



## IDENTIFYING DATA

### Biochemistry

Subject	Biochemistry			
Code	V11G201V01201			
Study programme	Grado en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Suárez Alonso, María del Pilar			
Lecturers	Suárez Alonso, María 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.			

## Training and Learning Results

Code				
A1	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	Ability for autonomous learning			
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			

## Expected results from this subject

Expected results from this subject	Training and Learning Results			
Identify and recognise the structure of the distinct types of biomolecules and represent them properly.	A1 A3 A5	B1	C20	D3
Recognise the different biological activities of the distinct types of biomolecules.	A1 A3 A5	B1	C20	D3
Define the kinetical enzymatic of the reactions catalized by enzymes as well as his general mechanisms.	A1 A3 A5	B1	C20	D3
Relate the vitamins with the corresponding coenzymes of enzymatic reactions.	A1 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.	A1 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.	A1 A3 A5	B1	C20	D3

Distinguish the metabolic roads of the biomolecules, as well as his interrelationships and regulation.	A1 A3 A5	B1	C20	D3
Justify the application of the different instrumental technicians in the analysis of biomolecules.	A1 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, ...)	A1 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) and Pentose phosphate pathway	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. Pentose phosphate pathway
Subject 11. Chain of electronic transport and oxidative phosphorylation	Chain of electronic transport: components, location and sequence of the electronic transport. Oxidative phosphorylation: ATP sintase enzymatic complex.
Subject 12. Gluconeogenesis	Overview of the synthesis of glucose de novo. Main gluconeogenic substrates. Own reactions of the gluconeogenesis.
Subject 13. 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 carboxilase and Fatty acid synthase reaction. Elongation and desaturation of fatty acids.
Subject 14. 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 carbonate skeleton of the amino acids. Form of excretion of the ammonium ion in the alive organisms: the urea cycle
Subject 15. Aminoacids anabolism.	Nitrogen cycle in the nature. Incorporation of the ammonium ion to the biomoléculas through the glutamate and glutamine. Aminoacids biosynthesis.
Subject 16. 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	1	12	13
Essay questions exam	1	12	13

\*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	In this section we will try to: 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) Clarify the doubts of the concepts previously explained in the master classes and in the seminars. c) In this section, we will also work on some contents related to energy metabolism, which, due to their difficult understanding, require 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.
Essay 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 seminars is very recommended for the back realization of a series of exercises: multiple choice questions, reasoning questions and various calculations that will reinforce the content acquired by the student. The realization of the exercises of each subject is obligatory and always in groups of 2 or 3 students. They are not individual. It is essential to obtain a minimum score of 6.0 out of 10 to be able to consider the rest of the sections. This activity is not recoverable if the required minimum is not reached.	20	A1 B1 C20 D3 A3

Mentored work	The realization of the works is obligatory, always in groups of 4 or 5 students and they will deal with some of the contents of the subject of Biochemistry. Both individual student work and group work will be assessed. The structure, originality, use of language in general and scientific terminology will be taken into account. The adequacy of the format previously required will also be taken into account. The works may be presented in the languages: Galician or Spanish. It is essential to obtain a minimum score of 7.0 out of 10 to be able to consider the rest of the sections. This activity is not recoverable if the required minimum is not reached.	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.	25	A1 B1 C20 D3 B3
Essay questions exam	There will be a second partial written test corresponding to the Metabolic Biochemistry part (items 8 - 15) on the date approved by the Faculty Board (consult the center's website). This test will consist of multiple choice questions, a metabolism integration question that includes the calculation of ATP performance. It is essential to obtain a minimum grade of 4.0 out of 10 in order to be weighted with the rest of the sections. This test will account for 35% of the final grade for the Biochemistry subject.	35	A3 B1 C20 D3 A5 B3 B4

### Other comments on the Evaluation

The evaluation of the subject of Biochemistry is continuous throughout the entire academic year. To be evaluated in this way, the student must carry out all the evaluable activities (problem solving, tutored work and two partial written tests).

The particular situations of each student that prevent participation in these activities on a regular basis (Example: employment contract, illness... etc) must be communicated as soon as possible to the responsible teacher to find a solution.

To pass the Biochemistry course (final grade as the sum of the weighted grades) it is essential to have obtained a grade equal to or higher than the minimum grade required in each of the activities that can be evaluated separately. If this is not the case, the total calculation will not be carried out and the grade that will appear in the Biochemistry report will be the highest of the failed sections, and the student must take the entire subject exam in the second call (July).

The final exam in the xullo call is equivalent to 60% of the final grade and is considered approved when a grade equal to or greater than 4.0 out of 10 is achieved.

It is important to note that problem solving activities and tutored work are not recoverable.

In the event that the student does not participate in any of the evaluable activities, he will appear as NOT PRESENTED in the Biochemistry certificate in both calls (January and July). On the contrary, participation in some of the evaluable activities but not in all of them will automatically imply a fail in the Biochemistry Act (both calls).

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/horarios> Examinations: <http://química.uvigo.es/eres/docencia/examenes>

### Sources of information

#### Basic Bibliography

J.M. Berg; J.L. Tymoczko; G.J. Gatto Jr; Stryer, L., **Biochemistry**, 9th, MacMillan, 2019

NELSON D. L. & COX M. M, **Lehninger. Principles of Biochemistry. International edition**, 7th, W.H. Freeman & Co Ltd, 2017

#### Complementary Bibliography

José M<sup>a</sup> Teijón Rivera y M<sup>a</sup> Dolores Blanco Gaitán, **Fundamentos de la Bioquímica metabólica**, 4<sup>a</sup>, Tebar, 2016

José M<sup>a</sup> Teijón Rivera y M<sup>a</sup> Dolores Blanco Gaitán, **Fundamentos de la Bioquímica estructural**, 3<sup>a</sup>, Tebar, 2017

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## **Recommendations**

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### **Subjects that it is recommended to have taken before**

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Physics: Physics I/V11G201V01102

Chemistry: Chemistry 2/V11G201V01109

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