UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Neuroscienze

2021-1-F0601Q089

Aims

A. Knowledge and understanding. The course presents a general view of the main concepts and research fields in Neurosciences, from the cellular to the system level, with a reference to some pathological implications.

B. Applied knowledge and understanding. The fundamental notions are indispensable to pursue further studies in neuropathology and pharmacology.

C. Making judgements. A comprehension of the logic and concepts of neuroscience will enable the student to make a personal critical opinion on neuroscientific matters.

D.Communication skills. The student will learn to properly communicate the neuroscientific concepts and notions.

E.Learning skills. The personal understanding acquired is necessary to proceed with personal studies.

Contents

1) Introduction and evolutionary aspects. 2) Cell neurophysiology. 3) Synaptic physiology and local neuronal circuits. 4) Integration and control of cerebral functions. 5) Some neuropathological implications.

Detailed program

Introduction. Evolution of the nervous systems of Vertebrates and Invertebrates. Experimental models in Neurobiology.

I) Selected topics in cell neurophysiology.

Main cell types, fundamentals of neurophysiology, molecular motors in the neuron. Blood-brain barrier. Control of pH and extracellular K+ in the brain. Peculiar aspects of cerebral metabolism: neuron-glia interaction. Volume regulation: role of glial cells, volume control in gliomas.

II) Synaptic physiology and local neural circuits.

Historical introduction. Fundamentals of glutamatergic, GABAergic and peptidergic transmission. Cellular basis of learning and memory.

Orientation and navigation. Role of the hippocampus. Local circuits. Cell diversity in the cerebral cortex. Laminar organization. Microcolumns.

Pathological implications: molecular and cellular mechanisms of epilepsy.

III) Integration and control of brain functions

Ascending modulatory systems. Mood control. Biological rhythms and environment. Suprachiasmatic nucleus, photoperiod. Sleep-waking cycle in the Animal Kingdom. Sleep in mammals and birds. Reticular system. Thalamocortical system.

Sensory Systems: general aspects and signal coding. Psychophysics and sensitivity. Adaptation. Central elaboration. Sensory cortices. Granular cortices. Associative areas. The 'binding' problem.

Motor Systems. Hyerarchical levels of control. Motor execution, error correction and learning. Motor schemes and locomotion. Cerebellum (hints). Motor and premotor regions. Agranular cortices. Pyramidal tract. Motor coding. Motor cortex plasticity. Premotor regions and mirror neurons. Volition and motor acts.

Neuropathological implications: autism and schizophrenia.

Prerequisites

General Physiology. Systems Physiology.

Teaching form

Oral lessons. During Covid-19 emergency, most lessons will be delivered telematically and asynchronously, with a few synchronous events (announced by the Forum through the E-learning page of the course).

Textbook and teaching resource

Pdf files and registered lessons on E-learning.

Reference textbooks:

Kandel et al., Principles of Neural Sciences, McGraw-Hill 2013.

Brady et al. Basic Neurochemistry. Academic Press, 2012.

Swanson. Brain Architecture. Oxford University Press.

Semester

First semester

Assessment method

Oral exam (by Webex, in case of Covid-19 emergency). There are no in itinere tests.

The exam begins with the student presenting a topic of his/her choice, among those treated during the course.

Next, the discussion is extended to other topics, to evaluate the student's comprehension of the main concept of modern Neurosciences.

Office hours

Appointment by E-mail