

UNIT 5. BIOLOGICAL DIVERSITY**Section 1: Three Domain Survey****Domain Bacteria**

- prokaryotes: bacteria, spirochetes, cyanobacteria (autotrophs)
 - formerly included in Monera

Domain Archaea

- extremophiles: thermophiles, halophiles, methanogens
 - formerly included in Monera

Domain Eukarya

- “simple” Eukaryotes: unicellular eukaryotes
 - formerly known as Protists
 - algae, euglenozoans, dinoflagellates, amoebozoans, ciliates, diatoms
- Fungi: chitin cell wall, heterotrophs
- Plants: cellulose cell wall, photosynthetic
 - eukaryotes
 - bryophytes (mosses): seedless non-vascular, dominant gametophyte
 - ferns: seedless vascular, dominant sporophyte, free-living gametophyte
 - gymnosperm (conifers): pollen, naked seeds, vascular, reduced dependent gametophyte
 - angiosperm (flowering): pollen, flowers, fruit, seeds, reduced dependent gametophyte, monocot vs. dicot
- Animals
 - porifera
 - sponges:
 - no true tissues
 - radials
 - cnidaria (jellyfish, hydra, corals):
 - gastrovascular cavity
 - bilaterals
 - protostome development (mouth 1st)
 - flatworms: acoelomates
 - annelids (segmented worms): coelomates
 - mollusks (snails, clams, squid, octopus): coelomates

- brachiopods: coelomates
- arthropods (insects, arachnids, crustaceans): coelomates
- nematodes (round worms): pseudocoelomates
- deuterostomes development (mouth 2nd)
 - invertebrates
 - echinoderms (sea stars, sea urchins): coelomates
 - vertebrates: coelomates

Section 2: Five Kingdom Survey

Monera

- no longer considered valid
- prokaryotes

Protists

- eukaryotes

Fungi

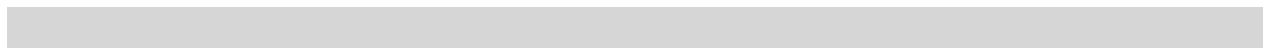
- eukaryotes

Plants

- eukaryotes

Animals

- eukaryotes



UNIT 6. PLANT FORM & FUNCTION**Section 1: Plant Structure & Function****Plant Tissues**

- ground tissues: parenchyma, collenchyma, sclerenchyma
- dermal tissues: epidermis, cuticle
- vascular tissue
 - xylem
 - tracheids, vessel elements, cells interconnected through pits
 - conduction of water & minerals, transpirational pull
 - dead at functional maturity
 - phloem
 - sieve tubes interconnected through pores/sieve plates, companion cells connected to sieve tubes through plasmodesmata giving physiological support
 - conduction of sugars, bulk flow, source to sink flow
 - living at functional maturity; loss of nuclei, ribosomes & central vacuole

Plant Growth

- meristem growth
 - primary growth: vertical growth
 - apical shoot
 - apical root: root cap, zone of cell division, zone of elongation, zone of maturation/differentiation
 - secondary growth: increase in girth
 - lateral meristems: vascular cambium (2° xylem & 2° phloem), cork cambium (periderm & bark)

Plant Structures

- root
 - epidermis, root hairs
 - cortex
 - endodermis, Casparian strip
 - stele (vascular cylinder), xylem, phloem
- leaf
 - cuticle

- upper palisade mesophyll (photosynthesis)
- lower spongy mesophyll (gas exchange), stomates, guard cells
- vascular bundle (vein), xylem, phloem

Plant Hormones

- auxin: promotes plant growth, cell elongation; apical dominance
- gibberellins: cell growth, fruit development; bigger grapes
- cytokinins: promote cell growth (cytokinesis); apical dominance
- ethylene: promote fruit ripening
- abscisic acid (ABA): maintains seed & bud dormancy
 - epidermis, root hairs

Section 2: Plant Reproduction

Alternation of Generation

- multicellular sporophyte (2n) —*meiosis*→ spores (1n) —*mitosis*→ multicellular gametophyte (1n) —*mitosis*→ gametes (1n) —*fertilization*→ multicellular sporophyte (2n)

Flowers & Seeds

- sepals, petals, anthers (pollen), pistil/carpel (egg)
- double fertilization:
 - zygote (2n): new plant
 - endosperm (3n): nutrition for new plant
- seed
 - embryo, seed coat, endosperm, cotyledons (seed leaves), hypocotyl (embryonic stem), radicle (embryonic root)

Section 3: Plant Response

Phototropism

- response to light
- auxin concentrates on shady side of plant, differential growth

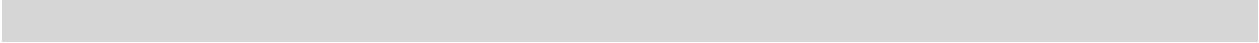
Gravitropism

- response to gravity
- auxin & gibberellin, starch statolith plastids

Thigmotropism

- response to touch

Photoperiodism

- response to relative length of daylight & darkness, circadian rhythm
 - phytochrome protein, P_r , P_{fr} , florigen
 - daylight: P_r + red light \rightarrow P_{fr}
 - darkness: P_{fr} + far-red light \rightarrow P_r
 - night length resets circadian-rhythm clock
 - long-day plants flower in longer days / shorter nights
short-day plants flower in shorter days / longer nights
day-neutral are not triggered by daylight changes
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UNIT 7. ANIMAL FORM & FUNCTION**Section 1: Animal Structure & Function****Homeostasis**

- thermoregulation

Respiratory System

- gill function: counter current exchange
- lung function: nose, pharynx, larynx, trachea, bronchi, bronchioles, alveoli, diaphragm
- CO₂ & O₂ diffusion across moist membranes, red blood cells,
 - O₂ transported by hemoglobin (iron)
 - CO₂ transported as dissolved bicarbonate
- regulation: monitor blood pH

Circulatory System

- open circulatory system (hemolymph)
closed circulatory system (blood), 2-, 3-, 4-chambered hearts, arteries, veins, capillaries
- heart function
 - atria, ventricles, valves, pulmonary circuit, systemic circuit, SA node, AV node, systole, diastole
- blood: RBC, WBC, platelets, plasma

Excretory System

- N waste: ammonia, urea, uric acid
- nephron function
 - glomerulus, Bowman's capsule, proximal tubule, loop of Henle, distal tubule, collecting duct, ureter, bladder, urethra
 - filtration, secretion, reabsorption
- osmoregulation: ADH (antidiuretic hormone), aldosterone

Digestive System

- mouth
 - salivary amylase, physical breakdown
- pharynx, epiglottis, esophagus, peristalsis
- stomach
 - gastric juices, HCl, pepsin, mucus
 - zymogen: pepsinogen
 - storage, disinfection, physical & chemical breakdown, controlled release

- small intestines
 - digestion & absorption: villi
 - duodenum: proteases, maltase, lactase, phosphatases
 - pancreas: trypsin, chymotrypsin, lipase, amylase
 - zymogens: trypsinogen chymotrypsin
- liver, gall bladder
 - bile (emulsify fats)
- large intestines
 - water absorption
 - E. coli symbiotic bacteria

Nervous System

- structure
 - CNS: brain, spinal cord
 - peripheral nervous system: sensory & motor neurons
 - somatic: skeletal muscle
 - autonomic
 - sympathetic: stimulate activities
 - parasympathetic: calming/slowing down effect, tranquil functions
 - reflex arc
- neuron function
 - cell body, dendrites, axon, synapse, myelin sheath, Schwann cells
 - polarized, resting potential, action potential, depolarization, repolarization, hyperpolarization, refractory period
 - K^+ , Na^+ , voltage-gated channels, Na-K pumps
 - synapse: Ca^{2+} gates, neurotransmitters, ion-gated channels
 - neuromuscular: acetylcholine, cholinesterase
 - CNS: epinephrine, dopamine, serotonin

Muscle System

- skeletal, smooth, cardiac
- muscle fiber function
 - sarcomere, sarcoplasm, sarcoplasmic reticulum, T-tubules, thin filaments (actin, troponin, tropomyosin), thick filaments (myosin)
 - sliding-filament model
 - ATP-myosin binding, Ca^{2+} release, Ca^{2+} -troponin binding, myosin-actin binding, actin filaments slide

Immune System

- Non-specific barriers
 - skin, anti-microbial proteins, gastric juices, symbiotic bacteria
- Non-specific patrol
 - phagocytes, complement proteins, inflammatory response (histamine, vasodilation, phagocytes)
- Specific immunity
 - lymphocytes, antigens, MHC (major histocompatibility complex), self vs. nonself
 - B cells: antibodies (immunoglobulins), plasma cells, memory cells
 - humoral response, attack circulating invaders, bone marrow
 - T cells: cytotoxic T cells (killer), helper T cells
 - cell-mediated response, attack infected or cancer cells
- Supplements
 - antibiotics, vaccines, passive immunity

Endocrine System

- homeostasis
 - blood sugar regulation, blood calcium regulation
 - negative feedback, positive feedback
- neurosecretory cells
 - hypothalamus, posterior pituitary (storage of ADH, oxytocin), anterior pituitary (release of TSH, ACTH, FSH, LH)
- ductless glands
 - pancreas: insulin, glucagons
 - adrenal: epinephrine, aldosterone
 - gonads: ovaries (estrogen, progesterone), testes (testosterone)
- hormones
 - steroid: transcription factors
 - protein: secondary messenger

Section 2: Animal Reproduction & Development**Anatomy**

- female: ovary, oviduct (fallopian tube), uterus, cervix, vagina, egg, corpus luteum
 - oogenesis
- male: testes (sperm production), epididymis (sperm maturation), vas deferens (sperm delivery), seminal vesicles (secretions), prostate gland (secretions), penis, sperm
 - spermatogenesis

Regulation

- female hormones: GnRH (hypothalamus), FSH (pituitary), estrogen (ovary), LH (pituitary), progesterone (corpus luteum),
 - ovulation

Development

- fertilization, cleavage, morula, blastula, gastrula, gastrulation, differentiation, organogenesis
 - ectoderm, mesoderm, endoderm, archenteron, blastopore
- regulation: egg cytoplasm (gray crescent in frogs), embryonic induction (dorsal lip in frogs), homeotic genes

Section 3: Animal Behavior**Types of Animal Behavior**

- instinct, FAP (sign stimulus), imprinting (critical period), learning, classical conditioning, operant conditioning (trial-and-error), habituation
- movement: kinesis (undirected change in speed), taxis (directed movement), migration
- foraging: herds, flocks, schools, packs
- social: agonistic, dominance/hierarchy, territoriality, altruistic (kin selection), cooperation, colonial

Communication

- chemical (pheromones), visual (displays), auditory, tactile

UNIT 8. ECOLOGY**Section 1: Population Ecology****Population growth & distribution**

- size, density, dispersal patterns (clumped, uniform, random), age structure, survivorship curves, reproductive tables
- limiting factors: density-dependent, density-independent
- growth: exponential growth, logistic growth, carrying capacity (K), r-selected, K-selected, population cycles

Section 2: Community Ecology**Interaction of populations**

- interspecific competition: (-/-) niche (competitive exclusion), resource partitioning, keystone species, dominant species
- predation: (+/-) predator, parasite, parasitoid, herbivore
- symbiosis: mutualism (+/+), commensalism (+/0), parasitism (+/-)
- coevolution: predator-prey adaptations, cryptic coloration, warning coloration, mimicry, Batesian mimicry (fooling) vs. Mullerian mimicry (warning), convergent evolution

Succession

- primary succession, pioneer species, climax community, secondary succession, fire climax

Section 3: Ecosystems**Biomes**

- tropical rain forest, savanna, temperate grassland, temperate deciduous forest, desert, taiga, tundra (permafrost), freshwater, marine

Trophic levels

- primary producers, primary consumers, secondary consumers, tertiary consumers, decomposers food chain, food web, ecological pyramids (energy, biomass, numbers), energy flow, nutrient recycling, eutrophication

Nutrient cycles

- carbon cycle, water cycle, nitrogen cycle, phosphorus cycle

Human Impact

- greenhouse effect (global warming), ozone depletion, acid rain, deforestation/loss of habitat & biodiversity/fragmented habitat, biomagnification, introduced species, over-exploitation, desertification