

Degree	Type	Year
Biotechnology	OP	4

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Teachers

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Teaching groups languages

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Prerequisites

- Basic knowledge on plant and animal morphology and systematics
- Basic concepts on population genetics
- Basic knowledge about methods for statistical inference.

Objectives and Contextualisation

Biotechnological development is mainly based on the use of a great variety of biological entities, forms and processes, collectively known as "Biodiversity". The "ultimate" causes explaining the origin and maintenance of such overwhelming diversity are deeply grounded on the evolutionary processes. Evolutionary facts and processes will be analyzed at different biological scales, from molecules to ecosystems, and from changes taking place within populations during several generations to patterns observed over the millennia. One of the first principles of the Theory of Evolution is the one about diversification from a common ancestor, meaning the existence of genealogical relationships between organisms. In that sense, one of the main goals of the course is the study of genealogic/phylogenetic relationships between organisms and how these relations are built from basic evolutionary principles.

The main objectives of the course are:

- 1) To widen the understanding of the causes, processes and consequences of Evolution.

1. Recognize the main evolutionary trends during diversification of biota throughout the history of life in our planet.
 2. Understand the main evolutionary mechanisms and how they interact with ecological processes.
- 2) To provide the basic conceptual and methodological tools needed to analyze evolutionary processes using the scientific method by:
1. Incorporating the dynamic view of evolutionary changes into the study and characterization of natural and anthropogenic systems.
 2. Understanding and establishing evolutionary relationships between organisms at every taxonomic level using the basic bioinformatics techniques.
 3. Enhancing the skills to develop a scientific perspective when facing complex problems and phenomena.
- 3) To reflect and develop a critical view on the social consequences and impact of the use of Biodiversity in the light of the Evolutionary Theory.

Learning Outcomes

1. CM31 (Competence) Work collaboratively in teams to solve problems and case studies in the field of applied biology.
2. KM33 (Knowledge) Determine biological entities in the regulation of natural services essential for human and environmental health.
3. SM30 (Skill) Perform functional tests for the characterisation of vital parameters in plants.

Content

CONTENTS(*):

PART-I. Microevolution: evolutionary processes in populations and species (*).

1. Introduction to evolutionary biology: fundamental principles.
2. Molecular evolution and characterization of genetic variability
3. Genetic variability and structure in populations. Genetic drift and migration. Breeding systems. Effective population size. Genomics and demographic inference
4. Units of selection. Natural selection: effects and quantification. Adaptation and exaptation. Determining adaptation: experiments, observational studies and the comparative method. Genomics and selection. Natural and sexual selection.
5. Evolution of life-history traits: general principles and constraints. Evolutionary game theory and the adaptive dynamics approach.
6. Speciation. The species concept and the genetics of speciation. Speciation and Dynamics of hybrid zones. The geography of speciation: allopatric, parapatric and sympatric speciation. Speciation by polyploidy and hybridization.

PART-II. Macroevolution and the history of life (*).

1. Patterns and processes in plant evolution. Extinction and survival in plant evolution from the perspective of the fossil record. The origin, diversification and evolutionary innovations in terrestrial plants. Speciation, coevolution and sexual evolution in plants.
2. Patterns and processes in animal evolution. Speciation from the perspective of the fossil record. Rates and types of morphological change. Evolutionary trends. Evolution of Biodiversity. Evolution of form: homeotic mutations and HOX genes. Dynamics of morphological change: heterochrony.

(*) Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Computer Lab	6	0.24	
In-Class Theoretical Lectures	39	1.56	
Seminars and In-class Individual and Group Activities	7	0.28	
Type: Supervised			
Data Analyses and Writing Activities	10	0.4	
Type: Autonomous			
Individual assignments and study	80	3.2	

- 1) Theoretical lectures: 39 h. in-class attendance
- 2) Seminars, discussions and student directed learning: 4 h. in-class attendance.
- 3) Practical learning in computer lab: 7 h. lab attendance.
- 4) Personal work and study: 80 h.
- 5) Preparing and writing of group work and personal assignment: 12 h
- 6) Exams and evaluation: 8 h

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical work, seminars, personal and group assignments	50%	4	0.16	CM31
Written exams and tests on theoretical lectures	50%	4	0.16	KM33, SM30

- The evaluation system is organized into 2 units:

- 1) UNIT-1. Theory. Tests and written exams on theoretical lectures: 50% of the final mark. This unit will be made of two independent exams:

1.1. Part. I. Microevolution: evolutionary processes in populations and species: 50% unit's mark (25% final mark)

1.2. Part. II. Macroevolution and the history of life: 50% unit's mark (25% final mark).

2) UNIT-2. Practical work, seminars, personal and group assignments: 50% of the final mark:

2.1. Individual exam on the practical work of the evolutionary analysis of morphological variation: 30% of the unit's mark (15% final mark).

2.2. Individual exam of activities in the computer lab about methods of phylogenetic inference: 70% of the unit's mark (35% final mark).

- Students have the right to have a retake of all the evaluation activities. The maximum grade in the retake exams will be a pass.
- To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score
- Dates and time schedules for exams and evaluation assessments will be indicated in the calendar provided by the coordinator or by the teaching staff.
- Passing a midterm exam of UNIT-1 implies full achievement of its content, skills and competences and do not need to be re-assessed in the final second-chance examination.
- To pass the course the student must get at least 5/10 in UNIT-1. Exams with marks lower than 4/10 will not be used in this calculation.
- The students that successfully pass the theoreticalunit (UNIT-1) also have the right accessing the second-chance reassessment exam so as to improve their mark in this unit. In this case, the final mark for this unit will be the one attained in this reassessment examination.
- Students also have the possibility to be graded with a single assessment.
- Students taking the single assessment option must notify the subject coordinator before taking the first continuous assessment test. Students taking any of the continuous assessment tests will be excluded from the right to a single assessment.
- The single assessment option will include all the types and individual assessment activities provided for in the continuous assessment:

UNIT-1: will consist of a test in which the contents of the entire theory program of the subject will be evaluated.

UNIT-2: will be assessed with the same type of tests that are carried out in the continuous assessment.

- The assessment activities will take place on the same day as the last continuous assessment test of the subject.
- The single assessment option also allows the second-chance reassessment.

Bibliography

BASIC TEXTS:

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- Freeman, S. & Herron J.C. 2007. Evolutionary Analysis. 4th. Edition. Pearson.
- Futuyma, D.J. & Kirkpatrick M. 2019. Evolution. 5th edition. Sinauer Associates, Inc., Sunderland.
- Gould, S.J. 1977. Ontogeny and Phylogeny. Harvard University Press, Cambridge (Massachusetts).
- Gould, S.J. 2004. La estructura de la teoría de la evolución. Tusquets Editores, Barcelona.
- Hall, B.K. & Hallgrímsson, B. 2008. Strickberger's Evolution. Jones and Bartlett Publishers, Sudbury.
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- MacLeod, N. & Forey, P.L. 2002. Morphology, shape and phylogeny. Systematic Association Special Volume Series 64. Taylor and Francis, London.
- Stearns S.C. & Hoekstra R.F. 2005. Evolution. An Introduction. 2nd. Edition. Oxford University Press.
- Strasburger, E. et al. 2004. Tratado de Botànica. 35ª ed. Ed. Omega. Barcelona.
- Willmer, P. 1991. Invertebrate relationships. Patterns in animal evolution. Cambridge University Press, Cambridge.
- Willis, K.J. & McElwain, J.C. 2002. The Evolution of Plants. Oxford University Press. Oxford.
- Zelditch, M.L., Swiderski, D.L., Sheets, D. i Fink, W.L. 2004. Geometric morphometrics for biologists: a Primer. Elsevier, San Diego, CA.

INTERNET RESOURCES:

<http://tolweb.org>

<http://life.bio.sunysb.edu/morph/>

<http://1kai.dokkyomed.ac.jp/mammal/en/mammal.html>

Software

- R for Statistical Computing / Rstudio /Jamovi
- Mega Software

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	231	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	232	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	231	Catalan	second semester	afternoon

(PLAB) Practical laboratories	232	Catalan	second semester	afternoon
(PLAB) Practical laboratories	233	Catalan	second semester	afternoon
(TE) Theory	23	Catalan	second semester	morning-mixed