



IDENTIFYING DATA

Biochemistry

Subject	Biochemistry			
Code	V11G201V01201			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Suarez Alonso, Maria del Pilar			
Lecturers	Suarez Alonso, Maria del Pilar			
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General description	The objective of Biochemistry is to provide students with the basic knowledge about the structure and function of biomolecules, as well as about their corresponding biosynthesis and degradation routes. It also enables them to analyze and identify biomolecules.			

Competencies

Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Autonomous learning ability
B3	Ability to manage information
B4	Ability for analysis and synthesis
C20	Know the structure and reactivity of the main classes of biomolecules and the chemistry of important biological processes
D3	Ability to communicate in both oral and written form in Spanish and / or Galician and / or English

Learning outcomes

Expected results from this subject	Training and Learning Results			
Identify and recognise the structure of the distinct types of biomolecules and represent them properly.	A2 A3 A5	B1	C20	D3
Recognise the different biological activities of the distinct types of biomolecules.	A2 A3 A5	B1	C20	D3
Define the kinetical enzymatic of the reactions catalized by enzymes as well as his general mechanisms.	A2 A3 A5	B1	C20	D3
Relate the vitamins with the corresponding coenzymes of enzymatic reactions.	A2 A3 A5	B1	C20	D3
Explain the concept of Bioenergetics. Conceptually reason the importance of the coupling of endergonic and exergonic processes in biological systems.	A2 A3 A5	B1	C20	D3
It enumerate the main structural appearances of the ATP that determine his paper in the transfer of energy. It describes the cycle ATP.	A2 A3 A5	B1	C20	D3

Distinguish the metabolic roads of the biomolecules, as well as his interrelationships and regulation.	A2 A3 A5	B1	C20	D3
Justify the application of the different instrumental technicians in the analysis of biomolecules.	A2 A3 A5	B1 B3 B4	C20	D3
Distinguish and propose analytical protocols to apply the technicians mentioned for the analysis of biomolecules in diverse areas (clinical, pharmaceutical, biomedical, ...)	A2 A3 A5	B1 B3 B4	C20	D3

Contents

Topic	
Subject 1. Amino acids and peptides	Amino acids: structure and classification. The peptide bond. Natural peptides of biological interest.
Subject 2. Proteins	General concept. Main functions of the proteins. Structural levels of the proteins
Subject 3. Enzymes and catalysis enzymatic	Concept, nomenclature and classification of the enzymes. Characteristics of the active centre. Kinetic of the enzymatic reactions: equation of Michaelis-Menten. Kinetic of the allosteric enzymes. Other mechanisms of the modulation of the enzymatic activities
Subject 4. Glucides	Monosaccharides: aldoses and cetoses. Linear structure. Structure cyclic and space formings. Monosaccharides of biological interest. Oligosaccharides and polysaccharides: general characteristics, structure and types more important to biological level.
Subject 5. Lipids	General characteristics and biological importance of the lipids. General classification. Characteristics and structure of the fatty acids. Saponifiable lipids: neutral and polar. Unsaponifiable lipids: eicosanoids, isoprenoids and steroids.
Subject 6. Vitamins and coenzymes	Structure and function of vitamins and coenzymes in metabolic reactions.
Subject 7. Nucleotides: structure and function	Biological importance. Composition and structure of nucleosides and nucleotides. Functions of the nucleotides.
Subject 8. Introduction to the metabolism.	General concepts of the energetic metabolism. The equivalent of the ATP. Definition of metabolic route: catabolic, anabolic and amphibole routes. Importance of the regulation of the metabolic routes.
Subject 9. Glycolysis and pyruvate metabolic destination	Stages and reactions of the glucolysis. Biological importance of this universal route. The glucolysis how amphibole route. Pyruvate metabolic destinations in anaerobiosis (fermentation lactic and alcoholic) and aerobiosis (acetylCoA synthesis in the mitochondrial matrix). Reoxidation of the cytosolic NADH. Stoichiometry and energetic balance of the glucolysis.
Subject 10. Cycle of the tricarboxylic acids (cycle of Krebs).	Central position of the acetylCoA molecule in the energetic metabolism. Reactions of the cycle of Krebs. Paper of the cycle of Krebs like amphibole route. Energetic balance of the cycle Krebs and of the aerobic degradation of the glucose.
Subject 11. Route of the pentoses phosphate	Characteristic and importance of the route of the pentoses phosphate. Oxidative and non-oxidative phase of the route of the pentoses phosphate.
Subject 12. Chain of electronic transport and oxidative phosphorylation	Chain of electronic transport: components, location and sequence of the electronic transport. Oxidative phosphorylation: ATP synthase enzymatic complex.
Subject 13. Gluconeogenesis	Overview of the synthesis of glucose de novo. Main gluconeogenic substrates. Own reactions of the gluconeogenesis.
Subject 14. Metabolism of the fatty acids	Activation and intracellular transport of the fatty acids. The beta-oxidation of the fatty acids. Energetic balance of the acid palmitic. Biosynthesis of acids fatty: acetylCoA carboxylase and Fatty acid synthase reaction. Elongation and desaturation of fatty acids.
Subject 15. Degradation of the amino acids and destination of the ammonium ion .	Overview of the catabolism of the amino acids: transamination and oxidative desamination reactions. Destination of the carbon skeleton of the amino acids. Form of excretion of the ammonium ion in the alive organisms: the urea cycle
Subject 16. Aminoacids anabolism.	Nitrogen cycle in the nature. Incorporation of the ammonium ion to the biomolecules through the glutamate and glutamine. Aminoacids biosynthesis.

Subject 17. Metabolism of the nucleotides	General appearances of the catabolism of nucleic acids and of nucleotides. Degradation of the nucleotides of purine and of pirimidine. Biosynthes of ribonucleotides and deoxyribonucleotides
Subject 18. Experimental methods in Biochemistry	Techniques used in the field of protein study: homogenization, subcellular fractionation, precipitation with salts, chromatographic, electrophoretic ...

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	12	24	36
Problem solving	24	54	78
Mentored work	0	10	10
Objective questions exam	2	24	26

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	In these classes the professor will explain and will develop the concepts and basic foundations of the *temario of clear form and *amena to facilitate his understanding. The contents of each subject will be exposed in the platform FEAR with sufficient time so that the students can consult them. It recommends that the student work on this material, consulting besides the bibliography recommended.
Problem solving	These classes include the following appearances: a) Each student of individual way or in groups will have to do a series of exercises to strengthen the study and understanding of the matter. These exercises will be considered for the evaluation. b) Explanations of doubts of the previously explained concepts in the masterclasses. c) In this section also will work some contents related with the characteristics and funtions of the biomolecules, that by experience of the professor are of more difficult understanding and that therefore require a greater didactic support.
Mentored work	Realization (search for information, preparation and presentation) of two work groups of 5 students. The works will be related to some of the contents of the subject of Biochemistry and will be proposed by the teacher. The teacher will be able to provide some of the information necessary for its execution. The work will be considered for evaluation. .

Personalized assistance

Methodologies	Description
Lecturing	To resolve all the doubts that can arise in relation to the masterclasses, the students have to his disposal personalized tutorials that will take place in the dispatch 9 (block B of the Building of Experimental Sciences, flat 3º) of the professor PILAR SÚAREZ ALONSO, in the schedule established.
Problem solving	To resolve all the doubts that can arise in relation to the seminars, the students have to his disposal personalized tutorials that will take place in the dispatch 9 (block B of the Building of Experimental Sciences, flat 3º) of the professor PILAR SÚAREZ ALONSO, in the schedule established.
Mentored work	To resolve all the doubts that can arise in relation with the realization of the works, the students have to his disposal personalized tutorials that will take place in the dispatch 9 (block B of the Building of Experimental Sciences, flat 3º) of the professor PILAR SÚAREZ ALONSO, in the schedule established.
Tests	Description
Objective questions exam	To resolve all the doubts that can arise in relation with the examinations, the students will have to his disposal personalized tutorials that will take place in the dispatch 9 (Block B, Building of Experimental Sciences, flat 3º) of the professor PILAR SÚAREZ ALONSO, in the schedule established.

Assessment

	Description	Qualification	Training and Learning Results
Problem solving	The assistance the masterclasses and the the seminars is very recommended for the back realisation of a series of exercises of type test and questions of reasoning that will reinforce the contents purchased by the student. It is essential to obtain a minimum grade of 5.0 out of 10 to be able to weigh with the rest of the sections.	20	A2 B1 C20 D3 A3

Mentored work	The individual contribution of each student to the whole work will be evaluated. Structure, originality, use of language in general and scientific terminology will be taken into account. Adequacy to the previously required format will also be taken into account. The works may be presented in Galician or Spanish. It is essential to obtain a minimum grade of 5.0 out of 10 to be able to weigh with the rest of the sections.	20	A3 B1 C20 D3 A5 B3 B4
Objective questions exam	There will be a partial test in the middle of the academic year, which will consist of test questions and short questions, and will represent 20% of the Biochemistry subject. It is essential to obtain a minimum grade of 5.0 out of 10 to be able to weigh with the rest of the sections. For students who passed the previous partial test, the final exam will cover the syllabus from the first partial onwards, and will represent 40% of the final grade. For students who did not pass the previous test, this exam will correspond to the entire Biochemistry syllabus and will account for 60% of the final grade. In any case, it is essential to obtain in this section a minimum grade of 5.0 out of 10 to be able to pass the Biochemistry subject, as well as weigh with the rest of the sections.	60	A2 B1 C20 D3 B4

Other comments on the Evaluation

The final grade for Biochemistry will be the sum of the (weighted) grades obtained by the student in all the activities of the subject (problem solving + supervised work + partial and final exam of objective questions).

In order to pass the Biochemistry subject, students must obtain a minimum grade of 5.0 out of 10.0 in the final exam with objective questions.

In the case of not exceeding 5.0, the Biochemistry grade in the minutes will be the weighted grade of the final examination of objective questions.

Those students who do not appear for the final exam of objective questions will appear in the minutes as Not Presented, although they have participated in the other activities of the subject of Biochemistry.

These criteria will be applied identically in the two calls (January and July).

The notes of the activities carried out during the course (solving exercises, supervised works and partial examination of objective questions) are kept throughout the academic year, as long as they have reached the required minimum grade.

Schedule: <http://química.uvigo.es/eres/docencia/horariosExaminations>: <http://química.uvigo.es/eres/docencia/examenes>

Sources of information

Basic Bibliography

STRYER, L.; BERG, J.M. & TYMOCZKO, J.L., **Bioquímica. Curso básico**, 1ª, Reverte, 2014

José Mª Teijón Rivera y Mª Dolores Blanco Gaitán, **Fundamentos de la Bioquímica metabólica**, 4ª edición, Tebar, 2016

José María Teijón Rivera y col., **Fundamentos de la Bioquímica estructural**, 3ª, Tebar, 2016

NELSON D. L. & COX M. M, **Lehninger. Principios de Bioquímica**, 7ª, Omega, 2019

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Biology: Biology/V11G201V01101

Physics: Physics I/V11G201V01102

Chemistry: Chemistry 2/V11G201V01109

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in

advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

In anticipation of a possible health alert caused by COVID-19, the teaching of Biochemistry could be semi-presential or through Virtual Classroom of the UVigo. In the first case: the masterclasses would be held from the classroom of the Faculty assigned to the subject and at the scheduled time for the academic year, alternating the presence of students in the classroom. Instead, the seminars would be totally presential in the assigned time and classroom. In the second case, both the masterclasses and the seminars would be held through the remote campus at their respective times and virtual classrooms.

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

In the case that teaching Biochemistry is blended, the tutoring hours can be carried out both in the teacher's physical office, maintaining sanitary security measures at all times and through the virtual office (UVigo remote campus). In addition, students can manage their doubts by email or by phone.

In the case of non-face-to-face teaching, students will answer their questions through the virtual office (remote campus), as well as by email or telephone.

* Modifications (if applicable) of the contents

In the case that teaching is blended or non-presential, the Biochemistry agenda will be the same.

* Additional bibliography to facilitate self-learning

In the event of a health alert by COVID-19, the professor would be responsible for providing the additional bibliography through videos, research articles for both the development of masterclasses, seminars and supervised work.

* Other modifications

=== ADAPTATION OF THE TESTS ===

* Tests already carried out

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

...

* Pending tests that are maintained

Test XX: [Previous Weight 00%] [Proposed Weight 00%]

The tests and the weight of each one will also be the same under any assumption. In the case of blended or non-presential teaching, the tests would be carried out online.

* Tests that are modified

[Previous test] => [New test]

* New tests

* Additional Information
