

Republic of Iraq

Ministry of Higher Education for Sciences

Al- Zahra University for Women

College of Health and Medical Technologies

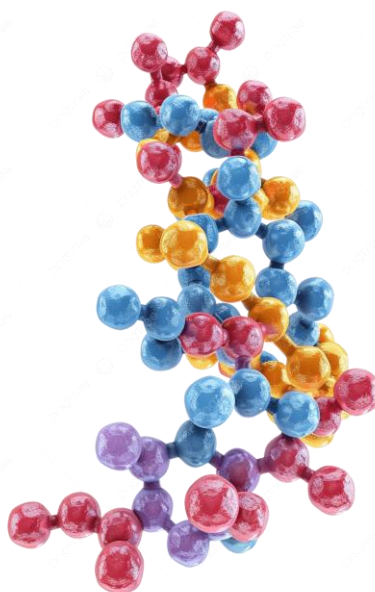
Department of Anesthesia Techniques



CHEMISTRY

Title of the lecture:

Lipids, classification, derived lipids, compound, lipids



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Lipids

Lipids are organic compounds that are essential components in living organisms. They are characterized by being insoluble in water but soluble in organic solvents such as alcohol, ether, and chloroform. Lipids play a crucial role in energy storage, cell membrane formation, and cellular signaling.

Classification of Lipids:

Lipids are classified into three main categories based on their chemical structure and biological functions:

1

Simple Lipids

Definition: These are esters of fatty acids with alcohol, without any additional components.

Fats and Oils

- Composed of fatty acids and glycerol.
- Fats are solid at room temperature, while oils are liquid.
- Function: Energy storage in living organisms.

Waxes:

- Esters of fatty acids with long-chain alcohols.
- Function: Water-repellent coating in plants and animals.

2

Compound Lipids

Definition: These contain additional components besides fatty acids and alcohol.



Phospholipids:

- Composed of fatty acids, glycerol, a phosphate group, and an additional compound like choline.
- Function: Major components of cell



Glycolipids:

- Contain fatty acids and sugars.
- Function: Play a role in cell recognition and signaling.



Lipoproteins:

- Mixtures of lipids and proteins.
- Function: Transport lipids in the bloodstream.

3

Derived Lipids

Definition: These are compounds derived from the hydrolysis of simple and compound lipids.

Fatty Acids

- Can be saturated (no double bonds) or unsaturated (contain double bonds).
- Function: Important energy source.

Steroids

- Include cholesterol and steroid hormones (e.g., cortisol and estrogen).
- Function: Involved in membrane structure and hormone production.

Fat-Soluble Vitamins

- Include vitamins A, D, E, and K.
- Function: Play vital roles in vision, metabolism, and antioxidant activity.

Importance of Lipids in the Body

- 1. Energy Source:** Lipids provide more energy than carbohydrates and proteins.
- 2. Cell Membrane Formation:** Lipids, especially phospholipids, are essential components of cell membranes.
- 3. Thermal Insulation:** Lipids act as an insulator to maintain body temperature.
- 4. Organ Protection:** They form a cushion that protects internal organs from shocks.
- 5. Vitamin Transport:** Lipids facilitate the absorption of fat-soluble vitamins.
- 6. Signaling Role:** Some lipids act as mediators for cellular signaling.

Lipid Metabolism

Lipid metabolism refers to the biological processes through which lipids are digested, absorbed, stored, and converted into energy or structural components for cells. This includes lipid synthesis (lipogenesis) and breakdown (lipolysis), as well as fatty acid oxidation and energy production.

Stages of Lipid Metabolism

1. Digestion of Lipids:

- Lipid digestion begins in the small intestine with the help of the following enzymes:
- **Pancreatic Lipase:** Breaks down triglycerides into fatty acids and monoglycerides.
- **Bile Salts:** Emulsify fats to facilitate enzymatic action.
- The final products of digestion include:
- Fatty acids.

- **Monoglycerides.**
- **Glycerol.**

2. Absorption of Lipids:

- **Fatty acids and monoglycerides are absorbed through intestinal cells (enterocytes) via diffusion or active transport.**
- **Within enterocytes:**
- **Triglycerides are reassembled.**
- **Packaged into lipoproteins called chylomicrons for transport in blood and lymph.**

3. Transport of Lipids:

- **Triglycerides and cholesterol are transported in the blood by various lipoproteins:**
- **Chylomicrons: Transport dietary fats from the intestine to tissues.**
- **Low-Density Lipoproteins (LDL): Deliver cholesterol to cells.**
- **High-Density Lipoproteins (HDL): Remove excess cholesterol from cells to the liver.**

4. Fatty Acid Oxidation:

- **Known as Beta-Oxidation:**
- **Occurs in the mitochondria of cells.**
- **Long-chain fatty acids are broken down into acetyl-CoA units.**
- **Products:**
- **Acetyl-CoA: Enters the Krebs cycle for energy production.**
- **NADH and FADH₂: Generate ATP via the electron transport chain.**

5. Fat Storage:

- **Excess lipids are stored as triglycerides in adipose tissue.**
- **When energy is needed:**
- **Lipolysis is activated by hormones such as glucagon and epinephrine.**
- **Fatty acids are released into the bloodstream for energy utilization.**

6. Lipogenesis (Fat Synthesis):

- **Occurs when there is an excess of carbohydrates or proteins:**
- **Glucose is converted into fatty acids in the liver.**
- **Stored as triglycerides in adipose tissue.**

Regulation of Lipid Metabolism

Lipid metabolism is regulated by:

- **Hormones:**
- **Insulin: Stimulates lipid storage (lipogenesis).**
- **Glucagon and Epinephrine: Promote lipid breakdown (lipolysis).**
- **Physical Activity: Increases fatty acid oxidation for energy.**
- **Diet: Affects blood and body lipid levels.**

Disorders Related to Lipid Metabolism

- 1. Hypercholesterolemia: Elevated LDL levels lead to cardiovascular diseases.**
- 2. Obesity: Excessive fat storage.**
- 3. Ketosis: Overproduction of ketones due to excessive fatty acid oxidation.**
- 4. Fatty Liver Diseases: Fat accumulation in the liver caused by excessive fat or alcohol consumption.**