Virginia Western Community College
CHM 260
Introductory Biochemistry

Prerequisites
CHM 112 or divisional approval.

Course Description

Explores fundamentals of biological chemistry. Includes study of macromolecules, metabolic pathways, and biochemical genetics.

Semester Credits: 3 **Lecture Hours: 3**

Required Materials

Textbook:
Biochemistry: A Short Course. Tymoczko, Berg & Stryer. 3rd edition. WH Freeman & Co. ISBN: 9781464126130

Course Outcomes

At the completion of this course, the student should be able to:

- Determine the charge and protonation state of biomolecules in physiological solution, and describe their behavior and function in terms of their state, using the Henderson-Hasselbalch equation.
- Master the basic principles of protein structures.
- Master the basic principles of nucleic acid structure and function.
- Visualize and understand how the conformational flexibility of proteins regulates their functions.
- Analyze and quantify the kinetics of enzyme reactions
- Analyze catalytic mechanisms of enzymes.
- Master the basic principles of the structure and function of carbohydrates and lipids.
- Be introduced to the components and organization of cell membranes.
- Be introduced to signal-transduction pathways.
- Understand how biomolecules work together to carry out the myriad tasks in cells.

Topical Description

Chapter 1: Introduction

- Categories of macromolecules
- Cellular organelles

Chapter 2: Water

- Hydrogen bonding, van der Waals forces, hydrophobic effect
- pH
- Henderson-Hasselbalch equation and application

Chapter 3: Amino Acids

- Structures of the 20 common amino acids
- Other amino acids and amino acid derivatives
- Ionization of amino acids
- Peptide bonds
- Protein purification and analysis
- Amino acid composition of proteins
- Sequencing of amino acids and proteins

Chapter 4: Protein Three-Dimensional Structure

- Levels of protein structure
- Conformation of the peptide group
- Secondary protein structure
- Tertiary protein structure
- Quaternary protein structure
- Protein-protein interactions
- Collagen, myoglobin and hemoglobin structure and function
- Antibodies structure and function

Chapter 5: Protein Biochemical techniques

- Protein purification- Chromatographic techniques
- Gel electrophoresis
- Immunologic techniques
- X ray crystaollography, NMR, Mass Spectroscopy

Chapter 7: Enzyme kinetics and regulation

- Michaelis Menten model
- Allosteric regulation

Chapter 8: Enzyme Mechanisms and Inhibitors

- Types of inhibition: competitive, noncompetitive, uncometitive
- Irreversible inhibitors
- Penicillin mechanism
- Chymotrypsin mechanism

Chapter 9: Hemoglobin

- Cooperative binding
- Allosteric regulation
- Role of hydrogen ions and carbon dioxide in oxygen release
- Mutations

Chapter 10: Carbohydrates

- Mono- poly- and disaccharides
- Types of linkages
- Glycoproteins
- Proteoglycans

Chapter 11: Lipids
- Fatty acids
- Triacylglycerols
- Glycerophospholipids and sphingolipids
- Steroids
- Biological membranes
- Membrane transport
- Signal transduction

Chapter 12: Membrane structure and function
- Phospholipids
- Membrane composition
- Membrane fluidity

Chapter 13: Signal Transduction pathways
- G protein coupled receptors
- Tyrosine kinases
- Second messengers
- Insulin signaling

Chapter 15: Metabolism
- ATP structure and function
- Phosphoryl-group transfer
- Redox reactions
- Metabolic pathway overview

Chapter 16: Glycolysis
- Ten steps of glycolysis
- Enzymatic reactions of glycolysis
- Fate of pyruvate
- Regulation of glycolysis
- Other sugars and glycolysis
- Gluconeogenesis

Chapter 18: Preparing for Citric Acid Cycle
- Oxidation of pyruvate

Chapter 19: Citric Acid Cycle
- Conversion of pyruvate into acetyl CoA
- Citric acid cycle enzymes
- Entry of pyruvate into the mitochondria
- Regulation of citric acid cycle

Chapter 20: Oxidative Phosporylation
- The mitochondrion
- Chemiosmotic theory and proton motive force
- Electron transport

Chapter 21: Proton-Motive Force

- ATP synthase structure and function
- Movement across mitochondrial membranes

Chapter 22: Photosynthesis (time permitting)

- Light gathering pigments
- Bacterial photosynthesis
- Plant photosynthesis
- Calvin cycle
- Sucrose and starch metabolism in plants

Notes to Instructors

None.