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# Biomolecules

Curated Notes by Chandra Shekhar

## 1. CARBOHYDRATES

**Definition:** Carbohydrates are organic compounds with general formula  $C_n(H_2O)_m$ , essentially hydrates of carbon.

### Classification:

#### 1) Monosaccharides:

- Cannot be hydrolysed further.
- Examples:
  - Aldotriose: 3C compound with an aldehyde group (e.g., Glyceraldehyde)
  - Ketotriose: 3C compound with a ketone group (e.g., Dihydroxyacetone)

#### 2) Disaccharides:

- Formed by condensation of two hexose units.
- General reaction:  
 $C_6H_{12}O_6 + C_6H_{12}O_6 \leftrightarrow C_{12}H_{22}O_{11} + H_2O$
- Examples:
  - Maltose = Glucose + Glucose
  - Lactose = Glucose + Galactose
  - Sucrose = Glucose + Fructose

#### 3) Polysaccharides:

- Long chains of monosaccharide units.
- Examples:
  - Starch, Cellulose — *Homopolysaccharides*
  - Inulin — *Heteropolysaccharide*

## 2. PROTEINS AND AMINO ACIDS

**Definition:** Proteins are polymers of amino acids containing nitrogen.

### Amino Acids Classification:

- Purines and Pyrimidines
- Porphyrins (e.g., heme group)
- Vitamins

## 5. ENZYMES

**Definition:** Biological catalysts, mostly proteins.

### Examples and Functions:

- **Pepsin, Trypsin:** Proteins → Amino acids
- **Nucleases:** DNA/RNA → Nucleotides
- **Amylase:** Starch → Glucose
- **Invertase:** Sucrose → Glucose + Fructose
- **Lactase:** Lactose → Glucose + Galactose
- **Urease:** Urea →  $CO_2 + NH_3$

- **Aliphatic:** Glycine, Alanine, Valine, Leucine
- **Aromatic:** Phenylalanine, Tyrosine
- **Heterocyclic:** Proline, Histidine, Tryptophan
- **Sulphur-containing:** Methionine, Cystine
- **Acidic:** Aspartic acid, Glutamic acid
- **Basic:** Arginine, Lysine
- **Hydroxyl-containing:** Serine, Threonine

## 3. PROTEIN TYPES

### Based on Structure:

- **Fibrous Proteins:**
  - Insoluble, elongated structures
  - Role: Structural support
  - Examples: Collagen (tendons), Keratin (hair, nails), Myosin (muscles)
- **Globular Proteins:**
  - Compact and soluble
  - Role: Enzymes, hormones, antibodies
  - Example: Insulin

### Based on Composition:

- **Phosphoproteins:** Casein (milk), Vitellin (egg yolk)
- **Glycoproteins:** Mucin (saliva), membrane components
- **Nucleoproteins:** Found in chromosomes, ribosomes, viruses
- **Chromoproteins:** Haemoglobin, Phytochrome (plant pigment)

## 4. FUNCTIONS OF AMINO ACIDS

- Building blocks of proteins
- Precursors for:
  - Hormones

- **Urease:** Urea  $\rightarrow$  CO<sub>2</sub> + NH<sub>3</sub>
- **DNA Polymerase:** Deoxynucleotide triphosphates  $\rightarrow$  DNA
- **RNA Polymerase:** Ribonucleotide triphosphates  $\rightarrow$  RNA
- **Maltase:** Maltose  $\rightarrow$  2 \* Glucose
- **Lactase:** Lactose  $\rightarrow$  2 \* Glucose

## 6. NUCLEIC ACIDS

**Function:** Carry genetic information and guide protein synthesis.

**Types:**

- **DNA (Deoxyribonucleic Acid):**
  - Double-stranded, found mainly in the nucleus.
  - Bases: A, G, C, T; Sugar: Deoxyribose
- **RNA (Ribonucleic Acid):**
  - Single-stranded, found in cytoplasm and nucleus.
  - Bases: A, G, C, U; Sugar: Ribose

**Key Functions:**

- **DNA:** Replication and storage of genetic info
- **RNA:** Protein synthesis and gene expression