UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Neurobiochemistry

2425-1-F0802Q064

Aims

The course aims to provide students with the fundamental tools to study brain function and the pathogenetic mechanisms underlying neurological and neurodegenerative disorders. To this end, the course provides advanced knowledge of brain biochemistry, the molecular bases of neurodegenerative disorders linked to both genetic mutations and to age-related environmental factors, the experimental models (cellular and animal), and the biotechnological applications for the development of biomarkers and new drugs.

Knowledge and understanding.
To gain the knowledge of mechanisms underlying brain function under physiological and pathological conditions, and new biotechnological approaches for diagnostics and therapy.

Applying knowledge and understanding.
To use this knowledge for both basic and applied biomedical research studies.

Making judgments.
To recognize, evaluate and integrate this knowledge with other scientific issues offered by other advanced studies.

Communication skills.
To acquire the appropriate communication skills for the discussion of the topics of the course.

Learning skills.
To be able to understand and integrate this knowledge to the new advances in neurobiochemistry offered by scientific literature.

Contents

Biochemistry of the nervous system: neuronal differentiation, energy metabolism, biochemistry of

neurotransmission, molecular mechanisms of neurodegenerative diseases and new biotechnological strategies for diagnosis and therapy.

Detailed program

Organization of the nervous system and properties of its cellular components (neurons and glial cells).
Brain metabolism: blood-brain barrier and energy metabolism; other brain metabolic pathways; neuro-metabolic coupling; biochemistry of aging.
Synaptic transmission; classes of neurotransmitters and their metabolism; neurotransmitter receptors and post-synaptic signaling; gliotransmission and tripartite synapse.
Brain development and aging; role of neurotrophic factor in regulating differentiatio, neuronal death-survival (apoptosis and autophagy), maintenance of neuronal phenotype, homeostasis and neurotransmitter activity.
Biochemical-molecular basis, diagnosis and therapeutic strategies neurodegenerative diseases: Alzheimer, Parkinson, Multiple Sclerosis, Amyotrophic Lateral Sclerosis and Huntington. Role of misfolded proteins, neurotrophic support, oxidative stress, excitotoxicity and reactive gliosis.
Models of neurodegenerations: neurons and glial cells (2D and 3D cultures) as in-vitro experimental models; animal models (pharmacological, surgical and genetic models) of neuropathologies.
New biotechonological strategies for diagnostics and therapy: gene therapy, cellular therapy using stem cells, vaccines, recombinant human proteins, mimetic molecules and nanoparticles for drug delivery.

Prerequisites

Background. Basic knowledge of biochemistry and cellular biochemistry.
Prerequisites. None

Teaching form

The course involves 21 face-to-face lectures. All of them are in presence and involve both Delivered and Interactive modes. Specifically:
20 lessons are in a Delivered mode, but with a strong Interactive feature, therefore all students are warmly invited and encouraged to participate and ask questions for both further explanations and/or in-depth analyses.
The last class is taken in a total Interactive manner, in a Journal club style, with the presentation of scientific article/s about one or more topics relevant to the content of the course, agreed with the students and involving the intervention of all of them.

Teaching language: italian.
The course will be in English, based on students request (at least 10% of students, or in the presence of students of the International programs Erasmus or double degree)

Textbook and teaching resource

Slides of the course. Available tuo all students on the e-learning platform of the course.

Bibliography. Selected scientific articles available on the e-learning platform of the course.

Textbooks
PRINCIPI DI NEUROSCIENZE / E.R. Kandel – Schwartz - Jessel
NEUROCHIMICA / George J. Siegel ... [Et al.]

Semester

Second semester

Assessment method

Oral exam based on the discussion on the topics of the course.
The exam initially focuses on one topic of choice by the student, among those of the course. The discussion continues with questions about other topics to evaluate the preparation of the student on the contents of the course and the communication skills.

Office hours

Contact: on demand by email to the teacher.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION