



Universitat de Lleida

DEGREE CURRICULUM
MOLECULAR BASIS OF LIFE

Coordination: ESPINET MESTRE, CARMEN

Academic year 2019-20

Subject's general information

Subject name	MOLECULAR BASIS OF LIFE			
Code	100502			
Semester	PRIMER QUADRIMESTRE			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Medicine	1	COMMON	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	1	2	3
	Number of groups	12	6	1
Coordination	ESPINET MESTRE, CARMEN			
Department	BASIC MEDICAL SCIENCES			
Important information on data processing	Consult this link for more information.			
Language	catalan			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
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Learning objectives

- 1- Know the structure of biomolecules.
- 2- Establish relationships between structure and function of biomolecules.
- 3- Understand the behavior of biomolecules in biological media.
- 4- Know and know how to use the basic concepts of enzymology and the regulation of enzymatic activity.

Competences

Skills that contributes to:

Biomolecules

Metabolism

Subject contents

UNIT 1. Molecular organization in living beings. Chemical characteristics differentiates from living matter. Levels of molecular organization in living beings: Bioelements. Biomolecules.

UNIT 2. Water and ions in aqueous solution. Biological importance of water. Water structure and physical-chemical properties. Interaction of water molecules with each other, and with other biological componenets. Ionic composition of body medias. Acid-base balance. Buffer systems

UNIT 3. General principles of organic chemistry. Links between carbons. Carbonate skeletons Links with heteroatoms. Hydrocarbons. Concept of functional group. Stereochemistry. Fischer projection. Isomerism and

types.

UNIT 4. Functional groups and classes of organic compounds. Functional groups with simple bonds: structure and characteristics of alcohols, ethers, peroxides, amines, thiols, thioethers, dithiols. Functional groups with multiple bonds: structure and characteristics of aldehydes, ketones, carboxylic acids, esters, amides, IMIDA, imines.

UNIT 5. Heterocycles. Heterocycles with a heteroatom in the skeleton of the cycle: pyrrole, furan, pyridine pyrano and derivatives. Heterocycles of more complex structure, quinoline, indole and derivatives. Heterocycles with more than one heteroatom: imidazole and derivatives, pyrimidine and pyrimidine bases, purine and purine bases. Nucleoside nucleotides.

UNIT 6. Carbohydrates. Generalities Classification. Monosaccharides: aldoses and ketoses. Stereochemistry of monosaccharides. Reactivity of monosaccharides. Derived monosaccharides. Oligosaccharides: the glycosidic bond. Nomenclature structure and properties of disaccharides. Polysaccharides: characteristics of structural, reserve and gelling polysaccharides. Glycosaminoglycans. Proteoglycans Glycoproteins

UNIT 7. Lipids. General characteristics and classification. Fatty acids. Acylglycerides. Glycerophospholipids. Sphingolipids: sphingophospholipids and sphingoglycolipids. Prostaglandins. Leukotrienes. Thromboxanes Isoprenoid lipids: terpenoids, carotenoids and steroids (sterols, acids and bile salts, steroid hormones). Pyrrolic lipids.

UNIT 8. Amino acids, peptides and proteins. Amino acids protein components. Structure and properties of amino acids. Rare and non-protein amino acids. Peptide bond. Peptides Proteins Primary, secondary, tertiary and quaternary structure of proteins. Folding of proteins. Structure-function relationship in proteins, examples. Structural characterization and physical-chemical properties of proteins.

UNIT 9. Biocatalysis. Molecular structure of enzymes. Mechanism of enzymatic reactions. General characteristics, active center, catalytic center and union center. specificity of enzymes. main classes of enzymes. Structural characteristics. Isozymes. Effect of the enzymes on the speed and on the equilibrium constant of the catalyzed reaction. Activation energy concept.

UNIT 10. Kinetics and regulation of enzymatic activity. Control of enzymatic activity. Influence on the speed of the enzymatic reactions of the pH, the ionic strength and the temperature. Enzymatic reactions with a single substrate and with several substrates. Kinetic constants V_{max} , K_{cat} , K_m . And $S_{0.5}$. Allostereism Mechanism of activation of proenzyme (zymogens).

UNIT 11. Vitamins. Vitamins as cofactors, precursors of cofactors, or prosthetic groups of certain enzymes. Describe and explain the structure, function, activation process, places and mode of action of vitamins

PRACTICAL AGENDA: Seminar 1. Buffer systems. (2h) Seminar 2. Spectrophotometry. Endpoint and kinetic studies. (2h) Seminar 3. Chromatographic techniques. (2h) Problems 1. Enzymatic kinetics. (2h)

LABORATORY PRACTICES

Practice 1. Espectrophotometry (2h)

Practice 2. Determination of the concentration of serum protein. (2h)

Practice 3. Electroforesi. Proteynogram (3h)

Practice 4. Enzymatic kinetics. Assay of the activity of the enzyme alfa amylase. Kinetic constants calculation (3h)

DIRECTED ACTIVITY: Bibliographic works. Preparation and exhibition of the works (5h)

Methodology

Objective	On-Campus activities

1) Structure of the biomolecules.	Teoric sessions. Seminars. Laboratory. Computer room.
2) Relationship between structure and function of the biomolecules	Teoric sessions. Seminars. Laboratory. Computer room..
3) Biomolecules in the biological media.	Teoric sessions. Seminars. Laboratory. Computer room.
4) Enzimology.	Teoric sessions. Seminars. Laboratory. Computer room.
	Evaluations

TEO: teoria

PRO: Problemes i casos

SEM: Seminari

INF: Informàtica

CAM: Camp

VIS: Visites

ACD: Activitat dirigida

LAB: pràctiques laboratoris

AVA: avaluació

S: setmana d'exàmens

Activity type	Summary description of the activity	Dedication (hours)	week	Training Objective
TEO	Molecular organization in living organisms	1		1,2,3
TEO	Water and ions in aqueous solution	3		1,2,3
TEO	General principles of organic chemistry	2		1,2,3
TEO	Functional groups and classes of organic compounds.	3		1,2,3

TEO	Heterocycles.	1		1,2,3
TEO	Carbohydrates	4		1,2,3
TEO	Lipids	3		1,2,3
TEO	Aminoacids, peptides and proteines	7		1,2,3
TEO	Biocatalisis	2		2,4
TEO	Kinetics and regulation of enzymatic activity.	3		2,4
TEO	Vitamines	1		2,4
SEM	Buffers.	2		1,2
SEM	Espectrophotometry	2		1,2,3
SEM	Cromatography	2		1,2,3
PRO	Enzymatic kinetics	2		4
INF	Activities in the computer room	3		1,2,3,4
ACD	Bibliographical works	5		1,2,3,4

LAB	Carbonated skeletons. Isomerism.	2		1,2,3
LAB	Biomolecules.	2		1,2,3
LAB	Protein electrophoresis	3		1,2,3
LAB	Enzymatic kinetics.	3		4
AVA	Evaluation	4		1,2,3,4

To achieve objective goals and acquire the attributed competencies, the following activities will be programmed: A part of the subject is developed in sessions of exhibition of theoretical concepts of one hour of duration. These concepts are reinforced in sessions of seminars and problems of one hour of duration. The laboratory practices allow the best understanding of theoretical concepts and the acquisition of basic skills in the laboratory work. Bibliographical works will be carried out in groups of 20 students, on topics proposed and related to the subject. The presentation will be oral.

Evaluation

Learning evaluations	%final mark	Evaluation type
Theory	75%	Written tests (2) on contents and theoretical and practical concepts related to biochemistry and molecular biology.
Practices and seminars	10	Assessment of activities through other written tests
works	15%	Assessment of the ability to integrate concepts and their application in a transversal way.

Evaluation		
Procedure	Time (hours)	% in the total marks
2 Written tests on the subject's program	4	25+50
Other written tests and exercises related to practices and seminars.	1	10
Oral presentations of the works	30min-1h	15

Bibliography

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6. Mathews CK, et al. 2013. Bioquímica. 4ª edición. McGraw-Hill Interamericana.
7. Rodwell VW, et al. 2015. Harper's Illustrated Biochemistry. 30th ed. Ed. John Wiley– Sons.
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11. Strayer L, Berg J, Tymoczko J. 2014. Bioquímica. 7ª ed. Ed. Reverté (6ª edició en català).
12. Strayer L, Berg J, Tymoczko J. 2014. Bioquímica. Curso básico. Ed. Reverté.
13. Voet D, Voet JG, Prat CW. 2016. Fundamentos de Bioquímica. 4a ed. Editorial Médica Panamericana