Teaching Guide				
Identifying Data				2021/22
Subject (*)	Genetics		Code	610G02019
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Vila Taboada, Marta	E-mail	marta.vila.taboada@udc.es	
Lecturers	Gonzalez Tizon, Ana Maria Martinez Martinez, M. Luisa Valdiglesias García, Vanessa Vila Taboada, Marta	E-mail	ana.gonzalez.tizon@udc.es m.l.martinez@udc.es vanessa.valdiglesias@udc.es marta.vila.taboada@udc.es	
Web				
General description	This subject's conceptual focus emphasizes the fundamental ideas of Genetics: the basics of heritable traits and an introduction to methodologies used in this discipline. By passing Genetics, students will prove to have acquired the theoretical knowledge and analytical skills needed to take the following subjects: Molecular Genetics (3rd year, compulsory), Population and Evolutionary Genetics (3rd year, compulsory), and Cytogenetics (4th year, optional).			
Contingency plan	A. In case of another lockdown because of covid19: 1. Contents will be the same. 2. In-person instruction will change to virtual-only. This means that all lectures will be hosted using MS TEAMS. 3. Tutoring sessions and any other communication will take place by means of email, videocalls or chat as implemented in MS TEAMS. 4. All students will be evaluated online. The final exam will make up 40% of the final grade. We will add another activity to be assessed (20% of the final grade) using part of the time initially planned for seminars. To pass the subject, students will have to score at least 50% of the total value of adding the grades obtained in the final exam grade plus the new activity. 5. The recommended reference list will remain the same. If needed, instructors will provide with any reading and/or course resources to the students. B. Should the number of students be larger than the room capacity, the Faculty will assign one or more "mirror lecture rooms" for this subject. The teacher will start a TEAMS videocall, so that students at the mirror rooms can attend the lecture.			

Study programme competences	
Code	Study programme competences
A1	Recoñecer distintos niveis de organización nos sistemas vivos.
A2	Identificar organismos.
A4	Obter, manexar, conservar e observar especímenes.
A11	Identificar e analizar material de orixe biolóxica e as súas anomalías.
A12	Manipular material xenético, realizar análises xenéticas e levar a cabo asesoramento xenético.
A20	Muestrear, caracterizar e manexar poboacións e comunidades.
A26	Deseñar experimentos, obter información e interpretar os resultados.

A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B6	Organizar e planificar o traballo.
B8	Sintetizar a información.
B9	Formarse unha opinión propia.

Learning outcomes			
Learning outcomes	Study programme competences		
Mendelian genetic analysis: the gene as unit of inheritance	A1 A12 A26 A29 A30 A31	B1 B2 B3 B5	
To study the chromosomal basis of inheritance, sex determination, extranuclear inheritance as well as genetic linkage and recombination.	A1 A4 A12 A26 A29 A30 A31	B1 B2 B3 B4 B5 B6 B9	
To learn about changes in the genetic material	A2 A11 A26 A29	B1 B2 B3 B5 B9	
To set the basis of quantitative and population genetics	A1 A20 A26 A29 A30 A31	B1 B2 B3 B5 B6 B8	

Contents	
Topic	Sub-topic
1. Introduction to Genetics	Definition of Genetics History of Genetics Genetics and other sciences Genetics and society
2. Mendelian Genetics	Mendel?s experiments: mono and dihibrid crosses Concept of geno and phenotype Terms and symbols Pedigree analysis

3. Chromosomal Basis of Inheritance and Sex Determination	Genetic implications of mitosis and meiosis Chromosomal theory of inheritance Sex determination Sex-linked inheritance Sex-limited and sex-influenced traits Gene dosage compensation
4. Extensions of and Deviations from Mendelian Genetic Principles	Modification of dominante relationships Multiple alleles Lethality Penetrance and expressivity Pleiotropy Gene interaction and epistasis Position effect Environmental interactions
5. Genetic Mapping in Eukaryotes	Linkage, recombination and mapping of genes on chromosomes Interference and coincidence Genetic map function: connecting recombination fractions and genetic map distances
6. Genetic Analysis and Mapping in Bacteria and Bacteriophages	Bacterial transformation Bacterial conjugation: plasmids and episomes Generalized and specialized transduction Genetic recombination in bacteriophages. Fine structure of the gene: rII system of phage T4
7. Extranuclear Inheritance	Maternal effect Maternal inheritance General features of mitochondrial and chloroplast genomes Heteroplasmy Infectious heredity
8. Quantitative Genetics	Quantitative traits Genes and environment Phenotypic distribution and norms of reaction Genetic basis of quantitative traits: Johannsen?s experiment Polygenic inheritance: Nilsson-Ehle?s experiment Heritability
9. Population Genetics	Mendelian population Genetic variation Allele and genotype frequencies Random mating and Hardy-Weinberg equilibrium Evolutionary forces: mutation, migration, random drift, and selection
10. The Nature of Genetic Material	Discovery of bacterial transformation DNA as source of genetic information: Hershey & Chase?s experiment RNA as genetic material in viruses Structure and properties of nucleic acids
11. DNA Organization in Chromosomes	Genome size: the C-value paradox Bacterial chromosomes Eukaryote chromosomes DNA packaging: Nucleosomes and Chromatin Centromeres and Telomeres Lampbrush and polytene chromosomes Karyotype

12. DNA Mutation	Random and adaptive mutation Mutant types Spontaneous and induced mutation Detecting mutagens: the Ames test
13. Variations in Chromosome Structure	Deletions Duplications Inversions Translocations Robertsonian fusions/dissociations
14. Variations in Chromosome Number	Euploidy and aneuploidy Monoploidy Polyploidy: Autopolyploidy and Allopolyploidy Aneuploidy: meiotic nondisjunction, monosomy, trisomy Somatic aneuploidy: mitotic nondisjunction, sexual mosaics B chromosomes
Teaching labs	Lab 1. GENETIC ANALYSIS IN CORN (Zea mays): INTERACTION AND EPISTASIS. Description of shape and colour of F2 seeds (kernel) obtained from different crosses Hypothesis testing (chi-square) Inference of genotype and phenotype of generations P and F1 Genetic and Biochemistry basis of the observed phenotypes Lab 2. SETTING UP EXPERIMENTS USING Drosophila. Raising and handling Drosophila in the lab Life cycle Analysing fruit flies: distinguishing sex, why isolating virgin females, observation of some mutant phenotypes Lab 3. LINKAGE MAPPING IN D. melanogaster. Reciprocal crosses between wild and three-factor mutant (yellow, white y miniature) Analysis of Offspring (F1) Testcrosses, analysis of offspring (F2) and statistical approach to determine the linkage order and map distances between the three loci on Drosophila chromosomes (calculation of frequencies of recombination, coincidence coefficient and interference) Lab 4. POLYTENE CHROMOSOME OF THE SALIVARY GLANDS OF D. buzzatii. Extraction of larval salivary glands Staining with orcein Identification of polytene chromosomes and the sex of larva Chromosome puffing Lab 5. COMPUTER LAB. Introduction to bioinformatics databases and resources offered through the NCBI Getting familiar with the following databases: PUBMED, BOOKS, TAXONOMY, OMIM.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours

Laboratory practice	A2 A4 A11 A12 A26 A30 A31 B1 B2 B3 B4 B5 B6	15	22.5	37.5
Mixed objective/subjective test	B1 B2 B3 B8 B9	2.5	0	2.5
Supervised projects	A1 A12 A26 A29 B1 B2 B3 B4 B5 B6 B8 B9	8	16	24
Guest lecture / keynote speech	A1 A11 A12 A20 A26 A29 B1 B2 B3	24	60	84
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**
Laboratory practice	The teaching labs are designed to allow groups of students to work side by side in order to (i) better comprenhend certain issues of the syllabus and (ii) see ?real? science as approachable, accessible and exciting. Each lab relies on a theoretical basis (teacher explanation + reading assignment) and a hands-on activity.
Mixed objective/subjective test	The final exam is usually composed by a multiple choice/true-false set, short-answer questions, and a set of genetic problems.
Supervised projects	Group work: students will be assigned a maximum of four sets of genetic problems, whose written solutions have to be handed in for evaluation by certain deadlines. Additional group activities may be assigned for the sake of a better comprehension of particular issues.
Guest lecture / keynote speech	Master class and reading groups: the teacher will explain the main contents of each lesson and will assign texts for further reading. Working with small groups will allow the exchange of ideas among students, under direct supervision of the lecturer.

Personalized attention	
Methodologies	**Description**
Supervised projects	All students are welcome to receive regular tuition in both theory and practical issues of the subject. Individual or group appointments may be arranged with the teacher.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Mixed objective/subjective test	B1 B2 B3 B8 B9	The final exam (test, short-answer, set of problems) aims at evaluating student's performance by (i) showing his/her understanding of theoretical concepts and (ii) developing problem-solving strategies.	60
Laboratory practice	A2 A4 A11 A12 A26 A30 A31 B1 B2 B3 B4 B5 B6	Laboratory attendance is mandatory. Pass mark of 50% in the corresponding lab test.	15
Supervised projects	A1 A12 A26 A29 B1 B2 B3 B4 B5 B6 B8 B9	Group work is not mandatory in order to pass the subject. Grading will reflect the students' comprehension of the topic, their analytical skills, as well as how well the assignment is written, presented and orthograpy.	25

Assessment comments

To pass the subject, students must score at least 50% pass in Laboratory Practice as well as 50% in Mixed objective/subjective test. If the cumulative final score is 5.0 or higher, but the student failed either the Mixed objetive/subjective test and/or the laboratory exam (50% pass mandatory in both of them), the grade report will read 4.5 (fail).
Having said this, students with scores [4.5-4.9] in Laboratory Practice may pass the subject if their score in the Mixed objective/subjective test is 5.0 or higher and the final cumulative result is 5.0 or higher.
Students with scores [4.5-4.9] in the Mixed objective/subjective test may pass the subject if their score in Laboratory Practis is 5.0 or higher adnt he final cumulative result is 5.0 or higher. In this case, even if the final cumulative result is higher than 5.0 the final grading will be 5.0.
Pass marks (5.0 or higher) obtained in Laboratory Practice will be kept for the July examination session and the two opportunities of the next academic year if scored at least 50% pass. For example, someone who pass his/her labs in 1st opportunity of year 2020/21 may keep that mark until the July examination session of year 2021/22. Also, is he/she passed the lab exam in the 2nd opportunity of year 2020/21, that result will also be kept until the July examination session of year 2021/22.
Pass marks (5.0 or higher) obtained in the Mixed objective/subjective test (1st opportunity) will be kept for the July examination session (2nd opportunity) but never for the next academic year.
Official withdraw from the course is only possible if the student attends neither Mixed objective/subjective test (final exam) nor the Laboratory Practice exam.
Part-time students or students who participate in equality and diversity
support programs are welcome to participate in this subject. The
teachers will adapt the different compulsory activities in order to
enable these students to fulfil the aims of the course.
If the university discovers a case of fraud or plagiarism in any exam or assignment, the student will fail the whole subject or just the assignment (respectively) as stated in the academic rules and regulations of our university.

Sources of information	
Basic	Griffiths AJF et al. (2012) Introduction to Genetic Analysis. WH Freeman, New York LibroKlug WS, Cummings MR (2011) Essentials of Genetics. Pearson, San Francisco LibroPierce BA (2011) Fundamentos de Genética: Conceptos y Relaciones. Editorial Médica Panamericana, Buenos Aires LibroPierce BA (2008) Genetics: A Conceptual Approach. WH Freeman, New York LibroRussell PJ (2010) iGenetics. A Molecular Approach. 3rd edition. Pearson International Edition

Complementary	Atherly, A.G., Girton, J.R. & McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.Brooker, R.J. 2005. Genetics: Analysis and Principles (2nd ed). McGraw-Hill, Boston, USA.Falconer, D.S. & Mackay, T.F.C. 2000. Introducción a la Genética Cuantitativa.Acribia, Zaragoza.Gardner, E.J., Simmons, M.J. & Snustad, D.P. 1998. Principios de Genética (4ª ed). México DF, México. Griffiths, A.J.F., Gelbart, W.M., Miller, J.H. & Lewontin, R.C. 2000. Genética Moderna. Interamericana-McGraw-Hill, Madrid.Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. & Darnell, J. 2000. Biología celular y Molecular (4ª ed). Panamericana, Madrid.Pierce, B.A. 2006. Genética. Un enfoque conceptual (2ª ed.) Editorial Médica Panamericana, Buenos Aires.Russell, P.J. 2002. iGenetics. Benjamin Cummings, San Francisco, USA.Snustad, D.P. & Simmons, M.J. 2006. Principles of Genetics (4ed). John Wiley & Sons, Inc. New York, USA.Tamarin, R.H. 2002. Principles of Genetics (7th ed.). McGraw-Hill, Boston, USA.Bibliografía de ProblemasBenito Jiménez, C. 1997. 360 Problemas de Genética Resueltos Paso a Paso. Síntesis, Madrid. Jiménez Sánchez, A. 2001. Problemas de Genética para un Curso General (2ª ed). Servicio de Publicaciones Universidad de Extremadura, Cáceres.Lacadena, J.R., Benito, C., Díez, M., Espino, F.J., Figueiras, A.M., Ochando, M.D., Rueda, J., Santos, J.L., Sendino, A.M., Vázquez, A.M. & Vega, C. 1998. Problemas de Genética para un Curso General. Alhambra, Madrid.Ménsua, J.L. 2003. Genética. Problemas y ejercicios resueltos. Pearson Prentice Hall, Madrid.Ochando, D. 1990. Genética poblacional, evolutiva, cuantitativa. Problemas. Eudesa Universidad, Madrid.Tormo Garrido, A. 1998. Problemas de Genética Molecular. Editorial Síntesis, Madrid.Viseras Alarcón, E. 1998. Cuestiones y Problemas Resueltos de Genética (2ª ed). Universidad de Granada, Granada.Recursos webAcompañamiento electrónico de librosHTTP://WWW.WHFREEMAN.COM/MGA/. Modern Genetic Analysis y An Introduction to Genetics Analysishttp://www.ultranet.com/~jkimball/BiologyPages/ Versión online del libro de Biología de JW Kimball. http://www.mhhe.com/tamarin7. Sitio web con problemas, ejercicios y links a otras páginas.Animaciones e ilustracioneshttp://www.dnaftb.org/dnaftb/ DNA from de beginning. Conceptos básicos de la herencia y biología molecular.Cursos de Genética onlinehttp://www.ndsu.nodak.edu/instruct/mcclean/plsc431/431g.htmBases de datos y herramientas bioinformáticashttp://www.ncbi.nlm.nih.gov/ National Centre for Biotechnology Information (NCBI) de USA.http://www.udc.es/biblioteca/ Biblioteca de Universidade da Coruña.Diccionarios, atlas y glosariosKing, R.C. & Stansfield, W.D. 1990. A dictionary of genetics (4th ed.) Oxford Unversity Press, New York, USA.Passarge, E. 2001. Color Atlas of Genetics (2nd ed). Thieme, Stuttgart, Germany.Rieger, R., Michaelis, A. & Green, M.M. 1991. Glossary of genetics. Clasical and molecular (5th ed). Springer-Verlag, Heidelberg, Germany.

Recommendations
Subjects that it is recommended to have taken before
Statistics/610G02005 Biology: Basic Levels of Organisation of Life I (Cells)/610G02007 Biology: Basic Levels of Organisation of Life II (Tissues)/610G02008 Biochemistry I/610G02011
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Molecular Genetics/610G02020 Population Genetics and Evolution/610G02021 Cytogenetics/610G02022
Other comments
Attending class regularly is one strategy to maintain satisfactory academic progress. Relying on Moodle notes is not enough to pass at the higher education level!Asking questions in class if you do not understand the material presented.The more you read, do homework, participate in class, the more familiar you will become with content, which is a strategy to help you pass.You will also be expected to read other materials in addition to the textbook to give you differing viewpoints and to develop your critical thinking.You are most welcome to set up meetings with your instructors to discuss any issue about the subject.GREEN CAMPUS strategy:assignments for this subject will be preferably handed in as digital documents. In the case that any assignment is required to be submitted in paper, students will (1) avoid the use of plastic, (2) use both sides of the paper sheet and (3) use recycled paper.

(*)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.