ORGANIC CHEMISTRY

Organic compounds are synthesized by cells and contain Carbon - made of carbon skeleton.

Carbon skeletons are attached at a FUNCTIONAL GROUP - which is the area that participates in chemical reactions.

BUILDING macromolecules (AKA. organic compounds):

- Macromolecules are large molecules called polymers.
- These polymers are composed of monomer subunits.

**FUNCTION**

**RE A CTIONS**

Condensation (dehydration synthesis) - monomers are connected to produce polymers; releases H₂O during the reaction.

Hydrolysis - polymers are broken down into their monomers; H₂O is needed for the reaction to occur.

ENZYMES assist in both reactions!

4 Types of Macromolecules

1. CARBOHYDRATES –
   - consist of C, H, O
   - Main source of energy - breakdown of sugar supplies immediate energy to cells; excess is stored as complex sugars in cells

<table>
<thead>
<tr>
<th>Monosaccharide</th>
<th>Disaccharide</th>
<th>Polysaccharide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple sugar (monomer)</td>
<td>Complex sugars (polymer)</td>
<td></td>
</tr>
<tr>
<td>Formula C₆H₁₂O₆</td>
<td>Formed by the combination of monosaccharides</td>
<td></td>
</tr>
</tbody>
</table>

**EXAMPLES OF SACCHARIDES** -

glucose, fructose, galactose

**shape of molecule will determine how it reacts**

sucrose, lactose, maltose

Cellulose stored in cell walls of plants for structural support.

Glucose produced by photosynthesis is stored as Starch (amylose) in plants.

Glycogen is stored in liver & muscle cells of animals.
2. **LIPIDS** -
- consist of C, H, O
- waxes, oils, fats, steroids (cholesterol & sex hormones)
- hydrophobic - *insoluble* in water

**FUNCTION**
- **Energy Storage** - breakdown of lipids provides long-term energy supply; excess is stored in fat cells; yields twice as much energy as carbohydrates
- Component of cell membrane (phospholipids)
- provides cushions, insulates and waterproofing (wax)

A fat is constructed from two kinds of smaller molecules, glycerol & fatty acids. (monomer)

3. **NUCLEIC ACIDS** -
- consist of C, H, O, N, P
- polymer of nucleotides (monomer)
- stores and transmits genetic information

**FUNCTION**
- Nucleotide
- Phosphate group
- Nitrogenous base
- Sugar
- Ester Linkage
- Glycosidic Linkage
- Formation of LIPID “Triglyceride” -
- Fatty acid chains can be saturated (solid at room temp) or unsaturated (liquid at room temp).
Two types of nucleic acids -
1. DNA (deoxyribonucleic acid) - double strand of genetic information
2. RNA (ribonucleic acid) - single strand copy of DNA used to build proteins

Examples of nongenetic nucleotides - plays a major role in cell metabolism
1. ATP (adenosine triphosphate) - carries energy for cellular activities
2. Subunits of coenzymes - enzyme helpers that transport hydrogen atoms plus electrons from one reaction site to another (examples - NAD+, FAD)

4. PROTEINS -
   • consist of C, H, O, N, S
   • polymers made of amino acids (monomer)

AMINO ACID
   • All 20 amino acids have the same structure - but the R group is different.
   • The “R” group may vary in size, shape, charge, hydrophobicity and reactivity.
   • The sequence of amino acids will determine which protein is made.

BUILDING a protein -
   • amino group bonds to a carboxyl group of another amino acid
   • Bond formed between the amino acids is called a PEPTIDE bond.

FUNCTIONS
   • Structural element of hair/nails (keratin) & bone/cartilage (collagen)
   • Increase rate of reaction as an enzyme (biological catalyst)
   • Transport and storage of molecules
   • Control of metabolism
   • Receptor proteins - signaling from cell to cell
   • Tissue defense (antibodies)