COURSE DATA

Data Subject	
Code	34447
Name	Biochemistry and molecular biology
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1204 - Degree in Medicine	Faculty of Medicine and Odontology	1	First term

Subject-matter

Degree	Subject-matter	Character
1204 - Degree in Medicine	4 - Biochemistry	Basic Training

Coordination

Name	Department
ALONSO IGLESIAS, EULALIA	30 - Biochemistry and Molecular Biology
JIMENEZ MARTI, ELENA	30 - Biochemistry and Molecular Biology

SUMMARY

Biochemistry and Molecular Biology constitute a basic area of the Medicine in which great progresses with technological and social impact are produced. The subject initiates the presentation of the molecular bases of the physiological and/or pathological mechanisms of the human organism. Through the theoretical lessons and the personal work, the student will learn the molecular bases of the dynamic structure and function of the proteins and nucleic acids, the mechanisms to obtain cellular energy and the organization and regulation of the metabolism of sugars, lipids and proteins. The seminars and practical lessons will allow them to initiate in the group of laboratory techniques of Biochemistry and Molecular Biology, which have a double application, both having a diagnostic and experimental nature.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Knowledge of biology and chemistry of Second high school.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1204 - Degree in Medicine

- Understand and recognise the effects of growth, development and aging which affect individuals and their social environment.
- Know how to use the sources of clinical and biomedical information available, and value them critically in order to obtain, organise, interpret and communicate scientific and sanitary information.
- Know how to use IT in clinical, therapeutic and preventive activities, and those of research.
- In the professional practise, take a point of view which is critical, creative, constructive and research-oriented.
- Be able to formulate hypothesis, gather information and evaluate it critically in order to solve problems by following the scientific method.
- Establish a good interpersonal communication which may allow professionals show empathy and talk to the patients efficiently,as well as to their relatives, the media and other professionals.
- Proper organisation and planning of the workload and timing in professional activities.
- Team-working skills and engaging with other people in the same line of work or different.
- Criticism and self-criticism skills.
- Capacity for communicating with professional circles from other domains.
- Acknowledge diversity and multiculturality.
- Consideration of ethics as a fundamental value in the professional practise.
- Working capacity to function in an international context.
- Knows the cell structure and its function. Implication of biomolecules. Knows the metabolism, its regulation and metabolic integration.
- Knows the procedures in cell communication and the function of excitable cell membranes.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Once the subject is finished the students must be able to:

1. Understand the molecular character of the current Medicine

2. Know the structure and the functioning of the proteins

3. Know the enzymes, their mechanism of action and their general ways of regulation.

4. Know the structure, organizations and mechanisms of biosynthesis of the nucleic acids of ADN and ARN

5. Know the molecular mechanism and its regulation of the synthesis, maturation and protein degradation

6. Know the current importance in Medicine of the Molecular Biology technologies.

7. Know the molecular mechanisms of the cell signaling.

8. Know the biological importance of the intermediate metabolism, the bioenergetics and the role of the Krebs' cycle and its regulation.

9. Know the glucidic metabolism, its regulation and its interest in Biomedicine.

10. Know the lipid metabolism, its regulation and its interest in Biomedicine.

11. Know the nitrogenous metabolism, its regulation and its interest in Biomedicine.

DESCRIPTION OF CONTENTS

1. THEORY (I)

1. Introduction to Biochemistry and Molecular Biology.
2. Relevance of biological molecules: Structure, function, reaction and interaction.
3. Amino acids and peptides. Primary structure of proteins.
4. Proteins: Secondary, tertiary and quaternary structure. Native conformation.
5. Protein folding and denaturation.
6. Reactions catalyzed by enzymes. Measurement of the catalytic activity of an enzyme. Enzymatic cofactors: general characteristics and properties.
7. Enzymatic kinetics and reaction rate. Michaelis-Menten model. Kinetics that deviate from the Michaelis-Menten model. Cooperativity.
8. Regulation of enzymatic activity and the amount of enzyme. Enzymatic inhibition.
9. Introduction to Molecular Biology: Structural levels of nucleic acids.
10. DNA replication.
11. RNA synthesis (transcription).
12. Post-transcriptional levels of gene expression control.
13. Protein synthesis (Translation).
14. Post-translational levels of gene expression control.
15. Cell signaling (I): Receptors and signal transduction.

16. Cell signaling (II): Introduction to signaling by hormones.
17. Intermediary metabolism and Bioenergetics (I): Thermodynamical concepts and coupling of reactions in Biochemistry. ATP, energy load and high energy compounds.
18. Intermediary metabolism and Bioenergetics (II): Phases of intermediary metabolism. The Krebs cycle or citric acid cycle. Anaplerotic reactions and regulation of the Krebs cycle. Oxidative phosphorylation: the electron transport chain and ATP synthesis.

2. THEORY (II)

19. Glycids: Concept, classification, importance and essential characteristics. Glycolysis: Function, reactional sequence and regulation.
20. Gluconeogenesis: Function, reactional sequence and regulation.
21. The Pentose Phosphate cycle: Function, reactional sequence and regulation.
22. Glycogen metabolism: Synthesis, mobilization and storage.
23. Structure, classification and function of simple and complex lipids.
24. Origin of lipids. Metabolic pathways and regulation of fatty acid oxidation. Metabolism and regulation of the synthesis and use of ketone bodies.
25. Biosynthetic pathways of fatty acids and complex lipids. Eicosanoids and their regulation.
26. Cholesterol and lipoprotein metabolism and their regulation.
27. Amino acid metabolism (I): Origin of amino acids.
28. Amino acid metabolism (II): Ammonium transport and urea synthesis.
29. Amino acid metabolism (III): Mechanism of degradation of amino acids and fate of the carbon chain of amino acids.
30. Nucleotide metabolism.

3. PRACTICES

PRACTICAL SEMINARS

1. Introduction to the laboratory of Biochemistry: Safety rules in the laboratory. Data management in the Biochemistry laboratory. Concentration calculations for the preparation of reagents and patterns. The clinical case in the learning of Biochemistry and Molecular Biology: Introduction to the methodology.
2. Basic techniques in Biochemistry: spectrophotometry, chromatography and electrophoresis.
3. DNA study methodologies: purification, manipulation and amplification. Sequencing. Medical applications of DNA technology.
4. Analysis of the functional activity of proteins: Study of enzymatic kinetics.
5. Integration of practices: review and discussion of the contents. The clinical case in the learning of Biochemistry and Molecular Biology: results and discussion.

LABORATORY PRACTICES

1. Introduction to the laboratory of Biochemistry: Handling of basic instruments. Solutions preparation problems.
2. Biochemical and molecular study of DNA (I): Purification, quantification and amplification of genomic DNA.

3. Molecular study of DNA (II): DNA analysis by electrophoresis.
4. Biochemical study of proteins (I): Spectrophotometric quantification of total proteins.
5. Biochemical study of proteins (II): Electrophoretic separation of heterogeneous proteins.
6. Biochemical study of proteins (III): Analysis of enzymatic activity.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Laboratory practices	12,00	100
Seminars	11,00	100
Tutorials	4,00	100
Study and independent work	90,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Theoretical Lessons (30 Thematic Units): master classes of 50 minutes taught in the classroom by the professors of the Subject. The teaching materials of each theoretical lesson will be available in advance for the students through Aula Virtual.

Laboratory Practical Lessons (6 Thematic Units): laboratory sessions of two hours of duration made in the Practices Room. After a short introduction to each practical session by the professor in charge of the subject, students will make different determinations, using analytical specific techniques of the Biochemistry and Molecular Biology. Students need to be updated and complete a Laboratory notebook, where the methodological procedures, the obtained results and a series of questions related with the practice will be collected. The Laboratory notebook will be available in advance for the students through the Aula Virtual.

Seminar Practical Lessons (5 Thematic Units): master classes taught in the Practices Rooms by the professors in charge. Each Seminar presents the basic techniques, the Biomedical applications, the methodological procedures and the results calculation of the practice.

Tutorials: practical work made by the students, in groups of 8 students, supervised by a professor in charge. The proposed topic is the same for all the groups and collects in an integrated way genomic, structural, metabolic and clinical aspects of a relevant process in Biochemistry and Molecular Biology. Each tutored group must write a written work and expose it in a public presentation, where the classmates and the professor in charge will be present. The dynamics of the tutored group implies at least four sessions for the group to be with the teacher in charge, which can be made in the classroom or in specific tutorials, being the first sessions the introduction to the Work topic and the last one the public exposition made by the students. The teaching materials for the Work, provided by the professor in charge, will be available in advance for the students through the Aula Virtual.

The gender perspective, the respect for diversity, and the sustainable development goals (SDGs) will be incorporated into teaching, whenever possible.

EVALUATION

The evaluation of the learning of theoretical, seminars and practices teachings is carried out through a final written exam whose grade represents 90% of the overall grade of the subject that is completed with the grade obtained in the regulated tutoring (tutored group), a voluntary practical teaching activity whose assessment represents 5% of the overall grade of the subject, and the voluntary resolution of a clinical case that also represents 5% of the overall grade of the subject.

The final written exam *includes a first part with 6 written development questions that will deal with the contents of the theoretical program and will aim to evaluate the acquisition of knowledge and the expository level of the student with a maximum value of 0.5 points per question and a maximum total of 3 points (30% of the overall grade);* ***and a second part with 60 objective questions*** (50% theory, 50% practices and seminars) *with 4 possible answers and only one of them correct, which will evaluate both the acquisition of competences from theoretical teaching and teaching taught through seminars and practices. Each correct answer is worth 0.1 point, each incorrect answer subtracts 0.025 points and blank answers do not penalize. The maximum total value of this second part is 6 points (60% of the overall grade).*

To pass the subject, the qualification obtained in the first and second parts of the exam must be at least 1 and 2 points, respectively.

The regulated tutorials (tutored groups) will have a continuous evaluation of the attendance, participation and acquisition of abilities by the student to react to complex specific situations. The qualification obtained by the student will have a maximum final value of 0,5 points, 5% of the overall grade of the subject.

Participation in the resolution of clinical cases raised in the seminar sessions will also have a continuous evaluation where the participation and ability of students to search for information critically and their ability to work in a team and present the result in an appropriate discursive way will be taken into account. The qualification obtained by the student will have a maximum final value of 0,5 points, 5% of the overall grade of the subject.

Attendance at practical activities is mandatory. The student is considered to meet this requirement if he or she has attended a minimum of 80% of these activities and has adequately justified the impossibility of attending the remaining sessions due to the occurrence of a cause of force majeure. It will be essential to comply with this requirement to pass the subject.

Overall, the learning acquired in theoretical teaching represents 60% of the overall grade of the subject while the remaining 40% will depend on the learning of practical teachings (seminars, laboratory practices, regulated tutorials and clinical case).

Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

REFERENCES

Basic

- Últimas ediciones de los siguientes recursos:

Pamile Champe y cols. Bioquímica. Ed. Mcgraw Hill.
Thomas M. Devlin y cols. Bioquímica: Libro de texto con implicaciones clínicas. Ed. Reverté.
Álvaro González Hernández. Principios de Bioquímica Clínica y Patología Molecular. Ed. Elsevier.
Emilio Herrera y cols. Bioquímica Básica. Ed. Elsevier.
Trudy McKee y James McKee. Bioquímica: Las bases moleculares de la vida. Ed. McGraw Hill.
Michael Murphy y cols. Bioquímica clínica. Texto y atlas en color. Ed. Elsevier.
Robert Murphy y cols. Bioquímica de Harper. Ed. McGraw Hill
Peter Ronner. Netter. Bioquímica esencial. Ed. Elsevier.
Lubert Stryer y cols. Bioquímica. Ed. Reverté.
Denise R. Ferrier. Bioquímica (Lippincot Ilustrated Reviews). Ed. Lippincott Williams & Wilkins.

RECURSOS e-Salut:
ClinicalKey Student Medicina, Odontologia y Enfermería [https://uv-es.libguides.com/RecursosSalut]
Acces Medicina [https://uv-es.libguides.com/Access_Medicina]
Médica Panamericana [https://uv-es.libguides.com/Medica_Panamericana]