COURSE DATA

DATA SUBJECT

Code: 36350
Name: Molecular Neurobiology and Neuropathology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Facultat de Ciències Biològiques	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	Integración fisiológica y fisiopatológica	COMPULSORY

COORDINATION

MORANTE REDOLAT JOSE MANUEL

NACHER ROSELLO JUAN

SUMMARY

The subject Neurobiology and Neuropathology is integrated in the supra-subject Physiologic and physiopathologic integration, inside the Biomedical Sciences module. This subject intends to offer a panoramic view of Neurobiology, from the most molecular and cellular aspects to behavior, and specially focusing on the study of nervous system pathologies. The subject is mostly based on the knowledge acquired in the subjects Functional Histology and Human Physiology, which are included in the same supra-subject. Neurobiology and Neuropathology will also be coordinated with Immunology and immunopathology, which is also offered in this 4th year, and will integrate knowledge on the interaction of the nervous and immune systems.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

COMPETENCES / LEARNING OUTCOMES

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Acquire skills to use the methodologies of molecular biosciences and to keep an annotated record of activities.

Be able to think in an integrated manner and approach problems from different perspectives.

Develop an ethical commitment and the capacity to participate in the social debate.

Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.

Know how to work responsibly and rigorously in the laboratory, considering the safety aspects in experimentation as well as the legal and practical aspects of the handling and disposal of waste.

Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.

DESCRIPTION OF CONTENTS

1. Structure of the nervous system

1. Basic plan of the nervous system.
2. Components of the nervous system: neurons and glial cells. Cerebral vasculature and blood-brain barrier. Neuroimmunology.
3. Neuronal structure. Soma, dendrites and axon. Neuronal ultrastructure. Neuronal cytoskeleton and axonal transport.

2. Neural signal transmission

1. Membrane potential and action potential.
2. Structure of electric and chemical synapses.
3. Neurotransmitters: Types, properties, receptors and release mechanisms.

1. First phases of neural development.
2. Neurogenesis and migration.
3. Neuritic growth and synapse formation.
4. Programmed cell death, neurotrophism and synapse elimination.
5. Plasticity during critical periods of development.

3. Neural development and plasticity

1. First phases of neural development.
2. Neurogenesis and migration.
3. Neuritic growth and synapse formation.6. Plasticity in the adult nervous system, neurogenesis and axonal regeneration.

4. Sensory, motor and regulatory systems

1. Visual information: retina, visual pathways and visual centres.
2. Auditory information: organ of Corti, auditory pathways and auditory centres.
3. Olfactory system and chemoreception.
4. Somatosensory and viscerosensory systems.
5. Motor systems: organization and control. From the cortex to the final motor neuron.
6. Control of autonomic, cardiovascular and respiratory functions.
7. Control of water and food intake and regulation of body fluids.
8. Neuroendocrine systems. Stress. The sexual brain.
9. Circadian rhythmicity and sleep.
10. Reward, motivation and addiction.

5. Neurobiology of cognition and behavior

1. Learning and memory, cellular and molecular mechanisms.
2. Cerebral systems involved in learning and memory.
3. Cerebral systems involved in other behavioral functions: language and executive functions.

6. Cellular and molecular bases of neurological and psychiatric disorders

1. General mechanisms of neurodegenerative diseases
2. Parkinsons disease
3. Alzheimers disease
4. Epilepsy
5. Schizophrenia and bipolar disorder
6. Disorders of the anxiety-depressive spectrum
7. Autism spectrum and disorders of language and attention.

7. LABORATORIES

1. Macroscopic anatomy. Dissection of a lamb brain.
2. Microscopic anatomy: arrangement and mounting of a histological series of mouse brain tissue sections. Use of the histological atlas of the mouse brain.
3. Anatomic and functional study of the brain cortex. Pulse and chase technique with nucleoside analogues for the study of corticogenesis and adult neurogenesis.
4. Dopaminergic pathways, stereotaxic surgery and neuroanatomical tracing.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	47,00
Laboratory	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	13,00
Independent study and work	32,00
Preparation of lessons	25,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the subject is structured in:

Theoretical sessions. Exposition and discussion of previously announced subjects. The teaching and bibliographic resources will be available for the students in multimedia. The teacher will expose the fundamental aspects of the subject, making emphasis on those requiring a special guidance for their understanding and will promote their integration with the rest of the activities of the subject. At the same time, the teacher will promote its transversality in relation to other subjects.

Laboratory practical sessions. In coordination and in parallel to the theoretical sessions, a program of practical sessions in the laboratory will be developed.

Seminars from visiting researchers. Seminars will be presented by researchers in the subject's field, in order to show the students how research is currently done in Neurobiology.

Turorial: There will be three tutorials of one hour each, one at the beginning of the corse and two at the end, in which topics, complementary to the contentof the subject, will be worked in small group.

EVALUATION

To assess student learning, the following will be implemented:

- An exam consisting of questions/cases where students will need to relate and apply the knowledge acquired during theoretical classes. This objective test on the subject matter will account for 80% of the final grade.
- An exam featuring practical exercises related to the content covered in practical sessions and tutorials on human neuroanatomy. This assessment will serve as evidence of individualized progress in practical activities and will contribute 20% to the final grade.

Students must achieve a minimum of 5 points out of 10 on each exam independently to calculate the weighted average of 80/20. If a student does not pass one of the two components (theory or practicals) in the first attempt, they may retain the passing grade exclusively for the second attempt within the same academic year.

Aula Virtual is considered the official notice board and primary communication channel between faculty and students. Exam schedules, notices regarding changes to the planned calendar, grade notifications, and exam review schedules will be announced on this platform. It is the responsibility of students to stay informed through these communications and to maintain access to the University-provided email inbox for receiving messages. Additionally, students must use their University email when communicating with professors and refrain from using any other email accounts.

REFERENCES

- Brady, Scott T.; Siegel, George J.; Albers, R. Wayne; and Price, Donald L. (2012). Basic Neurochemistry, 8th edition. Molecular, Cellular and Medical Aspects. Available on PubMed (6th ed): http://www.ncbi.nlm.nih.gov/books/NBK20385/
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3rd edition. Academic Press.
- Waxman SG (2005) From neuroscience to neurology: neuroscience, molecular medicine, and the therapeutic transformation of neurology. San Diego: Elsevier Academic Press.
- Paxinos G, Franklin KBJ. 2001. The Mouse Brain in Stereotaxic Coordinates. Academic Press, San Diego.
- Paxinos G, Watson C. 2007. The Rat Brain in Stereotaxic Coordinates, 6th Edition. Academic Press, San Diego.