Teaching Guide				
Identifying Data				2022/23
Subject (*)	Genetic Variation Mechanisms		Code	610441005s
Study programme	Máster Universitario en Bioloxía Molecular, Celular e Xenética (semipresencial)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	3
Language	SpanishEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	Bioloxía			
Coordinador	Gonzalez Tizon, Ana Maria	E-mail	ana.gonzalez.tizon@udc.es	
Lecturers	Gonzalez Tizon, Ana Maria	E-mail	ana.gonzalez.tizon@udc.es	
Web	cie48.udc.es			
General description	It aims to deepen the knowledge of the various mechanisms that generate genetic variation, both in the aspect of their molecular basis and in their impact on genomes and evolution.			

Study programme competences / results	
Code	Study programme competences / results
A3	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A6	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A11	Skills of understanding the structure, dynamics and evolution of genomes and to apply tools necessary to his study.
A12	Skills to understand, detect and analyze the genetic variation, knowing genotoxicity processes and methodologies for its evaluation, as well as carrying out diagnosis and genetic risk studies.
A13	Skills to become a professional in health, pharmacy, veterinary, animal production, biotechnology or food sectors.
B1	Analysis skills to understand biological problems in connection with the Molecular and Cellular Biology and Genetics.
B2	Skills of decision making for the problem solving: that are able to apply theoretical knowledges and practical acquired in the formulation of biological problems and the looking for solutions.
B3	Skills of management of the information: that are able to gather and to understand relevant information and results, obtaining conclusions and to prepare reasoned reports on scientific and biotechnological questions
B5	Ability to draft, represent, analyze, interpret and present technical documentation and relevant data in the field of the branch of knowledge of the master's degree in the native language and at least in another International diffusion language.
B7	Personal progress skills : that are able to learn from freelance way, adapting to new situations, developing necessary qualities as the creativity, skills of leadership, motivation for the excellence and the quality.
B9	Skills of preparation, show and defense of a work.
B11	That students know how to apply the knowledge acquired and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of ??study
B12	That students are able to integrate knowledge and face the complexity of formulating judgments based on information, which, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments
B13	That students know how to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way
B14	That students possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous
C1	Ability to express oneself correctly, both orally and in writing, in the official languages of the autonomous community
C2	Ability to know and use appropriately the technical terminology of the field of knowledge of the master, in the native language and in English, as a language of international diffusion in this field
C3	Using ICT in working contexts and lifelong learning.
C4	Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.
C5	Understanding the importanceof entrepreneurial culture and the useful means for enterprising people.

C8	Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Comprehensive reading of scientific texts related to the module subjects	AR3	BR1	CC1
Ability to expose the current state of knowledge within this field	AR6	BR2	CC2
Critical ability to evaluate hypotheses and interpret results	AR11	BR3	CC3
Understanding cell structure and function from an interdisciplinary vision in which Cell Biology, classical Cytology, Genetics and Molecular Biology converge	AR12	BR5	CC4
	AR13	BR7	CC5
Understanding of the biochemical and physiological processes that allow signaling between cells and with structural elements, as well as the causative aspects of pathologies related to alterations in cell signaling and the tools used for your study		BR9	CC8
		BC2	
Know the experimental techniques to access the study of the molecular mechanisms of regulation of gene expression as well as the molecular machinery involved and their regulatory systems		BC3	
		BC4	
To know the characteristics of the proteins and complexes involved in the regulation of gene expression, their interaction with genetic material and the enzymatic reactions that modulate their activity.		BC5	
To know the mechanisms that cause genetic variability			

Contents	
Topic	Sub-topic
Unit 1. Genetic variation: mutation	Genetic variation and its significance. Origin and consequences of mutation. Chromosome rearrangements. Mutation rates. Reversion and supression.
Unit 2. Mobile DNA	Abundance in the genomes. Classification of transposable elements. Proliferation Molecular evolution. Impact on the genomes. Domestication
Unit 3.Genetic recombination	Recombination rates. Gene conversion. Sexual dimorphism and recombination rate, crossing-over and gene conversion. Gene conversion bias.
Unit 4. Evolution of scientific thought regarding the origin of genetic variability. Woese's contribution.	Cellular evolution: the path "bumpy" to "who knows where." History of evolutionary thought. State of Microbiology (and Virology) during most of the 20th century. Carl Woese. LUCA. Generation of genetic variability in the beginning of life.
Unit 5. Microbial evolution in the genomics era.	The turbulent dynamics of microbial evolution. Damned concepts of classical genetics: genetic elements with a Lamarckian flavor? Evolution of Evolvability?
Unit 6. The mysterious world of viruses.	Are viruses alive? Evolution of viruses and viral replicons. Viral Population Dynamics Models

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A6 A11 A12 A13 B1 B2 C2 C3	0	23	23
Long answer / essay questions	A3 B2 C2 C3	2	11	13

Document analysis	A6 A11 A12 A13 B1 B2 B3 B5 B7 B9 B11 B12 B13 B14 C1 C2 C4 C5 C8	1	14	15
Laboratory practice	A3 C3	10	10	20
Personalized attention		4	0	4
(*)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	In each class the contents of the program will be exposed. The teachers' presentations will be incorporated into the Moodle platform. CONTINGENCY PLAN: the lectures will be held via TEAMS at the previously approved official hours
Long answer / essay questions	Written test in which any aspect addressed in the theoretical and practical teaching will be dealt with. CONTINGENCY PLAN: PRESENTIAL students will take the exam via TEAMS on the date and times previously established and approved
Document analysis	Students will read a series of research articles related to any aspect of the syllabus. This work will be reflected in a power point elaboration that will be presented and exhibited in the classroom. CONTINGENCY PLAN: students will present their work via TEAMS, in case of confinement. All works will be uploaded to the Moodle platform, after review by the subject teachers.
Laboratory practice	The laboratory practices are the following: Practice 1: PCR amplification of DNA sequences Practice 2: electrophoresis of PCR products Practice 3: Work with bioinformatics tools for the analysis of the sequences of the PCR products CONTINGENCY PLAN: in case of confinement, the practices will be reconverted or replaced in computer analysis working with different genomic sequences.

Personalized attention	
Methodologies	**Description**
Document analysis	The students will be able to attend the tutorials in the previously established schedules or agreed with the students of the subject. These tutorials may be individual or group via TEAMS, email or in person. CONTINGENCY PLAN: in case of confinement, they will be carried out through TEAMS individually, or by email.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A3 C3	Attendance to lab sessions and execution of exercises proposed by the teacher will be graded. For the monitoring and grading of learning, students must prepare and present a practical notebook with its introduction, materials and methods, description of results and conclusions. In this activity the acquisition of competence A5 will be evaluated.	15

Document analysis	A6 A11 A12 A13 B1 B2 B3 B5 B7 B9 B11 B12 B13 B14 C1 C2 C4 C5 C8	Os estudantes leerán varios artigos de investigación e realizarán unha presentación en power point de 10-12 minutos de duración	15
Long answer / essay questions	A3 B2 C2 C3	Test de resposta múltiple sobre os contenidos teóricos e prácticos. Cando menos o 50% da proba será en inglés. Nesta actividade avaliarase a adquisición das competencias A5, A9, A16.	70

Assessment comments
Laboratory practices are mandatory. To pass the subject, the student must obtain at least 50% of the score assigned to the essay / development test and another 50% of that of the laboratory practices. It will be considered NOT PRESENTED when the student has not participated in more than 20% of the scheduled assessable activities. This criterion applies to the January call. In the July call, to obtain the grade NOT PRESENTED, it will be enough to not appear for the objective tests (theory and practical exams). For the evaluation of the July call, the student, in addition to the corresponding exams, must present the power point presentation of the oral presentation. In the event that this activity was already evaluated in the January call, the grade obtained will remain for July. For students with part-time dedication and exemption from attendance, the teacher will adopt the measures that he deems appropriate to avoid damaging her grade (flexibility in the delivery dates of the assessable activities). Instead of the oral presentation, these students will make a 2-3 page summary that must be delivered in pdf to the teacher for evaluation.

Sources of information	
Basic	- Weiner, M. P., Gabriel, S., and Claibo, J. (2007). Genetic variation: a laboratory manual. Cold Spring Harbor Laboratory Press - Meyers, R. A. (2007). Genomics and genetics: from molecular details to analysis and techniques. Wiley-VCH - Gibson, G. (2009). A primer of genome science. Sinauer Associates - N L Craig et al. (2002). Mobile DNA II. ASM Press - E.C. Friedberg et al. (2006). DNA repair and mutagenesis. Second edition. ASM Press The students will receive from the teachers of the subject recent webgraphy and review articles to properly prepare the subject. They will be hosted (bibliography and webgraphy) on the Moodle platform.The students will receive from the teachers of the subject recent webgraphy and review articles to properly prepare the subject. They will be hosted (bibliography and webgraphy) on the Moodle platform.
Complementary	- Hartl, D. L. (2009). Genetics: analysis of genes and genomes. Jones and Bartlett - J. M. Coffin et al. (1997). Retroviruses. Cold Spring Harbor Laboratory Press - R Scott Hawley, MY Walker (2003). Advanced genetic analysis. Finding meaning in a genome. . Blackwell Publishing - Watson et al. (2004). Molecular Biology of the gene. Fifth edition. Pearson-Cummings

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

Attendance to the master classes enables the treatment of doubts or questions that may arise in the course of the explanations, facilitating the understanding of the topics. The study must contemplate the habitual consultation of at least the recommended bibliography. Study and group work favors understanding and develops a critical spirit. Doubts and difficulties raised by any aspect of the subject must be resolved as soon as possible, raising them in in-person classes or attending individualized tutorials. Given that part of the recommended bibliography for this subject is in English, it is advisable to have knowledge of this language, at least at the level of comprehension of written texts.Green Campus Program of the Faculty of Sciences: To help achieve a sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", documents requested as part of the course will be turned in electronically. If printed, plastic covers will not be used, they will be printed on both sides on recycled paper. Drafts will be avoided.