Teaching Guide				
Identifying Data				2020/21
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	Cerdan Villanueva, Maria Esperanza	E-mail	esper.cerdan@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.			
Contingency plan	1. There are no modifications in the contents. 2. Methodologies * Teaching methodologies that are maintained: Metabolic map, maintains its realization and delivery through moodle. * Teaching methodologies that change Face-to-face classes: they are replaced by online classes and aids through Teams and Moodle Practical classes: They are replaced with an online activity, videos, and data analysis. The data analysis will be published through Moodle for evaluation. Small groups: They are replaced by online classes and newsletter delivery in Moodle. Models with resolved issues are also offered 3. Mechanisms for personalized attention to students. Online tutorials (email and Teams chat) 4. Modifications in the evaluation. The percentages change. Objective test 65% (including practice test 5%), metabolic map 10% and problem solving 25%. 5. There are no modifications to the bibliography or webography that is accessible to students.			

Study programme competences / results	
Code	Study programme competences / results
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 / results		
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 / Results	Teaching hours (in-person & virtual)	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 to establish a schedule of activities to acquire and evaluate in a complementary way the competences.

Assessment			
Methodologies	Competencies / Results	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 all aspects learned in the laboratory. Attendance is mandatory	5
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 Practices: 5 points	85
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 Attendance is mandatory	5
Diagramming	A16 B1 B4 C3	The completion of the metabolic scheme is valued up to 5 points	5

Assessment comments

PRACTICES

The realization of the practices in the programmed groups is obligatory.
Failure to complete the practices implies having to pass a practical
examination in the laboratory on the techniques performed. If the student does not
do the practices and wishes to submit to a global evaluation, this situation
should be brought to the attention of the professor in charge of the subject
prior to May 15, in order to have the necessary materials, equipment and
reagents to carry out this exam. will perform at least a week in advance of the
theoretical exams of the official call.

ASSISTANCE

Attendance to master classes and small groups is compulsory, except if the
student has requested at the time of enrollment "part-time
dedication" or "assistance exemption", according to the current
regulations of the UDC.

EVALUATION MODALITIES:

1.-Continuous evaluation:

In this evaluation all the activities carried out during the course and the
scores reached by the student in the objective tests are taken into account.
Terms:

a) Assiduous participation in programmed activities; including, practical
classes, lectures and small groups.

b) The student must accumulate a minimum of 40 points in the sum of the
grades the objective tests (exam subjects1-4, exam subjects 5-7 and exam of

practices) to add the scores of the activities (attendance, participation and works) .

c) The final sum must be equal to 50 or more points.

There is an early opportunity for the completion of the test corresponding to Topics 1-4 (Partial). This exam is not compulsory, but obtaining at least 20 points frees the subject (topics 1-4) for the exam options in the official June and July exams, in which the score reached will be recorded for this part. in the partial. However, the student can repeat the evaluation of this part if he wants to raise the grade, but in this case the score reached in the corresponding test will be recorded, even if it is lower than that reached in the partial.

2. - Overall evaluation

Students with part-time dedication or with officially recognized exemption of attendance, or who for other circumstances have not been able to attend regularly to class and carry out the programmed activities, will be evaluated in this modality that will consist in the realization of a global examination on all the theoretical and practical content of the subject that will be scored on 95 points, which will be added the qualification of completion of practices either through the scheduled groups or in a practical laboratory test (about 5 points). The total score reached must be 50 points or more to pass the subject.

GRADING OF NOT PRESENTED

Students who do not attend any of the objective tests in the June or July option will have the grade of "not presented" in the corresponding minutes.

ALLOCATION OF HONOR REGISTRATIONS

Following the recommendations of the Quality Committee of the Faculty of Sciences, the Honors Enrollment will be granted preferably among those students who obtained the highest grades (outstanding) in the first evaluation option (June).

Sources of information	
Basic	BASIC · VOET, VOET, PRAT. Fundamentos de Bioquímica. 2nd Edition. Panamericana, (2007)OTHERS · CAMPBELL, M.K. Y FARRELL, S.O. Bioquímica, 8th edition. Cengage Learning (2015) or earliest by Thomson · RODNEY, BOYER. Conceptos de Bioquímica. International THOMSON Ed. (2000). · LEHNINGER. Principios de Bioquímica 6th edition. OMEGA (2014) or earliest ones. CHISTOPHER K. MATTEWS Bioquímica 4th edición. PEARSON (2013) or earliest ones
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.