

Study Guide - The Diversity of Life

In our first biology lesson we talked about the circle of life and that fact that all living organisms depend on each other. In this and the next few lessons we are going to discuss the different components of the cycle (the decomposers, the producers, and the consumers). We will give a general overview of how organisms are classified and then talk about the organisms that occupy the part of the cycle known as the decomposers. In the remaining lessons we will talk about the producers (plants) and the consumers (animals).

In our studies of genetics we learned that all living things have DNA, the basic unit that defines life. We talked of the importance of the tiny nucleotide bases that, when placed in different sequences, are able to express different characteristics in different organisms. For example, the same bases are present in a plant that are in an animal, the difference is the sequence and the amounts in which they are found. The many different gene sequences account for the enormous diversity of life that exists. The interesting thing about the diversity that exists is that we find so many organisms that are alike. This is explained in the theories of evolution which we are unfortunately not able to cover in these lessons. The similarities and differences brought about by evolution have prompted scientists to classify organisms in groups that are alike. The science of classification of organisms is called **taxonomy**.

Organisms are classified by their biological ancestry. Each organism has (or will have) a scientific name. These scientific names follow a **binomial nomenclature** set up, in that they specify the genus and the species of an organism. The genus and species are the most specific of all classifications, thus identifying a specific organism. Binomial nomenclature can be understood by seeing the example of humans - our scientific name is *Homo sapiens*. Homo being the genus and sapiens being the species.

Lets talk about the classification "scale" that explains the organization of organisms. Perhaps it will be best illustrated by the following chart with explanations given.

Kingdom (the largest and broadest category, we will mention five - monera, protista, fungi, plant, animal)

Phylum (for animals) **Division** (for plants) - represent related classes

Class - represent related orders

Order - represent related families

Family - represent related genera (plural form of genus)

Genus - represent related species

Species - represent organisms that interbreed in natural conditions and produce fertile offspring.

A few examples, particularly to illustrate the difference between genus and species. Lions and tigers are part of the same genus. Under natural conditions though, they do not interbreed. Some experiments resulted in a lion breeding with a tiger in a zoo in Salt Lake City, Utah. The offspring that was produced was called a liger, but the liger was a sterile animal (meaning it could produce no young). Therefore, lions and tigers are classified as different species of the same genus.

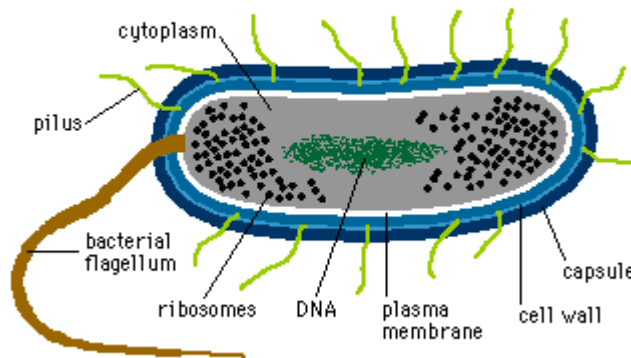
Since we are covering a great deal of information in this lesson, the presentation of information will be in a note format. We will be talking about three of the five kingdoms of organisms: Monera, Protista, and Fungi. We will have individual lessons on the Plant and Animal kingdoms. A basic outline of the notes will include general characteristics of the kingdom, representative members with their individual qualities, and other comments.

Kingdom Monera

Characteristics

- Prokaryotes - no nucleus or organelles except ribosomes
- Single loop of double-stranded DNA in nucleoid
- Multiply by asexual binary fission
- Live in virtually every environment

Typical Bacteria



Representatives

Bacteria

Characteristics

- **heterotrophic** - get their food from organic matter
 - **chemosynthetic bacteria** - use chemical reactions for energy source
- **autotrophic** - are able to produce their own food
 - **photosynthetic bacteria** - use pigments similar to plants for photosynthesis
- **saprobic** - feed on dead or decaying matter
- live virtually in every environment
 - **psychophilic** - live in very cold places
 - **mesophilic** - bacteria that live at human body temperatures
 - **thermophilic** - live at very high temperatures
 - **aerobic** - require oxygen
 - **anaerobic** - don't require oxygen
 - **facultative** - can live with or without oxygen
- activities
 - responsible for the decay of organic matter that returns it to the cycle of life
 - used to prepare foods and medicines
 - cheese, yogurt, pickles, penicillin, and pharmaceutical products
 - **pathogenic** - some cause human disease
 - tetanus, food poisoning,
- identified by their shape or function

Bacterial Shapes



coccus
(spherical)



rod or bacillus
(cylindrical)



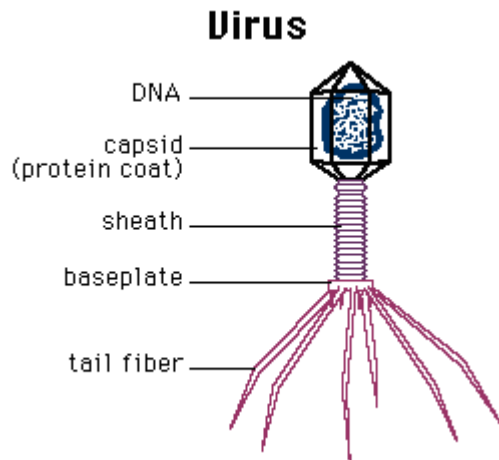
spirillum
(helical)

- **cocci** - spherical
 - **staphylococci** - irregular cluster of cocci - responsible for staph

- infections
 - **streptococci** - bead-like chains of cocci - causes strep throat
 - **diplococci** - pairs of cocci - an agent in pneumonia
- **bacilli** - rod-shaped
- **spirochetes** - rigid spiral bacteria
- **spirilla** - flexible spiral bacteria

Cyanobacteria - previously called the blue-green algae

- photosynthetic members of the kingdom monera
- many make up part of the **plankton** found in the oceans, and are known to produce a large part of the oxygen in the atmosphere.



Viruses

- technically not members of monera, but since they cause disease and are microscopic, we'll talk about them anyway.

Characteristics

- non-cellular organisms that lack properties of living things - but do have ability to replicate themselves
 - consist of the following parts
 - genome - central core of DNA or RNA
 - capsid - protein coating that contains the genome
 - shapes
 - icosahedron - 20 sided figure - like chicken pox
 - helix - coil-like - rabies, measles, influenza
 - how they work
 - attach to membrane
 - inject DNA into host cell
 - the genome takes over the host cell directing the formation of new viruses and the newly formed viruses spread throughout the organism.

Kingdom Protista

Characteristics

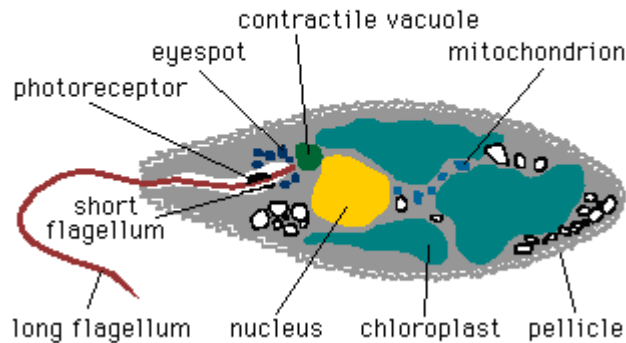
- eukaryotes
- majority single-celled, some colonial
- both autotrophic and heterotrophic
- many have contractile vacuoles helping them remove large amounts of water
- some are non-motile (they don't move around)
- majority move in some way
- include the base of the food chain in phytoplankton and zooplankton

Representatives

Phylum Protozoa

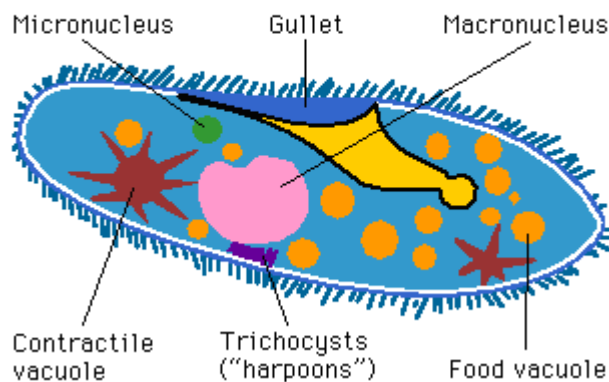
- characterized by their method of locomotion (movement)
- **Mastigophora**
 - characterized by one or more **whip-like flagella**
 - *Euglena* species is a good example

Euglena



- **zooflagellates** - live within the bodies of animals
- **phytoflagellates** - have photosynthetic abilities
- **Sarcodina**
 - represented by **amoebas** - have no definite shape
 - feed by phagocytosis - engulfing organic particles
 - **pseudopodia** - (false foot) - extension of cytoplasm that is used to move and in phagocytosis.
- **Ciliophora**
 - move by **cilia** - which provide precise movement (unlike other types)
 - all are heterotrophic
 - have specialized organelles - including a macro and a number of small micronuclei

Paramecium



- *Paramecium* typifies the Ciliophora
- body covered by pellicle - a slipper-shaped covering
- defensive organelles called trichocysts

- reproduce by conjugation - two come together and exchange nuclear material through the oral region.
- **Sporozoa**
 - exclusively parasites
 - *Plasmodium* - the cause of malaria

Division Algae

Characteristics

- size ranges from being unicellular (single-celled) plankton, to multicellular seaweed
- photosynthetic organisms - not classified with plants
- divided in divisions according to the color of pigment
- most are found in the ocean, some in freshwater and are an enormous source of food for many aquatic and marine organisms - commonly called phytoplankton.
- also supply many additives for cosmetics
- **Rhodophyta**
 - **red algae** - red pigment similar to the cyanobacteria
 - some are large enough to be called seaweeds
 - base of **agar** used in many laboratories
- **Pyrophyta**
 - **dinoflagellates** - unicellular organisms that are surrounded by armor-like plates. Two flagella are used for locomotion. Many are luminescent - that is when they are affected by sudden movements, they give off light (incidentally the root pyro means fire so this is describing the ability to light up). When they reproduce in large numbers they cause a condition known as the **red tide**.
- **Chrysophyta**
 - **golden algae**
 - **diatoms** - made of cell walls or shells that contain silica - are often used as a source for absorbents, fillers, and filtering material.
- **Phaeophyta**
 - **brown algae**
 - most seen in the ocean as rock seaweed and **kelp**
- **Chlorophyta**
 - **green algae**
 - **sea lettuce** *Ulva*

Kingdom Fungi



Characteristics

- also major decomposers of organic material
- most are **saprobies** - digest non-living organic matter
- some are **parasites** - attack living things and cause disease - like athlete's foot
- **extracellular digestion** - they digest food outside their bodies by using enzymes to break down the organic matter and then absorb the nutrients,
- made of **hypha** - microscopic filaments that make up fungi
- **mycelium** - networks of hypha and is a visible structure
- **chitin** - the polysaccharide that provides structure for the fungi
- **asexual reproduction** in many cases by producing spores which are spread, then germinate and divide, thus producing a genetically identical fungi. These **spores** are very important because they are haploid (a stage which dominates the life cycle of the fungi). The spores can also withstand extreme dryness and cold in order to produce a new fungus when conditions are just right.
- **sexual reproduction** - results in a very **short-lived diploid cell** that undergoes meiosis to produce haploid spores (which undergo mitosis and produce new individuals)

Representatives

- **Oomycetes**
 - **water molds**
 - have sexual spores known as **oospores**
 - in the process of sexual reproduction produces a **zoospore** which has a flagella and is able to move around like some animal cells.
 - seen in nature as downy mildew on grapes, and fungal infections on fish.
- **Zygomycetes**
 - the terrestrial fungi - like **bread molds**
 - in sexual reproduction sexually opposite **hypha** fuse and form **zygospores**
- **Ascomycetes**
 - in sexual reproduction they form sacs called **ascus** which are filled with **ascophores** and are capable of producing an entire organism.
 - they appear as powdery mildews and some form what are known as the cup fungi.
 - the producer of **Penicillin** is in this class as well as **yeast** for baking
- **Basidiomycetes**



- also called the club fungi because of the club-like structures called **basidia** that produce the sexual spores known as **basidiospores**.
- the most familiar member of this class is the **mushroom**.