Universitat Autònoma de Barcelona

Neurochemistry

2016/2017

Code: 100859
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OT	4	0

Contact

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Use of languages

Principal working language: catalan (cat)

Some groups entirely in English: No

Some groups entirely in Catalan: Yes

Some groups entirely in Spanish: No

Other comments on languages

The teaching materials (slides, exercices etc...) will be written partially or totally in English. The exercises of the seminars will be presented and discussed at class in English.

Teachers

Maria Josefa Sabria Pau

Lilian Enriquez Barreto

Prerequisites

There is no official requirements, but it is recommended that students have completed most of the subjects of the first three courses of the Biomedical Sciences or Biochemistry degrees.

Objectives and Contextualisation

In the context of Molecular Physiology, the Neurochemistry course is designed to understand the basic function, physiology and pathology of the central and pheripheral nervous system. This course includes the study of different cell types and regions involved in the function of the adult brain. The subject emphasizes the teaching of biochemical and cellular processes involved in interrelationships of different brain regions. A central point of the agenda is the knowledge of the different types of neurotransmission and molecular mechanisms that regulate the release of neurotransmitters and postsynaptic action (neuronal plasticity and gene expression). It focuses in molecular processes involved in metabolism, regulation and release of the major neurotransmitters (glutamate, GABA, acetylcholine, catecholamines, serotonin, neuropeptides and others), as well as their mechanisms of action in the postsynaptic cell. Finally, we will focus on the biochemical and pathophysiological mechanisms involved in brain diseases such as mental disorders and neurodegenerative diseases. The final objective is to examine the biochemical and molecular aspects of brain function in physiological and pathological conditions so that the student can develop critical reasoning about the nervous system.

The specific aims of this course are:

1. To understand the cellular organization of the nervous system.

2. To understand the anatomical organization of the nervous system.

3. Acquiring a global view of the relationships between different brain regions.

4. Understanding the importance of the blood-brain barrier and cellular compartmentalization in the context of the metabolism of nervous system.

5. To underrstand the molecular and electrical fundaments responsible for the transmission of nerve impulses.

6. To know the molecular events at synapses and neurotransmitter storage, release and inactivation

7. To know the molecular structure and function of ionchannels and membrane receptors for neurotransmitters

8. To know the basis of the metabolism and action of the main neurotransmitters

9. To understand the biochemical mechanisms involved in some diseases of the nervous system

10. Develop critical reasoning to deepen into scientific issues related to biochemistry of the nervous system

Content

CHAPTER I: FUNDAMENTS OF NEUROSCIENCE

1. CELLULAR STRUCTURE OF THE NERVOUS SYSTEM

Morphological, molecular and functional cell types of the nervous system: neurons and glial cells. Structure of myelin.

2. ANATOMY OF THE NERVOUS SYSTEM

Organization of the central and peripheral nervous system. Functional relationships of anatomical brain regions

3. HOMEOSTASIS OF THE NERVOUS SYSTEM

Cellular compartmentalization. Blood brain barrier. Cerebrospinal fluid.

CHAPTER II: BASIS OF THE NEURONAL EXCITABILITY

4. BIOCHEMICAL AND ELECTRICAL BASES OF NEURONAL EXCITABILITY

Electric transmission signal. Resting potential. Action potential.

Function and structure of ion channels. Local potential and neuronal integration.

CHAPTER III: NEUROTRANSMISSION: AN OVERVIEW

5. NEUROTRANSMISSION IN THE NERVOUS SYSTEM

Types of neurotransmission: chemical and electrical synapses. Structure, function and morphology of synapses. Calcium-dependent and -independent neurotransmitter release. Structure and cycle of synaptic vesicles. Processes associated with plasticity. Structure of neurotransmitter receptors: ionotropic and G protein-coupled receptors and effectors. Desensitization of neurotransmitter receptors. Mechanisms of activity-depependent neuronal gene expression.

CHAPTER IV: MAIN NEUROTRANSMITTERS

6. TYPES OF NEUROTRANSMITTERS

Neurotransmitter systems: acetylcholine, catecholamines, serotonin, histamine, amino acids, neuropeptides and others. General principles: neurotransmitter metabolism, storage, inactivation, receptors and brain pathologies associated with neurotransmitter systems.

CHAPTER V: ASPECTS OF NEURODEGENERATIVE DISEASES

7. BIOCHEMICAL AND PATHOLOGICAL ASPECTS OF NEURODEGENERATIVE DISEASES

Alzheimer's disease (AD) and other dementia disorders. Parkinson's disease (PD). Huntington's disease (HD). Amyotrophic lateral sclerosis (ALS).