



Teaching Guide				
Identifying Data			2021/22	
Subject (*)	Structural Biochemistry		Code	610G04019
Study programme	Grao en Nanociencia e Nanotecnoloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Vizoso Vázquez, Ángel José		E-mail	a.vizoso@udc.es
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General description	The Structural Biochemistry course is fundamental, from a basic point of view, to understand the main chemical, biophysical and structural properties of biological macromolecules and the relationship between these properties and the different functions they perform. The knowledge acquired will be essential for other subjects of the Degree in Nanoscience in Nanotechnology.			



Contingency plan	1. Modifications to the contents No changes will be made 2. Methodologies * Teaching methodologies that are maintained - Master session - Tutored jobs (with Personalized Attention) (counts in the evaluation) * Teaching methodologies that change (I) In the case of no presence caused by outbreaks of Covid-19: - The expository teaching will be face-to-face but via Teams. - Laboratory practices will consist of viewing videos related to practical subjects, solving practical cases and working with databases. (II) In that cases where the capacity of the classroom assigned for the subject is exceeded: - Availability of two or more classrooms and the teaching of the class through TEAMS for students who are not in the classroom with the teacher. - The number of sessions per group will be reduced and the hours will be completed with the resolution of practical cases and work with databases. 3. Mechanisms for personalized attention to students - Email: daily. Useful for making inquiries, requesting virtual meetings to resolve doubts and following up on supervised work. - Moodle: daily. According to the student's need. They have "thematic forums associated with the modules" of the subject, to formulate the necessary queries. There are also "forums for specific activities" to develop "Directed Discussions", through which the development of the theoretical contents of the subject is put into practice. - Teams: weekly session in small groups (up to 6 people), to follow-up and support in carrying out the "supervised work". This dynamic allows a standardised and adjusted monitoring of the student's learning needs to develop the subject work. 4. Changes in the evaluation - No changes in specific percentages. - The exams will be online by Moodle and/or Teams. 5. Modifications to the bibliography or webography - No modifications.
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Study programme competences	
Code	Study programme competences
A3	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
A6	CE6 - Manipular instrumentación y material propios de laboratorios para ensayos físicos, químicos y biológicos en el estudio y análisis de fenómenos en la nanoescala.
A7	CE7 - Interpretar los datos obtenidos mediante medidas experimentales y simulaciones, incluyendo el uso de herramientas informáticas, identificar su significado y relacionarlos con las teorías químicas, físicas o biológicas apropiadas.
A8	CE8 - Aplicar las normas generales de seguridad y funcionamiento de un laboratorio y las normativas específicas para la manipulación de la instrumentación y de los productos y nanomateriales.
B3	CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
B4	CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B6	CG1 - Aprender a aprender



B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
C3	CT3 - Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida
C6	CT6 - Adquirir habilidades para la vida y hábitos, rutinas y estilos de vida saludables
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinarios o transdisciplinarios, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.
C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad

Learning outcomes			
Learning outcomes	Study programme competences		
Identify the main biomolecules, their structure and function.	A3	B3 B4 B7	
Recognize the principles of enzymology.	A3 A7	B3 B4 B7	C3
Solve basic structural biochemistry problems.	A3 A6 A7	B3 B4 B6 B7 B8	C3 C7 C8
Apply the main biochemical techniques for the isolation, purification and characterization of biomolecules.	A6 A8	B3 B4 B8	C6 C7 C8

Contents	
Topic	Sub-topic
Module 1. Introduction to Biochemistry	Concept, origins and evolution of Biomolecules. Functional groups, chemical bonds and stereochemistry. Biomolecules in polar solvents: ionization of water, ionic balance and buffer systems. Thermodynamic processes in biochemistry.
Module 2. Biochemical techniques for the isolation and characterization of biomolecules.	General aspects of the methodology in biochemistry. The biological material used in biochemistry. Fractional precipitation and centrifugation. Chromatographic, electrophoretic and spectroscopic techniques. Dialysis and ultrafiltration. Radioactivity and isotopic techniques in biochemistry.



Module 3. Structure and function of biomolecules: carbohydrates, lipids, nucleic acids, amino acids and proteins.	3.1. Structure and function of carbohydrates: Classification. Monosaccharides: description, structure and physical and chemical properties. O-glycosidic bond. Oligosaccharides: nomenclature, description, structure and properties. Polysaccharides. Glycoconjugates: proteoglycans, glycoproteins and glycolipids. 3.2. Structure and function of lipids: Type of lipids and functions. Classification, physicochemical properties, structure and biological importance of fatty acids, cerides, glycerides, phosphoglycerides. sphingolipids, terpenes and steroids. Pyrrolic lipids. Cholesterol and derivatives. Lipoproteins. Fat-soluble vitamins. 3.3. Structure and function of nucleic acids: nature and function. Nucleotides, structure and properties. Phosphodiester bond and primary structure of nucleic acids. Watson and Crick model and alternative structures of deoxyribonucleic acids. Types and structure of ribonucleic acids. Complex formation and functionalization. Databases. 3.4. Structure and function of amino acids and proteins: Type of proteins and functions. Structure and properties of two amino acids. Classification. Structuring levels of proteins. Peptide bond. Primary structure and amino acid sequence of proteins. Protein secondary structure: description and prediction. Protein domain and folding concept. Tertiary and quaternary structure of proteins: characteristics and classification. Relationship between structure and function in proteins. Databases and in silico analysis. Protein extraction, purification and characterization techniques. Structural analysis of proteins.
Module 4. Enzymology: Enzymes, enzyme kinetics and enzyme regulation.	General properties. Classification and nomenclature of enzymes. Effects of catalysts on chemical reactions. Activation energy and transition state. Enzyme cofactors, coenzymes and the role of vitamins. The active site: three-dimensional structure and enzyme-substrate coupling. Enzyme mechanisms. Acid-base, covalent, electrostatic and metal ion catalysis. Proximity and orientation effects. Reaction speed and activation energy: concepts, calculations and units. Units of enzymatic activity. Effect of enzyme concentration. Enzymes used in clinical analysis, in the diagnosis of diseases or as therapeutic agents.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B3 B6 B8 C8	28	70	98
Laboratory practice	A3 A6 A7 A8 B3 B4 B6 B7 C3 C6	15	5	20
Problem solving	A3 A7 B3 B4 B6 B7 C7 C3	6	8	14
Mixed objective/subjective test	A3 A7 B3 B4	2	10	12
Personalized attention		6	0	6
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	The topics of the course will be taught by teachers and all presentations or other documentation will be made available to students on the Moodle platform.
Laboratory practice	A serie of activities will be conducted in the practical laboratory, so the students will learn how to handle basic scientific instrumental in Biochemistry and Molecular Biology.



Problem solving	In Moodle, the students will have a serie of questionnaires, tests practical problems to be solve individually as part of the continuous evaluation. Previously some of them will be solved in the seminar classes that will help the students to understand them.
Mixed objective/subjective test	Written test used to evaluate learning, and that can combine different types of questions: multiple choice, association, explanatory or calculation questions and problem solving.

Personalized attention

Methodologies	Description
Problem solving Laboratory practice	For all students (face-to-face or online), there will be personalized tutorials focused on guidance for problem solving and the study of practical cases, resolution of doubts and clarifications. The schedule of the tutorials will be specified at the beginning of the course. Students will also be able to request tutorials and solve specific questions via email.

Assessment

Methodologies	Competencies	Description	Qualification
Mixed objective/subjective test	A3 A7 B3 B4	Evaluation of the Theoretical knowledge (test, definitions, related issues).	50
Problem solving	A3 A7 B3 B4 B6 B7 C7 C3	Evaluation of the resolution of practical cases.	25
Laboratory practice	A3 A6 A7 A8 B3 B4 B6 B7 C3 C6	Laboratory practices are considered a COMPULSORY face-to-face activity to pass the course. The evaluation will consist of the preparation of a report of practices where the quality of the work, the adequacy in the graphic representation of data, interpretation of results, as well as the ability to discuss will be considered, for which the necessary condition will be considered the use of correct scientific language and verified bibliographic information.	25

Assessment comments

-THE LABORATORY PRACTICES are compulsory. Students who do not complete ALL the practices without a duly justified reason impede the passing of the subject. JUNE OFFICIAL OPPORTUNITY A.- To pass the course it will be necessary to reach 45% of the points, in each of the Parts: Objective Test, Problem Solving and Laboratory Practices. B.-HONOR REGISTRATION: Those students who appear at the first opportunity (official exam in June) will have priority to apply for MH. JULY OFFICIAL OPPORTUNITY A.- To pass the course it will be necessary to reach 45% of the points, in each of the Parts: Objective Test, Problem Solving and Laboratory Practices. Final Qualification, in the Minutes: In any of the 2 Options: June or July, ONLY the qualifications of all the Parties will be added (TEST OBJECTIVE / PROBLEMS / PRACTICES) if all reach 45% of their value. If this percentage is not reached in any of them, only the note of 4. CONSIDERATION OF NOT PRESENTED (NP) will appear in the Minutes: 1st Chance of June: The student who does not appear for the objective test on the official date. 2nd Opportunity in July: A NOT PRESENTED will be applied when the student does not take any of the exams of the evaluable parts. Exceptional cases: Exceptionally, in the event that the student, for duly justified reasons, has not been able to perform all the continuous assessment tests, the teacher/s will take the actions that he/she deems appropriate for this purpose. .-For students with part-time dedication or exemption from attendance, in the June and July session a specific global assessment exam will be carried out.

Sources of information



Basic	- Feduchi, E., Romero, C.S., Yáñez, E., García-Hoz Jiménez, C (2021). Bioquímica. Conceptos esenciales. 3a ed... Editorial Médica Panamericana - Mathews CK, Van Holde KE, Appling DR y Anthony-Cahill SJ (2013). Bioquímica, 4ª ed.. Ed. Pearson - David L. Nelson, Michael M. Cox. (2018). Lehninger Principios de Bioquímica. 7a ed.. Ed. Omega - Stryer, L., Berg, J.M. y Tymoczko, J.L. (2015). Bioquímica, 7ª ed.. Ed. Reverté
Complementary	- Voet, D., Voet, J.G, Pratt, C.W. (2016). Fundamentos de Bioquímica. 4a Ed.. Médica Panamericana - Bernhard Rupp (2009). Biomolecular Crystallography: Principles, Practice, and Application to Structural Biology 1a ed.. Garland Science - TERESE M. BERGFORS (2009). PROTEIN CRYSTALLIZATION 2a ed.. International University Line - Smith, C. A. y Wood, E. J. (1997). Moléculas biológicas. . Ed. Addison-Wesley Iberoamericana. - Stephenson F.H. (2012). Cálculo en Biología molecular y Biotecnología. 2a ed. Ed. . Elsevier España. Recursos web: Biomodel: Modelos moleculares en movimiento e interactivos que, junto con texto explicativo, ilustran la estructura tridimensional de las biomoléculas. Autor: Ángel Herráez Sánchez Estructura de macromoléculas: Modelo interactivo para profundizar en las estructuras macromoleculares: desde un enlace peptídico hasta una membrana biológica. Autor: Jesús M. Sanz Aula Virtual de Biomoléculas: Herramientas para conocer mejor las biomoléculas. Autor: José Luis Urdiales Ruiz Cibertexto de Biomoléculas: Un curso completo de la estructura de las biomoléculas (glúcidos, lípidos, proteínas y ácidos nucleicos) con la posibilidad de autoevaluarse. Autor: Juan Manuel González Mañas MATERIALES MULTIMEDIA Y BIOMOLÉCULAS: Material docente para el primer, segundo y tercer ciclo Autores: Pilar Roca, Jordi Oliver y Sergio Rodríguez Enlaces: Colección de enlaces sobre Bioquímica y Biología Molecular en español y otros idiomas en el mundo. Recopilador: Ángel Herráez Sánchez Otros materiales de apoyo: Materiales disponibles en la página web de la asignatura. CD-Rom: BioROM 2011 Ayudas al aprendizaje de la Bioquímica, Biotecnología y Biología Molecular

Recommendations

Subjects that it is recommended to have taken before

Chemistry: Equilibrium and Change/610G04008
Fundamentals of Mathematics/610G04001
Cell Biology/610G04003
Chemistry: Structure and Bonding/610G04005
Integrated Basic Laboratory/610G04004

Subjects that are recommended to be taken simultaneously

Thermodynamics: Equilibrium and Phases/610G04018
Instrumental Analysis/610G04014
Spectroscopy/610G04017

Subjects that continue the syllabus

Kinetic and Catalysis/610G04026
Fundamentals of Biotechnology/610G04029
Molecular and Metabolic Biochemistry/610G04023

Other comments

Green Campus Science Faculty Program To contribute to achieving a sustainable environment immediately and to comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary work carried out in this area will be requested in virtual format and computer support.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.