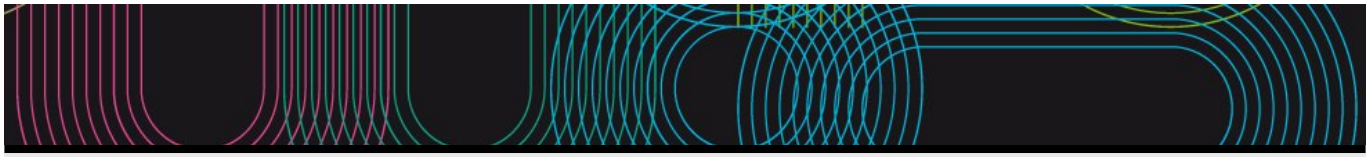

IDENTIFYING DATA				
Bioquemistry and cellular biology				
Subject	Bioquemistry and cellular biology			
Code	V12G420V01301			
Study programme	(*)Grao en Enxeñaría Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Pombal Diego, Manuel Ángel Gil Martín, Emilio			
Lecturers	Gil Martín, Emilio Magadán Mompo, Susana Megías Pacheco, Manuel Pombal Diego, Manuel Ángel			
E-mail	pombal@uvigo.es egil@uvigo.es			
Web				
General description	Conceptual subject on the principles of cellular and molecular organization of living organisms. The understanding of the dynamics of biological processes, based on the knowledge of the chemical composition and cellular structure of biological systems is the strategic objective.			

Competencies
Code

Learning outcomes	
Expected results from this subject	Training and Learning Results

Contents	
Topic	
1. Chemical composition of biological systems.	Macrobiogenic, microbiogenic and trace elments. The molecular logic of life. Structure of biological macromolecules.
2. Structural biochemistry of proteins.	Aminoacids: structure and properties. Peptide bond features. Three-dimensional structure of proteins: protein folding. Protein denaturation.
3. Principles of biocatalysis and regulation of enzyme activity.	Enzymes as biological catalysts. Enzyme structure and functional principles. How enzymes work. Substrate specificity: the active site. Classification of enzymes and nomenclature. Enzyme kinetics: the Michaelis-Menten equation and calculation of kinetic parameters.
4. Structural biochemistry of carbohydrates, lipids and nucleic acids. Biological relevance.	Structural units: structure and chemical properties. Macromolecular structure of carbohydrates, lipids and nucleic acids. Biological relevance.
5. Cell membrane and extracellular matrix.	Structure, composition and functions. Membrane transport. Cell junctions.

6. Organelles and intracellular traffic.	Endoplasmic reticulum and Golgi apparatus. Vesicular trafficking. Cell digestion: peroxisomes and lysosomes. Mitochondria: structure and function. Cytoplasmic inclusions.
7. Cytoskeleton and cell movement.	Actin filaments, microtubules and intermediate filaments.
8. Nucleus, cell cycle, apoptosis.	Nuclear envelope. Chromatin and chromosomes: structure and dynamics. Nucleolus. Cell cycle regulation. Cell death: apoptosis and necrosis.
Practice 1. Assay of enzyme activity.	Obtention of an active fraction of beta-D-galactosidase. Measurement of beta-D-galactosidase activity.
Practice 2. Quantification of total protein content in biological samples.	Seroalbumin standard calibration curve by the Lowry method. Determination of protein concentration in beta-D-galactosidase extract.
Practice 3. Kinetic characterization of enzyme activity.	Substrate saturation curve for beta-D-galactosidase. Determining Km and Vmax.
Practice 4. Thermal stability and optimum pH.	Determining the optimum pH of beta-D-galactosidase activity. Thermal inactivation of beta-D-galactosidase.
Practice 5. Cell types and extracellular matrix.	Observation of cell types and extracellular matrices at light microscopy.
Practice 6. Cell organelles I.	Observation of cell organelles at light microscopy.
Practice 7. Cell organelles II.	Identification of cell organelles in electron microscopy images.
Practice 8. Cell cycle.	Observation and quantification of mitotic phases in animal tissues.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	16	16	32
Lecturing	34	68	102
Objective questions exam	2	14	16

*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 include activities carried out in the laboratory involving the application to experimental contexts of theorical knowledge and technical guidelines discussed in the lectures. Practices, in addition to experimental work, include individual or group tasks aimed at promoting the acquisition of general, specific and transversal skills of the subject.
Lecturing	Teacher dissertations on concepts and practical guidelines required for the acquisition of general, specific and transversal skills of the subject. Lectures will be dynamical and open to debate with the students.

Personalized assistance

Methodologies	Description
Lecturing	Lectures are participatory and include questions and issues to be solved. They also allow monitoring the learning progress. Questions and doubts resolution may also be solved during individual tutorials.
Laboratory practical	Teachers will provide individual attention to each student during laboratory practices, as much support as they need for the correct understanding of experimental objectives, required methodology or technical procedures to be performed. Each student will be supervised by the teacher and will receive specific instructions according to the results achieved.
Tests	**Description**
Objective questions exam	Teachers will solve doubts during examination.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	Laboratory practices exam.	20	
Objective questions exam	Final theoretical exam of the subject with test and short answer questions.	80	

Other comments on the Evaluation

The attendance to lectures and laboratory practices is mandatory, except for documented reasons.

The subject will be passed by obtaining 5.0 or more out 10 as final mark, reached as follows:

- attendance to laboratory practices and completion of the practical exam (20%)

- completion of the final exam consisting oftest and short answer questions (80%) on the dates scheduled by the School: January (first edition) and June (second edition).

A numerical 0-10 rating system will be used according to the legislation contained in RD of September 1125/2003, BOE of September 18.

To pass the subject, it must be overcome the 40% of both, theory and practical exams. Otherwise, the final mark will be the result of multiplying theory + practices by 0.5.

In the case that final mark of the subject does not reach 5.0, but theory or practical part are passed, that score will be maintained for the second exam opportunity (July).

Repeating students from previous academic courses must perform all lecture and practical activities, of which they will be evaluated.

*Ethical commitment: students are expected to exhibit adequate ethics. In the case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, etc), the student will not pass the subject. In this case, the overall score in the current academic year will be 0.0.

Sources of information

Basic Bibliography

Alberts, B.; Johnson, A.; Lewis, J.; Raff, M.; Roberts, K.; Walter, P., **Molecular Biology of the Cell**, 6th ed, Garland Science, 2015

Becker, W.M.M., Kleinsmith, L.J.; Hardin, J., **The World of the Cell**, 8th ed, Benjamin-Cummings Publish. Comp., 2012

Berg, J.M.; Tymoczko, J.L.; Gatto, G.J.; Stryer, L., **Biochemistry**, 9th ed, WH Freeman Publishers, 2019

Cooper, G. M.; Hausmann, R.E., **The Cell: a Molecular Approach**, 7th ed, ASM Press, 2016

Voet, D.; Voet, J.G.; Pratt, Ch.W., **Fundamentos de Bioquímica: la vida a nivel molecular**, 4ª ed, Editorial Médica Panamericana, 2016

Complementary Bibliography

Megías, M.; Molist, P.; Pombal, M.A, **Atlas de histología vegetal y animal**, https://mmegias.webs.uvigo.es/,

Recommendations

Subjects that continue the syllabus

General physiology/V12G420V01402

Subjects that it is recommended to have taken before

Chemistry: chemistry/V12G420V01205

Other comments

In general, in order to register for this subject it is necessary to have completed or be enrolled in all the subjects of the previous course.

Contingency plan

Description

Given the uncertainty and unpredictable evolution of the health alert due to Covid-19, UVIGO has established an extraordinary teaching plan for the 2020-21 academic year, contained in the document " Medidas extraordinarias e urxentes para o desenvolvemento da organización docente no curso 2020/2021 en caso de crise sanitaria□, approved by the Consello de Goberno on June 12, and implemented through the Resolución Rectoral (RR) on June 17. This regulatory framework establishes that, based on the current situation and projections on the evolution of the disease, based on the precautionary principle, the start of the course will be in the mixed teaching mode (RR 16/12) and defines this type of teaching such as the one in which "o estudantado combinará as actividades docentes presenciais e non presenciais na proporción, na forma e no alcance que cada centro considere adecuado nun marco de coherencia coas memorias das titulacións, axustándose sempre á presencialidade máxima posible e en función das recomendacións feitas ao respecto desta modalidade de docencia polo

Ministerio de Universidades para o curso 2020/21. Likewise, according to the criteria of safety, health and responsibility, the extraordinary measures contemplate that, faced with a new health alert, a RR to this effect will decree the closure of the centers and the automatic transition to virtual teaching, which through intensive use of Casmpus Remoto and FaiTic will guarantee the continuation with maximum advantage of the learning process. Therefore, there is a need to plan specific measures to adapt to both teaching modalities and announce them in advance to students -through the Docnet tool- so that the learning process can continue in the most agile and effective way whatever the sanitary setting. Thus, and in accordance with Instruction 3/2020 (06/28) of the Vicerreitoría de Organización Académica e Profesorado about the preparation of teaching guides, the general lines by which the methodology, evaluation and personalized attendance for Biochemistry and Cell Biology course, from the first semester of the second year of Biomedical Engineering, are summarized below for mixed and virtual teaching scenarios.

TEACHING IN MIXED MODALITY
Teaching methodology
Theory. The subject Biochemistry and Cell Biology consists of master sessions and laboratory practices. In a mixed teaching scenario, the first ones will be developed normally in the classroom for an audience of face-to-face students and another audience of students in synchronous remote connection through Campus Remoto, so that all students can take advantage of the disertations and interact in real time with the teacher. The center will be eventually responsible for establishing the rotating shifts of both student groups.

Practices. The extraordinary measures of teaching organization for the next academic year foresee that it is not possible to maintain safety distances in teaching laboratories. Therefore, the permanent use between the teacher/s and students of the personal protection meaures stipulated by the Servicio de Prevención de Riscos Laborais (SPRL) (mask and/or protective screen) and the careful cleaning of the workplace and instruments before and after the practical session.

The dynamics of practical teaching in the mixed modality will be therefore face-to-face and will consist of short dissertations on the backgrounds and operating procedures of the different experimental techniques to be developed, followed by related experimental activities.

The health and hygiene security measures required by the SPRL will be scrupulously attended too. Therefore, although no changes are foreseen in the teaching methodology, the duration of the master sessions and laboratory practices will be reduced to a sufficient extent to ensure the cleaning and disinfection of workplaces and used material, as well as to guarantee the cleaning hands before entering and leaving the laboratory, which will require minimal adjustments in the scheduling and development of the sessions.

Personalized attention (tutorials)
The tutoring sessions will be held in the virtual classrooms of Campus Remoto or via email, previous appointment with the responsible teacher.

Evaluation system
As content and methodology are not affected, no changes are foreseen in the evaluation system in the case that the entire period of academic activity is in mixed mode. If 20% or more of the teaching period of one of the modules is affected by the closure of the center and the transition to the virtual modality, the evaluation system to be adopted –for the entire subject– will be that foreseen for the virtual modality.

Students in risk to Covid-19 and without the possibility of accessing the abovementioned teaching process will be provided with the specific learning path, evaluation and personalized attention provided for the virtual modality.

TEACHING IN VIRTUAL MODALITY
In the case of decreeing by RR the transition to virtual teaching due to a new health alert, the following adaptations in the methodology, evaluation and personalized attention of the students will be implemented.

Teaching methodology
The theoretical-practical sessions will be developed through the online teaching platforms provided by UVIGO: Campus Remoto and FaiTic. The synchronous sessions in the virtual classrooms of Campus Remoto will allow direct interaction with students. There will also be the possibility of recording these sessions for ulterior autonomous viewing. The FaiTic repository will enable documentation and learning resources and self-evaluation for consultation, study and monitoring of the learning process.

Theory sessions. The exposition and debate of the theoretical contents will take place in virtual classrooms of the Campus Remoto, sharing presentations and teaching material of different kind to debate the contents in real time and answering any questions arisen. All the consultation and study material (annotated presentations, videos and specialized web tutorials, solved problems, questionnaires, etc.) will be available to students previously in FaiTic.

Practical sessions. Laboratory practices will be addressed through protocols commented by the teacher/s (with eventual audio support), photographic material, videos, tutorials and specialized web utilities (such as, for example, virtual atlas), case studies and simulations of the experimental work of the different programmed techniques, which students could preview in FaiTic and use as learning guide. The time foreseen for the experimental execution will be used to explain and discuss in detail the learning material until reaching the understanding of the instrumental and operational requirements of each technique, its limitations and application fields. In the seminars with quantitative calculation, real data will be provided with which to carry out the mathematical processing, along with precise instructions for the autonomous preparation of deliverable/s of each module which, depending on the case, will be from questionnaires to individual or group reports.

These deliverables have been conceived as assimilation exercises of the specific methodology and data management. FaiTic will show all the study and supportive documentation necessary for their preparation, in addition to tutoring by teachers (through personalized attention mechanisms) to monitor the progress of the work. The deadlines will be flexible depending on the circumstances in which the teaching period unfolds. These deliverables are the materialization of learning outcomes and will therefore be the basis of continuous evaluation.

Evaluation system
The evaluation system will be modified in favor of the autonomous activities and deliveries stipulated by each module (questionnaires, objective response tests, reports, etc.). In this way, the subject will be awarded by continuous evaluation according to the tests carried out in each experimental module and according to the following distribution of percentages:

Cell Biology Module: Objective questions: 35%. Practice report: 15%.
Biochemistry module. Objective questions: 35%. Practice report: 15%.

The virtual assessment tests will be carried out through the UVIGO institutional platforms (Faitic and Campus Remoto) with visual and audio -proctoring of the students. In case of technical or personal impediments that hinder the reliable control of these tests, oral alternatives with image/voice recording will be offered, in order to document the evaluation. The recording may be extended, if necessary, to the exam review sessions. The platform to be used to carry out the tests, as well as the rules to which it will be necessary to attend for their realization, will be communicated in advance.

2nd opportunity: the rule stipulated in the Guía Docente is that the suspended student should only recover the module or activities not passed in the first opportunity.

Personalized attention
Group tutorials (by work groups) or individual (on demand) will be carried out, previous appointment, in the virtual offices of the teachers at Campus Remoto. Through this channel, the learning process will be monitored and questions will be answered. Part of these tasks may be alternatively addressed through email.