

Molecular and Physiological Neurobiology

2014/2015

Code: 42890
ECTS Credits: 9

Degree	Type	Year	Semester
4313792 Neurociències	OB	0	1

Contact

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Use of languages

Principal working language: espanyol (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Antonio Armario García
Victoria Clos Guillén
Marcel Jiménez Farrerons
Xavier Navarro Acebes
Maria Amalia Molinero Egea
Jordi Ortiz de Pablo
Carlos Alberto Saura Antolin
Roser Masgrau Juanola
Alfredo Jesús Miñano Molina
Francisco Jiménez Altayo
Ruben Lopez Vales

Prerequisites

Good level of English. Part of the classes and some of the material will be in English, so good level of this language is mandatory

In case any of the students does not speak Catalan, classes will be teach in Spanish and/or English, so it is mandatory to know also Spanish

Students with a degree in the biosciences field or similar (Biology, biochemistry, biotechnology, microbiology, genetics, biomedical sciences, medicine, veterinary, pharmacy, psychology...)

Some knowledgment about neuroanatomy is hihgly recomended

Objectives and Contextualisation

The main goal of the module is to learn the chemical, cellular and functional characteristics of the central and peripheral nervous system to reach a basic knowledge of Neurosciences, to be able to understand any field in neurosciences and the bases of the pathologies of the nervous system.

Skills

- Analyse and correctly interpret the molecular mechanisms operating in living beings and identify their applications.
- Analyse and explain normal morphology and physiological processes and their alterations at the molecular level using the scientific method.
- Continue the learning process, to a large extent autonomously.
- Develop critical reasoning within the subject area and in relation to the scientific or business context.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.

Learning outcomes

1. Continue the learning process, to a large extent autonomously.
2. Describe the working and the regulation of motor circuits, circuits of the autonomous nervous system and sensorial circuits.
3. Develop critical reasoning within the subject area and in relation to the scientific or business context.
4. Evaluate and implement improvements or changes, either in methods or parameters, in the clinical laboratory.
5. Explain electric phenomena in neurons, in molecular and ionic terms.
6. Explain the mechanism of action of drugs that are useful in the treatment of neurodegenerative processes.
7. Identify and describe the working of brain integration functions.
8. Recognise and explain the characteristics and special requirements of biochemical and genetic analyses in clinical laboratories
9. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
10. Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.

Content

- PROGRAMA DE L'ASSIGNATURA (en anglès)

- Generalities on neurotransmission and receptor pharmacology (Dr Ortiz)

General characteristics of synapse and chemical neurotransmission.

General concepts on receptor pharmacology: Specificity and multiplicity of neurotransmitter action.

Agonists and antagonists.

Interaction ligand-receptor and associated responses: affinity and EC50.

- Signal transduction mechanisms.(Dr Masgrau)

Receptors directly/indirectly linked to ionic channels. Structure and pharmacological sites of action.

Receptors linked to G proteins

Receptors with tyrosine kinase activity

- Excitatory and inhibitory aminoacid neurotransmission. (Dr Miñano)

Metabolism of glutamate and other excitatory amino acids. Pharmacology of glutamate receptors. Ionotropic and metabotropic receptors

GABA metabolism

GABA receptors pharmacology

Glycine receptors

- Serotonergic neurotransmission. (Dr Jiménez Altaya)

Metabolism of serotonin

Pharmacology of serotonin receptors

Monoaminergic hypothesis of depression

- Noradrenergic neurotransmission. (Dr Jiménez Altaya)
- Dopaminergic neurotransmission. (Dr Clos)
- Cholinergic neurotransmission. (Dr Clos)

Metabolism of acetylcholine

Functional aspects of cholinergic neurotransmission

Pharmacology of cholinergic receptors

- Histaminergic neurotransmission (Dr Ortiz)

Metabolism of histamine

Pharmacology of histamine receptors

- Purinergic neurotransmission. (Dr Saura)

Metabolism of adenosine and purine nucleotides

Pharmacology of purinergic receptors

- Neuropeptides (Dr Armario)
- Electrical phenomena of neurons. (Dr Jiménez Farrerons)

Ionic transport across cell membrane. Active transport, Ionic channels

Transmembrane resting potential

Action potential: generation and propagation

Production of pulse trains. Stimulus / frequency relation

- Somatosensory systems (Dr López)

Introduction to sensory physiology

Sensory receptors

Sensory pathways coding

Central integration and sensory information transduction

Somatic sensitivity to touch, cinesthesia, thermal, pain, and visceral

- Motor systems. (Dr Molinero)

Excitation and muscle contraction

Functional structure of striatal muscle fibers

Electrical phenomena. Neuro-muscular transmission

Mechanisms of muscle contraction in striatal and smooth fibers.

Segmentary control of movement and posture

Motor Unit

Segmentary reflex

Gamma-motor system

Propiospinal control circuits

Suprasegmentary control of movement and posture

Motor cerebral cortex

Basal ganglia

Motor centers of brainstem

Cerebellum

- Autonomic nervous system (Dr Navarro).

Efferent systems.

Hypothalamus. Functional organization and multisystemic control

Limbic system and cerebral cortex

Autonomic regulation of visceral functions

- Special Senses. (Dr Udina)

Taste sensitivity: Receptors, sensations, pathways and central connexions

Olfactory sensitivity: Receptors, sensations, pathways and central connexions

Hearing sensitivity:

Vestibular sensitivity:

Optic sensitivity:

- Integrative functions in the brain. (Dr Udina)

Electrical brain activity

Biological rhythms

Functional organization of neocortex

Language

- Practical sessions

-Nerve conduction and channels. (Dr Jiménez Farrerons)

-Electromyography. (Dr Udina)

Methodology

Theoretical classes where the more relevant themes will be exposed. It is assumed that the student will complement these sessions with reading of papers and books. The student must reach the knowledge required to pass through autonomous study.

Laboratory practices where the student will learn through the practice some of the theoretical concepts. These practical sessions will be evaluated through a group work or a short evaluation at the end of the session.

Integrative seminars, where the students have to prepare some articles that will be discussed in a seminar class. To understand the articles, students must integrate the knowledge of the program and its application on research.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Integrative seminars	10	0.4	
Laboratory practicals	5	0.2	
Theoretical classes	40	1.6	
Type: Autonomous			
Autonomous study	107	4.28	
Integrative seminars preparation	40	1.6	
Work preparation	15	0.6	

Evaluation

To pass the module, students must get a minimum mark of 5 (to 10). Two written exam will be 70% of this mark (students need a minimum of 4 in each exam to average). The 30% of the mark will be evaluated in the practical sessions (through a group work or a short evaluation at the end of the practical session) and in the integrative seminars (through the participation of the students and a short evaluation at the end of each session)

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Evaluation of Integrative seminars	0,03	0.8	0.03	
Evaluation of Practical sessions	0,01	0.2	0.01	
Written exam	0,28	7	0.28	

Bibliography

-Kandel E. Principles of neural science. Fifth edition, McGraw Hill, 2012.

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- Carpenter RHS. Neurophysiology. Ed Arnold, London, 2003.
- Cardinali. Neurociencia: sus fundamentos. Ed Panamericana, Buenos Aires, 2007
- Matthews GG. Neurobiology. Ed Blackwell Science, 2001.
- Squire LR et al. Fundamental Neuroscience. Ed Academic Press, Amsterdam, 2008.