CARBOHYDRATES

Carbohydrates are organic compounds composed of carbon, hydrogen, and oxygen in a ratio of approximately 1:2:1. They serve as a major source of energy and play crucial roles in living organisms.

Classification:

Carbohydrates are classified based on their molecular size and structure into three main groups:

1. Monosaccharide:

- **Definition**: The simplest form of carbohydrates, consisting of a single sugar molecule.
- **Characteristics**: They are sweet-tasting, soluble in water, and cannot be hydrolyzed further into simpler sugars.
- **Examples**: Glucose, fructose, and galactose.

2. Disaccharides:

- **Definition**: Formed when two monosaccharide are joined together by a glycosidic bond.
- **Characteristics**: They are relatively sweet and soluble in water.
- **Examples**: Sucrose (glucose + fructose), lactose (glucose + galactose), and maltose (glucose + glucose).

3. Polysaccharides:

- **Definition**: Complex carbohydrates composed of multiple monosaccharide units linked together.
- **Characteristics**: They are generally not sweet-tasting and often insoluble in water.

- **Examples**: Starch (energy storage in plants), glycogen (energy storage in animals), and cellulose (structural component in plant cell walls).

Characteristics:

- **Energy Source:** Carbohydrates are the primary source of energy for living organisms, particularly glucose.
- **Structural Role:** Polysaccharides like cellulose provide structural support in cell walls.
- **Storage:** They serve as energy reserves in the form of starch in plants and glycogen in animals.
- **Chemical Diversity:** Carbohydrates vary in size and complexity, influencing their physical properties and biological functions.

Examples of Carbohydrates in Daily Life:

- **Glucose**: Found in fruits, honey, and as the primary sugar in the bloodstream.
- **Fructose**: Found in fruits and honey, often used as a sweetener.
- **Sucrose**: Common table sugar found in sugar cane, sugar beets, and many processed foods.
- **Starch**: Found in grains, potatoes, and other plant-based foods as a storage form of energy.
- **Cellulose**: Found in plant cell walls, providing structural integrity.

PROTEINS

Proteins are macromolecules composed of amino acid chains folded into specific 3-dimensional structures, crucial for the structure, function, and regulation of cells and tissues. They can be classified based on various criteria, including structure, function, and composition.

Classification of Proteins:

1. Structural Classification:

- **Fibrous Proteins:** These proteins have a thread-like, elongated shape and provide structural support. Examples include:
- **Collagen:** Found in connective tissues like tendons and skin.
- **Keratin:** Present in hair, nails, and the outer layer of skin.
- **Globular Proteins:** These are compact, roughly spherical proteins that are typically involved in biochemical processes. Examples include:
- **Enzymes:** Catalytic proteins like **amylase**, which breaks down starch.
- **Hemoglobin:** Oxygen-carrying protein in red blood cells.

2. Functional Classification:

- **Enzymes:** Proteins that catalyze biochemical reactions. Examples include:
- **Lactase:** Digests lactose into glucose and galactose.
- **Antibodies:** Proteins that recognize and bind to specific antigens, part of the immune response.
- **Immunoglobulin G (IgG):** Antibody involved in immune defense against pathogens.

3. Based on Composition:

- **Simple Proteins:** Consist solely of amino acid residues. Examples include:
- **Albumin:** Found in blood plasma, maintains osmotic pressure.
- **Histones:** Involved in DNA packaging in chromosomes.
- **Conjugated Proteins:** Contain a non-protein component in addition to amino acids.
- **Hemoglobin:** Contains iron-containing heme groups.

4. Based on Shape and Function:

- **Transport Proteins:** Facilitate the movement of molecules across membranes or within cells.
- **Ion channels:** Allow specific ions to pass through cell membranes.
- **Structural Proteins:** Provide support and shape to cells and tissues.

Characteristics of Proteins:

- **Amino Acid Sequence:** Determines the protein's primary structure.
- **Structure:** Includes secondary (alpha helices, beta sheets) and tertiary (overall 3D shape) structures.
- **Function:** Dictated by the protein's shape, which allows specific interactions with other molecules (substrates).
- **Specificity:** Proteins often exhibit high specificity for their substrates or binding partners.
- **Regulation:** Proteins can be regulated through various mechanisms such as allosteric regulation or post-translational modifications.

Each type of protein plays a vital role in maintaining cellular functions, from catalyzing biochemical reactions to providing structural support and regulating gene expression. The diversity of proteins reflects their diverse functions in biological systems.

FATS/LIPIDS

Fats, also known as lipids, are a class of biomolecules that serve critical functions in living organisms. They are characterized by their hydrophobic nature and are essential for energy storage, structural components of cell membranes, and signaling molecules. Fats can be classified based on their structure, saturation of fatty acids, and function. Here's an overview of the classification and characteristics of fats:

Classification of Fats

1. Based on Structure:

a) Simple Lipids (Neutral Fats):

Description: Simple lipids consist of fatty acids esterified to glycerol.

Examples:

- Triglycerides: Composed of three fatty acids esterified to a glycerol molecule. They are the main storage form of fat in adipose tissue and serve as a major energy source in the body.

b) Compound Lipids:

Description: Compound lipids contain other substances in addition to fatty acids and glycerol.

Examples:

- Phospholipids: Consist of a glycerol molecule, two fatty acids, a phosphate group, and a polar head group (e.g., choline, ethanolamine). They are major components of cell membranes and are crucial for membrane structure and function.

c) Derived Lipids:

Description: Derived lipids are formed by hydrolysis of simple or compound lipids.

Examples:

- Fatty acids: Long-chain carboxylic acids derived from hydrolysis of triglycerides or phospholipids. They serve as energy sources and precursors for other lipid molecules.
- Steroids: Lipids with a fused ring structure, including cholesterol and steroid hormones like estrogen and testosterone.

2. Based on Saturation of Fatty Acids:

I. Saturated Fats:

Description: Saturated fats have fatty acids with no double bonds between carbon atoms, making them solid at room temperature.

Examples:

- Butter
- Coconut oil
- Animal fats

II. Unsaturated Fats:

Description: Unsaturated fats have one or more double bonds between carbon atoms, making them liquid at room temperature.

Examples:

- Olive oil
- Sunflower oil
- Avocado