

**Neurochemistry**

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, exercises etc...) will be written partially or totally in English. The exercises and seminars will be presented and discussed at class in English.

**Teachers**

José Rodríguez Álvarez  
Esther Dalfo Capella

**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 bases of function, physiology and pathology of the central and peripheral 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 the function and relationships of cells in the brain. 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 anatomical organization of the nervous system.
2. To understand the cellular organization of the nervous system.
3. Acquiring a global view of the cellular mechanisms involved in differentiation and function of cells in the nervous system
4. Understanding the importance of the blood-brain barrier and cellular compartmentalization in the context of the metabolism of nervous system.
5. To understand the molecular and electrical fundamentals 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 ion channels 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 THE NERVOUS SYSTEM**

#### **1. ANATOMICAL ORGANIZATION OF THE NERVOUS SYSTEM**

Organization of the central and peripheral nervous system.

#### **2. CELLULAR ORGANIZATION OF THE NERVOUS SYSTEM**

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

#### **3. HOMEOSTASIS OF THE NERVOUS SYSTEM**

Cellular compartmentalization and metabolism. Blood brain barrier. Cerebrospinal fluid.

### **CHAPTER II: OVERVIEW OF NEUROTRANSMISSION**

#### **4. NEUROTRANSMISSION IN THE NERVOUS SYSTEM**

Types of neurotransmission: chemical and electrical synapses. Structure and function of synapses. Calcium-dependent and -independent neurotransmitter release. Structure and cycle of synaptic vesicles. Structure and function of neurotransmitter receptors: ionotropic and G protein-coupled receptors and effectors. Desensitization of neurotransmitter receptors. Molecular mechanisms of synaptic plasticity

### **CHAPTER III: BASIS OF THE NEURONAL EXCITABILITY**

#### **5. 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 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: NEURODEGENERATIVE DISEASES**

### **7. BIOCHEMICAL AND PATHOLOGICAL ASPECTS OF NEURODEGENERATIVE DISEASES**

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