COURSE DATA

DATA SUBJECT

Code: 33067
Name: Neurobiology
Cycle: Undergraduate Studies
ECTS Credits: 5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Facultat de Ciències Biològiques	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1100 - Degree in Biology	Fundamentals of health biology	ELECTIVES

COORDINATION

NACHER ROSELLO JUAN

AGUSTIN PAVON MARIA CARMEN

SUMMARY

Neurobiology is an optional subject within the intensification in *Foundations of Health Biology* (FBS, from the Spanish *Fundamentos de Biología Sanitaria*), which uses both theoretical and practical approaches to the understanding of the nervous system. Within the degree of Biology, *Neurobiology* is located in the second half of the fourth year, simultaneously with the subjects *Immunology* and *Pathogens and Disease*. *Neurobiology* studies one of the two systems of regulation of animal organisms, the nervous system. The other, the endocrine system is studied during the first semester in *Endocrinology and Reproduction*.

The significance *Neurobiology* relays on the importance of the nervous system for animal function. Indeed, the physiology of the nervous system determines our mental functions, our individual identity (e.g. brain transplantation would, in fact, be body transplantation) and even the legal definition of live and death (electroencephalographic activity). On the other hand, neurobiology is one of the most active and fruitful fields of modern biology, as evidenced by the dimensions of the international meetings on Neurosciences (the USA Society for Neuroscience annual meeting, exceeds 30,000 attendees). The neurobiology course seeks to address the study of some basic aspects of the structure, function and diseases of the nervous system, from a multidisciplinary perspective that covers from the cellular-molecular level to behavior. It also tries to give the student some ideas of how Neurobiology can be integrated with other disciplines related to the biology of health, such as endocrinology (neuroendocrinology) and genetics (genetics of

neurological and mental illnesses).

To do so, we have programmed four types of activities (lectures, practical lab activities, seminars and tutorials) through which we will review the following topics:

- Development of the nervous system and adult neuroanatomy.
- Neurogenesis, neuronal migration and axonal growth
- Synaptogenesis, neuronal death and survival
- Neurons and glial cells
- Neuronal physiology: axonal transport, electrical activity and ionic channels
- Synaptic transmission and synaptic integration. Mechanisms of synaptic plasticity
- Axonal plasticity during early life: critical periods and experience
- Motor and sensory systems
- Learning and memory
- Neurodegeneration, neurodegenerative diseases and psyquiatric diseases

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PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

The student must have passed 120 ECTS

COMPETENCES / LEARNING OUTCOMES

1100 - Degree in Biology

Apreciación del rigor, el trabajo metódico, y la solidez de los resultados.

Aprendizaje autónomo y adaptación a nuevas situaciones.

Capacidad de análisis crítico de textos científicos.

Capacidad de elaborar artículos, informes o proyectos y de exponerlos a diferentes auditorios.

Capacidad de organización, planificación y gestión de la información usando bases de datos bibliográficas adecuadas.

Capacidad de resolución de problemas y toma de decisiones.

Capacidad de utilización de herramientas matemáticas y estadísticas.

Comprender el desarrollo del sistema nervioso central y periférico y la estructura adulta en mamíferos.

Comprender las bases celulares y moleculares de la función nerviosa.

Conocer el sustrato biológico y la patogenia de las enfermedades neurológicas y mentales.

Conocer los fundamentos de la neurofarmacología.

Conocer los principales métodos y técnicas experimentales aplicadas al estudio de las enfermedades humanas, su etiología y la efectividad de los tratamientos.

Conocer y saber aplicar el método científico.

Conocimiento de las enfermedades y disfunciones más frecuentes durante las distintas etapas de la vida.

Conocimiento de sistemas de gestión en tareas profesionales en Biología sanitaria.

Entender las relaciones entre función cerebral y función mental.

Entender y evaluar críticamente las estrategias de tratamiento de las enfermedades neurológicas y mentales.

Habilidad para el trabajo en equipo y en contextos multidisciplinares.

Potenciación de la capacidad de liderazgo.

Potenciar la creatividad, iniciativa y espíritu emprendedor.

Reflexión ética sobre la actividad profesional.

Utilización del vocabulario específico de la Biología sanitaria.

DESCRIPTION OF CONTENTS

1. BLOCK 1: DEVELOPMENT

1. Development, formation of the cephalic vesicles and the SNP. Neurogenesis, differentiation, radial and tangential migration in the cortex.

2. Neuritic growth and synaptogenesis. Neurotrophins, survival and neuronal death. neuronal plasticity and critical periods. Neuronal regeneration.

2. BLOCK 2: STRUCTURE AND FUNCTION

3. Structure and neuronal function. Structure of Neuron and Synapse. Glia: role in development, the neural function and Neurodegeneration.

4. Neurotransmitters, receptors and synaptic transmission: pharmacological characterization. Generation of excitatory and inhibitory postsynaptic potentials. Biogenic amines, ATP, peptide neurotransmitters, non-conventional neurotransmitters: nitric oxide and endocannabinoids. Production, degradation and reuptake of the neurotransmitters: pharmacological potential.

3. BLOCK 3: SYSTEMS NEUROBIOLOGY

5. Sensory systems. Visual information: retina, circuits and Visual centers; Auditory information: organ of Corti, pathways and hearing centers; Olfaction and chemoreception; Information organization somato - and viscero-sensorial.

6. Motor systems: Organization and control of motor cortex to motor neuron systems.

7. Memory and learning. Cellular and molecular mechanisms: the NMDA-dependent LTP as a model. Types of memory and learning: characteristics, circuits and animal models. Alterations of memory.

4. BLOCK 4: NEUROPATHOLOGY

8. Neurodegenerative diseases: Parkinson's disease, Corea, dementia. Etiopathogenesis, therapy and perspectives.

9. Mental diseases: schizophrenia, bipolar syndrome and depression. Therapies, hypothesis and animal models.

5. PRACTICES

1. Macroscopic anatomy of the nervous system. Dissection if a mammalian brain. Comparative anatomy.

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.Analysis of microscopy samples marked with immunohistochemistry in animal models of CNS diseases.

4. Human neuroanatomy.Structure and function of different types of cortex.
Corticogenesis and analysis of an experiment of pulse and chase.

5. Study of the dopaminergic circuits of the basal ganglia and the reinforcement system. Basic principles of stereotaxy. Neuroanatomic tracers: analysis of an experiment.

6. Tests of immediate memory and working memory.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	33,00
Laboratory	15,00
Total hours	**50,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	46,25
Preparation of lessons	8,75
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**75,00**

TEACHING METHODOLOGY

In this subject we will apply the following teaching methodologies:

1. **Theoretical lessons**. Based on the expositive method/Master class and the study and resolution of questions related to the matter taught. These classes will be given to the complete group during an hour.
2. **Tutorials**. There will be two tutorials in groups of 16 students and sessions of 1 hour about topic complementary to the content of the subject.
3. **Practical classes**. They will be developed mainly in the laboratory in groups of 16 students. Practical classes will consist on macroscopic and microscopic observation of the nervous system from control, pathological or experimental material and the execution of the final phases of experiments.

EVALUATION

Every programmed activity will be evaluated by the professor and it will contribute to the final grade. To pass the subject, it is necessary to pass both theoric and practical exams.

THEORY 60%

- Exam. The theoretical knowledge will be evaluated with an exam at the end of the term, following the calendar established by the Faculty Council. The exam will consist on questions for which the comprehension of the basic concepts of the subject is necessary, as well as the ability to use them to give plausible answers to small problems related to the neurological pathology or the experimental neurobiology.

PRACTICAL CLASSES 30%

- Attendance to these classes is compulsory, a single unjustified absence or 2 justified absences will be allowed.
- Exam. The student¿s achievement in the practical classes will be evaluated in a final exam, which can include the interpretation of macroscopic and histological images of the nervous system relative to experiments or pathologies. During the exam the student will be allowed to use the mouse brain atlas.

TUTORIALS 10%

Individual or two by two essay on clinical cases or problems discussed in the tutorial sessions.

IMPORTANT INFORMATION

Aula Virtual is considered the official noticeboard and the normal way of communication between the students and the professors. The calls for exams, news on alterations in the calendar, notifications of grades and exam revision schedule will be announced in this platform and it is the responsibility of the student to be aware of these communications, as well as to have the e-mail box provided by the University, in proper conditions to receive these communications. The students are also advised to use the University¿s e-mail account and no other in their communications with the professors. Messages from any other e-mail account will be ignored.

REFERENCES

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Edició. Editorial Médica Panamericana. Sisena Edició anglesa de 2018, de Sinauer. La tercera edició està disponible en àngles en Pubmed: http://www.ncbi.nlm.nih.gov/books/NBK10799/

- Siegel Gj, Agranoff BW, Albers RW, Fisher SK, Uhler MD (2011). Basic Neurochemistry, 6th edition. Molecular, Cellular and Medical Aspects. Disponible en angles en Pubmed: http://www.ncbi.nlm.nih.gov/books/NBK20385/

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- 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. Book w/ CD-ROM, Reference

- FULLES WEB Aquestes dues fulles web són molt útils per estudiar les pràctiques i aconseguir una visió tri-dimensional del cervell. Atles online del cervell del ratoli del Mouse Brain Library. Es un atles senzill i fàcil dusar, dimatges estàtiques del cervell del ratolí, que és el que més estudiarem al llarg de les pràctiques http://www.mbl.org/atlas170/atlas170_frame.html Material neurohistològic per observació amb java. Permet observar imatges com si foren una preparació, des duna visió panoràmica al detall que dona un microscopi a 200-400 augments. No és una animació, són imatges de talls reals de cervells de diferents espècies tractades amb diferents tècniques. Probablement serà útil al final de lassignatura, perquè requereix uns certs coneixements neuroanatòmics previs. http://brainmaps.org/index.php

- Kandel ER, Jesell T, Siegelbaum S, Schwartz JH, Hudspeth AJ. 2013. Principles of Neural Science. 5th ed. McGraw-Hill.