

**Neuroanatomy and Cell Neurobiology**

Code: 42909  
ECTS Credits: 9

Degree	Type	Year	Semester
4313792 Neurosciences	OB	0	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

### Contact

Name: Alfonso Rodríguez Baeza

Email: Alfonso.Rodriguez@uab.cat

### Other comments on languages

some activities

### Use of Languages

Principal working language: spanish (spa)

### Teachers

Joaquim Martí Clúa

Juan Tony de Sousa Valente

María Luisa Ortega Sánchez

### Prerequisites

Requirements are those of access to the master. It is necessary to have a sufficient level of English for the classes taught in this language. Other languages used will be Spanish and Catalan.

### Objectives and Contextualisation

The general objective of this module is the knowledge of the basic, structural and anatomical cellular characteristics of the Central and Peripheral Nervous System that allows you to understand neuroscience research and give you the basis to understand the pathologies that affect this system.

### 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.
- Recognise the anatomical and cellular structure of the nervous system, the cell biology of the different types of neuron and of the glial cells, and formulate experimental approaches to their study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

### Learning Outcomes

1. Continue the learning process, to a large extent autonomously
2. Design optimal contrast methods to observe the cell types of the nervous system
3. Identify the anatomical nuclei affected in the principal pathologies of the nervous system.
4. Identify the cell types affected in the principal pathologies of the nervous system.
5. Identify the different cell types of the nervous system in histological preparations and know their functional characteristics.
6. Identify the principal anatomical structures of the nervous system and their interconnections.
7. Seek out information in the scientific literature using appropriate channels, and use this information to formulate and contextualise a research topic.
8. Show skill in the histological processing of nerve tissue and in the use of an optical microscope.
9. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

## Content

### THEORY AND PRACTICAL SKILLS

#### DEVELOPMENT OF THE NERVOUS SYSTEM (Alfonso Rodríguez-Baeza)

Zygote, Morula and Blastula. Gastrulation. Primary and secondary neurulation. Spinal cord formation. Early vesicles and flexures: Rhombencephalon, Mesencephalon and Prosencephalon. Secondary vesicles and derivatives: Myelencephalon, Metencephalon, Mesencephalon, Diencephalon and Telencephalon. Cerebral cortex formation. Basal nuclei formation. Hippocampal formation. Neural crest and derivatives. Ectodermal placodes. Peripheral nervous system formation: spinal and cranial nerves. Autonomic nervous system formation. Overview of the sense organs formation. The perinatal nervous system.

#### CELLULAR NEUROBIOLOGY (Juan Tony de Sousa Valente)

Cytology of neurons. Neuronal cytoskeleton: mechanisms of axonal transport. Dendritic arborisation and synaptic terminals. Astrocytes: metabolism, cytoskeleton, function and cell subtypes. Structure and function of blood-brain barrier. Microglia: metabolism, functions and cell types. Radial glia: Characteristics and functions. Ependymocytes and tanocytes: localization, characteristics and functions. PNS satellite glia. Myelination: oligodendrocytes and Schwann cells. CNS and PNS myelination. Molecular structure of myelin. Paranode and fissures. Ranvier node in CNS and PNS. Glia-glia and neuron-glia communication: contact and soluble signalling factors.

#### NEUROGENESIS AND GLIOGENESIS (Joaquim Martí Clua)

Embryonic and postnatal neurogenesis. Timetables of neurogenesis. Migration and neuron settled pattern. Neurogenetic gradients. Gliogenesis. Stem and progenitor cells. Embryonic origin of stem cells. Neuroepithelial cells, radial glia and adult neural stem cells. Germinative zones and neurogenesis in the adult brain: animal and human models. Neural stem cells, cancer stem cells and development of the malignant brain tumours.

#### NEUROANATOMY (Alfonso Rodríguez-Baeza).

Introduction to the anatomical organization of the CNS. Overview of the brain: lateral, vertical and basal aspects. Overview of the skull and cranial meninges organization. Cerebrum: cerebral hemispheres, basal ganglia and diencephalon. Brain stem: medulla oblongata, pons and midbrain. Cerebellum. Reticular formation. Spinal cord: morphology and overview spinal nerves systematization. Overview of the spine and spinal meninges organization. Ventricular system and cerebrospinal fluid circulation. Cranial nerves: nuclei of origin, pathway and overview of the peripheral distribution. Overview of the special senses: olfaction, vision, taste, hearing and balance. Overview of the autonomic nervous system: sympathetic and parasympathetic. Overview of the ascending and descending pathways. CNS vascularisation: arteries and veins. Basic notions of comparative neuroanatomy.

#### NEUROHISTOLOGY (Juan Tony de Sousa Valente)

Basic structure of nervous tissue. Microscopic structure of peripheral nerve and ganglia. Spinal cord: organization of grey and white matter. Cerebellum: Organization of grey and white matter. Cortical citoarchitecture. Brain. Neocortex. Cytoarchitecture of neocortical layers. Brain. Limbic system. Hippocampal

cytoarchitecture. Ventricles and choroid plexus. Meninges: organization and structure. Basic techniques for the histologic study of the nervous system.

## PRACTICAL SESSIONS IN LAB

Neurohistology Lab (Juan Tony de Sousa Valente)

Analysis of microscopic slides with histological and immunohistochemical techniques. Study of specific cellular markers in neuropathological tissues (Alzheimer's disease, multiple sclerosis, etc.).

Performing immunocytological techniques in mixed glia cell cultures (astrocytes, oligodendrocytes and microglia) to determine different neural subpopulations (from undifferentiated cells to mature cells).

Dissection Lab (Alfonso Rodríguez-Baeza and Marisa Ortega):

Observation of human anatomical structures in dissected samples and topographic sections.

"unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents"

## Methodology

GUIDED ACTIVITIES:

**THEORETICAL CLASSES** (type TE) Teaching essentially expository and is typically done in a classroom at a time previously scheduled. The students acquire knowledge own module attending lectures and complimenting them with study subjects taught staff.

**LABORATORY** (type PLAB) Activity that involves carrying out assignments that require students to use a particular infrastructure (dissection and histology labs). It is performed in a specifically equipped premise within a specific time, with the assistance of permanent staff. Programmed on a schedule and within its own premises. In dissection lab of the Faculty of Medicine is compulsory to wear gowns and gloves, and never allowed to take photographs and / or videos to the dissection room. Students must have the certificate that accredits them to carry out the practices in the dissection lab.

SUPERVISED ACTIVITIES:

**ON-LINE ACTIVITIES AND TUTORIALS:** Teaching taught without classroom attendance and intensively using information and communication technologies (ICT). Students have complementary teaching material for the different training activities through the UAB Campus Virtual, and personal tutorials with the teacher (upon request).

AUTONOMOUS ACTIVITIES:

Comprehension and reading articles. Personal study, implementation of schemes and summaries, conceptual assimilation of the course content.

"the proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities".

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

Title	Hours	ECTS	Outcomes
Type: Directed			
Cellular Neurobiology, Neurogenesis and Gliogenesis, and Neurohistology	26	1.04	7, 8, 2, 5, 4, 1, 9
Neuroanatomy and development of Nervous System	26	1.04	7, 3, 6, 1, 9
Type: Supervised			
On line activities and tutorials	50	2	7, 5, 3, 4, 6, 1, 9
Type: Autonomous			
Personal study, comprehension and reading articles, conceptual assimilation of contents	113	4.52	7, 2, 5, 3, 4, 6, 1, 9

## Assessment

### Evaluation of the module

The skills of the module will be evaluated by the following activities:

- A continuous evaluation for active participation in the different directed training activities, which will represent 10% of the final score with a minimum attendance of 80%
- A structured objective evaluation in Anatomy Lab practices, which will represent 5% of the final score
- A structured objective evaluation in Histology Lab practices, which will represent 5% of the final score
- A written evaluation by means of objective test of limited response and recognition of the contents taught in the Anatomy classes, which will represent 40% of the final score
- A written evaluation by means of objective test of short answer and recognition of structures of the contents taught in the Histology classes, which will represent 28% of the final score
- A written evaluation by means of objective test of limited response of the contents taught in the Neurogenesis classes, which will represent 12% of the final score

To apply these percentages the following requirements must be met:

- Not having a 0,0 in any of these evaluable activities, and
- Have obtained a minimum score of 4.5 out of 10.0 in each of the following objective tests: Anatomy Lab practices, Histology Lab practices, written evaluation of Anatomy, written evaluation of Histology and written evaluation of Neurogenesis.

To pass the module the student must obtain a score equal to or greater than 5.0 once the established percentages and requirements have been applied.

Students who have not passed the module will have the possibility of doing a recovery tests that will consist of:

- A written evaluation by means of objective test of limited response and recognition of structures of the contents taught in the Anatomy classes
- A written evaluation by means of objective test of short answer and recognition of structures of the contents taught in the Histology classes
- A written evaluation by means of objective test of limited response of the contents taught in the Neurogenesis classes

The continuous evaluation as well as the structured objective evaluation of Anatomy and/or Histology Lab practices, by their very nature, are NOT recoverable.

To be eligible for the recovery process, the student should have been previously evaluated in a set of activities equalling at least two thirds of the final score of the module. Thus, the student will be graded as "No Avaluable" if the weight of all conducted evaluation activities represents less than 67% of the final score.

"student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities".

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continues evaluation	10%	4	0.16	7, 8, 2, 5, 3, 4, 6, 1, 9
Evaluation of Lab practices (Anatomy and Histology)	10%	2	0.08	8, 2, 5, 3, 4, 6, 1, 9
Objective written evaluation of Anatomy contents	40%	2	0.08	7, 3, 6, 1, 9
Objective written evaluation of Histology contents	28%	1.5	0.06	7, 2, 5, 4, 6, 1, 9
Objective written evaluation of Neurogenesis contents	12%	0.5	0.02	7, 5, 4, 6, 1, 9

## Bibliography

### BIBLIOGRAPHY

Anastasi, G., Gaudio, E., Tacxchetti, C. (Alfonso Rodríguez Baeza editor edición en español) (2018) Anatomía humana - atlas - 1ª ed. Ed. Ergon

Carlson, B.M. (2019) Embriología humana y Biología del Desarrollo. 6ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C20180056236>

Crossman, AR., Neary, D. (2019) Neuroanatomía: Texto y Atlas en color. 6ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C2019000684X>

Dauber, W. (2021) Feneis Nomenclatura Anatómica Ilustrada. 11ª ed. Ed. Elsevier.

Felten, DL., O'Banion, MK., Maida, ME. (2016) Netter Atlas de Neurociencia. 3ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UB, UAB, UPC, UPF, UdG, UdL, URV, UVic-UCC i UJI](#)  
<https://www.sciencedirect.com/science/book/9780323265119>

Haines, D.E., Mihailoff, G.A. (2019) Principios de Neurociencia. Aplicaciones básicas y clínicas. 5ª ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB. Cal registrar-se prèviament](#)  
<https://www.clinicalkey.com/student/content/toc/3-s2.0-C20170037795>

Haines, DE. (2021) Neuroanatomía clínica. Texto y Atlas. 10ª ed. Ed. Wolters Kluwer. [Accés restringit als usuaris de la UB i UAB](#) <https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2873>

Junqueira, L.C., Carneiro, J. (2015) Histología Básica. 12ª ed. Ed. Médica Panamericana.

Kandel, E.R., Schwartz, J.H., Jessell, T.M. (2012) Principles of Neural Science. 5<sup>th</sup> ed. Ed. McGraw Hill. [Accés restringit als usuaris de la UAB](#) <http://lib.myilibrary.com/?id=396874>

Mai, J.K., Paxinos, G. (2011) The Human Nervous System. 3<sup>rd</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB http://lib.mylibrary.com/Open.aspx?id=334767](http://lib.mylibrary.com/Open.aspx?id=334767)

Matthews G.G. (2000) Neurobiology. Molecules, Cells and Systems. 2<sup>nd</sup> ed. Ed. John Willey & Sons.

Moore, K.L., Persaud, T.V.N., Torchia, M.G. (2019) The Developing Human. Clinically Oriented Embryology. 11<sup>a</sup> ed. Ed. Elsevier.

Mtui, E., Gruener, G., Dockery, P. (2017) Fitzgerald. Neuroanatomía Clínica y Neurociencia. 7<sup>a</sup> ed. Ed. Elsevier.

Pawlina, W. (2020) Ross. Histología: Texto y atlas. 8<sup>a</sup> ed. Ed. Wolters Kluwer.

Purves, D., Augustine, G.J., Fitzpatrick, D, et al (2018) Neuroscience. 6<sup>th</sup> ed. Ed. Oxford University Press. [Accés restringit als usuaris de la UAB http://www.medicapanamericana.com/VisorEbookV2/Ebook/9788498359831](http://www.medicapanamericana.com/VisorEbookV2/Ebook/9788498359831)

Sadler, T.W. (2019) Langman. Embriología Médica. 14<sup>a</sup> ed. Ed. Wolters Kluwer. [Accés restringit als usuaris de la UB i UAB https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2899](https://cienciasbasicas.lwwhealthlibrary.com/book.aspx?bookid=2899)

Sanes, D.H., Reh, T.A., Harris, W.A. (2019) Development of the Nervous System. 4<sup>rd</sup> ed. Ed. Elsevier.

Schoenwolf, G.C., Bleyl, S.B., Brauer, P.R. et al (2014) Larsen's Human Embryology. 5<sup>a</sup> ed. Ed. Elsevier

Spittgerber, R. (2019) Snell Neuroanatomía clínica. 8<sup>a</sup> ed. Ed. Wolters Kluwer.

Squire, L.R., Berg, D., Bloom, F.E. et al. (2012) Fundamental Neuroscience. 4<sup>th</sup> ed. Ed. Elsevier.

Standring, S. (2020) Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42<sup>th</sup> ed. Ed. Elsevier.

Vanderah, T.H., Gould DJ. (2020) Nolte's the Human Brain. An introduction to its functional Anatomy. 8<sup>a</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de la UAB https://ebookcentral.proquest.com/lib/UAB/detail.action?docID=2036217](https://ebookcentral.proquest.com/lib/UAB/detail.action?docID=2036217)

Waxman, S.G. (2007) Molecular Neurology. 1<sup>st</sup> ed. Ed. Elsevier. [Accés restringit als usuaris de UB, UAB https://www.sciencedirect.com/science/book/9780123695093](https://www.sciencedirect.com/science/book/9780123695093)

## Software

Is not necessary specific software