Teaching Guide				
Identifying Data				2018/19
Subject (*)	Biochemistry and Biological Chemistry		Code	610G01034
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Third	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Lamas Maceiras, Mónica		E-mail	monica.lamas@udc.es
Lecturers	Barreiro Alonso, Aida Inés Cerdan Villanueva, Maria Esperanza Lamas Maceiras, Mónica		E-mail	aida.barreiro@udc.es esper.cerdan@udc.es monica.lamas@udc.es
Web				
General description	Structure, properties and chemical reactivity of biomolecules. Structure and function of macromolecules and biological membranes. Catalysis and control of biochemical reactions. Functions of metals in biological systems. Bioenergetics and metabolism. Genetic Information.			

Study programme competences	
Code	Study programme competences
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A5	Understanding of principles of thermodynamics and its applications in chemistry
A9	Knowledge of structural characteristics of chemical and stereochemical compounds, and basic methods of structural analysis and research
A10	Knowledge of chemical kinetics, catalysis and reaction mechanisms
A12	Ability to relate macroscopic properties of matter to its microscopic structure
A13	Understanding of chemistry of main biological processes
A15	Ability to recognise and analyse new problems and develop solution strategies
A16	Ability to source, assess and apply technical bibliographical information and data relating to chemistry
A20	Ability to interpret data resulting from laboratory observation and measurement
A21	Understanding of qualitative and quantitative aspects of chemical problems
A22	Ability to plan, design and develop projects and experiments
A23	Critical standards of excellence in experimental technique and analysis
A24	Ability to explain chemical processes and phenomena clearly and simply
A25	Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life
B1	Learning to learn
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
B5	Teamwork and collaboration
B7	Effective workplace communication
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)
C3	Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life
C4	Self-development as an open, educated, critical, engaged, democratic, socially responsible citizen, equipped to analyse reality, diagnose problems, and formulate and implement informed solutions for the common good

C6	Ability to assess critically the knowledge, technology and information available for problem solving

Learning outcomes			
Learning outcomes	Study programme competences		
As a result of learning it is expected that students know the nomenclature of the usual functional groups in biomolecules and biochemical terminology , measurement units , international conventions and classification models representing biomolecules	A1 A9 A12 A15 A21 A25	B1 B2 B3 B4	
The students will understand the mechanisms transmission of transmission of genetic information: replication, transcription and translation. They will understand the importance of molecular biology in scientific and technological development.	A13 A16 A21 A24	B1	C3 C6
The student will understand enzymatic catalysis. The peculiarities of enzymes as catalysts. The concept of catalytic center, reaction mechanisms, enzymatic catalysis processes, the kinetics of the reactions catalyzed by enzymes and enzymatic regulation in response to metabolic and hormonal changes. Solve problems related to these contents.	A1 A10 A13 A15 A20 A21 A24	B1 B2 B3 B4	
The students will understand the systems of generation, storage and trasnferencia of energy in the cell, the application of the principles of thermodynamics and its applications in the chemistry of living organisms; and solving problems related to these contents.	A5 A13 A24 A25	B1 B2 B3 B4	
To know general concepts of metabolic processes and their regulation and their interconnections. Understanding of the role of the control of enzyme regulation on metabolic pathways. To know how to use the right language for the description of the metabolic processes. To be able to solve problems related to metabolic flow diagrams, to do balances and metabolic studies by labeling metabolites.	A13 A15 A24 A25	B1 B2 B3 B4	
To knowi the apparatus, instruments and basic protocols in the biochemistry laboratory. Implement the theoretical knowledge of the subject. Interpret the results, and propose alternative methods; properly express the results in a lab report. To work with security, and develops skills for systematic methods and excellence in laboratory work.	A9 A10 A13 A15 A16 A20 A21 A22 A23	B1 B3 B4 B5 B7	C1 C4

Contents	
Topic	Sub-topic

1.- Biomolecules. Structure, characteristics and chemical reactivity	Structure of biomolecules: Configuration and conformation. Isomerism: Concept and types. Carbohydrates: Nomenclature and structure; classification and importance. Lipids: Concept, classification and importance; Nomenclature and structure. Properties of proteins in solution. Parameters characterizing a protein and techniques for determination. Primary, secondary, tertiary and quaternary structure. Fibrous and globular proteins. Folding. Conformers in the spatial organization of nucleic acids. Parameters characterizing a nucleic acid and determination. De-naturation and re-naturation. Biochemical techniques used for the isolation and purification of biomolecules.
2.-Genetic information	Replication and transcription of DNA: DNA and RNA biosynthesis. Protein translation: genetic code and protein metabolism.
3.-Structure and function of macromolecules and biological membranes.	The interaction of proteins with ligands and conformational changes. The concept of cooperativity and models. Conjugated proteins: Union to metals, to prosthetic groups, to glycids, to lipids. Interactions between nucleic acids and proteins. Structure and properties of the membranes.
4.-Catalysis and control of biochemical reactions.	Enzyme purification. Purification parameters and tables. Units of enzymatic activity. The methods to measure EU. Coupled- Assays. Catalysis as a model of the enzyme-substrate interaction. Catalytic centers. Specificity. Coenzymes and their involvement in catalysis. The concept of enzymatic regulation. Models. Allosterism. Isoenzymes. Multienzyme complexes. The kinetics of enzymatic reactions. Calculation of kinetic parameters in mono and bi-substrate reactions. Kinetics in the presence of inhibitors. Inhibition constants calculation. The kinetics of allosteric enzymes.
5 - The role of metals in biological systems	Iron in biological molecules: heme group and siro-heme, Fe-S and Fe-SO centers. Transport and storage of Fe: Transferrin and Ferritin. Siderophores. The copper in biological systems: Structure of different types of complexes with Cu and containing proteins. Other complexes with trace elements. Metal toxicity. Metals in medicine.
6.-Bio-energetics	Systems of energy transfer between the reactions. Exchange systems of phosphate groups; systems based on the use of co-enzyme and re-dox reactions. The problems associated with cellular compartments: shuttle systems.
7.- Metabolism.	Introduction to Metabolism. Metabolic pathways of degradation. Metabolic pathways of biosynthesis. Peculiarities of chemical reactions in biological systems. Interaction and regulation of biological reactions. Case studies of interpretation of reactions in metabolic pathways. Glycolysis, TCA cycle. Fermentations. Pentose Phosphate pathway. Glioxalate cicle. Beta-oxidation. Biosynthesis of Palmitoleic acid. Urea cycle.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A5 A9 A10 A12 A13 A24 A25 B1 C3	25	49	74
Laboratory practice	A1 A9 A10 A15 A20 A21 A22 A23 B1 B2 B3 B4 B5 B7	10	5	15
Problem solving	A1 A5 A9 A10 A12 A13 A15 A16 A20 A21 A24 A25 B1 B2 B3 B4 B5 B7 C1 C3 C4 C6 C8	9	27	36
Diagramming	A16 B1 B4 C3	1	18	19

Mixed objective/subjective test	A1 A5 A9 A10 A12 A13 A24 A25 B2 C1	4	0	4
Personalized attention		2	0	2
(*)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 complemented by the use of audiovisual media about chemical biological processes in order to build the capacity of understanding of the issues by the students.
Laboratory practice	The students will work in the lab experimentally setting up various techniques related to the subject of the isolation, characterization and identification of biomolecules. They will learn to work in the laboratory in accordance with safe and reproducible patterns. They also will learn how to present and interpret the results and discuss them according to knowledge acquired in the theoretical part of the subject by preparing a lab report.
Problem solving	With the resolution of practical problems and work with molecular models will delve into the practical application of the concepts explained in the lectures and will take advantage of the smaller size of the group to generate questions to help reflection and personal involvement of students in the process of learning.
Diagramming	Diagrams of the metabolic routes
Mixed objective/subjective test	Trial combining different types of questions to assess the knowledge acquired in the various activities undertaken. PARTIAL (date stablished in the scholar calendar) It is not mandatory, it is eliminatory

Personalized attention	
Methodologies	**Description**
Laboratory practice Problem solving Diagramming	Personal attention will be conducted throughout the course and at any time requested by the student. The working, development of supervised works will be guided by the teacher through personal tutorials, as well as resolving any questions that could arise during this activity. Students with part-time dedication or waiver of presence should contact the teachers of the subject in the early going to establish a schedule of activities to acquire and evaluate in a complementary way the competences.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A1 A9 A10 A15 A20 A21 A22 A23 B1 B2 B3 B4 B5 B7	It is: the work developed in the laboratory, the formulation of the results and the results of a test that includes all aspects learned in the laboratory. Attendance is mandatory Participation is valued at 5 points The test is valued at 5 points	10

Mixed objective/subjective test	A1 A5 A9 A10 A12 A13 A24 A25 B2 C1	Evaluation of the knowledge and skills acquired during course development including master classes, group activities, and practices. The proportion in the evaluation will be: Tracks 1-4: 40 points (eliminatory with 20 points) Tracks 5-7: 40 points	80
Problem solving	A1 A5 A9 A10 A12 A13 A15 A16 A20 A21 A24 A25 B1 B2 B3 B4 B5 B7 C1 C3 C4 C6 C8	Active participation in groups that let you work these skills valued up to 5 points The completion of the metabolic scheme is valued up to 5 points	10

Assessment comments
Practical work is mandatory to pass the course and qualification. Omission of the practical work means having to overcome a practical exam in the laboratory about the techniques performed.1.- Continuous evaluation: assistance, autonomous work and participation in scheduled activities is valued. The student has to reach 50% in the sum of the parts to pass. The first exam is not obligatory. 2. Overall evaluation. In the July / June options, the student (without taking into account the grades obtained during the course) will do only a theoretical final exam (90%) and a practical laboratory exam (10%). You have to notify in writing to the teacher of the subject this option before May 15 for both the first and second choice for the exams (June or July). Students with part-time dedication or waiver attendance may choose to be evaluated in this mode if they do not qualify for continuous evaluation. The student has to reach 50% in the sum of the parts to pass.Following the rules of qualifications and records in Masters Degrees proposed by the Commission of Quality of the Faculty of Sciences, the Distinction MH will be awarded preferably to those students who obtain the highest marks (outstanding) in the first choice of assessment (June).

Sources of information	
Basic	BIBLIOGRAFÍA BÁSICA · VOET, VOET, PRAT. Fundamentos de Bioquímica. 2ª Edición. Panamericana, (2007) BIBLIOGRAFÍA COMPLEMENTARIA Otros libros disponibles en la biblioteca que puede ser útil consultar si no se dispone del texto recomendado: · CAMPBELL, M.K. Y FARRELL, S.O. Bioquímica, 4ª edición. Thomsom, (2004). · RODNEY, BOYER. Conceptos de Bioquímica. International THOMSON Editores. (2000). · LEHNINGER. Principios de Bioquímica 2ª edición. Omega. (1995). · MATHEWS, C.K. y VAN HOLDE, K.E. Bioquímica. 2ª edición. McGraw-Hill. (1998). · RAWN, J. Bioquímica. Tomos I y II. McGraw-Hill. (1989). · STRYER, L. Bioquímica IV Edición. Tomos I y II. Ed. Reverté. (1995). · LEHNINGER. Principios de Bioquímica 3ª edición. Omega. (2001). · MATHEWS C. K., VAN HOLDE, K. E. y AHERN, K. G. Bioquímica 3ª Edición Addison- Wesley. (2003). · METZLER, D. E. Biochemistry: The chemical reactions of living cells. 2nd Ed. Harcourt. Academic Press. (2001).
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments

It is essential to participate in classes and activities as well as work every day with the support of the recommended bibliography taht will help to better understanding and comprehension of the subject study. Continued assistance is recommended since there will be classes for solving exercises and scoring experimental problems will help the study and preparation of the final examination by the student. Also attending tutorials to resolve questions and issues on the agenda that are of particular difficulty for the student is advised.