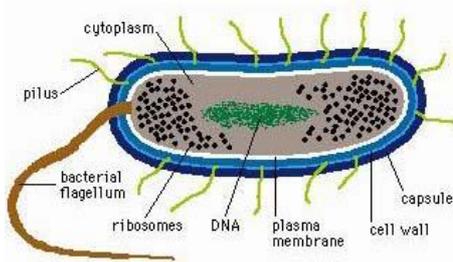


Bacteria

Kingdom monera is the general name given to the largest group of organisms, *bacteria*.

- All members of the monera kingdom are **prokaryotes**. (No nucleus or organelles.)
- Bacteria are *unicellular organisms*, present everywhere in the *biosphere*. (air, soil, water)



All bacteria have a **cell wall** (peptidoglycan), **cell membrane**, **chromosomes** found in nucleoid(DNA), **ribosomes** and an internal **cytoplasm**. They usually have a **plasmid** (small DNA separate from chromosomal DNA). Some also have a **capsule** (additional layer for protection) and **flagella** (movement).

➤ Types of bacteria:

1. **Spherical** (coccus/cocci)
2. **Spiral** (spirillum/spirilla)
3. **Rod** (bacillus/bacilli).

➤ **Binary fission** is asexual reproduction in bacteria. {1. DNA replication. 2. Cells size increases. 3. Two identical DNA move to opposite sides of the cell. 4. Cytokinesis (cell division) occurs.}

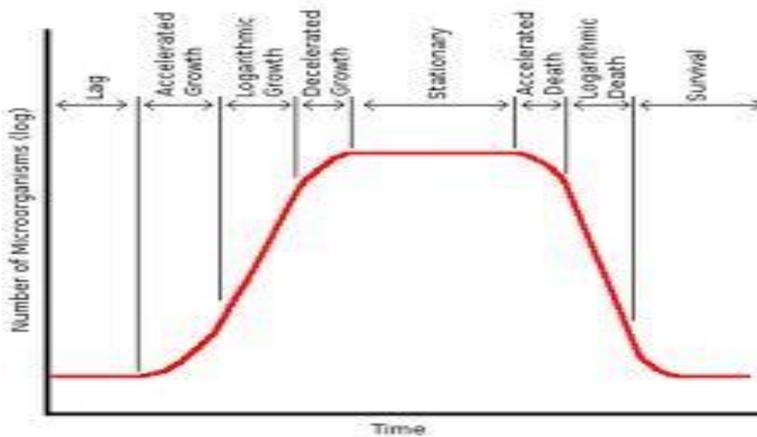
➤ An **endospore** is a thick and tough-walled, dormant and dehydrated bacterial cell formed during unsuitable conditions.

1. *Conditions become less favourable* for bacterium.
2. *Polar division occurs* (asymmetrical binary fission).
3. The *smaller cell is engulfed by the larger cell*.
4. A *cortex* (thick wall) forms around the engulfed cell.
5. An *outer coat forms around the cortex* as an extra layer of protection,
6. The *endospore matures, the larger cell holding it degenerates and it is released*.

➤ **Autotrophic nutrition** in bacteria is when the bacteria produce their own food.

1. **Chemosynthetic**- use chemicals.(nitrifying bacteria)
2. **Photosynthetic**- use sunlight. (purple-sulphur bacteria)

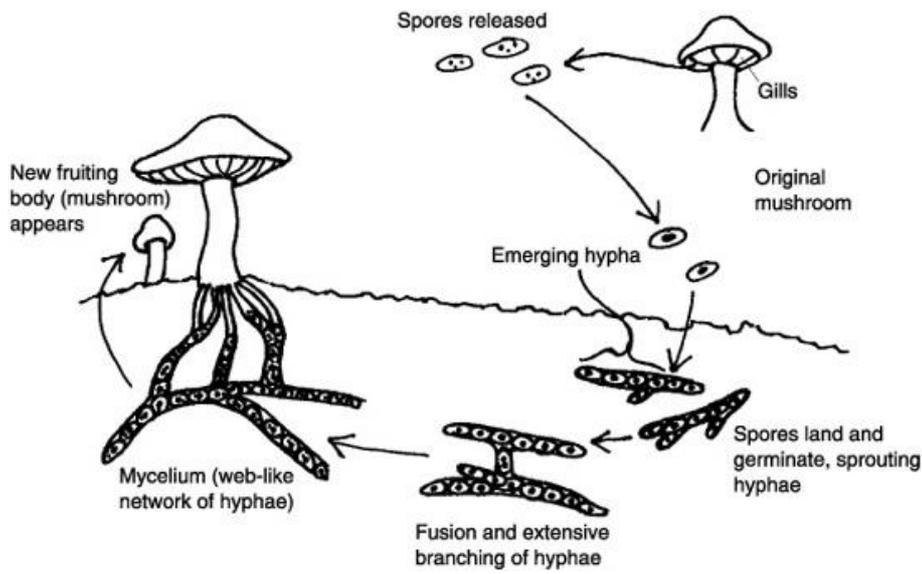
- **Heterotrophic nutrition** in bacteria is where bacteria obtain their own food from other living organisms.
 1. ***Saprophytic***- feed off dead organic matter.(bacteria of decay)
 2. ***Parasitic***-feed off living organisms (host) as a parasite.(E. coli)
- **Hyperthermophilies** are bacteria that live and grow between 80-120°C.
- Most bacteria are **aerobic** (require O₂), however some are **anaerobic**.
- **Acidophilies** can live in very acidic environments. **Alkaliphilies** are the opposite.
- **Growth curve of microorganisms:**
 1. ***Lag phase:*** microorganisms are adjusting to the conditions.
 2. ***Log phase:*** once they've adjusted binary fission is exponential.
 3. ***Stationary phase:*** food levels drop and waste and toxins rise.
 4. ***Decline phase:*** death of the microorganisms is much greater than reproduction.
 5. ***Survival phase:*** endospores are produced. (They don't all encounter this stage).



- **Beneficial bacteria** include lactic acid bacteria (aids the growth of desirable bacteria) and E. coli which can also be harmful (lives in L intestine producing vitamins K and B).
- **Harmful bacteria**(pathogenic) include strep throat bacteria (causes sore throat and scarlet fever) and tuberculosis bacteria or TB (painful chest, cough, coughing up blood)
- **Antibiotics** are chemicals produced by microorganisms that prevent the growth of, or kill, other microorganisms. (E.g. penicillin). Antibiotics have no effect on viruses, therefore aren't used to treat cold and flu symptoms. **Overuse of antibiotics** has led to the emergence of antibiotic resistance among bacterial strains such as MRSA, which is resistant to all known antibiotics.
- **Food processing** is the process of taking raw ingredients and converting them to food fit for consumption. There are two main types of food processing that are used with bacteria; both occur in large stainless steel bioreactors.

1. **Batch processing**-only a measured amount of nutrients are added to a bioreactor. The bioreactor is then *inoculated* with a culture of bacteria which are then, which are allowed to grow.*(Used for yoghurt and alcoholic beverages)*.
2. **Continuous-flow processing**-nutrients are continuously added to the bioreactor and product is continuously removed. More complicated and expensive than batch processing.
(used for single-cell protein production)

Asexual reproduction of fungi:

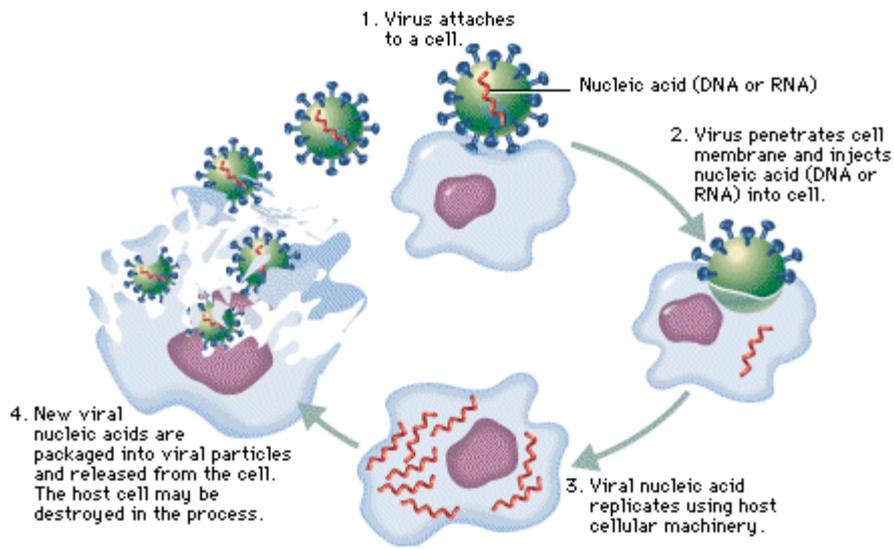


Viruses

Virology is the study of viruses.

- Viruses measure 20-300 nm in diameter (1nm = 1 billionth of a meter) and can only be seen with an electron microscope.
- They're obligate parasites (meaning they can only replicate within a host cell).
- They demonstrate organisation because they've a capsid (organised protein coat), DNA or RNA and sometimes a lipoprotein envelope.
- They demonstrate response by responding to the surface antigens of living cells.
- They don't however demonstrate nutrition, excretion or reproduction and therefore can't be classified as living organisms.
- Viruses are classified by their shape:
 1. Rod shaped-tobacco mosaic virus (TMV).
 2. Round shaped- rhinovirus (causes common cold and flu).
 3. Complex shaped- bacteriophage (infects bacteria).
- Stages in viral replication:
 1. **Attachment**- The virus binds to complementary proteins on the surface of a host cell. (*They can't attach to any cell they like they must have the correct proteins.*)
 2. **Entry**- The whole virus may enter the cell or in the case of more complex viruses inject its DNA/RNA.
 3. **Replication**- The virus or its DNA/RNA takes over the nucleus of the host cell and its ribosomes and uses them to produce new viral proteins and DNA/RNA.
 4. **Assembly**- Thousands of new viruses are pieced together by the host cell.
 5. **Release**- New viruses may burst the host cell or diffuse out through its cell membrane.
- Harmful viruses include HIV (human immunodeficiency virus) which causes AIDs (acquired immunodeficiency virus), and hepatovirus which causes hepatitis (inflammation of the liver)
- SV40 virus is used in genetic engineering for cancer research.

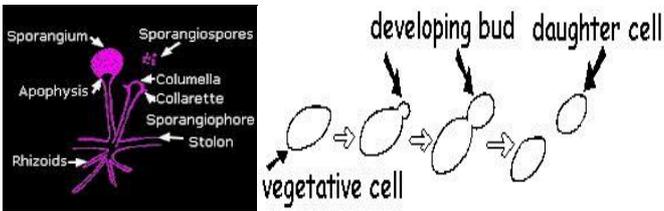
Diagram showing viral replication:



Fungi

- ❖ Fungi are a diverse group of **heterotrophic** living organisms, can be found in most areas of the biosphere and are all **eukaryotic** in nature.
- ❖ The study of fungi is called **mycology** and scientists who study fungi are **mycologists**.
- ❖ Their cell walls are made from a polysaccharide called **chitin** (as opposed to cellulose in plants) and they don't produce their own food (**no chlorophyll**)
- ❖ An example of *saprophytic fungi* is **mushrooms**. **Athlete's foot** is a *parasitic fungus*.
- ❖ **Yeast** is a single-celled (unicellular) fungus. They reproduce asexually by a process known as **budding**. The new cell may remain attached to the parent cell and form a string of yeast cells or break off giving single-celled yeast.

Structure of Rhizopus: Budding of yeast:



- ❖ **Rhizopus** (common bread mould) is a saprophytic fungus which consists of microscopic, thread-like structures called **hyphae**.
- ❖ The hyphae that grow upwards are called **sporangiochore**. At the end of each sporangiochore is a **sporangium** (holds **spores** for *asexual reproduction*), supported by **apophysis** and **columella**.
- ❖ The hyphae that grow horizontally along their substrate are called **stolons**.
- ❖ The hyphae that grow down into their substrate are called **rhizoids**. They *anchor the substrate, release digestive enzymes* into the substrate and *absorb nutrients*.
- ❖ All the hyphae together are called a **mycelium**. All the cells in a mycelium are *haploid*.
- ❖ Reproduction of Rhizopus:
 1. **Asexual**- occurs by **sporulation**. **Mitosis** occurs within the sporangium, spores are released when the sporangium is fully mature, they're dispersed, settle and germinate into a new fungus.
 2. **Sexual**- two hyphae of opposite strain grow close together, swellings called **progameteangia** develop, they eventually fuse to form a **gametangium**, haploid cells from

both hyphae fuse to form diploid cells and a **zygospore** forms, the zygospore then germinates by **meiosis** to form a new mycelium.

- ❖ **Aseptic technique**(asepsis) is a procedure where contact with, or contamination by, microorganisms is avoided.
- ❖ **Sterile** is a state of being free from microorganisms.
- ❖ Beneficial effects of fungi include ***alcohol*** and ***bread*** production (yeasts), ***antibiotic*** production, ***edible mushrooms*** and ***cheese*** production (moulds).
- ❖ Harmful effects of fungi include ***athlete's foot*** (parasitic), ***poisonous mushrooms*** that can be fatal (death cap) and ***bread mould***.

Kingdom Protista

- All protists are **eukaryotic** in nature. They comprise mostly of single celled microorganisms but do include multi cellular organisms (e.g. seaweeds).
- There is great variation among protists, some are **heterotrophic** (*amoeba*) and others are **autotrophic** (*algae*).
- **Cryptosporidium** is another example of a protist, causes *cryptosporidiosis*.

Diagram of amoeba:

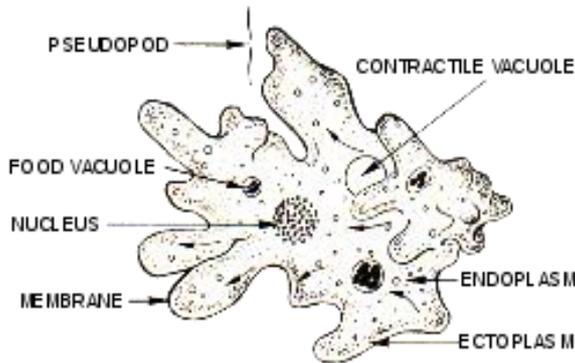


image of various seaweeds:



- **Amoebae** are single celled protists that live in freshwater streams, rivers, ponds and lakes as well as marine habitats. They feed on other protists such as algae, but also on bacteria and single-celled fungi. **Pseudopods** are extensions of the **endoplasm** (watery) and **ectoplasm** (viscous), they enable movement of the amoeba and surround prey. The **cell membrane** is responsible for diffusion of gasses and water. The **nucleus** controls the metabolic activities of the cell. **Fat droplets** store fat as an energy reserve. **Food vacuoles** secrete acids and digestive enzymes to kill and digest the prey. **Contractile vacuoles** assist in osmoregulation.
- **Osmoregulation** prevents the amoeba from bursting by removing excess water from the cell gathered by osmosis. Marine amoebae don't have contractile vacuoles as there is no osmotic gradient present between the inside and outside of the cell. This is due to the high salt concentration of the sea.