

### Phylogenies & History of Life

**PHYLOGENY:** hypothesis abt evolutionary relationships, built as trees

**Molecular Clocks:** estimates the absolute time of evolutionary change based on mutation rates and fossils (limited bc mut. rates vary)

**NOTE:** Show patterns of descent NOT levels of advancement and similarity does not always mean close relatedness

**Fossil Record:** shows macroevolutionary changes in history of life and reveals extinct species, transitional forms, and timing of major events

**Tree Parts:** Root, Node, Branch, Sister taxa

**Origin of Life:** earth started with little oxygen but lots of water vapor

**Sister Taxa:** two lineages that share a more recent common ancestor

processes could make simple cells in 4 stages (hypotheses)

**Basal taxon:** branch diverges out from all other ones

1) RNA (RNA as genetic material and a catalyst)

**Monophyletic (Clade):** ancestor + all descendants

2) Synthesis of macromolecules

**Paraphyletic:** ancestor + some descendants

3) Protocells (with lipid membranes)

**Polyphyletic:** distantly related without common ancestor

4) Abiotic Synthesis

**Homology:** similar by shared ancestry

**Analogy:** similar by convergent evolution

**Homoplasy:** similar not due to ancestry

**Orthologous Genes:** speciation, different species

**Paralogous Genes:** gene duplication, within species

### Viruses & Vaccines

**Viruses:** acellular infectious agents that exist between living and nonliving

**Viruses Classified By:** type of nucleic acid, single vs double stranded, RNA sense (+ or -), presence of envelope

**WE DON'T KNOW IF THEY ARE ALIVE**

**Retroviruses:** single stranded RNA genome that uses reverse transcription to copy its genome into DNA called PROVIRUS

**WHY NOT LIVING:** cannot keep homeostasis, cannot reproduce without host, does not grow or respond to stimuli on own

**Lysogenic:** dormancy without destruction

**Genome:** DNA or RNA (not both)

**Lytic:** immediate destruction

**Capsid:** protein coat that protects genome, built from capsomeres

**Capsid Shapes:** icosahedron (sphere), helical (rod), complex (bacteriophages)

**Envelope (optional):** lipid bilayer from host cell membrane, viral glycoproteins

**Bacteriophages:** infect bacteria, elongated head with DNA and protein tail, best understood of viruses

**How vaccines work:** mimics the process of antigen exposure in a safe way. antigen presenting cells take up antigens and present immune cells, T & B cells respond

### PLANTS (cont)

### PLANTS

Plant Form & Physiology Plant Organs •  
 Roots: anchor, absorb water/minerals, storage • Stems: support, transport •  
 Leaves: photosynthesis Tissue Types •  
 Dermal: protection (epidermis, cuticle) •  
 Ground: photosynthesis, storage, support o Parenchyma (metabolism) o Collenchyma (flexible support) o Sclerenchyma (rigid, lignin) • Vascular: o Xylem → water/minerals (dead cells) o Phloem → sugars (living cells)  
 Transport • Transpiration: water loss through stomata • Cohesion-tension theory: pulls water upward in xylem • Pressure-flow hypothesis: sugars move source → sink in phloem Stomata • Controlled by guard cells • Open for gas exchange, close to prevent water loss Plant Hormones • Auxin: elongation, phototropism • Gibberellin: growth, germination • Cytokinin: cell division, delays aging • Ethylene: fruit ripening • ABA: dormancy, stress response Seedless Plants General Traits • No seeds or pollen • Reproduce by spores • Require water for fertilization • Alternation of generations Bryophytes (Nonvascular) • Mosses, liverworts • No true roots/stems/leaves • Gametophyte-dominant • Small, moist habitats Seedless Vascular Plants • Ferns, horsetails • Have xylem & phloem • Sporophyte-dominant • Larger size Life Cycle • Sporophyte (2n) → spores • Gametophyte (n) → gametes • Fertilization → zygote → sporophyte Seed Plants Key Innovations • Seeds: protect embryo + food supply • Pollen: reproduction without water • Reduced gametophyte • Dominant sporophyte Gymnosperms • Naked seeds (cones) • Wind pollination • Conifers, cycads Angiosperms • Flowering plants • Seeds enclosed in fruit • Double fertilization o Zygote + endosperm Flower Parts • Sepals: protect • Petals: attract pollinators • Stamen: male • Carpel/Pistil: female Monocots vs Eudicots • Monocots: 1 cotyledon, parallel veins, flower parts in 3s • Eudicots: 2 cotyledons, net veins, flower parts in 4s/5s