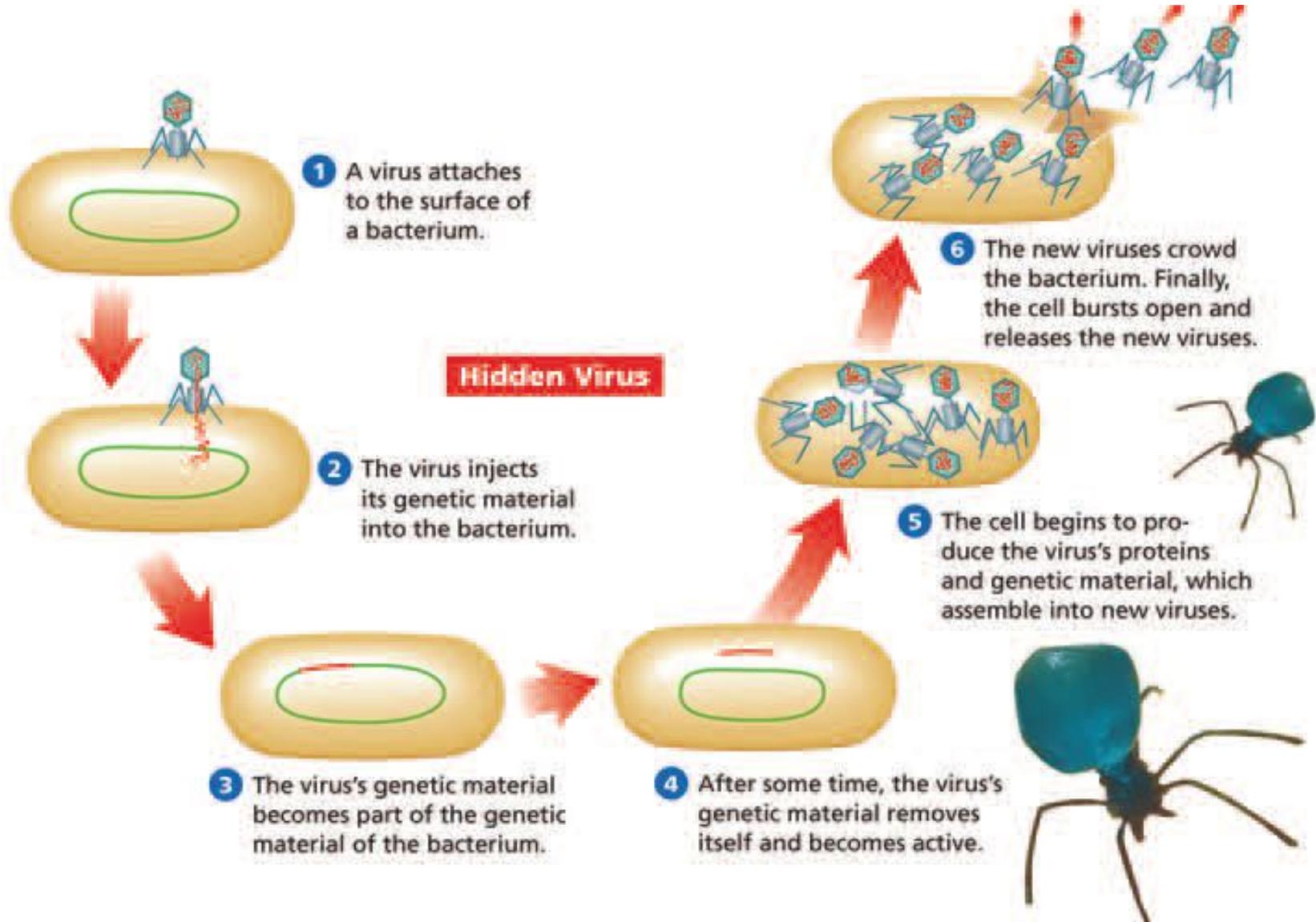
- 3 The virus's genetic material takes over the cell functions of the bacterium. The cell starts to produce the virus's proteins and genetic material.



- 4 The proteins and genetic material assemble into new viruses that fill the bacterium.



# Hidden Virus

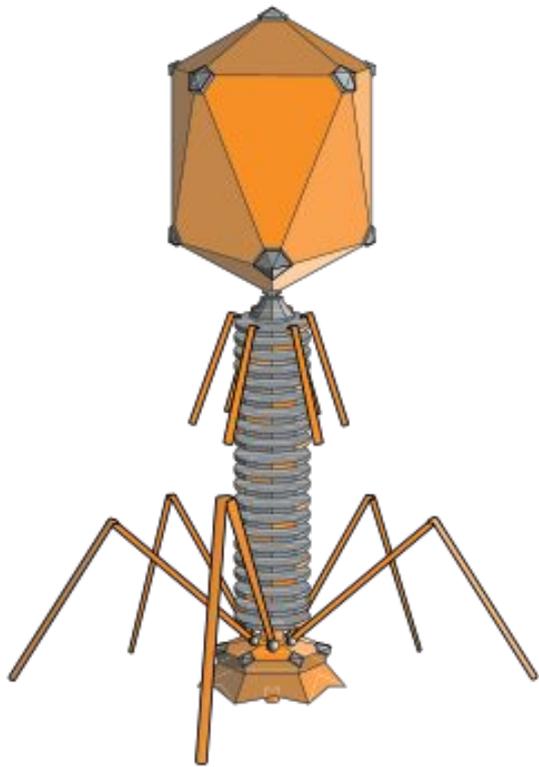


# Common Viruses

- Some viruses are very mild such as the common cold, while others, such as HIV have severe consequences for the host.

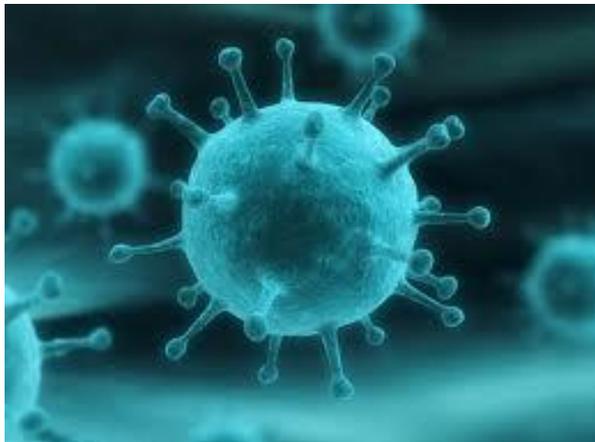
# Common Viruses

- **Bacteriophage** are robot like viruses that infect bacteria

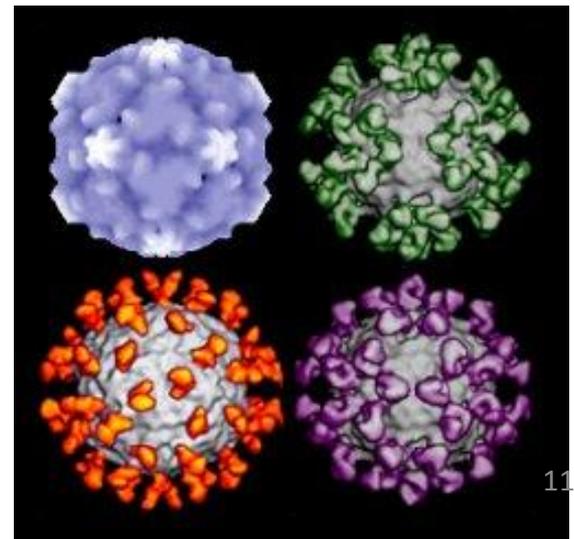


# Common Viruses

## Common Cold - Rhinovirus



## The Flu - Influenza Virus

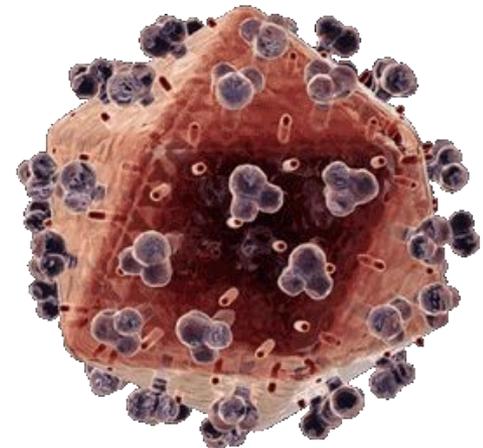
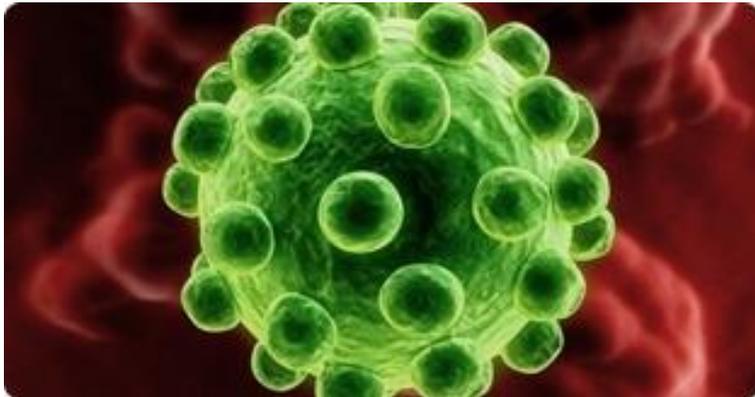


# Common Viruses

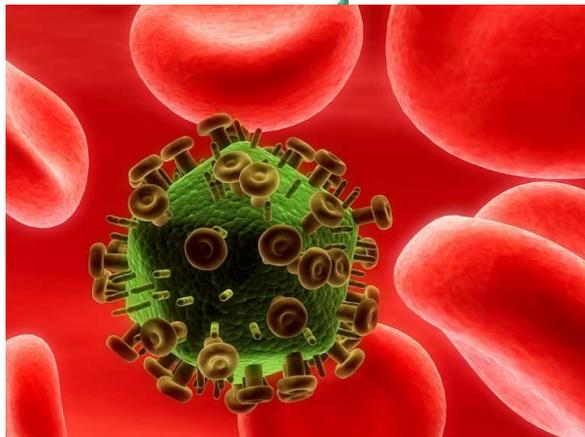
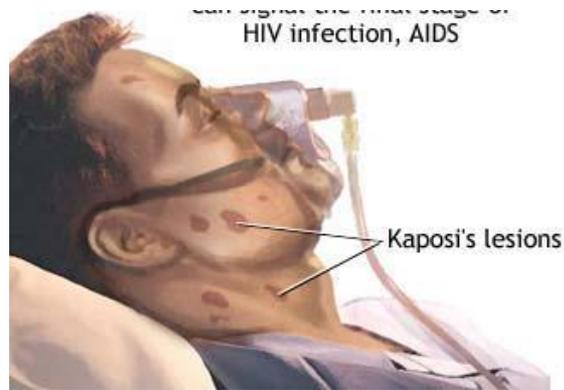
## Chicken Pox



## Measles



# Common Viruses

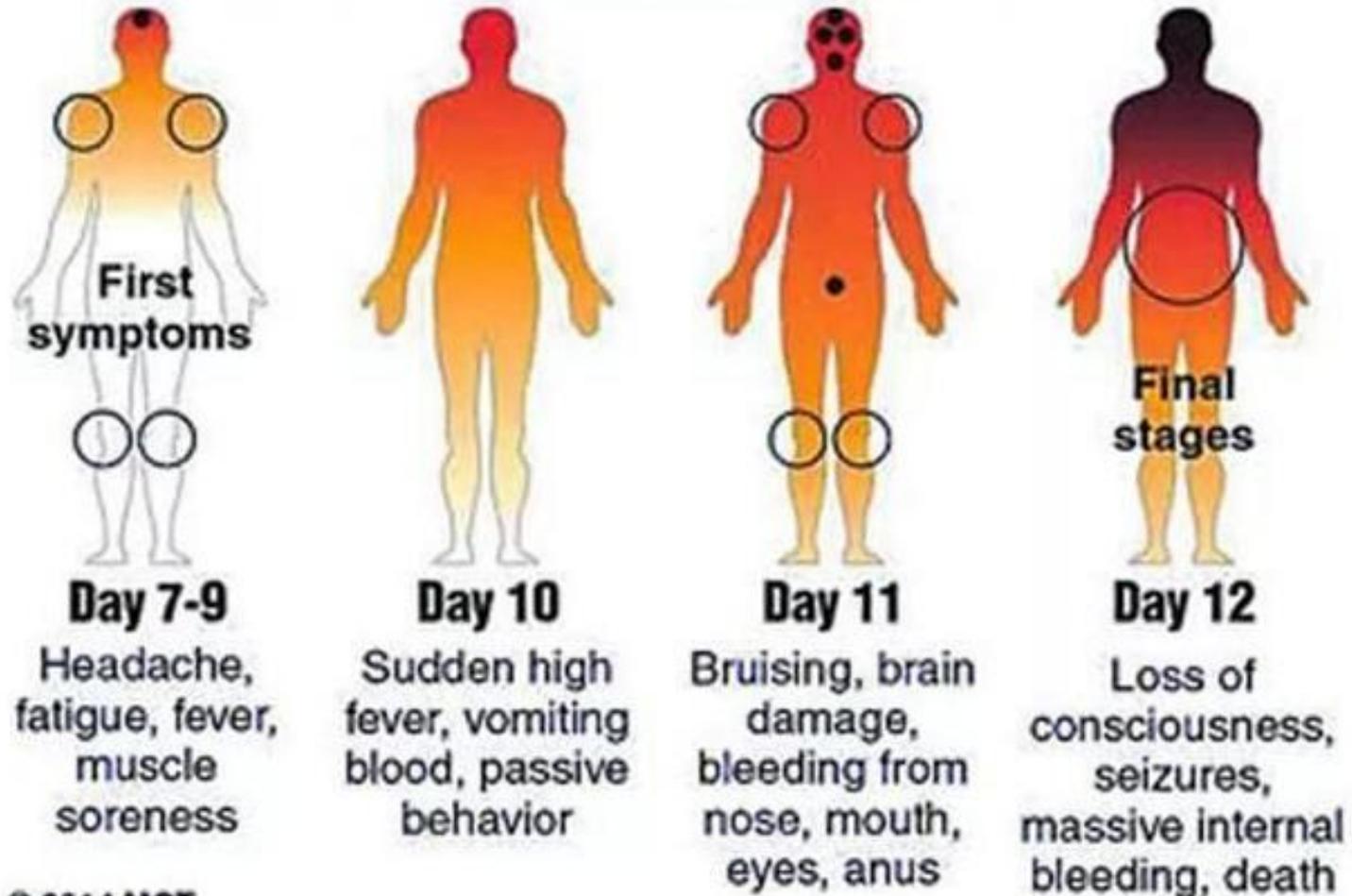


**HIV - Human Immunodeficiency Virus**

**SARS - Severe Acute Respiratory Syndrome**

# Ebola Virus

Ebola virus' typical path through a human being



© 2014 MCT

Source: U.S. Centers for Disease and Control, BBC

Graphic: Melina Yingling

(Source: cdc.gov) Ebola is a rare and deadly disease caused by infection with a strain of Ebola virus. The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa. The risk of an Ebola outbreak affecting multiple people in the U.S. is very low.



- ❑ What is the main difference between a virus and an organism? **Viruses are non-living**
- ❑ What basic structures do all viruses share? **Genetic material, a protein coat, and surface proteins**
- ❑ What is the main goal of a virus (what is it trying to do)? **Multiply**
- ❑ What role do the proteins in a viruses outer coat play? **They allow it to attach to it's host**

# Viral Transmission

**Viruses can be spread in many ways:**

- Contact with a contaminated object
- Bite of an infected animal
- In sneezes and coughs
- Contact with body fluids such as blood

# Viral Treatment

- There are currently no cures for viral diseases.
- There are prescription medications called “**ANTIVIRAL DRUGS**” that can be used to treat influenza illness.
- Resting, plenty of fluids, and well balanced meals may be all you can do to help your immune system fight a virus.

# Preventing Viral Diseases

- A **VACCINE** is a substance introduced into the body to trigger the body's natural defenses.
- A weakened or altered version of the virus puts the body on “alert”. The immune system fights it off and makes antibodies so that if the virus ever infects the body it can be destroyed before it becomes harmful.

# Video Link

- How Virus Invades Your Body
- <https://www.youtube.com/watch?v=Rpj0emEGShQ>



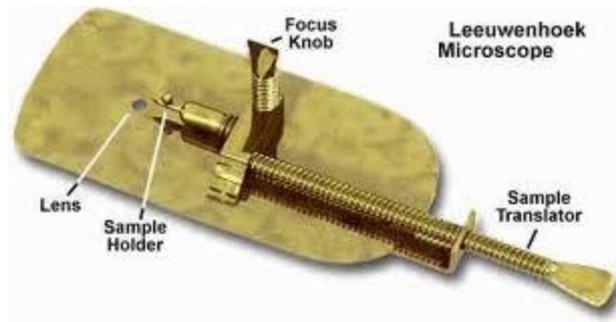
- ❑ List some ways viruses can be transmitted.  
Contact with a contaminated object
- ❑ Since there are no cures for viruses, what can you do as a treatment? Rest, treat symptoms
- ❑ How are vaccines important in preventing viral diseases? They trigger your immune system to make antibodies, which keep you from catching a virus
- ❑ Do you think the cold virus is an active virus or a hidden virus? Why? Active, you are sick very soon after being exposed to the virus.

# Bacteria

- Bacteria were discovered by accident in the late 1600's by a Dutch merchant named Anton van Leeuwenhoek.



Antonie van Leeuwenhoek  
(1632-1723)



# Bacteria

## Structure

- Bacteria are **PROKARYOTES**:
  - Unicellular or one-celled organism
  - No nucleus
  - DNA in a loop in the cell
  - Few organelles
  - Usually have a cell wall
  - Usually have a flagellum



# Bacteria

## Structure

- Most bacteria cells have one of three basic shapes:



**(a) Spherical  
Coccus**



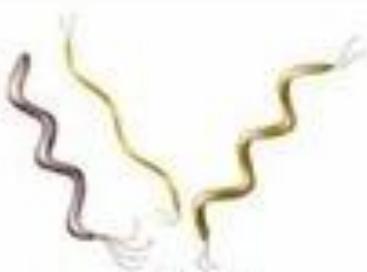
**(b) Rod-shaped  
Bacillus**



**(c) Spiral  
Spirila**

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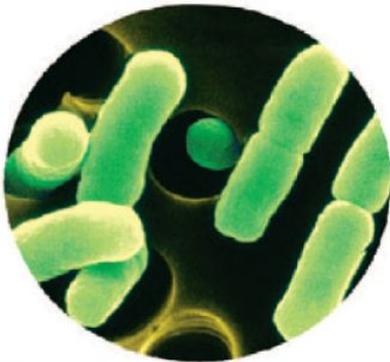
# Bacterial shapes and arrangements

 <p><b>Coccus</b></p>		 <p><b>Rod, or Bacillus</b></p>		 <p><b>Curved forms: Spirillum/Spirochete</b></p>	
 <p><b>Diplococci (cocci in pairs)</b></p>	 <p><b>Neisseriae (coffee-bean shape in pairs)</b></p>	 <p><b>Coccobacilli</b></p>		 <p><b>Vibrios (curved rods)</b></p>	
 <p><b>Tetrads (cocci in packets of 4)</b></p>	 <p><b>Sarcinae (cocci in packets of 8,16,32 cells)</b></p>	 <p><b>Mycobacteria</b></p>	 <p><b>Corynebacteria (palisades arrangement)</b></p>	 <p><b>Spirilla</b></p>	
 <p><b>Streptococci (cocci in chains)</b></p>	 <p><b>Micrococci and staphylococci (large cocci in irregular clusters)</b></p>	 <p><b>Spore-forming rods</b></p>	 <p><b>Streptomyces (moldlike, filamentous bacteria)</b></p>	 <p><b>Spirochetes</b></p>	

# Bacteria

obtaining food and energy

- Like all living things, bacteria need to have a sources of food and a way to break that food down in order to survive.



▲ These heterotrophic bacteria, found in yogurt, break down the sugars in milk for food.



▲ The autotrophic bacteria that cause the green, cloudy scum in some ponds use the sun's energy to make food.



▲ These autotrophic bacteria, found in hot springs, use chemical energy from their environment to make food.

- Most bacteria need oxygen to break their food down, but a few do not require oxygen for respiration.

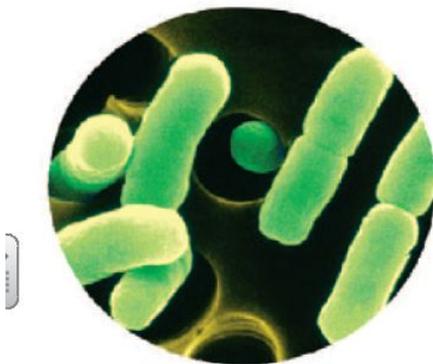
# Bacteria

obtaining food and energy

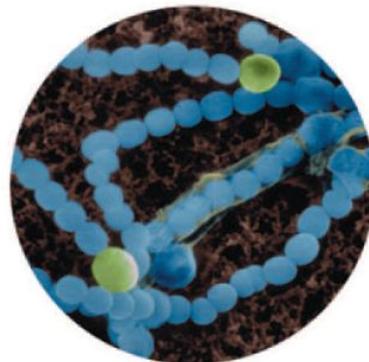
An organism that **cannot manufacture its own food** and instead obtains its food and energy by taking in organic substances, usually plant or animal matter. All animals, protozoans, fungi, and most bacteria are **HETEROTROPHS**.

An organism that **manufactures its own food** from inorganic substances, such as carbon dioxide and ammonia.

Most **AUTOTROPHS**, such as green plants, certain algae, and photosynthetic bacteria, use light for energy.



▲ These heterotrophic bacteria, found in yogurt, break down the sugars in milk for food.



▲ The autotrophic bacteria that cause the green, cloudy scum in some ponds use the sun's energy to make food.

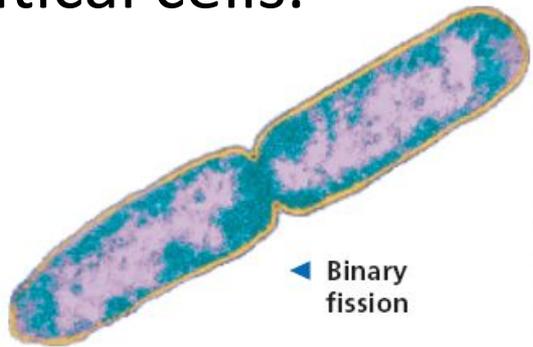


▲ These autotrophic bacteria, found in hot springs, use chemical energy from their environment to make food.

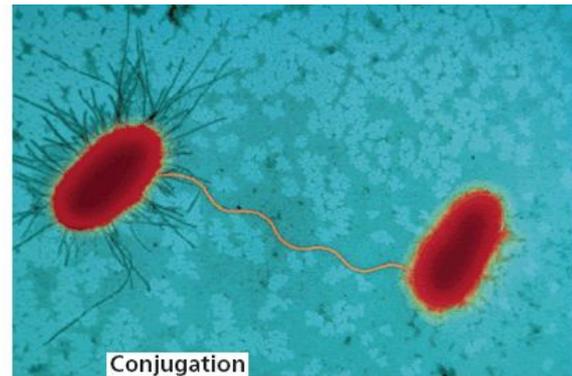
# Bacteria

## reproduction

- Bacteria can reproduce **ASEXUALLY**(one parent) by means of **BINARY FISSION**: one cell divides into two identical cells.



or

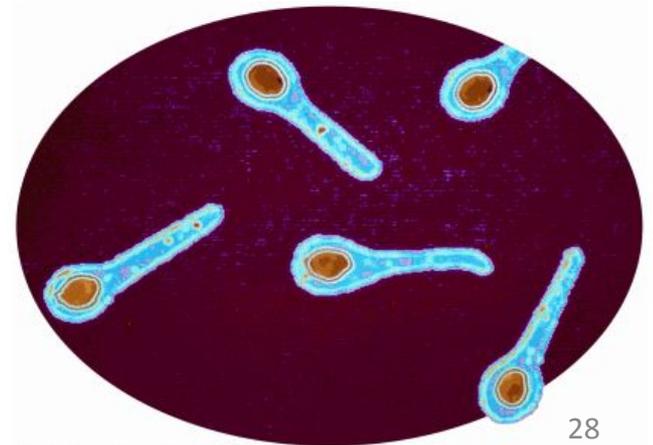


- Bacteria can reproduce **SEXUALLY**(two parents) by means of **CONJUNCTION**: one bacteria transfers some genetic material to another bacteria through a thread like bridge.

# Bacteria

## Endospore formation

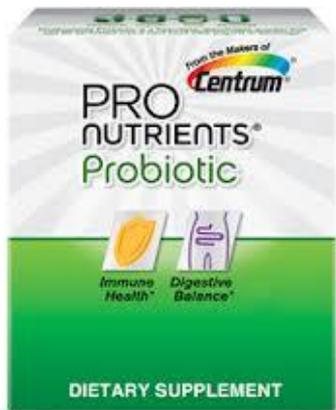
- Some bacteria can survive harsh conditions like freezing, heating and drying by forming an endospore.
- An **endospore** is a small rounded, thick walled, resting cell that forms in a bacteria cell and houses the bacterial DNA.





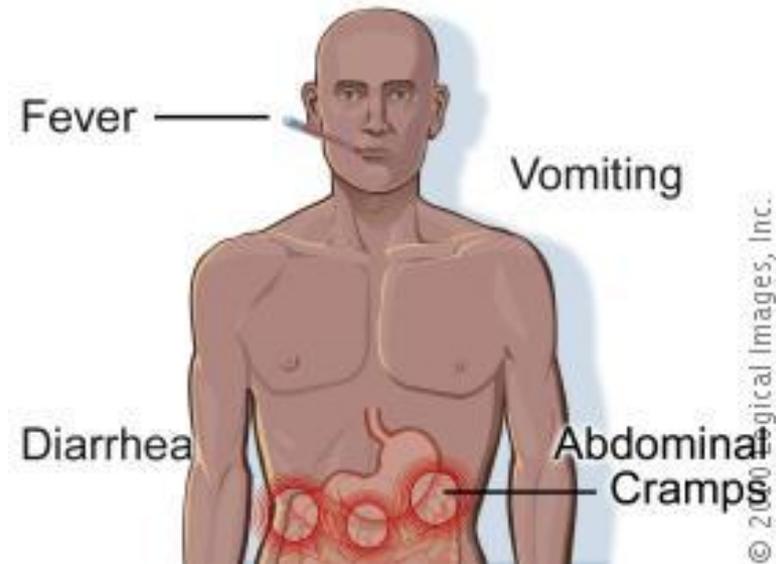
- Where is the genetic material located in a bacteria cell? **In a loop of DNA in the cytoplasm**
- What is the role of a flagella? **Help the bacteria move**
- What are two ways bacteria can obtain food?  
**Heterotroph (eating) Autotroph (using energy from the sun or from chemicals in it's environment to make food)**
- How do bacteria obtain energy to carry out their functions? **Respiration or fermentation**

# Is Bacteria *Good* or **Bad**?

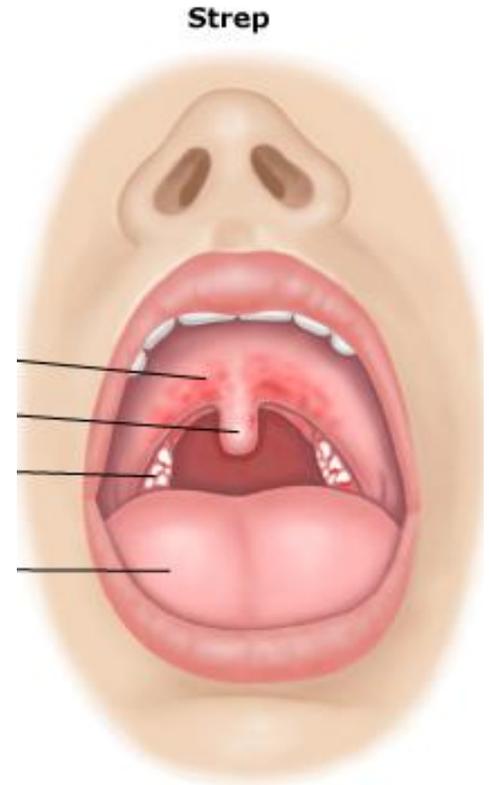




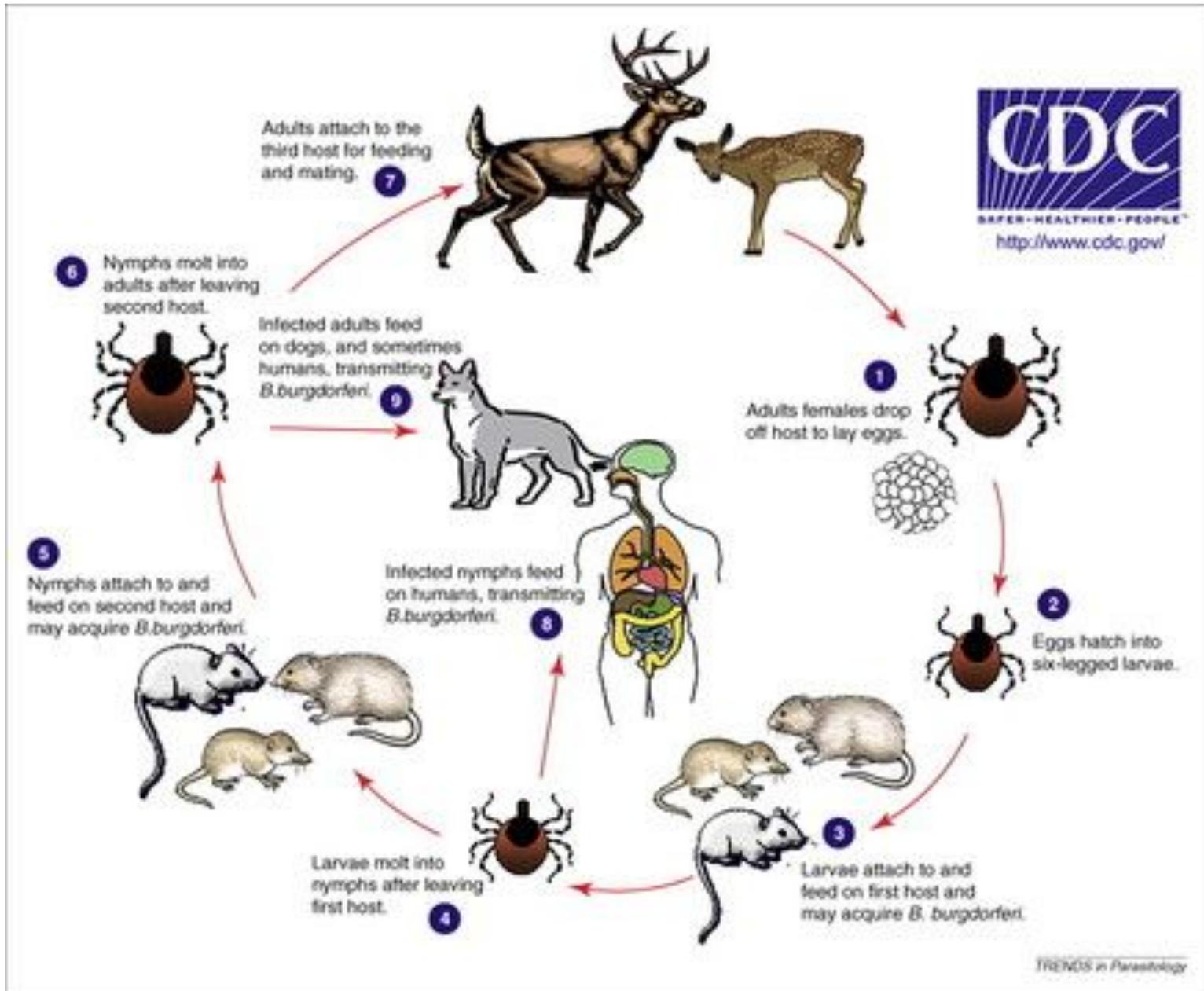
# Is Bacteria *Good* or **Bad**?



**Salmonella**



# Lyme Diseases



# History of Lyme Disease

**One theory — compelling but controversial —**

about the sudden emergence of the disease in Connecticut blames the accidental release of infected ticks during experiments at Plum Island Animal Disease Center, on Long Island Sound about eight miles south of Lyme.

It resulted the first Lyme Disease outbreak in 1975.

# Lyme Disease

Lyme disease is a bacterial infection primarily transmitted by Ixodes ticks, also known as deer ticks, and on the West Coast, black-legged ticks.

These tiny arachnids are typically found in wooded and grassy areas.

Once a tick has attached, if undisturbed it may feed for several days.

The longer it stays attached, the more likely it will transmit the Lyme and other pathogens into your bloodstream.



# Transmission of Bacterial Pathogens

- **PATHOGENS** are microorganisms that can cause disease
- **In Sneezes, Coughs, Saliva:**  
(Pneumonia, Whooping Cough, Bacterial Meningitis)
- **By Animal Vectors:**
  - (bubonic plague, typhus)
- **In Contaminated Food or Water:**
  - (typhoid, salmonella, e. Coli)

# ANTIBIOTICS

## Treatment of Bacterial Pathogens

- The discovery of the antibiotic penicillin by Alexander Fleming in the 1920s made a big impact on human history.
- Not only did it lead to a cure for bacterial infections that were once deadly, but it also led a big interest in finding new antibiotics.
- The antibiotic penicillin is from blue-green mold and it works by keeping a bacterium from building a cell wall.

# Blue-Green Mold



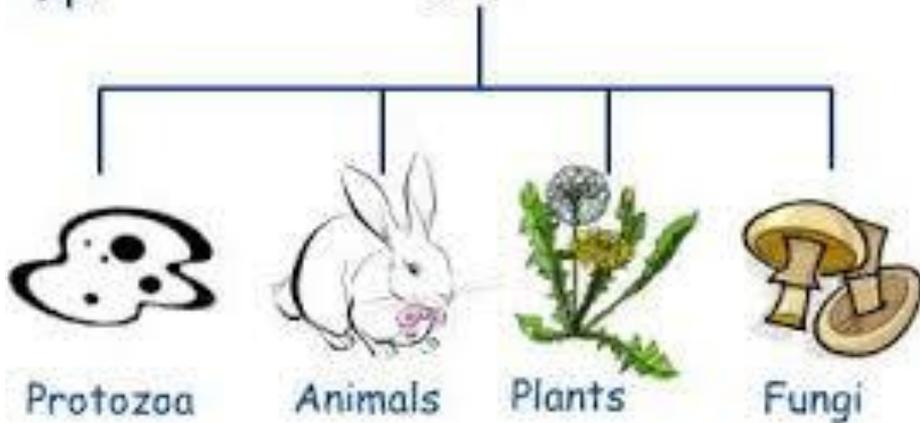
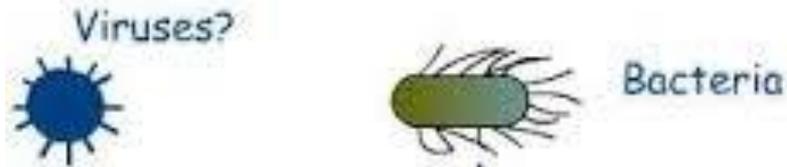
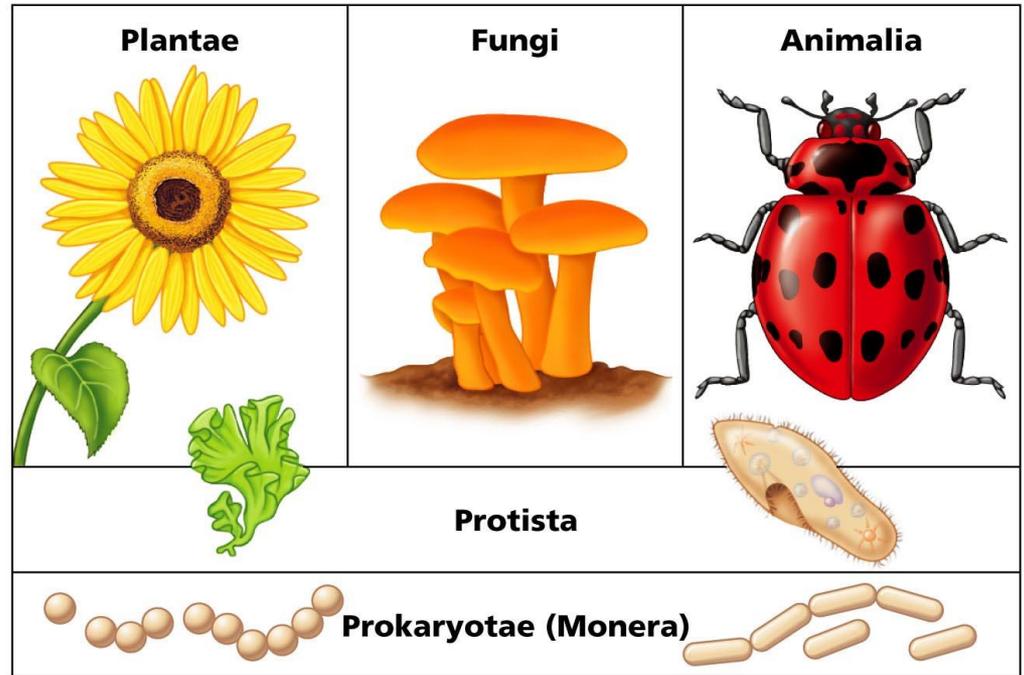
# How Antibiotic Resistance Happens?

- Bacterial resistance to antibiotics is produced by changes in the bacterium's DNA, called 'Mutations'.
- One bacterium with a mutation can survive the antibiotic and reproduces millions more with the same resistance within the space of a day.

# Video Link

- What is Bacteria?
- [https://www.youtube.com/watch?v=pcXdfofL\\_oj0](https://www.youtube.com/watch?v=pcXdfofL_oj0)

# The 5 Kingdoms



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# Animal-Like Protists

- Animal-like protists are heterotrophs and most are able to move from place to place to obtain food, however, unlike animals they are unicellular.
- Animal-like protists may be called **PROTOZOANS.**
-

# Animal-Like Protists

1. Protozoans with Pseudopods (ex. Amoeba)



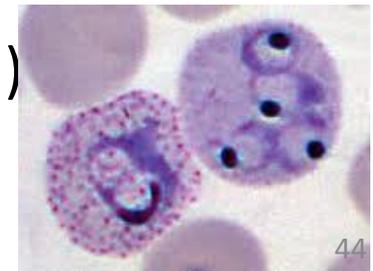
2. Protozoans with Cilia (ex. Paramecium)



3. Protozoans with Flagella (ex. *Peranema*)



4. Protozoans that are Parasites. (ex. Plasmodium)  
Mosquitoes that can cause Malaria



# Pseudopods

## Pseudopod

An amoeba uses pseudopods to move and feed. Pseudopods form when cytoplasm flows toward one location and the rest of the amoeba follows.

## Food Vacuole

When the ends of two pseudopods fuse, they form a food vacuole. Food is broken down inside the food vacuole in the cytoplasm.

## Nucleus

The nucleus controls the cell's functions and is involved in reproduction. Amoebas usually reproduce by binary fission.

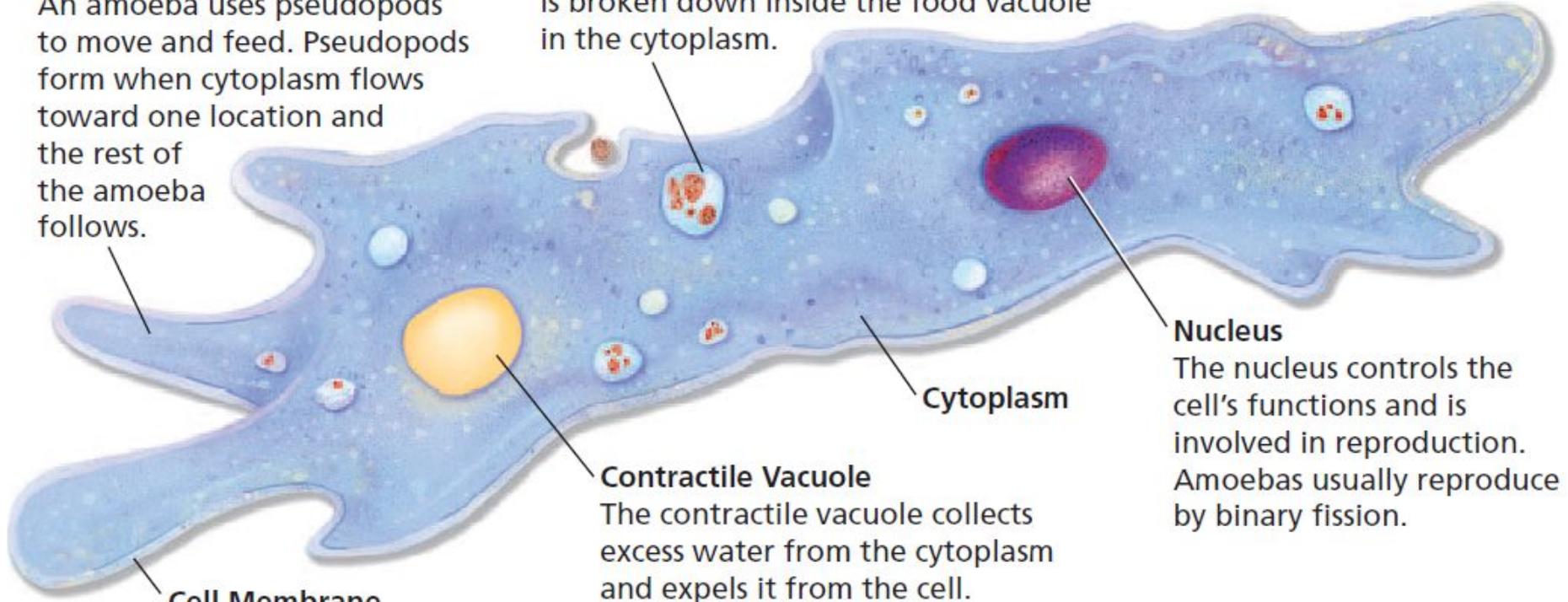
## Contractile Vacuole

The contractile vacuole collects excess water from the cytoplasm and expels it from the cell.

## Cell Membrane

Because the cell membrane is very thin and flexible, an amoeba's shape changes constantly.

## Cytoplasm

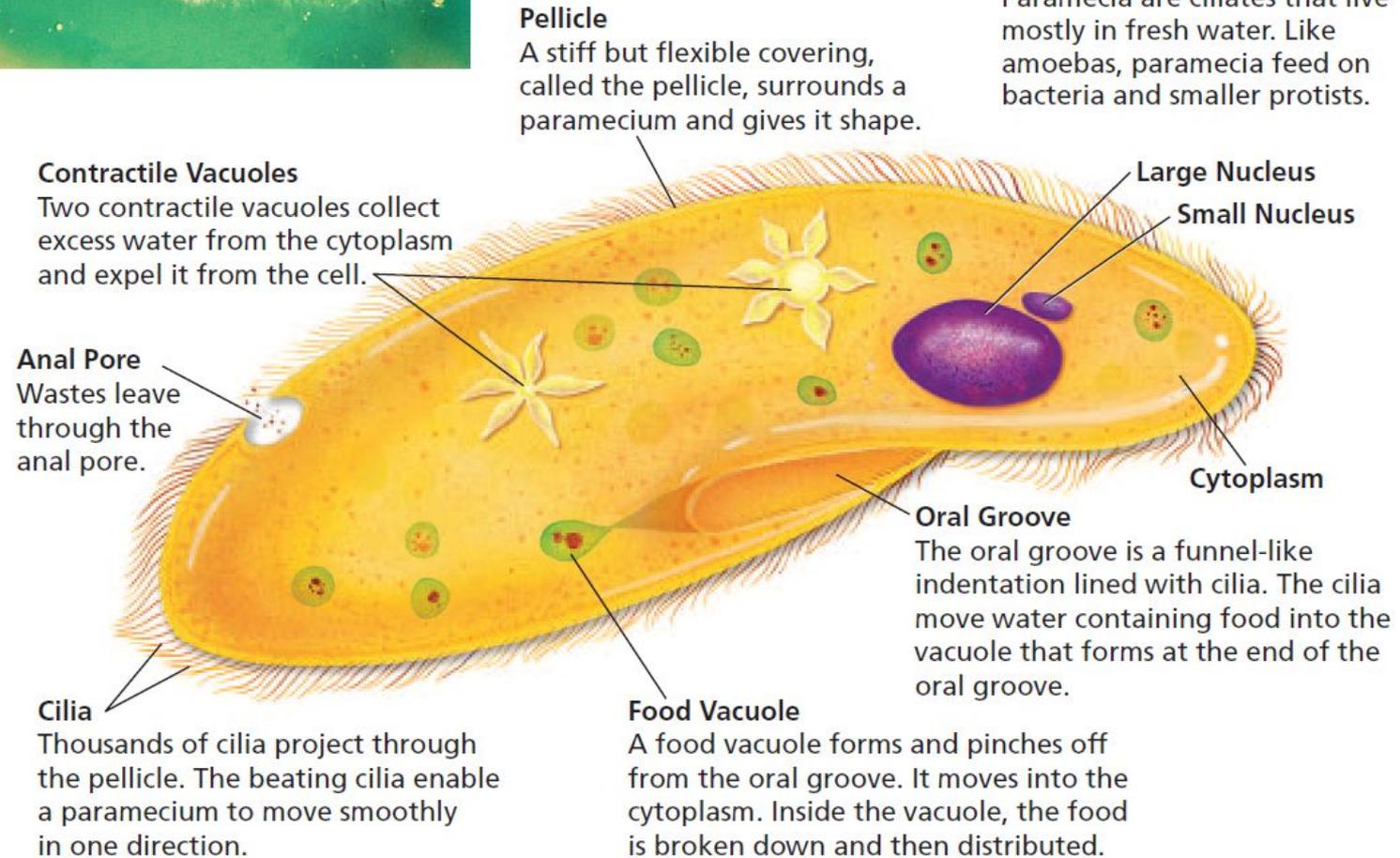


# Ciliates



FIGURE 16  
**Paramecium**

Paramecia are ciliates that live mostly in fresh water. Like amoebas, paramecia feed on bacteria and smaller protists.

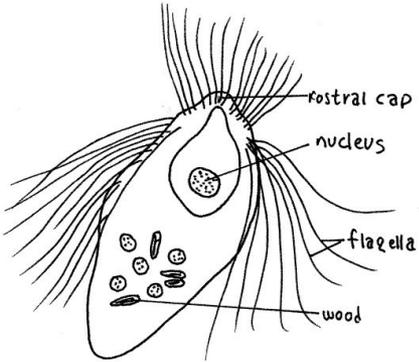


# Flagellates

Giardia



Trichonympha



# Parasites

Plasmodium



# Plant-Like Protists

- Plant-like protists are commonly called ALGAE. They are grouped together because, like plants, they are all autotrophs.



**Diatoms**



**Euglena**

**Dinoflagellates**

# Plant-Like Protists

- Plant like protists play an important role in ecosystems.
- They provide a source of food for many other organisms.
- They make much of the oxygen that makes up the Earth's atmosphere.

# Fungus-Like Protists

- Like fungi, fungi-like protists are heterotrophs, have cell walls, and use spores to reproduce.
- Molds are part of the natural environment, and can be found everywhere, indoors and outdoors. Mold is not usually a problem, unless it begins growing indoors.
- **The best way to control mold growth is to control moisture.**



**Slime Mold**



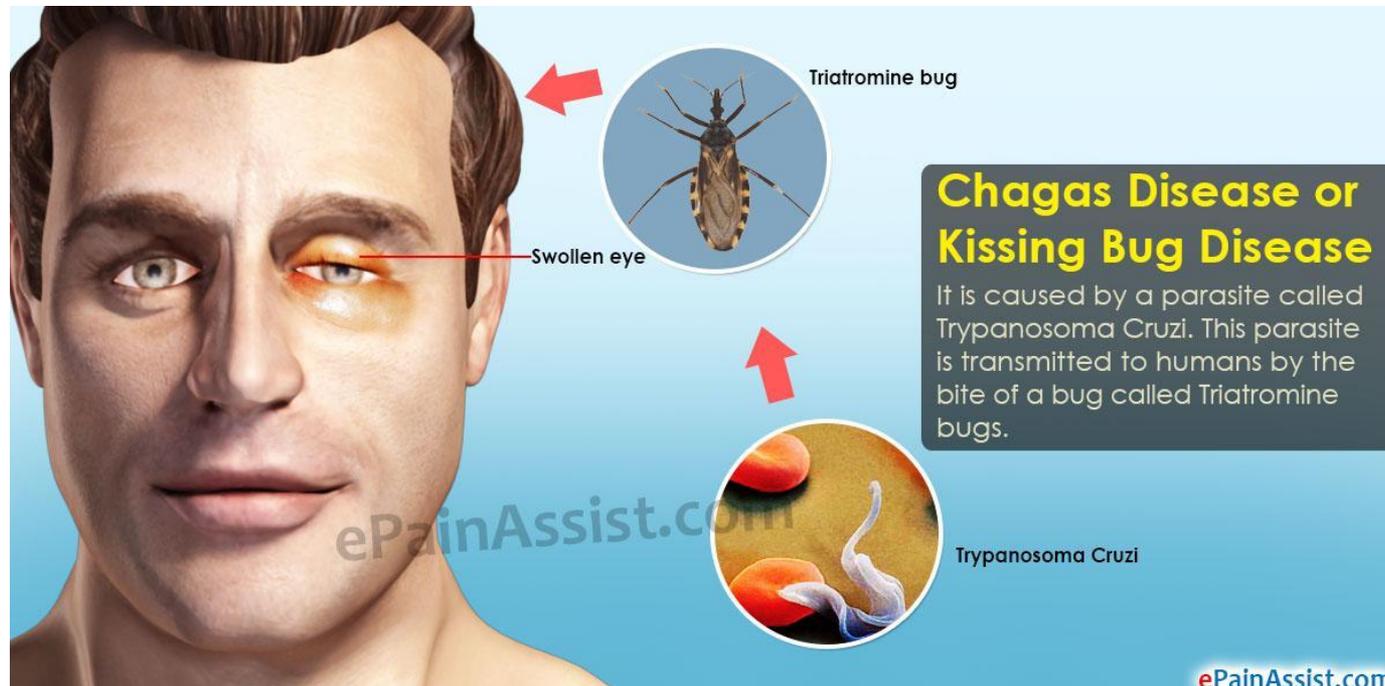
**Downy Mold**



**Water Mold**

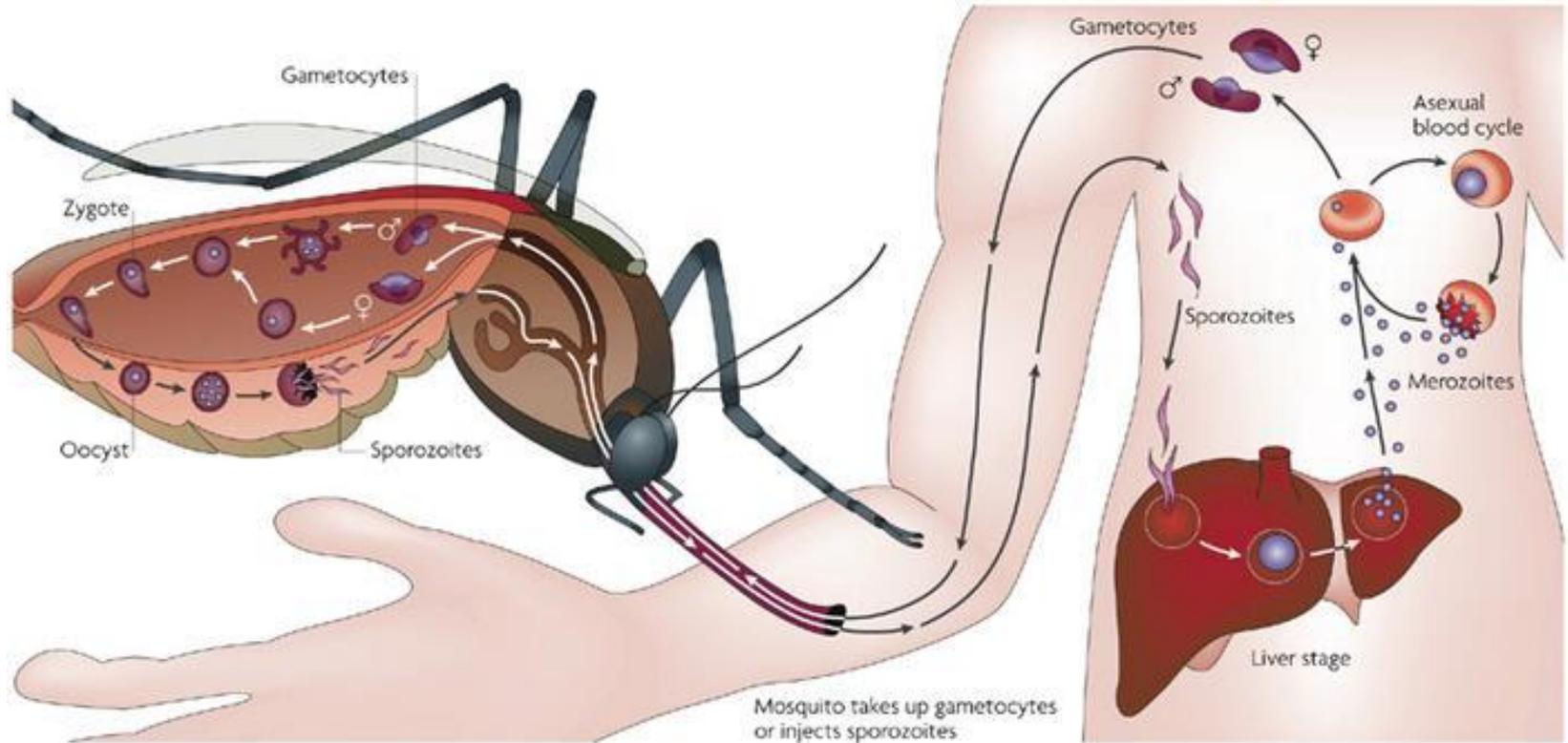
# Diseases Caused by Protists

- African sleeping disease (caught via flies) and **CHAGAS** (caught via the 'assassin bug') are each caused by different types of Trypanosoma protists.
- Treatment of Chagas disease focuses on killing the parasite in acute infection and managing signs and symptoms in later stages.



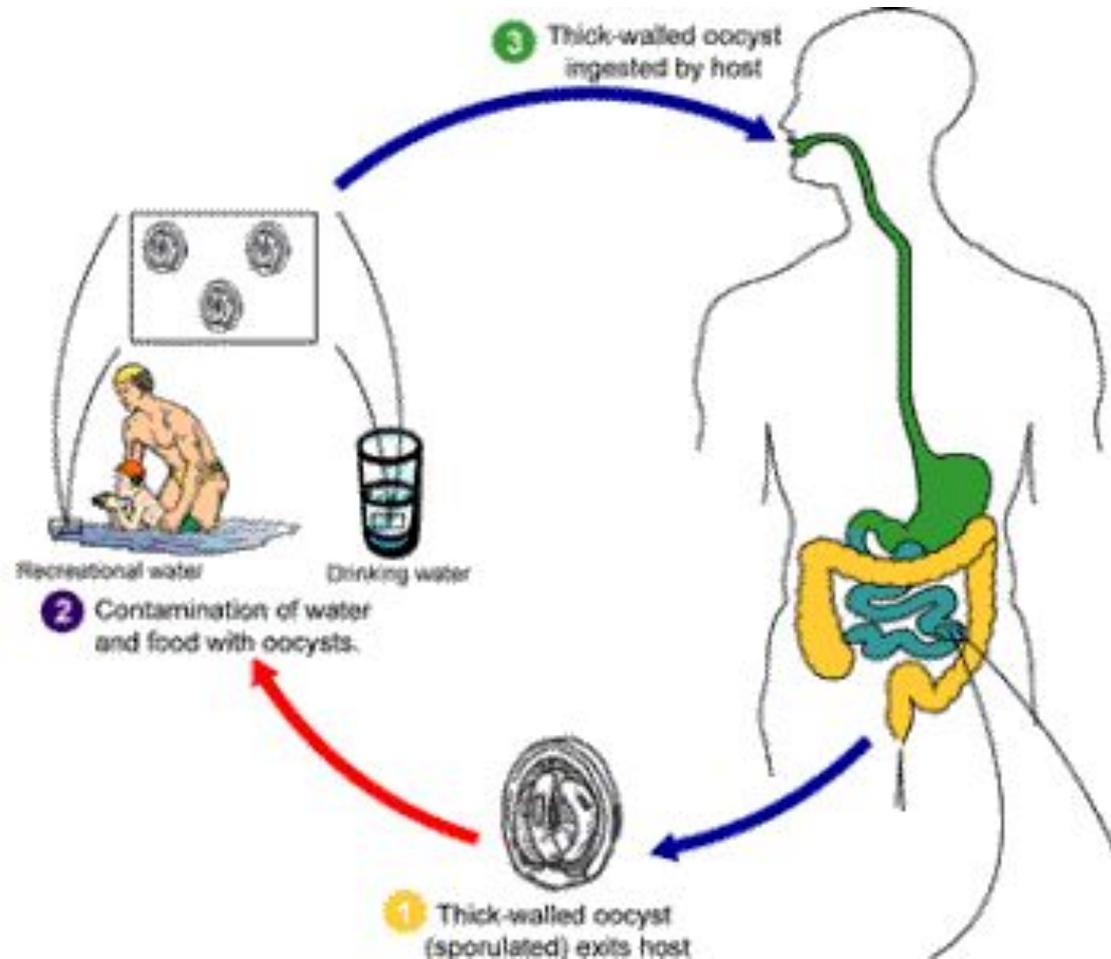
# Diseases Caused by Protists cont..

- **MALARIA** is caused by a **Plasmodium** protist, which travels via a mosquito vector. Treatment should be initiated as soon as possible



# Diseases Caused by Protists cont..

- **GIARDIA** is found in untreated water. Children and adults who have giardia infection without symptoms usually don't need treatment unless they're likely to spread the parasites. Many people who do have problems often get better on their own in a few weeks.



# Do Now:



- All protists are eukaryotes, unicellular and microscopic.
- Name 3 classifications of protists. Plant like, animal like, and fungus like
- All animal like protists are Heterotrophs that move
- Protozoans are further classified by how they move.
- 4 classes of protozoans are Pseudopods, ciliates, flagellates and parasites
- All plant like protists are autotrophs.
- Plant like protists are colorful because they contain pigments which help them with photosynthesis
- A common name for plant like protists is Algae.
- Fungi like protists are heterotrophs who can't move.

# Fungi

- Fungi are **EUKARYOTES** that have cell walls, are **HETEROTROPHS** that feed by absorbing their food, and use spores to reproduce.



# Fungi

## Reproduction

- **Asexual Reproduction:** Cells at the tips of the hyphae can divide to form spores, which grow into fungi that are genetically identical to the parent.
- **Sexual Reproduction:** Hyphae of two fungi can grow together and exchange genetic material, then grow a new spore producing structure.

# Fungi

## Reproduction

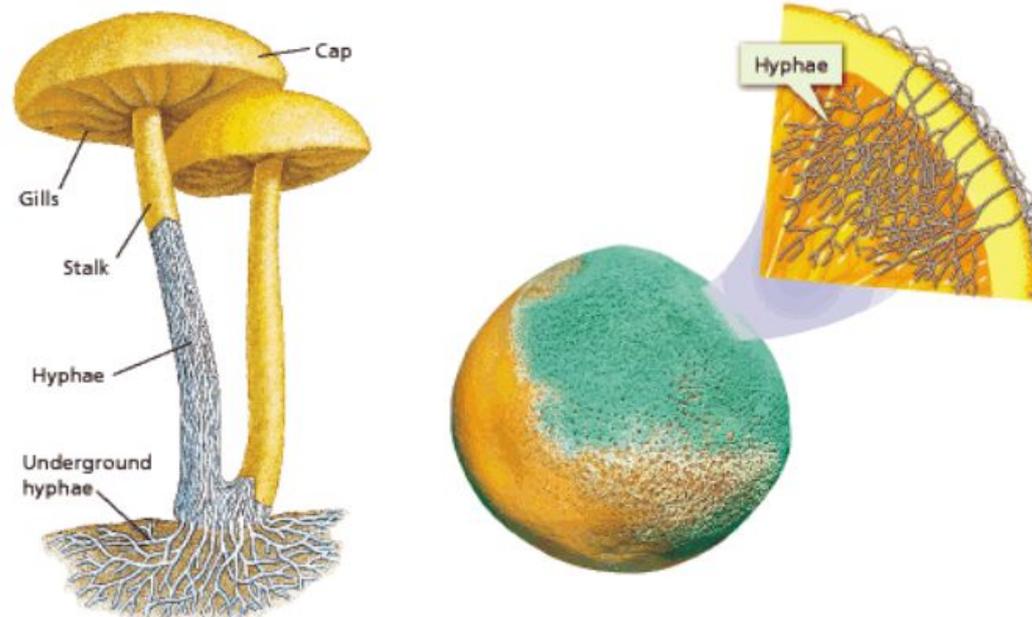
- Fungi usually reproduce by making lightweight **spores** in reproductive structures called **fruiting bodies**. The spores can then be carried easily through the air or water to new sites.
- Most fungi reproduce both sexually and asexually.

# Fungi

## Cell Structure

- Fungi may be unicellular, like yeast, or **MULTICELLULAR**.
- The cells of multicellular fungi are arranged into branching threadlike tubes called **hyphae**.

What a fungus looks like depends on how the hyphae are arranged.



# Fungi

## Obtaining Food

- First fungi grow hyphae into a food source.
- Then digestive chemicals ooze from the hyphae into the food, breaking it down into small substances that can be absorbed by the hyphae.

FIGURE 28

## Classification of Fungi

Three major groups of fungi include sac fungi, club fungi, and zygote fungi.

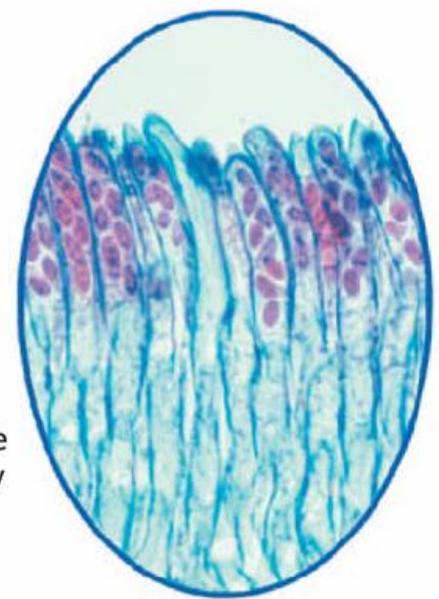


### ▲ Club Fungi

Club fungi produce spores in tiny clublike structures. This group includes mushrooms, rusts, and puffballs, such as these.

### ▶ Sac Fungi

Sac fungi produce spores in structures that look like long sacs, such as these. The largest group of fungi, they include yeasts, morels, and truffles.



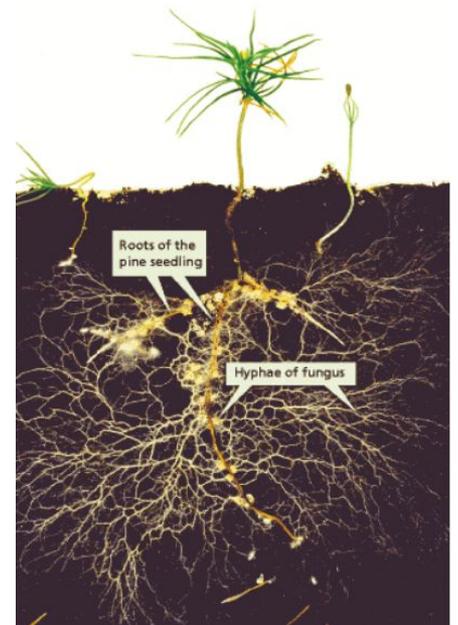
### ▲ Zygote Fungi

Zygote fungi produce very resistant spores. This group includes many common fruit and bread molds, like this *Rhizopus*.

# Fungi

role in nature

- Fungi are food
- Fungi are environmental recyclers
- Fungi fight disease
- Fungi cause disease
- Fungi help plants grow



# Fungal Diseases



**RINGWORM APPEARANCE**

In most cases, **ringworm** of the skin can be treated with antifungal creams or ointments. Many are available without a prescription.



Most cases of athlete's foot can be treated at home using an antifungal medicine to kill the fungus or slow its growth.



- Fungi are eukaryotes, heterotrophs and have Cell walls \_\_\_\_\_.
- The cells of fungi are arranged in threadlike tubes called hyphae
- Fungi reproduce using spores which are produced in structures called Fruiting bodies \_\_\_\_\_.
- How are fungi classified? By how they produce their spores, (club, sac, or zygote)
- Explain different roles of fungi in nature.  
Food, medicine, environmental recyclers, symbiotic partners, diseases