



Teaching Guide				
Identifying Data				2014/15
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			
Prerequisites				
Department	Bioloxía Celular e Molecular			
Coordinador	Freire Picos, María Ángeles	E-mail	maria.freirep@udc.es	
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Web	ciencias.udc.es/bcm			
General description	Os contidos da asignatura proporcionan ó estudante a información básica das reaccións bioquímicas, catálise, e metabolismo. O seu estudo no segundo curso do grado permitirá ó alumno ter o coñecemento básico necesario para comprender os mecanismos moleculares que rexen moitas respostas nos seres vivos.			

Study programme competences	
Code	Study programme competences
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.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes	
Subject competencies (Learning outcomes)	Study programme competences



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	B1	C6
	A10	B2	C7
	A26	B3	C8
	A29	B4	
	A30	B5	
	A31	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	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	24	60	84
Problem solving	8	16	24
Laboratory practice	15	22.5	37.5
Mixed objective/subjective test	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	Exposición oral complementada co uso de medios audiovisuais e a introdución de algunhas preguntas dirixidas aos estudantes, coa finalidade de transmitir coñecementos e facilitar a aprendizaxe. A clase maxistral é tamén coñecida como ?conferencia?, ?método expositivo? ou ?lección maxistral?. Esta última modalidade sóese reservar a un tipo especial de lección impartida por un profesor en ocasións especiais, cun contido que supón unha elaboración orixinal e baseada no uso case exclusivo da palabra como vía de transmisión da información á audiencia.
Problem solving	Técnica mediante a que se ten que resolver unha situación problemática concreta, a partir dos coñecementos que se traballaron, que pode ter máis dunha posible solución.
Laboratory practice	Metodoloxía que permite que os estudantes aprendan efectivamente a través da realización de actividades de carácter práctico, tales como demostracións, exercicios, experimentos e investigacións.
Mixed objective/subjective test	Exame que integra preguntas tipo de probas de ensaio, preguntas tipo de probas obxetivas así como resolución de casos e problemas.

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

Assessment		
Methodologies	Description	Qualification
Problem solving	Student´s work in reduced groups and controls.  Competencie A29 will be evaluated.	20



Laboratory practice	Participation in the clases and Exam.  Competencies: A8, A10, A26, A30, A31, will be evaluated.	15
Mixed objective/subjective test	The knowledgements aquired by the students in both, the master clases and the problem solving will be evaluated.  Competences A8 and A10 will be evaluated	65

#### Assessment comments

In January and July, the practical course will be evaluated in a practical exam, independent of the "Mixed test". For those that passed the practical course in January (but not other parts) the numerical note will be saved until July.

It's necessary to pass the three parts: problems, practical course and exam independently to pass the subject.

The numerical value of the practical part is valid only in January and July.

For the final note (in January) if the sum of the notes is higher than 5 but any of the parts failed, in the final calification it will show up a 4,9 and it will be necessary to repeat this part in July.

The assistance to the practical course is mandatory.

In order to have a Non-presented, the students shouldn't participate in more than 10% of the programmed parts.

In July it will be possible to recover the 100% of the subject value with the exams of practical course (15%) and Mixed test (85%).

#### Sources of information

<b>Basic</b>	- (). - Stryer, Berg y Tymoczko (2009). Bioquímica 6ª Edn. Reverte - Feduchi, Blasco, Romero y Yáñez (2011). Bioquímica, conceptos esenciales. Panamericana - Lehninger, Nelson y Cox (2006). Principios de Bioquímica. Omega
<b>Complementary</b>	- Melo y Cuamatzi (2004). Bioquímica de los procesos metabólicos. Reverté-UAM Xochimilco

#### Recommendations

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

Bioquímica e Bioloxía Molecular/610G02013

Fundamentos bioquímicos de biotecnoloxía/610G02014

##### Subjects that are recommended to be taken simultaneously

##### Subjects that continue the syllabus

Química/610G02001

Bioquímica: Bioquímica I/610G02011

#### Other comments

We inform that to be honored with "matrícula" the best qualified students in the first opportunity (January) will have preference.

Drinks or food are not allowed in the classroom.

To Pass successfully the subject is necessary to pass each of the parts: Exams, practical course and Activities in reduced group.

We recommend the assistance 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.