



Universitat de Lleida

DEGREE CURRICULUM  
**MOLECULAR BASIS OF LIFE**

Coordination: ESPINET MESTRE, MARIA CARMEN

Academic year 2023-24

## Subject's general information

<b>Subject name</b>	MOLECULAR BASIS OF LIFE			
<b>Code</b>	100502			
<b>Semester</b>	PRIMER QUADRIMESTRE			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Medicine	1	COMMON/CORE	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	Only examination			
<b>Coordination</b>	ESPINET MESTRE, MARIA CARMEN			
<b>Department</b>	BASIC MEDICAL SCIENCES			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	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

### COMPETENCES

The curriculum is methodologically organized so that students in addition to acquire knowledge and that they know how to apply it, they must acquire competences and professionals. Starting from this idea and in accordance with the MINISTERIAL ORDER ECI / 332/2008, the training of graduates at the Lleida School of Medicine will guarantee that the interested party has acquired the necessary knowledge to exercise the following competencies:

General competences

### PROFESSIONAL VALUES, ATTITUDES AND BEHAVIORS

#### SCIENTIFIC FOUNDATIONS OF MEDICINE:

CG 7. Understand and recognize the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems, in the different stages of life.

CG 8. Recognize the bases of normal human behavior and its alterations.

GC 9. Understand and recognize the effects, mechanisms and manifestations of the disease on the structure and function of the human body.

CG 10. Understand and recognize the causative agents and risk factors that determine the states of health and the development of the disease.

CG 11. Understand and recognize the effects of growth, development and aging on the individual and his social environment.

CG 12. Understand the foundations of action, indications and efficacy of interventions

based on available scientific evidence.

## INFORMATION MANAGEMENT:

CG 30. Know, critically assess and know how to use the sources of clinical information and biomedical to obtain, organize, interpret and communicate scientific information and sanitary.

CG 31. Knowing how to use information and communication technologies in activities clinical, therapeutic, preventive and research.

CG 32. Maintain and use records with patient information for later analysis, preserving the confidentiality of the data.

## CRITICAL ANALYSIS AND INVESTIGATION:

CG 33. Having, in professional activity, a critical, creative point of view, with constructive and research-oriented skepticism.

CG 34. Understand the importance and limitations of scientific thought in the study, prevention and management of diseases.

CG 35. Be able to formulate hypotheses, collect and critically assess information for problem solving, following the scientific method.

CG 36. Acquire basic training for research activity.

## 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 components. Ionic composition of body fluids. 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

<b>TEO</b>	Aminoacids, peptides and proteines	<b>7</b>		<b>1,2,3</b>
<b>TEO</b>	Biocatalisis	<b>2</b>		<b>2,4</b>
<b>TEO</b>	Kinetics and regulation of enzymatic activity.	<b>3</b>		<b>2,4</b>
<b>TEO</b>	Vitamines	<b>1</b>		<b>2,4</b>
<b>SEM</b>	Buffers.	<b>2</b>		<b>1,2</b>
<b>SEM</b>	Espectrophotometry	<b>2</b>		<b>1,2,3</b>
<b>SEM</b>	Cromatography	<b>2</b>		<b>1,2,3</b>
<b>PRO</b>	Enzymatic kinetics	<b>2</b>		<b>4</b>
<b>INF</b>	Activities in the computer room	<b>3</b>		<b>1,2,3,4</b>
<b>ACD</b>	Bibliographical works	<b>5</b>		<b>1,2,3,4</b>
<b>LAB</b>	Carbonated skeletons. Isomerism.	<b>2</b>		<b>1,2,3</b>
<b>LAB</b>	Biomolecules.	<b>2</b>		<b>1,2,3</b>
<b>LAB</b>	Protein electrophoresis	<b>3</b>		<b>1,2,3</b>

<b>LAB</b>	Enzymatic kinetics.	<b>3</b>		<b>4</b>
<b>AVA</b>	Evaluation	<b>4</b>		<b>1,2,3,4</b>



**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.

## Development plan

- Theoretical classes: 100 presential.

- Seminars: Eithe presentials or virtuals (Connection through the "videoconference" tab). Previously, the ppt that will be passed in class will have been attached in "resources". Students can print it out and follow the class better.

-Computer seminars:ppresentials

-Practices: presentials

- Exams: All face-to-face.

## Evaluation

Learning evaluations	%final mark	Evaluation type
<b>Theory</b>	75%	Written tests (2) on contents and theoretical and practical concepts related to biochemistry and molecular biology.
<b>Practices and seminars</b>	10	Assessment of activities through other written tests
<b>works</b>	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	30 +45
Other written tests and exercises related to practices and seminars.	1	10
Oral presentations of the works	30min-1h	15

From 4 in exams 1 and 2, it will be averaged with the notes of the written tests of seminars and practices and work. If the result is 5 or more, the corresponding part of the subject is approved and it is not necessary to make up. If the exam grade is less than 4 or the average with the other tests is less than 5, the corresponding subject must be recovered.

## Bibliography

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