

American University of Beirut

Faculty of Arts and Sciences

Department of Biology

BIOL244 Introduction to Neurobiology

-3 credits-

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Lectures: T-TH, 2-3:15pm

Catalogue Entry

BIOL 244 Introduction to Neurobiology 3.0; 3 cr.

A comprehensive introduction to neural signaling, brain development and regeneration in the adult brain. The course covers molecular to higher organizational level of neural functions. It emphasizes the fundamental principles and mechanisms associated with brain development and physiology including nerve communication, neurogenesis, patterning and regionalization as well as neural stem cells function. *Prerequisite: BIOL 202. Annually.*

Syllabus description

The course covers the major areas of cellular and molecular neurobiology and is divided into two main units. The first unit explores the major concepts in neural signaling including electrical signals of nerve cells, excitable cell and membranes, ions channels and transporters, synaptic transmission, neurotransmitters and their receptors. The second unit focuses on brain development including early neural induction and pattern formation, cell lineage and fate determination, neuronal migration, axon guidance, synapse formation and stabilization. This unit also emphasizes the cellular and molecular properties of neural stem cells and progenitors cells as well as regeneration in the adult brain. Material includes lectures and exams and involves class presentations and discussions of primary literature and relevant topics.

Textbook and Resources:

- 1) Purves 2008, Neuroscience, 4th edition
- 2) The material for the course including lectures, recent literature and references are available on Moodle

Course syllabus

Unit 1: Neural Signaling

Chapter 1: Studying the nervous system

Chapter 2: Electrical signals of nerve cells

Chapter 3: Voltage-dependent membrane permeability

Chapter 4: Channels and transporters

Chapter 5: Synaptic transmission

Chapter 6: Neurotransmitters and their receptors

Chapter 7: Molecular signaling within neurons

Unit 2: Neural Development and Brain Regeneration

Chapter 22: Early brain development

- Molecular mechanisms of neural induction
- Mechanisms of patterning, regionalization and migration in the brain
- Neural stem cells and progenitor cells
- Neurogenesis

Chapter 23: Construction of neural circuits

Chapter 25: Repair and Regeneration in the peripheral and central nervous systems

- Adult neurogenesis

Learning outcomes

The students will be able to:

1. learn the cellular components of the nervous system and their function. BIOL BS PLO 2e
2. study the organization and function of the neural systems. BIOL BS PLO 3c
3. study the mechanisms of generation of different electrical signals among nerve cells. BIOL BS PLO 4
4. compare and contrast the characteristics of the different types of ion channels and active transporters found across the nerve cell. BIOL BS PLOs 3a and 3b
5. learn the principles of synaptic transmission. BIOL BS PLOs 3a and 3b
6. study and compare the function of the different types of neurotransmitters and their receptors. BIOL BS PLO 3a
7. learn about some of the latest techniques used in cell and molecular neurobiology. BIOL BS PLO 5b
8. discover the early steps in brain development, neural induction and pattern formation. BIOL BS PLO 4a
9. identify the main brain subdivisions and their derivatives. BIOL BS PLO 3c
10. learn about the molecular basis of neural induction and patterning. BIOL BS PLO 4a
11. study the process of neurogenesis and compare the properties of stem cells and progenitor cells. BIOL BS PLOs 3a and 3b
12. assess and compare regeneration in the peripheral and central nervous systems. BIOL BS PLO 3b
13. study regeneration in the adult mammalian brain. BIOL BS PLO 4a

In addition:

Each student will give:

- a short presentation (15min) on a selected topic that is directly related the course content
- a short seminar (20min) on recent literature and discuss the major findings in the article. BIOL BS PLO 7

Exams

Exam 1: 20%

Exam 2: 25%

Final Exam: 37.5%

Attendance and participation: 7.5%

Class presentations: 10%