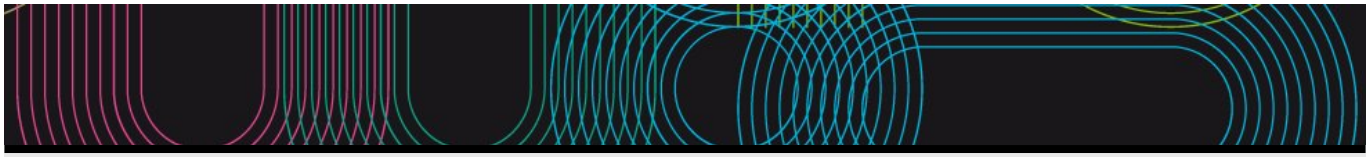

IDENTIFYING DATA				
Biochemistry I				
Subject	Biochemistry I			
Code	V02G031V01201			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Suárez Alonso, María del Pilar			
Lecturers	San Juan Serrano, María Fuencisla Suárez Alonso, María del Pilar			
E-mail	psuarez@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The subject Biochemistry aims to provide students with basic knowledge about the structure and function of biomolecules, as well as their corresponding routes of biosynthesis and degradation. It also enables them to analyze and identify biomolecules.			

Training and Learning Results	
Code	
A1	Students should prove understanding and knowledge in this study field that starts in the Secundary Education and with a level that, even though it is suppported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.
A2	Students should know how to apply their knowledge to their work or vocation in a professional way. They also should have the competences that are usually proved through the elaboration and defence of arguments and the resolution of problems within their study field.
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.
B3	Apply the knowledge acquired in the degree and use the scientific-technical instrumentation and CIT in contexts of Biology and/or related to the professional practice.
B6	Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines.
C3	Perform and interpret molecular, physicochemical and biological analyses, including samples of human origin. Conduct assays and functional tests under normal and abnormal conditions.
C4	Isolate, identify and growth microorganisms, cells, tissues and organs, making easier their study and the assessment of their metabolic activity.
C6	Understanding and integrate the functioning of living beings (cellular, tissue, organ and individual level), explaining their homeostatic and adaptive responses.
D1	Understand the meaning and use of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a fairer and more equal society.
D2	Communicate speaking and in writing in Galician.
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.

Expected results from this subject	Training and Learning Results			
Recognize the structure, properties and function of biomolecules.	A1	B2 B3 B6	C3	D1 D2

Understand and know the fundamentals of bioenergetics.	A1 A2 A3	B2 B3 B6	C3 C6	D1 D2
Identify the mechanisms of action and regulation of enzymes.	A1 A2 A3	B2 B3 B6	C3 C4 C6	D1 D2
Know the general organization of metabolism.	A1 A2 A3	B2 B3 B6	C3 C4 C6	D1 D2
Apply biochemical knowledge to isolate, identify, handle, and analyze specimens and samples of biological origin, including viruses, as well as to characterize their cellular and molecular constituents.	A1 A2 A3	B2 B3 B6	C3 C4 C6	D1 D2
Apply knowledge and technology related to biochemistry in aspects related to the production, exploitation, analysis and diagnosis of biological processes and resources.	A1 A2 A3	B2 B3 B6	C3 C4 C6	D1 D2 D3
Contrast information, develop experiments and interpret results.	A1 A2 A3	B2 B3 B6	C3 C6	D1 D2
Understand the social projection of biochemistry and its repercussions on professional practice, as well as know how to use its contents for teaching and dissemination.	A1 A2 A3	B2 B3 B6	C6	D2 D4
Handle the concepts, terminology and scientific-technical instrumentation related to biochemistry.	A1 A2 A3	B2 B3 B6	C3 C4 C6	

Contents

Topic	
(*)Topic 1. Introduction to Biochemistry	(*) Inorganic components of living organisms. Nature of molecular interactions. The role of water in biological processes: ionic product of water and the concept of pH. Ionic balance: Henderson-Hasselbalch equation, pKa concept and buffer solutions. Ionic strength concept.
(*) Topic 2: amino acids and peptides	(*) Amino acids : structure and classification. the peptide bond. Natural peptides of biological interest
(*) Topic 3: Proteins	(*) General concepts. Main functions of proteins. Levels of structural organization of proteins.
(*) Topic 4: Enzymes and enzymatic catalysis	(*) Enzymes: concept and chemical nature. Active center concept. Nomenclature and classification of enzymes. Enzymatic catalysis: concepts and mechanisms.
(*) Topic 5: Enzymatic catalysis	(*) Kinetics of enzymatic reactions. Kinetics of allosteric enzymes. Other mechanisms of modulation of enzymatic activity.
(*) Topic 6: Structure and properties of monosaccharides.	(*) Monosaccharides: aldoses and ketoses. linear structure. Cyclic structure and spatial conformations. Monosaccharides of biological interest.
(*) Topic 7: Oligosaccharides and polysaccharides	(*) General characteristics, properties and structure of the main oligosaccharides, polysaccharides and heterosides.
(*) Topic 8: Simple and complex lipids, and isoprenoids.	(*) General characteristics and biological importance of lipids. General ranking. Fatty acids and alcohols. simple lipids. complex lipids. Isoprenoid lipids.
(*) Topic 9: Nucleotides: structure and function	(*) Purine and pyrimidine bases. Structure and function of nucleosides and nucleotides.
(*) Topic 10. Introduction to metabolism	(*) Metabolism concept. General characteristics of metabolic pathways. Anabolic, catabolic and amphibolic pathways. General aspects of metabolic regulation.
(*) Topic 11. Carbohydrate Catabolism	(*) Glycolysis: description of enzymatic reactions. Incorporation of other monosaccharides to the glycolytic pathway. Pentose phosphate pathway: general concepts and biological significance.
(*) Topic 12. Metabolic fates of pyruvate	(*) Anaerobic destination: alcoholic and lactic fermentation. Aerobic fate: formation of acetyl-CoA by oxidative decarboxylation. Study of the pyruvate dehydrogenase enzyme complex.
(*) Topic 13.Cycle of tricarboxylic acids.	(*) Position of acetyl-CoA in intermediary metabolism. Overview of the cycle and sequence of reactions.
(*) Topic 14. Electronic transport chain and oxidative phosphorylation.	(*) Shuttle systems. Electronic transport chain: components, location and sequence of electronic transport. Oxidative phosphorylation and coupling to electron transport. ATP synthase enzyme complex.
(*) Topic 15. Gluconeogenesis.	(*) Gluconeogenesis: overview and main substrates. Description of the route. Specific reactions of gluconeogenesis.

(*) Topic 16. Glycogen metabolism	(*) Degradation of dietary glycogen. Lysosomal breakdown of glycogen. Glycogenolysis: enzymatic reactions. Glycogenogenesis: enzymatic reactions.
(*) Topic 17. Degradation of lipids and fatty acids.	(*) Digestion, absorption and transport of dietary lipids and endogenous lipids. Activation and intracellular transport of fatty acids. The beta-oxidation of saturated fatty acids with an even number of carbon atoms. Cetogenesis.
(*) Topic 18. Biosynthesis of fatty acids and lipids	(*) Biosynthesis of saturated fatty acids. Acetyl-CoA carboxylase reaction. Fatty acid synthase enzyme complex. Biosynthesis of the alcoholic components of lipids and triacylglycerols.
(*) Topic 19. Proteolysis, amino acid degradation and fate of the ammonium ion	(*) Digestion of dietary proteins. intracellular proteolysis. Overview of amino acid catabolism. Transamination and deamination. Decarboxylation reactions. Fate of the carbon skeleton of amino acids. Forms of ammonium nitrogen excretion. Urea cycle: enzymatic reactions.
(*) Topic 20. Biosynthesis of amino acids	(*) Nitrogen cycle in nature. Incorporation of the ammonium ion in amino acids: glutamate and glutamine pathways. Study of the different biosynthetic families.
(*) Topic 21. Nucleotide metabolism	(*) General aspects of the catabolism of nucleic acids and nucleotides. Degradation of purine and pyrimidine nucleotides. Biosynthesis of ribonucleotides and deoxynucleotides
PROGRAM OF PRACTICAL CLASSES PRACTICE 1	Elaboration of a serum albumin standard line by the Lowry method.
PRACTICE 2	Determination of protein concentration in rat liver supernatant.
PRACTICE 3	Preparation of a standard line of p-nitrophenol.
PRACTICE 4	Determination of beta-D-galactosidase activity in rat liver supernatant.
PRACTICE 5	Expression of beta-D-galactosidase activity in rat liver supernatant.
PRACTICE 6	Determination of the optimal pH of beta-D-galactosidase activity.
PRACTICE 7	Effect of substrate concentration on beta-D-galactosidase activity. Calculation of kinetic parameters.
PRACTICE 8	Effect of temperature on the stability of the enzyme beta-D-galactosidase.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	10	10	20
Lecturing	35	52.5	87.5
Seminars	3	4.5	7.5
Objective questions exam	1	14	15
Essay questions exam	2	18	20

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

Methodologies

	Description
Laboratory practical	They will take place in the Biochemistry teaching laboratory. Attendance to the practical classes is compulsory. During the practical sessions, students will follow a practical script prepared by the lecturer to develop the experimental protocols. During the course of the practicals, students must present the results obtained and answer a series of questions. At the end of the practicals, they must write a report on them
Lecturing	The lecturer will explain the contents of the subject in lectures, with slide projections. Students will be provided with supporting copies of figures, diagrams and tables. The classes will be developed interactively with the students. The Moovi platform will be used as a support tool.
Seminars	In the seminars, students will deal with topics under the supervision of the teacher and will solve questionnaires on the material explained in the theoretical classes.

Personalized assistance

Methodologies	Description
Lecturing	In order to resolve any doubts that may arise in relation to the lectures, students have at their disposal personal tutorials that will take place in the teacher's office PILAR SUÁREZ ALONSO (office 9, 3rd floor, Block B, Experimental Sciences Building).
Laboratory practical	The small size of the practical groups allows for personalized attention from the lecturer. Students will also have at their disposal personal tutorials that will take place in the teacher's office FUENCISLA SAN JUAN SERRANO (office 10, 3rd floor, Block B, Experimental Sciences Building).

Seminars	To resolve any doubts that may arise in relation to the seminars, students have at their disposal personal tutorials that will take place in the teacher's office FUENCISLA SAN JUAN SERRANO (office 10, 3rd floor, Block B, Experimental Sciences Building).

Tests	**Description**
Objective questions exam	To resolve any doubts that may arise during the preparation for the written exam, students have personalized tutorials available to them that will take place in the office of Professor PILAR SUÁREZ ALONSO (office 9, 3rd floor, Block B, Experimental Sciences Building).
Essay questions exam	To resolve any doubts that may arise during the preparation for the written exam, students have personalized tutorials available to them that will take place in the office of Professor PILAR SUÁREZ ALONSO (office 9, 3rd floor, Block B, Experimental Sciences Building).

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	Attendance is mandatory. The teacher will assess the experimental results, the student's responses and the conclusions about the experimentation carried out by presenting a practical report, which will account for 20% of the final grade for the Biochemistry I subject. It is essential to obtain a minimum score of 5 out of 10 in this section in order for it to count towards the final mark. This activity is not recoverable if the required minimum is not reached.	20	A1 B2 C3 D3 A2 B3 C4 D4 A3 B6 C6
Seminars	During the academic year, two seminars of 1.5 hours each will be programmed. Knowledge of the topics covered will be evaluated by solving exercises, which will be delivered on the date indicated by the teacher. Attendance at the seminars as well as the delivery of the corresponding exercise is mandatory. To pass this activity it is essential to have a 5 out of 10 to be able to weigh the final grade with the rest of the sections.	20	A1 B2 C6 D1 A2 B6 D3 A3
Objective questions exam	There will be a first written test corresponding to Structural Biochemistry (items 1-7). This test will consist of multiple choice questions and an exercise. It is essential to obtain a minimum score of 5.0 out of 10 to be able to weigh with the rest of the sections. This grade will account for 25% of the final grade.	25	A1 B2 C3 D1 A2 B6 C4 D2 A3 C6
Essay questions exam	There will be a second written test corresponding to Metabolic Biochemistry (items 8-15). This test will consist of multiple choice questions and a metabolism integration question that includes the calculation of energy output (ATP). It is essential to obtain a minimum score of 5.0 out of 10 to be able to weigh with the rest of the sections. This grade will account for 35% of the final grade.	35	A1 B2 C3 D1 A2 B3 C4 D2 A3 B6 C6

Other comments on the Evaluation

The evaluation of the Biochemistry I subject is continuous throughout the academic year. To be evaluated in this way, the student must carry out all the proposed activities (laboratory exercises, seminars and two written tests).
The particular situations that prevent participation in the usual activities (laboratory practices and seminars) (example: employment contract, illness, etc.) must be communicated as soon as possible to the teacher to find a solution.
Attendance is mandatory in the case of seminars and laboratory practices, admitting a single lack of attendance, which must be duly justified.
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 assessed separately (5.0 out of 10). Otherwise, the grades will not be added, and the grade that will appear in the Biochemistry I report will be the highest of the failed activities.
The activities that obtained a grade equal to or higher than the minimum required (5.0 out of 10) in the first opportunity (January) of an academic year are saved for the second opportunity (July). In the second opportunity (July) it will not be possible to recover laboratory practices and seminars, only the written tests not passed in the first opportunity can be carried out. The final grade for Biochemistry I (xullo) will be the sum of the weighted grades for each section as long as the minimum required grade (5.0 out of 10) has been reached.
If the student does not attend any of the evaluable activities, he will appear as NOT PRESENTED in the Biochemistry I report on both occasions (January and July). Carrying out any of the proposed evaluable activities, but not all, automatically implies a fail in the Biochemistry Act (both opportunities).
These criteria will be applied identically on both occasions.
Likewise, students who prefer a global evaluation of the Biochemistry I subject must notify them within the period provided by the center. The global exam will include laboratory practice questions, seminar exercises and all the theoretical part.
Students who do not pass the subject of Biochemistry I in either of the two opportunities, will keep the marks of the activities (practices and seminar) for the following two academic years, as long as they have reached the minimum required grade.
Only activities not passed will be repeated. Activities that have already been passed cannot be re-evaluated.

The academic calendar can be consulted at the following link: http://bioloxia.uvigo.es/gl/docencia/horarios
The exam schedule can be consulted at the following link: http://bioloxia.uvigo.es/gl/docencia/exames

Dates of the final exams: http://bioloxia.uvigo.es/es/docencia/examenes

Sources of information

Basic Bibliography

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

NELSON D. L. & COX M. M, **Lehninger. Principios de Bioquímica**, 6ª Edición, Omega, 2014

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

MATHEWS, C.K.; VAN HOLDE, K.E; APPLING, D.R. & ANTHONY-CAHILL, S.J., **Bioquímica**, 4ª Edición, Pearson, 2013

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

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Biology: Basic laboratory techniques/V02G031V01108
Physics: Physics of biological processes/V02G031V01102
Chemistry: Chemistry applied to biology/V02G031V01105