

Kingdom	Monerans (Bacteria)	Protists
Cellular Features	<ul style="list-style-type: none"> - <u>Prokaryotic</u> – lack nuclei and membrane organelles - <u>External Cell Wall</u> of <u>peptidoglycan</u> - <u>Gram Positive</u> = One cell wall layer of phospholipid bilayer and peptidoglycan - <u>Gram Negative</u> = Two layers of phospholipid bi-layer with peptidoglycan sandwiched in between - Motility - Flagella of prokaryotes made of <u>flagellin</u> protein instead of tubulin as in eukaryotic cells. 	<ul style="list-style-type: none"> - Unicellular, Colonial, or Multicellular Eukaryotes - May have given rise to plants, fungi, animals - Animal-like <u>protozoa</u> are heterotrophic, some with flagella made of <u>tubulin</u> - Plant-like protozoa are autotrophic with chlorophyll and accessory pigments for PS - Fungi-like protists have spore-bearing filaments
Reproductive Life Cycle and Genetic Exchange Mechanisms	<ul style="list-style-type: none"> - Circular DNA in nucleoid region - <u>Plasmid</u> DNA with helpful genes such as antibiotic resistance - Asexual reproduction = <u>Binary Fission</u> (DNA replication with cytokinesis) - Sexual reproduction = <u>Conjugation</u> involving plasmid exchange with a sex pili - <u>Transformation</u> = Use of endocytosis to take up foreign DNA from environment - <u>Transduction</u> = use of viral vectors to bring in foreign DNA from other bacteria - Endospore Formation = involves copying of DNA and creating a hard exterior wall to store DNA. Can withstand high stress and temperatures. Spores are spread and germinate into new bacterial cultures when conditions are favorable. 	<ul style="list-style-type: none"> Protozoa – - Use mitosis to asexually reproduce - Can exchange micronuclei with other protists (similar to conjugation) - Some form gametes in sexual reproduction Plant-like Protists - - Form gametes of varying sizes - <u>isogamous, anisogamous, oogamous</u> - Asexually reproduce by mitosis Fungi-like Protists - - Haploid spores created in meiosis within <u>sporangium</u>
Major Subgroups or phyla with features and adaptations	<p>Archaeobacteria Domain</p> <ul style="list-style-type: none"> - <u>Methanogens</u>: anaerobic and heterotrophic; produce methane gas - <u>Halophiles</u>: Live in high salt env't - <u>Thermoacidophiles</u>: live in hot and acidic env't <p>Eubacteria Domain</p> <ul style="list-style-type: none"> - <u>Cyanobacteria</u>: Photosynthetic, release oxygen, important in creating oxygen atmosphere in Earth's history - <u>Chemosynthetic bacteria</u>: use chemical energy (instead of light) to fix CO₂ into sugars - <u>Nitrogen Fixing bacteria</u>: Changes nitrogen (N₂) gas into a form of Nitrogen (ammonia, ammonium) that organisms can use - <u>Spirochetes</u>: coiled bacteria 	<p>Protozoa (Animal-like)</p> <ul style="list-style-type: none"> - <u>Amoebas</u>: have pseudopods - <u>Foraminiferans</u>: ray feet, Calcium Carbonate Shells - <u>Zooflagellates</u> – flagellated and can cause disease (like giardia) - <u>Sporozoa</u> – parasitic, with special apex on cells to invade host - <u>Ciliates</u> – have cilia, with contractile vacuoles for water balance, often with micro and macronuclei <p>Plant-like Protists</p> <ul style="list-style-type: none"> - <u>Euglena</u>: with eyespot to detect light for PS, flagellated, pellicle exterior - <u>Dinoflagellates</u> – produce red-tide with toxins, have 2 spinning flagella - <u>Golden Algae</u>: Yellow and brown pigments for PS - <u>Diatoms</u>: Glass-like - <u>Green Algae</u>: Chl A for PS - <u>Brown Algae</u>: Giant Kelp – Multicellular - <u>Red Algae</u>: Phycobillin red pigment <p>Fungi-like Protists</p> <ul style="list-style-type: none"> - <u>Cellular Slime Molds</u>: aggregated amoebas dries to form fruiting body - <u>Plasmidial Slime Molds</u>: Feeding mass of multinucleated, unicellular plasmodium - <u>Water molds</u>: coenocytic filaments; most like fungi

Kingdom	Fungi	Plants
Cellular Features	<ul style="list-style-type: none"> - Eukaryotic Heterotrophs - Often Saprobes, parasitic, or have mutualistic relationships - Predominant stage is haploid filaments or mycelium - Some hyphae filaments are <u>coenocytic</u> (no septa or cross walls) - Cell Wall made of <u>chitin</u>, not cellulose or peptidoglycan 	<ul style="list-style-type: none"> - Eukaryotic Autotrophs - Cell Wall of <u>Cellulose</u> - Chlorophyll a and accessory pigments for PS - Multicellular - Cuticle to prevent water loss - Vascular system for water transport in most
Reproductive Life Cycle and Genetic Exchange Mechanisms	<p>Asexual Reproduction:</p> <ul style="list-style-type: none"> - Asexual spores formed in sporangia or conidia fruiting bodies - <u>Budding</u> of hyphae - <u>Fragmentation</u> of mycelium <p>Sexual Reproduction:</p> <ul style="list-style-type: none"> - <u>plasmogamy</u> (two haploid spores can join cytoplasm but retain separate nuclei) - <u>Karyogamy</u> (two haploid nuclei of different filaments can join into a diploid nuclei) - <u>Meiosis</u> restores haploid conditions by producing haploid spores 	<p><u>Bryophytes:</u></p> <ul style="list-style-type: none"> - Sporophyte never leaves large, dominant gametophyte. - Sperm must swim to egg in <u>archegonia</u> <p><u>Pteridophytes:</u></p> <ul style="list-style-type: none"> - Sperm swim to egg in <u>archegonia</u> - Heart shaped, small haploid gametophyte that large, diploid sporophyte grows out from after fertilization <p><u>Gymnosperm:</u></p> <ul style="list-style-type: none"> - Pollen from male cones fertilize ovule within female cones - Fertilized seed is "naked" on modified leaves called <u>sporophyll</u> <p><u>Angiosperm:</u></p> <ul style="list-style-type: none"> - Flower structure used for sexual reproduction - Pollen contain sperm - Ovule contain egg - <u>Double fertilization</u> process occurs within ovule – One sperm fertilizes the egg to create a <u>zygote</u>; the other sperm fertilizes the two haploid polar nuclei to produce a triploid <u>endospore</u> used as a food source for the embryo
Major Subgroups or Phyla with features and adaptations	<p><u>Zygomycota: (Bread Mold)</u></p> <ul style="list-style-type: none"> - coenocytic hyphae filaments - Haploid zygospores germinate into haploid filaments <p><u>Ascomycota: (yeast, mildew)</u></p> <ul style="list-style-type: none"> - hyphae filaments with septa - haploid ascospores made in ascus - Ascocarp is the fruiting structure that holds the ascus <p><u>Basidiomycota: (Mushroom)</u></p> <ul style="list-style-type: none"> - hyphae filaments with septa - haploid basidiospores formed within basidia (gills) in a fruiting body called basidiocarp <p><u>Deuteromycota:</u></p> <ul style="list-style-type: none"> - no sexual life cycle <p><u>Lichens:</u></p> <ul style="list-style-type: none"> - mutualistic relationship between fungi and algae <p><u>Mycorrhizae:</u></p> <ul style="list-style-type: none"> - mutualistic relationship between fungi and plant root. 	<p>Bryophytes: (moss)</p> <ul style="list-style-type: none"> - Nonvascular - Large gametophyte, small sporophyte - Sporangia produce haploid spores that germinate into gametophyte <p>Pteridophytes: (Ferns, horsetails, clubmosses)</p> <ul style="list-style-type: none"> - Vascular - Smaller heart-shaped gametophyte with dominant sporophyte generation - Sporangia called <u>sori</u> in ferns and <u>strobili</u> in horsetails and club mosses <p>Gymnosperms: (Pine trees, conifers)</p> <ul style="list-style-type: none"> - Naked seed, Vascular - Two types of Sporangia: <ul style="list-style-type: none"> <u>Megasporangia</u> (ovulate cone) <u>Microsporangia</u> (male cone) - Sporophyll = specialized leaf that carries seed - Sporophyte generation dominant <p>Angiosperms: (Flowering plants, enclosed seed within fruit (mature ovary))</p> <ul style="list-style-type: none"> - Vascular - Sporophyte generation dominant - Megasporangia within female ovule - Microsporangia within anther

Comparison of the Major Animal Phyla

Common Name	Sponges	Hydra, Anemones	Flatworms	Roundworms	Segmented Worms
Phylum	Porifera	Cnidaria	Platyhelminthes	Nematoda	Annelida
Level of Body Organization	<u>Parazoa</u>	<u>Eumatozoa</u>	<u>Eumatozoa</u>	<u>Eumatozoa</u>	<u>Eumatozoa Protostome</u>
Germ Layers	None	2	3	3	3
Symmetry	<u>Asymmetric</u>	<u>Radial</u>	<u>Bilateral</u>	<u>Bilateral</u>	<u>Bilateral</u>
Cephalization	None	None	Yes	Yes	Yes
Body Cavity?	None	None	None	<u>Pseudocoelomate</u>	<u>Coelomate</u>
Segmentation?	None	None	None	None	Yes
Digestive System	<u>Amoebocyte</u> Cells Distributes nutrients from food to other cells	- One opening for mouth and anus; - incomplete digestive tract - <u>Gastrovascular</u> cavity	- Incomplete digestive tract - one opening <u>Gastrovascular</u> cavity - Mouth called <u>Pharynx</u> - Generally no specialization or compartments in digestive system	- Complete digestive tract -2 openings - Nutrients transported in <u>pseudocoelom</u> liquid	- Complete digestive tract -2 openings - Diversified sections: crop, gizzard, intestines (specialization of digestive tract)
Circulatory System	None	None	None	None	Closed system (blood enclosed in vessels)
Respiratory System	-No respiratory organ -Direct diffusion through cells	Direct diffusion through cells	Direct diffusion through cells	Diffusion through skin	Diffusion through skin
Excretory System (fluid regulation)	- No organ - Direct diffusion through cells	Waste excreted from mouth	<u>Flame cells</u> which form ducts release fluid to outside	Ducts excrete waste outside of body	<u>Metanephridia</u> tubes removes waste from blood and coelomic fluid
Nervous System	None	<u>Nerve net</u> – No centralized brain	- <u>Ganglia</u> : cluster of nerve cells at the "head" region to detect stimulus - <u>Ventral nerve cords</u> extend along body from ganglia	<u>Ganglia</u> and <u>nerve cords</u>	1 pair of <u>nerve cords</u> run length-wise <u>Cerebral ganglia</u> in head region
Reproduction	- Gametes released in water for sexual reproduction - Asexual budding can occur	- Sexual reproduction in <u>medusa</u> stage, where egg and sperm are released and fertilized in water - Asexual reproduction can occur in <u>polyp</u> stage by budding	- Asexual reproduction by regeneration of parts - Sexual reproduction by copulation between two hermaphrodites	- Separate sexes exist for sexual reproduction - Fertilization occurs internally - Fertilized eggs are deposited externally	- Sexual reproduction by cross fertilization between two hermaphrodites
Support, skeletal system	<u>Spicules</u> (bony spikes throughout sponge)	None	None	<u>Cuticle exoskeleton</u> on skin	None

Comparison of the Major Animal Phyla

Common Name	Insects, Arachnids, Crustaceans	Snails, Clams, Squid	Sea Stars, Sea Urchins	Vertebrates (birds, fish, mammals, amphibians, reptiles, humans)
Phylum	Arthropoda	Molluska	Echinodermata	Chordata
Level of Body Organization	Eumatozoa Protostome	Eumatozoa Protostome	Eumatozoa Deuterostome	Eumatozoa Deuterostome
Germ Layers	3	3	3	3
Symmetry	Bilateral	Bilateral	Radial Adults Bilateral Larvae	Bilateral
Cephalization	Yes	Yes	No	Yes
Body Cavity?	Coelomate	Coelomate	Coelomate	Coelomate
Segmentation?	Yes	No	No	No
Digestive System	- Complete digestive tract - Has Food breakdown and food absorption compartments	- Gills help feed clams - Radula (tongue) and complete digestive tract in snails - Beak and complete digestive tract in squid	- External digestion (digestive enzymes released from digestive glands outside of the body) - Small but complete digestive tract with mouth on the bottom of central disk and anus on top of central disk	Complete digestive tract Diversified tract, with mouth, small and large intestines Some have specialized features such as crops and gizzards
Circulatory System	Open system – no vessels Hemolymph fluid (blood and coelomic fluid mixed)	- Mostly open system - Closed system with heart and vessels in squid (cephalopods only)–	** Information not given in text or insignificant	Closed circulatory system with vessels, veins, and multi-chambered heart
Respiratory System	Diffusion by gills or tracheal tubes in insects	- Gills in bivalves (clams) and cephalopods (squid) - Diffusion through lining in mantle in gastropods (snails)	Small gills	- Lungs for terrestrial organisms - Gills for aquatic organisms
Excretory System (fluid regulation)	Malpighian tubes (outpocket of digestive tract)	Nephridium – small kidney like organ to filter blood and coelomic fluid	** Information not given in text or insignificant	Nephron system in kidney organ
Nervous System	Well developed system of eyes, olfactory receptors for smell, antennae for touch and feel, small brain	Cephalopods with well developed nervous system and complex brain	Radial Nerve system ** Information not given in text or insignificant	Well developed with brain, spinal cord, peripheral and central nervous systems
Reproduction	- Separate sexes - Sexual reproduction through internal fertilization	- Separate sexes (most) - Some hermaphrodites - Use sexual reproduction and internal fertilization	- Sexual reproduction, with males and females releasing gametes into water	- Sexual reproduction with internal fertilization
Support, skeletal system	Exoskeleton made of protein and chitin	Calcium Carbonate Shells - Cephalopods have “pen” = internal shell or missing shell - Gastropods have one shell - Bivalves have two shells	Waternvascular system: network of water filled tubes for support and movement	Bony skeleton

