



Isfahan University of Medical Sciences

Course Plan

Course Title: **Cellular & Molecular Biochemistry**

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| Course Code: 3114019 | Degree: MBBS |
| Course credit: 1.88 unit (Theory) | Academic Year: 2022-23/ Term: 1_(1401-02_1) |
| Days & hours of Class Time: Sunday 8-10a.m | Classroom Location: Shahid Soleimani Bldg |
| Starting Date: Sun 9 th October 2022 | Course Leader: Prof Pourfarzam (Office Phone: 7045) |
| Email: pourfarzam@pharm.mui.ac.ir | Office Address: Dept of Clinical Biochemistry School of Pharmacy |

The General Purpose of the Lesson:

Learning biochemistry is an excellent foundation for learning all of biology. Although it can be difficult to make sense of the complexity of biochemical systems. The course aims to provide an advanced understanding of the concept of Biochemistry regarding the structure and function of biomolecules: carbohydrates, proteins, lipids, nucleic acids, enzymes, vitamins and cofactors. You'll learn about the principles governing the interactions of individual biomolecules. This will prepare you, to learn later how these principles apply at the scale of cells and organisms and to see how biochemistry interconnects with human disease and clinical care.

Learning Objectives:

Water

The student is expected to explain weak Interactions in aqueous systems, ionization of water, weak acids, and weak bases, buffering against pH changes in biological systems, water as a reactant and the fitness of the aqueous environment for living organisms.

Carbohydrates and Glycobiology

The student will recall the structure and function of monosaccharides, disaccharides, polysaccharides, glycoconjugates, proteoglycans, glycoproteins, and glycosphingolipids. Explains carbohydrates as informational molecules, the sugar code and how to Work with Carbohydrates.

Enzymes

The student is expected to explain how enzymes work, enzyme classification, the basic features of enzyme Kinetics as an approach to understanding mechanism. Describes examples of enzymatic reactions and regulatory enzymes. Becomes familiar with factors affecting enzyme concentrations in blood, selection of enzyme tests, Isoenzymes, clinical utility of enzyme measurement (creatine kinase, alanine transaminase,

aspartate transaminase, alkaline phosphatase, γ -glutamyltransferase, lactate dehydrogenase, lipase, amylase)

Nucleotides and Nucleic Acids

The student is expected to explain the nucleic acid structure, nucleic acid chemistry and other functions of nucleotides. Describes DNA-based Information technologies, studying Genes and their products, using DNA-based methods to understand protein function.

Vitamins

The student is expected to describe how reference intakes for vitamins are determined and explain why reference intakes published by different authorities differ. Define a vitamin and describe the metabolism, principal functions, deficiency diseases associated with inadequate intake, and the toxicity of excessive intakes of the vitamins.

Amino Acids, Peptides, and Proteins

The student is expected to describe the structure, function and main properties of amino acids, peptides and proteins, principles of working with proteins, and the primary structure of proteins.

Proteins

The student will be able to identify the three-dimensional structure of proteins including: protein secondary, tertiary and quaternary structures, protein denaturation and folding. The student will also recall some important functions of protein, reversible binding of a protein to a ligand with examples including oxygen-binding proteins. The student will gain knowledge of complementary interactions between proteins and ligands including the Immune system and Immunoglobulins and protein interactions modulated by chemical energy including Actin, Myosin, and molecular motors

Lipids

The student will be able to: define simple and complex lipids and identify the lipid classes in each group and indicate their functions. Appreciate the importance of cholesterol as the precursor of many biologically important steroids, including steroid hormones, bile acids, and vitamins D. Appreciate lipids as signals, cofactors, pigments and explain principles of working with lipids

Biological Membranes and Transport

The student will have an understanding of the basic elements, the composition and architecture of membranes, membrane dynamics and solute transport across membranes.

Recommended Biochemistry Textbooks:

- Harper's Illustrated Biochemistry. 31st ed. (2018)
- Lehninger Principles of Biochemistry, 7th ed. (2017)
- Lippincott Illustrated Reviews: Biochemistry, 7th Edition (2017)
- Medical BIOCHEMISTRY. Baynes and Dominiczak. 5th ed (2019)
- Biochemistry. Ed. Lubert Stryer

Cellular & Molecular Biochemistry (Theory)_ 2022-23/ Term: 1

| Session | Topic | Reading Source | |
|---------------------|--|-------------------------|------------|
| | | Harper | Lehninger |
| 1 | Introduction, Biochemistry & Medicine | Chap 1 | Chap 1 |
| 2 | Water, Buffers & pH | Chap 2 | Chap 2 |
| 3 | Structure & Function of Amino Acids & Peptides (Part I) | Chap 3 | Chap 3 |
| 4 | Structure & Function of Amino Acids & Peptides (Part II) | Chap 3 | Chap 3 |
| 5 | Proteins: Structure, Properties & Function (Part I) | Chaps 4, 5 & 6 | Chap 4 & 5 |
| 6 | Proteins: Structure, Properties & Function (Part II) | Chaps 4, 5 & 6 | Chap 4 & 5 |
| 7 | Structure & Function of Lipids of Physiologic Significance (Part I) | Chap 21 | Chap 10 |
| 8 | Structure & Function of Lipids of Physiologic Significance (Part II) | Chap 21 | Chap 10 |
| Midterm Exam | | | |
| 9 | Membranes: Structure & Function | Chap 40 | Chap 11 |
| 10 | Structure & Function of Carbohydrates of Physiological Significance (Part I) | Chap 15 | Chap 7 |
| 11 | Structure & Function of Carbohydrates of Physiological Significance (Part II) | Chap 15 | Chap 7 |
| 12 | Nucleic Acid Structure & Function | Chap 34 | Chap 8 |
| 13 | The lipid-soluble Vitamins: Structure, principal functions and deficiency state | Chap 44 | |
| 14 | The water-soluble Vitamins: Structure, principal functions and deficiency state | Chap 44 | |
| 15 | Enzymes: Classification, Mechanism of Action & Regulation of Activities | Chap 7, 8 & 9 | Chap 6 |
| 16 | Clinical Enzymology: factors affecting enzyme concentrations in blood, selection of enzyme tests, Isoenzymes, clinical utility of enzyme measurement | Slides, Class materials | |
| Final Exam | | | |

| Evaluation and Exams | | |
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| Midterm | 40% | Exam Date is scheduled at the first session |
| Final Exam | 60% | Exam Date is scheduled by the University |
| | Up to 20% | Classroom & active learning activities |

INFORMATION AND POLICIES

1. The Department of Biochemistry upholds and enforces the University's policies on, plagiarism and cheating. These policies are available from International students office. All students are advised to read these policies.
2. Absences will be treated according to the university's vice-chancellor for education policies.
3. Late arrival more than 5minutes is considered absence.
4. Mobile phones, Tablets, and other electronic devices must be turned off at all times unless being used for a purpose relevant to the class. Students having a Mobile phone, tablet, or computer on their person during an exam will be assumed to have it for the purpose of cheating.
5. Any recordings of lectures may only be performed with written permission of the lecturer, and are for personal use only. The instructor retains copyright to such recordings and all lecture materials provided for the class (electronic and otherwise); these materials must not be shared or reposted on the Internet.
6. Course materials, such as notes, problem sheets, examinations, example sheets, or review sheets, may not be redistributed without the explicit written permission of the instructor.