



Teaching Guide

| Identifying Data | | | | |
|---------------------|--|--------|------------------|---|
| Subject (*) | | | Genetics | Code |
| Study programme | | | Grao en Bioloxía | 610G02019 |
| 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 Vila Taboada, Marta | | E-mail | natalia.mallo@udc.es ana.gonzalez.tizon@udc.es m.l.martinez@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). | | | |

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 espécimes. |
| 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 | |
| Introduction to quantitative and population genetics | A1 A20 A26 A29 A30 A31 | B1 B2 B3 B5 B6 B8 | |

| Contents | |
|---|--|
| Topic | Sub-topic |
| 1. Introduction to Genetics | Subdisciplines of Genetics Model organisms History of Genetics |
| 2. Mendelian Genetics | Mendel's experiments: mono and dihybrid crosses Concept of genotype 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 dominance 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 |
| 6. Genetic Analysis and Mapping in Bacteria and Bacteriophages | Mapping bacterial genes using conjugation, transformation and transduction Genetic recombination and gene mapping in bacteriophages Fine structure of the gene: rII system of phage T4 |
| 7. Extranuclear Inheritance | Infectious inheritance Organelle inheritance Heteroplasmy |
| 8. Quantitative Genetics | Types of quantitative traits Infinitesimal model Components of the phenotypic variance Heritability |
| 9. Population Genetics | Allele and genotype frequencies Hardy-Weinberg equilibrium and departures |
| 10. DNA Organization in Chromosomes | Bacterial and viral genomes Genome size: the C-value paradox Eukaryote chromosomes DNA packaging: Nucleosomes and Chromatin Centromeres and Telomeres Lampbrush and polytene chromosomes Karyotype |
| 11. DNA Mutation | Types of mutations Spontaneous and induced mutation |
| 12. Variations in Chromosome Structure | Deletions Duplications Inversions Translocations |
| 13. Variations in Chromosome Number | Euploidy and aneuploidy Trisomic analysis Polyploidy: autopolyploidy, allopolyploidy |
| 14. Developmental Genetics | Maternal effect genes and zygotic genes controlling embryonic development in metazoans |



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

| 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 |
| Guest lecture / keynote speech | A1 A11 A12 A20 A26 A29 B1 B2 B3 | 24 | 84 | 108 |
| 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 | <p>The teaching labs are designed to allow groups of students to work side by side in order to (i) better comprehend certain issues of the syllabus and (ii) see 'real' science as approachable, accessible and exciting.</p> <p>Each lab relies on a theoretical basis (teacher explanation + reading assignment) and a hands-on activity.</p> |
| Mixed objective/subjective test | The final exam is usually composed by questions/essays to assess theoretical knowledge and a set of problems/exercises. |
| 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 |
|---------------|--|
| | 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 (theory, 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. | 80 |
| 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 |

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.

The Mixed objective/subjective test (final exam) will include both theory and exercises.

If the cumulative final score is 5.0 or higher, but the student failed either the Mixed objective/subjective test and/or the laboratory exam (50% pass mandatory in both of them), the grade report will read the grade of the failed exam.

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 the 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 fulfill 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 | <p>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 Problemas Benito 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 web Acompañamiento electrónico de libros HTTP://WWW.WHFFREEMAN.COM/MGA/. Modern Genetic Analysis y An Introduction to Genetics Analysis http://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 ilustraciones http://www.dnafb.org/dnafb/ DNA from de beginning. Conceptos básicos de la herencia y biología molecular. Cursos de Genética online http://www.ndsu.nodak.edu/instruct/mcclean/plsc431/431g.htm Bases de datos y herramientas bioinformáticas http://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 glosarios King, R.C. & Stansfield, W.D. 1990. A dictionary of genetics (4th ed.) Oxford University 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. Classical and molecular (5th ed). Springer-Verlag, Heidelberg, Germany.</p> |
|----------------------|---|

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



Attendance at the master classes enables understanding of the subject matter and allows for addressing any doubts or questions that may arise during the explanations. Any doubts or difficulties regarding any aspect of the subject should be resolved as soon as possible, either in the in-person classes or by attending individual tutorials. Attending tutorials (individual or group) facilitates the correct resolution of problems, issues, or doubts that may arise during the preparation of the material and reinforces learning. Students are advised to make use of them. Studying should involve regularly consulting the recommended bibliography. Group study and work promote understanding and develop critical thinking skills. Green Campus Program, Faculty of Sciences To help achieve an immediate sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)," the documentary work carried out in this subject: a. Will be primarily requested in virtual format and electronic support. b. If done on paper: Plastics will not be used. Double-sided printing will be done. Recycled paper will be used. The creation of drafts will be avoided.

(*) 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.