

Tutorial 1: Overview, Life and Natural Selection

Evolution- changes in genetic structure of a population

- Explains the diversity of life

Adaptations- traits that help an organism survive in its current environment

Natural Selection- process by which a population becomes better adapted to its environment over time (differential reproduction/fitness)

Tutorial 2: Carbon and Life

Properties of Water: polar molecule, high surface tension, specific heat, heat of vaporization, electronegative, cohesion (stick together), adhesion (stick to other surfaces)

- Covalent bonds hold together hydrogen's and oxygen, hydrogen bond hold together molecules
- Ice is less dense than water

Metabolism- the set of chemical reactions that happen in living organisms to maintain life

Anabolism- combination of molecules

- Condensation/ Dehydration Synthesis- releases water

Catabolism- broken down

- Hydrolysis (digestion)- addition of water to breakdown polymers

Macromolecules

1. Carbohydrates (sugars)

- Used for energy storage (starch)
- Structural support (cellulose)
- Plays a role in information storage in nucleic acids (DNA and RNA)
- Monomer= Monosaccharide's (simple sugars)
- Disaccharides- anabolic reactions (water released)
- Polysaccharide- several thousand monomers (starches)
 - o Glycogen- sugar storage in animals
 - o Cellulose-plant cell walls, most abundant polymer
 - o Chitin- structural purposes

2. Lipids (fats)

- Hydrophobic
- Not polymers
- Energy storage, protection, insulation (fats)
 - o Saturated fats- no double bonds
 - o Unsaturated fats- double bonds
- Structure of cell membranes (phospholipids/ cholesterol)
 - o Phospholipids- hydrophilic head, hydrophobic tail

- Hormones/Steroids (estrogen/testosterone)
3. Proteins (amino acids)
 - Structural support, digestive enzymes, pigment, move muscles, transport oxygen
 - 20 commonly seen amino acids
 - Polypeptides- a polymer chain of amino acids
 4. Nucleic Acids (DNA and RNA)
 - Polymers of nucleotides
 - RNA- expresses genetic information, ribose, AUGC
 - DNA- carries genetic information, deoxyribose, ATGC

Tutorial 3: Antiquity of Life

Universe= 13.7 billion

Solar System= 4.55-4.56 billion

Earth= 4.5 billion

Life= 3.5 billion

Primitive Earth's Atmosphere

- Anaerobic- No oxygen (oxygen oxidizes substances= removing all the electrons)
- Highly reducing- gained electrons

Plate Tectonics- large plates move with respect to each other

Continental drift- the continents are constantly moving

Pangaea- super continent (180 million years ago)

- Evidence
 - o S. American and African continents fit together
 - o Fossils of unusual plants/animals on coastlines of S. American and Africa
 - o Fossils of tropical plants in Antarctica

Fossils

Precambrian—Paleozoic—Mesozoic—Cenozoic

1. Sedimentary Rock- (best source)
 - Relative Dating- farther down the older (not accurate age)
2. Radiometric Dating- using elements with radioactive isotopes that decay at known rates (less than 50,000 years)
 - o Half-life
3. Dendrochronology- one tree ring= one year (drought= narrower)

Tutorial 4: Prokaryotes I – Cellular and Genetic Organization

Prokaryote-

- o No membrane bound nuclei, small
 - o Coccus- spherical
 - o Bacillus- rod shaped
 - o Spirillum- helical
- o Divide quickly because of their small genome, simple morphologies, and because they reproduce via binary fission
- o Nucleoid= where DNA (plasmids) are located
- o Gene Transfer
 1. Transformation- acquire genes from surrounding environment
 2. Conjugation- attachment to each other (pilus, must have F Factor, F+)
 3. Transduction- phages/ viruses that infect bacteria

Eukaryote- membrane bound organelles and nuclei

Three major domains of life:

1. Bacteria
 - o Prokaryote
 - o Single celled or colonial
 - o Cell walls have peptidoglycan
 - o Genes lack introns (non-coding region of gene)
 - o Endospores- thick coated, resistant cells for harsh conditions
 - o Sporulation= formation of endospores
 - o Good Bacteria
 - o Aid Digestion, Bioremediation, make medicines, nitrogen fixation
2. Archaea (extremophiles)-
 - o Prokaryote
 - o Single celled or colonial
 - o Cell walls lack peptidoglycan
 - o Some genes have introns
3. Eukarya
 - o Eukaryotes
 - o Divide via mitosis/meiosis
 - o Complex cells
 - o Tubulin (vs flagella)

Tutorial 5: Prokaryotes II – Structure and Function

Prokaryotes:

- o Cells are encased in plasma membrane (keeps salt and liquids balanced)
- o Cell walls contain peptidoglycan
- o Capsule- additional layer outside of the cell wall