

## ESTRUCTURAL BIOCHEMISTRY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Basic Sciences	Biochemistry	1	2	6	Fundamental
<b>LECTURER(S)</b>			<b>Postal address, telephone n°, e-mail address</b>		
Abdelalí Daddaoua			Department of Biochemistry and Molecular Biology 2, School of Pharmacy. 4th floor 958-243838 <a href="mailto:daddaoua@ugr.es">daddaoua@ugr.es</a>		
<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>			<b>TUTORSHIP</b>		
Food Science and Technology			<a href="http://farmacia.ugr.es/BBM2/">http://farmacia.ugr.es/BBM2/</a>		
<b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>					
<p>Have studied the subjects Biology, General Chemistry I Have adequate knowledge of:</p> <ul style="list-style-type: none"> <li>• Scientific English</li> <li>• Basic Computer skills</li> <li>• Access, search and management of scientific literature</li> </ul>					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)</b>					
<ul style="list-style-type: none"> <li>• Structure of biomolecules, enzymology, membranes, cell signaling.</li> <li>• Molecular Biology</li> </ul>					
<b>GENERAL AND PARTICULAR ABILITIES</b>					
<ul style="list-style-type: none"> <li>• CE.1 Recognize and apply the fundamentals physical, chemical, biochemical, biological, physiological, mathematics and statistics necessary for the understanding and development of science and food technology</li> </ul>					
<b>OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)</b>					
<p>At the end of this course the student is expected to be able to:</p> <ul style="list-style-type: none"> <li>• Understand the essential facts, concepts, principles and basic theories of Biochemistry.</li> <li>• Apply this knowledge to the resolution of issues and problems related to Biochemistry.</li> </ul>					



- Understanding the relationship between structure and function of biomolecules and the general structure of proteins and their biological functions.
- Knowing the structure of biological membranes and their selective permeability feature. Understand their role in signal transduction into the cell
- Learning the structure of genetic material and mechanisms of perpetuation and expression of the genome
- Knowing what the major metabolic pathways that occur in the human

## DETAILED SUBJECT SYLLABUS

### THEORETICAL PROGRAM

1. Introduction to the study of biochemistry. Characteristics of living matter. Overview of key biological constituents. Molecular organization of the cells. Production and consumption of energy metabolism. Transfer of genetic information.
2. Carbohydrates. Monosaccharides and derivatives. Oligosaccharides. Polysaccharides. Glycoproteins and proteoglycans.
3. Lipids. Simple lipids. Complex lipids. Isoprenoid compounds. Sterols
4. Liposoluble vitamins. Vitamins A, D, E and K.
5. Nucleotides and nucleic acids. Cyclic nucleotides.
6. Amino acids, peptides and proteins. Structural characteristics and biological functions
7. Protein structure. Secondary structures. Forces that stabilize the protein structure. Fibrous proteins. Collagen
8. Tertiary and quaternary structures of globular proteins. Forces involved in its stability. Structural and functional domains. Holoproteins and heteroproteins. Myoglobin and Hemoglobin
9. Enzymes. Features. Enzymatic Catalysis: activation energy, transition state, specificity and active site. Factors affecting the catalytic efficiency. Types of enzymatic catalysis. Enzyme cofactors. Metal ions. Coenzymes. Water-soluble vitamins.
10. Enzyme kinetics. Monosubstrate reactions. Hyperbolic kinetics: Michaelis-Menten equation. Enzyme inhibition.
11. Enzymatic regulation. Types of enzyme regulation. Allosteric regulation and regulation through covalent modification. Zymogens. Regulatory subunits. Isoenzymes.
12. Chemical organization of biological membranes. Transport mechanisms through membranes.
13. Communication between cells and tissues. Extracellular chemical messengers, hormones, neurotransmitters, growth factors and differentiation, cytokines and eicosanoids.
14. Signaling pathways. Receptors: agonist and antagonist ligands. Signal transduction. G protein-coupled receptors: adenylate cyclase systems and phospholipase C. Receptor tyrosine kinase.
15. Structure of nucleic acids. Denaturation and renaturation of nucleic acids. DNA supercoiling. Genetic organization.
16. DNA replication. Replication in prokaryotic and eukaryotic cells. DNA repair systems. Transposition.
17. Transcription in prokaryotic and eukaryotic cells. RNA polymerases. Promoters. Transcription factors. Post-transcriptional processing of RNA: splicing, base modifications, modifications of the 5' end and modifications of the 3' end. Reverse transcription.
18. Translation. Genetic code. Role of tRNA as an adapter. Mechanism of activation of amino acids: aminoacyl-tRNA synthetases. Synthesis of the peptide chain: phase, energy balance, and fidelity of the process. Posttranslational modifications: Folding and maturation peptide chain. Protein degradation.
19. Regulation of gene expression in prokaryotes and eukaryotes. Levels of regulation of gene expression. Regulation of transcription. Regulation of processing pre-mRNAs. Regulation of mRNA degradation. Regulating the biosynthesis of the polypeptide chain. Epigenetics.
20. Introduction to Metabolism. General concepts. Routes and phases of metabolism. Catabolism and anabolism. General principles of regulation: control of the activity and amount of enzyme. Compartmentalization.

### LABORATORY SESSIONS

1. Preparation of chromosomal DNA. Plasmid DNA purification. DNA electrophoresis.
2. Study of acetylcholinesterase activity. Location tissue. Effect of enzyme concentration on enzymatic activity
3. Determination of kinetic parameters of acetylcholinesterase
4. Colorimetric determination of protein. Lowry and Bradford methods

### READING

#### FUNDAMENTAL READING:

- Devlin TM. "Bioquímica". 4ª Edición. Reverté, Barcelona, 2004.



- Feduchi E, Romero C, Yáñez E, Blasco I, García-Hoz C. BIOQUÍMICA. Conceptos esenciales. Ediciones Panamericana, Barcelona, 2015
- HARPER. Bioquímica ilustrada. 28ª Edición. McGrawHill. Madrid. 2010.
- Herráez A. "Texto ilustrado e interactivo de Biología Molecular e Ingeniería Genética. Conceptos, técnicas y aplicaciones en Ciencias de la Salud". 2ª Edición. Elsevier, Barcelona, 2012.
- Mathews CK y Van Holde KE. "Bioquímica". McGraw-Hill-Interamericana, Madrid. 4ª Edición. 2011.
- Nelson DL, Cox MM. "Lehninger. Principios de Bioquímica". 5ª Edición. Ediciones Omega, Barcelona, 2009.
- Sánchez-Medina F y Vargas AM. "Bioquímica Estructural y Metabólica". Editorial Técnica AVICAM, Granada, 2013.
- Stryer L, Berg JM, Tymoczko JL. "Bioquímica". 7ª Edición. Reverté, 2013.
- Tymoczko JL, Berg JM, Stryer L "Bioquímica. Curso Básico". Reverté, 2014.
- Voet D y Voet J. "Bioquímica". 3ª edición. Ediciones Panamericana, Barcelona, 2006.
- Voet D, Voet J. y Pratt CW "Fundamentos de Bioquímica". Ediciones Panamericana, Barcelona, 2007.

COMPLEMENTARY READING:

- Genes VIII. Lewin B. Oxford University Press. 2003.
- Biotechnology for Beginners. Renneberg, R. Elsevier/Academic Press 2008.
- Molecular Cell Biology. 6ª Edición. Lodish I, Harvey F, et al. WH Freeman&Co 2007.
- Watson JD, Gilman M, Witkowski J, Zoller M Recombinant DNA, 2nd Edition, Scientific American books, WH Freeman , New York, 1992.

**RECOMMENDED INTERNET LINKS**



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<http://grados.ugr.es>