



NEUROGENESIS AND COMPARATIVE NEUROMORPHOLOGY

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	BIO/06 (COMPARATIVE ANATOMY AND CYTOLOGY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	NEUROBIOLOGY
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (01/10/2021 - 14/01/2022)
ECTS	9
Lesson hours	80 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	BOTTONE MARIA GRAZIA (titolare) - 4 ECTS GARAGNA SILVIA - 1 ECTS RODA ELISA - 3 ECTS ZUCCOTTI MAURIZIO - 1 ECTS
Prerequisites	An adequate knowledge of Cell Biology and Comparative Anatomy is required.
Learning outcomes	The course is intended to provide knowledge on the concept of stemness and on its epigenetic regulation; on the origin of stem cells also through cell reprogramming technologies; this knowledge is necessary for the understanding of the development and morphology of central nervous system. Particular attention will be focused on (i) embryonal and adult neurogenesis, and (ii) evolution and comparison of vertebrate CNS, also in relation to the complex architecture of brain areas in mammals.

Course contents

Part 1. Following an introduction on the techniques used for the study of the cell structure and function, and of the signalling pathways of cell communication, the course will describe the epigenetic mechanisms regulating cell stemness.

Part 2. The concept of stemness will be resumed through the study of the phases of peri-implantation embryo formation and the formation of embryonic territories towards neurulation; the different types of stem cells and their sources; the derivation of pluripotent stem cells and the reprogramming of terminally differentiated cells.

Part 3. Topics covered will include: 1) CNS ontogenesis in vertebrates: morphology and molecular aspects. Induction and formation of the neural tube; brain vesicles; neuromeres. Neurogenesis in the brain ventricle wall: proliferation, migration and differentiation. Development of brain cortical areas. Genesis of synaptic contacts, cell death and synapse elimination; neural circuits. 2) Adult neurogenesis and stem cells: neurogenic areas and molecular markers.

Part 4. The course will describe: (i) anatomical organization of the invertebrate brains, including structure and cytoarchitecture of the brain in molluscs, annelida and artropods; (ii) CNS evolution in the vertebrates. In particular anatomy, cytoarchitecture and functional aspects will be examined, with particular attention to the evolutionary changes of cerebral and cerebellar archi-, paleo- and neo-cortices, in correlation with the evolution of the encephalon macro and microcircuits. Contemporaneously, the main cellular, morphological and morphofunctional techniques applicable in neurobiology will be illustrated, mainly through laboratory demonstrations. In particular, the following methods will be discussed: 1) cellular techniques of neurobiologic interest; 2) advanced microscopic techniques; 3) biomolecular immunocytochemistry on nervous cells and tissue. Frontal lectures will be further integrate with scientific seminar concerning (i) neurobiological in vitro and in vivo experimental studies; (ii) notions of Comparative Anatomy, essential for the comprehension of the topics covered in the course (Part 3 and 4).

Teaching methods

Part 1 and Part 2: Frontal lectures.

Part 3 and Part 4: Frontal Lectures, seminars and lab practice exercises.

Reccomended or required readings

Part 1 and Part 2: the teachers will make all the slides used during the lessons available to the students and, also, they will provide with scientific articles

Part 3 and Part 4:

Lecture notes and Bibliographic material provided by the teacher.

Recommended textbooks:

(i) "Lo sviluppo del Sistema Nervoso" Sanes D.H. et al., Zanichelli Ed.

(ii) "Guide to Research Techniques in Neuroscience"

Authors: Matt Carter, Jennifer C. Shieh

(Stanford University, School of Medicine, Stanford), Academic Press (Elsevier Ed.)

(iii) "Cellular and molecular methods in neuroscience research"

Editors: Adalberto Merighi, Giorgio Carmignoto, Springer-Verlag New York, Inc.

A common written exam with open questions on contents of all course parts.

The exam will evaluate how the student has integrated the knowledge acquired during the course and the level of achievement of the training goals.

The final grade will be the weighted average of the mark obtained in the test of parts 1 and 2 with the mark obtained in the test of parts 3 and 4.

Further information

The teachers are available to provide clarifications on the contents of the modules by appointment via e-mail.

Goal 4. High quality education

[The goals](#)