
HMX Fundamentals Biochemistry

A solid understanding of biochemical principles is essential for the practice of medicine, because so many different diseases and therapies have a basis in chemistry and the interactions of molecules. This course focuses on the foundational principles and themes in biochemistry, spanning from the molecular up to the whole organism. Participants will:

- Understand fundamental principles of energy and thermodynamics, and the importance of enzymes in biochemical pathways
- Learn about cellular specialization and how cell functions are explained by the chemical properties and structure of biological molecules
- See how foundational concepts apply in real-life scenarios and clinical settings

Topics Covered

Course Overview

- Course introduction
- Meet the faculty

The Rules of Energy

- Thermodynamics of chemical reactions
- Equilibrium and Le Chatelier's principle
- The role of enzymes and enzyme regulation
- Glycolysis

How Energy is Harnessed

- Coupling chemical reactions
- Energy currencies: ATP and NADH
- The tricarboxylic acid cycle
- The electron transport chain

How Energy is Transformed

- Bypass reactions and catabolic pathways
- Gluconeogenesis
- Metabolic networks
- Diet and energy

Cellular Specialization

- Cellular metabolic specialization
- The liver and muscle in carbohydrate metabolism
- The role of adipose tissue in lipid metabolism
- Diabetes

Compartmentalization of Biochemical Pathways

- Membranes and organelles
- Pumps and osmolarity
- Sequestration of chemical reactions
- Fatty acid synthesis and oxidation
- The secretory pathway

Signaling Pathways

- Response to stimuli
- Receptors, ligands and enzyme cascades
- Positive and negative feedback
- Endocrine signaling (insulin and glucagon)

The Chemistry of Life

- The hydrophobic effect
- Amino acid and protein structure
- How structure dictates function
- Inhibitors
- Allosteric and covalent enzyme regulation

Each HMX course is designed to give learners a solid foundation in the basic science principles that are relevant to human health and disease. Concepts are taught using whiteboard-style videos and animations and reinforced by interactive elements, true-to-life scenarios, and real patient cases to enhance learning.