UNIVERSIDADE DA CORUÑA

| Teaching Guide | | | | |
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| Identifying Data | | | | 2022/23 |
| 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 | |
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| 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). | | | |

| Study programme competences / results | |
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| Code | Study programme competences / results |
| 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 | |
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| Learning outcomes | Study programme competences / results |

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

| Contents | |
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| **Topic** | **Sub-topic** |
| 1. Introduction to Genetics | Definition of Genetics<br>History of Genetics<br>Genetics and other sciences<br>Genetics and society |
| 2. Mendelian Genetics | Mendel?s experiments: mono and dihibrid crosses<br>Concept of geno and phenotype<br>Terms and symbols<br>Pedigree analysis |
| 3. Chromosomal Basis of Inheritance and Sex Determination | Genetic implications of mitosis and meiosis<br>Chromosomal theory of inheritance<br>Sex determination<br>Sex-linked inheritance<br>Sex-limited and sex-influenced traits<br>Gene dosage compensation |
| 4. Extensions of and Deviations from Mendelian Genetic Principles | Modification of dominante relationships<br>Multiple alleles<br>Lethality<br>Penetrance and expressivity<br>Pleiotropy<br>Gene interaction and epistasis<br>Position effect<br>Environmental interactions |

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| 5. Genetic Mapping in Eukaryotes | Linkage, recombination and mapping of genes on chromosomes<br>Interference and coincidence<br>Genetic map function: connecting recombination fractions and genetic map distances |
| 6. Genetic Analysis and Mapping in Bacteria and Bacteriophages | Bacterial transformation<br>Bacterial conjugation: plasmids and episomes<br>Generalized and specialized transduction<br>Genetic recombination in bacteriophages. Fine structure of the gene: rII system of phage T4 |
| 7. Extranuclear Inheritance | Maternal effect<br>Maternal inheritance<br>General features of mitochondrial and chloroplast genomes<br>Heteroplasmy<br>Infectious heredity |
| 8. Quantitative Genetics | Quantitative traits<br>Genes and environment<br>Phenotypic distribution and norms of reaction<br>Genetic basis of quantitative traits: Johannsen?s experiment<br>Polygenic inheritance: Nilsson-Ehle?s experiment<br>Heritability |
| 9. Population Genetics | Mendelian population<br>Genetic variation<br>Allele and genotype frequencies<br>Random mating and Hardy-Weinberg equilibrium<br>Evolutionary forces: mutation, migration, random drift, and selection |
| 10. DNA Organization in Chromosomes | Genome size: the C-value paradox<br>Bacterial chromosomes<br>Eukaryote chromosomes<br>DNA packaging: Nucleosomes and Chromatin<br>Centromeres and Telomeres<br>Lampbrush and polytene chromosomes<br>Karyotype |
| 11. DNA Mutation | Random and adaptive mutation<br>Mutant types<br>Spontaneous and induced mutation<br>Detecting mutagens: the Ames test |
| 12. Variations in Chromosome Structure | Deletions<br>Duplications<br>Inversions<br>Translocations<br>Robertsonian fusions/dissociations |
| 13. Variations in Chromosome Number | Euploidy and aneuploidy<br>Monoploidy<br>Polyploidy: Autopolyploidy and Allopolyploidy<br>Aneuploidy: meiotic nondisjunction, monosomy, trisomy<br>Somatic aneuploidy: mitotic nondisjunction, sexual mosaics<br>B chromosomes |

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| Teaching labs | Lab 1. GENETIC ANALYSIS IN CORN (Zea mays): INTERACTION AND EPISTASIS.<br>Description of shape and colour of F2 seeds (kernel) obtained from different crosses<br>Hypothesis testing (chi-square)<br>Inference of genotype and phenotype of generations P and F1<br>Genetic and Biochemistry basis of the observed phenotypes<br><br>Lab 2. SETTING UP EXPERIMENTS USING Drosophila sp.<br>Raising and handling Drosophila in the lab<br>Life cycle<br>Analysing fruit flies: distinguishing sex, why isolating virgin females, observation of some mutant phenotypes<br><br>Lab 3. LINKAGE MAPPING IN Drosophila sp.<br>Reciprocal crosses between wild and three-factor mutant (yellow, white y miniature)<br>Analysis of Offspring (F1)<br>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)<br><br>Lab 4. POLYTENE CHROMOSOME OF THE SALIVARY GLANDS OF Drosophila sp.<br>Extraction of larval salivary glands<br>Staining with orcein<br>Examination of the slides under the microscope<br><br>Lab 5. COMPUTER LAB.<br>Introduction to bioinformatics databases and resources offered through the NCBI<br>Getting familiar with the following databases: PUBMED, BOOKS, TAXONOMY, OMIM. |

| Planning | | | | |
|---|---|---|---|---|
| Methodologies / tests | Competencies / Results | Teaching hours (in-person & virtual) | 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 | |
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| 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.<br>Each lab relies on a theoretical basis (teacher explanation + reading assignment) and a hands-on activity. |

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| Mixed objective/subjective test | The final exam is usually composed by questions/essays to assess theorecial knowledge and a set of problems/exercises. |
| 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 / Results** | **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, (ii) developing problem-solving strategies, and (iii) communication skills. | 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. Grading will reflect the students' comprehension of the topic, their analytical skills, as well as how well the document is written and presented. | 20 |
| Supervised projects | A1 A12 A26 A29 B1 B2 B3 B4 B5 B6 B8 B9 | Supervised projects are 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 and presented. | 20 |

| Assessment comments |
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To pass the subject, students must score at least 50% pass in Laboratory Practice as well as 50% in Mixed objective/subjective test.
The Mixed objective/subjective test (final exam) will include both theory and exercises. Students should score at least 50% in the theory part to add points for their solutions to exercises.
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 Practice is 5.0 or higher and 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, if 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 |

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| 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 |
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| **Subjects that it is recommended to have taken before** |
| Statistics/610G02005<br>Biology: Basic Levels of Organisation of Life I (Cells)/610G02007<br>Biology: Basic Levels of Organisation of Life II (Tissues)/610G02008<br>Biochemistry I/610G02011 |
| **Subjects that are recommended to be taken simultaneously** |
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| **Subjects that continue the syllabus** |
| Molecular Genetics/610G02020<br>Population Genetics and Evolution/610G02021<br>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. Instructors will discourage the handing of paper drafts. |

(*)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.