UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

EVOLUTIOANARY BIOLOGY

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	BIO/05 (ZOOLOGY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	EXPERIMENTAL AND APPLIED BIOLOGY
Curriculum	Biologia ambientale e biodiversità
Year of study	2°
Period	2nd semester (01/03/2022 - 14/06/2022)
ECTS	9
Lesson hours	72 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	GOMULSKI LUDVIK MARCUS (titolare) - 9 ECTS
Prerequisites	General Zoology Course
Learning outcomes	At the end of the course the student is expected to be able to understand and be able to explain and apply the various concepts in evolutionary theory taught during the course
Course contents	The Evolutionary Biology course (9 CFU) is held by Prof. Ludvik Gomulski. The rise of evolutionary biology: Origins and development of evolutionary thought. Lamarck's evolutionism. Cuvier and catastrophism. Darwin and Wallace: the theory of natural selection. Mendel and the discovery of the mechanisms of inheritance. The "modern synthesis".

Molecular and Mendelian genetics:

The origins of the variation; mechanisms of inheritance: Mendelism and inheritance by non-Mendelian blending.

Evidence to support evolution

Natural selection:

The theory of natural selection; The Hardy-Weinberg equilibrium; Fitness and selection coefficient; Selection models; advantage of the heterozygote; frequency-dependent selection.

Random Events in Evolution:

Genetic drift; founder effect; bottleneck and coalescence. Effective population size and genetic drift.

Speciation:

The concept of species: pre- and post-mating barriers. Dobzhansky-Muller theory. Haldane's rule. Allopatric speciation. Peripatric speciation; hybrid zone; tension zone; reinforcement. Sympatric speciation; Sequential speciation.

Evolution of Sex:

The existence of sex is an important unsolved problem of evolutionary biology; Sex has a cost; Sex can accelerate the speed of evolution; selective interference, Hill-Robertson effect. Kondrashov's mutational theory of sex. Hamilton's theory of parasite-host coevolution of sex. Ruby-in-the-rubbish effect. Muller's ratchet. Inbreeding and cross-fertilization. Evolution of the sex ratio.

Sexual selection: Competition between males: Alternative strategies: Sperm competition. Infanticide. Sexual selection on males: female choice; Ronald Fisher and Galloping Selection; Good genes and Zahavi's Handicap Theory. Hamilton's parasitic theory of sexual selection. Sexual selection on females. Polyandry: multiple mating by females. Sexual selection in flowering plants. Sexual dimorphism in humans.

Coevolution:
Coevolution and coadaptations; Coevolution between plants and herbivores - mirror phylogenies, and the lack of cofilogenesis; host shifts. Coevolution between angiosperms and pollinators. mutualism. Host-parasite coevolution. Evolution of parasite virulence, trade-off hypothesis; short-sighted hypothesis of evolution; coincidental hypothesis of evolution: The coevolutionary arms race; antagonistic coevolution; progressive evolution and escalation: arms race; the Red Queen hypothesis

Molecular evolution:

	Natural selection and random drift in molecular evolution; The "pure" neutral theory; the molecular clock. The nearly-neutral theory of molecular evolution; Evolutionary rate and functional constraint; Relationship between non-synonymous and synonymous mutations as a proof of selection (dN / dS ratios); Preferential trends in the use of synonymous codons; “Hitchhiking and Background selection" effects; Selective sweep. The reconstruction of phylogeny: Phylogeny inferred from morphological characters using cladistic techniques; Homologies and homoplasies; Ancestral homologies and derived homologies; Inference of the polarity of the states of character - comparison with the outgroup and the fossil record; Molecular sequences and phylogeny; Statistical techniques for inferring phylogenies from molecular sequences - molecular distances - principle of parsimony - principle of maximum probability; Orientation of trees; Reliability of phylogenetic prediction; Applications of molecular phylogenetics. Punctuated Equilibrium and Stasis
Teaching methods	Lessons
Reccomended or required readings	Evolution. Douglas J. Futuyma & Mark Kirkpatrick. 4th Edition. 2017. Sinauer Associates. Evolution. Ridley M. Evolution. 3rd Edition. 2004. Blackwell Publishing.
Assessment methods	The exam consists of a written exam, aimed at ascertaining the skills acquired in relation to the course contents. The exam focuses on at least four distinct topics relating covered during the course. The final assessment is based on the degree of depth and understanding of the topics presented and on the ability to integrate the knowledge acquired during the course.
Further information	The exam consists of a written exam, aimed at ascertaining the skills acquired in relation to the course contents. The exam focuses on at least four distinct topics relating covered during the course. The final assessment is based on the degree of depth and understanding of the topics presented and on the ability to integrate the knowledge acquired during the course.
Sustainable development goals - Agenda 2030	15 Life on Land The goals