



Carleton
UNIVERSITY

PSYC2307T (Human Neuropsychology I)

Midterm Take - Home Assignment

Emailed May 21, 2020, **Due before 11:59 pm, May 26, 2020**

Course Instructor: **Dr. Brian Tansley**

PLEASE READ & UNDERSTAND THESE INSTRUCTIONS:

- ***In order to meet the course's learning objectives you are to complete this assignment on your own, without assistance or collaboration from others.***
- This take-home assignment is worth **40%** of your course grade.
- ***There are two parts:*** Part 1 has a maximum score of **140** points and Part 2 has a maximum score of **60** points. for a total of **200** points.
- ***There's no limit to how many questions you may answer.*** It's common for students to answer about 50% more than the minimum (i.e., 20+ questions on Part 1 and 10+ questions on Part 2 or, if you are really keen, answer them all!). This strategy works because of the marking scheme I use.
- **Marking Scheme:** Each of your answers will be read by a TA marker who compares it against an answer key I provide them. They adjudicate the answer and award up to a maximum of **10** points, in even increments. Marking stops when either (1) the maximum assignment total is achieved on a given part or (2) they run out of answers to mark.
- ***The assignment is 'open book format'.*** Use your lecture notes, CuLearn resources and other online resources (e.g., Wikipedia, etc.) to assemble the information you need to craft your answers. BUT: Each answer must be written **in your own words**. Copying the work of others (e.g., cutting and pasting *verbatim* from a website, a textbook or the work of another student and representing it as your own is an academic offence. Please read what I've written about plagiarism in the Course Outline.)
- A typical assignment answer consists of a paragraph or two of grammatically correct English (with minimal spelling errors), that answers the question by **integrating** relevant facts and concepts presented in the course.
- Write your answer to each question with a text processor program (e.g., MS Word, single spaced, Arial 12 pt. font).
- ***Put each answer on its own page in the document,*** with the question number centered at the top. List all of the sources you used to create your answer at the bottom of the page.
- Put YOURLASTNAME, Student Number and 2307MIDTERM in the header of every assignment page.
- **Save your completed assignment as a pdf file** (whose filename is YOURLASTNAME2307MIDTERM)
- Attach your completed assignment file to an **email** sent to brian.tansley@carleton.ca **before the deadline (11:59 pm, May 26)**
- Submissions received after this deadline will not be marked.

Velis et Remis

PART 1:
(Maximum attainable score: 140)

1. Describe four functions of ***inhibition*** in nervous system organization (2 points each; 10 points for all 4).
2. **Describe** five phenomena associated with increased local cortical metabolism. (2 points each)
3. Compare and contrast isocortex and allocortex in human brain.
4. Discuss the term ‘functional modularity’ as it applies to cortex.
5. Compare and contrast the major differences between excitatory and inhibitory cortical **neurons**.
6. In addition to the example, below, there are 10 other ways that drugs can affect neurotransmission. Briefly describe each of these 10 ways. Include in your answer whether the drug’s effects are AGONISTIC or ANTAGONISTIC. Provide one generic drug that produces the described effect. (0.5 mark for each description and 0.5 mark for the correct AGONIST/ANTAGONIST designation and example drug name)

EXAMPLE: Drug acts as a precursor to neurotransmitter. (AGONIST) Example Drug: L-DOPA.

7. Explain the term ‘refractory period’ as it applies to the production of an action potential. Include in your answer a distinction between the **absolute and relative** refractory periods.
8. Explain the term “orthodromic propagation” in regards to action potentials.
9. Describe the structures and their major functions of the Somatic Nervous System
10. In a sentence or two elaborate on each of the following in your own words.

(1 point each):

Closed head injury:

Cerebral edema

Cerebral Infarct.

Ischemia

Thrombosis

Stroke

Hydrocephalus

Encephalitis

Anoxia

Meningitis

11. Compare and Contrast Action Potentials, Excitatory Post Synaptic Potentials (EPSPs) and Inhibitory Post Synaptic Potentials (IPSPs).
12. Name and briefly describe the role of each of the 5 different types of glial cells in the nervous system.

13. Explain what is meant by the 'columnar' organization of the cerebral cortex.
14. Compare and contrast excitatory and inhibitory synapses and explain why both are necessary.
15. Compare and contrast neural signaling with action potentials and with neurotransmitters.
16. Why do you think there are so many types of neurotransmitters but only one type of action potential?
17. Describe 5 factors that are believed to be responsible for accelerating the evolutionary differences that have emerged between humans and other primates
18. Briefly describe the events that lead to an action potential following neurotransmitter release into the synaptic cleft. (2 points each)
19. Briefly describe five 19th century-early 20th century technological developments that advanced brain/behaviour studies (2 points each).
20. Briefly describe the three main **functions of the spinal cord** (3 points each; 10 points for all three)
21. Symptoms of disorders of the Central Nervous System almost always include alterations in perceptual experience. Explain why this is so.
22. Distinguish between the four main types of drug antagonists. Provide an example of an irreversible antagonist (2 points each).
23. "The relationship between the flow of information between primary/secondary cortical areas and association cortex is generally reversed, depending upon whether we are referring to sensory or motor cortex." Explain this statement.
24. How is the blood-brain barrier created and maintained? (5 points) List **3** regions in the brain where the blood-brain barrier is absent.(1 point each; 5 points for all 3).
25. When a molecule of neurotransmitter binds to a receptor embedded in the postsynaptic membrane **one of two possible changes** occur to the postsynaptic membrane. Describe these two possible changes and name the most common neurotransmitter associated with each type of change. (5 points each).
26. The Autonomic Division of the Peripheral Nervous System has, itself, two divisions. Briefly name them and describe their functions and where they project from the spinal cord.
27. Briefly describe the two ways that postsynaptic potentials are integrated (summed) in the dendritic and neural soma to affect the probability of the creation of an action potential.
28. In a paragraph explain how 'functional' neuroimaging methods differ from traditional imaging methods.
29. How does the Sodium/Potassium pump help to maintain the resting potential in neurons?
30. Compare and contrast visual apraxia and visual agnosia in terms of the behaviours observed, the type of brain damage associated with each and the prognosis for recovery..
31. Describe ten types of Central Nervous System Agents and their mechanism of action on neurotransmitters (1 point each)
32. Cerebrospinal fluid (CSF) provides, among other things, a 'bouyant' environment for the brain and spinal cord. Explain what advantage this has for brain function.

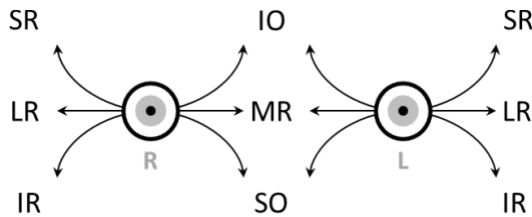
33. Define the term “central pattern generator” and provide two examples of where they are found in the nervous system.
34. Describe three types of changes that might indicate neuroplasticity has occurred and briefly describe how each type of change would be measured (3 points each: 10 points for all 3).
35. Name the two cations and the two anions that are mainly responsible for neuronal signal transmission and describe where their action is located within the neuron.
36. Write a brief critique of the use of computers as a model of the human brain (this one might be of interest to cognitive science students). Include both ‘pros’ and ‘cons’...
37. Briefly describe the term “**Pre-Pulse Inhibition**” and explain its use as a dependent measure for assessment of specific nervous system agents. What types of drugs would you expect it to be used to evaluate?
38. What is the adaptive significance of the hemidecussation of the optic nerve?
39. Briefly describe the **autoreceptor**: its location and function.
40. Briefly describe the functions associated with the myelencephalon. (2 points each)
41. In daylight we’re visually sensitive to a narrow band of electromagnetic radiation whose wavelengths are centered at 550 nanometers whereas in moonlight we’re most sensitive to a narrow band whose wavelengths are centred at 505 nanometers. What is the adaptive significance of this shift in sensitivity?
42. Most of the neurons in the brain are ‘post mitotic’ – meaning that they cannot reproduce or regenerate following injury. Name and describe the functions of two brain structures that can.
43. Compare and contrast neurotransmitters and hormones.
44. Many emergency medicine departments recommend that a patient suspected of any condition that could cause intracranial hypertension undergo a CT scan before being subjected to a lumbar puncture. Explain the rationale behind this recommendation
45. Explain the advantage of action potentials over graded potentials for long-range signaling.
46. During neonatal development, CNS myelination progresses in **four directional trends**. List them. (2 points each; 10 points for all 4)
47. What is the therapeutic index of a drug and how is it measured?
48. Many introductory psychology textbooks state that the occipital cortex is the terminus of the visual system (e.g., the retinogeniculocortical pathway). Why is this misleading?
49. Pick any two of the following neuropsychology pioneers and, in a paragraph for each, briefly describe their contribution to our understanding of brain/behaviour relationships. (**Bain, Jackson, Fechner, Helmholtz, Fritz and Hitzig, Darwin, Galvani, Wundt, Weber, Golgi, Ramon y Cajal, Penfield, Galton**) (5 points each).
50. Compare and contrast, **with examples**, the experience-independent and experience-dependent neural development.
51. Distinguish between a neuropsychologist and a clinical psychologist in terms of (1) their **work environment** (including their typical colleagues in the health care environment), (2) **their training** and the (3) **types of problems each deals with** on a day-to-day basis.
52. In a paragraph or two describe how the recording of a visually-evoked potential is made from scalp electrodes (where are they placed, what’s the stimulus used, what must be done to increase the very low signal to noise ratio, etc.)

- 53.** The bulk of brain myelination takes place from two months prenatally to two months after birth. However, brain myelination continues until well into the second decade of life in some areas of the cerebral cortex. The first 3 cortical regions to myelinate are the motor cortex, the olfactory cortex and the somatosensory cortex. What are the last 3 cortical areas to fully myelinate? Briefly describe their functions. (3 points each)
- 54.** Select any one of the papers provided within each of the first 8 course topic frames and, in your own words, write a summary of the paper's objective(s) and findings. Comment upon how difficult the paper was to read and what suggestions you would make to improve its readability if you were an editor reviewing it for publication in a journal like Scientific American (written for 'popular' consumption rather than professional consumption).
- 55.** Name and briefly describe the functions of the three structures in the diencephalon.

Part 2:

(Max. attainable score: 60)

56. In the figure below, each of the six extraocular muscles of each eye moves the eye in the direction indicated.



Beside each extraocular muscle, below, write the numeral of the cranial nerve that controls it.

Superior Rectus (SR):

Lateral Rectus (LR):

Inferior Rectus (IR):

Inferior Oblique (IO):

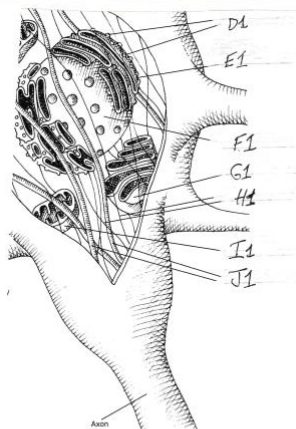
Medial Rectus (MR):

Superior Oblique (SO):

57. The following 5 stages are associated with early neural development: **Neuron death, Process Growth and Synapse Formation, Aggregation, Proliferation, Migration**. List these stages in the correct **temporal order** in which they occur, starting with the earliest, and briefly describe what happens in each stage. (5 points for the correct temporal order of the list and 1 point for each correct description).

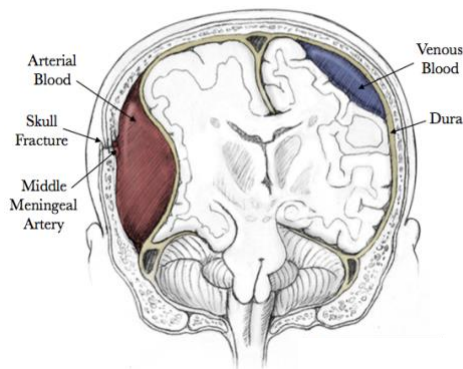
58. Briefly Describe the structures of the basal ganglia.

59. Write the name of the associated neural structure beside its designated number on your answer page.



60. Write each sentence out in full on your answer page, filling in the blanks (1 point each)

- a. The cerebral aqueduct is located in the _____.
 - b. The synapse is a tiny space between a _____ membrane and a _____ membrane.
 - c. The mesencephalon minus the tegmentum = the _____.
 - d. _____ receptors are associated with signal proteins and G-proteins.
 - e. _____ are glial cells that play a role in the blood-brain barrier.
 - f. Prominent in the cytoplasm of the cell body is a structure consisting of a system of plate-shaped membranous sacs, much of which has a rough appearance. This structure is called the _____.
 - g. The pyramids are bulges on the ventral surface of the medulla, created by the left and right dorsolateral _____ tracts.
 - h. Myelinated fibres from the Corona Radiata form each **internal capsule** which passes through a channel bounded by the _____ and _____ on the medial side and the caudate on the lateral side on the way to the spinal cord.
61. The 12 pairs of cranial nerves innervate the head and neck. Some are purely sensory (i.e., carry information to the brain) like CN1 (the Olfactory nerve) while others, like CN12 (Hypoglossal nerve) are purely motor (in this case innervating the muscles of the tongue). Other cranial nerves have both sensory and motor components. Name each of the other 10 cranial nerves, in order from CN2 to CN11 and state whether each has only sensory (S), only motor (M) or both sensory and motor (B) components. (1 point for each correct answer from CN2 to CN11)
62. There are many different kinds of neurons in the cerebral cortex but most fall into one of two basic categories **pyramidal cells** and **stellate cells**. What are the morphologic differences between these two categories and what do these differences tell us about the functional properties of neurons within them?
63. This mid-coronal slice through the human skull and brain shows two types of hematomas.



Name each and identify and explain why one type requires rapid medical intervention.

64. Write out the paragraph in full, filling in the blanks (1 point per correct term)

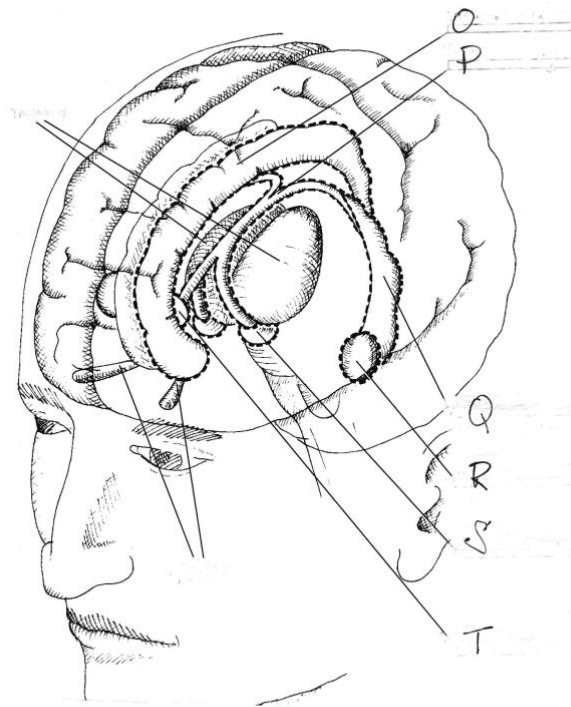
- The myelencephalon is commonly called the _____.
- Most of the 4th ventricle is located near 'colourful' structures such as the _____ the _____ and the _____, all part of the _____.
- The tectum is made up of two pairs of nuclei: the _____ which play a role in vision.
- The _____ tracts, which are major descending motor pathways, _____ in the posterior part of the medulla.
- Running up the core of the brain stem from the medulla to the midbrain is the _____ system which plays a role in alertness, attention and sleep.
- The ventral posterior, lateral geniculate and medial geniculate are sensory relay nuclei located in the _____.
- Damage to the _____ results in ataxia.
- The myelencephalon consists mainly of _____.

65. Compare and contrast interhemispheric and intrahemispheric white matter tracts

66. Write each sentence out in full, filling in the blank (1 point per correct blank up to 10)

- The cerebral hemispheres are separated by the _____ fissure.
- The _____ - is a limbic structure juxtaposed to allocortex in the inferior medial temporal lobes.
- Immediately superior to the corpus callosum is the _____ cortex, which is a structure of the limbic system.
- Cortical 'association' areas receive their input from _____ sensory cortex.
- The caudate, putamen, globus pallidus and amygdala are, collectively, referred to as the _____.
- The _____ and _____ gyri are on opposite sides of the central fissure; their functions are motor and somatosensory, respectively.
- Caudate + putamen = _____.
- The hippocampus, cingulate cortex, septum and fornix are all structures of the _____ system.
- The primary gustatory cortex is in the parietal lobe, largely out of sight in the _____ fissure.
- The _____ lies between the thalamus and putamen.
- Neocortex is to 6 as allocortex is to _____.
- Located between the lateral fissure and the middle temporal gyrus is the _____ temporal gyrus.

67. The following figure shows the components of the limbic system. Write the name of each limbic system structure beside its appropriate letter. (1 point for each correct term)



68. What is the Circle of Willis? What advantage does the Circle of Willis potentially confer upon those who have it?
69. Write out the paragraph in full, filling in the blanks (1 point for each).

By prenatal week number _____ the developing human brain is visible at the _____ end of the neural tube as 3 swellings. In order from posterior to anterior these are the _____, the _____ and the _____. Within about another week, these 3 swellings develop into 5 swellings that eventually develop into the five major divisions of the adult brain. The five are (from posterior to anterior) the _____, the _____, the _____, the _____ and the _____.

70. The lateral view of the left hemisphere, shown below, has outlines of some of the major cortical gyri. Write the name of the gyrus beside each corresponding letter (1 point each: 10 points for all 9).

