Ben- Gurion University of the Negev
Faculty of Health Sciences
Joyce & Irving Goldman Medical School

Name of the module: **Neurophysiology**

Number of module: 471.8.2027

BGU Credits: 2

ECTS credits:

Academic year: 2nd year medicine.

Semester: spring semester.

Hours of instruction: 8are – 10am.

Location of instruction: TBA

Language of instruction: Hebrew

Cycle: B. Med. Sci.

Position: Obligatory module intended for 2nd year medical students, as part of their preclinical teaching.

Field of Education: Physiology.

Responsible department: Physiology and Cell Biology.

General prerequisites: Students should complete successfully the preceding course in cellular physiology. Basic knowledge in physics, cellular biology and medical biochemistry is assumed.

Grading scale: from 0 to 100.

30% - active participation in classes.

70% - final exam.

Students should pass the final exam with a grade of 65 and above.

Course Description: The course explores various mechanisms in the nervous system. It deals with the operation of some of the sensory systems, from the sensory transduction to the network mechanisms of sensory processing. Other topics will include motor planning and execution, sleep and synchronization.

Aims of the module: Introduce basic principles in the operation of the CNS. Emphasis is placed on the many open questions, and current research directions.

Objectives of the module: Develop knowledge in brain mechanisms, ability to read research papers, and sufficient curiosity required to promote additional reading and future follow-up of the topic.

Learning outcomes of the module: On successful completion of the course, the student should be able to:

1. Demonstrate knowledge of the sensory organs and sensory transduction mechanisms.
2. Demonstrate basic understanding of neuronal network operations behind sensory processing
3. Show knowledge of the mechanisms behind motor planning and execution.
4. Read current articles.
5. Understand basic deficits in neurological disease.

Attendance regulation: Obligatory in discussion groups.

Teaching arrangement and method of instruction: The course is based on 'flipped classroom' method. The class will be divided into 4 groups, and each group will discuss a topic with one of 2 lecturers every other week.

Lecturer 1: Prof. Yael Amitai
Contact details:
Office phone: 6477329
Email: yaela@bgu.ac.il
Office hours: by Email appointment.

Lecturer 2: Prof. Rony Azouz
Contact details:
Office phone: 649851
Email: razouz@bgu.ac.il
Office hours: by Email appointment.

Module evaluation: at the end of the semester the students will evaluate the course. Students' representatives discuss their comments with the lecturers and Faculty representatives.

Confirmation: 2002
Last update: 2015

Assessment:

1. Multiple-choice examination. – 70%
2. Active participation in discussion groups – 30%

Work and assignments: NA

Time required for individual work: in addition to attendance in class, the students are expected to do their assignment and individual work:
Students are expected to study and prepare for discussion. Reading materials include textbook, presentations and various web sites. They are expected to spend 4 hours / week studying for this course.

Module Content\ schedule and outlines:

Lecture 1: Introduction of the structure of the CNS: cellular constituents, gray and white matter, major subdivisions of the CNS, modulatory nuclei, structure of the neocortex.

Lecture 2: Sensory transduction 1 – the chemical senses: the receptor cells, transduction mechanisms, coding strategies in the sensory organ - population code vs. labeled lines, the unique properties of the olfactory system.

Lecture 3: Sensory transduction 2 – the eye: the anatomy of the eye, mechanisms of the transduction, cellular components of the retina, and receptive fields in the retina.

Lecture 4: Sensory transduction 3 – mechano receptors: the anatomy of the inner ear, transduction of sound in hair cells, amplification mechanisms, acoustic trauma. The vestibular organ and the sense balance and head position.

Lecture 5: the somatosensory system 1: the different senses, properties of receptors in the skin, peripheral sensory axons, somatotopic organization.

Lecture 6: the somatosensory system 2: somatosensory representation in the neocortex, symptoms of damage to the posterior parietal lobe. The unique properties of the sense of Pain.

Lecture 7: spinal control of movement: the motor unit and the NMJ, spinal cord organization, reflexes.

Lecture 8: brain control of movement: movement planning in the motor cortex. Cerebellum. The extrapyramidal system – physiology and pathophysiology.

Lecture 9: the visual system 1: dark and light adaptation, retinal processing, ganaglion cells receptive fields, the LGN.

Lecture 10: the cortical visual processing: anatomy of the striate cortex, receptive fields in the primary striate cortex and beyond. Visual perception.

Lecture 11: the hippocampus: anatomy, role in memory systems, place cells.

Lecture 12: brain rhythms and sleep: EEG and mechanisms of brain rhythms. The functional states of the brain, sleep cycle, circadian rhythms and the suparachiasmatic nucleus.

Lecture 13: brain mechanisms of emotion: theories of emotion, the limbic system, the amygdala and fear, difficulties with the single emotion system concept.

Lecture 14: Discussion of a recent article.

Required reading:

Relevant chapters from either:

(1) Bear, Connors, Paradiso: Neuroscience, exploring the brain, 3rd edition.

(2) Purves D, Augustine GJ, Fitzpatrick D, et al, Neuroscience, 2nd edition: http://www.ncbi.nlm.nih.gov/books/NBK10799/

Additional literature:

1) Jordt SE et al., Lessons from peppers and peppermint: the molecular logic of thermosensation, Current Opinion in Neurobiology 2003, 13:487–492
2) Carleton A et al., Coding in the mammalian gustatory system. TINS, 2010, 33:326–334.
3) Berson et al., Phototranbsduction by retinal ganglion cells that set the circadian rhythm. Science, 2002, 295:1070-73.
4) Matyas et al., Motor control by sensory cortex. Science, 2010, 330:1240-43.

*** All learning material will be available to the students on the module's website (high-learn)/ library/ electronic documents available to BGU students.**