



## Teaching Guide

Identifying Data					2024/25
Subject (*)	Genetic Variation Mechanisms	Code	610441005s		
Study programme	Máster Universitario en Biología 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	Biología				
Coordinador	Gonzalez Tizon, Ana Maria	E-mail	ana.gonzalez.tizon@udc.es		
Lecturers	Gonzalez Tizon, Ana Maria Vila Sanjurjo, Antón	E-mail	ana.gonzalez.tizon@udc.es anton.vila@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.
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.

## Learning outcomes

Learning outcomes	Study programme competences / results



Comprehensive reading of scientific texts related to the module subjects	AR3	BR1	CC2
Ability to expose the current state of knowledge within this field	AR6	BR2	CC3
Critical ability to evaluate hypotheses and interpret results	AR11		
Understanding cell structure and function from an interdisciplinary vision in which Cell Biology, classical Cytology, Genetics and Molecular Biology converge	AR12		
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	AR13		
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			
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.			
To know the mechanisms that cause genetic variability			

Contents	
Topic	Sub-topic
Topic 1. Nature of mutations.	Estimates of mutation rate and frequency. Types of lesions caused by mutations. Physical and chemical mutagens. Reversion and deletion. Paramutation.
Topic 2. DNA repair mechanisms.	Preventive methods. Direct repair. Excision repair. Post-replication repair.
Topic 3. Genetic diseases related to mutagenic agents.	Cancer. Diseases due to failures in repair systems.
Topic 4. Mobile DNA:	abundance in genomes. Classifications of transposable elements. Proliferation. Modular evolution. Impact on genomes. Domestication.
Topic 5. Recombination processes.	Recombination rates. Gene conversion. Sexual dimorphism of the rate of recombination, crossing over and gene conversion. Biased gene conversion.
Topic 6. Evolution of scientific thinking about the origin of genetic variability. The contribution of Woese.	Introduction: Cell evolution: the "bumpy" path to "who knows where" History of evolutionary thought: Lamarck History of evolutionary thought: Darwin History of evolutionary thought: Modern Synthesis of Evolutionary Biology State of Microbiology (and Virology) for most of the 20th century Carl Woese LUCA Generation of genetic variability in the beginning of life
Unit 7. Microbial evolution in the era of genomics	Introduction The turbulent dynamics of microbial evolution HGT Damned concepts of classical genetics: genetic elements with Lamarckian flavor? Damned concepts of classical genetics: Evolution of evolution?



Unit 8. The mysterious world of viruses	<p>Introduction</p> <p>figures and definitions</p> <p>Are the viruses alive?</p> <p>Early ideas about the evolution of viruses</p> <p>Structural biology allows a deep look into the past</p> <p>The origin of viral replicons</p> <p>When did viruses originate?</p> <p>Gene flow between viruses and hosts</p> <p>New discoveries about the evolution of viruses</p> <p>Viral population dynamics models</p> <p>conclusions</p>
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Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 A6 A11 A12 A13 B2 B1 C2 C3	0	36.2	36.2
Events academic / information	A6 A11 A12 B1 B2 C2 C3	0	8.8	8.8
Objective test	C2 C3	2	0	2
Laboratory practice	A12 A13 B1 B2 C2 C3	16	8	24
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	<p>In each class the contents of the program will be exposed. The teachers' presentations will be incorporated into the Moodle platform.</p> <p>CONTINGENCY PLAN: the lectures will be held via TEAMS at the previously approved official hours</p>
Events academic / information	Students will make a poster that will be sent digitally to teachers and defended orally on the day arranged for this activity. Via Teams.
Objective test	<p>Written test in which any aspect addressed in the theoretical and practical teaching will be dealt with.</p> <p>CONTINGENCY PLAN: PRESENTIAL students will take the exam via TEAMS on the date and times previously established and approved</p>
Laboratory practice	<p>The laboratory practices are the following:</p> <p>Practice 1: PCR amplification of DNA sequences</p> <p>Practice 2: electrophoresis of PCR products</p> <p>Practice 3: Work with bioinformatics tools for the analysis of the sequences of the PCR products</p> <p>CONTINGENCY PLAN: in case of confinement, the practices will be reconverted or replaced in computer analysis working with different genomic sequences.</p>

Personalized attention	
Methodologies	Description



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
Events academic / information	A6 A11 A12 B1 B2 C2 C3	Students will make a poster that will be sent digitally to teachers and defended orally on the day arranged for this activity. Via Teams.	25
Objective test	C2 C3	Examen que constará de preguntas de resposta corta, tipo test ou resposta múltiple.	60
Laboratory practice	A12 A13 B1 B2 C2 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

## Assessment comments

Laboratory practices are mandatory.

To pass the subject or student, you must obtain at least 50% of the objective test qualification and 50% of the laboratory practice qualification.

It will be considered NOT PRESENTED when the student does not participate in more than 20% of the eligible scheduled activities. This criterion applies to the xaneiro call,

In the xullo call, to obtain the NON-PRESENTED qualification, it will be enough to not present the objective tests (theory exam and practical exam).

For the evaluation of the xullo or student call, in addition to two theory and practical exams, you must present a poster. In case it is endorsed in the xaneiro call, the qualification obtained will remain in Xullo.

For students with part-time dedication and exemption from attendance exemption, teachers will adopt measures to be agreed upon by the student (flexibility in assignment delivery dates).

## Sources of information

<b>Basic</b>	<ul style="list-style-type: none"><li>- Weiner, M. P., Gabriel, S., and Claibo, J. (2007). Genetic variation: a laboratory manual. Cold Spring Harbor Laboratory Press</li><li>- Meyers, R. A. (2007). Genomics and genetics: from molecular details to analysis and techniques. Wiley-VCH</li><li>- Gibson, G. (2009). A primer of genome science. Sinauer Associates</li><li>- N L Craig et al. (2002). Mobile DNA II. ASM Press</li><li>- E.C. Friedberg et al. (2006). DNA repair and mutagenesis. Second edition. ASM Press</li></ul> <p>O alumnado recibirá por parte dos profesores da materia webgrafía recente e artigos de revisión para preparar axeitadamente a materia.</p>
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<b>Complementary</b>	<ul style="list-style-type: none"><li>- Hartl, D. L. (2009). Genetics: analysis of genes and genomes. Jones and Bartlett</li><li>- J. M. Coffin et al. (1997). Retroviruses. Cold Spring Harbor Laboratory Press</li><li>- R Scott Hawley, MY Walker (2003). Advanced genetic analysis. Finding meaning in a genome. . Blackwell Publishing</li><li>- Watson et al. (2004). Molecular Biology of the gene. Fifth edition. Pearson-Cummings</li></ul> <p>&lt;br /&gt;</p>
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## 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 at lectures makes it possible to deal with any doubts or questions that may arise in the course of the explanations, facilitating the understanding of the subjects. Study should include regular reading of at least the recommended bibliography. Group study and work favours understanding and develops a critical spirit. The doubts and difficulties that arise in any aspect of the subject will be resolved as soon as possible, raising them in the classroom or attending individual tutorials. Given that part of the recommended bibliography for this subject is in English, it is recommended to have a good command of this language, at least at the level of comprehension of written texts.

**Gender Perspective**  
In this subject, the gender perspective will be taken into account, sexist attitudes will not be tolerated and the values of respect and equality will be promoted.

**Program Green Campus**  
Empower of Sciences To help to achieve some sustainable immediate surroundings and fulfil with the point 6 of the Environmental Statement of the faculty of Sciences (2020), the documentary works that realise&nbsp; in this matter:  
a. They will request mostly in virtual format and computer support  
b. To realise in paper:-they will not employ plastic-will realise impressions to double expensive-will employ paper recycled-will avoid the realisation of drafts  
To Environmental Statement is available  
in:[https://ciencias.udc.es/images/Facultade/Green\\_Campus/Regulamento\\_Comit%C3%A9\\_Green\\_Campus\\_FCiencias.pdf](https://ciencias.udc.es/images/Facultade/Green_Campus/Regulamento_Comit%C3%A9_Green_Campus_FCiencias.pdf)

(\*)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.