Universitat Autònoma de Barcelona

2018/2019

Biodiversity

Code: 100931
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OT	4	0

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Francesc Muñoz Muñoz
Javier Lopez Alvarado

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 firs 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.

Skills

- Adopt clear, objective scientific criteria in order to project a positive, transparent image of biotechnology to economic, political and social agents.
- Interpret experimental results and identify consistent and inconsistent elements.
- Learn new knowledge and techniques autonomously.
- Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English or in one's own language.
- Read specialised texts both in English and ones own language.
- Reason in a critical manner
- Search for and manage information from various sources.
- Think in an integrated manner and approach problems from different perspectives.
- Work individually and in teams

Learning outcomes

1. Build up a global vision of the importance of the evolutionary and ecological processes that give rise to living organisms.
2. Critically and objectively evaluate the impacts of biotechnological advances on nature, society and political life.
3. Interpret experimental results and identify consistent and inconsistent elements.
4. Learn new knowledge and techniques autonomously.
5. Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English or in one's own language.
6. Read specialised texts both in English and ones own language.
7. Reason in a critical manner
8. Recognise the importance of biology-related organisations in the regulation of services that are essential to human health and the environment.
9. Recognise the need to preserve the biological processes that contribute to the generation and use of living organisms.
10. Search for and manage information from various sources.
11. Think in an integrated manner and approach problems from different perspectives.
12. Work individually and in teams

Content

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

1. Introduction to Evolutionary Biology: fundamental principles.

2. Genetic variability: types and applications of molecular markers.

4. Genetic variability and structure in populations. Genetic drift and migration. Breeding systems. Effective population size.

5. Units of selection. Natural selection: effects and quantification. Adaptation and exaptation. Determining adaptation: experiments, observational studies and the comparative method.

6. Speciation. The species concept. Barriers to gene flow. Gradual speciation: allopatric, parapatric and sympatric speciation. Speciation by polyploidy and hybridization. Dynamics of hybrid zones.

6. Evolution of life-history traits. Optimization, trade-off and constraints. The cost of reproduction. Life span and senescence. Offspring size and number.

7. Evolution of behavior. Evolutionary stable strategies. Sexual selection. Evolution of biological interactions.

PART-II. Macroevolution and the history of life

1. The origin of life and precambric evolution. The tree of life.
2. Patterns and processes in plant evolution. Extinction and survival in plant evolution from the perspective of the fòssil record. The origin and diversification of Angiosperms.
3. 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.

Methodology

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

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Computer Lab	7	0.28	3, 1, 11, 7
In-Class Theoretical Lectures	4	0.16	5, 3, 6, 11, 7, 12
Seminars and In-class Individual and Group Activities	39	1.56	9, 2, 1, 11, 7, 8
Type: Supervised			
Data Analyses and Writting Activities	12	0.48	11, 7, 12
Type: Autonomous			
Individual assignements and study	80	3.2	4, 9, 2, 3, 6, 1

Evaluation

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 reatke of all evaluation activities.

*** 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 evalutaion assessments will be indicated in the calendar provided by the degree 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 theoretical unit (UNIT-1) also have the right accessingthe 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.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Practical work, seminars, personal and group assignments	50	4	0.16	4, 3, 7, 12
Written exams and tests on theoretical lectures	50	4	0.16	9, 2, 10, 5, 6, 1, 11, 7, 8

Bibliography

BASIC TEXTS:

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

Freeman, S. & Herron J.C. 2007. Evolutionary Analysis. 4th. Edition. Pearson.

Fontdevila, A & Moya, A. 2003 Evoluciuón. Origen, adaptación y divergencia de las especies. Ed. Síntesis, Madrid.

Futuyma, D.J. 2009. Evolution. 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.

Strasburger, E. et al. 2004. Tratado de Botànica. 35ª ed. Ed. Omega. Barcelona.

Vargas P. & Zardoya R. 2012. El árbol de la vida; sistemática y evolución de los seres vivos. P. Vargas y R. Zardoya (Eds.). Madrid.

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

http://www.nature.com/scitable