Anatomy and Physiology of
Central Nervous System and Complex Nervous Activity
Spring 2013

PSY 127
ID:

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Office hours: by appointment
Course language: English
Classes:
Credits: 6
Prerequisites: no
Course status: required for PSY-112

Course description

This intensive terminology-heavy course encompasses the overview of the biological functioning and mechanisms of human central nervous system, staring with the examination of the structural units and their functions and with a further insight into physiological aspects of both normal and abnormal CNS activity. Students will be introduced to the description and analysis of major components of complex higher nervous activity and will be encouraged to work on an independent basis while investigating the topical issues in contemporary biological psychology, neuropsychology, and neuroscience.

From the human anatomy perspective we will study the nervous system and the structure of the brain, identify its different lobes and cortices, and analyze various tissues and organ systems within CNS in accordance to their functional and regional contexts. As human physiology investigates the vital activity and functioning of the human organism and its specific parts – biological systems, tissues, and cells, we will study the mechanisms and principles of their interaction with each other and the outer environment. Thus, students will learn about neuron development and plasticity, neurobiological systems, such as the sensory and motor systems, and the neural mechanisms of such complex phenomena, as memory, cognition, and emotions.

Course objectives

The main goal of the course is to provide students with an opportunity to examine the structural and functional features of human nervous system and higher nervous activity in the pursuit of deeper understanding of the biological basics of human behavior. Thus, core objectives of the course are:

- Identification of the organization of the CNS and its anatomy alongside explanation of the interactions and communication between major organ systems,
- Thorough presentation and explanation of the complementary interaction between structure and function complement within human nervous system,

- Sound investigation and analysis of the major neurobiological systems in the human body,
- Overview of the contemporary research methodology used for historical and modern neuroscientific studies,
- Analysis of neurobiological mechanisms underlying higher behavioral functions, such as language, emotion, learning, as well as those involved in various psychopathological states.

Course materials

1. Carlson, N. *Physiology of Behavior,* 9th edition. Allyn-Bacon (2007).
2. Seeley, R.R., Stephens, T.D., Tate, P. *Essentials of Anatomy and Physiology*. McGraw-Hill (1999).
3. Bear, M.F., Connors, B.W., Paradiso, M.A. *Neuroscience: Exploring the Brain, 3rd edition*. Lippincott Williams & Wilkins (2001).
4. Garrett, B. *Brain and Behavior: An Introduction to Biological Psychology, 2nd edition*. Sage (2009).
5. Thompson, R. *The Brain: A Neuroscience Primer, 2nd edition*. W.H. Freeman and Company (1993).
6. The New York Times. *Book of the Brain (edited by Nicholas Wade).* The New York Times (2001).
7. Blumenfeld, H. *Neuroanatomy through Clinical Cases*. Sinauer Associates, Inc. (2002).
8. DeArmond, S.J., Fusco, M.M., Dewey, M.M. *Structure of the Human Brain: A Photographic Atlas, 3rd edition*. Oxford University Press (1989).
9. Steward, O. *Principles of Cellular, Molecular, and Developmental Neuroscience*. Springer-Verlag (1989).
10. Saladin, K. *Anatomy and Physiology: the Unity of Form and Function*. McGraw-Hill (1998).
11. Fox, S.I. *Perspective on Human Biology*. Brown Publishers (1991).
12. Mader, B. *Human Biology*. McGraw-Hill (1998).
13. Kandal, et al. *Principles of Neural Science*. McGraw-Hill (2000).
14. Kandal, et al. *Essentials of Neural Science and Behavior*. McGraw-Hill (1995).

Course assessment

1. **Attendance – 10%**. Students are expected to attend every class. Missing more than 3 classes without presenting a proper excuse (e.g. medical certificate) will not only affect your grade for attendance, but also your participation grade.

2. **Participation – 10%**. Students are expected to take part in all discussions and actively facilitate them. It is essential that students prepare assigned reading before the lecture. Participation will be strictly graded on the basis of students' participation in class discussions.

3. **Mini-tests – 20%.** Mini-tests will take place practically each seminar class to ensure that students have prepared their reading assignments, to evaluate students' understanding and comprehension of the course materials, and to help students in preparation for the final exams.

4. **Presentation and discussion facilitation – 20%**. Students will be required to make an individual presentation for the course and facilitate the discussion based on the presentation material in class. Presentation topics are offered later in this syllabus. To facilitate the discussion students will need to prepare at least a couple of critical questions for their fellow students based on the chosen topic or plan a debate related to the topic of the presentation. The facilitator needs to inform the instructor about the time required for the planned discussion activity in advance.

   Assessment of the individual presentation (max 20):
   Content – 10
   Comprehensible presentation and/or usage or visual aids – 3
   Discussion facilitation – 5
   Proper formatting and graphics – 2

5. **Exams – 40% (20% each)**. There will be two exams, each covering the first and second half of the provided course material. Exams will contain both multiple choice and essay questions. Bonus questions will be available as well.

Grading scale

A	91-100%	C	61-65%
A-	86-90%	C-	56-60%
B+	81-85%	D+	51-55%
B	76-80%	D	46-50%
B-	71-75%	D-	41-45%
C+	66-70%	F	0-40%

Tentative class schedule

1. Introduction to the discipline. Structure of a cell.
2. Communication within a neuron: action potential. Communication between neurons: synapse and non-synaptic interactions.
3. Structure of the central nervous system and the brain. Major lobes and cortices.
4. Protection system of the brain. Brain-blood barrier.
5. Structure and functions of the limbic system.
6. Structure and functions of mesencephalon.
7. Brain development. Functioning of autonomous, endocrine, and immune systems within CNS.
8. Sensory systems: vision, hearing, olfaction, gustation, somatic sensation (proprioception).
9. Neural regulation of movement. Neurobiology of pain. Nociception.
10. Neural mechanisms of sleep. Biorhythms.
11. Neural regulation of emotions and motivation. Neural bases of sexual behavior.
12. Neurobiology of cognitive functioning: learning and memory.
13. Neurological disorders. Neurodegenerative conditions. Stroke. Epilepsy. Syndromes and sensory impairments.
14. Neurobiological bases of mental disorders. Eating disorders. Mood and anxiety disorders. Schizophrenia and other psychotic conditions. Developmental disorders. Substance-related disorders and addictions.
15. Research methods and technologies in contemporary neurobiological research. Applications of neurobiological findings.

Integrates anatomy and physiology of cells, tissues, organs, the systems of the human body, and mechanisms responsible for homeostasis.Â Recognize the complex connections within the subcortical structures of the basal nuclei. Explain the arrangement of gray and white matter in the spinal cord. The Cerebrum. Cerebral Cortex.Â The brain and the spinal cord are the central nervous system, and they represent the main organs of the nervous system. The spinal cord is a single structure, whereas the adult brain is described in terms of four major regions: the cerebrum, the diencephalon, the brain stem, and the cerebellum. A personâ€™s conscious experiences are based on neural activity in the brain. The regulation of homeostasis is governed by a specialized region in the brain. The central nervous system has been thoroughly studied by anatomists and physiologists, but it still holds many secrets; it controls our thoughts, movements, emotions, and desires. It also controls our breathing, heart rate, the release of some hormones, body temperature, and much more. The retina, optic nerve, olfactory nerves, and olfactory epithelium are sometimes considered to be part of the CNS alongside the brain and spinal cord.Â The brain is the central control module of the body and coordinates activity. From physical motion to the secretion of hormones, the creation of memories, and the sensation of emotion. To carry out these functions, some sections of the brain have dedicated roles. Learn and reinforce your understanding of Nervous system anatomy and physiology through video. The nervous system is composed of the central nervous system.Â The afferent division brings sensory information from the outside into the central nervous system, and includes visual receptors, auditory receptors, chemoreceptors , and somatosensory or touch receptors. On the other hand, the efferent division brings motor information from the central nervous system to the periphery, ultimately resulting in contraction of skeletal muscles to trigger movement through the somatic nervous system, as well as contraction of the smooth muscles to trigger activity of the internal organs through the autonomic nervous system. The nervous system is a complex network of nerves and cells that carry messages to and from the brain and spinal cord to various parts of the body. Â© VectorMine / Shutterstock.com. The nervous system includes both the Central nervous system and Peripheral nervous system. The Central nervous system is made up of the brain and spinal cord and The Peripheral nervous system is made up of the Somatic and the Autonomic nervous systems. The Central Nervous System (CNS). The central nervous system is divided into two major parts: the brain and the spinal cord. The Brain. The brain lies within the skul