
Research Laboratory in Madrid

COURSE DESIGNATOR MAD 4901

LANGUAGE OF INSTRUCTION ENGLISH

NUMBER OF CREDITS 3 credits

CONTACT HOURS 45

COURSE DESCRIPTION

INSTRUCTOR/COORDINATOR Ksenija Jovanovic, PhD.

DESCRIPTION

The *Research Laboratory in Madrid Course* aims to offer an introduction to Neuroscience research in its different branches, with the opportunity to work one-on-one with psychologists and scientists in a 6-week-long research program during the summer. The course has been designed to be research and theory oriented in order to provide a comprehensive foundation for studying basic neuroscience concepts and phenomena.

COURSE OBJECTIVES

- To teach students how to perform hypothesis-driven research
- To search and review scientific literature
- To learn how to collect clinical data from health information records
- To analyze and interpret results
- To improve scientific writing and communication skills

METHODOLOGY

We will combine the research internship with one class session per week. Class sessions will include analysis and reviews of scientific articles, lectures, power point presentations and discussions of required readings. Sessions will be conducted in English, but as the course progresses, the instructor will gradually introduce some useful scientific vocabulary in Spanish. The students are expected to have read the required material before class and to be prepared to participate in integrative and meaningful discussions. Students may be tested on all material covered in lectures and in research labs, as well as on additional required readings that may not be covered in class. All indicated assignments are to be completed in timely fashion and respecting deadlines.

REQUIRED READING/MATERIALS

Course Material:

The readings required for the course will be assigned throughout the course, posted on the Moodle platform or e-mailed by the instructor before the class.

GRADING

Each student will be graded individually according to the following criteria:

Participation	15%
Class discussion	15%
Individual class presentation	20%
Research internship	50%

Participation

All classes (including lectures, activities, etc) require the student's active participation. In order to receive a high grade the student must be prepared in advance and make meaningful observations, comments or questions that prove his/her comprehension and interest in the subject.

CRITERIA FOR GRADING AND GRADING STANDARDS

Grading Rubric		
A	93-100	Achievement that is outstanding relative to the level necessary to meet course requirements.
A-	90-92	Achievement that is significantly above the level necessary to meet course requirements.
B+	87-89	
B	83-86	
B-	80-82	Achievement that meets the course requirements in every respect.
C+	77-79	
C	73-76	
C-	70-72	Achievement that is worthy of credit even though it fails to meet fully the course requirements.
D+	67-69	
D	60-66	
F	0-59	Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I.

Individual Research Project & Class Presentation

The final evaluation of the course will consist of a power point presentation about the research internship the students carried out. An abstract needs to be send by e-mail to the instructor before the presentation and handed in to the rest of the students at the moment of the presentation. The presentations should be ten minutes long and students may use any kind of available support.

- Presentation structure:
 1. Abstract
 2. Hypothesis
 3. Introduction
 4. Material & Methods
 5. Discussion
 6. Conclusions
 7. Bibliography
- The written abstract must be submitted **on Monday the 16th of July**.
- **On Friday 20st July** each student will present to the class a summary of the main conclusions of his/her research.

IMPORTANT. No papers or requirements will be accepted after due dates.

CLASS ATTENDANCE

Regular attendance and punctuality are mandatory in order to earn full marks. Nevertheless, students are allowed ONE UNJUSTIFIED absence. From that one on, each absence will decrease 5 points the final grade [e.g.: from 92 (A-) to 87 (B+)]. Instructor may deny the access to the classroom if the student arrives more than 10 minutes after the class has started. In the case of absences, it is the student's responsibility to find out what information was given in class including any announcements made.

CLASS SCHEDULE (Note: This schedule is subject to change)

- Week 1 - Neuroscience: basic concepts and neuroanatomy
- Week 2 - New and old techniques in modern neuroscience
- Week 3 - Neuron, action potential and synaptic transmission
- Week 4 - Plasticity of the central nervous system, development and behavior
- Week 5 - Data collection and analysis
- Week 6 - Scientific communication: presentations, articles and projects

DESCRIPTION OF LABORATORIES PARTICIPATING IN THE COURSE MADR4901

Developmental Neurobiology, Cajal Institute, CSIC-Fernando de Castro, MD, PhD

Our lab is focused on the study of oligodendrocytes, the cells that form the myelin sheet around nerve fibers and facilitate the nerve impulse transmission. These cells die in multiple sclerosis (MS) and other demyelinating diseases. We study the basis of myelination and demyelination to identify potential biomarkers that better diagnose multiple sclerosis (the second leading cause of paraplegia) and to advance the neural repair therapy of the disease. We are especially interested in oligodendrocytes precursors (OPCs) in the adult central nervous system (CNS), comprising 3-5% of total cells thereof. Our experimental work, employing samples from patients with MS and animal models of the disease, addresses different molecular interactions underlying the development of oligodendrocytes and myelination, as well as in vitro studies of OPCs and other relevant cell types. Students will have the opportunity to learn about various aspects of the research process, including experimental design, implementation and execution, animal or tissue samples handling, data collection and analysis and literature review.

Neuronal Engineering (HM Hospital-CINAC)-Guglielmo Foffani, PhD

Neuronal activity represents the functional basis of the central nervous system. Modern neurophysiological techniques allow scientists to record neuronal activities of increasing complexity as: populations of single neurons, local field potentials, multichannel EEG and functional imaging. However, the complexity of these signals often impedes the correct pathophysiological interpretation of the recorded neuronal activities. The overall objective of our research is to develop and apply methodologies for recording and analyzing signals in order to extract pathophysiological information from complex neuronal activities. The main research lines are the following: (1) brain reorganization after spinal cord injury; (2) neuronal oscillations in neurodegenerative disorders; (3) neural codes in the somatosensory system; (4) development and application of neuromodulation techniques to treat neurological and neuropsychiatric disorders. Students will get familiar with specialized software for electrophysiological data recording and gain experience in computer analysis and interpretation of different patterns of neuronal activity.

The López-Ibor Clinic, Madrid - María José López Ibor, MD, PhD

Stigma against people with mental illness is common in Western societies. This social rejection and the discrimination that goes along with it, make life all the more difficult for people with serious psychological conditions. To some, the stigma is so unbearable that they avoid seeking help for their illness. Our clinic is dedicated to the comprehensive care of people suffering from mental illness. In addition, one of our objectives is to fight the social stigma and discrimination of people suffering from mental illness that negatively affects patients and their families alike. Besides conventional therapies, our team has extensive experience in the application of Transcranial Magnetic Stimulation (TMS) to patients suffering from mental illnesses that have not responded to other treatments, specifically in cases of resistant depression, obsessive compulsive disorder (OCD) and some cases of schizophrenia. Students will work under supervision, their involvement will be observational and without a direct contact with patients. To enroll in this lab, students must have a medium-to-high level of Spanish.

Foundation Institute Spiral-Leandro Palacios, MD, Clinical psychologist

Our institution is dedicated to treating chemical addictions, alcoholism and mental disorders. Similar to alcohol and drugs abuse, mental disorders pose a risk to the individual's physical and emotional well-being and have important social impact. We address these disorders through clinical research, up to date clinical programs and the use of the latest advances in psychiatry, psychotherapy and psychology, as well as through public outreach and education. In our center we carry out programs and treatments for detoxification, rehabilitation, and social insertion.

Students will work under the supervision, their involvement will be observational and without a direct contact with patients. To enroll in this lab, students must have a high level of Spanish.

Molecular Neuropathology (Centre for Molecular Biology Severo Ochoa-CBMSO)-Maria Dolores Ledesma, PhD

In the CBMSO we focus our research on the study of the molecular basis of human diseases with the goal of providing the necessary knowledge to design therapies, procedures and diagnostic methods that help improve the life expectancy. Specifically, our laboratory is centered on investigating the role of lipids in neuronal physiology and pathology with the focus on their participation in synapses (i.e. contacts formed between neurons). The observation that most lipidosis lead to cognitive impairment and mental retardation further supports the relevance of lipids in such process. We focus on the analysis of sphingolipids and cholesterol because, among other reasons, they are particularly enriched in neurons and have the ability to form signaling platforms. As experimental models we use mice in which enzymes related to lipid metabolism have been genetically altered allowing in vivo analysis. These mice mimic human genetic diseases, such as Niemann pick type A and desmosterolosis, which cause severe mental retardation. Since the lipidic alterations we have found in these mice are similar to those reported in aging brains our results might have implications not only in the establishment and maintenance of synapses but also in their functional decay during aging.

Students will work under the supervision of a graduate student or a post-doc and will have the opportunity to learn about different laboratory procedures, animal handling, molecular biology and genetic modifications.

Neuroregenerative Chemistry (National Hospital for Paraplegics, Toledo)-Ernesto Doncel-Perez, PhD

Research in our laboratory focuses on regeneration and repair of a lesioned central nervous system (CNS). Specifically, we use rats and/or cell cultures to pursue two lines of research: 1) control of the glial scar formation and promotion of neural/axonal growth in the lesioned CNS area; and 2) development of new biomarkers for Guillain Barré Syndrome. Furthermore, we study bio-compatible and bio-degradable polymers and their potential as vehicles for drug delivery and/or possible substrates for cellular transplants. To accomplish these objectives we employ methodologies stemming from organic chemistry, cellular and molecular biology, immunohistochemistry, as well as animal models of the CNS pathologies (especially in spinal cord injury and peripheral neuropathy) perusing the development of compounds that may be transferred to the clinic and used effectively as therapies in patients with spinal cord lesions and other pathologies of the CNS.

Students will have the opportunity to perform dissections of neural tissue and isolation of neural cells, to grow cell cultures, to get familiar with molecular and cellular methodologies, confocal microscopy and imaging techniques, and quantification of neural markers.

Sensorymotor Function (HNP & University of Castilla La Mancha)-Julian Taylor, PhD and Julio Gomez-Soriano, PhD

Spinal cord injury is associated with a significant reduction in quality of life and independence of patients due to the neurological injury and limited recovery of the sensorimotor function system, which includes the development of debilitating symptoms such as spasticity, paralysis and pain. Our research activities have two main objectives: i) Improvement of early diagnosis of spasticity and pain, based on the measurement of pathophysiological changes associated with spinal cord injury, and ii) Development of new sensory stimulation techniques for the neurorehabilitation of spasticity, paralysis and pain whilst promoting adaptive sensorimotor neuroplasticity after spinal cord injury.

Students will gain experience in basic clinical neurophysiological techniques (electromyography, reflex and startle response), neurological assessment of sensorimotor function (isometric and isokinetic muscle force) and pain psychophysics (conditioned pain modulation with electroencephalography).

ACADEMIC BEHAVIOUR

The Fundación Ortega-Marañón expects all the students to complete coursework responsibilities with fairness and honesty. Plagiarizing and cheating on assignments or examinations will be considered scholastic dishonesty. Within this course any student with such behavior can be assigned an F. No cellular phones may be connected during classes or any other Program Activities.

STUDENTS WITH DISABILITIES

Students in need of assistance have to fill a form at their Home University in order to help us make the Fundación facilities suitable to their needs. In the first class, students must inform the instructor in order to make appropriate arrangements.

DISCLAIMER

The class schedule and material is subject to change. The placement in one of the participating labs will be available on first come first serve basis. Unlike at the US universities, the labs are scattered within Madrid's metropolitan area and some of them in nearby Toledo, so the students will need to use the public transportation to get to them. The FOGM staff will provide students with detailed information about the public transportation and if necessary accompany them to their labs.