



| Teaching Guide           |   |        |   |           |
|--------------------------|---|--------|---|-----------|
| Identifying Data         |   |        |   | 2022/23   |
| Subject (*)              | Genetics and molecular evolution  |        | Code  | 614522005 |
| Study programme          | Mestrado Universitario en Bioinformática para Ciencias da Saúde             |        |   |           |
| Descriptors              |   |        |   |           |
| Cycle                    | Period  | Year   | Type  | Credits   |
| Official Master's Degree | Yearly  | First  | Optional  | 6         |
| Language                 | Spanish   |        |   |           |
| Teaching method          | Face-to-face  |        |   |           |
| Prerequisites            |   |        |   |           |
| Department               | Biología  |        |   |           |
| Coordinador              | Vila Taboada, Marta   | E-mail | marta.vila.taboada@udc.es   |           |
| Lecturers                | Gonzalez Tizon, Ana Maria<br>Naveira Fachal, Horacio<br>Vila Taboada, Marta | E-mail | ana.gonzalez.tizon@udc.es<br>horacio.naveira.fachal@udc.es<br>marta.vila.taboada@udc.es |           |
| Web                      |   |        |   |           |
| General description      | Introduction to Mendelian, Molecular and Evolutionary Genetics.             |        |   |           |

| Study programme competences / results |  |
|---------------------------------------|--|
| Code                                  | Study programme competences / results  |
| A8                                    | CE8 - Understanding the basis of the information of the hereditary material, its transmission, analysis and evolution  |
| A9                                    | CE9 ? To understand the benefits and the problems associated with the sequencing and the use of biological sequences, as well as knowing the structures and techniques for their processing                    |
| B1                                    | CB6 - Own and understand knowledge that can provide a base or opportunity to be original in the development and/or application of ideas, often in a context of research  |
| B2                                    | CB7 - Students should know how to apply the acquired knowledge and ability to problem solving in new environments or little known within broad (or multidisciplinary) contexts related to their field of study |
| B5                                    | CB10 - Students should possess learning skills that allow them to continue studying in a way that will largely be self-directed or autonomous.   |
| B6                                    | CG1 - Search for and select the useful information needed to solve complex problems, driving fluently bibliographical sources for the field  |
| B7                                    | CG2 - Maintain and extend well-founded theoretical approaches to enable the introduction and exploitation of new and advanced technologies   |
| B8                                    | CG3 - Be able to work in a team, especially of interdisciplinary nature  |
| C1                                    | CT1 - Express oneself correctly, both orally writing, in the official languages of the autonomous community  |
| C2                                    | CT2 - Dominate the expression and understanding of oral and written form of a foreign language   |
| C3                                    | CT3 - Use the basic tools of the information technology and communications (ICT) necessary for the exercise of their profession and lifelong learning  |
| C7                                    | CT7 ? To maintain and establish strategies for scientific updating as a criterion for professional improvement.  |
| C8                                    | CT8 - Rating the importance that has the research, innovation and technological development in the socio-economic and cultural progress of society   |

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



|  |            |  |                                 |
|--|------------|--|---------------------------------|
| Análise xenética mendeliana estudando o xene como unidade da herdanza  | AJ8        | BJ1<br>BJ2<br>BJ5<br>BJ6<br>BJ7<br>BJ8 | CJ1<br>CJ2<br>CJ3<br>CJ7<br>CJ8 |
| Estudar a base cromosómica da herdanza, a determinación do sexo, herdanza extranuclear e o ligamento e recombinación xénica. | AJ8<br>AJ9 | BJ1<br>BJ2<br>BJ5<br>BJ6<br>BJ7<br>BJ8 | CJ1<br>CJ2<br>CJ3<br>CJ7<br>CJ8 |
| Estudar os cambios no material xenético  | AJ8<br>AJ9 | BJ1<br>BJ2<br>BJ5<br>BJ6<br>BJ7<br>BJ8 | CJ1<br>CJ2<br>CJ3<br>CJ7<br>CJ8 |
| Estudo da xenética das poboacións.   | AJ8<br>AJ9 | BJ1<br>BJ2<br>BJ5<br>BJ6<br>BJ7<br>BJ8 | CJ1<br>CJ2<br>CJ3<br>CJ7<br>CJ8 |

| Contents  |  |
|---|--|
| Topic   | Sub-topic  |
| Tema 1. ANALISE XENÉTICA MENDELIANA.                                      | Os experimentos de Mendel: cruzamentos de monohíbridos e dihíbridos. Concepto de xenotipo e fenotipo. Terminoloxía e simboloxía. Análise de pedigrís.  |
| Tema 2. BASE CROMOSÓMICA DA HERDANZA E DETERMINACIÓN DO SEXO.             | Significado xenético da mitosis e a meiosis. Teoría cromosómica da herdanza. Determinación do sexo. Herdanza ligada ao sexo.   |
| Tema 3. EXTENSIONES DA ANALISE XENÉTICA MENDELIANA.                       | Modificacións da dominancia. Alelismo múltiple. Letalidade. Penetrancia e expresividade. Pleiotropía. Epistase e interacción xénica.   |
| Tema 4. HERDANZA EXTRANUCLEAR.  | Efecto materno. Herdanza materna. Heteroplasmia.   |
| Tema 5. LIGAMENTO E RECOMBINACIÓN EN EUCARIOTAS.                          | Ligamento e recombinación dos xenes nos cromosomas. Mapas de ligamento. Interferencia e coeficiente de coincidencia. Función de mapa: relación entre a distancia de mapa real e a frecuencia de recombinación. |
| Tema 6. LIGAMENTO E RECOMBINACIÓN EN BACTERIAS E VIRUS.                   | Transformación bacteriana. Conxugación: plásmidos e episomas sexuais. Transducción xeralizada e especializada.   |
| Tema 7. ORGANIZACIÓN DO MATERIAL XENÉTICO NOS CROMOSOMAS.                 | Compoñentes do cromosoma eucariota. Paradoxa do valor C. Centrómeros e telómeros. O cariotipo. Secuencias únicas e secuencias repetidas. Familias xénicas. Mapas físicos e xenéticos.                          |
| Tema 8. A MUTACIÓN.   | Mutación aleatoria e adaptativa. Tipos de mutacions. Mutación espontánea e inducida.   |
| Tema 9. A MUTACIÓN CROMOSÓMICA (I): CAMBIOS NA ESTRUCTURA DOS CROMOSOMAS. | Deleccións. Duplicacións. Inversións. Translocacións. Fusións e disociacións robertsonianas.   |
| Tema 10. A MUTACIÓN CROMOSÓMICA (II): CAMBIOS NO NÚMERO DOS CROMOSOMAS.   | Euploidías e aneuploidías. Monoploidías. Poliploidías: autoploidía e alopoliploidía. Aneuploidías: non disxunción meiótica, monosomías, trisomías.   |



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|--|--|
| Tema 11. LA RECOMBINACIÓN GENÉTICA         | Papel da recombinación xenética. Conversión xénica. Recombinación dos xenes de inmunoglobulinas.   |
| Tema 12. ELEMENTOS XENÉTICOS TRANSPONÍBLES | Elementos xenéticos transpoñibles. Significado evolutivo.  |
| Tema 13. XENÉTICA DO DESENVOLVEMENTO       | Xenes de efecto materno, xenes de segmentación e xenes homeóticos.   |
| Tema 14. ENFERMEDADES XENÉTICAS HUMANAS    | Enfermedades monoxénicas e multifactoriais.<br>Xenes e cancro.   |
| Tema 15. XENÉTICA DE POBOACIÓNS            | Frecuencias alélicas e xenotípicas. Equilibrio de Hardy Weinberg. Efectos do apareamiento non aleatorio, mutación, selección, migración e azar.      |
| Tema 16. EVOLUCIÓN MOLECULAR               | Reconstrucción filoxenética. Árbores de xenes e de especies. Taxas de evolución do ADN e das proteínas. Orixe de novos xenes: ortólogos e parálogos. |

| Planning                       |  |                                      |                               |             |
|--------------------------------|--|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies / Results                       | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| ICT practicals                 | A8 A9 B1 B5 B6 B7<br>B8 C2 C3 C7 C8          | 21                                   | 31.5                          | 52.5        |
| Student portfolio              | A8 A9 B2 B5 B6 B8<br>C1 C2 C3 C7 C8          | 0                                    | 16.5                          | 16.5        |
| Objective test                 | A8 A9 B1 B2 B5 B6<br>B7 B8 C1 C2 C3 C7<br>C8 | 4                                    | 0                             | 4           |
| Guest lecture / keynote speech | A8 A9 B1 B5 B6 C1<br>C2 C7 C8                | 21                                   | 52.5                          | 73.5        |
| Personalized attention         |  | 3.5                                  | 0                             | 3.5         |

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

| Methodologies                  |  |
|--------------------------------|--|
| Methodologies                  | Description  |
| ICT practicals                 | Computer labs aiming at learning how to solve particular questions with open-source software.  |
| Student portfolio              | Students will have to hand in in due time their solution to a couple of sets of problems/exercises.                                    |
| Objective test                 | The exam will cover both questions of theory and calculation/reasoning exercises.  |
| Guest lecture / keynote speech | Instructors will explain each topic and provide the instructions for any associated activity (sets of exercises and/or computer labs). |

| Personalized attention  |   |
|---|---|
| Methodologies   | Description   |
| Guest lecture / keynote speech<br>ICT practicals<br>Student portfolio | Instructors will typically be available via email/MS TEAMS. Students can arrange for in-person tutoring sessions. |

| Assessment     |                                     |  |               |
|----------------|-------------------------------------|--|---------------|
| Methodologies  | Competencies / Results              | Description  | Qualification |
| ICT practicals | A8 A9 B1 B5 B6 B7<br>B8 C2 C3 C7 C8 | All students will have to submit a reports following the instructor's guidelines. In these reports, students will answer questions and/or solve exercises using their own computer and the software introduced during the computer labs. | 20            |



|                   |  |   |    |
|-------------------|--|---|----|
| Student portfolio | A8 A9 B2 B5 B6 B8<br>C1 C2 C3 C7 C8          | Valorarase o grao de comprensión do tema tratado, a capacidade de análise e síntese, a bibliografía consultada e a claridade da exposición ou redacción. No caso de boletíns de cuestións e problemas valorarase a capacidade de razoamento e de achegar solucións. Non será indispensable aprobar os traballos tutelados para aprobar o conxunto da materia. | 20 |
| Objective test    | A8 A9 B1 B2 B5 B6<br>B7 B8 C1 C2 C3 C7<br>C8 | In order to pass the subject, all students will have to take an exam that will include theory questions and calculation/reasoning exercises.  | 60 |

#### Assessment comments

Students scoring at least 50 (out of 100) points but not reaching the aforementioned thresholds (ICT practicals: 10 out of 20 points; Objective test; 21 out of 60 points) will be awarded a 4.5 (out of 10) score. When resitting, they can choose to take both exams or only the failed one.

Students will be scored as "ABSENT" (Non presentado) only when not involved in any of the assessed activities.

Evaluation criteria and methodology will be same for the first and second opportunities, except for mark "A with distinction" which will only be awarded to outstanding students passing the subject in the first opportunity.

#### Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | Griffiths AJF (2008) <i>Genética</i> . 9ª edición. McGraw-Hill Interamericana. Klug WS (2013) <i>Conceptos de Genética</i> . 10ª edición. Pearson. Pierce BA (2015) <i>Genética: un enfoque conceptual</i> . 5ª edición. Editorial Médica Panamericana. Russell PJ (2010) <i>iGenetics. A Molecular Approach</i> . 3rd edition. Pearson International Edition. |
| <b>Complementary</b> |  |

#### 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

(\*)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.