

## *The Hebrew University of Jerusalem*

### *Syllabus*

### *systems neuroscience - 96207*

*Last update 18-11-2024*

*HU Credits:* 8

*Degree/Cycle:* 1st degree (Bachelor)

*Responsible Department:* Medicine

*Academic year:* 0

*Semester:* 2nd Semester

*Teaching Languages:* Hebrew

*Campus:* Ein Karem

*Course/Module Coordinator:* Prof. Shahar Arzy  
Prof. Lili Anglister

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*Coordinator Office Hours:* Please set up the appointment by email

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### Teaching Staff:

Prof. Lili Anglister,  
Dr. Ariel Gilad,  
Prof. Shahar Arzy,  
Dr. Rokni Dan,  
Dr. Anat Arzi,  
Prof. Alexander Binshtok,  
Dr. Sagit Stern,  
Dr. Muneer Abu-Snineh

### Course/Module description:

The course “the nervous system of the healthy person” will be taught in the current academic year as system neuroscience. The course will cover functions of the nervous system, starting from the sensory and motor systems, encompassing essential aspects like motor skills, vision, and hearing, and delving into higher brain functions, such as emotions, sleep, and consciousness.

The course offers a profound understanding of each cognitive system through engaging clinical presentations, and will be led by experts from the Biomedical field, as well as experts physicians and researchers. Furthermore, students will have the opportunity to explore cutting-edge technologies and computational tools that are revolutionizing the field, including brain-machine interfaces and cochlear implants. The course also includes a workshop dedicated to strengthening students' understanding of neuroanatomy, brain lesions, and brain network functions. In this workshop, students will apply computational tools for lesion analysis, fostering hands-on learning. The neuroanatomy component is designed to provide a comprehensive learning experience, combining labs and engaging lecture. Throughout the course, enriching material will be provided, offering in-depth research papers, insightful podcasts, and stimulating online lectures that align with the subjects covered.

### Course/Module aims:

Provide students with knowledge of the detailed structures and functions of the central (brain, spinal cord) and peripheral nervous system. Understanding functional brain correlates in brain regions and networks, focusing on important knowledge for physicians in any field.

### Learning outcomes - On successful completion of this module, students should be able to:

- Explaining functioning of brain systems and networks.
- Understand and explain how the nervous system controls and executes various functions of the normal healthy human: sensation, movement, emotion, and higher brain functions.

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- Recognize in detail the gross anatomy of the central and peripheral nervous system.
  - Analyzing the link between focal brain lesions to brain functioning and brain networks.

Attendance requirements(%):

Presence is not mandatory in the theoretical lectures, but is highly recommended due to the seminars, clinical presentations, and special lectures given by renowned physicians and researchers.

During the neuroanatomical part of the course and the workshop, presence is 100% mandatory. Failure to fulfill this requirement may lead to reduced grade or failure in the course.

Teaching arrangement and method of instruction: Frontal lectures, seminars and lectures given by expert physicians, special lectures given by guest researchers, lectures and laboratories of human brain dissections, a workshop.

Course/Module Content:

Part A – System neuroscience

1. Introduction.

Lecture: What is it like to have a brain? from greek philosophy to modern concepts

Clinical presentation: Introduction of Complex Neurological / Psychiatric clinical case and Discussion of possible structures-functions involved.

2. Pyramidal Motor system: organization and neurophysiology in the central nervous system, Brain-Machine Interface, Anatomy: Spinal cord & peripheral nervous system.

Clinical presentation: ALS

Case based teaching: sensory-motor deficits

3. The brainstem and the cranial nerves: brain stem functions, autonomic nervous system, cranial nerves.

Clinical presentation + Patient examination: BS/CN impairment, cranial nerve examination or sleep disorders.

Seminar: sleep and sleep loss

4. The human expression through motor manifestations (movement, speech, gestures, Facial expressions, eye movements) - interaction between the pyramidal motor and other non-pyramidal motor function systems. Cerebellum, anatomy and function of the basal ganglia.

Clinical presentation + patient examination: Patient with idiopathic Parkinson's Disease + signs of movement disorder

Case based teaching: Pathologies of basal ganglia

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*Seminar: Deep Brain Stimulation*

*5. Sensory systems:*

*a. Vision: anatomy of the eye and orbit, neuroanatomy & neurophysiology of vision.*

*Clinical presentation: visual processing.*

*Seminar: From the photon to color*

*b. Hearing and Sense of Position: Functional anatomy & neurophysiology of external, middle and inner ear, Physiology of central + peripheral vestibular system.*

*Clinical presentation: Cochlear implant and/or patient examination: Vestibular vertigo and dizziness.*

*Seminar: central auditory processing and perception.*

*c. Smell and taste: Functional Anatomy of the oral cavity and nose Throat, transduction of taste and smell, central Processing of odor and taste.*

*d. Somatic sensation: Physiology of somatosensation, anatomy of sensory pathways, Transduction and transmission of external stimuli, Modulation of pain, peripheral and central mechanisms leading to chronic pathological pain.*

*Seminar: Psyche and Pain: Suffering; chronicity*

*Problem Oriented learning: patient with chronic pain and allodynia*

*6. Telencephalon – High Brain function: Introduction to the imaging of the nervous system, brain Rhythms, learning and memory in brains and machines, neuroplasticity & rehabilitation, high brain functions.*

*Clinical presentation: Dementia & Amnesia*

*Case based teaching: The dementias/localized high cognitive disorders*

*Patient examination: Neuropsychological findings*

*7. Lab: lesion analysis.*

*8. The mind: from brain areas to brain networks, emotion, consciousness and unconsciousness.*

*Clinical presentation: Schizophrenia and intake*

*Case based teaching: Disorders of Consciousness and Locked-in Syndrome*

*Seminar: The human self: from phenomenology to brain systems*

*Part B - Structure of the Human Brain (lectures and lab):*

*1. General topography of the brain and spinal cord, development, meninges, ventricles, CSF circulation, blood supply, cranial nerves*

*The cerebrum: Hemispheres, cortex and topography,*

*2. The cerebrum: White matter: association, projection and commissural fibers*

*3. The cerebrum: Basal nuclei (ganglia), amygdala, internal capsule*

*4. Diencephalon, lateral and third ventricles, development of the diencephalon, cerebrum and temporal lobe. Choroid plexus and CSF formation*

*5. Sections through the brain: identification of structures in sections and imaging*

*6. Brainstem: midbrain, pons, medulla- nuclei and tracts.*

*Cerebellum Functional anatomy of the cerebellum.*

*Fourth ventricle and neighboring structures.*

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Required Reading:

- *Gitlin's dissector of the human brain*
- *The Human Nervous System, Kiernan, J.A. Lippincott-Raven*
- *Anatomy Atlas (Netter/Sobota/Other)*

Additional Reading Material:

*Will be given in the course website.*

*Part B - Structure of the Human Brain:*

- *Essentials of Neural Science and Behavior, Kandel, E., Schwartz, J.H., Jessel, T.M. Appelton & Lange*
- *From Neuron to Brain, Nicholls, J., Martin, A.R., Wallace, B. Sinauer*
- *Neuroscience, Purves, D., Augustine, G.J., et al. Sinauer*
- *Gitlin's dissector of the human brain*
- *The Human Nervous System, Kiernan, J.A. Lippincott-Raven*
- *Anatomy Atlas (Netter/Sobota/Other)*

Grading Scheme:

*Written / Oral / Practical Exam 25 %*

*Essay / Project / Final Assignment / Home Exam / Referat 45 %*

*Mid-terms exams 15 %*

*Clinical Work / Lab Work / Practical Work / Workshops 15 %*

Additional information: