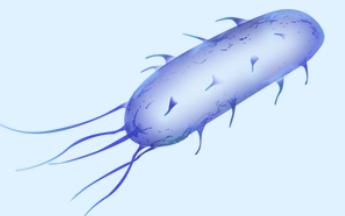


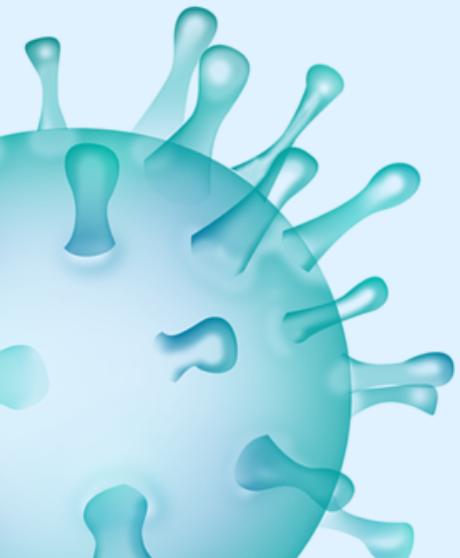
UNIT 1

CHEMISTRY OF

LIFE



THE 4 MACROMOLECULES





Carbohydrates

Proteins

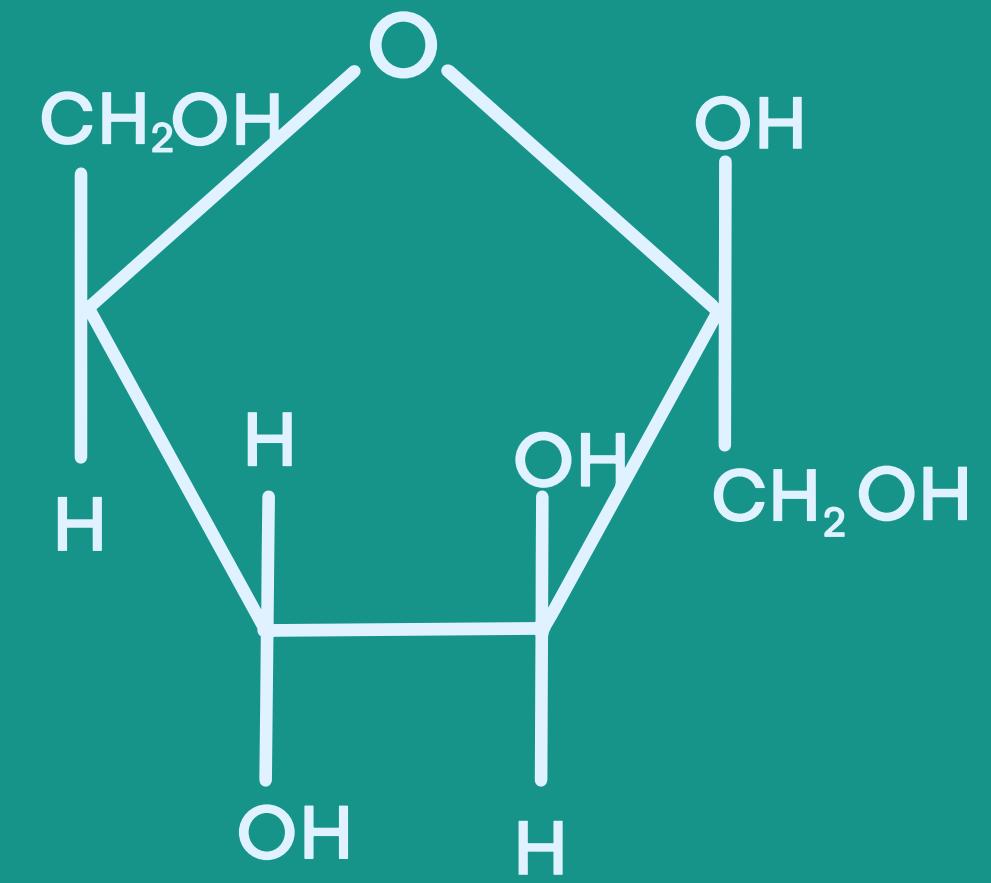
Nucleic Acids

Lipids



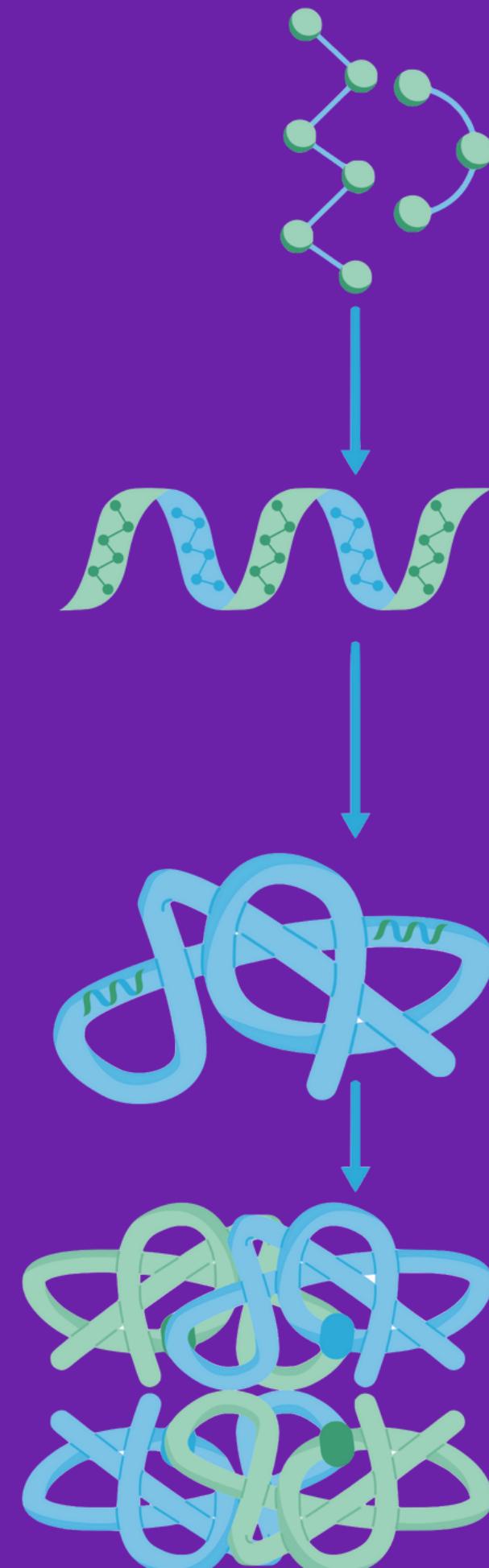
Carbohydrates

- **Elements:** C, H, O
- **Ratio:** 1:2:1
- **Monomer:** Monosaccharide
 - Glucose
 - Fructose
 - Galactose
- **Two monomers:** Disaccharide
 - Lactose - Glucose and Galactose
 - Maltose - 2 Glucose
 - Sucrose - Glucose and Fructose
- **Polymer:** Polysaccharide
- **Bond Type:** Glycosidic linkage
- **Structural Examples:**
 - Cellulose: found in plant cell wall
 - Chitin: found in fungi cell walls and exoskeleton of arthropods
- **Storage Examples:**
 - Starch: used for storage for plants
 - Glycogen: used for storage in animals



Proteins

- **Monomer:** Amino acid
- **Elements:** C, H, O, N, S
- **Bond between amino acids:** Peptide
- **Protein Structure Levels:**
 - Primary
 - Bond Type: Peptide
 - Secondary
 - Bond Type: Hydrogen bonds between backbones (oxygen of one amino acid and hydrogen on another)
 - Structure: Alpha helix or beta pleated
 - Tertiary
 - Bond Type: Any type of bond between R Groups (Covalent, ionic, hydrogen, etc.)
 - Structure: 3D polypeptide
 - Quaternary
 - Bond Type: Any type of bond between R Groups of different polypeptides
 - Structure: 3D protein



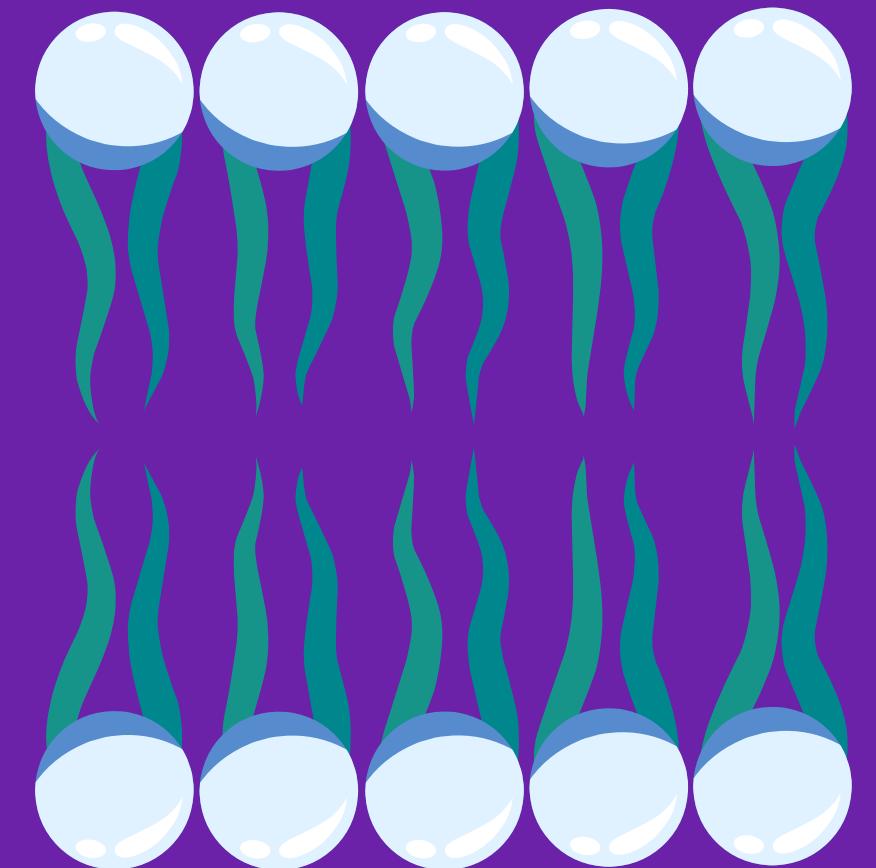
Nucleic Acids

- **Monomer:** Nucleotide
- **Elements:** C, H, O, P, N
- **Bond between Monomers:** Phosphodiester linkage
- **Directionality:** 5' to 3'
- **DNA vs RNA**
 - DNA
 - Nitrogenous Bases: Adenine, Thymine, Guanine, Cytosine
 - Sugar: Deoxyribose
 - Strands: Double-stranded
 - RNA
 - Nitrogenous Bases: Adenine, Uracil, Guanine, Cytosine
 - Sugar: Ribose
 - Strands: Single-stranded
- **Base Pairing Rules:**
 - A (adenine) pairs with T (thymine) & U (uracil) — 2 hydrogen bonds
 - C (cytosine) pairs with G (guanine) — 3 hydrogen bonds

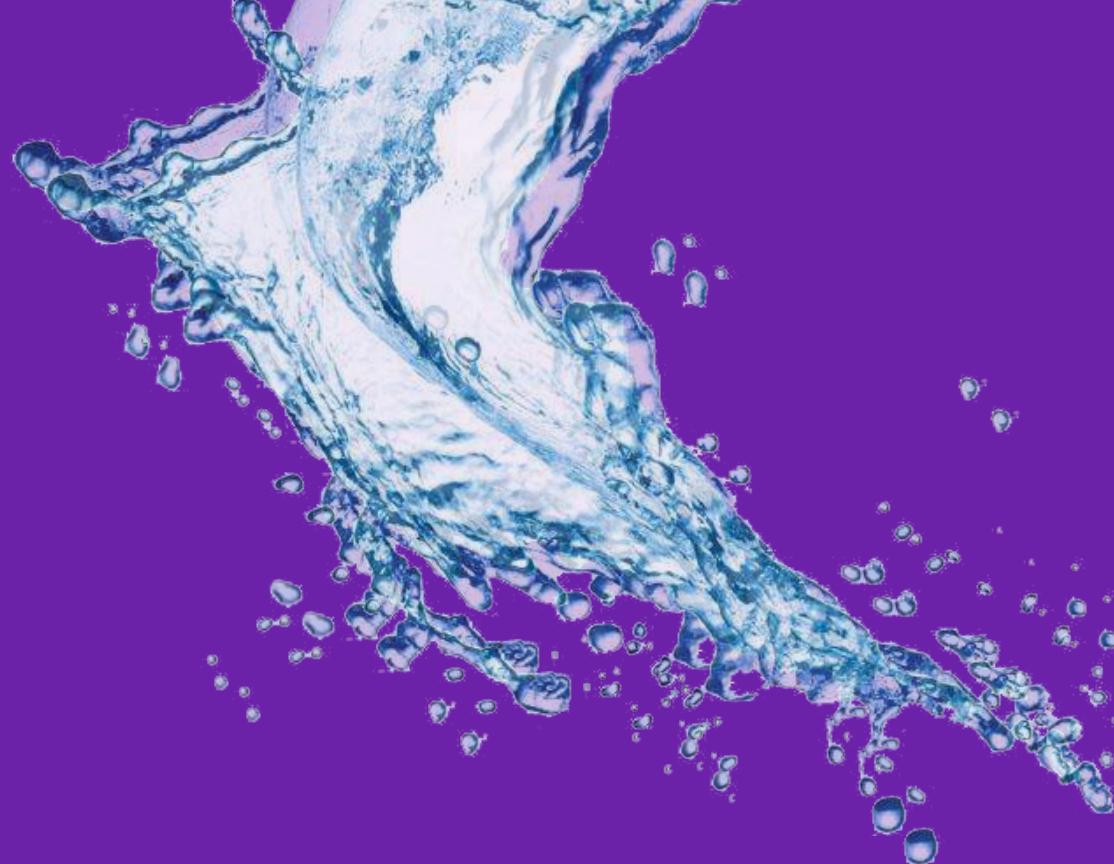


Lipids

- No true monomer
- Elements: C, H, O
- Types of Lipids:
 - Fats
 - Saturated fats
 - Solid at room temperature
 - Single bond between atoms
 - Each carbon atom is saturated with a hydrogen
 - Unsaturated fats
 - Liquid at room temperature
 - At least one double bond between atoms
 - Not all carbon atoms are saturated with a hydrogen
 - Phospholipids
 - Amphipathic
 - Hydrophilic phosphate head
 - Hydrophobic fatty tails
 - Form a bilayer that is semi-permeable
 - Steroids



WATER PROPERTIES





Polarity

Universal Solvent

Cohesion & Adhesion

High Specific Heat

Surface Tension

COHESION & ADHESION

Cohesion

- Water molecules stick to other water molecules
 - Electronegative oxygen attracts partially positive hydrogen

Adhesion

- Water molecules stick to other polar molecules
 - Electronegative oxygen attracts partially positive atoms of other molecules

Together, these enable capillary action.

SURFACE TENSION & SOLVENT PROPERTIES

Surface Tension

Caused by hydrogen bonds between water molecules

Solvent Properties

Water dissolves polar substances as it is polar itself

HIGH SPECIFIC HEAT & ICE

High Specific Heat

Water resists temperature change because of the hydrogen bonds between water molecules

Why is Ice Less Dense?

As ice forms, the molecules arrange themselves in a crystal structure with empty spaces—and those spaces act as a means for the ice to float

Result: Ice floats on liquid water

pH

pH Formula

$$-\log[H^+]$$

As H increases, pH decreases.
As H decreases, pH increases.