COURSE DATA

DATA SUBJECT

Code: 36350
Name: Molecular Neurobiology and Neuropathology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

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 course Neurobiology and Neuropathology is part of the subject Physiological and Physiopathological Integration, within the Biomedical Sciences module. The course aims to provide a broad overview of neurobiology, covering aspects ranging from molecular and cellular levels to behaviour, with a particular emphasis on the study of nervous system pathologies. It is largely based on the knowledge acquired in Functional Histology and Human Physiology, with which it shares content.

It should be noted that the course includes content explicitly related to gender diversity and sexual identity, as well as sexual freedom, thereby complying with the provisions of Organic Law 3/2007 on the effective equality of women and men and Organic Law 10/2022 on the comprehensive guarantee of sexual freedom. Specifically, these contents are included in the block Sensory, Motor and Regulatory Systems, in the section The Sexual Brain.

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

1109 - Degree in Biochemistry and Biomedical Sciences

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.

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. Programmed cell death, neurotrophism and synapse elimination.
5. Plasticity during critical periods of development.
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. Parkinson's disease
3. Alzheimer's 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	0,00
Independent study and work	45,00
Preparation of lessons	25,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The course is structured as follows:

Lectures. Presentation and discussion of previously announced topics. Teaching materials and recommended reading will be made available to students through the virtual learning environment. Lecturers will introduce the key concepts of each topic, placing particular emphasis on those requiring additional guidance to facilitate understanding. They will also help students integrate these concepts with

the rest of the course content and encourage connections with related subjects.

Laboratory practical sessions. The practical teaching programme will be delivered in coordination with and in parallel to the lectures, and attendance is compulsory, with a minimum requirement of 80%.

Where the teaching schedule permits, seminars will be delivered by invited researchers working in the relevant field, providing students with first-hand insight into current research related to the topics covered in the course.

Tutorials. Three one-hour tutorials will be held: one at the beginning of the semester, focusing on the practical component of the course, and two towards the end, during which students will work in small groups on topics that complement the course content.

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. The 6th edition is available on PubMed: http://www.ncbi.nlm.nih.gov/books/NBK20385/

Carlson, N. R. (2013). Physiology of Behavior (11th ed.). Pearson. Spanish translation: Fisiología de la conducta (11th ed.). Madrid: Pearson Educación.

Bianchi, L. M. (2022). The Developing Brain and its Connections (1st ed.). CRC Press. Earlier edition: Bianchi, L. (2017). Developmental Neurobiology (1st ed.). Garland Science.

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Squire, L. R., Berg, D., Bloom, F. E., du Lac, S., Ghosh, A., & Spitzer, N. C. (2012). Fundamental Neuroscience (4th ed.). Academic Press.

Waxman, S. G. (2005). From Neuroscience to Neurology: Neuroscience, Molecular Medicine, and the Therapeutic Transformation of Neurology. San Diego: Elsevier Academic Press.

Paxinos, G., & Franklin, K. B. J. (2001). The Mouse Brain in Stereotaxic Coordinates. Academic Press, San Diego.

Paxinos, G., & Watson, C. (2007). The Rat Brain in Stereotaxic Coordinates (6th ed.). Academic Press, San Diego.