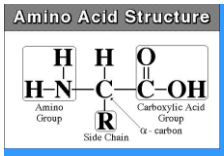
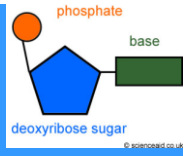
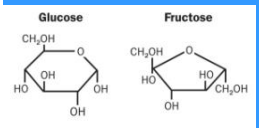
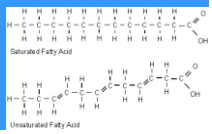




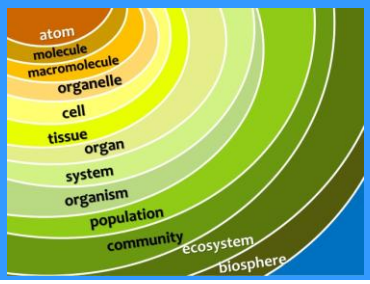
1.4 Properties of Biological Macromolecules





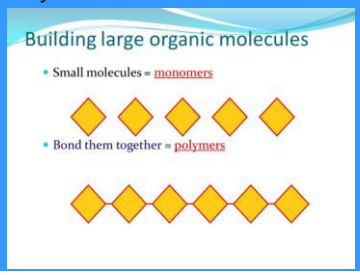
ENDURING UNDERSTANDING

SYI-1 Living systems are organized in a hierarchy of structural levels that interact.



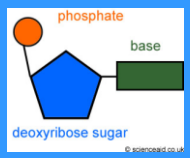
SYI-1.B Describe the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules.

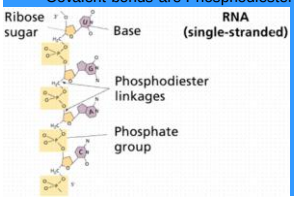
- Structure and function of polymers are derived from the way their monomers are assembled

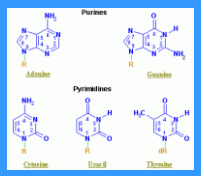


Nucleic Acids

- Biological information is encoded in sequences of Nucleotide Monomers.
  - Pentose sugar (deoxyribose or ribose)
  - Phosphate group
  - Nitrogenous base
    1. Pyrimidines: cytosine, thymine, uracil(RNA)
    2. Purines: adenine, guanine
- Covalent bonds are Phosphodiester linkages

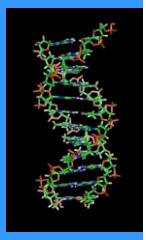


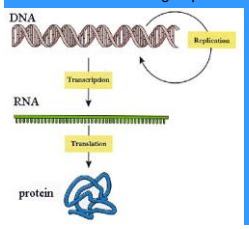


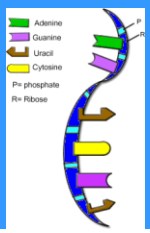


Nucleic Acids

- Deoxyribonucleic acid (DNA)
  1. stores essential info for almost all cell activities
  2. blueprint for all proteins
- Ribonucleic acid (RNA): stores, transfers info essential for the manufacturing of proteins.

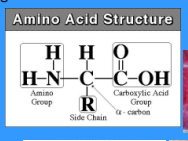


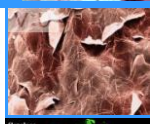


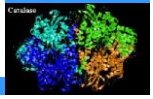


Proteins

- Form muscle, skin, and enzymes
- Monomers are Amino Acids(20)
  - Amino acids have directionality, with an amino (NH_2) terminus and a carboxyl (COOH) terminus.)
  - H atom
  - Variable group (R)
    1. Can be categorized by chemical properties (hydrophobic, hydrophilic and ionic)
    2. Interactions of R groups determine structure and function of that region of the protein.

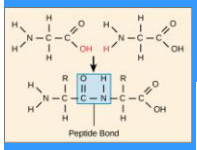


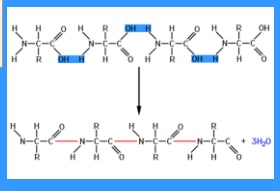




Proteins

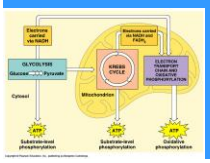
- Covalent bond is a peptide bond (dehydration synthesis)
- 4 or more amino acids is a polypeptide
- The specific order of amino acids in a polypeptide (primary structure) determines the overall shape of the protein

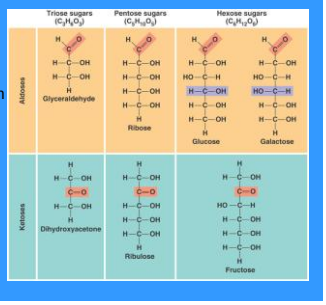




Carbohydrates

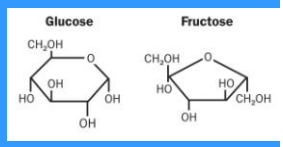
- Sugar monomers whose structures and bonding with each other by dehydration synthesis determine the properties and functions of the molecules
- Monosaccharides
  - CH_2O formula
  - Simple single sugars
  - Used for cellular respiration
  - Aldoses and Ketoses

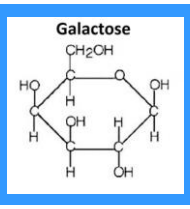


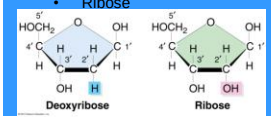


Carbohydrates

- Glucose
  - Made by plants during photosynthesis
  - Main source of energy for plants and animals
  - Metabolized during cellular respiration.
  - Ring structure in water
- Fructose
  - Found in fruit.
  - Sweetest sugar.
- Galactose- Found in milk.
- Deoxyribose
- Ribose

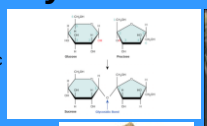


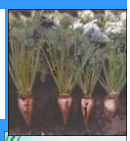


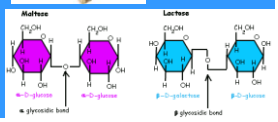


Carbohydrates

- Disaccharides
  - Covalent bond is Glycosidic bond
  - Sucrose
    - Fructose + Glucose
    - table sugar
    - from beets and cane
  - Lactose
    - Glucose + Galactose
    - found in milk
  - Maltose
    - Glucose + Glucose
    - Fermented barley

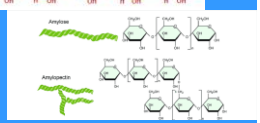


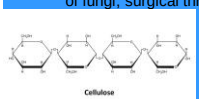


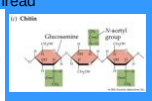


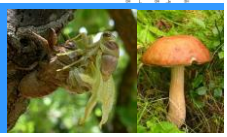
Carbohydrates

–Polysaccharides
- •Three or more monosaccharides
- •Storage:
  - ○Glycogen- The way animals store glucose.
  - ○Starch- The way plants store glucose.
- •Structural:
  - ○Cellulose- most abundant organic compound, cell walls of plants
  - ○Chitin- exoskeletons; cell walls of fungi; surgical thread



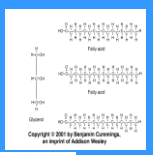


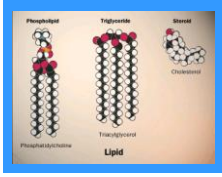


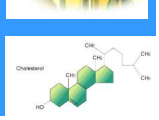


Lipids

- In general, lipids are nonpolar (don't dissolve in water)
- Fats, oils, waxes, phospholipids, steroids.
- Differences in saturation determine the structure and function of lipids.

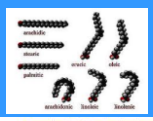


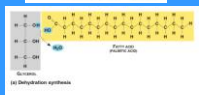


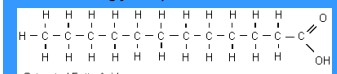


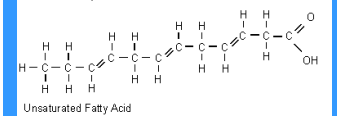
Fatty Acids

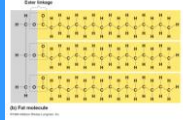
- The monomer that makes most lipids
- One end contains a hydrophilic carboxyl (COOH)
- Non-polar C-H bonds in fatty acid 'tails' (hydrophobic)
- Covalent bond is an ester bond (3 fatty acids to 1 glycerol)





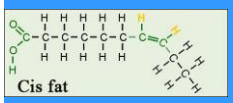


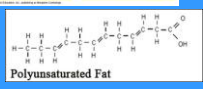


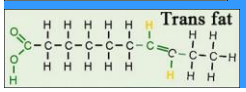


Fatty Acids

- Saturated: only single bonds
- Unsaturated: some double bonds
  - mono or poly
  - Cis isomer (natural form, oils)
  - Trans isomer (some natural, most by hydrogenation)

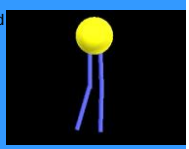


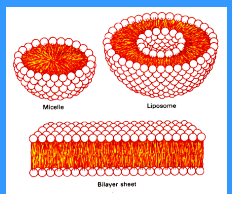


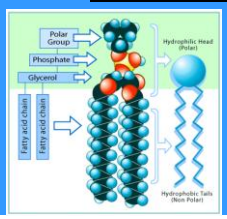


Phospholipids

- 2 fatty acids tails and one phosphate group head
  - 'Tails' hydrophobic
  - 'heads' hydrophilic
- Can spontaneously form
  - Micelle
  - Liposome
  - Bilayer (cell membranes)

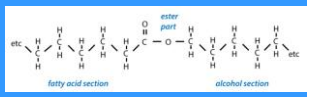


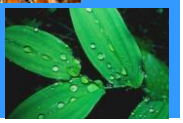




Waxes

- Long fatty acid connected to long alcohol
- Long fatty acid = hydrophobic
- Protective barriers in plants and animals.





Steroids

- Lipids with 4 fused carbon rings
- Not fatty acids.
- Four carbon ring that does not dissolve in water.
- Found in hormones, nerve tissue, toad venoms, plant poisons.
- Cholesterol
  - Cell membranes
  - Precursor for other steroids