UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biology of Reproduction and Development

2526-1-F0602Q102

Aims

The course aims to describe the complex mechanisms that regulate the reproduction and development of a new animal organism, from a comparative and evolutionary point-of-view.
The main objectives are the following:
The student will learn tha main phases and mechanisms that shape an animal body through gametogenesis, fertilization and embryo developpment, in particular for Mammalians and other Vertebrate classes.
The student will be able to apply the knowledges aquired in the fields of classic and experimental embryology and developmental biology by reconstructing the developmental stages of model organisms
The student will be provided with instruments to critically elaborate the contents of the course and to stimulate the self evaluation of the aquired knowledges and the scientific advancements in the field of reproductiove and developmental biology.
The student will develop the ability to correctly communicate the contents of the course and the results achieved by the recent scientific literature, by mean of a rigorous scientifc language and using different tools.
The student will aquire strong skills to autonomously perform the studies on the biological phenomena involved in the reproduction and development of animals. Such skills will be also useful to face further courses on animal and cell biology for biomedical and environmental applications.

Contents

During the course, the steps that regulate the development of a new organism, starting from the gamete production and fertilization, to the development of new tissues and organs, will be described. In particular, the development of model Vertebrates will be addressed, with special emphasis on Mammalians. The main developmental phases, i.e. fertilization, cleavage, gastrulation and organogenesis, will be covered during the course.

Detailed program

Male and female reproductive system.
Gametogenesis: mechanisms that regulate the process of spermatogenesis and oogenesis in Mammals. Morphology of gametes. Classification and comparison of egg cell in experimental models of development.
Fertilization: Activation of the spermatozoon. Interaction, binding and recognition of gametes. Activation of egg cell metabolism and zygote formation.
Cleavage: mechanisms that regulate segmentation in Mammals and comparison with experimental models of development (sea urchin, amphibians, birds). Morphology of the blastocyst, specification of cell fate in the blastocyst. Mechanisms that regulate the blastocyst implantation.
Gastrulation: cell specification, organization of embryonic germ layers and extra-embryo membranes. Formation of ectoderm, mesoderm and endoderm. Identification of the axes.
Embryonic annexes and placenta: description and functional role of the embryonic annexes in vertebrate embryos; differentiation of the placenta in Mammals.
Organogenesis: mechanisms that regulate organogenesis. Neural tube formation: primary and secondary neurulation. Neural tube differentiation. Differentiation of the presumptive epidermis.Differentiation of paraxial mesoderm: processes that regulate somitogenesis. Determination and fate of the sclerotome, dermatome and myotome.Differentiation of intermediate mesoderm. Differentiation of the mesoderm of the lateral laminae.Differentiation of the endoderm.The development of the tetrapod limb.
Introduction to reproductive and deveopmental toxicology, including teratology.
Experimental models in embryology: environmental and biomedical applications
Environment and Developmental Biology: the Eco-Devo principles
During the course, the students will perform laboratory experiences with aquatic vertbrate embryo models, to recognize the different developing stages and eventual perturbations in presence of xenobiotics..

Prerequisites

Cytology, Histology and Comparative Anatomy

Teaching form

delivered didactics in presence: 16 lessons of 2 h
interactive didactics in lab: 1 experience of 2 h and 2 experiences of 4 h

Textbook and teaching resource

Recommended textbooks:
Biologia dello sviluppo (V ed IT). Aut. S.F. Gilbert, M.J.F. Barresi, Ed. Zanichelli
Developmental biology (XI ed. ENG). Aut. Gilbert and Barresi, Ed. Sinauer.

Manuale di Biologia dello Sviluppo Animale. Aut. Menegola, Bonfanti, Colombo, del Giacco, Ed. EdiSES (2019)

Additional textbooks
Embriologia (III ed.) Aut. Barbieri e Carinci, Ed. CEA
Embriologia umana (VI ed) Aut. Larsen, Ed. Edra
Eco-Devo. Ambiente e biologia dello sviluppo. Aut. Gilbert, Epel. Ed. Piccin

Biologia dello sviluppo. Aut. Giudice, Augusti-Tocco, Campanella. Ed. Piccin

The teaching material used in classroom (slides), the registrations of the lessons and the scientific papers will be uploaded on the Moodle page of the course

Semester

First semester

Assessment method

Oral examination.
The exam will be based on questions on the different parts of the program and lab activities and on specific topics from the scientific literature. The candidate should demonstrate to have acquired the basic knowledge on the different embryological aspects, as well as the capacity to link the processes that regulate the development of an organism. Moreover, the ability of the student to critically discuss a paper from the scientific literature will be evaluated.

Office hours

By appointment upon request to the e-mail address:paride.mantecca@unimib.it

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | LIFE BELOW WATER | LIFE ON LAND