UAB
Universitat Autònoma de Barcelona

Phylogeny and Evolution

Code: 100828
ECTS Credits: 6

2025/2026

Degree	Type	Year
Environmental Biology	OB	3

Contact

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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 molecular and population genetics.

- Basic knowledge about methods for statistical inference.

Objectives and Contextualisation

Evolution is one of the most important unifiying 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 palce 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 tha 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.

Competences

- Apply ICT resources pertaining to this field of study.
- Design models of biological processes.
- Develop analysis and synthesis skills.
- Focus on quality.
- Integrate knowledge of different organisational levels of organisms in their functioning.
- Reason critically.
- Recognise and analyse phylogenetic relations.
- Understand the bases of regulation of vital functions of organisms through internal and external factors, and identify environmental adaptation mechanisms.
- Work in an international context.

Learning Outcomes

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

Content

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	1, 2, 12
In-Class Theoretical Lectures	39	1.56	3, 9, 11
Seminars and In-class Individual and Group Activities	7	0.28	3, 11
Type: Supervised			
Data Analyses and Writting Activities	8	0.32	6, 10, 13
Type: Autonomous			
Individual assignements and study	80	3.2	3, 2, 4, 5, 8, 9, 7, 11

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Learning Assessment on Bioinformatic and Seminar Activities	50%	6	0.24	3, 1, 2, 6, 10, 11, 12, 13
Written Exams and Tests on Theoretical Lectures	50%	4	0.16	3, 4, 5, 8, 9, 7, 11

- 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:

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. & Hallgrimsson, 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

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