

Teaching guide

IDENTIFICATION DETAILS

Degree:	Pharmacy		
Scope	Pharmacy		
Faculty/School:	Experimental Sciences		
Course:	BIOCHEMISTRY		
Type:	Basic Training	ECTS credits:	9
Year:	2	Code:	2525
Teaching period:	Third semester		
Subject:	Biochemistry		
Module:	Biologics		
Teaching type:	Classroom-based		
Language:	Spanish		
Total number of student study hours:	225		

SUBJECT DESCRIPTION

The subject of Biochemistry, taught in the third semester of the degree in Pharmacy, focuses on the study of biomolecules, molecules that constitute life (mainly sugars, lipids, amino acids and proteins and nitrogenous bases, nucleosides, nucleotides and nucleic acids). This study will address a dual analysis: 1) on the one hand, the relationship between the composition, structure and function of these biomolecules will be analyzed and 2) on the other hand, their participation in the set of metabolic reactions that constitute the biochemical basis of life and that allow every cell to maintain proper homeostasis.

Biochemistry is the science that deals with the study of the chemical constituents of living beings, their functions, and the transformations they undergo within an organism in order to obtain the energy and new structures necessary for the development of life. Therefore, it is the study of life from a molecular point of view. In this sense,

its relationship with other disciplines such as Cell Biology and Molecular Genetics is evident, since there is a close link between them that allows us to understand the phenomenon of life from an experimental point of view, and with it, to apply the knowledge achieved to various fields, such as health, biotechnological applications...

By taking this course, the student will acquire the necessary knowledge to understand at a basic level the molecular structures of biomolecules and their functions. In addition, this knowledge will be necessary to later understand how these biomolecules are altered in pathological processes, as well as other relevant issues to be addressed in subjects such as Clinical Biochemistry or Pharmacology. For all these reasons, Biochemistry will be one of the basic subjects that every pharmacist must know and understand so that they can optimally carry out their future professional activity.

GOAL

The objective of the Biochemistry course is to provide students with the Degree in Pharmacy with fundamental knowledge about the main biomolecules present in living organisms, such as the relationship between their composition, structure and functions, and the reactions used by the cell to obtain energy and synthesize new biomolecules necessary for the proper maintenance of its homeostasis.

PRIOR KNOWLEDGE

The student who studies the subject of Biochemistry and wishes to achieve optimal use of it must have knowledge in the areas of General Chemistry and Organic Chemistry, and Cell Biology. In this regard, it would be advisable for the student to have passed the subjects of General Chemistry (taught during the first semester of the Degree), Organic Chemistry (taught during the second semester of the Degree) and General Biology (taught during the first semester of the Degree).

COURSE SYLLABUS

THEORETICAL CONTENTS.

I. INTRODUCTION

Topic 1: Introduction to Biochemistry.

II. PROTEINS

Theme 2. Amino acids. Structure and properties. Peptides. Peptide bond.

Theme 3. Protein structure and function: structural levels. Structure-function relationship. Fibrous proteins and globular proteins.

III. ENZYMOLOGY

Topic 4. Enzymes (I): enzymatic mechanisms and regulation. Importance of enzymes. Enzyme catalysis. Enzyme classes and types of reactions.

Topic 5. Enzymes (II): enzyme kinetics models. The Michaelis-Menten model. Graphical representations of the Michaelis-Menten model. Competitive and non-competitive inhibition.

IV. INTRODUCTION TO METABOLISM

Theme 6. Structure and transport across biological membranes. Biosignaling.

Topic 7. Introduction to metabolism. Bioenergetics.

V. CARBOHYDRATES

Topic 8. Carbohydrates. Monosaccharides. Oligosaccharides and polysaccharides. Other glycoconjugates.

Topic 9. Major routes of carbohydrate metabolism. Glycolysis. Gluconeogenesis. The Cori cycle. Glycogen synthesis and degradation.

Topic 10. The mitochondria and the citric acid cycle. Pyruvate dehydrogenase. The citric acid cycle. Aerobic metabolism and the function of the citric acid cycle.

Topic 11. Respiratory complexes and ATP synthesis. Mitochondrial respiratory complexes. Action of ATP synthase in oxidative phosphorylation. Chemiosmotic coupling.

Topic 12. Other carbohydrate metabolism routes. The pentose phosphate route. Complex carbohydrate metabolism.

I SAW. LIPIDS

Topic 13. Structure and types of lipids: fatty acids and acylglycerols. Phospholipids. Cholesterol. Sphingolipids. Eicosanoids.

Topic 14. Lipid metabolism. Lipid absorption and storage. Fatty acid catabolism. Ketone bodies and their oxidation. Fatty acid biosynthesis. Elongation and modification of fatty acids. Biosynthesis of triglycerides and membrane lipids. Cholesterol metabolism.

VII. NITROGEN COMPOUNDS

Topic 15. Amino acid metabolism. Overview of amino acid metabolism. Amino acid biosynthesis. Amino acid catabolism. The urea cycle.

Topic 16. Nucleotide metabolism. Purine and pyrimidine biosynthesis. Degradation of purines and pyrimidines.

PRACTICAL CONTENT. In the laboratory, experimental procedures will be put into practice that allow students to better assimilate the fundamental concepts addressed in the theoretical part.

EDUCATION ACTIVITIES

Training activities:

Theory classes (AFP1),

Practical classes (AFP2),

Exercise classes and problems (AFP3),

Seminars and/or exhibition of works (AFP4),

Tutoring (AFP5),

Taking exams (AFP6)

Study of theory, exercises and problems (AFNP1)

Preparation and study of practices (AFNP2)

Work preparation (AFNP3)

Tutoring preparation (AFNP4)

Detailed description: The Biochemistry classes will make use of a combined methodology, in order for students to achieve the proposed objectives. In the face-to-face sessions, the expository lesson given by the teacher of the subject will alternate and/or combine with the discussion and resolution of issues, case studies and problems.

Active learning methodologies will be used, such as flipped classroom, problem-based learning and collaborative work. The teaching of the subject of biochemistry also includes eminently practical sessions, both in the form of seminars and consisting of carrying out real experiments in the teaching laboratory (laboratory practices). The virtual platform of the course will serve as a fundamental support tool for learning. In addition, tutoring will take place.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
100 Horas	125 Horas

Cross Skills

To nurture an attitude of intellectual curiosity and a quest for truth in all areas of life.

To be able to approach a subject by means of rigorous, profound and comprehensive thought.

To be able to assess knowledge acquired.

To be able to apply the theoretical knowledge learnt in the of solving problems and practical cases linked to the various subjects.

LEARNING RESULTS

To know the structures of biomolecules and their transformations in the cell.

Know the properties of cell membranes and the distribution of drugs.

Know the main metabolic pathways involved in drug degradation.

SPECIFIC LEARNING RESULTS

Identify the structures of biologically important biomolecules (carbohydrates, amino acids and proteins, nucleic acids and lipids) and recognize their role in cells and organisms.

Describe the chemical nature of the peptide bond.

Describe the relationship between structural levels of proteins and their biological function.

Describe the structure of biological membranes and recognize the mechanisms involved in transporting substances across them.

Describe the principles of enzyme catalysis and how enzymes carry out their functions.

Relate enzymes to the substrates and products of each of the metabolic pathways studied throughout the

program.

Identify the regulatory factors to which the enzymes that control each of the metabolic pathways being studied are subject.

Interrelate the metabolic pathways studied with the different organs of higher organisms to understand how they maintain proper homeostasis.

Explain the mechanisms of perpetuation and expression of genetic material.

LEARNING APPRAISAL SYSTEM

ORDINARY EVALUATION SYSTEM.

This is the priority evaluation system for the subject. This system is based on continuous evaluation and distributes the final grade of the subject into different sections. Thus, for the calculation of the final grade of the subject, the weighting of the different sections will be as follows:

Written exam (SE1): 60%.

Performing daily activities and exercises (SE2): 7.5% + Attendance and participation in face-to-face activities in the classroom (SE4): 2.5% (total (SE2) + (SE4): 10%).

Preparation of individual and group work (SE3): 15%.

Attendance and participation in face-to-face activities in the laboratory (SE8): 15%.

Attendance at all practical sessions and seminars (regardless of where they take place: laboratory, classrooms, etc.) is mandatory. The unjustified absence of any of these sessions leads to the loss of the right to the evaluation of practices and seminars in the ordinary call and a suspension of the course. Students in this situation should immediately contact the teacher. Practices will be evaluated by carrying out one or more objective tests.

Exceeding it (minimum grade of 50% of the maximum grade) is essential to pass the course. Passing the subject: to consider the theory (theory exam) and practice (objective laboratory tests) parts for the calculation of the final grade, each of them must be approved (grade equal to or greater than 5.0). The course is approved with a grade equal to or greater than 5.0. If you pass the theory part (theory exam) but not the practice part (objective laboratory tests), the score of the theoretical exam will be kept until the extraordinary call. The same will happen if the practical part is approved but not the theoretical part. The grades obtained in the rest of the evaluable concepts ('Carrying out daily activities and exercises', 'Preparation of individual and group works', 'Attendance and participation in face-to-face activities in the classroom') will be maintained until the extraordinary call.

ALTERNATIVE EVALUATION SYSTEM. This system is intended for repeat students who do not take advantage of the ordinary evaluation system because they cannot attend classes on a regular basis. Students in second or subsequent enrollment must contact the teacher to request to take advantage of this alternative evaluation system, in which face-to-face activities in the classroom ('Performing daily activities and exercises', 'Attendance and participation in face-to-face activities in the classroom') will be replaced by individual or small group learning monitoring activities. As for first-time students, attendance at all practical sessions and seminars will be mandatory. Thus, for the calculation of the final grade of the subject, the weighting of the different sections will be as follows: Written exam: 60% Individual and group learning activities: 10% Preparation of individual and group work: 15% Attendance and participation in face-to-face activities in the laboratory: 15% Important note: Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the Regulations for Coexistence of the university.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:

- a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
- b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
- c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
- d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.

2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the [Guide for the Responsible Use of Artificial Intelligence in Studies at UFV](#). Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.

3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

VOTE, Donald. Foundations of Biochemistry: Life at the Molecular Level/4th ed. Buenos Aires; Madrid:Editorial Médica Panamericana, 2016.

(VOTE, Donald. Foundations of Biochemistry: Life at the Molecular Level/4th ed. Buenos Aires; Madrid:Editorial Médica Panamericana, 2016. , ||Nelson, David L. Lehninger: principles of biochemistry/8th ed. New York:WH Freeman, 2021.)

coordinator: José María Teijón Rivera... [et al.]. Foundations of Metabolic Biochemistry/4th ed. Madrid:Tebar,2017.

José María Teijón Rivera, María Dolores Blanco Gaitán (coordination and scientific direction); Rosa María Olmo López... [et al.]. Foundations of structural biochemistry/3rd ed. Madrid: Tebar Flores, 2017.

Additional

Elena Feduchi Canosa... [et al.]; collaborator Carlota García-Hoz Jiménez. Biochemistry: Essential Concepts/Madrid: Panamericana, 2011.

(Elena Feduchi Canosa... [et al.]; collaborator Carlota García-Hoz Jiménez. Biochemistry: Essential Concepts/Madrid: Panamericana, 2011. , ||Pamela C. Champe, Richard A. Harvey, Denise R. Ferrier. Biochemistry/3rd ed. Mexico: McGraw-Hill, 2006.)