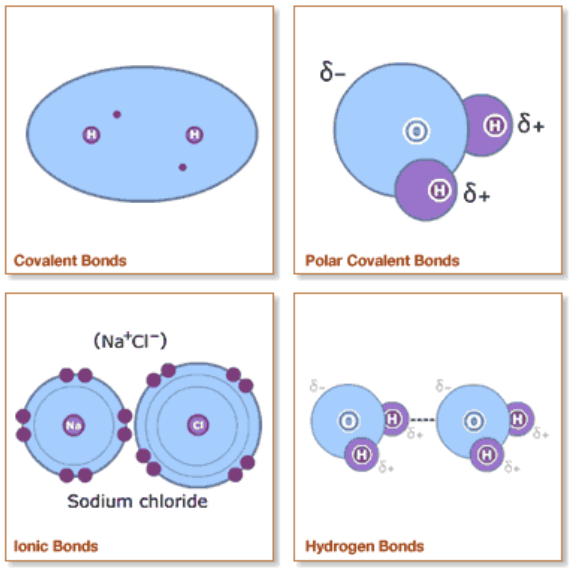
Study Guide: Fall Final Exam

HONORS BIOLOGY: UNITS 1-5

Directions: *The list below identifies topics, terms, and concepts that will be addressed on your Fall Final Exam. This list should help you focus your review. This is <u>not</u> a homework assignment you will turn into me.*

Chemical Bonds

- 3 types of bonds (Examples of each. Comparative strengths of bonds)
- Importance of electron configuration (**rule of 8**)

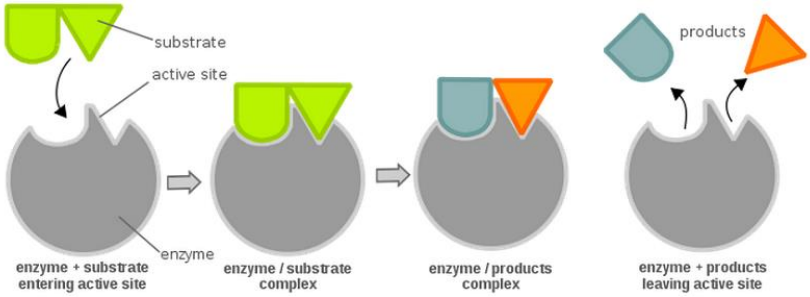


Enzymes

- Importance to living things
- Effects of enzymes on chemical reactions
- **Lock and key model** (Enzyme, Substrate, Active site)
- Importance of 3-demensional shape ("Structure determines function")

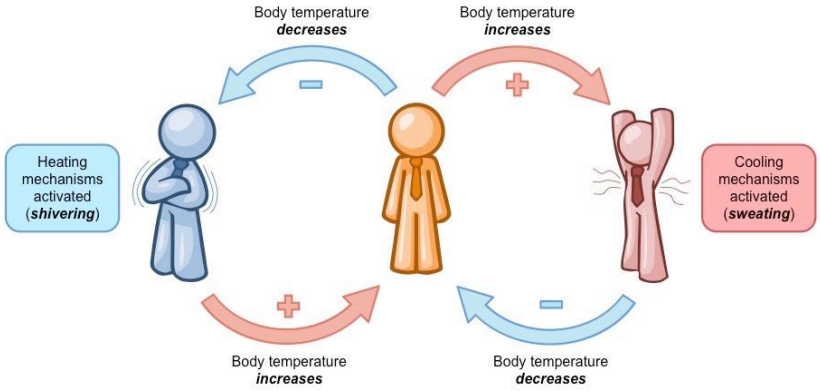
Organic Compounds

- Unique qualities of carbon
- 4 categories of carbon-based (organic) compounds
  - **Monomers** and **polymers** of each
  - Importance to living things
- **Dehydration synthesis** (examples)
- **Hydrolysis** (examples)
- **Metabolism, catabolism, anabolism**
- Compare and contrast **saturated** and **unsaturated fats**



Homeostasis

- Definition
- Examples of homeostasis
- **Negative feedback** systems (and positive feedback)



pH

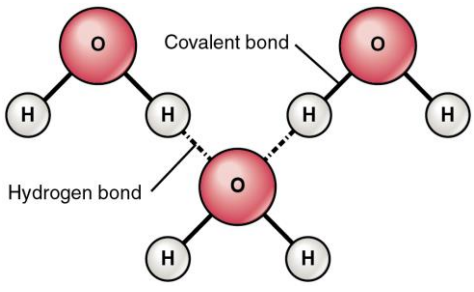
- pH scale (acid-neutral-base)

Scientific Method

- Steps of Scientific Method
- Controlled experiment (importance)
- Variables
  - **Dependent variables** (observed and measured)
  - **Independent variables** (manipulated)
  - **Controlled variables** (constants)

Data Analysis

- Interpreting graphs and data tables
- Interpreting experimental data and forming conclusions



Properties of Water

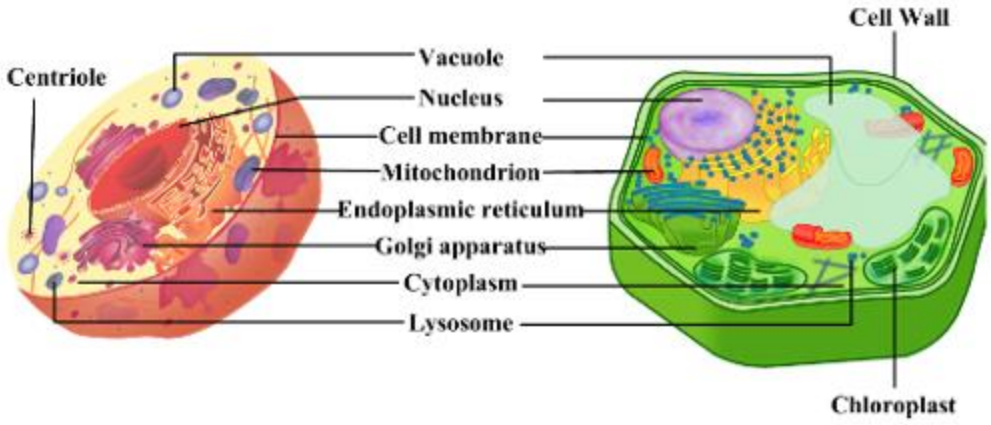
- Polarity of water molecule
- Adhesion
- Cohesion

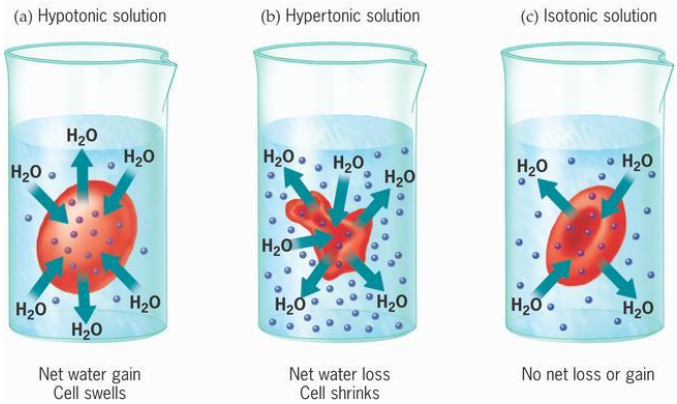
Chemistry

- Ions
- Atoms
- Elements
- Chemical compound
- Chemical reactions (Reactants and products)
- Solutions (Solute/solvent)
- Inorganic/organic compounds

Cell Structures and Organelles

- Identify cell structures/organelles and their function
  - **Nucleus**
  - **Nucleolus**
  - **Nuclear membrane**
  - **Cytoplasm**
  - **Cell membrane**
  - **Ribosomes**
  - **Rough ER**
  - **Smooth ER**
  - **Golgi apparatus**
  - **Lysosomes**
  - **Mitochondria**
  - **Chloroplasts**
  - **Vacuoles**
  - **Cytoskeleton**
  - **DNA/chromatin**
  - **Centrosomes/centrioles**
  - **Cell wall**
- Differences between plant and animal cells
- Pathway for production of a protein and releasing them from cell (organelles involved)





Cell Transport

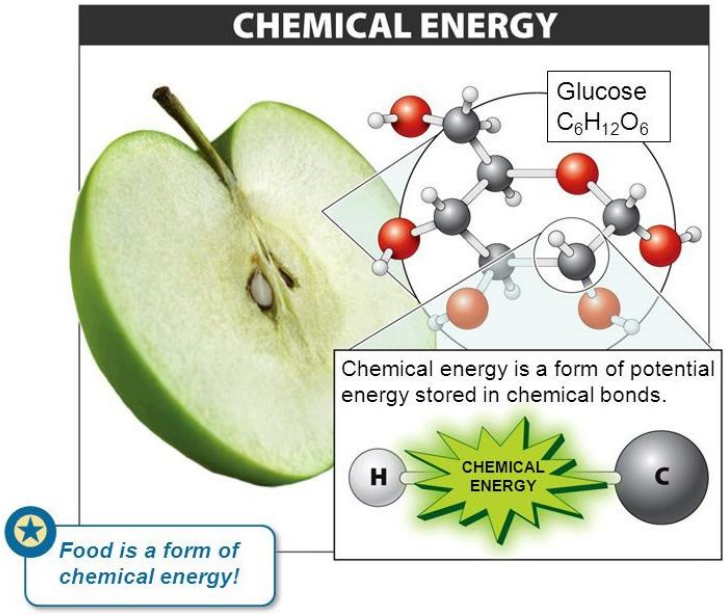
- **Active transport** (endocytosis, exocytosis)
- **Passive transport** (Diffusion and Osmosis, Facilitated diffusion)
- **Transport proteins**
- Concentration gradient (**Isotonic, Hypertonic, Hypotonic**)
- **Dynamic equilibrium**

Cell Theory

- **Prokaryotes** vs. **Eukaryotes**
- 3 parts of theory
- **Endosymbiotic theory**
- Importance of different organic compounds in the cell

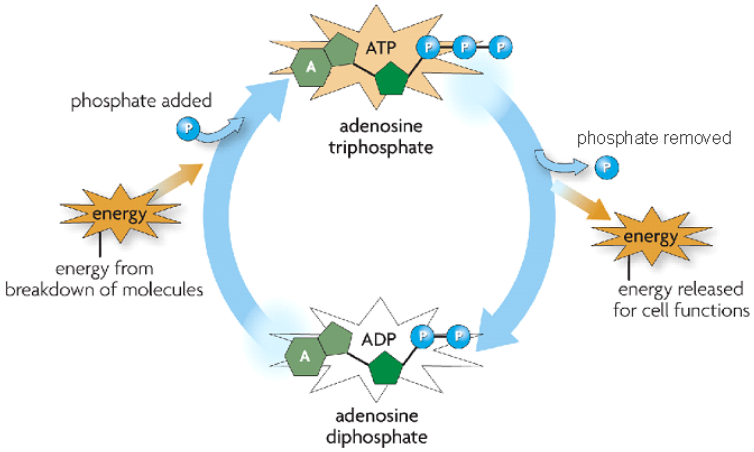
Energy

- What is energy?
- Forms of energy (**Kinetic** energy, **Potential** energy)
- Where is energy stored in molecules?
- **Law of Conservation of Energy** (examples of conversions of energy)



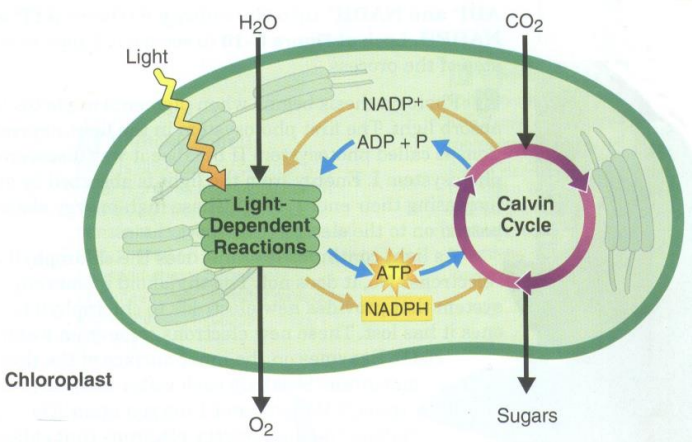
Chemical Energy and ATP

- What is **ATP** used for?
- Where is energy stored in ATP?
- Most important energy sources (types of organic compounds)
- Structure of ATP (3 parts)
- Describe cycle: **ATP** → **ADP** → **ATP** (What provides the energy add phosphate back onto ADP)
- **Autotrophs/producers, Heterotrophs/consumers**
- **Chemosynthesis**



Photosynthesis

- Definition of photosynthesis (equation for photosynthesis)
- **Chloroplasts**
  - Colors absorbed by chlorophyll and reflected
  - Grana
  - Thylakoids
  - Stroma
  - Importance of membranes (What reactions take place here?)
- Stages of Photosynthesis
  - **Light Dependent Reaction**
    - What powers LD reaction
    - Photosystem I and II
    - Where does it occur
    - ATP Synthase (what does it produce and what powers it?)
    - Reactants and Products
  - **Light Independent Reaction**
    - What powers LI reaction (name energy molecules and where they were produced?)
    - Where does it occur?
    - Reactants and products



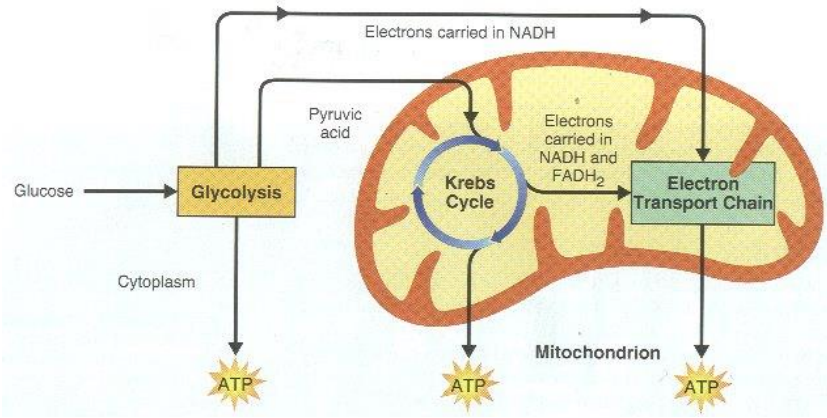
- Functions of photosynthesis (Base of food chain, Regulation of Earth's atmosphere)

Leaf structure and function

- Guard cells and stoma (function and location)
- Palisade and Spongy Mesophyll (function and location)

Cellular Respiration

- **Mitochondria**
- Overall equation (reactants and products) and total 36 ATP produced
- **Glycolysis** (reactants and products)
  - Anaerobic
  - Net ATP production (2 ATP)
  - Location of glycolysis

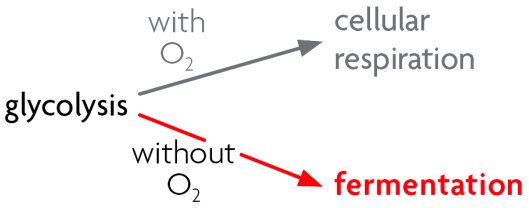


- **Krebs cycle**
  - Location
  - Starting molecule $C_6H_{12}O_6$ first transformed into pyruvate in glycolysis

- Pyruvate → CO_2
- Energy molecules produced (NADH, ATP, $FADH_2$)
- 2 molecules ATP produced

- **Electron Transport Chain**
  - Source of energy
  - Location it takes place
  - 32 molecules of ATP produced

Fermentation is an anaerobic process that allows glycolysis to continue.



Fermentation

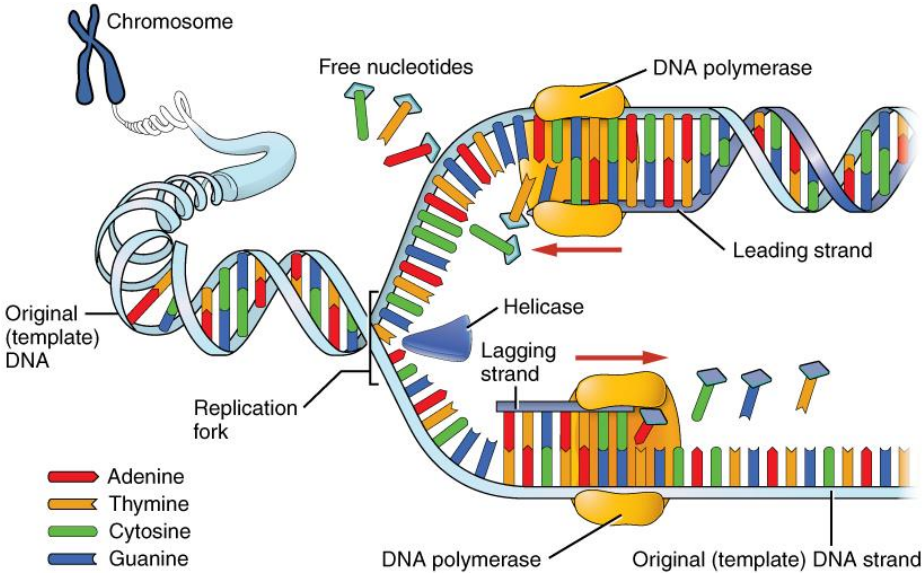
- Allows glycolysis to continue (recycle NAD^+ to NADH)
- Purpose of fermentation (when does it occur and why)
- 2 types (**Lactic Acid** and **alcoholic**)

Energy and Exercise

- Quick energy (source and amount)
- Long term energy (source and amount)

Identifying DNA as the Genetic Material

- Discoveries and significance
  - **Griffith , Avery, Hershey and Chase** (DNA genetic material)
  - **Chargaff** (A =T, C = G)
  - **Rosalind Franklin and Maurice Wilkins** (DNA helix)
  - **Watson and Crick** (how did they use prior work to develop model of DNA?)



Structure of DNA

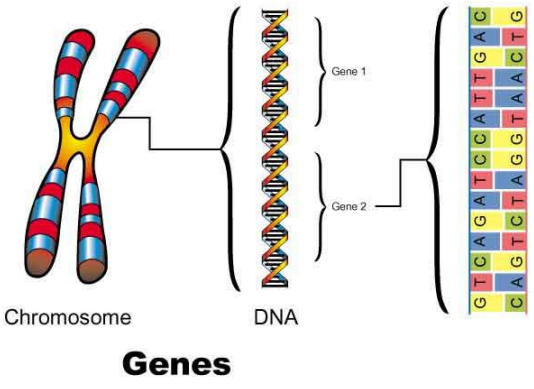
- Monomers (ATCG) and structure
- Chargaff's Rule
- DNA molecule (backbone and rungs, bonding on backbone and rungs)

DNA Replication

- Definition (purpose)
- Role of enzymes
- Importance of hydrogen bonds
- Result of replication (one old strand and one new strand)

Chromosomes

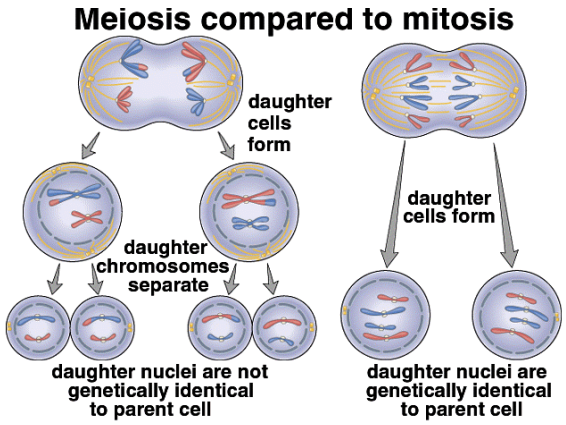
- **Somatic cells**
- **Germ cells**
- **Autosomes** (22 pairs)
- **Sex chromosomes** (1 pair, XX or XY)
- **Homologous chromosomes**
- Composition of chromosome (sister **chromatids**)
- What are **genes**
  - How do they store genetic code?
  - What do genes do with code?
  - How many genes do we have?
- Diploid and haploid



Cell Cycle

- Stages of Cell Cycle

- Rates of cell division vary
- Limits of cell size (surface area to volume ratio)



Mitosis

- Cells that undergo **mitosis** (somatic cells)
- What takes place prior to mitosis
- Genetically identical daughter cells
- 4 main phases of mitosis (**PMAT**)
- **Cytokinesis**
- **Cancer** (Uncontrolled cell growth) Types (benign and malignant)
- Asexual reproduction (**Binary fission**-genetically identical)
- Advantages and disadvantages of asexual and sexual reproduction

Meiosis

- Takes place in germ cells
- Products of meiosis (haploid cells, genetically unique)

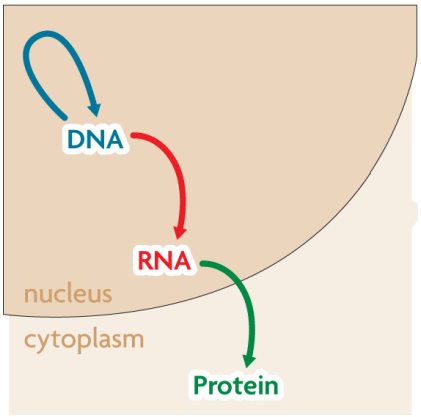
Multicellular Life

- **Levels of organization**
- **Cell differentiation**

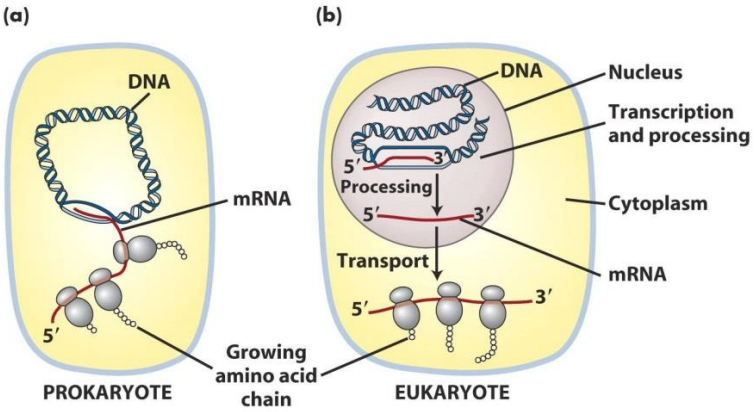
Stem Cells

- Importance of stem cells

Transcription

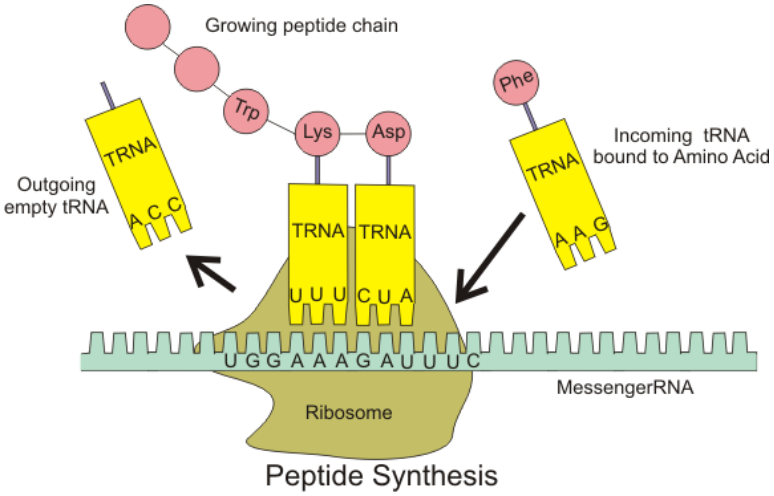


- Central dogma of molecular biology (Francis Crick)
  - **Replication (DNA → DNA)**
  - **Transcription (DNA → RNA)**
  - **Translation (RNA → Proteins)**
- **Prokaryotic cells**
  - Replication, transcription, translation in cytoplasm
- **Eukaryotic cells**
  - Replication and transcription in nucleus
  - Translation in cytoplasm
- Differences between DNA and RNA
- Transcription produces 3 kinds of RNA (mRNA, rRNA, tRNA)
- Process of transcription
- **Complimentary bases in RNA** (A=U, C=G)

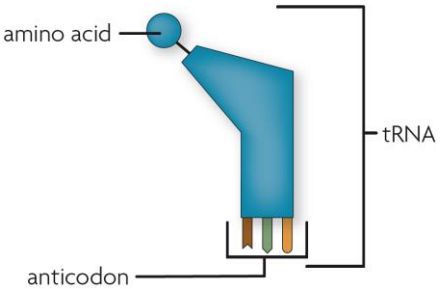


Translation (Protein Synthesis)

- RNA making Proteins (polypeptides)
- Amino acid monomer, Protein Polymer
- **Codon** (3-letter code on RNA) 64 combinations, only 20 amino acids
  - Special codons (Start and stop codons)
  - Universal code (Suggests common ancestor)
- Two important "tools" needed to translate a codon into an amino acid
  - **Ribosome** (site of protein synthesis)

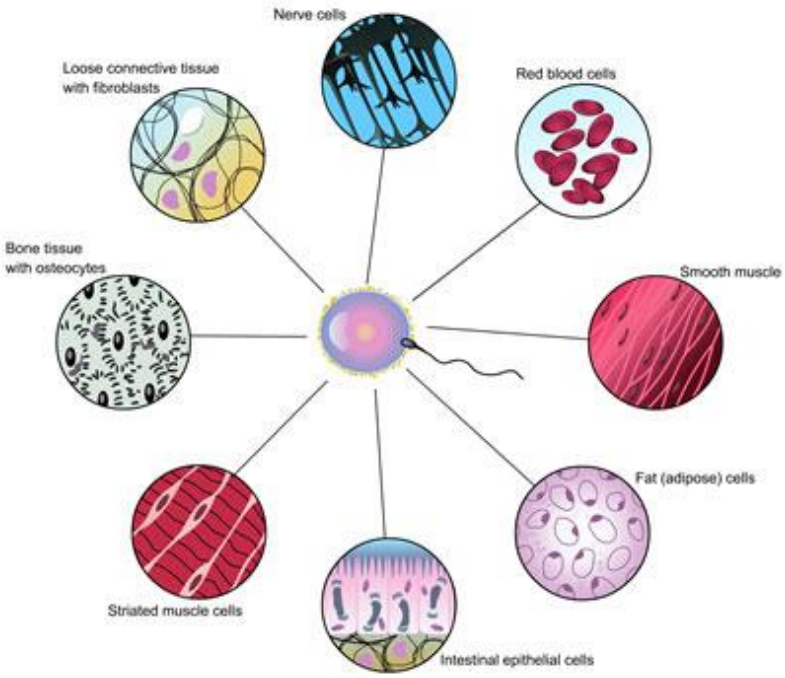


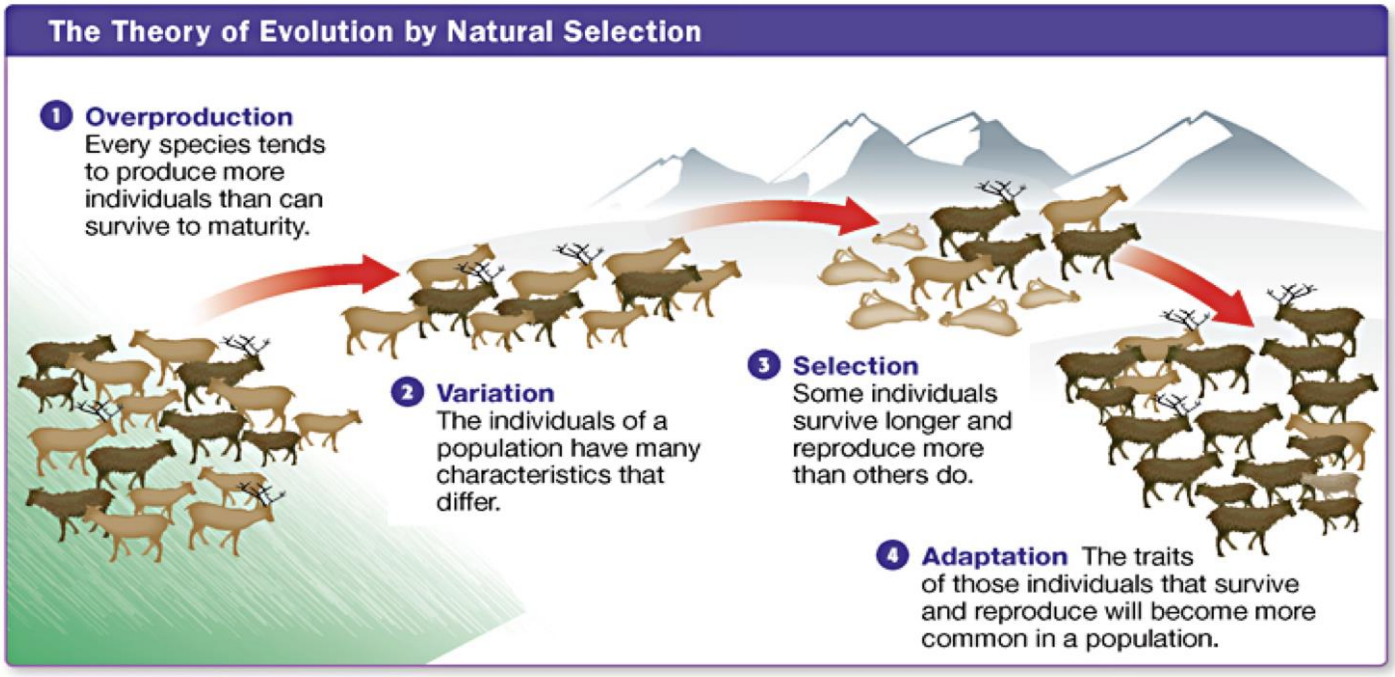
    - **tRNA** (attaches to specific amino acid. Has "3-letter" **anticodon**)
- Occurs in cytoplasm
    - Reads one codon at a time
    - Anticodon complimentary to codon
    - Amino acids bond to each other



Gene Expression

- cells can control when gene is "turned on or off"
- **Cell specialization** (only certain genes are expressed in each type of cell)



Mutations

- any change in an organism's DNA
- In single gene usually happen during replication
- Group of genes or chromosome happen during meiosis
- Mutation may or may not affect phenotype
    - Premature stop codon
    - Change 3-D shape of protein
    - Change in gene regulation
    - Mutation may be in "silent" region of DNA
    - May not affect protein folding
- Mutation in body cells cannot be passed on
- Mutations in sex cells either harmful or beneficial
- **Natural selection** removes mutant alleles
- Mutations caused by several factors