COASTAL AND MARINE BIOLOGY AND ECOLOGY (LM51)

(Lecce - Università degli Studi)

Teaching DEVELOPMENT AND EVOLUTION OF MARINE ORGANISMS

GenCod A005726

Owner professor Stefano PIRAINO

Teaching in italian DEVELOPMENT AND EVOLUTION OF MARINE ORGANISMS

Course year 1

Teaching DEVELOPMENT AND EVOLUTION OF MARINE ORGANISMS

Language INGLESE

SSD code BIO/05

Curriculum PERCORSO COMUNE

Reference course COASTAL AND MARINE BIOLOGY AND ECOLOGY

Course type Laurea Magistrale

Location Lecce

Credits 5.0

Semester Primo-Semestre

Teaching hours Ore-Attivita-frontale: 42.0

Exam type

Assessment

For enrolled in 2019/2020

Course timetable https://easyroom.unisalento.it/Orario

Taught in 2019/2020

BRIEF COURSE DESCRIPTION

Evolutionary developmental biology, or EvoDevo, is one of the most active frontiers of the life sciences, despite the fuzzy definition of its scope and its sometimes problematic boundaries in respect to the parent disciplines – evolutionary biology and developmental biology. Many marine animal taxa offer superb opportunities towards the comparative approach of animal morphogenesis and evolution. The course will provide a rapid snapshot of modern issues regarding the establishment of animal bauplan across a range of model organisms, providing evidence in support of deep evolutionary homologies at the base of the diversification of all organisms. A core parallelism between biodiversity and biohomology will inspire the whole course.

REQUIREMENTS

Fundamentals of general biology, zoology, developmental biology and genetics are prerequisites to achieve high proficiency of this course.

COURSE AIMS

The main knowledge acquired by the student will be - learning the fundamental mechanisms that regulate ontogenesis, the influence of the environment on genotype and phenotypic plasticity. - the study of non-traditional animal models for the analysis of animal phylogenesis; - understanding of the fundamental mechanisms of cellular development and differentiation, the concepts of homology and analogy; - the development of the ability to communicate the information acquired through correct terminology - the development of the ability to present relevant information in a concise and clear manner, analyzing it logically and critically.

TEACHING METHODOLOGY

32 hours of lectures (16 lessons of 2 hours each) and two exercises for a total of 10 hours of workshop activity.

ASSESSMENT TYPE	The achievement of the credits attributed to teaching is obtained through a written test with five open-ended questions with different degrees of complexity. This work evaluates the learning outcomes acquired by the student. The analysis of answers will be carried out by direct interview with the teacher. Upon motivated request of the student, the written test is completely replaced by an oral exam. The final grade is expressed in thirtieths, with possible praise. For each given answer, the student will get up to 6 point, depending on the level of inclusivity and the supporting arguments provided by the answer. Any answer not given will equal to 0 points. To pass the exam it is necessary to obtain a minimum score of 18 points, equal to a grade of 18/30. If the exam is insufficient, or the final score is less than 18, the written test must be repeated. Following a double failure to pass the written test (due to insufficiency or non-acceptance of the grade obtained), the exam can only be taken by interview with the teacher. The attribution of the final score will be taken into account: of the level of theoretical and practical knowledge acquired (50%); the ability to apply the acquired knowledge (30%); autonomy of judgment (10%); of communication skills (10%).
ASSESSMENT SESSIONS	to be published by August 2019.
OTHER USEFUL INFORMATION	Students enrolled at the University of Salento can obtain free access to a dropbox or google drive folder where they are available in pdf format: a) slides of 16 lectures; b) material used for laboratory exercises; c) in-depth scientific articles.

FULL SYLLABUS

Definition of Eco-Evo-Devo. Genotype and phenotype, adaptive plasticity. Epigenetic landscape and seascape. Polyphenism, ecomorphs. Mutants and polymorphic variants. Phenotypic plasticity: norm of reaction and polyphenism. Cysts and resting stages. Predator-induced, nutritional, social, environmental polyphenism. Imposex. Kairomones. Evolution at work: the case of the stickleback fish. Environment as source or filter of variation. Cnidarians and the evolution of Metazoa: old dogmas, new perspectives. Hypotheses on the striated muscle evolution. The medusary nodule as an example of triploblastic organization of cnidarians. Ctenophores and their evolutionary placement at the base of the metazoan tree. On the origin and evolution of nervous system: CNS, neurons, and ion channels evolution. Extraretinal photoreception in cnidarian larvae. Light perception in the sea. The Darwinian prototypic eye. The giant compound eye of sea urchins. Cnidarians as model organisms for aging and senescence studies. Reverse development and morph rejuvenation. Principles of cell differentiation and cell transdifferentiation. Morph rejuvenation in colonial ascidians: Blastogenesis. Pluripotent stem cells. IPCs and the search of Yamanaka's factors in marine invertebrates. Integrative modern taxonomy and DNA barcoding. Speciation: mechanisms and patterns. Anagenesis and cladogenesis. Coexistence of species by character displacement: Homage to Santa Rosalia. The fractal nature of environment. Character displacement and behavior: the case of kleptopredation. Keystone species. Species and population, metapopulations. Introgression mechanisms.Prezygotic and postzygotic barriers as mechanisms of speciation. Allopatric, Parapatric, Sympatric models of speciation. Habitat fragmentation. Assortative mating. Carson's hypothesis (1975) - Flush and Crash as a temporal mode of speciation.
Proofs of Evolution: fossil records, comparative anatomy and comparative developmental biology, DNA. Brief history of the evolutionary theories: from Anaximander to Darwin and beyond. Tetrapods and mechanisms of limb development. Horizontal Gene Transfer and reticulate evolution. Epigenesis: intrapopulation allele polymorphism and the finch beaks' thickness. The Red Queen Hypothesis and coevolutionary processes. Molecular clocks. Natural selection, acclimation and adaptation. The gradualistic model of speciation. A paleontologist's view: the punctuated Equilibria theory by Eldredge and Gould. Neutralism and neodarwinism. Epigenetic molecular changes in development. Methylation and glucocorticoid receptors. Genomic cross-talks between animals and microbes. The importance of associated microbiomes: an example from the sponges as holobionts.

REFERENCE TEXT BOOKS

- Wanninger A (ed.) Evolutionary Developmental Biology of Invertebrates. Springer
- Carroll S, Grenier JK, Weatherbee SD. From DNA to Diversity. Molecular Genetics and the evolution of animal design. Blackwell.
- Gilbert S, Epel D. 2009. Ecological Developmental Biology: Integrating Epigenetics, Medicine, and Evolution. Sinauer.