Study Programme : MSc in Biology

Degree level: Master degree

Course Title: Mechanisms of animal growth and development

Professor: Milica Matavulj

Required/Elective Course: ElectiveCourse

Number of ECTS: 7

Prerequisites: Courses of: Cell biology, and Histology and Embryology

Course Objective: Course in Mechanisms of growth and development has goal to offer to students detailed insights in biology of development and in the last advance in knowalage and investigations in this area. Taken in account priviously knowalages from courses of Cell biology, Histology and ebryology and Genetics this course takes into consideration of specific machansams of development and morphogenesis of animal organisms.

Course Outcome:

At the end of the course, students will acquire theoretical and practical knowledge of: animal development processes, cellular bases of development, cell fate, potency and determination during development, cell differentiation during development, localized cytoplasmatic determinants, body axes and planes formation, the principle of induction, pattern formation and embryonic fields, hormonal control of development, organismic growth and senescence

Course Content:

Theoretical part

Analysis of development (the principle of epigenesis, classical analitical strategies in developmental biology. The role of the cells in development (the principle of cellular continuity). Gametoogenesis (spermatogenesis, oogenesis). Fertilization (interactions before sperm-egg adhesion, fertilization in sea urchins, fertilization in mammals, egg activation, blocks to polyspermy). Cleavage (yolk distribution and cleavage pattern, clevage patterns of representative animals). Cell fate, potency and determination (fate mapping, potency of embryonic cells, determination of embryonic cells, properties of the determined state). Genomic equivalence and the cytoplasmic environment (totipotency of nuclei from embrionic animal cells, pluripotency of nuclei from differentiated animal cells, control of nuclear activities by the cytoplasmic environment). Localized cytoplasmic determinants body (the principle of cytoplsmic localisation, properties of localized cytoplasmic determinants). Axis formantion and mesoderm induction (body axes and planes, the principle of induction, molecular mechanisms of dorsoventral axis formation and mesoderm induction). Gastrulation (the analysis of morphogenesis, gastrulation in: sea urchins, amphibians, fishes, birds and humans). Cell adhesion and morphogenesis (cell aggregation studies in vitro, cell adhesion molecules, ECM molecules and their receptors, the role of cell and substrate adhesion molecules in morphogenesis). Neurulation and axis induction (neurulation and axis induction, mechanisms of neurulation in amphibians, the role of induction in axis formation, pathways of neural induction. Cell differentiation (the principle of cell differentiation). Pattern formation and embryonic fields (regulation and the field concept, charasteristictics of pattern formation). Hormonal control of development (general aspects of hormone action, hormonal control of: sex differentiation in mamales, brain development and behavior in vertebrate, insect metamorphosis, amphibian metamorphosis). Organismic growth (measurment and mechanisms of growth, growth hormones, growth factors, cell cycle control, growth and pattern formation) and oncogenesis (tumor-related genes). Senescence (evolutionary hypotheses on senescence).

Practical part

Laboratory practice covers: (1)l ight microscopy examinations of: oogenesis on preparate of ovari, spermatogenesis on preparates of prepubertal and adalt testes, frogg blastula, nural tubes of frogg and chicken, and (2) computer animations of main developmental processes: fertilization, blastulation, gastrulation and neurulation in animal model systems (sea urchins, amphibians, fishes, birds and humans).

Reading List:

1. Kalthoff, K. (2001). Analysis of biological development. McGrawHill, New York.
2. Walbot, V., Holder, N. (1987). Developmental biology. Random House, New York

Total hours:				
Lectures: 2	Practicals: 2	Other:	Student research work:	

Methods of instruction:

: lectures, laboratory practice, seminars

Assessment (maximum number of points 100)

Requirements	**points**	**Final exam**	**points**
Active participation in lectures	5	Practical exam	30
Active participation in practicals	5	Oral exam	
Test(s) or	60		
Pre-exam testing			

Remark: -