Introduction to biochemistry

Introduction to Biochemistry

What is Biochemistry?

- Biochemistry is the branch of science that explores the chemical processes and substances occurring within living organisms.
- It serves as a bridge between biology and chemistry, aiming to understand life at the molecular level.

Scope and Importance

- Biochemistry helps explain how biological molecules give rise to the processes that occur within and between living cells.
- It plays a critical role in fields such as medicine, genetics, agriculture, and biotechnology.

Key Areas of Study in Biochemistry:



A. Structure and Function of Biomolecules

- Study of essential biological molecules including:
  - **Proteins** – enzymes, structural components, signaling molecules.
  - **Carbohydrates** – energy storage and structural functions.
  - **Lipids** – membrane components and energy storage.
  - **Nucleic Acids (DNA & RNA)** – genetic material and information transfer.

B. Metabolism

- Investigation of chemical reactions that sustain life, including:
  - Energy production (catabolism)
  - Synthesis of biomolecules (anabolism)

C. Enzymology

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- Study of enzymes, their mechanisms, structure, kinetics, and regulation in catalyzing biochemical reactions.

D. Genetics and Molecular Biology

- Examination of:
  - DNA and RNA structures
  - Gene expression and regulation
  - Molecular mechanisms of inheritance

E. Signal Transduction and Cellular Communication

- Understanding how cells detect, process, and respond to signals, enabling regulation and coordination of cellular activities.

Scope of Biochemistry in Pharmacy

Biochemistry plays a crucial role in pharmacy and pharmaceutical sciences.

A. Drug Design and Development:

- Biochemistry helps in understanding how drugs interact with biological molecules (like enzymes, receptors, DNA).
- Structure-activity relationships (SAR) are derived using biochemical knowledge.

B. Pharmacodynamics and Pharmacokinetics:

- **Pharmacodynamics**: What the drug does to the body — involves understanding biochemical pathways.
- **Pharmacokinetics**: What the body does to the drug — involves metabolism, which is deeply rooted in biochemical processes (e.g., liver enzyme activity).

C. Enzyme Inhibition:

- Many drugs act by **inhibiting specific enzymes** (e.g., ACE inhibitors for hypertension).
- Understanding enzyme kinetics is essential in drug development.

D. Disease Mechanisms:

- Biochemistry helps understand **pathophysiology** — how diseases alter biochemical pathways (e.g., diabetes, cancer).
- This knowledge aids in designing targeted therapies.

E. Clinical Biochemistry:

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- Laboratory tests based on biochemical markers are used for **diagnosis**, **monitoring**, and **prognosis** of diseases.
- Example: Blood glucose, cholesterol levels, liver and kidney function tests.

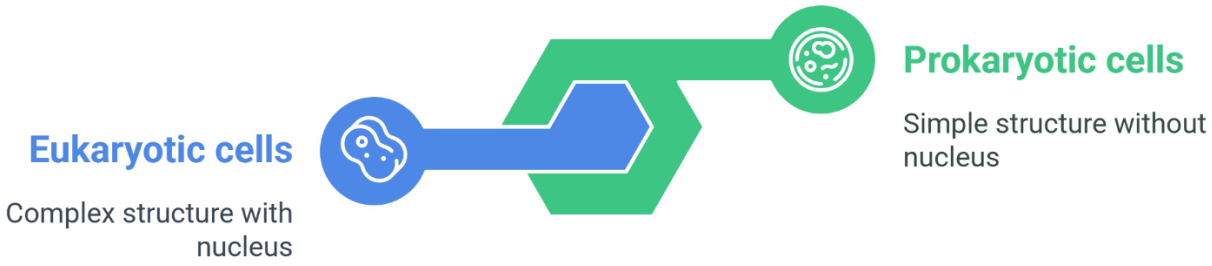
F. Biotechnology and Molecular Pharmacology:

- Involves genetic engineering, recombinant DNA technology, and biopharmaceuticals.
- Biochemistry is the foundation for understanding and applying these techniques.

Cell and Its Biochemical Organization

- The **cell** is the **basic structural and functional unit** of life. A clear understanding of cellular organization is essential to appreciate how biochemical reactions occur in different compartments.

Types of Cells:



- **Prokaryotic cells**: Simple structure, no nucleus (e.g., bacteria).
- **Eukaryotic cells**: Complex structure, with nucleus and membrane-bound organelles (e.g., human cells).

Major Components of a Eukaryotic Cell:

Organelle	Structure & Function	Biochemical Significance
Plasma Membrane	Phospholipid bilayer with embedded proteins	Regulates transport, signal transduction
Nucleus	Contains DNA	Site of transcription (DNA → RNA)
Mitochondria	Double membrane, has its own DNA	Site of ATP production (aerobic respiration)
Endoplasmic Reticulum (ER)	Smooth & rough (with ribosomes)	Protein and lipid synthesis
Golgi Apparatus	Stacked membranous sacs	Modifies, sorts, packages proteins

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

Lysosomes	Membrane-bound vesicles	Contains digestive enzymes (autophagy, apoptosis)
Ribosomes	RNA and protein	Site of protein synthesis
Cytoplasm	Gel-like fluid	Contains enzymes for metabolic reactions

Biochemical Processes in the Cell:

- **Glycolysis** in cytoplasm.
- **Krebs cycle** and **oxidative phosphorylation** in mitochondria.
- **Protein synthesis** on ribosomes (cytoplasmic or attached to ER).
- **DNA replication** and **RNA transcription** in nucleus.
- **Detoxification** in smooth ER (especially in liver cells).

Cell Membrane and Transport:

- **Passive transport**: Diffusion, osmosis.
- **Active transport**: Requires energy (e.g., Na^+/K^+ pump).
- **Endocytosis & exocytosis**: Bulk transport of materials.

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

First Hope

FREE PREVIEW

Click here to visit our website

PHARMACY PREMIUM NOTES

Complete subject and semesters are available on FirstHope app only.

Scan or click here

Click here to get the app >

Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram >

Scan or click here

@FirstHopeNotes

Instagram

@firsthope.official

Click here to follow >

YouTube channel

FirstHope-Pharmacy / Live streams

Click here to watch >

WhatsApp channel

Follow FirstHope on WhatsApp

Click here to join >

FirstHope website

firsthope.co.in

Click here to visit >

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.