

UNIVERSITY OF PUERTO RICO
SCHOOL OF MEDICINE

PHYSIOLOGY DEPARTMENT

COURSE DESCRIPTION

COURSE TITLE: **INTRODUCTION TO NEUROSCIENCE**

COURSE CODE: **FISA 8525**

CREDIT HOURS: **3 CREDITS (54 HOURS)**

COURSE DURATION: **18 WEEKS**

NUMBER OF STUDENTS: **MIN.: 4 MAX.: 16**

COORDINATOR NAME: **DR. JORGE D. MIRANDA**

COORDINATOR OFFICE HOURS: **TO BE ARRANGED**

COORDINATOR OFFICE: **A-682**

COURSE HOURS: **SEE ATTACHED SCHEDULE (1.5 hrs. twice/week)**

WHEN WILL BE OFFERED: QUATERLY X SEMESTER (S1)
 X YEAR (1^{ER}) SUMMER

PREREQUISITE: **VERTEBRATE PHYSIOLOGY I - II**

JUSTIFICATION: This course was designed to develop the graduate student knowledge in three basic areas of neuroscience. These areas are: Neuroanatomy, Neural development and plasticity in the central nervous system. Modern biotechnology frequently provides new discoveries of axonal tracts and cellular events during neural development, making this a dynamic course for students. The topics covered in this course and the time assigned for each theme, are not offered to students in any other course at the Graduate School. Therefore, under departmental approval this course will be available to students of other departments and from other units of the University of Puerto Rico.

DESCRIPTION: This course offers essential information of spinal cord circuits, neural development and plasticity, integrating basic concepts, theories and research strategies from different disciplines like Anatomy, Physiology, Biochemistry, Pharmacology, Cell & Molecular Biology. Topics within this course include Neuroanatomy of axonal tracts in the spinal cord, control of movement, circuits related to pain, glial cells, myelin formation, axonal transport, neural development and plasticity in the adult central nervous system. The central focus of this course will be the biochemistry, cellular and molecular analysis of neural development and behavior of the nervous system. In addition, the sensory and motor systems in relation to the spinal cord will be discussed. The material will be presented as conferences of specific topics recently published in scientific journals. The ultimate goal of this course is to teach students the basic molecular and cellular concepts of neural development and behavior, and demonstrate the main tracts used by the central nervous system to control movement.

COURSE OBJECTIVES:

- 1) Identify the main structures and the cellular components of the central nervous system (brain & spinal cord)**
- 2) Describe the tracts in the spinal cord and circuits that modulate movement.**
- 3) Examine the molecular and cellular concepts of development in the central nervous system (induction, proliferation, migration, axonal outgrowth, synapse formation, polarization and regionalization).**
- 4) Analyze events that are evidence of plasticity in the adult nervous system and understand the intracellular mechanisms that modulates the activity (regeneration and Long Term Potentiation)**
- 5) Study the axonal transport mechanisms to the synaptic terminal (anterograde) or toward the cell body (retrograde).**

TEACHING STRATEGIES:

METHODS:

**Conferences
Group Discussions
Assigned Readings**

AUDIOVISUAL RESOURCES:

**Slides
Transparencies
Illustrations
Pictures
Blackboard**

ESSENTIAL REQUIREMENT:

Attendance and punctuality

EVALUATION STRATEGIES:

Category	Value (%)
Partial Exam I	25%
Partial Exam II	25%
Partial Exam III	25%
Oral Presentation	20%
Attendance and Class Participation	5%
Total	100%

GRADING SCALE:

Average (%)	Grade
100-88	A
87-78	B
77-70	C
69>	F

BIBLIOGRAFY:

Reference Books:

1. Principles of Neural Science (4th edition, by Kandel, Schwartz & Jessell , 2000)
2. Development of the Nervous System (1st edition, by Sanes, Reh & Harris, 2000)
3. Neuroscience/Exploring the brain (2nd edition, by Bear, Connors & Paradiso, 2001)
4. Neuroscience (1st edition, by Purves, Augustine, Fitzpatrick, Katz, LaManantia & McNamara, 1997)
5. Neurobiology (2nd edition, by Matthews G, 2001)
6. From Neuron to Brain (3rd edition, by Nicholls, Martin and Wallace, 1992).

Scientific Journals:

1. "Neuron"
2. "Current Opinion in Neurobiology"
3. "Annual Review of Neuroscience"
4. "International Journal of Developmental Neuroscience"
5. "Journal of Neurochemistry"
6. "Trends in Neuroscience"
7. "Journal of Neuroscience"
8. "Journal of Neurotrauma"
9. "Journal of Experimental Neurology"
10. "Developmental Brain Research"

FISA 8525

Introduction to Neuroscience

Course Schedule

Coordinator: Dr. Jorge D. Miranda

Neuroanatomy:

1st lecture: Dr. Jorge D. Miranda

Review: Cellular Organization, Action Potential, Membrane Resting Potential, Synapsis (release of neurotransmitters), Postsynaptic depolarization (VGIC, G-protein coupled receptors, LGIC)

- 2nd lecture: Dr. Jorge D. Miranda
Organization of the Brain and Spinal Cord (Ventricular System, meninges, BBB & blood circulation)
- 3rd lecture: Dr. Jorge D. Miranda
Ascending Spinal Cord Tracts
- 4th lecture: Dr. Jorge D. Miranda
Descending Spinal Cord Tracts
- 5th lecture: Dr. Jorge D. Miranda
Mechanism of Motor Control (Modulation by Basal Ganglia and Cerebellum)
- 6th lecture: Dr. Jorge D. Miranda
Pain (Circuit in the spinal cord)
- 7th lecture: By: Student
Manuscript presentation & group discussion

Exam I

Developmental Neurobiology:

- 8th lecture: Dr. Jorge D. Miranda
Neural Induction (Molecular basis & formation of major brain subdivision)
- 9th lecture: By: Student
Manuscript presentation & group discussion
- 10th lecture: Dr. Jorge D. Miranda
Neural Birth and Migration
- 11th lecture: By: Student
Manuscript presentation & group discussion
- 12th lecture: Dr. Jorge D. Miranda
Neural Determination and Differentiation
- 13th lecture: By: Student
Manuscript presentation & group discussion
- 14th lecture: Dr. Jorge D. Miranda
Axon Growth and Guidance

- 15th lecture: By: Student
Manuscript presentation & group discussion
- 16th lecture: Dr. Jorge D. Miranda
Target selection
- 17th lecture: By: Student
Manuscript presentation & group discussion
- 18th lecture: Dr. Jorge D. Miranda
Synapse Formation & Electric Function
- 19th lecture: By: Student
Manuscript presentation & group discussion
- 20th lecture: Dr. Jorge D. Miranda
Refinement of Synaptic Connection
- 21st lecture: By: Student
Manuscript presentation & group discussion
- 22nd lecture: Dr. Jorge D. Miranda
Polarity & Regionalization
- 23rd lecture: By: Student
Manuscript presentation & group discussion

Exam II

Neural Plasticity:

- 24th lecture: Dr. Jorge D. Miranda
Degeneration & Regeneration of the Adult Central Nervous System
- 25th lecture: By: Student
Manuscript presentation & group discussion
- 26th lecture: Dr. Jorge D. Miranda
Learning & memory
- 27th lecture: By: Student
Manuscript presentation & group discussion
- 28th lecture: Dr. Jorge D. Miranda
LTP: Molecular Mechanisms of learning and memory
- 29th lecture: By: Student
Manuscript presentation & group discussion

30th lecture: Dr. Jorge D. Miranda
Axonal Transport

31st lecture: By: Student
Manuscript presentation & group discussion

32nd lecture: Dr. Jorge D. Miranda
Glial cells and Myelin Formation

Exam III