

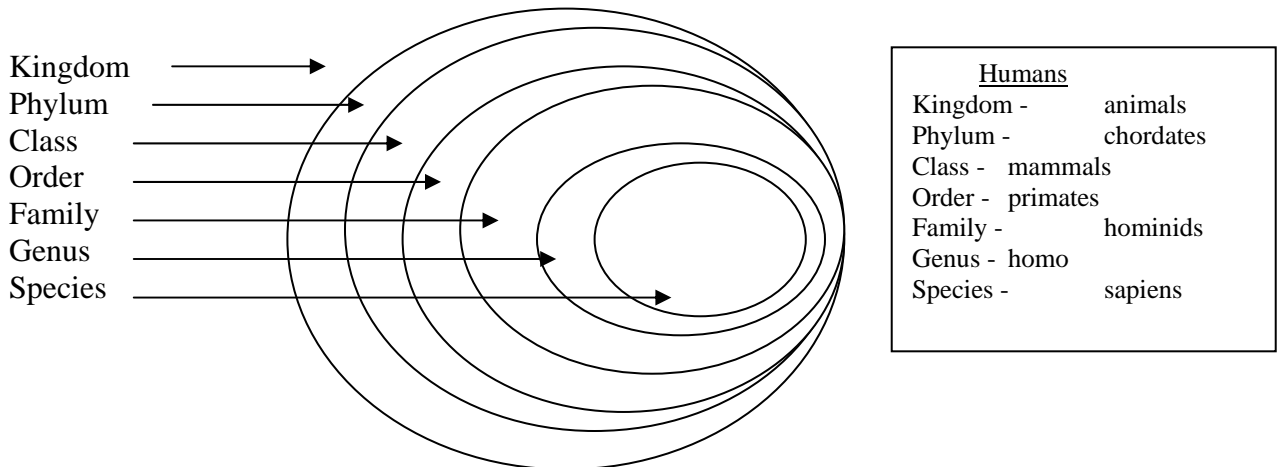
Objective 2 Taxonomy

1. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.

Classification – grouping objects according to their characteristics

Taxonomy – the branch of biology that names and groups organisms according to their characteristics and evolutionary history

King--Phillip--Came--Over--For--Good--Soup

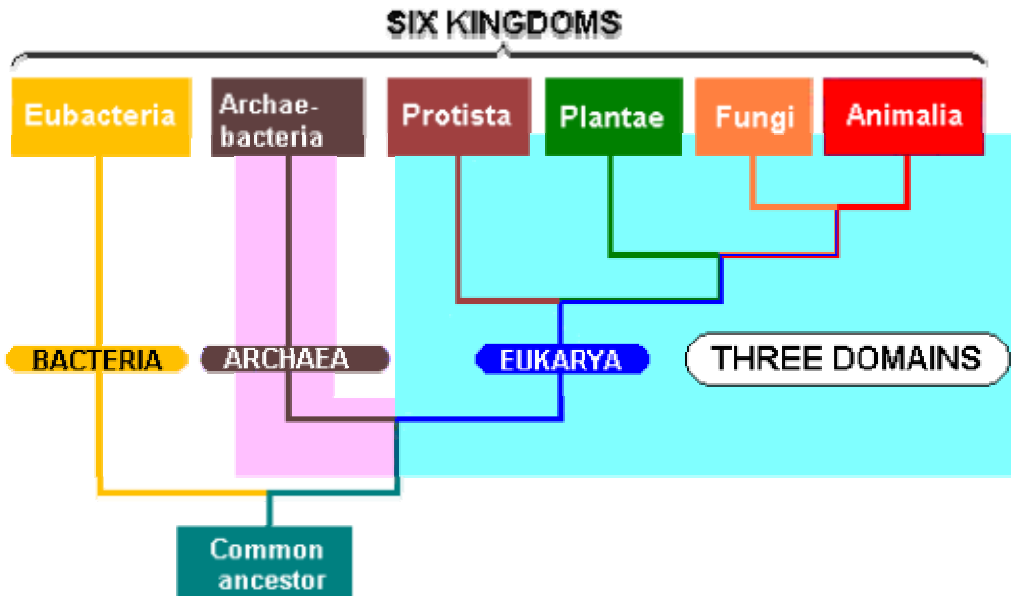


Binomial nomenclature – “2 name system” uses the genus and the species to identify an organism. (homo sapien)

Modern taxonomists now classify organisms according to their phylogeny, or evolutionary history.

This has become a branch of biology called systematics and uses the following information

1. Fossil record
2. Morphology
3. Embryological patterns of development
4. Chromosomes and macromolecules (dna and proteins)
5. Cladistics is the classification of organisms because of a shared derived characteristic (such as feathers) that is thought to only have evolved in one group from a common ancestor



6 Kingdoms of Life

Kingdom	Cell Type	Number of Cells	Movement	Food	Example
Archaeobacteria	Prokaryotic	Single celled	Some Motile (move)	Get energy by breaking down chemicals in their environment.	bacteria
Eubacteria	Prokaryotic	Single-celled	Some Motile	Some Autotrophic (make food); Some Heterotrophic (eat)	blue-green algae
Protista	Eukaryotic	Single-celled & Multicelled	Some Motile	Some Autotrophic; Some Heterotrophic	ameba paramecium euglena algae
Plantae	Eukaryotic	Single-celled & Multicelled	Sessile (do not move)	Autotrophic	mushrooms molds & mildews yeast (unicellular)
Fungi	Eukaryotic	Multicelled	Sessile	Feed on dead and decaying organisms. Heterotrophic	moss ferns flowering plants bushes trees
Animalia	Eukaryotic	Multicelled	Motile	Heterotrophic	insects jellyfish, hydra crabs fish birds lions,tigers,bears (oh my !)

Characteristics of Archaeobacteria and Eubacteria

Archaeobacteria:

These prokaryotic organisms are more closely related to bacteria (Eubacteria) than to Eukaryotes. However, they are fundamentally different from bacteria in their membrane lipids, cell walls and rRNA nucleotide sequence. The group includes organisms that are able to survive in extreme environments where most other organisms cannot exist. Methanogens are able to live in anaerobic conditions and can convert carbon dioxide to methane (sometimes called “swamp gas”). They are found in such diverse habitats as swamps, hot springs, deep-sea vent communities, and even in sewage treatment plants. Halophiles are organisms that thrive in concentrated salt environments. These organisms have been found living in the Dead Sea. Thermoacidophiles live in hot, acidic environments such as the hot sulfur springs and geysers of Yellowstone National Park. *Most of Archaea reproduce by binary fission.*

Eubacteria:

This group of prokaryotic organisms is enclosed in a rigid cell wall, (made of peptidoglycan), that protect them from rupture in different osmotic environments. These walls give them the characteristic shapes that are used for their classification. The most common bacterial shapes are

- rod-like (bacillus),
- round (coccus) and
- corkscrew (spirillum).

Some bacteria have flagella used for locomotion, a few pathogenic bacteria have slime capsules used to protect themselves from the internal hostile environments of their hosts, and others have fuzzy hair-like projections called pili used to attach themselves to other organisms. Many pathogenic bacteria cause diseases, such as tuberculosis, anthrax, tetanus, food poisoning and strep throat. Many bacteria are able to weather harsh conditions by forming hibernating structures called endospores, which are able to survive until favorable growth conditions return. Most bacteria reproduce by binary fission, however some reproduce by conjugation. Some unique examples of bacteria include the primitive cyanobacteria (formerly, blue-green algae) and nitrogen-fixing bacteria. Cyanobacteria are photosynthetic and live in aquatic environments. Most live in chain-like colonies. A good example is *Oscillatoria*, the pond scum that plugs up polluted waterways and intake vents of hydroelectric plants. Nitrogen-fixing bacteria live in nodules on the roots of legumes (i.e. alfalfa, soybeans), capture nitrogen gas from the air, and combine it with hydrogen to form plant nutrients (nitrates) in the soil. Many soil bacteria decompose organic matter and add it to the soil.

Characteristics of Protists

Kingdom Protista contains eukaryotic unicellular organisms. The kingdom includes protozoans, unicellular algae and slime molds. Protists are found in moist areas and most aquatic environments. Protists obtain food in a variety of ways including photosynthesis, ingestion and absorption. Most protozoans reproduce by binary fission, however, some also reproduce by conjugation.

Protozoans are animal-like protists with no cell walls that ingest their food. Protozoans are classified by their locomotive structures. Sarcodines, like *Amoeba*, have *pseudopods*. These “false feet” are projections of cytoplasm that allow the organism to flow in any direction and to engulf their food. Most sarcodines are found in fresh water habitats, however, some are pathogenic and can cause dysentery. Some protozoans are symbiotic and live in the intestines of their hosts. Without the protozoans that live in their guts, termites would not be able to digest the cellulose in wood. Ciliates, like *Paramecium*, have *tiny hairs called cilia* that they use for locomotion. Zooflagellates have *whip-like tails for locomotion*. Most are free living, however, some are pathogenic. *Trypanosoma*, which is passed from host to host by the tse-tse fly, causes African sleeping sickness. Sporozoans have *no locomotion structures* and must live in a host. *Plasmodium*, which is passed from host to host by a mosquito, caused malaria.

Plant-like protists and unicellular algae are found in most aquatic environments. They are the basic producers of all aquatic food chains. *Algae are classified by the color of their photosynthetic pigments*: green algae (Chlorophyta), dinoflagellates (Pyrrophyta, fire algae that cause “red tides”), diatoms (Chrysophyta, golden algae), and euglenoids (Euglenophyta, animal-like & plant-like). Some algae are used as food, as smoothing agents in toothpaste and ice cream, and the agar used as bacterial media. The layers of silica sand (diatomaceous earth), which comes from silicon shells of golden algae, are processed to make computer chips, glass, and the media for dialysis machine filters and swimming pool filters.

Fungus-like protists include slime molds and water molds. Slime molds have an ameba-like phase for eating and locomotion; and a fungus-like phase, when it becomes immobile and reproduces with spores. Most water molds are aquatic habitat decomposers; however, some are parasites of aquatic organisms.

Characteristics of Fungi

Most fungi have a body composed of an interwoven mass of threads (mycelium). The individual threads (hyphae) are long filamentous, multinucleated cells. At times cells link together into long tubes with porous partitions called septa. These hyphae dissolve their way through their food and transport the nutrients through the filamentous tubes to the mycelium. When enough reserve energy is stored, the fungus may produce fruiting bodies with spores. Fungi can also reproduce sexually by producing special haploid cells at the end of special hyphae that will fuse with the haploid cell of another fungus. The resulting diploid zygote will develop into a fungus with combined genetic qualities of the two donor fungi.

Fungi are classified according to the shape and color of their fruiting bodies and spore containers.

Zygoter fungi (Zygomycota) reproduce by forming diploid zygospores. These developing spores produce hyphae that dissolve their way through their food. This group of fungi contains the common molds. Their colorful asexual spore cases (sporangia) produce spores (sporangiospores) that give each mold species their distinctive color. Examples are soft fruit rot and bread mold.

Sac fungi (Ascomycota) reproduce by forming sexual spores within sacs called asci (singular = ascus). Sac fungi include colorful molds, morels, truffles and

yeast. Some members of this group are responsible for Dutch Elm disease and chestnut blight, while others are used for fermentation by the baking and brewing industries.

Club fungi (Basidiomycota) produce club-shaped reproductive structures (basidia) containing sexual spores (basidiospores). Common club fungi are mushrooms, puffballs, shelf fungi, bracket fungi, as well as parasitic rusts and smuts that attack grain crops. Germinating basidiospores form hyphae of two mating types, which fuse to produce underground mycelium. The filaments grow outward in a circular pattern and send up new mushrooms in a ring-like pattern called a fairy ring.

The imperfect fungi (Deuteromycota) have no means of sexual reproduction. Some produce useful antibiotics (*Penicillium* makes penicillin), while some are used to flavor cheese (gorgonzola, bluecheese, etc). Others cause diseases such as ringworm and athlete's foot.

Some fungi live in symbiotic relationships with other organisms. Lichen is an association of fungi (sac fungi) with photosynthetic algae or cyanobacteria. The fungus provides a home and water, the algae provides the food. Lichen can live in extreme environments, including bare rock. Mycorrhizae are fungi (club or sac fungi) associated symbiotically with the roots of many plants. The fungal hyphae invade the root cells, digesting organic nutrients in the soil and pass them directly to the root cells. The plant provides sugar to the fungal cells

Characteristics of Plants

Plants are eukaryotic multicellular organisms. Their cells have cell walls. They obtain their food through photosynthesis. During photosynthesis, they convert water and carbon dioxide into sugar and release oxygen gas as a byproduct. They have an alternation of generation life cycle consisting of both a diploid sporophyte generation and a haploid gametophyte generation. Sporophytes develop from a zygote and produce haploid cells by meiosis. Gametophytes develop from a spore/seed and produces diploid cells by mitosis as it grows. Plants vary in complexity from simple multicellular algae and mosses to large complex conifers and flowering trees.

Multicellular algae lack true roots, stems, leaves and complex reproductive structures like flowers and cones. They shed their gametes directly into the water and have varied complex life cycles. Examples are green algae (Chlorophyta), like sea lettuce; red algae (Rhodophyta), like red tropical seaweed; and brown algae (Phaeophyta), like kelp and rockweed.

Bryophytes are nonvascular multicellular land plants that lack true roots, stems and leaves. They have root-like rhizoids that anchor the plant and absorb water. But since bryophytes are nonvascular, they are small and must pass all materials from cell to cell by diffusion. Examples of bryophytes are mosses and liverworts. These tiny plants thrive in temperate climates in moist shady environments.

Seedless vascular plants (all vascular = tracheophytes) include smaller divisions such as club mosses (Lycophyta) and horsetails (Sphenophytes), as well as, a large division of ferns (Pteridophytes). Ferns are the only seedless broadleaf plants. The sporophyte generation of these plants is large and produces asexual spores in sori, but the small gametophytes lack conducting vessels and require that their sperm swim through water to reach the egg.

Gymnosperms include cycads, ginkos and conifers. Conifers (pines, firs, spruces, hemlocks, junipers, cedars and cypresses) are adapted to dry, cold climates. This is due to their thick evergreen needle leaves that prevent evaporation and the production of “antifreeze” in their sap to allow transport of nutrients in sub-freezing temperatures. Gymnosperms produce seeds in cones or cone-like structures. Separate pollen cones produce pollen with sperms that must float to the seed cones to fertilize the eggs.

Angiosperms are the flowering plants. They are successful because: (1) their reproductive structures (stamen and pistils) are located within flowers for protection; (2) fertilization takes place within the plant’s ovary and their seeds develop within fruits that attract animals and entice them to disperse seeds; and, (3) their broad leaves increase the amount of sunlight for photosynthesis in warm moist climates. Most temperate angiosperms drop their leaves annually, during fall and winter and become dormant. However, many tropical angiosperms are evergreen and lose a few leaves year round. Angiosperms can be grouped into the monocots (most grasses, grains, palms) and dicots (most trees, shrubs, herbs)

Characteristics of Animal

Animals are complex eukaryotic organisms. Their multicellular bodies lack cell walls. Animals are heterotrophic and must ingest nutrients from the environment. Other animal characteristics include sexual reproduction, motility and rapid response to the environment. As animals increase in complexity, additional features may include distinct germ layers (ectoderm, mesoderm, endoderm), an internal body cavity, cephalization (has definite head and tail end), organ in systems, and complex nervous systems. Animals are subdivided into invertebrates (sponges, cnidarians, worms, mollusks, echinoderms and arthropods) and vertebrates (chordates including fish, amphibians, reptiles, birds and mammals).

Sponges (Porifera) are sessile as adults and lack true tissues and neurons. Their bodies are porous and have specialized cells to carry out body functions. They reproduce by asexual buds or sexually through fusion of sperm and eggs. Sponges are found in most aquatic environments.

Cnidarians, like hydra, jellyfish, anemones and coral, have true tissues; a nerve net to control contractile tissue and feeding; and, trailing tentacles with stinging cells to paralyze and capture prey. They have one body opening (mouth) that leads into an internal digestive sac. Cnidarians are found in all aquatic habitats, including abyssal hydrothermal vent communities.

The worms are divided into three major phyla: flatworms (Platyhelminthes), round worms (Nematoda), and segmented worms (Annelida). Flatworms include planarians, flukes and tapeworms. Most planarians are free living; the latter two phyla are parasites with complex life cycles than include several hosts. Roundworms include free-living groups (soil nematodes and vinegar eels) and parasitic groups (i.e. hookworms, heartworms and trichina). Annelida include free-living groups (earthworms and sandworms) and a parasitic group (leeches). Annelida are the most complex worms. They have a true body cavity with all body systems except respiratory and skeletal. Most segmented worms (and flatworms) are hermaphroditic.

Arthropods are animals with exoskeletons of chitin and jointed legs. Major phyla

include: millipedes (Chilopoda); centipedes (Diplopoda); insects, like grasshoppers, butterflies, bees termites, beetles, and dragonflies (Insecta); crustacean, like crabs, lobsters, crayfish and shrimp (Crustacea); and arachnids, like spiders, scorpions, ticks and mites (Arachnida). Arthropods are the largest group of animals and they are found in all terrestrial and aquatic environments.

Mollusks have a soft body, modified muscular foot, a mantle cavity with gills, and most have a shell. Mollusks are grouped most often by their shell and foot modifications. Major phyla include filter feeding bivalves, like clams and mussels (Bivalvia); mollusks that crawl on their stomachs and scrape food with a radula, like snails and slugs (Gastropoda); predatory mollusks with a head, eyes and tentacles, like the octopus and squid (Cephalopoda); and, the primitive chitons that have shells with 8 overlapping plates.

Echinoderms are spiny-skinned animals with an internal skeleton of calcium plates. They have a water vascular system to operate their tube feet, which are used for locomotion and feeding. These exclusively marine, radially symmetrical, organisms include starfish (Asteroidea), sand dollars (Echinoidea), brittle stars (Ophiuroidea), sea cucumbers (Holothuroidea) and sea lilies (Crinoidea).

Chordates include the most advanced animals on earth, the vertebrates (subphylum Vertebrata), which includes fish [supra class Pisces includes jawless fish, like lampreys (Agnatha), cartilaginous fish like sharks and rays (Chondrichthyes) and bony fish like perch and bass (Osteichthyes)], amphibians like frogs and toads (Amphibia), reptiles like lizards and snakes (Reptilia), birds like hawks and songbirds (Aves) and mammals like dogs and humans (Mammalia). Three invertebrate chordate subphyla also exist: the tunicates (Urochordata), lancelets (Cephalochordata) and acorn worms (Hemichordata). All chordates have three common characteristics at some stage of their development: a notochord, paired pharyngeal gill slits and a dorsal nerve cord. In vertebrates, the first two are embryonic and develop into a backbone and respiratory organ, respectively. Vertebrates have internal skeletons of cartilage or bone, paired appendages, and a large complex brain. All chordates, except birds and mammals, are cold blooded. The highly evolved mammals feature internal fertilization and internal development and nurse their young with mammary glands that produce milk.