Universidad de Navarra

Molecular and cellular neurobiology (MInvB)
Teaching guide 2025-26

INTRODUCTION

Molecular and Cellular Neurobiology

Molecular and cellular neurobiology is concerned with the basic understanding of the cell biology of the central nervous system. How cells in the brain communicate with each other, including synaptic transmission and receptor-mediated signalling, how neurons work together and how changes in function can lead to disease. Understanding brain function at the cellular and subcellular levels is key to understanding the pathogenic mechanisms of neurological and psychiatric disorders and translating this knowledge into improved therapies. The course is an ideal introduction to further subjects and provides a foundation for understanding higher physiological systems.

Professors:

Dra. Marisol Aymerich, Departamento de Bioquímica y Genética de la Universidad de Navarra and Cima-Universidad de Navarra

Credits: 3 ECTS

Degree: Master in Biomedical Research

Module: Module II: Specialty

Area: Specialty in Neuroscience and Cognition

Department and School: Biochemistry and Genetics, School of Sciences

Calendar description: first semester

Classroom and schedule: specified in the Master calendar

Type of subject: required in the speciality of Neuroscience and Cognition and elective for the other specialties

Languaje: english

LEARNING OUTCOMES (COMPETENCES)

Basic competences

- BS6: Possess and understand knowledgeable facts that serve as a basis or opportunity for being original in the development and/or application of ideas, frequently within the context of research.
- BS7: The students will be able to apply acquired knowledge and problem solving abilities to fields outside this program, including that which is new and scarcely known, within a more ample or multidisciplinary context related to the research, development and innovation of drugs.
- BS8: The students will be able to integrate concepts and manage the complex task of drawing valid conclusions from information which, in spite of being incomplete or limited, includes reflections regarding social and ethical

responsibilities linked to the application of general knowledge, specific concepts and common sense to the research, development and innovation of drugs.

- BS9: The students will learn to relay their conclusions -and the most recent facts and reasoning supporting said conclusions- to specialized personnel and to the general public in a clear and precise manner.
- BS10: The students will have acquired learning abilities that will permit them to continue studying in a self-directed and autonomous manner.

General competences

- CG1: Ability to deal with biomedical challenges in depth, from different viewpoints, identifying the state of present-day science.
- CG2: Identification of significant questions or hypotheses regarding biomedical issues or problems and definition of the steps necessary to resolve such questions.
- CG3: Possession of creative ability and originality in order to be able to respond to the questions raised in biomedical research.
- CG4: Ability to select and use appropriate techniques in order to efficiently and accurately carry out biomedical research work.
- CG6: Possession of critical ability, both when reading scientific biomedical literature and when interpreting the results of experiments.
- CG7: Ability to orally communicate biomedical research matters or data in a fluent way, in both Spanish and English, taking into account the audience for which the presentation is intended.
- CG8: Ability to write correct, precise and well-structured texts about different types of biomedical research work.

Neuroscience and cognition specialty competences

- CEE1: Overall view of the functioning of healthy and diseased human brains, from the point of view of the different disciplines of neuroscience.
- CEE2: Deeper knowledge of the molecular basis of synaptic transmission, the functioning of neurons and their organization into neuronal circuits and networks in order to understand human behavior.
- CEE3: Knowledge of the problems caused by different neurological and psychiatric pathologies, as well as the latest advances in research.
- CEE5: Understanding of the specific techniques used in neuroscience research.
- CEE6: Ability to select appropriate techniques in order to respond to questions posed within the field of neuroscience research and to use said techniques to obtain precise and reproducible results, which allow valid and objective conclusions to be drawn.

PROGRAM

SPECIALTY IN NEUROSICENCES-FIRST TERM (14 Septiembre-Diciembre)

During the first trimester, the functioning of the nervous system under physiological conditions will be explained.

Basic Courses, 9 ECTS:

MCN: Molecular and Cellular Neurobiology (3 ECTS) - Dra. Marisol Aymerich

NM: Neuromorfología (3 ECTS)- Dra. Mar Cuadrado

BFSN: Bases funcionales del sistema nervioso (3 ECTS) - Dra. Manolo Alegre

1st Term Programm (2 h Sessions)

Fundamentos

1. Neurodesarrollo. Meninges, sistema ventricular y líquido cefaloraquídeo NM Mar Cuadrado

2. Cells of the Nervous System. MCN

Práctica: 1 h microscopía.

Práctica: 2 h. SNC conceptos básicos y vascularización

3. Neurogenesis. MCN

4. The blood brain barrier and the immune system in the central nervous system. MCN

5. Potencial de membrana y potencial de acción. BFSN Manolo Alegre

Práctica: Manolo Alegre

6. Protein synthesis and intracellular neuronal transport systems. MCN

7. Proteostasis. MCN

8. Neurotransmitter systems. MCN

9. The pre-synaptic terminal. MCN

10. The post-synaptic terminal and synaptic plasticity. MCN

Morfología

11. Neuroanatomía regional de la médula espinal. NM

Práctica 2 h. Médula espinal y tronco del encéfalo 1

12. Placa neuromuscular. Fisiología de la contracción muscular. BFSN Manolo Alegre

13. Aferencias y receptores musculares. Reflejos espinale. BFSN Manolo Alegre

Práctica EMG CUN

14. Tronco del encéfalo 1. NM

15. Tronco del encéfalo 2. NM

16. Cerebelo y Diencéfalo. NM

Práctica 2 h: Troco del encéfalo 2, pares craneales diencéfalo

17. Telencéfalo. Hipocampo. NM

18. Corteza cerebral. NM

19. Ganglios basales. NM

Practica 2 h: Telencéfalo y ganglios basales

Sistemas

20. Sistemas motores

21. Estimulación magnética y sistemas somatosensoriales

22. Neurotrophic factors. MCN

23. Sistemas somatosensoriales

24. Sistema auditivo y visual

25. Sentidos químicos

26. Biological clocks: circadian cycles.

Paper presentation I. MCN M: Aymerich & M. Arrasate

Paper presentation II. MCN M: Aymerich & M. Arrasate

27. EEG

28. Ciclo sueño vigilia y fases del sueño

Práctica EEG sueño CUN

29. Sistema vestibular postura y marcha

30. Cognición I

31. Cognición II

EDUCATIONAL ACTIVITIES

This is a course of 3 ECTS (75 h). The work is distributed as follows:

1. Class activities (1.04 ECTS, 26 h)

- Lecture format: 0.8 ECTS, 20 h

The lectures are based on the presentation of a topic by the professor. The content of the classes is based on this theory program. Power point slides will be made available to students in advance through ADI.

- 11 sessions, 2-hours each.

- Paper presentation: 0.16 ECT, 4 h

The aim of this kind of session is to identify relevant information from scientific papers. It will take place once the theory content has been explained. The professors will select papers relevant to the course and each student will choose one of them. After reading it carefully,

students have to be able to summarize the main findings and to present them to the rest of the class in an oral presentation (10 min).

- 2 sessions, 2-hours each

- **Final examination:** 0.08, 2 h

The theory knowledge will be assessed in an exam that will consist in short questions regarding the basic aspects of the course.

- 1 session, 2-hours

2. Personal work (1.96, 49 h)

Student´s personal work is part of the learning process. It involves the use of scientific sources of information to go into detail about the contents explained in the lectures and the developing of analysis capacity in the comments of the paper provided.

ASSESSMENT

To obtain a pass in this subject it is necessary to obtain a final grade of 5 (50%) or above. Students are required to obtain at least 35% of the final grade in the final examination.

- Continuous assessment: 5%
- Paper presentation: 35%
- Final examination: 60%

Re-sit examinations

The re-sit examination offers students another opportunity to be assessed on their theory knowledge. The continuous assessment and the paper presentation grades are retained despite failure in the theory part of the course.

Grades:

10-9.0: SB

8.9-7.0: NT

5.0-6.9: AP

0-4.9: SS

- Those students with a final grade of 9 or above are eligible for Honors.

OFFICE HOURS

To contact with the professors ask for an appointment by e-mail:

Marisol Aymerich

BIBLIOGRAPHY AND RESOURCES

- Squire LR, McConnell SK, Zigmond MJ. "Fundamental Neuroscience". 4th Edition (2013). Academic Press. (2nd Ed. 2003. ebook). [Find it in the Library](#)
- Kandel ER, Schwartz JH; Jessell TM. "Principles of neural science". 5th Edition (2013). Mc Graw-Hill. [Find it in the Library](#)
- Mark F. Bear, Barry W. Connors, Michael A. Paradiso. "Neurociencia : la exploración del cerebro". 4ª Edición (2016). Wolters Kluwer. [Find it in the Library](#)
- Purves. "Neurociencia". 5ª Edición (2016). Ed. Panamericana. [Find it in the Library](#)
- Carlson BM. "Embriología humana y biología del desarrollo". 6th Edition. Elsevier. [Find it in the Library](#).

There will be a folder in ADI with recommended papers for each lecture.