## IDENTIFYING DATA

### Genetics II

| | |
|---|---|
| Subject | Genetics II |
| Code | V02G030V01505 |
| Study programme | (*)Grao en Bioloxía |

| Descriptors | ECTS Credits | | Choose | Year | Quadmester |
|---|---|---|---|---|---|
| | 6 | | Mandatory | 3rd | 1st |

| | |
|---|---|
| Teaching language | Spanish<br>English |
| Department | Biochemistry, Genetics and Immunology |
| Coordinator | Pérez Diz, Ángel Eduardo<br>Caballero Rúa, Armando |
| Lecturers | Arenas Busto, Miguel<br>Caballero Rúa, Armando<br>Carvajal Rodríguez, Antonio<br>Fernández Silva, Íria<br>Pérez Diz, Ángel Eduardo<br>Quesada Rodríguez, Humberto Carlos<br>Rolán Álvarez, Emilio |
| E-mail | angel.p.diz@uvigo.es<br>armando@uvigo.es |
| Web | |
| General description | The subject Genetics II is an extension of the specific contents of Genetics taught in Genetics I. The topics covered in this subject include the structure of genomes, mutation and repair of genetic material, recombinant DNA technology, population genetics, evolution and the inheritance of quantitative traits. The lectures will be complemented with practical sessions in which the students will be able to exercise the knowledge acquired in the theoretical classes. As a complement to face-to-face training, this course has an online learning platform that implements the new technologies of learning and knowledge with the functioning of the subject, facilitating the personalized work and the integration of different sources of information. |

## Competencies

| Code | |
|---|---|
| A1 | Students should prove understanding and knowledge in this study field that starts in the Secundary Education and with a level that, even though it is suppported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field. |
| A2 | Students should know how to apply their knowledge to their work or vocation in a professional way. They also should have the competences that are usually proved through the elaboration and defence of arguments and the resolution of problems within their study field. |
| A3 | Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics. |
| A4 | Students should able to communicate information, ideas, issues and solutions to all audiences (specialist and unskilled audience). |
| B2 | Ability of reading and analizing scientific papers and having critical assessment skills to understand data collection, deducing the main idea from the least relevant ones and basing on the correponding conclusions. |
| B3 | Acquisition of general knowledge about the basic subjects of biology, both at theory and experimental level, without dismissing a higher specialization in subjects that are oriented to a concrete professional area. |
| B4 | Ability in handling experimental tools, both scientific and computer technology equipment that support the search for solutions to problems related to the basic knowledge of biology and with those of a concrete labour context. |
| B5 | Understanding of the levels of organization of living beings from a structural (molecular, cellular and organic) and functional point of view by observing their relations with the environment and other organisms, as well as their appearances in situations of environmental alteration. |
| B7 | Collection of information about issues of biologic interest, analysis and emission of critical opinions and reason them including the reflection about social and/or ethical aspects related to the issue. |
| B10 | Development of analytic and abstraction skills, the intuition and the logical and rigorous thought through the study of biology and its uses. |

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|---|---|
| B11 | Ability to communicate in detail and clearly: knowledge, methodology, ideas, issues and solutions to all audiences (not only qualified but unskilled in Biology). |
| B12 | Ability to identify their own educational necessities in the biology field and in concrete labour areas and to organize their learning with a high grade of autonomy in any context. |
| C2 | Recognizing different levels of Living systems organization. Performing phylogenetic analysis and identifying evidence of evolution. |
| C3 | Identifying, analysing and characterizing biological samples, including those of human origin, and possible anomalies. |
| C4 | Isolating, analysing and identifying biomolecules, viruses, cells, tissues and organs. |
| C7 | Manipulating and analysing genetic data and carrying out genetic counseling |
| C10 | Analysing and assessing the adaptation of living beings to the environment. |
| C11 | Sampling, characterizing, managing, preserving and restoring Populations, Communities and Ecosystems. |
| C16 | Growing, producing, transforming, improving biological resources as well as getting profits. |
| C20 | Designing, using and supervising biotechnological processes. |
| C21 | Processing and interpreting bioessays and biological diagnoses. |
| C24 | Designing biological process models. |
| C25 | Gathering background information, develop experimental work and analysing data results |
| C31 | Knowing and handling technical and scientific apparatus. |
| C32 | Knowing and handling basic or specific key concepts and terminology |
| C33 | Understanding the social projection of Biology. |
| D1 | Development of capacity of analysis and synthesis |
| D2 | Acquisition of the organization and planning capacity for tasks and time |
| D3 | Development of oral and writting communication abilities |
| D4 | Acquisition of foreign language knowledge related to the study field |
| D5 | Use of computer resources related to the study field |
| D6 | Research and interpreting of information from different sources |
| D7 | Resolution of issues and decision making in an effective way |
| D8 | Development of the ability of independent learning |
| D9 | Ability to work in collaboration or creating groups with an interdisciplinary character |
| D10 | Development of the critical thinking |
| D11 | Adquisition of an ethical agreement with the society and the profession |
| D12 | Respectful behaviour to diversity and multiculturalism |
| D13 | Sensitivity for environmental issues |
| D14 | Adquisition of abilities in the interpersonal relationships |
| D15 | Development of creativity, initiative and enterpreneurial spirit |
| D16 | Acceptance of a quaility commitment |
| D17 | Development of the self-criticism ability |
| D18 | Development of negotiating power |

## Learning outcomes

| Expected results from this subject | Training and Learning Results | | | |
|---|---|---|---|---|
| To know and understand the evolutionary mechanisms and models | A1 | B2 | C2 | D1 |
| | A2 | B3 | C3 | D2 |
| | A3 | B4 | C4 | D3 |
| | A4 | B5 | C7 | D4 |
| | | B7 | C10 | D5 |
| | | B10 | C11 | D6 |
| | | B11 | C16 | D7 |
| | | B12 | C20 | D8 |
| | | | C21 | D9 |
| | | | C24 | D10 |
| | | | C25 | D11 |
| | | | C31 | D12 |
| | | | C32 | D13 |
| | | | C33 | D14 |
| | | | | D15 |
| | | | | D16 |
| | | | | D17 |
| | | | | D18 |

| To know and understand the genetic basis of systematics and phylogeny | A1 | B2 | C2 | D1 |
| --- | --- | --- | --- | --- |
| | A2 | B3 | C3 | D2 |
| | A3 | B4 | C4 | D3 |
| | A4 | B5 | C7 | D4 |
| | | B7 | C10 | D5 |
| | | B10 | C11 | D6 |
| | | B11 | C16 | D7 |
| | | B12 | C20 | D8 |
| | | | C21 | D9 |
| | | | C24 | D10 |
| | | | C25 | D11 |
| | | | C31 | D12 |
| | | | C32 | D13 |
| | | | C33 | D14 |
| | | | | D15 |
| | | | | D16 |
| | | | | D17 |
| | | | | D18 |
| To know and understand the genetic diversity | A1 | B2 | C2 | D1 |
| | A2 | B3 | C3 | D2 |
| | A3 | B4 | C4 | D3 |
| | A4 | B5 | C7 | D4 |
| | | B7 | C10 | D5 |
| | | B10 | C11 | D6 |
| | | B11 | C16 | D7 |
| | | B12 | C20 | D8 |
| | | | C21 | D9 |
| | | | C24 | D10 |
| | | | C25 | D11 |
| | | | C31 | D12 |
| | | | C32 | D13 |
| | | | C33 | D14 |
| | | | | D15 |
| | | | | D16 |
| | | | | D17 |
| | | | | D18 |
| To know and understand the genetic basis of adaptation to the environment | A1 | B2 | C2 | D1 |
| | A2 | B3 | C3 | D2 |
| | A3 | B4 | C4 | D3 |
| | A4 | B5 | C7 | D4 |
| | | B7 | C10 | D5 |
| | | B10 | C11 | D6 |
| | | B11 | C16 | D7 |
| | | B12 | C20 | D8 |
| | | | C21 | D9 |
| | | | C24 | D10 |
| | | | C25 | D11 |
| | | | C31 | D12 |
| | | | C32 | D13 |
| | | | C33 | D14 |
| | | | | D15 |
| | | | | D16 |
| | | | | D17 |
| | | | | D18 |

| To know and understand the genetic structure and population dynamics | A1 | B2 | C2 | D1 |
| --- | --- | --- | --- | --- |
| | A2 | B3 | C3 | D2 |
| | A3 | B4 | C4 | D3 |
| | A4 | B5 | C7 | D4 |
| | | B7 | C10 | D5 |
| | | B10 | C11 | D6 |
| | | B11 | C16 | D7 |
| | | B12 | C20 | D8 |
| | | | C21 | D9 |
| | | | C24 | D10 |
| | | | C25 | D11 |
| | | | C31 | D12 |
| | | | C32 | D13 |
| | | | C33 | D14 |
| | | | | D15 |
| | | | | D16 |
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| | | | | D18 |

## Contents

| Topic | |
| --- | --- |
| Mutation and recombination | Molecular basis of mutation and repair<br>Chromosomal mutations<br>Recombination<br>Transposable elements |
| Genetic engineering | Cloning<br>Molecular markers<br>Applications of recombinant DNA |
| Genomics | Genome organization and structure<br>Genome evolution<br>Functional genomics |
| Population genetics | Hardy-Weinberg equilibrium<br>Linkage disequilibrium<br>Genetic drift and inbreeding<br>Mutation and migration |
| Evolutionary genetics | Natural selection<br>Molecular evolution<br>Speciation |
| Quantitative genetics | Quantitative trait analysis<br>Artificial selection |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
| --- | --- | --- | --- |
| Introductory activities | 1 | 0 | 1 |
| Lecturing | 25 | 40 | 65 |
| Problem solving | 8 | 24 | 32 |
| Computer practices | 15 | 6 | 21 |
| Autonomous practices through ICT | 0 | 31 | 31 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

| | Description |
| --- | --- |
| Introductory activities | The objective is to define and focus the Genetics II subject describing the working method to be followed |
| Lecturing | The master sessions of the program are organized in 50-minute classes. In most cases they will be devoted to explain and develop basic concepts and methodologies, but due to the time constraints students must work autonomously |
| Problem solving | Classes of problems and exercises have as a basic mission to integrate and apply knowledge acquired in the theoretical classes. In an experimental science such as genetics learning using a problem-based approach is an essential didactic resource |
| Computer practices | The aim of the practices in the computer classroom is to obtain an overview of the different contents of the subject |
| Autonomous practices through ICT | One of the competences that the student should achieve throughout their training is the ability to work autonomously. It is necessary to provide non-presential activities to guide them in this learning. The teledocencia platform TEMA will be used. |

**Personalized attention**

| Methodologies | Description |
|---|---|
| Autonomous practices through ICT | The student's learning process that complements the lectures and practices will take place through the development of autonomous activities through the platform TEMA. In this platform the student will find the material with the presentations of the classes of theory, complementary reading, useful documents for studying and completing theoretical classes, practice lists, lists of problems and exercises to be performed within a given period, and self-evaluation. The lecturers will reserve a time to attend and solve the students' doubts. In these activities the lecturer will guide the learning process of the students and help them to successfully carry out the corresponding autonomous work. Lecturers will indicate the first days of class the place, day and hours for that personalized attention. |

**Assessment**

| | Description | Qualification | Training and Learning Results | | | |
|---|---|---|---|---|---|---|
| Lecturing | - Two tests during the course<br>- Final examination<br>- Assistance to the face-to-face activities | 45 | A1<br>A2<br>A3 | B2<br>B3<br>B5<br>B7<br>B10 | C2<br>C3<br>C4<br>C10<br>C11<br>C16<br>C20<br>C21<br>C24<br>C25<br>C32<br>C33 | D1<br>D3<br>D4<br>D6<br>D10<br>D11<br>D12<br>D13<br>D15<br>D16<br>D17<br>D18 |
| Problem solving | - Two tests during the course<br>- Final examination<br>- Assistance to the face-to-face activities<br>- Resolution of problems | 30 | A1<br>A2<br>A3<br>A4 | B3<br>B4<br>B11<br>B12 | C2<br>C3<br>C10<br>C11<br>C16<br>C20<br>C21<br>C24<br>C25<br>C32<br>C33 | D1<br>D2<br>D6<br>D7<br>D8<br>D9<br>D10<br>D14<br>D16<br>D17 |
| Computer practices | - Assistance and performance<br>- Written examination | 15 | A1<br>A2<br>A3 | B4<br>B12 | C7<br>C10<br>C24<br>C25<br>C31<br>C32<br>C33 | D1<br>D5<br>D6<br>D7<br>D8<br>D9<br>D10<br>D17 |
| Autonomous practices through ICT | - Online and other evaluations<br>- Presentation of exercises within the established deadline | 10 | A1<br>A2<br>A3 | B2<br>B3<br>B4<br>B7<br>B10<br>B12 | C2<br>C10<br>C24<br>C32<br>C33 | D1<br>D2<br>D3<br>D4<br>D5<br>D6<br>D7<br>D10<br>D11<br>D17 |

**Other comments on the Evaluation**

The subject will be evaluated in the following way:

- Final examination, that will imply 55% of the final qualification. To pass the subject it will be necessary to obtain a minimum of 5 points (out of 10) in that final examination. The examination will consist of questions about theory and problems. Final exam date can be checked in the following link: http://bioloxia.uvigo.es/en/teaching/exams.

- Two tests carried out during the course (31st October and 14th December 2018), that will imply 20% of the final qualification and will consist of questions of theory and problems.

- Assistance and performance during the realisation of the practices in the classroom of computers. Written examination on the practices. This complete activity will be 15% of the final qualification.

- On-line and other type of activities and required exercises, that will imply 10% of the final qualification. At the end of each subject there will be a deadline to handle exercises via platform TEMA.

To pass the subject it will be necessary to obtain 5 points of 10 in the global qualification.

All qualifications, except that of the final exam, will be saved for the second opportunity in July, and indefinitely for later courses.

The students not attending the final examination will be marked as "No Presentado".

Any attempt to carry out illegal activities in the examinations (copy, etc.), as well as the plagiarism in the activities will imply a failure of the subject.

TEACHING SCHEDULE: http://bioloxia.uvigo.es/en/teaching/schedules

## Sources of information

### Basic Bibliography

Benito, C., Espino, F. J., **Genética: Conceptos esenciales**, Médica Panamericana, 2013

W.S. Klug, M.R. Cummings, C.A. Spencer, M.A. Palladino, **Concepts of Genetics**, Pearson, 2014

A.J.F. Griffiths, S.R. Wessler, S.B. Carroll, J. Doebley, **Introduction to Genetic Analysis**, W. H. Freeman, 2010

### Complementary Bibliography

Caballero, A., **Genética Cuantitativa**, Síntesis, 2017

Fontdevila, A., Moya, A., **Introducción a la Genética de Poblaciones**, Síntesis, 2017

D.S. Falconer, T.F.C. Mackay, **Introduction to Quantitative Genetics**, Pearson, 1996

## Recommendations

### Subjects that are recommended to be taken simultaneously

Advanced techniques in biology/V02G030V01504

### Subjects that it is recommended to have taken before

Biology: Evolution/V02G030V01101

Statistics: Biostatistics/V02G030V01204

Biochemistry I/V02G030V01301

Biochemistry II/V02G030V01401

Genetics I/V02G030V01404