

**COURSE DATA****Data Subject**

<b>Code</b>	36350
<b>Name</b>	Molecular Neurobiology and Neuropathology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2023 - 2024

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	4	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1109 - Degree in Biochemistry and Biomedical Sciences	11 - Integración fisiológica y fisiopatológica	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
MORANTE REDOLAT, JOSE MANUEL	21 - Cellular Biology and Parasitology
NACHER ROSELLO, JUAN	21 - Cellular Biology and Parasitology

**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 4<sup>th</sup> 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

## OUTCOMES

### 1109 - Degree in Biochemistry and Biomedical Sciences

- Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.
- 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.
- Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.
- Acquire skills to use the methodologies of molecular biosciences and to keep an annotated record of activities.
- 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.

## LEARNING OUTCOMES

**English version is not available**

## 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.
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. 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**

ACTIVITY	Hours	% To be attended
Theory classes	47,00	100
Laboratory practices	10,00	100
Tutorials	3,00	100
Development of group work	10,00	0
Development of individual work	3,00	0
Study and independent work	25,00	0
Readings supplementary material	7,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	10,00	0
<b>TOTAL</b>	<b>150,00</b>	

**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.



**Tutorial:** There will be three tutorials of one hour each, one at the beginning of the course and two at the end, in which topics, complementary to the content of the subject, will be worked in small group.

## EVALUATION

The subject will be evaluated using:

- One or various exams, which will include theoretical-practical questions and problems
- Evaluation of practical activities by means of an exam containing questions relative to the laboratory sessions.
- Continuous evaluation of each student, based on regular attendance to classes and in-company lessons, participation and degree of involvement in the process of teaching-learning.

The evaluation of other activities (conferences, journal clubs and current research news) will be included, if it is considered necessary, in the evaluation of the theoretical-practical block.

Theoretical-practical block:

In order to evaluate the knowledge of the theoretical-practical block, the student will do two written exams: one will consist in questions about the theory and the other about the practical sessions. In order to pass this block, the student should obtain a minimum of 5 points over a total of 10 in both exams independently. When both exams are passed, the final qualification will be 80% of the qualification of the theory and 20% of that of the practical exam.

If in any of the 2 exams the student does not obtain the minimum of 5 points over 10, he/she will not pass the theoretical-practical block and, consequently, will not pass the subject.

Aula Virtual is considered the official board of announcements and the usual way of communication between the faculty and the students. The calls for exams, announcements on calendar alterations and the notification of qualifications and exam revision schedules will be announced using this platform and it is the responsibility of the student to be aware of these communications and to use the e-mail account that the Universitat facilitates in proper condition to receive the messages. In their communications with the faculty the students should use this e-mail account and no other. Messages from other accounts will be ignored.





## REFERENCES

### Basic

- - Brady, Scott T.; Siegel, George J.; Albers, R. Wayne; and Price, Donald L. (2012). Basic Neurochemistry, 8th edition. Molecular, Cellular and Medical Aspects. Disponible en Pubmed la 6ª ed: <http://www.ncbi.nlm.nih.gov/books/NBK20385/>
- Carlson NR. 2013. Physiology of Behavior, 11th ed. Pearson. Traducción al castellano: Fisiología de la conducta. 11ª edición. Madrid: Pearson Educación.
- Purves D, Augustine, Fitzpatrick, Hall, LaMantia, McNamara, White. 2012. Neuroscience. 5th ed. Sinauer Assoc. Traducción al castellano de la 3ª ed.: Neurociencias, Editorial Médica Panamericana. La 2ª edición está disponible en Pubmed: <http://www.ncbi.nlm.nih.gov/books/NBK10799/>
- Kandel ER, Jesell T, Siegelbaum S, Schwartz JH, Hudspeth AJ. 2013. Principles of Neural Science. 5th ed. McGraw-Hill.
- Squire LR, Berg D, Bloom FE, du Lac S, Ghosh A, Spitzer NC. 2008. Fundamental Neuroscience, 3ª edición. Academic Press.
- Waxman SG (2005) From neuroscience to neurology: neuroscience, molecular medicine, and the therapeutic transformation of neurology. San Diego: Elsevier Academic Press.

### Additional

- - 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