Universitat Autònoma de Barcelona

2019/2020

Evolution

Code: 101961
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	OB	3	2

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

"*Nothing in biology makes sense except in the light of evolution*". This sentence by Theodosius Dobzhansky (*The American Biology Teacher* 1973; 35:125-129) encapsulates the role of Evolutionary Theory as unifying principle in biology. Evolutionary Analysis integrates and therefore requires knowledge from all biological sciences. To follow the course, it is advised to come in with a prior basic background in:

- Transversal math and biometrical skills (basic linear algebra and calculus, randomness and probability, random variable, discrete and continuous variables, mathematical model, distribution function, stochastic process, binomial and multinomial distributions, geometric and exponential distributions, Poisson distribution, chi-square distribution, normal distribution, populations and samples, parameters and statistics, measures of central tendency and dispersion, measures of relationship, correlation and causation, statistical inference, sampling error, bias and dispersion, null hypothesis, test of hypothesis, confidence interval, significance level, experimental error, experimental design, replication, non-parametric approximation, pseudoreplication, simulation, Bayesian approximation), learnt in the degree subjects of Mathematics (1st course, 1st semester) and Biostatistics (2nd course, 1st semester).
- Understanding of metabolism, physiology, anatomy and taxonomy of procaryote and eucaryote cells and organisms, and of fundamental concepts of classical genetics (gene, allele, homozygous and heterozygous,genotype and phenotype, asexual and sexual reproduction, somatic and germinal lines, mitosis and meiosis, gametes and genotypes, recessivity and dominance, codominance, allele segregation at one locus and at multiple loci, linkage and recombination); molecular genetics (molecular characters, nucleic acids structure, gene concepts, structural and functional categories of genomic sequences, origin and types of genetic changes, structure of regulatory regions, physical and chemical properties of amino acids, protein amino acid composition and structure, genetic codes, levels of genetic code degeneracy, mechanisms of patterning and morphogenesis, gene expression, genetic basis of development, feedback loops, epigenetics); population genetics (individuals and populations, variability, Hardy-Weinberg equilibrium, deviations from random mating, sources of genetic variation, census and effective population size, mechanisms of the evolutionary process, mutation, genetic drift, migration and gene flow, natural selection, sexual selection, adaptation, fitness and fitness components, polymorphism, substitutions and replacements, genetic load, linkage disequilibrium, genetic interaction, epistasis, adaptive landscape); quantitative genetics, (resemblance between relatives, monogenic and polygenic traits, components of phenotypic variance, additive and dominant genetic effects, heritability, selection differential, response to selection, genotype-environment interaction, nature versus nurture, genetic background, reaction norm, conflicts and trade-offs); and ecology (environment, energy flow, niche and habitat, life cycle, K and r reproductive strategies, demographic structure, population growth model, carrying capacity, survival curve, acclimation, competitive exclusion, competition and symbiosis,

conflict and cooperation, trophic levels, dispersal, metapopulation, community, ecosystem, ecological network, homeostasis, resilience, robustness, ecotone, spatiotemporal patterns of diversity) learnt in the degree subjects of Microbiology (1st course, 1st semester), Animal and Plant Biology (1st course, 2nd semester), Biochemistry (1st course, 2nd semester), Genetics (1st course, 2nd semester), Molecular Genetics of Procaryotes and Eukaryotes (2nd course, 1st semester), Cytogenetics (2nd course, 1st semester), Ecology (2nd course, 1st semester), Developmental Biology (2nd course, 2nd semester), Population Genetics (2nd course, 2nd semester), and Animal Physiology (2nd course, 2nd semester).

Objectives and Contextualisation

The theory of evolution by natural selection *represents perhaps the greatest intellectual revolution experienced by mankind* (Ernst Mayr. 2001. *What Evolution Is*. New York: Basic Books).

- To arouse an "intense" interest in evolution as an overarching explanatory framework of the natural world and of our place in it.
- To provide a solid understanding of the modern theory of evolution, and how this knowledge came to be through creativity, rigorous scientific method and the collaborative effort of scientists around the world, within changing socio-cultural contexts.
- To promote awareness towards the manifold philosophical and social implications of the evolutionary thought.
- To confront the student to the uncertainty associated with complexity and the multiple perspectives of reality, against which there are usually no unique answers.
- To promote tolerance against ambiguity and the diverse styles of learning-to-learn and to deepen in the meaning of reality.
- To promote intellectual autonomy in the search and acquisition of knowledge.
- To transmit a constructive critical stance towards alternative explanations, permanently questioning any statement and, in general, any knowledge in the light of the underlying intentions and interests.
- To translate theoretical knowledge into practice, demonstrating the applicability of evolutionary science and the positive impact that responsible citizens equipped with this knowledge can have in society.

Competences

- Apply knowledge of theory to practice.
- Be able to analyse and synthesise.
- Be able to communicate effectively, orally and in writing.
- Describe the diversity of living beings and interpret it evolutionally.
- Develop analysis, synthesis and communication strategies to transmit the different aspects of genetics in educational settings.
- Use and interpret data sources on the genomes and macromolecules of any species and understand the basics of bioinformatics analysis to establish the corresponding relations between structure, function and evolution.
- Use and manage bibliographic information or computer or Internet resources in the field of study, in ones own languages and in English.

Learning Outcomes

1. Apply knowledge of theory to practice.
2. Be able to analyse and synthesise.
3. Be able to communicate effectively, orally and in writing.
4. Defend, while synthesising genetic and other evidence, evolution as fact.
5. Describe the characteristic features of human evolution.
6. Describe the main groups of organisms that form past and present biological diversity.
7. Enumerate and define the microevolution and macroevolution processes that have caused and diversified life.
8. Use and manage bibliographic information or computer or Internet resources in the field of study, in ones own languages and in English.

9. Use genomic information to infer the evolutionary processes of genes, genomes and organisms.

Content

Outline of the course

Lectures

1. Evolution explanation and language.
2. The evidence for evolution.
3. History of evolutionary thought
4. Molecular evolution
5. Phylogeny and the timing of evolutionary events.
6. Species and speciation
7. Radiation and extinction

Theory seminars:

1. Origin of life
2. Human evolution
3. The diversity of human populations
4. Evolution of the brain and language
5. Evolution and health
6. Conflict and cooperation

Methodology

The course is based on continuous assessment, with an emphasis placed on the acquisition of both knowledge and skills. Student participation, not fearing to ask for assistance or clarification is highly encouraged and valued.

Learning activities will consist of:

Directed

- Visually supported lectures
- Theory seminars

Supervised

- Individual tutoring support
- Student presentations
- Group work
- In-class debates

Autonomous student study

- Critical reading of prescribed texts

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory / Problems seminars	15	0.6	1, 4, 3, 2, 8, 9
Theory Lectures	30	1.2	4, 6, 5, 7, 2, 8, 9

Type: Supervised			
Tutorials	6	0.24	1, 3, 2
Type: Autonomous			
Bibliographical searches	12	0.48	1, 2, 8
Critical reading of prescribed texts	20	0.8	2, 8
Study	60	2.4	1, 3, 2, 8

Assessment

Assessment activities

- Partial written exam 1 (35%).
- Partial written exam 2 (35%)
- Theory seminars, student presentations, group work and in-class debates (30%).

Note

- To pass a partial exam, students must obtain a grade equal or superior to 5. Failing a written exam implies a FAIL for the whole course.
- The grade for the written exam activity is the average of the grades for the two partial exams.
- Students who obtain a grade equal or superior to 4 in a partial exam can compensate if the average with the grade of the other partial exam is equal or superior to 5.
- Students who fail or do not attend a partial exam must attend the re-assessment exam to pass the subject (see third point in the Re-assessment section below).

Re-assessment

- Students will re-assess only those written exams that they did not pass.
- The maximum grade that can be awarded at re-assessment is PASS.
- To be eligible for the re-assessment 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

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Critical reading of prescribed texts	30%	0	0	1, 3, 2, 8
First partial test	35%	3.5	0.14	1, 4, 6, 5, 7, 3, 2, 9
Second partial test	35%	3.5	0.14	1, 4, 6, 5, 7, 3, 2, 9

Bibliography

The basic textbooks for this subject are:

- Futuyma D and M Kirkpatrick. 2017. Evolution (4th ed.) Sinauer.
- Graur D. 2015. Molecular and Genome Evolution (1st ed.) Sinauer.