COURSE DATA

DATA SUBJECT

Code: 34699
Name: Biochemistry
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1206 - Degree in Dentistry	Facultat de Medicina i Odontologia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1206 - Degree in Dentistry	Biochemistry	BASIC

COORDINATION

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SUMMARY

Biochemistry is a compulsory subject in the first course of the *degree in Dentistry* that is taught during the first quarter. The activities under this subject are developed in classroom and laboratory practical classes. Biochemistry introduces basic concepts of composition and functioning of living organisms from a molecular point of view. It describes the principal biological molecules, their structure and functional characteristics, covering basic aspects of Enzymology, Molecular Biology, Signaling, Bioenergetics, Metabolism and Immunology. In addition, it pays special attention to the specific molecular characteristics of dental tissues, including their formation, dynamics and stability within the environment of the mouth, and gives an introduction to Clinical Biochemistry and Molecular Pathology. Biochemistry is a multidisciplinary field, closely related to other important subjects of the degree in Dentistry, especially Biology, Microbiology, Biophysics, Physiology and Biomaterials

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

Basic knowledge of Chemistry, Biology and Physics

COMPETENCES / LEARNING OUTCOMES

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Comprender las ciencias biomédicas básicas en las que se fundamenta la Odontología para asegurar una correcta asistencia buco-dentaria.

Comprender y reconocer la estructura y función normal del aparato estomatognático, a nivel molecular.

Conocer, valorar críticamente y saber utilizar las fuentes de información clínica y biomédica para obtener, organizar, interpretar y comunicar la información científica y sanitaria.

Conocer del método científico y tener capacidad crítica para valorar los conocimientos establecidos y la información novedosa. Ser capaz de formular hipótesis, recolectar y valorar de forma crítica la información para la resolución de problemas, siguiendo el método científico.

Conocer de los procesos generales de la enfermedad, entre los que se incluyen la infección, la inflamación, las alteraciones del sistema inmune, la degeneración, la neoplasia, las alteraciones metabólicas y los desórdenes genéticos.

Conocer los procedimientos y pruebas diagnósticas clínicas y de laboratorio, conocer su fiabilidad y validez diagnóstica.

Conocer los procesos generales de enfermar, curar y reparar, entre los que se incluyen la infección, la inflamación, la hemorragia y la coagulación, la cicatrización, los traumatismos y las alteraciones del sistema inmune, la degeneración, la neoplasia, las alteraciones metabólicas y los desordenes genéticos.

Conocer y entender las condiciones bioquímicas que repercuten en la salud bucal.

Promover el aprendizaje de manera autónoma de nuevos conocimientos y técnicas, así como la motivación por la calidad.

Saber compartir información con otros profesionales sanitarios y trabajar en equipo.

DESCRIPTION OF CONTENTS

1. THEORETICAL CLASSES

1. Water and its importance to life. Structure and physicochemical properties of water. Weak interactions in aqueous solution: Ionic interactions, dipole interactions, hydrogen bonds and hydrophobic effect. Acid-base reactions in aqueous solution.

2. Major biological molecules and their properties Common organic functional groups in biological molecules. Small biological molecules. Biological Macomolecules
3. Amino acids, peptides and proteins. Types and properties of amino acids. Modified amino acids. The peptide bond. Examples of important peptides and their functions. Types of proteins.
4. Protein structure Levels of structure. Primary, secondary, tertiary and quaternary structure. Denaturation of proteins. Structure-function relationships.
5. Fibrous proteins. Collagen Properties and functions of fibrous proteins. The collagen synthesis, structure, and function.
6. Globular proteins. Hemoglobin Properties and functions of globular proteins. Importance of protein dynamics. Protein-ligand interactions. Cooperativity and allosterism. Oxygen transport in hemoglobin.
7. Enzymes. Biological catalysts. Active site. Types of enzymes. Enzyme cofactors: vitamins. Enzyme kinetics. Chemical kinetics and enzyme kinetics. Michaelis-Menten model.
8. Regulation of enzymes. Enzyme regulation. Molecular mechanisms of enzyme regulation. Alosteric enzymes. Enzyme inhibition. Regulation by covalent modification. Isozymes.
9. Structure of nucleic acids. Types of nucleic acids. Structure and properties of the double helix of DNA. Supercoiling. Structure of RNA.
10. Replication Molecular mechanism of replication. Molecular origin of mutations. Error correction mechanisms.
11. Gene expression. Molecular mechanism of transcription. Post-transcriptional modifications. Regulation of transcription. The genetic code. Molecular mechanism of translation. Folding and post-translational maturation of proteins.
12. Basic principles of hormone action. Metabolic functions of hormones. Effects on oral structures. Mechanisms of hormone action.
13. Introduction to intermediary metabolism. Energy supply to the cell. Catabolism and anabolism. Molecules of high energy content. Basic principles of regulation.
14. Cellular energy metabolism. Tricarboxylic acid cycle: reaction sequence, function and control. Mitochondrial electron transport. Oxidative phosphorylation. Respiratory control.
15. Intermediary metabolism of glycosides Glycolysis. Destinations of pyruvate. Anaerobic oxidation, fermentation. Gluconeogenesis. Coordinated regulation of glycolysis and gluconeogenesis. Glycogen metabolism and its regulation. Pentose phosphate pathway.
16. Intermediary metabolism of lipids Mobilization of lipid reserves. Oxidation of fatty acids. Metabolism of ketone bodies. Biosynthesis of fatty acids. Regulation of fatty acid metabolism. Cholesterol metabolism. Lipoproteins.
17. Intermediary metabolism of amino acids Origin and fate of amino acids. Biosynthesis. Amino acids as precursors of other biomolecules. Amino acids catabolism: Deamination. Destination of the carbon chain. Synthesis of urea.
18. Metabolic integration. Interconnections of the metabolic pathways. Cooperation between tissues. Metabolic profiles of different tissues. Metabolic integration in pathophysiological situations of interest.
19. Biochemical basis of inflammation Elements involved in the inflammatory reaction. Biochemistry of inflammation: plasma and tissue mediators
20. Biomineralisation and phosphocalcic metabolism. Biomineralisation and epitaxy. Calcium phosphate minerals in calcified tissues. Crystal structure of hydroxyapatite and fluorapatite.
21. Biochemistry of calcified tooth tissues. Composition of mineralised dental tissues. Organic and inorganic molecules of enamel, dentine and cementum. Physical properties of the calcified tissues of the tooth: Relationship to their composition Formation of enamel, dentine and cementum.
22. Dynamics and stability of enamel and the role of saliva. Solubility equilibria of enamel. Influence of pH. Regulatory role of saliva. Stephan's curve. The oral ecosystem. Periodontal disease.

2. PRACTICES

SEMINARS

Seminar 1. Ionic equilibria in aqueous solutions. pH scale. Ionization equilibria of weak acids and weak bases. Buffer solutions. Concept of pKa and isoelectric point.
Seminar 2. Bioenergetics. Thermodynamics of metabolic pathways. Molecules with high energy content. Reducing power.
Seminar 3. Respiratory control. Inhibition and uncoupling of oxidative phosphorylation. Reactive oxygen species. Questions of Biochemistry (I).
Seminar 4. Questions of Biochemistry (II).
Seminar 5. Questions of Biochemistry (III).
Seminar 6. Questions of Biochemistry (IV)

LABORATORY PRACTICES

Practice 1. Basic techniques of Biochemistry and Molecular Biology.
Practice 2. Introduction to biochemistry laboratory.
Practice 3. Spectrophotometric determination of protein concentration.
Practice 4. Clinical enzymology: determination of enzymatic activities in serum samples.
Practice 5. Electrophoretic analysis of proteins.
Practice 6. Discussion of results.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	33,00
Laboratory	12,00
Classroom practices	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	35,00
Preparation of lessons	15,00
Preparation for assessment activities	40,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

In the lectures, the teachers will present and explain the contents corresponding to the theory program.

Active learning will be encouraged in the Seminar sessions. Some specific topics will be developed and discussed in more detail and various questionnaires will be resolved with the participation of the students. In addition, several activities will be carried out that allow students to expand their knowledge of the subject and to promote the acquisition of skills different from those acquired in theory classes. These activities will be reflected in a digital portfolio that each student will have to complete individually. These activities will be mandatory, will be evaluated and will part of the continuous assessment of the subject.

In the laboratory practices, common tests and biochemical analyses will be carried out. These practical sessions will be supported by a brief introduction about the theoretical basis of the methods used, the objectives of each practice, the results to be expected and the correct way to interpret these results.

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

EVALUATION

The evaluation will be based on an assessment of learning for both, theoretical contents, and practical skills.

The theoretical part will account for 75% of the final grade of the subject and will be assessed as follows: i) Mandatory activities and tasks carried out during the course as proposed by the teaching staff and reflected in the digital portfolio will be graded. The grades obtained in this continuous assessment will represent 20% of the theory grade. ii) A final exam (16 short questions) will be held, and its score will correspond to 80% of the theory grade. To be able to add the grades from the mandatory activities and tasks, which account for 20% of the grade, to the final theory grade, a minimum score of 4 on the theory exam is required. If this score is not achieved, the total theory grade will correspond solely to the exam score.

The evaluation of the practical part will correspond to 25% of the final score. The assessment of practices will be made as follows: i) Students will be valued through questions corresponding to the background and objectives of each practice, to be resolved in a personalized way at the beginning of each session. The results of these assessments will correspond to 1/3 of the total score for practices. ii) A final exam will be made with 20 multiple-choice questions, relating to the methods used for the practices, their use in the laboratory, the results and their interpretation. The score from this test corresponds to 2/3 of the total score for practices. It will be necessary to obtain a minimum grade of 3 in the practical exam and if this score is not achieved, the total grade for the practices will correspond only to the exam grade.

To pass the course, all the following conditions must be met:

- 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.

- The score of the theory part must reach at least 45% of its maximum value (4.5 out of 10)

- The practice score must reach at least 40% of its maximum value (4 out of 10)

- The overall score (sum of the theory and practical parts, considering the percentage value of each part) must reach at least 50% of its maximum value (5 out of 10).

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

REFERENCES

BASIC

- LOZANO TERUEL, J.A. (2000). Bioquímica y Biología molecular para ciencias de la salud. 2ª ed. McGraw Hill-Interamericana, Madrid.
- MÜLLER-ESTERL, W. (2008). Bioquímica. Fundamentos para Medicina y Ciencias de la Vida. Reverté, Barcelona.
- TIMOCZKO, J., Berg, J.M., Stryer, L. (2014), Bioquímica. Curso Básico. Reverté.
- STRYER, L: Berg, J.M; Tymoczko, JL; Gatto, GJ; Trueba MA; (2021), Bioquímica: con aplicaciones clínicas. Editorial Reverté, Barcelona.

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]

ADDITIONAL

- MCKEE, T y Mckee J.R. (2009), Bioquímica: las bases de la vida. 4ª ed. McGraw-Hill. México.
- DEVLIN, T.M. (2004). Bioquímica: libro de texto con aplicaciones clínicas. 4ª ed. Reverté, Barcelona.
- HERRERA, E (2014). Bioquímica básica. Elsevier, Barcelona.