COURSE DATA

DATA SUBJECT

Code: 34077
Name: Biochemistry II
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Facultat de Farmàcia i Ciències de L'alimentació	2	Second quarter
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Facultat de Farmàcia i Ciències de L'alimentació	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	Biochemistry	BASIC
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	COMPULSORY

COORDINATION

SANCHO MEDINA MONICA

SUMMARY

Biochemistry II is a second-year (second semester) basic subject of the Degree in Pharmacy (University of Valencia). This subject accounts for a total of 6 ECTS in the curriculum.

The aim of the course is to deepen the knowledge of Biochemistry and Molecular Biology. The course is focused on providing a deeper and integrated insight of the intermediary metabolism and the fundamental characteristics of the molecular mechanisms involved in the transmission of genetic information.

Part I. Intermediary metabolism. Pentose phosphate pathway. Gluconeogenesis. Glycogen metabolism.

Metabolism of lípids, amino acids and nucleotides. Coordinate regulation of intermediate metabolism. Interdependence of the major organs in fuel metabolism. Main processes of fuel storage, mobilization and use during different physiological situations.

Part II. Structure and function of nucleic acids. Structure of nucleic acids. Genes and chromosomes. Denaturation and renaturation of nucleic acids. Replication, repair and recombination of DNA. Transcription and RNA maturation. Translation, protein maturation and posttranslational protein transport. Regulation of gene expression. Methods in molecular biology.

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PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

It is recommended to have studied the subjects of General Chemistry, General Biology and Physical Chemistry. To study Biochemistry II must have completed Biochemistry I.
Basic knowledge of general chemistry and cell biology. Basic concepts of metabolism and bioenergetics. Hormonal regulation of metabolism. Metabolism of carbohydrates and their regulation. Metabolic fates of pyruvate. Citric acid cycle. Electron transport and oxidative phosphorylation.

COMPETENCES / LEARNING OUTCOMES

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Act with autonomy in learning, making informed decisions in different contexts, issuing judgements based on experimentation and analysis, and transferring knowledge to new situations.

Apply the scientific method and acquire skills in handling the main bibliographic sources.

Collaborate effectively in work teams, assuming responsibilities and leadership roles and contributing to collective improvement and development.

Contribute to the design, development and implementation of solutions that respond to social demands, taking into account the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical thinking in the field of the degree programme, considering aspects such as professional ethics, moral values and the social implications of the different activities carried out.

Develop skills to update knowledge and undertake further studies, including pharmaceutical specialisation, scientific research, technological development and teaching.

Gather and transmit information in English at a level of proficiency equivalent to B1 of the Council of

Europe.

Know and understand, within the field of the degree programme, gender inequalities in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem solving.

Know and understand the essential processes in the transmission of genetic information from DNA to protein.

Know how to apply knowledge specific to the field to the professional world.

Know how to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Know how to interpret, evaluate and communicate relevant data in the different areas of pharmaceutical activity, using information and communication technologies.

Know the main metabolic pathways and gain an integrated view of metabolism and its regulation.

Know the mechanisms of energy production and transformation.

Know the structure and properties of biomolecules and their relationship to the function they perform, as well as their transformations within the cell.

Module: Biology. Develop skills to identify therapeutic and biotechnological drug production targets, as well as to use gene therapy.

Module: Biology. Know the main metabolic pathways involved in the degradation of medicines.

Possess and understand knowledge in the different areas of study included in pharmacist training.

Propose creative and innovative solutions to complex situations or problems within the field of knowledge, to respond to diverse professional and social needs.

Recognise one's own limitations and the need to maintain and update professional competence, placing particular emphasis on self-learning of new knowledge based on available scientific evidence.

Transmit ideas, analyse problems and solve them with critical spirit, acquiring teamwork skills and assuming leadership when appropriate.

Understand and use basic scientific terminology in the field of biochemistry and molecular biology.

Understand how enzymes work and how they are regulated.

Understand the molecular origin of the basic functions of living organisms and their main biotechnological and medical implications.

DESCRIPTION OF CONTENTS

1. Gluconeogenesis

General features of gluconeogenesis. Precursors for the synthesis of glucose. Specific reactions of gluconeogenesis. Regulation of gluconeogenesis. Tissue relationships in the hepatic synthesis of glucose.

2. Pentose phosphate pathway

Functions, tissue and subcellular localization. Reaction sequence. Regulation of pentose phosphate pathway.

3. Glicogen metabolism

General features of glycogen metabolism. Glycogen breakdown. Glycogen synthesis. Control of glycogen metabolism.

4. Lipid catabolism

Digestion, absorption and transport of dietary lipids. Mobilization of triacylglycerols stores. Fatty acid oxidation. Metabolism of ketone bodies.

5. Lipid biosynthesis

Lipogenesis: biosynthesis of fatty acids and triacylglycerols. Regulation of fatty acid metabolism. Coordinated regulation of synthesis and degradation of fatty acids. Cholesterol biosynthesis.

6. Metabolism of plasma lipoproteins

Definition, classification and characteristics of major lipoproteins. Transport of lipoproteins. Endocytosis of

LDL. Regulation of synthesis and transport of cholesterol.

7. Amino acid metabolism

Introduction to amino acid catabolism. Origin and fate of amino acids in mammals. Catabolism of amino acids. Nitrogen excretion and the urea cycle. Fate of amino acid carbon skeletons. Biosynthesis of nonessential amino acids in mammals.

8. Nucleotide metabolism

De novo synthesis of purine ribonucleotides and salvage pathways. De novo synthesis of pyrimidine ribonucleotides. Formation of deoxyribonucleotides. Degradation of nucleotides.

9. Integration of metabolism and tissue and organ specialization

Introduction. Interdependence of the major organs in fuel metabolism. Main processes of fuel storage, mobilization and use during the well-fed state, starvation, exercise, excessive alcohol consumption and in diabetes mellitus.

10. Genes and chromosomes

The Human Genome. Conformation of DNA: conformational variations and unusual structures. Tertiary structure: supercoiling of DNA. Structure of RNA. Forces stabilizing nucleic acid structures: denaturation and renaturation. Eukaryotic chromosome structure: chromatin.

11. DNA replication

General features of DNA replication. Enzymology of replication: DNA polymerases. Other proteins involved in replication. General scheme of the replication complex in the replicative fork of prokaryotes: the replisome. Bacterial chromosome replication. Replication in eukaryotes. The cell cycle. Replication

initiation. Completion of replication: telomeres and telomerase. Compounds that inhibit replication.

12. Mutation, repair and recombination

Concept and classification of mutations. Biological effects. Causes and mechanisms of mutations. DNA repair. Direct reversal of damage. Mismatch repair. Excision repair. The SOS response. Double-strand break repair. Recombination. Homologous and site-specific recombination. Mobile genetic elements. Retrotransposition.

13. Transcription

Introduction. RNA polymerase and reaction mechanism. Transcription in prokaryotes: Stages. Main differences in transcription in prokaryotes and eukaryotes. Basal machinery of eukaryotic transcription. Stages of transcription in eukaryotes.

14. Regulation of gene expression in eukaryotes

Introduction. Genetic regulatory mechanisms: Sequences. Transcription factors - types, function, structure, characteristics and activation/inactivation models. Epigenetic regulatory mechanisms: Introduction to epigenetics. Epigenetic regulation of transcription - Chromatin remodeling, Histone modification, DNA methylation, siRNAs and miRNAs. Molecular mechanisms of gene expression regulation.

15. RNA Maturation and Transport

Definition of mRNA maturation. mRNA capping, polyadenylation and splicing. Recognition sequences and spliceosome formation. Alternative maturation. Editing. Intracellular and extracellular mRNA transport.

16. Translation

The genetic code and characteristics of translation. Components of translation. Structure of ribosomes.

Structure of tRNAs. Activation of amino acids. Protein synthesis in prokaryotes. Stages. Translation in eukaryotes. Cytosolic pathway. Secretory pathway - signal peptide and stop transfer. Regulation of eukaryotic translation.

17. Practicals

Determination of metabolites in blood obtained during feeding and fasting. Digestion of plasmidic DNA with restriction endonucleases. Visualization of the fragments generated by electrophoresis. Determination of the size of the fragments. Elaboration of the restriction map.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	40,00
Seminar	2,00
Laboratory	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	2,00
Independent study and work	58,00
Preparation of lessons	20,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Lectures. The teacher will develop the essential concepts of the subject.

Group tutorials. They will be held in groups of 16 students, according to the established time-table. These sessions should reinforce the concepts presented in the lectures and should encourage the active

participation of students. To do this, the teacher will propose questions to be discussed during the session. Also, it is the ideal means for students to raise questions or issues that may arise during the course. This will reveal how students assimilate concepts, identify any gaps or failures in the learning system and directly assesses the student's work.

Practicals. They will be held in groups of 16 students. They should allow students to become familiar with some basic techniques of biochemistry and molecular biology, to acquire some skills in lab work and to critically analyze the results, as well as to complement the concepts learned during the lectures. Attendance will be compulsory. There will be 3 laboratory sessions in groups of 2 students. Once finished, each working group should elaborate and present a written results report.

Seminars. They will consist in the realization of complementary activities about specific topics proposed by the responsible teacher within the general objectives of the subject. These activities can consist in the realization of exhibitions, case studies, work analysis, problem/question solving or discussion of current issues among others.

EVALUATION

1. **Theory** (70 points). Written final exam that will consist of short questions and multiple choice questions.

2. **Practice** (20 points):

- **Written test** (15 points). Final exam written on a practical case and short or test questions about the procedures performed during the practice sessions.

- **Laboratory work** (5 points). The attitude and the correct execution of the practical procedures will be valued, as well as a memory of the results.

3. **Seminars** (10 points). The evaluation method will be in accordance with the nature of the proposed activities, which may include the resolution of short exams/questions, the delivery of reports, the evaluation of class participation or the quality of oral presentations, among others.

To pass the subject a score equal to or greater than 50 points out of 100 is needed, taking into account the following limitations:

a) For written tests, theory or practice, a minimum of 30 points will be accepted in the theory exam or a

minimum of 6 points in the practical exam as compensable, provided that the total sum of both tests is 42 points.

b) In the case of laboratory work and seminars there is no minimum score, but they will only taken into account if the sum of the two exams (theory and practice) reaches the minimum of 42 points.

The student who does not pass the subject in the first call may keep for the second call of the same academic year the mark of the theoretical exam when it is equal or superior to 35 points, or the mark of the practical exam, when it is equal or superior to 7.5 points. In any case, the note obtained in the seminar and the laboratory work note will be kept.

In case of failing the course, the laboratory practices will be optional in following courses, as long as they have been taken at least once. Likewise, the qualification of laboratory work will be recorded. If the practical exam has been passed with a mark equal to or higher than 7.5 points, the mark will be kept during the immediately following academic year if a new enrollment is made. Neither the score of the theoretical exam nor the grade of the seminars will be kept.

failling the subject, the realization of the laboratory practices will be optional in the following courses, as long as they have been done at least once. Likewise, the qualification of laboratory work will be maintained from one course to the next, as well as the mark for the practical exam if it is equal to or superior to 7.5 points. The mark of the theoretical exam or the seminar marks will not be saved.

Copying or manifest plagiarism, AI included, of any task in the assessment will result in the impossibility of passing the subject, subject to the appropriate disciplinary procedures. It must be taken into account that, in accordance with article 13. d) of the University Student Statute (RD 1791/2010, of December 30), it is the duty of the student body to abstain of the use or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university. Fraudulent practices will be dealt with according to the "Protocol of action against fraudulent practices at the University of Valencia" (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83.pdf

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