**BIO Test 1 Review**

**Biology**: scientific study of life

**Characteristics of living things**:

* Order: structure is very ordered
* Reproduction
* Growth and development
* Energy processing: use of chemical energy for activities and chemical reactions (such as metabolism, photosynthesis, and cellular respiration)
* Sensitivity and response to the environment
* Regulation (homeostasis): ability to control inner climate in order to maintain life, stay at the state or physiological condition in which the organisms is stable
* Evolutionary adaptation: organisms with favorable characteristics in their environment have more success reproducing and passing on their traits

**Emergent properties**: due to the arrangement and interactions of parts as complexity increases. (ex. Photosynthesis occurring in chloroplast, required specific organization of molecules). Isolated components of living systems lack a number of significant properties that emerge at higher levels of organization.

**Structure and function**: at each level of biological organization, we find a correlation between structure and function. Analyzing structure gives clues about what it does and how it works.

**Levels of organization**:

* Biosphere: all life on Earth and all the places where life exists (hydrosphere, lithosphere, atmosphere, etc.).
* Ecosystem: all the living (biotic) things in a particular area along with nonliving (abiotic) components of the environment with which life interacts (soil, water, light, etc.).
* Community: array of organisms inhabiting a particular ecosystem and living close enough to each other to interact
* Population: all the individuals of a species living within the bounds of a specified area. Same population can be defined as organisms having the same number of chromosomes and can breed
* Organisms: individual living things
* Organ system: formed of a grup of organs
* Organs: a body part that is made up of multiple tissues and has a specific function in the body
* Tissue: a group of cells that work together, performing a specialized function
* Cells: fundamental unit of structure and function, a cell is made from other cells, genetic material is copied
* Organelles: functional components present in cells, with a particular structure related to its function
* Molecules: chemical structure consisting of two or more units called atoms (structure and form important for function)
* Atoms: smallest unit that creates the properties of elements
  + Elements: substances that cannot be broken down into simpler substances through normal chemical reactions
* Subatomic particles: what make up atoms

**Prokaryotic and Eukaryotic cells**:

* Prokaryotic: lacks a nucleus or other membrane-enclosed organelles, generally smaller than eukaryotic cells
* Eukaryotic: contained membrane-enclosed organelles, nucleus found in every type of eukaryotic cell

**Classification of organisms:**

* Originally 2 kingdoms: animal and plant
* Now, there are 5:
  + Monera: prokaryotes
  + Protist: unicellular eukaryotes
  + Fungi: non photosynthetic eukaryotes
  + Plant: photosynthetic eukaryotes
  + Animal: non photosynthetic eukaryotes
  + Archaebacteria
* Domains:
  + Domain bacteria: most diverse and widespread prokaryotes, eubacteria (classified into multiple kingdoms)
  + Domain archaea: prokaryotes, archaebacteria
  + Domain eukaryote: includes all eukaryotes

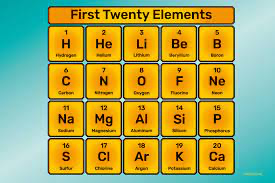
**Diversity and unity in organism**

* Organisms have adapted to the environments they live in
* Diversity in life but showing unity
  + Different animals that have similar skeletons
  + The language of DNA is universal/for all
  + Similarities between organisms at every level of biology
* Difference at physical and anatomical levels
* **Evolution**: process of biological change in which species accumulate differences from their ancestors as they adapt to different environments over time
  + Different species could have descended from common ancestors but diverged at a certain point, which is why they share certain traits
  + History of life: documented by fossils and other evidence of a changing earth over billions of earths
  + This idea introduced by Charles Darwin, “On the Origin of Species by Means of Natural Selection”
    - First point: species came from a succession of past species that were different (Descent with Modification)
      * Can change sequence of a genome of cells by taking out, adding, or switching certain genes. Alternating genome will change species (causing evolution)
      * Alteration can be favorable or unfavorable depending on environment, could be helpful or an abnormality. Favorable alterations can allow species to continue reproducing and surviving
      * These changes accumulate and create the differences of characteristics that will cause the species to diverge from ancestors (creating two different organisms)
    - Second point: “natural selection” mechanism of descent with modification. Some characteristics are favorable and some are not. Some individuals inherit more favorable traits for the environment and therefore more likely to reproduce and survive, slowly those without the trait or who are less suited will die out. Natural environment consistently “selects” for the propagation of certain traits among naturally occurring variant traits in the population
    - Three observations of Darwin:
      * Individuals in a population vary in their traits, many of which seem to be heritable (passed on from parents to offspring)
      * A population can produce far more offspring than can survive to produce offspring of their own, therefore there is competition
      * Species generally are suited to their environments, they are adapted to their circumstances (birds who eat hard seeds have hard beaks)
    - Inference of Darwin: Individuals with inherited traits that are better suited to the local environment are more likely to survive and reproduce than are less well-suited individuals. Over many generations, a higher and higher proportion of individuals will have the advantageous traits = Natural selection

**Scientific Method**:

* Inductive and deductive
  + Inductive: type of logic in which generalizations are based on a number of specific observations (specific observations lead to a generalized conclusion), this is what guide hypothesis
  + Deductive: type of logic in which specific results are predicted from a general premise (predicting results)
    - Deductions: predictions of results is a hypothesis is correct
* A series of steps
* Created by Descartes
* Steps:
  + Observation and establishment of problem
    - Direct observation through vision, smell, touch, hearing, and taste
    - Indirect observation: with the use of instruments, use of microscope
    - Observations made in the form of data: qualitative or quantitative
  + Formulate problem and find possible explanation/answer (hypothesis: tentative answer to a question, possible explanation passed on available data “educated guess”)
  + Design experiment and carry it out, validate or prove false hypothesis
    - Designed to find the effects of a variable, which is an attribute or characteristic that differs between individuals or events
      * Independent variable: what is manipulated for the objective of studying how it affects depend variable
      * Dependent variable: factor that is observed to determine effect of independent variable (cause)
      * Experimental group: related to independent variable and what is being studied
      * Control group: not affected in order to compare results
        + Both have same variables, a difference in results between these two groups would be the effect of the independent variable
  + Analysis of results
  + Conclusion: divulge results
* Theory: hypotheses confirmed at multiple occasions, supported by evidence that make it broader than a hypothesis, multiple attempts at proving false, consistent with all the evidence found
* Science is a social activity: scientists work in groups at different areas of specialty and scientific community (like universities), integration with technology, scientist redo experiments to confirm or prove false, scientific societies for the exchange of knowledge through different scientific reunions

**Matter**: everything that has weight and occupies space

* Three states of matter: solid, liquid, and gas
* Matter is made up of elements
  + Elements: substances that cannot decompose to more simple forms with normal chemical reactions
    - Atom: smallest unit of matter that has properties of the element it is from
    - 92 natural elements
    - Other synthetic elements
    - Made up of 200 different parts, only three are stable: electron (neg. charge), neutron (neutral charge), and proton (pos. charge)
      * Neutron and proton make up nucleus of the atom
      * Atoms can gain or lose protons through fusion and fission reactions which change the atom
      * Electron cloud surround the nucleus
      * Dalton: an atomic mass unit, a proton/neutron have 1 dalton
    - Compounds: 2 or more atoms which join chemically in a fixed proportion (emergent properties- compound has chemical and physical characteristics different from its constituent elements)
    - Molecule: group of 2 or more atoms held together by a chemical bond
    - Oxygen (O), carbon (C), hydrogen (H), and nitrogen (N) make up 96% of living matter. Calcium (Ca), phosphorus (P), Potassium (K), and sulfur (S) make up other 4%
      * Trace elements: required by organisms in minute quantities, some needed by all forms of life some only unique to some forms of life
    - Every element has a specific symbol that is unique to it (ex. H, O, C)
    - Every element has a specific atomic number (number of protons) and atomic mass (sum of protons and neutrons)
    - Isotopes: when the same type of element has different number of neutrons (ex. Carbon-12 and Carbon-13)
      * Some have unstable nucleus’s (are radioactive cause they are degrading) and have biological markers (ex. Carbon-14)
      * Radioactive isotopes aids by allowing diagnostic and medical treatment (ex. Phosphorus forbones)
    - Electron clouds: made up of electrons are the part of an atom that react during a chemical reaction (the clouds of the two atoms intersect, once they are close enough a reaction happens). Has different energy levels, which is based on how far away the electron is from the nucleus (the closer it is the more energy due to strong attraction, so more work needs to be done)
      * Energy: the capacity to cause change by doing work
        + Potential energy: the energy that matter possesses because of its location or structure. An electron that is closer to a nucleus has less potential energy, an electron that is farther away has more potential energy

Electron levels: different levels depending on how far away a certain electron is, an electrons energy level is correlated with its average distance from the nucleus

First level: 2 electrons (1s), nearest to the nucleus, lowest potential energy

Second level: 8 electrons (2s, 2py, 2pz, 2px)

Orbital: the route an electron follows as it orbits the nucleus (one orbital will have 2 electrons max, one with negative spin and one with positive spin)

Valence electrons: farthest away electrons

Valence level: farthest away level

When an electron absorbs energy, it moves an energy level farther away from the nucleus (energy from light can cause this, happens in photosynthesis). When an electron loses energy, it falls down an energy level (causes a release of visible or ultraviolet light)

The chemical characteristic of an atom depends on the distribution of electrons in the energy levels

Valence: ability an element has to form bonds with other atoms, generally equal to the number of electrons required to complete the farthest away electron level

**Periodic Table**:

* A column is a family
* Every new row, a new electron ring is added
* Every atom in the same row has the same amount of rings

**Chemical bonds**: depending on incomplete valence shells, atoms can interact with certain other atoms in such a way that each partner completes its valence shell, by either sharing or transferring valence electrons.

* Strongest kind: covalent bonds, ionic bonds in dry compounds (in aqueous solutions they are weak)
* Covalent bonds: when two atoms share electrons
  + Polar: type of covalent bond between atoms that have different electronegativity (which is the attraction an atom has to shared electrons, determined by the nucleus). In this type of bond, the electrons are not shared equally as one atom in the molecule is more electronegative and attracts the electrons more
  + Nonpolar: both atoms have the same electronegativity, so electrons are shared equally
* Ionic bonds: when a cation (ion with positive charge) unites with an anion (ion with negative charge); when the more electronegative atom strips the electrons from the less electronegative atom; opposite charges of the two ions attract each other
* Hydrogen bonds: when a hydrogen of one molecule is attracted to an electronegative atom like oxygen and nitrogen of another polar molecule (ex. Attraction between water molecules)
  + Atoms that hydrogen is attracted to are usually oxygen or nitrogen
* Van der Waals: happens to a polar covalent molecule due to a redistribution of molecules, when the molecule temporarily become electronegative (electrons accumulate in a specific region for a small amount of time)

**Chemical reactions**: making and breaking of chemical bonds, leading to changes in the composition of matter

* Ex of how chemical reactions rearrange matter: photosynthesis, CO2 and H2O becomes glucose and oxygen
* Products become reactants
* Chemical equilibrium: when the forward and reverse reactions occur at the same rate and relative concentration stop changing. Concentration isn’t equal, concentrations have stabilized at a particular ratio

**Water**: water is a polar molecule, at its liquid state the hydrogen bonds holding the many water molecules together are constantly breaking and reforming with each other, most of the water molecules are hydrogen bonded to their neighbors. Hydrogen bonds give water many of its unique properties that make it important to life on earth:

* Cohesion: due to hydrogen bonding, water molecules stay close to each other. The many links of hydrogen bonds happening at once makes water more structured than most liquids, which give water its cohesive quality
  + Contributes to transport of water and nutrients dissolved in it, in plants against the force of gravity.
  + As water evaporates on the leaf, hydrogen bonds cause water leaving the veins to tug on the molecules further down, pulling the water up from the roots
* Adhesion: attraction between different types of molecules, also contributes to the transport of water and nutrients in plants and its parts. The water gets attracted to the cell of water conduction in the plant (through hydrogen bonds)
* Superficial tension: measure of how difficult it is to stretch or break the surface of a liquid. This is due to how the water molecules are hydrogen bonded to one another and to the water below but not the air above
* Moderation of temperature: absorbs heat from the air that is warmer and releases stores heat to air that is cooler, can absorb or release a relatively large amount of heat with only a slight change in its own temperature
  + Thermal energy: kinetic energy of random movement of atoms or molecules, total kinetic energy so depends on volume
  + Temperature: average kinetic energy of the molecules in a body of matter, regardless of volume
  + Heat: thermal energy in transfer from one body of matter to another
  + Calorie: the amount of heat it takes to raise the temperature of 1g of water, 1ºC
  + Specific heat: the amount of heat that must be absorbed or lost for 1 g of that substance to change its temperature by 1°C
    - Due to waters high specific heat, it resists changes in temperature (this is due to hydrogen bonding)
    - Bodies of water can therefore moderate the temperature around them
    - Organisms contains water as well, able to resist changes in their own temperature
  + Heat of vaporization: quantity of heat a liquid must absorb for 1 of it to be converted from the liquid to the gaseous state. High specific heat also means a high heat of vaporization
    - Waters high heat of vaporizations helps moderate Earths climate, a considerable amount of solar heat absorbed by seas is consumed during the evaporation of surface water. The most tropical air circulates and then releases the heat as it condenses and forms rain
  + Evaporative cooling: the hottest molecules (ones with greatest kinetic energy) are the most likely to leave as a gas and leaves behind the surface the liquid was on cool
    - This is what allows sweat to cool organisms down
* Floating ice: when water freezes it floats because it is less dense as a solid than as a liquid. When it freezes, molecules expand. Due to hydrogen bonds, when water molecules freeze, each molecule is bonded to four other molecules that are kept at arm’s length, allowing for less density
  + Greatest density of water is at 4ºC when the there are less hydrogen bonds so the molecules are moving closer together but before the molecules begin to move faster
  + This floating ice allows for life to continue on earth even during the colder winter months, because bodies of water wont freeze completely solid and there will be a layer of ice and then liquid water under that
* As a solvent:
  + Solution: a liquid that is a completely homogeneous mixture of two or more substances
  + Solvent: the dissolving agent
  + Solute: what is being dissolved
  + Aqueous solution: water is the solvent
    - Water is a versatile solvent, due to the polarity of the water molecules
    - Hydration shell: the sphere of water molecules that surround each dissolved ion of the solute
    - Ions and nonionic polar molecules can all dissolved in water
    - A smaller percentage of water molecules dissociate into ions (H+ and OH-)
      * Different types of solutions contribute or remove hydrogen ions
      * Acids: compound that donates hydrogen ions to a solution
        + Acidic solution: higher concentration of H+ than OH-
      * Bases: compound that accepts hydrogen ions and removes it from a solution
        + Basic solution: higher concentration of OH- than H+
      * pH: pH=-log[H+]
        + Ex. [H+]=10^-7 is 7 pH
        + Human blood needs to be 7.4, at 7.0 or 7.8 the person dies
        + Buffers: minimize changes in pH accepting H+ when there is an excess and donating H+ when there isn’t enough

**Organic chemistry**: the study of compounds that contain carbon, if it has carbon, it is an organic compound

* Exception is CO2 and CO, which have carbon but are not organic
* Cells are made up mostly of water, but the rest is carbon
* Carbon can form simple and complex molecules
  + Carbon has 4 valence electrons to form bonds, bonds with a variety of atoms
  + Tetrahedral: makes it possible the formation of big and complex molecules
  + When two carbons double bond, the molecule has a planer form
* Carbon is compatible with other elements to form covalent bonds. Most frequently bonded with hydrogen, oxygen, and nitrogen. These elements create the code for construction for important biological molecules
* Carbon chain: forms the skeleton of the majority of organic molecules
  + Linear: can vary in length
  + Branching (ramificación): some can be branched and some unbranched
  + Double bonds: a molecule can have a double bond that can be found in different possible location in the molecule, giving different structures
  + Rings
* Hydrocarbons: simplest organic compounds consisting of only carbon and hydrogen, can affect reactions that liberate great quantities of energy
  + Alkane (alkanos): all single bonds
  + Alkene (alkenos): have double bonds
  + Alkyne (alkinos): have triple bonds
  + Fats: supplies of energy containing hydrocarbons
* Isomers: compounds with the same chemical formula but different structures (causing different properties)
  + Structural isomers: different covalent bond arrangements in their molecules, which cause different structures
  + Geometric isomers (cis/trans): same covalent bond arrangement but different special arrangement due to inflexibility of double bonds
  + Enantiomers: isomers that are mirror images of each other (L and D isomers)
    - Important in pharmaceutical industry, two enantiomers can have different effects

**Functional groups**: components of an organic molecule that’s mostly involved in chemical reactions

* Hydroxyl (hydroxilo): -OH, alcohol, at the end of an organic compound
  + For alcohols the more carbons the more energy
* Carbonyl (carbonilo): >C=O, Ketone (central)/Aldehyde (terminal), can be in a central or terminal position
* Carboxyl (carboxilo): -COOH, carboxylic acid, only terminal position
* Amino: -NH2, amine
* Sulfhydryl (sulfhydrilo): -SH, thiol, only one that doesn’t increase solubility of a compound
* Phosphate (fosfato): -OPO3^2-, organic phosphate
  + ATP (adenine triphosphate): primary form of transferring energy between molecules of a cell
    - Contains an organic molecule called adenine (purine), and a pentose sugar, and three phosphate groups
    - ADP is produced when ATP reacts with water and creates an inorganic phosphate as well as the ADP molecule and energy
* Methyl (metilo): -CH3, methylated compound

**Macromolecules**:

* Types of polymers (except for lipids which aren’t actual polymers but act like it)
* Poly is many, many monomers
* Mono is one, monomers become polymers through chemical reaction called condensation reaction
  + When two molecules are covalently bonded to each other with the loss of a water molecule (dehydration reaction)
    - The H from one monomer bonds with the OH of another monomer
* Polymers are disassembled through hydrolysis reactions in which a water molecule is added
* Carbohydrates: polymer called polysaccharides made up of monomers called monosaccharides (simple sugars)
  + Trioses: 3 carbon sugars
  + Pentose: 5 carbon sugars
  + Hexoses: 6 carbon sugars (can be linear or a ring)
    - Disaccharide: 2 monosaccharides bonded through a glycosidic linkage (dehydration reaction)
      * Glucose bonded with fructose makes sucrose
      * Glucose bonded with glucose make maltose
      * Beta and alpha bonds, our bodies can break down alpha bonds only: when OH group is either positioned below or above the plane of the ring
        + Beta is when the OH groups make it seem like each glucose molecule is upside down in relation to its neighbors
        + Enzyme can digest a linkages by hydrolysis but not b linkages
    - Polysaccharide: structure and function determined by its sugar monomers and position of glycosidic linkages
      * Storage polysaccharides: starch stored as granules,
        + animals store glycogen in muscle cells which can be broken down to release glucose
        + 1-4 glycosidic linkages
        + Alpha linkage
        + Branched structure, more efficient for storing glucose units
      * Structural polysaccharide: helps build strong material (cellulose in plant cell walls) (chitin is another type of structural polysaccharide found in exoskeletons of bugs and cell walls in fungus)
        + 1-4 glycosidic linkages
        + Beta configuration
        + A straight molecule, not branched, parallel to each other (due to b linkages the OH groups from one molecule strand is able to have a hydrogen bond with the OH groups of another molecule strand)
* Lipids: does not include true polymers and not big enough to be considered macromolecules
  + Hydrophobic: mix poorly with water due to the abundance of hydrocarbon regions lipids are made up of
  + Types of lipids: fats, phospholipids, and steroids
    - Fats: large molecules assembled from smaller molecules by dehydration reactions. Consists of a glycerol molecule joined to three fatty acids
      * Glycerol is an alcohol, its carbons have a hydroxyl group
      * A fatty acid is a long carbon skeleton of 16/18 carbons, the carbon at the end of the skeleton being part of a carboxyl group. Rest of the skeleton is hydrocarbon chains
      * Due to the nonpolar C-H bonds in the hydrocarbon chains, fat is hydrophobic
      * Ester linkage: dehydration reaction that joins together the fatty acid molecule and the glycerol. It is a bond between the hydroxyl group (-OH) and a carboxyl group (>C=O)
      * Diglycerol: 2 fatty acids and a glycerol
      * Diglycerol: 3 fatty acids and a glycerol
      * Saturated or unsaturated:
        + Saturated: when there are no double bonds, as many hydrogen atoms can bond to the carbon chain as possible, it is saturated with hydrogen

All carbons have 2 hydrogens, last one in chain has three

Solid at room temp because the molecules are flexible and are able to be packed tightly together

* + - * + Unsaturated: when there is one or more double bond with fewer hydrogen atoms

Every double bond is a cis double bond, both hydrogens are on the same side, which causes a kink in the chain and structure of the molecule

Liquid at room temperature because the kinks in molecule prevent them from packing closely together

* + - * Greater energy storage than a polysaccharide (plants are immobile, they can survive on only starch). Animals move around and need to carry their energy reserves with them.
    - Phospholipids: one part is hydrophilic, and one part is hydrophobic. The tail is hydrophobic with 2 fatty acids. The glycerol is attached to a phosphate group which is attached to a small molecule (diff. types). The glycerol, phosphate group, and small molecule are hydrophilic
      * Major parts of a cell membrane: assemble into double layered sheet called bilayer that shields the hydrophobic fatty acid tails from the water, leaving the hydrophilic heads outside in contact with the water
        + This forms a boundary between the insides of the cell and the outside environment
        + There is usually a protein included that allows for water to passy through the layer when needed
    - Steroids: a carbon skeleton of four fused rings, different steroids are determined by which chemical group is attached to the rings
      * Cholesterol: found in cell membranes of animals, not plants (between two phospholipids in the bilayer)
      * Most steroids are hydrophobic
    - Proteins: polymers made up of monomers called amino acids
      * All proteins are made up of 20 different amino acids, which bond together to form the polymer called a polypeptide through a peptide bond
      * Amino acid: alpha carbon that is bonded to four different molecules/elements/functional groups
        + Basic format is an R group, an amino group (N terminal), a carboxyl group (C terminal), and a hydrogen atom
        + The only thing that distinguishes the 20 amino acids from each other is the R group, which will determine the unique characteristics of every particular amino acid and functional role in a polypeptide (can be a hydrogen or a carbon skeleton)
        + Amino acids (also known as peptides): become polypeptides and dipeptides through a dehydration reaction where the OH of the carboxyl group combines with the H from the amino group to create H2O
        + Amino acids can be classified in three ways, depending on their side chains (R group):

polar (hydrophilic)

no polar (hydrophobic)

electronically charged

positive (basic)🡪due to carboxyl group which is dissociated) hydrophilic

negative (acid)🡪due to amino groups) hydrophilic

* + - * All polypeptides have a N and C terminal no matter how long of a chain it is
      * Proteins have four different structures: primary, secondary, tertiary, quaternary
        + Primary: polypeptide chain
        + Secondary: 2 polar amino acids form hydrogen bonds between the hydrogen of the amino group and the oxygen of the carboxyl group which cause the polypeptide chain to sin into a helix (alpha). Happens every fourth amino acid

Can be pleated too (beta pleated sheet)

* + - * + Tertiary: due to interactions between the R groups, making the chain become more folded and ball like

Hydrophobic interaction: Amino acids with hydrophobic nonpolar side chains cluster at the core of the protein out of contact with water. This interaction is the exclusion of nonpolar substances by water molecules.

Van der Waals: when the amino acid R groups are close together they are held together by van der Waals interactions.

Hydrogen bonds: this happens between polar side chains

Ionic bonds: happens between positively and negatively charged side chains

Sulfur bonds (disulfide bridges): when two sulfide groups in the R groups are brought close together, the two sulfurs bond.

* + - * + Quaternary: when proteins consist of two or more polypeptide chains aggregated into one functional macromolecule

Globular protein

Ex. Collagen: 3 diff polypeptides / help in connective tissue in skin, bones, tendons, ligaments, etc.

Ex. Hemoglobin: 4 diff polypeptides / globular protein

* + - * Protein function:
        + Enzyme: accelerates chemical reactions
        + Defensive: protects against disease, antibodies inactivate and destroy virus, leaving a memory that gives immunity
        + Storage: storing amino acids
        + Transport: transport substances through the membrane of the cell, ex. Hemoglobin transporting oxygen
        + Hormonal: coordination of organism’s activities. Ex. Insulin
        + Receptor: cell membranes have proteins that act as antennas, response of cell to chemical stimuli, then there is a union of receptor protein and chemical stimuli
        + Motor proteins: movement in cells and organelles (cilia, flagella). Actin and myosin proteins responsible for contraction of muscles
        + Structural proteins: support, ex. Collagen🡪 fibrous framework
        + Neurotransmitter proteins: signaling in cell
    - Nucleic acids:
      * DNA: deoxyribonucleic acid
      * RNA: ribonucleic acid
        + Same monomer: nucleotide
        + A nucleotide is made up of three things: nitrogenous base, a sugar, and a phosphate group

Nitrogenous bases:

Pyrimidines: Cytosine, Thymine (only DNA), Uracil (only RNA)

Purine: Adenine, Guanine

\*DNA: A🡪T, G🡪C

\*RNA: G🡪C, U🡪A

Sugars:

DNA: deoxyribose

RNA: ribose

Nucleotides only differentiate in their nitrogenous base, all have sugar-phosphate backbone

* + - * + DNA is helix shape with two chains the different nitrogenous bases compliment each other. One chain goes from 3’ to 5’ and 5’ to 3’, they are antiparallel and go in opposite directions (phosphate groups either attach to the number 3 carbon or number 5)

Strands held together by hydrogen bonds between paired bases

Stores hereditary information, directs RNA synthesis and through RNA control protein synthesis

* + - * + RNA is like DNA except ribose sugar and its own nitrogenous bases. RNA has one chain of nucleotides; it has its shape due to hydrogen bonds that attach the nucleotides pairings. Stretches of the molecules can run antiparallel to each other

Messenger RNA: every three nucleotides in the chain will convert into a peptide for the protein. The order of the amino acids in the protein will be the same as the order of the amino acids in the DNA

Transfer RNA: brings amino acid to the ribosome during the synthesis of a polypeptide

Ribosomal RNA