

BIOLOGY 4752 WA – NEUROBIOLOGY II

DR. R. OMELJANIUK

1. Instructor.

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2. Intent.

To provide senior undergraduate students with an opportunity to study selected aspects of neurobiology in a directed study approach.

3. Marking Scheme.

10 Assignments valued at 10 final marks each = 100 final marks. Assignments are due as indicated; late assignments will not be accepted. In the event of extenuating circumstances students are encouraged to request extensions on an individual basis in writing. Assignments are to be submitted into the Assignment box no later than 1200 hrs on the Friday of the Assignment Deadline week.

4. Execution.

a. General. Students will be assigned specific readings from the course textbook and will be prepared to discuss the subject matter and any difficulties they may have with it in group discussion on a weekly basis. Attendance at coordination and discussion meetings is required. Students' comprehension and mastery of the material will be evaluated on the basis of assignments submitted no later than one week following discussion of the subject matter. Answers to assigned questions may take any neatly presented format including text, figures and tables submitted as a hard copy; paragraph and short-essay answers supported by diagrams of the student's own design will be most appropriate. All assignments must be credibly completed; in the event a student completes the course with a mark between 40 and 49 %, they will be eligible to apply for a Special Exam to be arranged with Lakehead University Scheduling. The examination will cover the entire course material and the examination mark will take the place of the course mark.

b. Tentative Outline.

Serial	Chapter #	Chapter Title	Discussion Date (week of)	Assignment Deadline (week of)
1	18 19	The Functional Organization of Perception and Movement. Integration of Sensory and Motor Function: the Association Areas of the Cerebral Cortex and the Cognitive Capabilities of the Brain.	12 Jan	19 Jan
2	20	From Nerve Cells to Cognition: The Internal Cellular Representation Required for Perception and Action.	19 Jan	26 Jan
3	21	Coding of Sensory Information; and	26 Jan	02 Feb

	22	The Bodily Senses.		
4	23 24	Touch. The Perception of Pain.	02 Feb	09 Feb
5	26 29	Visual Processing by the Retina; and Color Vision.	09 Feb	16 Feb
6	25	Constructing the Visual Image.	N/A	23 Feb
7	27	Central Visual Pathways.	23 Feb	02 Mar
8	28	Perception of Motion, Depth, and Form	02 Mar	09 Mar
9	30 31	Hearing Sensory Transduction in the Ear	09 Mar	16 Mar
10	32	Smell and Taste: the Chemical Senses	16 Mar	23 Mar

5. Textbook.

Principles of Neural Science (4th ed). E.R. Kandel, J.H. Schwartz, and T.M. Jessell. McGraw-Hill. New York. 1414 pp. 2000.

NOTE: Answer lengths quoted are exclusive of diagrams and tables submitted in support.

Assignment 1.

1. Describe the location, structure and functional organization of the thalamus. (Limit 3.0 pp; 3.0 marks).
2. Trace the routes of sensory and motor signals related to touch and fine motor control associated with playing the piano. (Limit 3.0 pp; 3.0 marks).
3. Association areas.
 - a. Diagrammatically identify the major association areas and state their roles and the three principles that govern association areas. (1 mark).
 - b. Use the prefrontal association areas to illustrate the function of an association cortex. (Limit 4.0 pp; 4 marks (sort of a bonus)).

Assignment 2.

1. Describe, using the cortex as a model, how the brain represents "personal space". (Limit 3.0 pp; 3.0 marks).
2. Discuss the brain's representation of personal space from the perspectives of personal experience and the influence of memory. (Limit 3.0 pp; 3.0 marks).
3. Is consciousness accessible to neurobiological analysis? Answer "yes" or "no" and support your answer from all the material in the chapter as well as the conclusions you draw yourself. (Limit 4.0 pp; 4.0 marks).

Assignment 3.

1. Identify and briefly discuss the four attributes of a stimulus that can be correlated with a sensation. (Limit 0.5 pp; 1.0 marks).
2. What is the meaning and significance of "Labelled Line Code" to sensory modality? (Limit 0.5 pp; 1.0 marks).
3. Discuss the relationship of stimulus amplitude and sensory intensity. (Limit 1.0 pp; 3.0 marks).
4. Identify and describe skin mechanoreceptors and their functional relationship with touch. (No limit; 4.0 marks).
5. Briefly describe and explain the termination patterns of somatic sensory neurons in the spinal cord and medulla. (Limit 1 p; 1.0 marks).

Assignment 4.

1. Describe and explain data input into, and integration within the primary sensory cortex. (Limit 3.0 pp; 3.0 marks).
2. Discuss the role of inhibitory networks and the influence of neurons in higher cortical areas in resolution of perception. (Limit 4.0 pp; 4.0 marks).
3. Consider the neuroanatomical and neurochemical origins of pain and discuss the paths along which this information is transmitted to the thalamus and cerebral cortex. (Limit 3.0 pp; 3.0 marks).

Assignment 5.

1. Discuss the cellular and biochemical basis of phototransduction in the retina. (Limit 4.0 pp; 3.0 marks).
2. Discuss the role and actions of ganglion cells in propagation of visual signals from the retina. (Limit 3.0 pp; 3.0 marks).
3. Discuss the neurobiological and biochemical substrates of color vision at the level of the retina. (Limit 4.0 pp, 4.0 marks).

Assignment 6.

1. Discuss the role of brain cortical areas in the processing of visual information. (Limit 4.0 pp; 5.0 marks).
2. Identify and discuss the roles of specific pathways used in conveying visual information. (Limit 4.0 pp; 5.0 marks).

Assignment 7.

1. Describe in an integrated fashion, neural paths which convey visual information from the retina through to the visual cortex. (Limit 3.0 pp; 3.0 marks).

2. Discuss the physical organization of the primary visual cortex and how it organizes initial inputs into visual images. (Limit 4.0 pp; 5.0 marks).
3. What is the role of the retino-geniculate pathway in visual image processing? (Limit 3.0 pp; 2.0 marks).

Assignment 8.

1. Discuss the analysis and resolution of motion images. Use diagrams to support your answer as required. (Limit 4.0 pp; 4.0 marks).
2. What is the neural basis for depth of vision? (Limit 3.0 pp; 3.0 marks).
3. Explain the neurobiological substrates and processing related to the construction of visual "form". (Limit 3.0 pp; 3.0 marks).

Assignment 9.

1. Describe, in an integrated fashion, the gross and fine anatomy of the inner ear. Pay particular attention to the functional anatomy of the cochlea and explain the basis of sound transduction to a neural signal. (Limit 4.0 pp; 4.0 marks).
2. Discuss the neurobiological basis of audio signal processing to the level of the auditory cortex. (Limit 4.0 pp; 4.0 marks).
3. Describe the electrochemical basis of hair cell operation and regulation in the inner ear. (Limit 4.0 pp; 5.0 marks (sort of a bonus)).

Assignment 10.

1. Describe and contrast the structures and organization of taste receptors and olfactory receptors. (Limit 4 pp; 3 marks).
2. Describe the operation of taste receptors. (Limit 1 p; 1 mark).
3. Describe the operation of olfactory receptors. (Limit 3 pp; 2 marks).
4. Describe and contrast the neural pathways followed by taste and olfactory data to brain destinations. (Limit 4 pp; 5 marks (sort of a bonus)).