



## IDENTIFYING DATA

### Molecular Evolution

|                     |  |          |      |            |
|---------------------|--|----------|------|------------|
| Subject             | Molecular Evolution  |          |      |            |
| Code                | V02M123V01210  |          |      |            |
| Study programme     | (*)Máster Universitario en Ciencias Biológicas: Biología Molecular, Computacional e Ambiental e Bio-Industrias   |          |      |            |
| Descriptors         | ECTS Credits   | Type     | Year | Quadmester |
|                     | 6  | Optional | 1st  | 2nd        |
| Language            | English  |          |      |            |
| Department          |  |          |      |            |
| Coordinator         | Posada González, David   |          |      |            |
| Lecturers           | Posada González, David<br>Quesada Rodríguez, Humberto Carlos   |          |      |            |
| E-mail              | dposada@uvigo.es   |          |      |            |
| Web                 | <a href="http://http://webs.uvigo.es/biologicalsciences/">http://http://webs.uvigo.es/biologicalsciences/</a>  |          |      |            |
| General description | The intention of this subject is to familiarize the student with current methods and tools for the evolutionary analysis of DNA and protein sequences. |          |      |            |

## Competencies

| Type A | Code | Competences Specific  |
|--------|------|---|
|        | A1   | (*)To know the scientific method and the correct use of the scientific terminology as well as to acknowledge the contribution that scientific research provides to the overall knowledge and professional practice.     |
|        | A2   | (*)Ability to describe and to analyse biological diversity, the mechanisms determining the interactions with the biotic and abiotic environment and being able to select those which might have technical applications. |
|        | A3   | (*)Ability to manage and/or to develop basic tools for validating and analysing data by means of statistics and bioinformatics.   |
|        | A4   | (*)To know the ethical and legal aspects governing the collection and the handling of biological samples, organisms and habitats.   |
|        | A5   | (*)Ability to design, evaluate and implement models of biological structures, systems and processes.  |
|        | A6   | (*)To learn the sampling techniques and the instrumental methodologies, in the field and laboratory, for their application in the Biological Sciences   |
|        | A7   | (*)To have an integrated view of the R&D processes and their possible transfer to the industrial sector. Planning and supervising facilities together with managing their human and economic resources.                 |
|        | A8   | (*)Ability to classify, evaluate, conserve, restore and manage natural and productive systems. Developing and implementing land management and sustainability plans.  |
|        | A9   | (*)To understand and know how to apply quality control systems and safety protocols in any biological laboratory of the public or private sector.   |
|        | A10  | (*)To acquire the professional ability to teach and spread Biology and to offer expertise advice for elaborating scientific, technical and socioeconomic biology reports. Address environmental consulting.             |
|        | A11  | (*)To perform an individual Master Project (critical and in-depth study) under the supervision of a tutor in a research or working environment demonstrating that skills have been acquired.                            |

## Type B Code Competences Transversal

|    |   |
|----|---|
| B1 | (*)Dissemination of results and conclusions of the biological studies, in oral and written English, through complex presentations that address ideas related with R&D in Biology. |
| B2 | (*)Managing computational, laboratory, field and industrial techniques in order to obtain, process and apply the acquired information.  |
| B3 | (*)Disseminating and broadcasting ideas in contexts both academic and non-specialised.  |
| B4 | (*)Reflecting on social and ethical responsibilities.   |

## Learning aims

| Subject competences  | Typology         | Competences                |
|--|------------------|----------------------------|
| To understand the main aspects of the evolutionary process at the molecular level                            | know             | A1<br>A5<br>A6<br>B1<br>B3 |
| Ability to use statistical models to describe the process of molecular evolution                             | know<br>Know How | A1<br>A2<br>A3<br>A5<br>B1 |
| To learn the use of different computational tools for the evolutionary analysis of DNA and protein sequences | Know How         | A2<br>A3<br>A5<br>B2       |
| Ability to report computational analyses of molecular evolution  | Know How         | A10<br>B1<br>B3            |

## Contents

| Topic                         |   |
|-------------------------------|---|
| Multiple sequence alignment   | Homology<br>Substitution, insertion and deletion<br>Global and local alignment  |
| Phylogenetic analysis         | Models of molecular evolution<br>Gene tree reconstruction<br>Species tree reconstruction  |
| Coalescence theory            | Gene genealogy and the coalescent theory<br>Evolutionary inference using the coalescent   |
| Molecular population genetics | Populations, variation and evolution<br>Analysis of genetic diversity within and between populations<br>Finding and describing selection in the genome. |

## Planning

|   | Personalized attention              | Assessment                          | Ordinary class hours<br>A | Face-to-face hours<br>outside the classroom<br>Guided academic<br>environment<br>B | Student's work factor<br>C | Outside the classroom<br>hours<br>D | Total hours (A+B+D)<br>E |
|---|-------------------------------------|-------------------------------------|---------------------------|--|----------------------------|-------------------------------------|--------------------------|
| Master Session                                | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 20                        | 0  | 0.5                        | 10                                  | 30                       |
| Classroom work                                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 10                        | 0  | 0                          | 0                                   | 10                       |
| Autonomous troubleshooting and / or exercises | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 0                         | 0  | 0                          | 108                                 | 108                      |
| Multiple choice tests                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 2                         | 0  | 0                          | 0                                   | 2                        |
| Total hours E:                                |                                     |                                     |                           |  |                            |                                     | 150                      |
| Work load in UVIGO ECTS credits:              |                                     |                                     |                           |  |                            |                                     | 6                        |

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

## Methodologies

|   | Description                                       |
|---|---|
| Master Session                                | The professor explains concepts and tools         |
| Classroom work                                | Students do computational work with the professor |
| Autonomous troubleshooting and / or exercises | Students do computational work on their own       |

## Personalized attention

|   | Description   |
|---|---|
| Autonomous troubleshooting and / or exercises | Professors will be in touch with the students online (forum, discussion list, chat) to answer their questions. Professors will also help students in person if necessary. |
| Classroom work                                | Professors will be in touch with the students online (forum, discussion list, chat) to answer their questions. Professors will also help students in person if necessary. |
| Multiple choice tests                         | Professors will be in touch with the students online (forum, discussion list, chat) to answer their questions. Professors will also help students in person if necessary. |

## Assessment

|   | Description  | Qualification |
|---|--|---------------|
| Master Session                                | Students are expected to participate actively in the discussions maintained in the classroom | 5             |
| Autonomous troubleshooting and / or exercises | Students will write a report on their computational assignments                              | 60            |
| Classroom work                                | Students are expected to participate actively in the discussions maintained in the classroom | 5             |
| Multiple choice tests                         | Students will carry out an exam on the items discussed in the course                         | 30            |

## Other comments and second call

### Sources of information

Page RDM & Homes EC, Molecular Evolution: A Phylogenetic Approach, 1<sup>o</sup> ed, 1998

Felsenstein J, Inferring phylogenies, 1<sup>o</sup> ed, 2004

Nielsen R & Slatkin M, An Introduction to Population Genetics: Theory and Applications, 1<sup>o</sup> ed, 2013

### Recommendations

#### Subjects that continue the syllabus

Systems Biology/V02M123V01212

Structural Biology/V02M123V01211

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

Knowledge Discovery/V02M123V01113

Computational Genomics/V02M123V01209

Statistical and Mathematical Methods in Bioinformatics/V02M123V01112

Programming for Bioinformatics/V02M123V01111