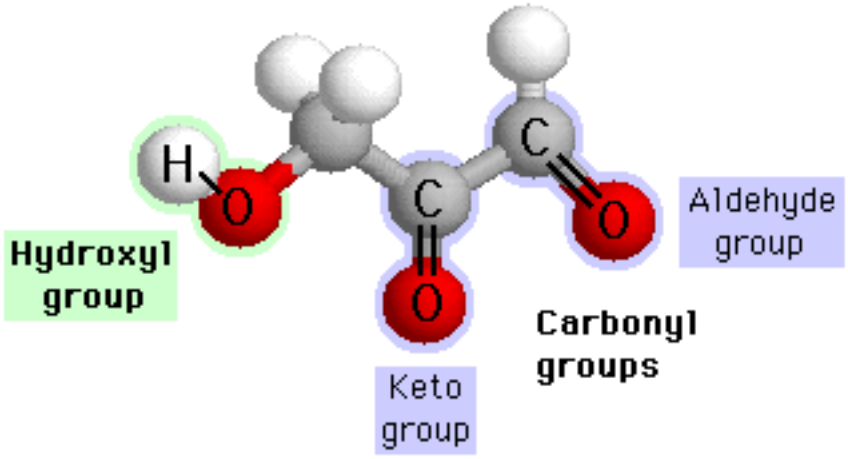
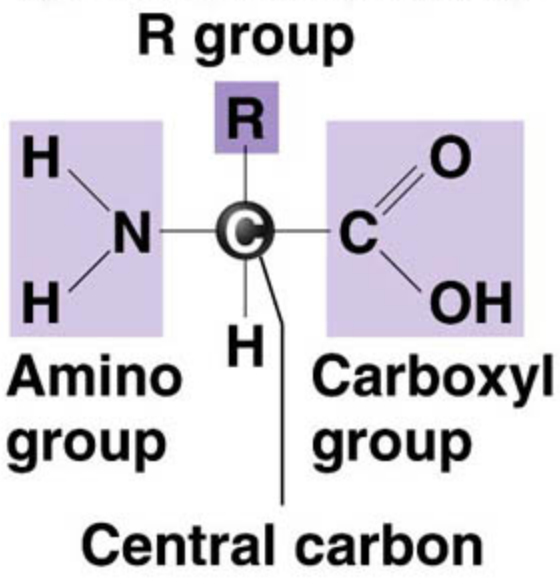
LEARNING OBJECTIVES #5 – BIOCHEMISTRY:
THE STRUCTURE AND FUNCTION OF CARBOHYDRATES, LIPIDS AND PROTEINS
I. Carbohydrates
A. Names for carbohydrate: Sugars and saccharides
B. Functions of carbohydrates: Living things use carbohydrates as their main source of energy. Plants and some animals and other organisms also use carbohydrates for structural purposes.
D. Lipids: Not soluble in water. Can be used to store energy. Proteins: Macromolecules that contain nitrogen as well as carbon, hydrogen and oxygen



E.
G. **Isomer:** Molecules with the same molecular formula but different chemical structures. Isomers contain the same number of atoms of each element, but have different arrangements of their atoms in space Isomers do not necessarily share similar properties, unless they also have the same functional groups. Glyceraldehyde, the simplest carbohydrate exhibits properties of an isomer compound. This molecule forms the basis for the designation of the isomers of all of the carbohydrates.
H. **Dehydration Synthesis:** A chemical reaction that involves the loss of water from the reacting molecule. It is also known as a dehydration reaction, it is a type of condensation reaction in which monomers join together into polymers while losing water molecules.
I. How hydrolysis can be used to break down a triglyceride.: A triglyceride is broken down into its fatty acids and glycerol through a chemical reaction called hydrolysis, which is the decomposition of a compound by the addition of water.
J. Why lipids are not polymers: For something to be classified as a polymer, it needs to have large molecules in repetitive chains. Proteins are considered to be polymers because they have long chains of amino acids. However, lipids are not considered to be polymers because they have smaller molecules that are not structured in the form of repetitive chains.
K. Why a lipid is large and how it can increase in size: Lipids can be used to store energy
L. The function of the adipose tissue is insulation and protection of organs, muscle fibers, nerves, and supports blood vessels. protects us from excessive heat loss or increase.
M. The main role, or function, of white adipose tissue is to collect, store and then release lipids. Every adipose cell must touch at least one capillary or blood vessel. From this the cells draw all their needed supplies, including lipids. Fatty foods, with high lipid content, often provide more lipids than can be digested and used right away. The excess is stored in the adipose tissue. Excess carbohydrate and protein taken in with meals can also be converted to fat Fatty foods, with high lipid content, often provide more lipids than can be digested and used right away. The excess is stored in the adipose tissue. Excess carbohydrate and protein taken in with meals can also be converted to fat.

N. Brown fat: Has more capillaries than white fat, because of its higher oxygen consumption. Brown fat also has many unmyelinated nerves, providing sympathetic stimulation to the fat cells. Brown fat generates heat by burning calories. When it is cold, brown fat's lipid reserves are depleted, and its color gets darker.
White Fat: The result of storing excess calories. When we consume too many calories, the body converts them into a contingency energy reserve in the form of white fat.
II. Proteins
A. Function of Proteins: The main function of protein in the human body is building and repair of body tissues especially muscles. Over 45% of the human body is made up of proteins and besides repair of damaged tissue, proteins are essential for water processes such as water balancing and nutrient transportation.
B. Amino acids are defined as molecules that contain an amino group, a carboxylic acid and a chain that contains different amino acids. They are the building block of proteins.
C. The basic structural formula for an amino acid is NH2. NH2 is the formula for the amino group while COOH is the formula for the carboxylic acid. The 2-amino acid group is when an amino is attached to a carbon atom.



D. A

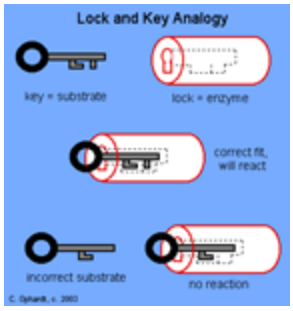
E. **R** represents a side-chain specific to each **amino acid**. The carbon atom next to the carboxyl group is called the α–carbon and **amino** acids with a side-chain bonded to this carbon are referred to as alpha **amino** acids.

F. A peptide bond is a covalent chemical bond formed between two molecules when the carboxyl group of one molecule reacts with the amino group of the other molecule, thereby releasing a molecule of water (H2O). This is a dehydration synthesis reaction.
H. Four levels of organization of protein structure
Primary Structure refers to the linear sequence of amino acids that make up the polypeptide chain. This sequence is determined by the genetic code, the sequence of nucleotide bases in the DNA. The bond between two amino acids is a peptide bond. This bond is formed by the removal of a H20 molecule

from two different amino acids, forming a dipeptide. The sequence of amino acids determines the positioning of the different R groups relative to each other. This positioning therefore determines the way that the protein folds and the final structure of the molecule.
The secondary structure of protein molecules refers to the formation of a regular pattern of twists or kinks of the polypeptide chain. The regularity is due to hydrogen bonds forming between the atoms of the amino acid backbone of the polypeptide chain. The two most common types of secondary structure are called the alpha helix and ß pleated sheet.
Tertiary structure refers to the three dimensional globular structure formed by bending and twisting of the polypeptide chain. This process often means that the linear sequence of amino acids is folded into a compact globular structure. The folding of the polypeptide chain is stabilized by multiple weak, noncovalent interactions.
Quaternary structure refers to the fact that some proteins contain more than one polypeptide chain, adding an additional level of structural organization: the association of the polypeptide chains. Each polypeptide chain in the protein is called a subunit. The subunits can be the same polypeptide chain or different ones. For example, the enzyme ß-galactosidase is a tetramer, meaning that it is composed of four subunits, and, in this case, the subunits are identical - each polypeptide chain has the same sequence of amino acids. Hemoglobin, the oxygen carrying protein in the blood, is also a tetramer but it is composed of two polypeptide chains
I. Monomers proteins: amino acids
Polymers in proteins: polypeptides
J. Ph: a figure expressing the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral, lower values are more acid, and higher values more alkaline.
K. Denaturation: A process in which proteins or nucleic acids lose their structure by application of some external stress or compound.
L. How does temperature and pH effect the function of enzymes: Raising the temperature will denature an enzyme so that it is no longer functional. Lowering the temperature will reduce the rate of the reaction so low as to make it seem non-functional. Altering the pH above or below its optimum pH will also reduce the enzyme's activity, and at extremes the enzyme may be permanently denatured
III. Enzymes
- catalysts: substance that speeds rate of chemical reactions
- in order for there to be a chemical reaction, the two molecules/atoms must collide to create enough activation energy (amount of required energy for chemical reactions to occur)
- catalysts decrease the amount of activation energy needed
- reactants -> enter chemical reaction

products -> produced by chemical reaction
- enzyme-substrate complex: site of chemical reaction

(reduces energy so bonds are broken and reformed)
- LOCK AND KEY MODEL: enzyme and substrate fit together perfectly



o INDUCED FIT MODEL: enzyme recognizes substrate, active site (flexible) changes shape to fit substrates