Teaching Guide				
Identifying Data				2015/16
Subject (*)	Bioquímica: Bioquímica II		Code	610G02012
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Second	FB	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía Celular e Molecular			
Coordinador	Freire Picos, María ÁngelesCerdan Villanueva, Maria Esperanza	E-mail	maria.freirep@udc.esesper.cerdan@udc.es	
Lecturers	Barreiro Alonso, Aida Inés Cerdan Villanueva, Maria Esperanza Freire Picos, María Ángeles Gonzalez Siso, Maria Isabel Lamas Maceiras, Mónica Rico Díaz, Agustin Varela Eirín, Marta	E-mail	aida.barreiro@udc.es esper.cerdan@udc.es maria.freirep@udc.es isabel.gsiso@udc.es monica.lamas@udc.es agustin.rico.diaz@udc.es marta.varelae@udc.es	
Web	ciencias.udc.es/bcm			
General description	The subject contents provide to the student the basic information for knowing and understanding the biochemical reactions,enzyme catalysis and metabolism. Studying in the second year of Biology degree will allow the student to achieve the basic knowledge to understand the molecular mechanisms governing many responses in the live organisms.			

Study programme competences / results	
Code	Study programme competences / results
A8	Illar, analizar e identificar biomoléculas.
A10	Avaliar actividades metabólicas.
A26	Deseñar experimentos, obter información e interpretar os resultados.
A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B7	Comunicarse de maneira efectiva nunha contorna de traballo.
B10	Exercer a crítica científica.
B11	Debater en público.
B13	Comportarse con ética e responsabilidade social como cidadán e como profesional.

Learning outcomes	
Learning outcomes	Study programme competences / results

Understand and describe the mechanisms by which the Enzymes act in biological catalysis. To design, combining and using the methodology of the practical course and theoretical classes, systems to purify and analyse enzymes. To know the importance of the pathways to obtain energy in the biological systems to maintain life. To know the main metabolic pathways in the cell and its regulation. Develop the capability to relate the different metabolic pathways.	A8 A10 A26 A29 A30 A31	B1 B2 B3 B4 B5 B7 B10 B11 B13	

Contents	
Topic	**Sub-topic**
1. Biological Enzymes as catalysts.	Structural features that give them advantages over chemical catalysts. Reaction mechanisms. Antibodies as catalysts. Ribozymes.
2. Kinetics of chemical reactions.	Monosubstrate reactions and Michaelis-Menten kinetics Transformation of the Michaelis- Menten equation. Bisubstrate reaction kinetics. Irreversible inhibitors; binding, examples and applications. Reversible Inhibition: types of inhibition. Kinetics in the presence of inhibitors.
3. Regulation of enzymatic activity.	Importance of regulation in metabolism. Allosteric enzymes. Covalent modification. Isoenzymes. Zymogens or proenzymes.
4. Methodology for determination of enzyme activities.	Direct and indirect assays. Purification of enzymes: specific activity, yield and purification factor. Importance and current applications of enzymology.
5. Introduction to Metabolism.	Anabolic and catabolic pathways. Compartmentalization. Need for coordination and interaction between the different routes, and variability among species. Levels of obtaining energy. Methodology for the study of metabolic pathways. Levels of study.
6. Transport of metabolites across cell membranes.	Types of transport depending on the energy sources. Structural data. Examples with specific metabolites
7. Obtaining chemical energy.	Oxidation reduction in energy production. Coenzymes involved. Generation of ATP: substrate-level phosphorylation, oxidative phosphorylation and photosynthetic phosphorylation and energy production systems. Detailed study of oxidative phosphorylation and photosynthetic phosphorylation.
8: Glycolysis and catabolism of hexoses.	Location of the routes. Stages and pathway regulation. Fermentations. Relationship with the pentose phosphate pathway.
9: TCA cycle	Location of the route. Conversion of pyruvate to acetyl-CoA. Study of the pyruvate dehydrogenase complex and interaction with other routes. Anaplerotic routes, importance of mitochondrial shuttles and balances.
10. Gluconeogenesis.	Definition and localization, metabolic need for this route. Gluconeogenesis from: pyruvate, lactate, amino acids and triglycerides. Glyoxylate cycle.
11. "Dark Phase" of photosynthesis. Relationship with gluconeogenesis.	The Calvin cycle. Photorespiration. Regulation. The C4 pathway of tropical plants. The crassulacean acid metabolism. Sucrose metabolism and starch.
12. Glycogen metabolism.	The reserve polysaccharide glycogen. Biosynthesis and degradation of muscle and liver glycogen. Regulation. The role of the liver in the maintenance of blood glucose. Congenital anomalies of glycogen metabolism
13. Lipid Metabolism.	Lipid catabolism: lipolysis, beta-oxidation. Biosynthesis of fatty acids, triglycerides, membrane lipids and steroids. Regulation of lipid metabolism. Metabolism of ketone bodies.

14. Metabolism of amino acids.	Digestion and degradation of intracellular proteins. Nitrogen removal of amino acids: transamination, deamination. Urea cycle. Ammonia transport to the liver. Fate of the carbon skeleton of amino acids. Amino acid biosynthesis: origin of nitrogen and carbon skeleton. regulation
15. Derivatives of amino acids.	Amino acid precursor functions: Amines with biological activity, glutathione, porphyrins. Metabolism of purine and pyrimidine nucleotides. regulation
16. Integration of metabolism.	Metabolic profiling of major organs. Key connections between routes: glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic adaptations to stress. Fasting, exercise.
17. Hormonal regulation of metabolism.	Hormones as chemical messengers. Second messengers. Metabolic targets of hormone action. Hormone receptors. Adenylate cyclase system. Phospholipase system. Receptor dimerization

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A10 B1 B3 B4 B7 B10 B11 B13	24	60	84
Problem solving	A10 A29 B1 B2 B3 B4 B5 B7 B10 B11 B13	8	16	24
Laboratory practice	A8 A26 A30 A31 B1 B2 B3 B4 B5 B7 B10 B13	15	22.5	37.5
Mixed objective/subjective test	A8 A10 A26 B2 B3 B7 B13	2	0	2
Personalized attention		2.5	0	2.5
(*)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	Oral presentation supplemented with the use of media and the introduction of some questions to the students, in order to impart knowledge and facilitate learning. The master class is also known as "conference" , " expository method " or " maxistral lesson." The latter method is usually reserved for a special kind of lesson taught by a teacher in special occasions, containing original preparation involved and based on the use of the word and images as a means of transmission of information to the audience.
Problem solving	Technique by which you have to solve a specific problem situation, from the previous theoretical resources, and may have more than one possible solution.
Laboratory practice	Methodology that allows students actually learn -as through conducting practical activities, such as demonstrations exercises, experiments and research.
Mixed objective/subjective test	Exam that integrates objective test, short questions and resolution of cases and issues.

Personalized attention	
Methodologies	Description
Mixed objective/subjective test	We will be available (and recommend) for personalized tutorials, and review of exams.

Assessment

Methodologies	Competencies / Results	Description	Qualification
Problem solving	A10 A29 B1 B2 B3 B4 B5 B7 B10 B11 B13	Student´s work in reduced groups and controls.	20
Laboratory practice	A8 A26 A30 A31 B1 B2 B3 B4 B5 B7 B10 B13	Participation in the clases and Exam.	15
Mixed objective/subjective test	A8 A10 A26 B2 B3 B7 B13	The knowledgements aquired by the students in both, the master clases and the problem solving will be evaluated.	65

Assessment comments
Attendance at the laboratory practice is mandatory. Practices in January and July are evaluated through a practical examination, which is independent of the joint test. The practices approved in January are saved for Julio. The approved practices score is valid only in January and July. The practices carried out in the immediately preceding year can be validated as approved practices (on request). You must have passed the 3 parts: Problem solving, Laboratory practice and Mixed test independently to pass the course. In the final qualification (in January) if the sum of the notes is greater than 5 but a part is suspended, the final score will appear 4.9 and you will have to recover the failed part in July. In July you can recover 100% of the score for the course with practice exams (15%) and mixed test (85%). To obtain a "not evaluated" students could not have participated in more than 10% of evaluable scheduled activities.

Sources of information	
Basic	- Feduchi, Blasco, Romero y Yáñez (2011). Bioquímica, conceptos esenciales. Panamericana - Lehninger, Nelson y Cox (2006). Principios de Bioquímica. Omega - Stryer, Berg y Tymoczko (2009). Bioquímica 6ª Edn. Reverte - Tymoczko, Berg, Stryer (2014). Bioquímica curso básico. Reverté Others that will be included in the moodle platform.Others that will be included in the moodle platform.
Complementary	- Melo y Cuamatzi (2004). Bioquímica de los procesos metabólicos. Reverté-UAM Xochimilco

Recommendations
Subjects that it is recommended to have taken before
Química/610G02001 Bioquímica: Bioquímica I/610G02011
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Bioquímica e Bioloxía Molecular/610G02013 Fundamentos bioquímicos de biotecnoloxía/610G02014
Other comments
We inform that to be honored with "matrícula" the best qualifyed students in the first oportunity (January) will have preference. Drinks or food are not allowed in the classroom. We recommend the assistence to the reduced groups and the personal tutorials to increase the student´s succes.

(*)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.