

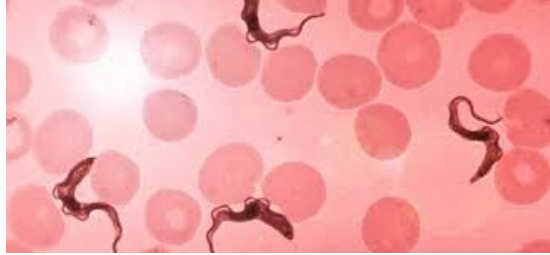
Biology II LAB Practical I

~Kingdom Protista~

Phylums:

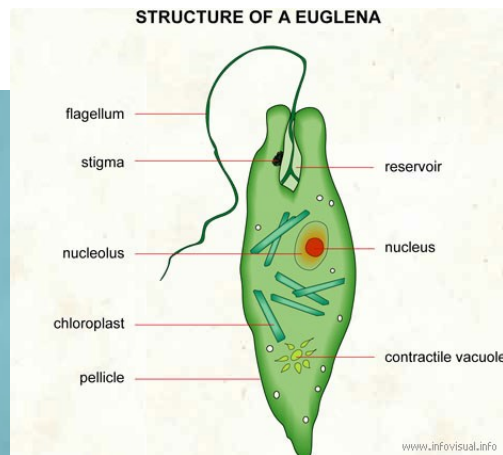
Euglenophyta (Euglenids, trypanosoma-sleeping sickness)

Trypanosoma



- Trypanosomes evade immune responses with an effective “bait-to-switch” defense. The surface of a trypanosome is coated with millions of copies of a single protein. However, before the host’s immune system can recognize the protein and mount an attack, new generations of the parasite switch to another surface protein with a different molecular structure. Frequent changes in the surface protein prevent the host from developing immunity.

Euglena



- Euglenid has a pocket at one end of the cell from which one or two flagella emerge. Many of the Euglena are mixotrophs: in sunlight they are autotrophic, but when sunlight is unavailable, they can become heterotrophic, absorbing organic nutrients from their environment.

Heterotrophic:

- An organism that cannot synthesize its own food and is dependent on complex organic substances for nutrition.

Autotrophic:

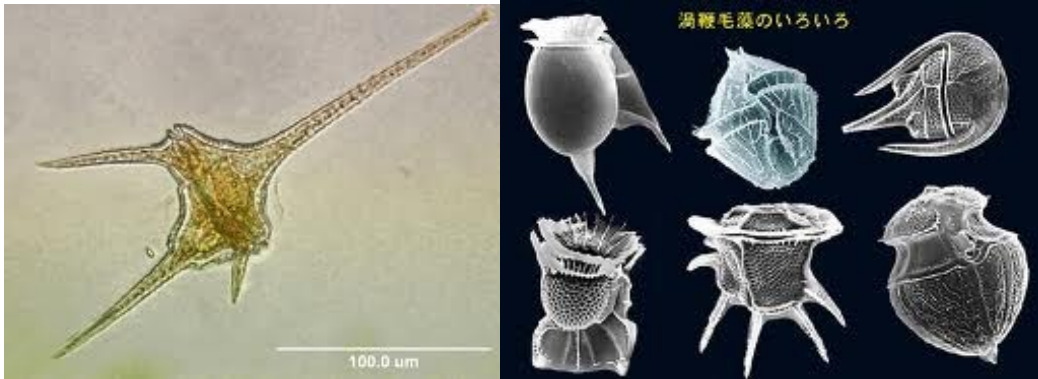
- An organism capable of making nutritive organic molecules from inorganic sources via photosynthesis (involving light energy) or chemosynthesis (involving chemical energy).

Heterotrophs and Autotrophs

- Organisms are divided into autotrophs and heterotrophs according to their energy pathways. Autotrophs are those organisms that are able to make energy-containing organic molecules from inorganic raw material by using basic energy sources such as sunlight. Plants are the prime example of autotrophs, using photosynthesis. All other organisms must make use of food that comes from other organisms in the form of fats, carbohydrates and proteins. These organisms, which feed on others, are called heterotrophs.

Dinoflagellata (Dinoflagellates)

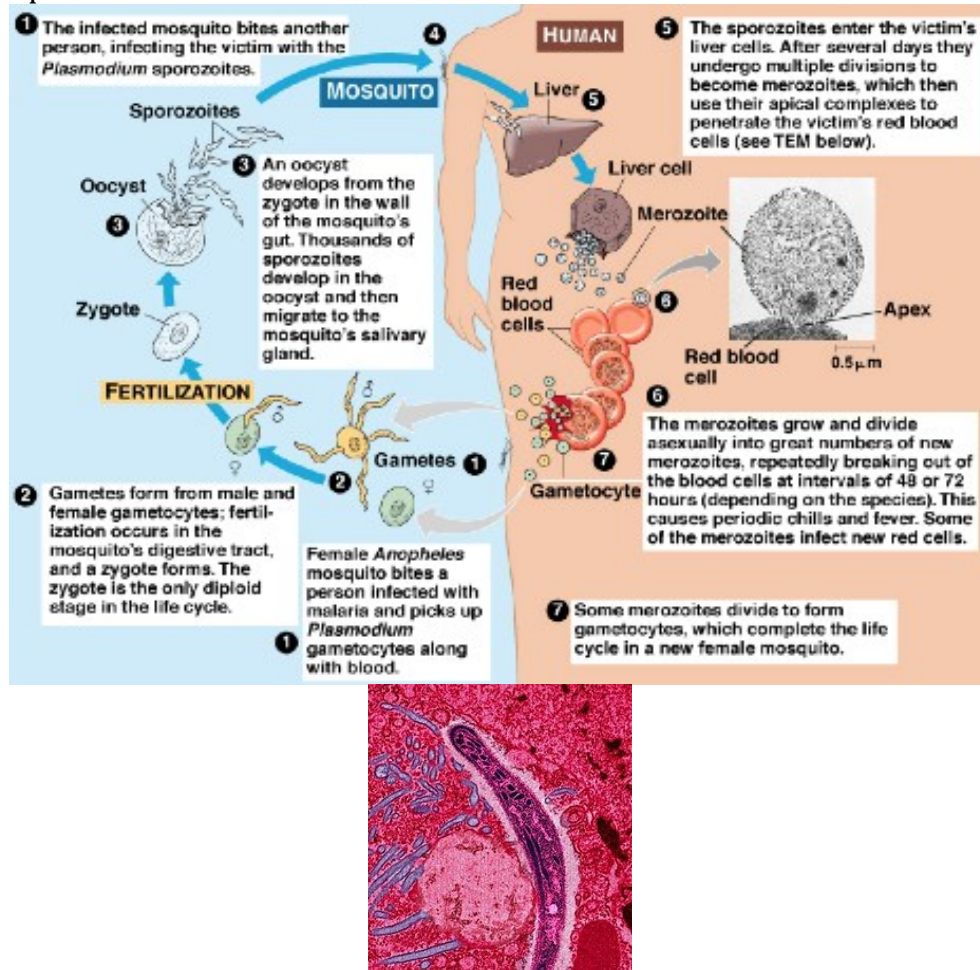
Dinoflagellates



- They are a large group of flagellate protists. Most are marine plankton, but they are common in fresh water habitats as well. Their populations are distributed depending on temperature, salinity, or depth. Many dinoflagellates are known to be photosynthetic, but a large fraction of these are in fact mixotrophic, combining photosynthesis with ingestion of prey. Dinoflagellates are the largest group of marine eukaryotes aside from the diatoms.
- Are unicellular
- Two flagella

Apicomplexa (apicomplexan, malaria)

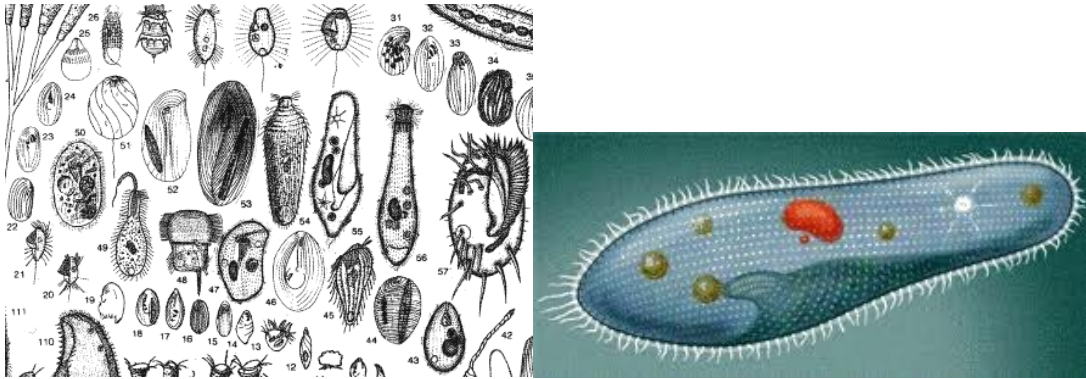
Apicomplexan



- Apicomplexan causes malaria
- **Apicomplexans** are a large group of protists, most of which possess a unique organelle called apicoplast and an *apical complex* structure involved in penetrating a host's cell. They are unicellular, spore-forming, and exclusively parasites of animals. Motile structures such as flagella or pseudopods are present only in certain gamete stages. This is a diverse group including organisms such as coccidia, gregarines, piroplasms, haemogregarines, and plasmodia. Diseases caused by apicomplexan organisms include malaria.
- **Malaria** is a mosquito-borne infectious disease of humans and other animals caused by protists (a type of microorganism) of the genus *Plasmodium*. It begins with a bite from an infected female mosquito (Anopheles Mosquito), which introduces the protists via its saliva into the circulatory system, and ultimately to the liver where they mature and reproduce. The disease causes symptoms that typically include fever and headache, which in severe cases can progress to coma or death.

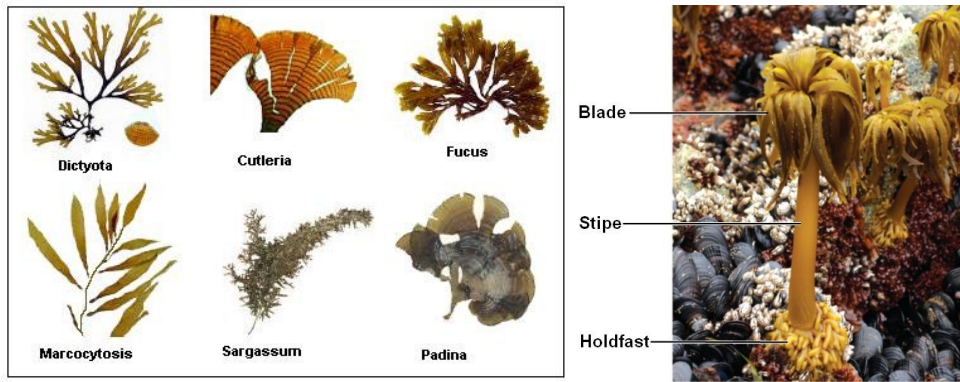
Ciliophora (Ciliates)

Ciliates



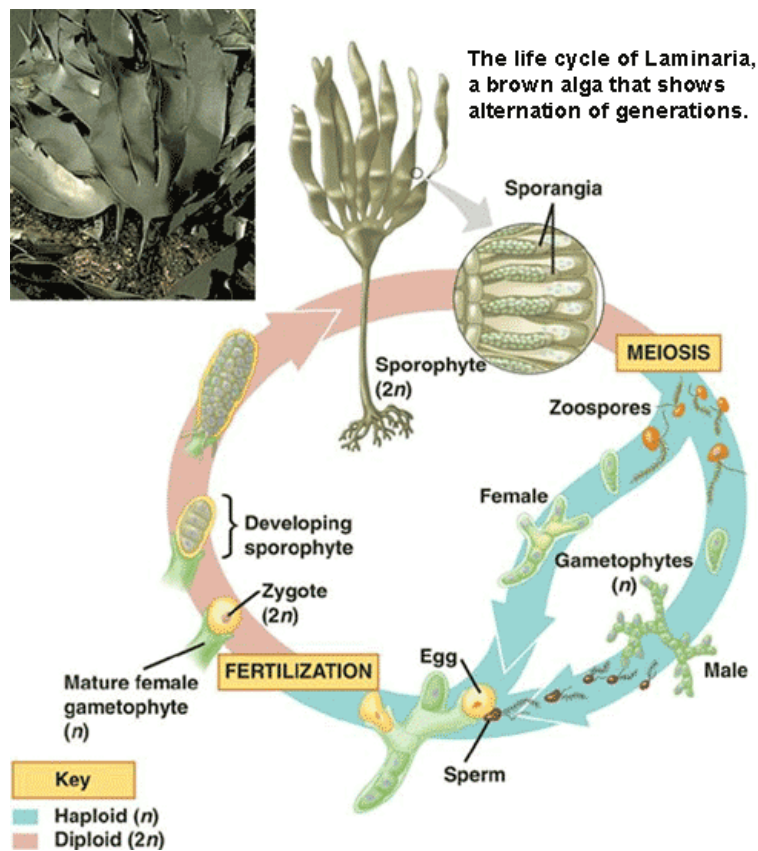
- The ciliates are a group of protozoans characterized by the presence of hair-like organelles called cilia, which are identical in structure to eukaryotic flagella, but typically shorter and present in much larger numbers with a different undulating pattern than flagella. Cilia occur in all members of the group (although the peculiar Suctorians only have them for part of the life-cycle) and are variously used in swimming, crawling, attachment, feeding, and sensation.
- Ciliates are one of the most important groups of protists, common almost everywhere there is water — in lakes, ponds, oceans, rivers, and soils. Ciliates are large single cells, a few reaching 2 mm in length, and are some of the most complex protozoans in structure.

Phaeophyta (Brown Algae)



- Brown algae are the largest, most complex type of algae. This type of marine algae is brown, olive or yellowish-brown in color.
- All brown algae are multicellular.

Life cycle of the brown algae laminaria: example of alternation of generations.



Oomycota (water molds)

Water mold



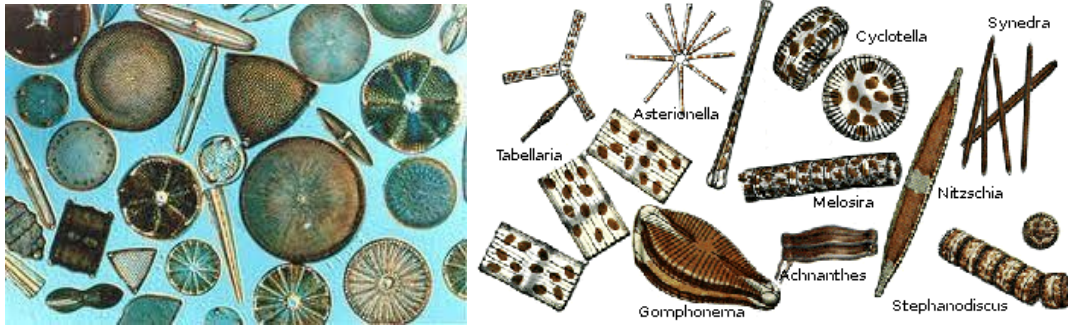
- Oomycetes aka water molds have cell wall made of cellulose. They do not perform photosynthesis. Instead, they typically acquire nutrients as decomposers or parasites.
- The potato famine in Ireland: The water mold virtually wiped out the country's potato crops, which were an essential staple in the Irish diet.

Chrysophyta (golden Algae)



- The cells of golden algae are typically biflagellated, with both flagella attached near one end of the cell. Many golden algae are components of freshwater and marine plankton. While all golden algae are photosynthetic, some are mixotrophic. Most species are unicellular, but some are colonial.

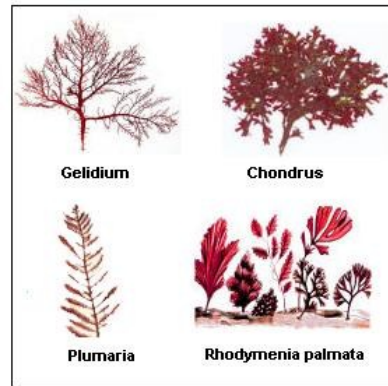
Bacillariophyta or Crystophyta (Diatoms)



- Diatoms are unicellular algae that have a unique glass-like wall made of hydrated silica. Diatoms are a major group of algae, and are one of the most common types of phytoplankton. Most diatoms are unicellular, although they can exist as colonies in the shape of filaments or stellate colonies. Diatoms are producers within the food chain. A characteristic feature of diatom cells is that they are encased within a cell wall made of silica.
- Diatoms are the most common marine algae in the world!!!
- They have a shell around them.
- Single cell
- Shell is transparent
- We use sand from the bottom of the ocean to heat it/melt it.
- The sand came from bodies of dead diatoms. We are recycled!!
- The diatoms kicked the silica out of the solution in the water. They make glass in the form of their own shell. Their body's die and form sand, then we dig down and take it to a glass factory and turn it into a window.
- Golden algae, brown algae: two different photosynthesizers doing photosynthesis according to a little different biochemical pathway than green plants.

What do we know that is common and transparent? Silica? (Glass)

Rhodophyta (red algae)



- Red algae are the most abundant large algae in the warm coastal waters of tropical oceans. Most red algae are multicellular. Most red algae are also macroscopic, marine, and have sexual reproduction.

Chlorophyta (Green Algae)



- Green algae are divided into two main groups: the charophytes and the chlorophytes.
- Charophytes: are the algae most closely related to land plants.
- Chlorophytes: live mostly in fresh water, but there are also many marine and some terrestrial species. They are unicellular.
- Most chlorophytes have both sexual and asexual reproductive stages. Nearly all species of chlorophytes reproduce sexually by means of biflagellated gametes that have cup-shaped chloroplasts.

Charophyta (Advanced Green Algae)



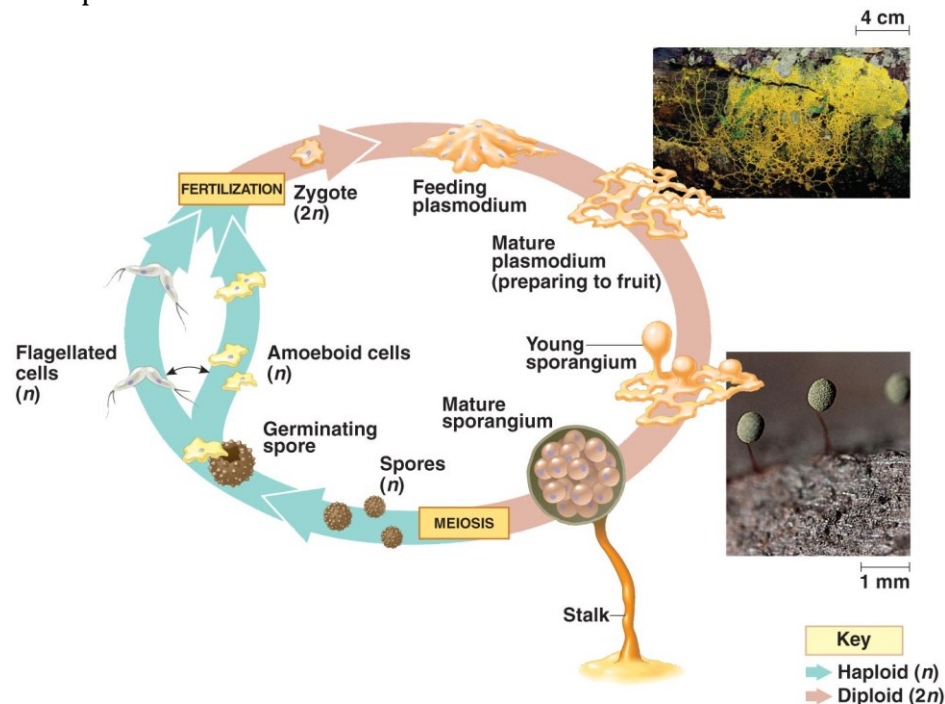
- Charophytes: are the algae most closely related to land plants.
- Charophyte algae inhabit shallow waters around the edges of ponds and lakes.

Amoebazoa (slime molds, amoebas)

Slime Mold

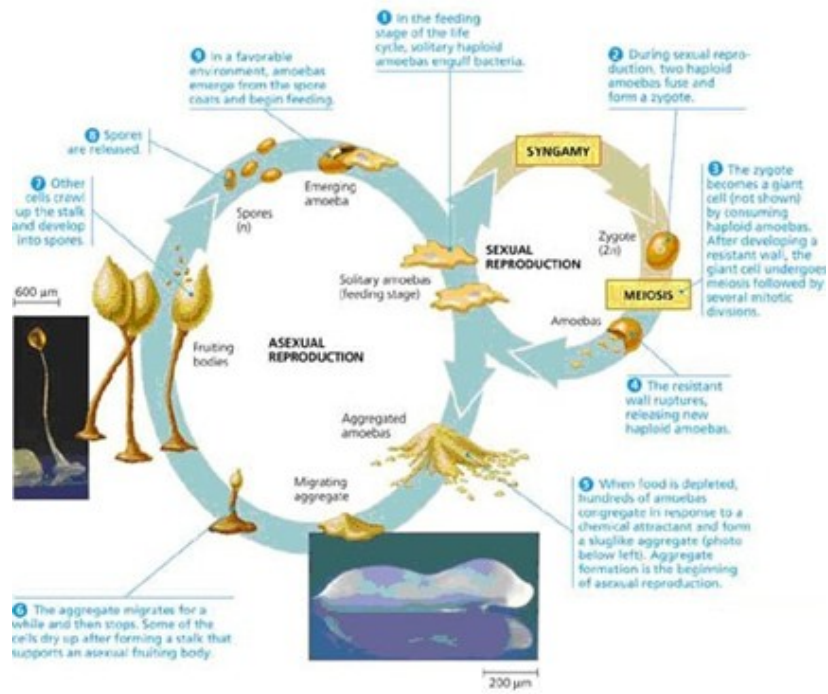


- Slime molds produce fruiting bodies that aid in spore dispersal.
- They descended from unicellular ancestors.
- Slime molds have diverged into two main branches: plasmodial slime molds and cellular slime molds.
- **Plasmodial:** They are basically enormous single cells with thousands of nuclei. They are formed when individual flagellated cells swarm together and fuse. The result is one large bag of cytoplasm with many diploid nuclei. These "giant cells" have been extremely useful in studies of cytoplasmic streaming (the movement of cell contents) because it is possible to see this happening even under relatively low magnification. In addition, the large size of the slime mold "cell" makes them easier to manipulate than most cells.



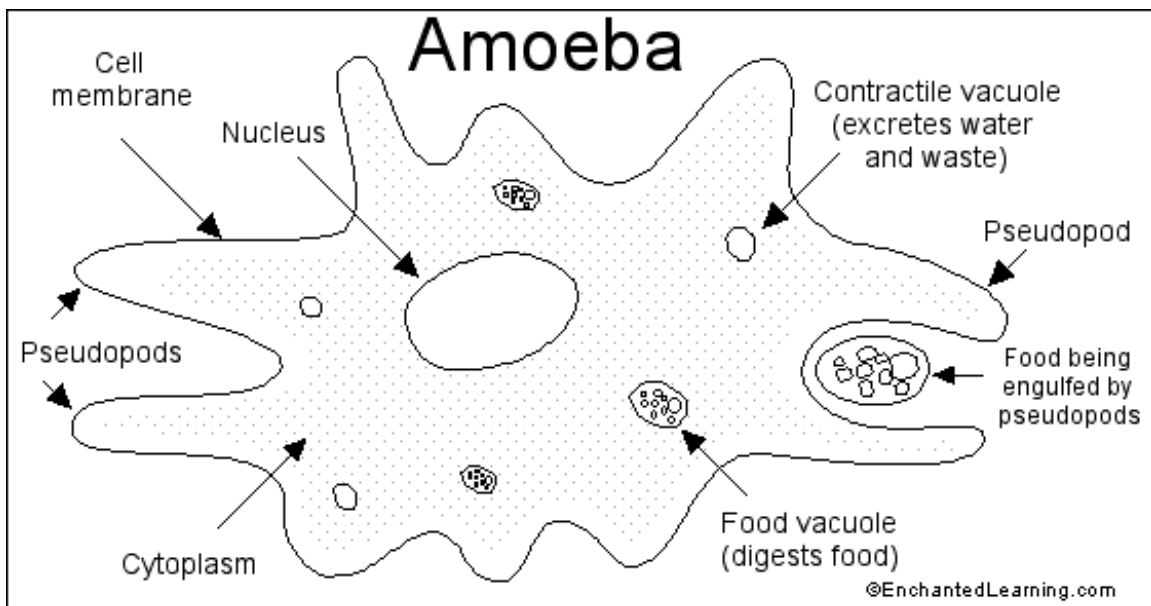
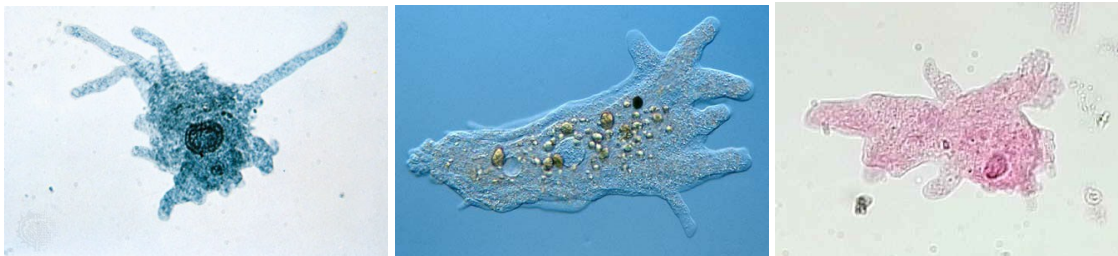
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- **Cellular:** spend most of their lives as separate single-celled amoeboid protists, but upon the release of a chemical signal, the individual cells aggregate into a great swarm. Cellular slime molds are thus of great interest to cell and developmental biologists, because they provide a comparatively simple and easily manipulated system for understanding how cells interact to generate a multicellular organism.



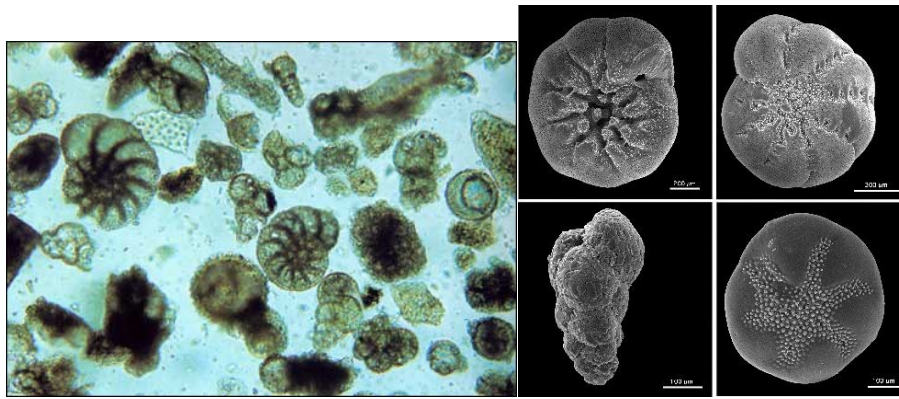
- What these two groups have in common is a life cycle that superficially resembles that of the fungi. When conditions become unfavorable, these slime molds form **sporangia** - clusters of spores, often on the tips of stalks such as in the sporangium of a *Physarum*. Spores from the sporangia are dispersed to new habitats, "germinate" into small amoebae, and the life cycle begins again.

Amoeba



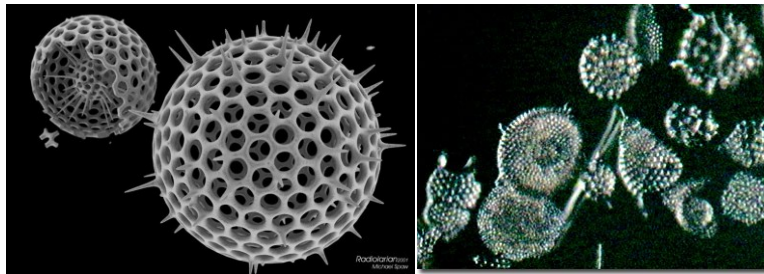
- Any of various one-celled aquatic or parasitic protozoans of the genus *Amoeba* or related genera, having no definite form and consisting of a mass of protoplasm containing one or more nuclei surrounded by a flexible outer membrane. Amoebas move by means of pseudopods.

Foraminifera (Forams)



- Foraminifera are "hole bearers", or forams for short) are a phylum or class of amoeboid protists. They are characterized both by their thin pseudopodia that form an external net for catching food, and they usually have an external shell, or test, made of various materials and constructed in diverse forms. Most forams are aquatic, primarily marine, and the majority of species live on or within the seafloor sediment.
- Book: forams are named for their porous shells, called tests. Foram tests consist of a single piece of organic material hardened with calcium carbonate. The pseudopodia that extend through the pores function in swimming, test, information, and feeding. Many forams also derive nourishment from the photosynthesis of symbiotic algae that live within the tests.

Radiolaria (radiolarians)

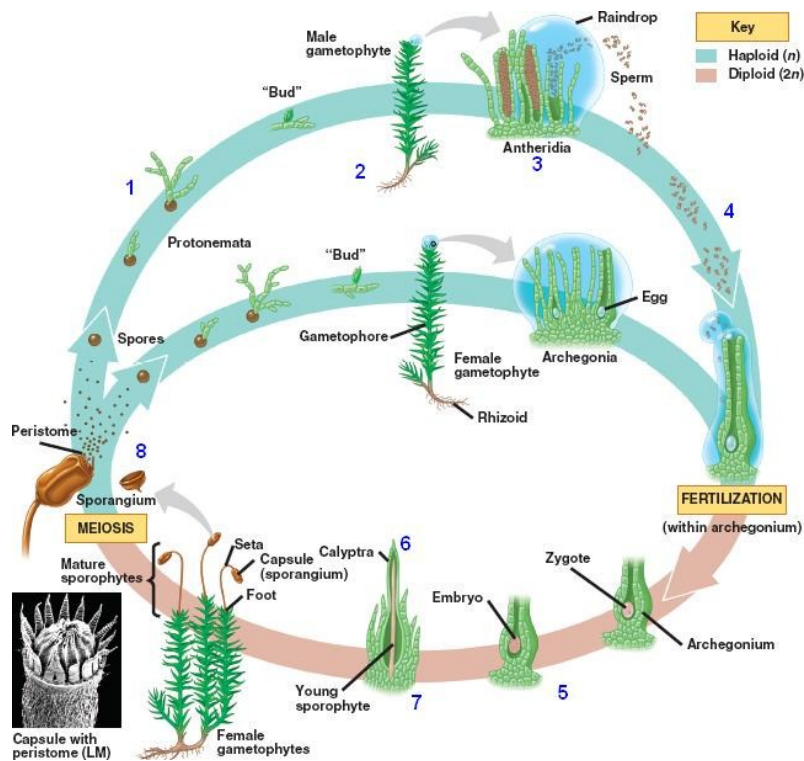


- Radiolarians have delicate, intricately symmetrical internal skeletons that are generally made of silica. The pseudopodia of these mostly marine protists radiate from the central body and are reinforced by bundles of microtubules. The microtubules are covered by a thin layer of cytoplasm, which engulfs smaller microorganisms that become attached to the pseudopodia. Cytoplasmic streaming then carries the captured prey into the main part of the cell. After radiolarians die, their skeletons settle to the seafloor where they have accumulated as an ooze that is hundreds of meters thick in some locations.

~Kingdom Plantae~

Phylums

Bryophyta (mosses)



- Mosses are nonvascular

Habitats of a moss thrive in moist soil. Live in fresh water, pond banks, stream banks, riverbanks.

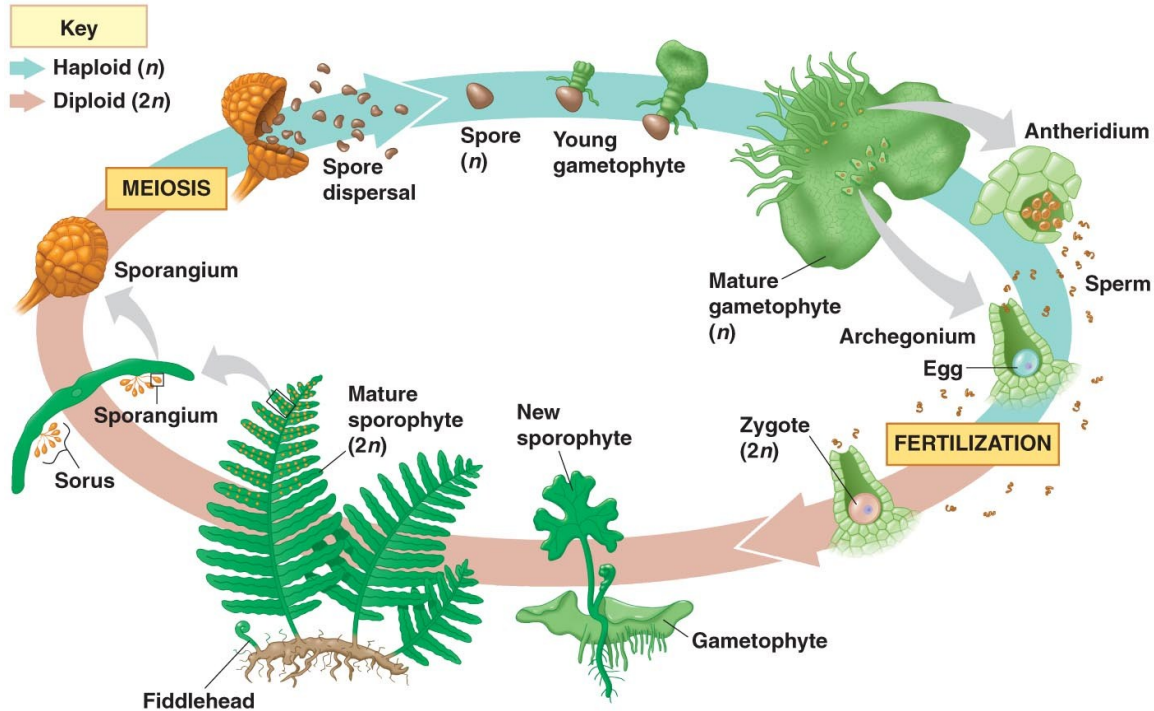
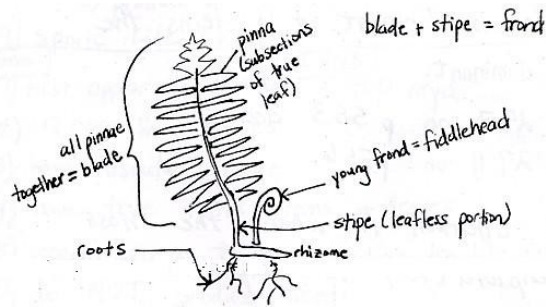
1. Spores develop into threadlike protonemata.
2. The haploid protonemata produces "buds" that divide by mitosis and grow into gametophores.
3. Sperm must swim through a film of moisture to reach each egg.
4. The zygote develops into a sporophyte embryo.
5. The sporophyte grows a long stalk (seta) that emerges from the archegonium.
6. Attached by its foot, the sporophyte remains nutritionally dependent on the gametophyte.
7. Meiosis occurs and haploid spores develop in the capsule. When the capsule is mature, its lid pops off, and the spores are released.

Moss

- Spores are produced when conditions are dry. Transitional plants.

- A leaf has vascular tissue. Leaflets
- Sperm are biflagellate, they have two flagella on them.
- How do you tell the difference between male and female gametophytes?
Has a stalk growing out of the top (female)
- Live in transitional habitats.

Pterophyta (ferns)



1. Sporangia release spores. Most fern species produce a single type of spore that develops into a bisexual photosynthetic gametophyte.
2. Each gametophyte develops sperm-producing organs called antheridia and egg-producing organs called archegonia. Although this simplified diagram shows a sperm fertilizing an egg from the same gametophyte, in most fern species a gametophyte produces sperm and eggs at different times. Therefore, typically an egg from one gametophyte is fertilized by a sperm from another gametophyte.
3. Sperm use flagella to swim to eggs in the archegonia. An attractant secreted by archegonia helps direct the sperm.
4. A zygote develops into a new sporophyte, and the young plant grows out from an archegonium of its parent, the gametophyte.
5. On the underside of the sporophyte's reproductive leaves are spots called sori. Each sorus is a cluster of sporangia.

Fern:

- Two vascular tissues are Xylem and Phloem
- The largest group of living seedless vascular plants.
- Sporangia produce the spores by meiosis when they dry out.
- Has both male and female structures on them at the same time.

Fern anatomy

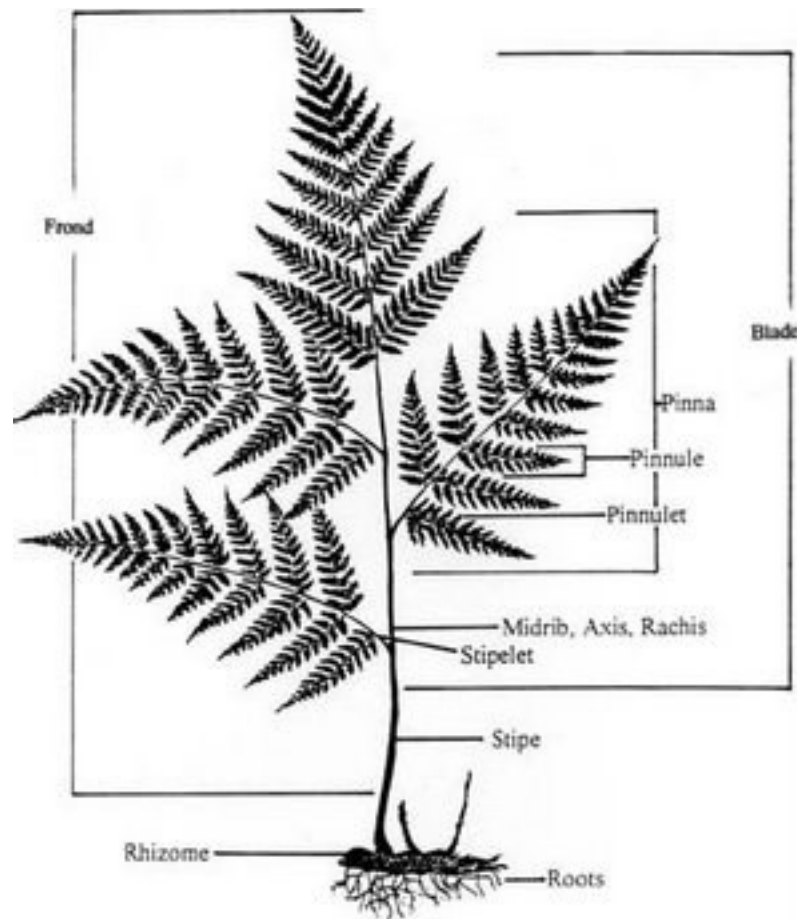


Fig. Diagram of Fern

-
- Sori: sporangia cluster on the leaf (bumpy)
- Pinna: leaf containing spores on sporophyte pterophyta
- Antheridia and archegonia: male and female reproductive structures
- Fiddlehead: tightly coiled leaf of sporophyte pterophyta
- Rhizome: horizontal stem that holds the pterophyta in place
- Annulus: one cell layer thick, functions to disperse spores from sporangia
- Protonema: early germinating structure from spores

Difference between the fern and the moss:

- The sporophyte in the fern is much bigger and much more independent.
- In the fern, the gametophyte is very small.

Does it have alternation of generation?

- Yes

Ferns have vascular tissues

- Vascular tissues specifically are Xylem and Phloem (full of cellulose fiber)

All of the coal in the world comes from fern forest.

Coal: Fossilized fern wood

Central Florida is the Fern capital of the world

World first forest was a fern forest.

Coniferophyta (conifers)



Conifers: Sporophyte is dominant; gametophyte depends on sporophyte for nutrition.

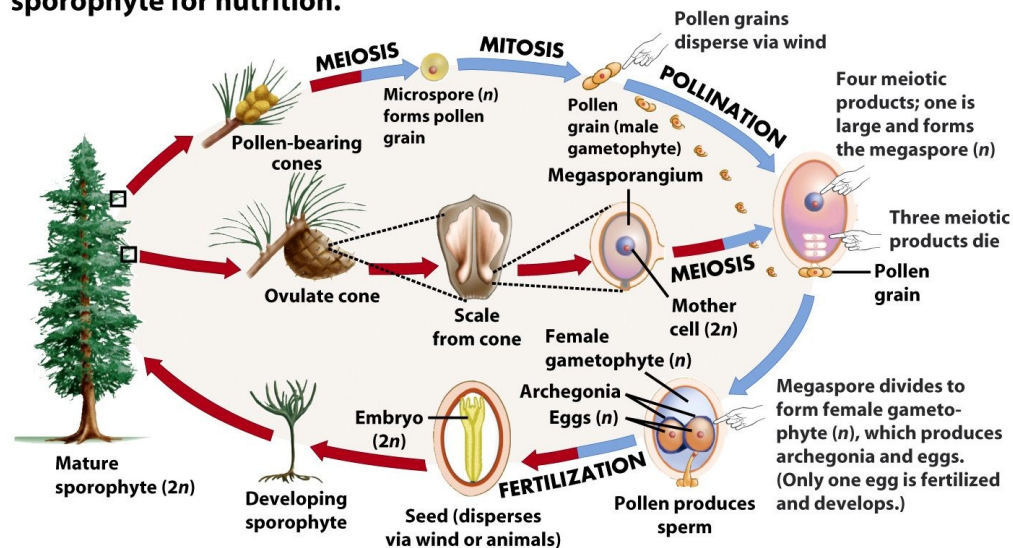


Figure 29-14d Biological Science, 2/e
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- They are cone-bearing seed plants with vascular tissue; all extant conifers are woody plants, the great majority being trees with just a few being shrubs. Typical examples of conifers include cedars, Douglas-firs, cypresses, firs, junipers, kauri, larches, pines, hemlocks, redwoods, spruces, and yews.
- Phylum coniferophyta is by far the largest of the gymnosperm phyla. Conifers dominated the northern hemisphere.
- Any of various gymnosperms that bear their reproductive structures in cones and belong to the phylum Coniferophyta. Conifers evolved around 300 million years ago and, as a group, show many adaptations to drier and cooler environments. They are usually evergreen and often have drought-resistant leaves that are needle-shaped or scalelike. They depend on the wind to blow pollen produced by male cones to female cones, where fertilization takes place and seeds develop. Conifers are widely distributed, but conifer species dominate the northern forest biome known as the taiga. There are some 550 species of conifers, including the pines, firs, spruces, hemlocks, cypresses, junipers, yews, and redwoods.

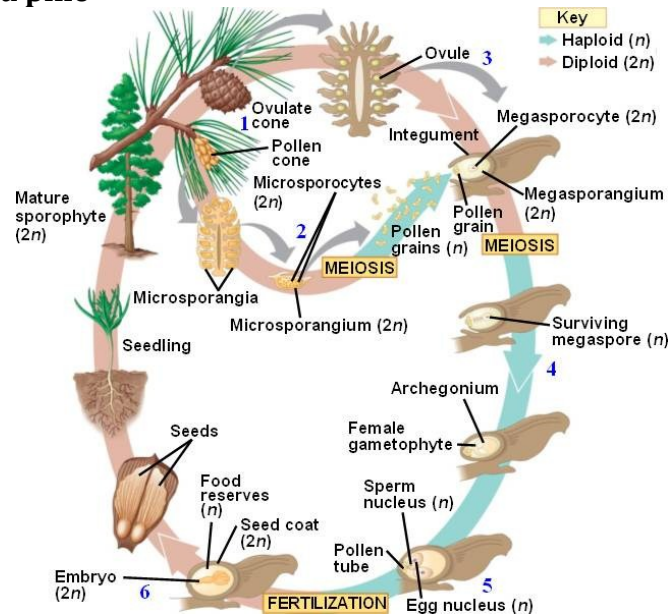
Phylum Coniferophyta (softwood trees)

- Is by far the largest of the gymnosperm phyla.
- Any plant that produces a cone. (cones are sporophytic, diploid)
- Many coniferophyta's are large trees: Pines, cedars spruces, hemlocks, junipers, tamarack (New England), cypress, red wood, and sequoia.
- Known as the softwood trees

- Douglas fir is the harder wood softwood tree.
- Leaves are tough and spiky. Protects from animals.
- Grows on poor soil

Softwoods are the lightest and strongest wood in the world

The life cycle of a pine



1. In most conifer species, each tree has both ovulate and pollen cones.
2. Microsporocytes divide by meiosis, producing haploid microspores. A microspore develops into a pollen grain (a male gametophyte enclosed within the pollen wall).
3. An ovulate cone scale has two ovules, each containing a megasporangium. Only one ovule is shown.
4. Pollination occurs when a pollen grain reaches the ovule. The pollen grain then germinates, forming a pollen tube that slowly digests its way through the megasporangium.
5. While the pollen tube develops, the megasporocyte undergoes meiosis, producing four haploid cells. One survives as a megaspore.
6. The megaspore develops into a female gametophyte that contains two or three archegonia, each of which will form an egg.
7. By the time the eggs are mature, two sperm cells have developed in the pollen tube, which extends to the female gametophyte. Fertilization occurs when sperm and egg nuclei unite.
8. Fertilization usually occurs more than a year after pollination. All eggs may be fertilized, but usually only one zygote develops into an embryo. The ovule becomes a seed, consisting of an embryo, food supply and seed coat.

Ovulate cone: female

Pollen cone: male

Overriding theme:

- The conifers use physical forces of the environment to assist them rather than animal forces.

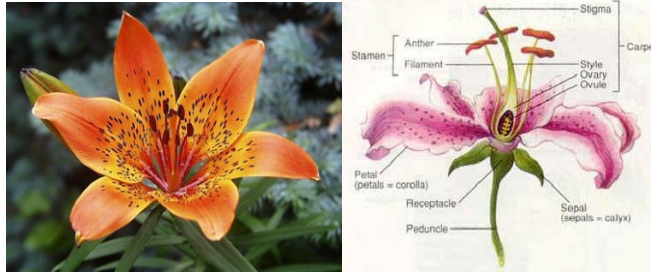
Mortality

- 1000 to 1

- Life expectancy is low
- How does a tree beat those odds? Makes a lot of seeds.
- Chief source of mortality for seeds? Seed eating animals.

Anthophyta (flowering plants, dicot vs monocot)

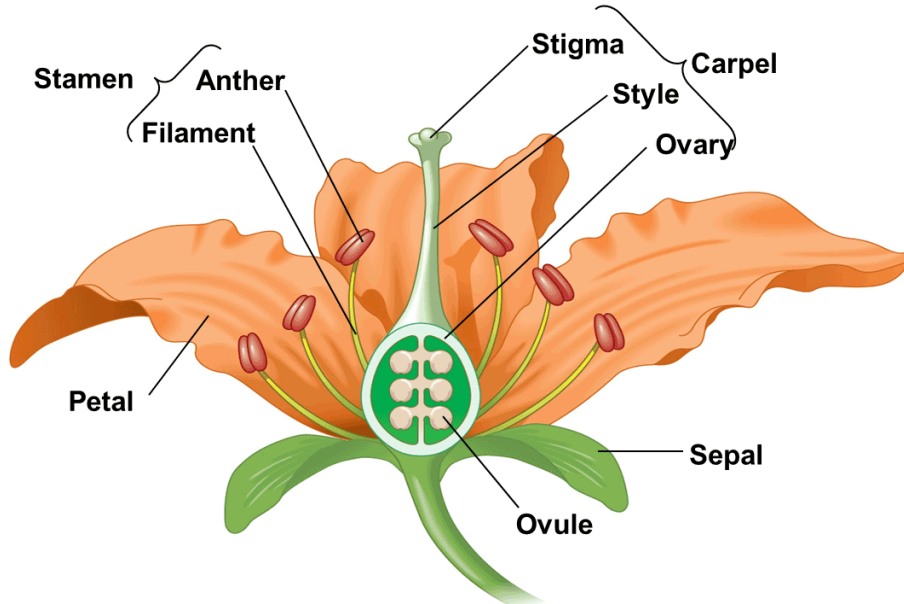
Flowering plants



- The flowering plants (angiosperms), also known as Angiospermae or Magnoliophyta, are the most diverse group of land plants. Angiosperms are seed-producing plants like the gymnosperms and can be distinguished from the gymnosperms by a series of synapomorphies (derived characteristics). These characteristics include flowers, endosperm within the seeds, and the production of fruits that contain the seeds. Etymologically, angiosperm means a plant that produces seeds within an enclosure; they are fruiting plants, although more commonly referred to as flowering plants.

The Reproductive adaptations of angiosperms include flowers and fruits

The structure of a “perfect flower”.



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Perfect flower:

- Has both male and female structures
- Stamen: Male
- Carpel: Female

Pistol

- The number of carpels fused together. But the carpel is the functional unit.

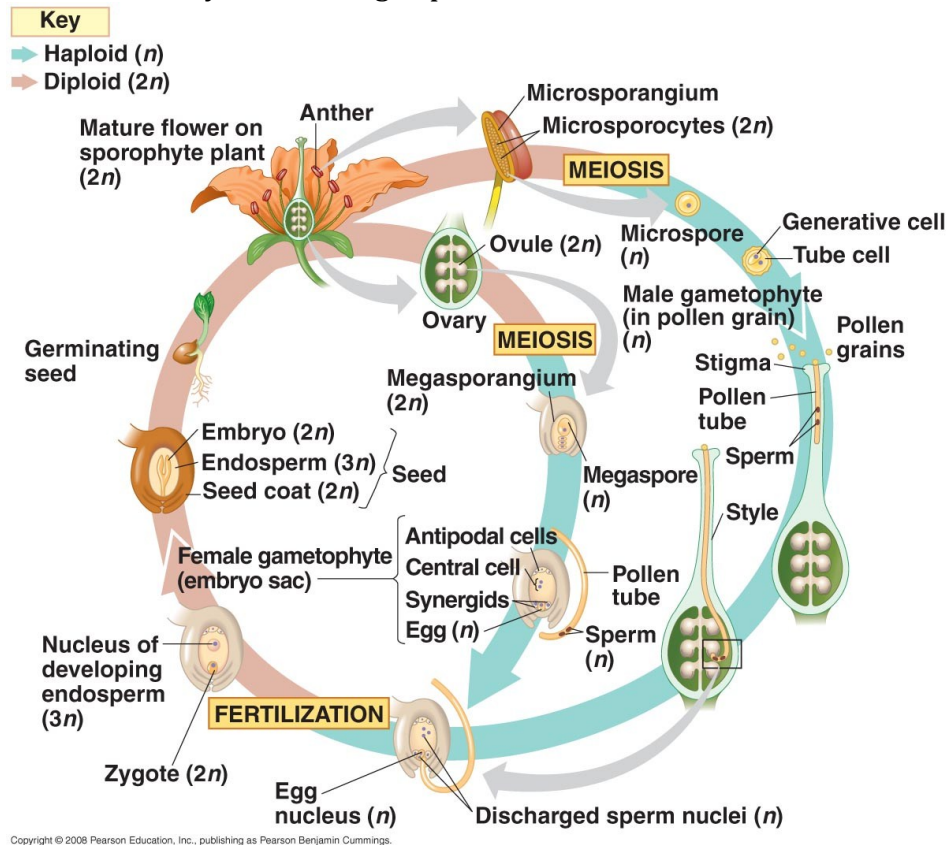
The term division is a botanical (studied plants) term

The term Phylum is a zoological (studies animals) term

Flower

- A flower is an angiosperm structure specialized for sexual reproduction. Insects or other animals transfer pollen from one flower to the sex organs on another flower, which makes pollination more directed than the wind-dependent pollination of most gymnosperms.

Figure 30.10 The life cycle of an angiosperm



1. On the anther, each microsporangium contains microsporocytes that divide by meiosis, producing microspores.
2. A microspore develops into a pollen grain. The generative cell of the gametophyte will divide, forming two sperm. The tube cell will produce the pollen tube.
3. In the megasporangium of each ovule, the megasporocyte divides by meiosis, producing four megaspores. One survives and forms a female gametophyte.
4. After pollination, eventually two sperm cells are discharged in each ovule.
5. Double fertilization occurs. One sperm fertilizes the egg, forming a zygote. The other sperm fertilizes the central cell, forming the endosperm (a food supply).
6. The zygote develops into an embryo that is packaged along with food into a seed. (The fruit tissues surrounding the seed are not shown).
7. When a seed germinates, the embryo develops into a mature sporophyte.

Monocot vs. Dicot

MONOCOTS

Embryo with single cotyledon
Pollen with single furrow or pore
Flower parts in multiples of three
Major leaf veins parallel
Stem vascular bundles scattered
Roots are adventitious
Secondary growth absent

DICOTS

Embryo with two cotyledons
Pollen with three furrows or pores
Flower parts in multiples of four or five
Major leaf veins reticulated
Stem vascular bundles in a ring
Roots develop from radicle
Secondary growth often present

Pollen structure -- The first angiosperms had pollen with a single furrow or pore through the outer layer (**monosulcate**). This feature is retained in the monocots, but most dicots are descended from a plant which developed three furrows or pores in its pollen (**triporate**).

Number of flower parts -- If you count the number of petals, stamens, or other floral parts, you will find that monocot flowers tend to have a number of parts that is divisible by three, usually three or six. Dicot flowers on the other hand, tend to have parts in multiples of four or five (four, five, ten, etc.). This character is not always reliable, however, and is not easy to use in some flowers with reduced or numerous parts.

Leaf veins -- In monocots, there are usually a number of major leaf veins which run parallel the length of the leaf; in dicots, there are usually numerous auxillary veins which reticulate between the major ones. As with the number of floral parts, this character is not always reliable, as there are many monocots with reticulate venation, notably the aroids and Dioscoreales.

Stem vascular arrangement -- Vascular tissue occurs in long strands called **vascular bundles**. These bundles are arranged within the stem of dicots to form a cylinder, appearing as a ring of spots when you cut across the stem. In monocots, these bundles appear scattered through the stem, with more of the bundles located toward the stem periphery than in the center. This arrangement is unique to monocots and some of their closest relatives among the dicots.

Root development -- In most dicots (and in most seed plants) the root develops from the lower end of the embryo, from a region known as the **radicle**. The radicle gives rise to an **apical meristem** which continues to produce root tissue for much of the plant's life. By contrast, the radicle aborts in monocots, and new roots arise **adventitiously** from nodes in the stem. These roots may be called prop roots when they are clustered near the bottom of the stem.

Secondary growth -- Most seed plants increase their diameter through secondary growth, producing wood and bark. Monocots (and some dicots) have lost this

ability, and so do not produce wood. Some monocots can produce a substitute however, as in the palms and agaves.

Are pine trees monocots or dicots?

- Pines are **conifers**, and are neither monocots nor dicots. Only flowering plants are considered to be members of these two classes. This question is similar to asking whether a chicken is a monocot or a dicot; it is neither.

Extra Notes

	Asexual	Sexual
Number of organisms involved	One	Two
Cell Division	Mitosis	Meiosis
Advantages	Quick, no need to search for mate. Requires less energy.	Variation, unique. Organisms more protected.
Disadvantages	No variation. If parent has a disease, the offspring will too.	Requires 2 organisms and requires more energy.
	Constant environment	Changing environment

Vascular

- Vascular plants (from latin *vasculum*: duct), also known as tracheophytes (from the equivalent greek term *trachea*) and also higher plants, form a large group of plants that are defined as those land plants that have lignified tissues (the xylem) for conducting water and minerals throughout the plant. They also have (non-lignified) tissue to conduct products of photosynthesis. Vascular plants include the clubmosses, *horsetails*, ferns, gymnosperms (including conifers) and angiosperms (flowering plants).

Nonvascular

- Non-vascular plants are plants without a vascular system (xylem and phloem). Although non-vascular plants lack these particular tissues, a number of non-vascular plants possess simpler tissues that are specialized for internal transport of water.
- Non-vascular plants do not have a wide variety of specialized tissue types. Leafy liverworts have structures that look like leaves, but are not true leaves because they are single sheets of cells with no cuticle, stomata or internal air spaces have no xylem or phloem. Consequently they are unable to control water loss from their tissues and are said to be poikilohydric. Likewise, mosses and algae have no such tissues.

- All land plants have a life cycle with an alternation of generations between a diploid sporophyte and a haploid gametophyte, but in all nonvascular land plants the gametophyte generation is dominant. In these plants, the sporophytes grow from and are dependent on gametophytes for taking in water and mineral nutrients and for provision of photosynthate, the products of photosynthesis.

Vascular Plants vs. Nonvascular Plants

Characteristics of Vascular Plants



- Vascular plants absorb nutrients necessary for their survival through an internal system that conducts water, minerals, sugars and other nutrients. This system includes roots, stems and leaves.

Characteristics of Nonvascular Plants



- Nonvascular plants do not have specific internal conducting systems for receiving nutrients. Instead, the entire plant absorbs and stores nutrients directly into the cells.

Types of Vascular Plants

- Most of the world's plants are vascular. This includes all flowering plants and conifers, such as pines, spruces and firs. There are approximately 235,000 species of vascular plants.

Types of Nonvascular Plants

- Types of nonvascular plants include mosses and liverworts. Liverwort is generally found in a permanently wet habitat, while mosses can be found throughout forested areas.