

**Physiopathology and Regeneration in Neurological
Illnesses**

Code: 42910
ECTS Credits: 9

Degree	Type	Year	Semester
4313792 Neurosciences	OB	0	2

Contact

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Use of Languages

Principal working language: spanish (spa)

Teachers

José Aguilera Ávila
Xavier Navarro Acebes
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Carlos Alberto Saura Antolin
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Victor J. Yuste Mateos Grup mort cel.lular, senescència i super
Carlos Barcia Gonzalez
Africa Flores de los Heros
Jordi Bruna Escuer
Guillermo García Alias
Alfredo Jesús Miñano Molina
Albert Quintana Romero
Mireia Herrando Grabulosa
Ruben Lopez Vales

External teachers

Javier Pagonabarraga
Joan Vidal
Miquel Vila

Prerequisites

Basic knowledgment from previous subjects in the master is recomended (M1-M3)

Objectives and Contextualisation

This module offers an updated vision of the processes involved in neurodegeneration and neuroregeneration in the nervous system. The module covers the cellular and molecular mechanisms underlying neurodegenerative diseases, analyzing the etiopathogenesis of these diseases as well as the development of therapies. On the other hand, the module also covers the mechanisms of neuroplasticity after traumas and / or metabolic conditions, both from the molecular and the clinical point of view. Finally, recent articles regarding the different subjects will be discussed in small groups and students will also prepare a workshop, where they would have to propose an innovative therapy for one pathology of the nervous system.

The general objectives of the subject are:

- Learn the basic concepts about the molecular and cellular bases of the neurodegenerative processes of different neurological pathologies.
- Learn the basics about the processes of regeneration and plasticity in the nervous system that underlie and start after traumatic injuries
- To train the student to apply the knowledge acquired on neurodegeneration and regeneration in a scientific context.
- Acquire skills and technical knowledge for scientific research on neurodegeneration and regeneration
- Acquire the ethical and rigorous attitudes to develop the work of scientific research.

Competences

- Conceive, design, develop and synthesise scientific projects in the field of neurosciences.
- Continue the learning process, to a large extent autonomously
- Explain the basis of treatments for pathologies of the nervous system.
- Identify and use the techniques for studying the neurobiological substrate of behaviour, neurodegenerative processes, neuroprotective strategies and strategies of plasticity of the nervous system.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Learning Outcomes

1. Adapt to working in multidisciplinary teams in varying cultural and scientific contexts, creating and fostering a climate of open collaboration and team spirit.
2. Analyse the differences between the central and peripheral nervous systems' regenerative response to lesions
3. Compare the main strategies for repair of the nervous system from a holistic, innovative perspective.
4. Continue the learning process, to a large extent autonomously
5. Develop a deep sense of responsibility and respect for those affected by diseases of the nervous system and their families.
6. Interpret nervous system responses to lesions and neurodegenerative processes at the molecular, cellular and system levels.
7. Know and use the techniques applied to the characterisation of cell death.
8. Link up the strategies of neural response modulation that are useful for postlesion neurorehabilitation.
9. Recognise the different molecular mechanisms of cell death and the mechanisms of action of the drugs that modulate these.
10. Seek out information in the scientific literature using appropriate channels, and use this information to formulate and contextualise a research topic.
11. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Content

Molecular and cellular bases of neurodegenerative processes that include:

- Introduction to the clinical impact of neurodegenerative diseases
- Molecular mechanisms of inflammation

- Molecular Mechanisms of Neural Death
- Pathophysiology of various neurodegenerative diseases: Alzheimer's disease, diseases that affect basal ganglia, mitochondrial disease and sinaptopathies.
- Neurotoxicology

Basic processes of regeneration and plasticity in the nervous system

- Injuries and peripheral regeneration
- Strategies for peripheral nerve repair
- Injuries and central regeneration
- Therapeutic strategies after spinal cord injuries
- Post-lesion plasticity
- Introduction to neurorehabilitation

Methodology

- Lectures
- Cooperative learning
- Technical learning
- Discussions
- Oral Presentation
- Tutorials
- Elaboration of work
- Personal study
- Reading articles / reports of interest

Lectures

Systemized exhibition of the subject's agenda, giving relevance to the most important concepts. The student acquires the basic scientific knowledge of the subject attending the lecture classes, which will complement the personal study of the subjects of the teaching program.

Workshops:

Development of critical thinking through the analysis and debate of scientific publications. The bibliographical research skills and rigorous selection criteria are also developed, the active self-learning, the clear exposition of their own ideas and the respectful debate are promoted.

Seminars:

Presentation and discussion on dissertations related to neurodegenerative processes and their possible therapeutic approaches. In these sessions, the acquired knowledge is applied and the critical inventiveness, reflection and analysis capabilities are indispensable for their future scientific activity

Individual tutorials

Availability of support tutorials for the study and autonomous development of biological and medical concepts

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions	12	0.48	2, 10, 3, 7, 9, 1, 6, 4, 8, 11
Seminar	41	1.64	2, 10, 3, 7, 5, 9, 6, 4, 8, 11
Theoretical classes	5	0.2	2, 10, 3, 5, 1, 4, 8, 11
Type: Supervised			

Support tutorials	7	0.28	2, 10, 3, 7, 5, 9, 6, 4, 8, 11
Type: Autonomous			
Preparation of knowledge and abilities objectives	35	1.4	2, 10, 3, 7, 9, 1, 6, 4, 8, 11
Preparation of practicals	35	1.4	2, 10, 3, 7, 5, 9, 1, 6, 4, 8, 11
Preparation of seminars	90	3.6	2, 10, 3, 7, 5, 9, 6, 4, 8, 11

Assessment

The assessment will be based on individual written tests and one seminar presentation. The written tests will be based on the theoretical content of the module, and will also include an exercise of critical comments of experimental works related to nervous system disorders. There will be several evaluation tests during the course. The seminars will be assessed by means of an oral test. Participation in debates will be encouraged and will be taken into account for the final grades. To pass the module it will be necessary to obtain a minimum score of 5.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of practicals	30	0	0	2, 10, 3, 7, 9, 1, 6, 4, 8, 11
Debate	5	0	0	2, 10, 3, 7, 9, 1, 6, 4, 8, 11
Practical evaluation	30	0	0	2, 10, 3, 7, 9, 1, 6, 4, 8, 11
Seminar	20	0	0	2, 10, 3, 7, 5, 9, 1, 6, 4, 8, 11
Seminari Institute of Neuroscience	5	0	0	2, 10, 3, 7, 5, 9, 1, 6, 8, 11

Bibliography

Up-to-date review papers that will be recommended by each of the lecturers during the theoretical classes.

Handbooks:

Beal MF, Lang EA, Ludolph AC. Neurodegenerative Diseases: Neurobiology, Pathogenesis and Therapeutics. Cambridge University press, 2005
 Kordower J, Tuszynski MH. CNS regeneration: basic science and clinical advances. 2^a ed, 2007