

Degree programme	Type	Course
Environmental Biology	OB	3

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

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

Objectives

Evolution is one of the most important unifying theories in Biology, and evolutionary processes give us the "ultimate" explanation about the diversification of organisms and life. Evolution will be examined at different scales, from molecules to ecosystems, and from changes taking place within populations and species throughout several generations to patterns of change across millennia. One of the basic principles of Evolutionary Theory is the diversification from a common ancestor, that is to say, the presence of genealogical relationships between organisms. Therefore, one of the main objectives of this module is the study of genealogical/phylogenetic relationships between organisms and how these relations are defined by the basic evolutionary processes.

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. Develop analysis and synthesis skills.
2. Apply ICT resources pertaining to this field of study.
3. Work in an international context.
4. Reason critically.
5. Focus on quality.
6. Interpret the diversity of the principal groups of living and extinct beings, from the perspective of their origins and their phylogenetic relationships.
7. Critically assess scientific advances in the field of evolution of the lineages of living beings.
8. Apply the theory of evolution to the different levels of biological organisation.
9. Interpret the general processes of adaptation to the medium on the part of organisms.
10. Recognise the principal mechanisms of speciation and their connections to adaptation to the medium.
11. Interpret the functional significance of the origin and evolution of the principal lineages of living beings.
12. Apply basic modelling techniques to establish phylogenetic relationships.
13. Recognise the principal methodologies of molecular analysis used in establishing phylogenetic relationships.

Contents

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

2. Introduction to evolutionary biology: fundamental principles.
4. Molecular evolution and characterization of genetic variability
6. Genetic variability and structure in populations. Genetic drift and migration. Breeding systems. Effective population size. Genomics and demographic inference
8. 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.
10. Evolution of life-history traits: general principles and constraints. Evolutionary game theory and the adaptive dynamics approach.
12. 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 (*).

2. 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.
4. 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.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
In-Class Theoretical Lectures	39	1.56	8, 9, 10
Computer Lab	6	0.24	2, 12, 13
Individual assignments and study	80	3.2	1, 2, 6, 7, 8, 9, 10, 11
Seminars and In-class Individual and Group Activities	7	0.28	8, 10
Data Analyses and Writing Activities	8	0.32	3, 4, 5

- 1) Theoretical lectures: 39 h. classroom attendance
- 2) Seminars, discussions and student directed learning: 7 h. classroom attendance.
- 3) Practical learning in computer lab: 6 h. lab attendance.
- 4) Personal work and study: 80 h.
- 5) Preparing and writing of group work and personal assignment: 8 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	Weight	Hours	ECTS	Learning outcomes
Written Exams and Tests on Theoretical Lectures	50%	4	0.16	1, 6, 7, 8, 9, 10, 11
Learning Assessment on Bioinformatic and Seminar Activities	50%	6	0.24	2, 3, 4, 5, 8, 10, 12, 13

- 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.

- Any irregularity committed in an assessment activity (academic fraud, plagiarism, or improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant alteration of the grade will result in that assessment activity being graded as 0. If the course syllabus establishes that obtaining a minimum grade in that assessment activity is an essential requirement to pass the course, or if multiple

irregularities occur in assessment activities, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

- In the event of suspected irregularities in any assessment activity (including academic fraud, plagiarism, or the improper use of AI), the instructors responsible reserve the right to require the students involved to undergo an in-person oral reassessment.

Bibliography

Basic Texts:

Carrión, J.S. 2003. Evolución vegetal. DM. Murcia.

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.

Judd, W.S. et al. 2002. Plant Systematics. A phylogenetic approach. 2ª ed. Sinauer Associates Inc. Sunderland.

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 realtionships. 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

- The R Project for Statistical Computing / Rstudio

- Mega Software

Course groups and languages

The information provided is provisional until November 30. After this

date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	23	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	231	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	231	Catalan	second semester	afternoon
(PAUL) Classroom practices	232	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	232	Catalan	second semester	afternoon
(PLAB) Practical laboratories	233	Catalan	second semester	afternoon