

ENGLISH

Date 15 December 2010

Examination NEVR2010

There are two types of questions.

SHORT ANSWER QUESTIONS and TRUE or FALSE questions.

Each short answer question requires only a short answer and behind each question is indicated how many points you will get in case of a correct answer. **Simple questions will yield 1 point** and a **higher number of points** indicate that a **more complex** and/or **elaborate** answer is required.

True or false questions always **score 1 point**. You are required to clearly indicate the right answer by writing either **True or False** on your answer document. **Do not add** to the answer in any way, because that may influence the mark you will get.

The exam comprises a total of 74 questions (100 points) on 5 pages (including this cover page).

You have 6 hours to complete the exam.

Use of dictionaries and other tools of assistance. You are allowed ONE dictionary that translates standard language from your mother tongue to English, i.e. French-English, German-English etc. NO SPECIALIZED DICTIONARIES WILL BE ALLOWED, such as English-English dictionaries that provide definitions, or medical dictionaries of any description. Native English or Norwegian speakers are not allowed any dictionary.

SHORT ANSWER QUESTIONS

1. What is the functional difference between outer and inner hair cells? (1)
2. The auditory neural system is "tonotopical organized". What does this mean? (1)
3. Give one brief example of how learning can be studied in the sea slug *Aplysia*. (1)
4. Is plasticity as seen in short term sensitization a presynaptic or a postsynaptic event? (1)
5. Describe briefly (2 lines max) the mechanism that underlies plasticity in short term sensitization. (1)
6. Which stimulation patterns can induce long term depression (LTD) and which can induce long term potentiation (LTP)? (1)
7. What are the three most important sensory systems for balance control? (2)
8. Which part of the central nervous system is characteristically affected in Parkinson's disease? (1)
9. Which role has the cerebellum in controlling movements? (2)
10. Describe briefly the functional difference between the anteromedial (ventral) and lateral corticospinal tracts. (2)
11. Name two major pathways of the somatosensory system and describe their main differences with respect to the type of information carried by them. (2)
12. Where do we find the cell bodies of the sensory neurons that constitute the somatic division of the peripheral nervous system? (1)
13. Give a short explanation of the phenomenon of referred pain. (2)
14. What is the name of the cranial nerve that carries touch information from the face into the central nervous system? (1)
15. What are the names of the three cranial nerves relevant for eye movement? (2)
16. Give the name and origin in the brain of three modulatory systems. (2)
17. Describe briefly the functional relevance of the muscle spindle. (2)
18. There are three light sensitive elements in the retina. Briefly describe their main functional and organizational differences. (2)
19. Describe the pathways that mediate temperature information from the hand to the primary somatosensory cortex. (3)

20. What is actually measured with BOLD fMRI? (1)
21. Why does an axon potential normally travel only in one direction that is away from the soma? (1)
22. What conductance is responsible for resetting the neuron after firing an action potential? (1)
23. Describe the main mechanisms that are responsible for the resting membrane potential (ca. -65 mV) in neurons. (2)
24. Give a short description of the three different levels of Marr's computational theory of cognition. (3)
25. What is (mental) representation? (2)
26. What is the name of the thalamic nucleus that receives afferent projections from the gustatory portion of the nucleus of the solitary tract? (1)
27. The taste system detects five perceptually distinct categories of tastants. Provide the name of the taste of glutamate and other amino acids. (1)
28. Name each of the brain vesicles at the 5 vesicle stage of development. (2)
29. The neural tube is comprised of three layers. Which layer results in grey matter, and which results in white matter? (1)
30. Name two enzymes that are present in astrocytes, but not in neurons. (1)
31. Which amino acid is released by astrocytes that neurons can take up and convert to glutamate and GABA? (1)
32. List the main neuron categories making up the glomerular network of the olfactory bulb. (2)
33. Explain the transduction mechanism of the olfactory sensory neurons, i.e. how the neurons transform chemical energy to electric signals. (3)
34. What is the name of the primary thalamic nucleus that conveys auditory information to the cortex? (1)
35. What is the name of the thalamic nucleus that defines the prefrontal cortex? (1)
36. Name the subcortical structure in the brain most strongly associated with fear perception. (1)
37. Describe briefly the main features of visual perception occurring in the primary visual cortex. (2)

38. Which structure in the brain is most important for procedural learning? (1)
39. Describe the difference between semantic and episodic memory. (2)
40. Based on what you know about the memory systems in the brain, derive the most likely place where semantic memories are stored and provide the arguments. (3)
41. What is the major pathway by which the amygdala interacts with the autonomic nervous system. (1)
42. Name three metals which may cause neurodegenerative effects. (2)
43. List three possible signs of neurotoxicity (2)
44. In maximum three sentences explain one major reason why some compounds are neurotoxic in the foetus and not in the mother (2)

Total 70 points

TRUE/FALSE QUESTIONS

1. LTP induction normally depends on NMDA receptors. **True/false**
2. If you lose a finger, the other fingers take over the space in the somatosensory cortex representing that finger. **True/false**
3. Balance is controlled at the level of the spinal cord. **True/false**
4. Pre-motor cortex is necessary to plan movements. **True/false**
5. The cerebellum plays an important role in motor learning. **True/false**
6. Sweet substances bind specifically to the T2R receptor. **True/false**
7. The circumvallate papillae are situated at the most posterior portion of the tongue. **True/false**
8. The G-protein coupled receptor gustducin is found only in taste cells that detect salt and sour substances. **True/false**
9. The notochord contains the signal to induce the folding of the neural tube. **True/false**
10. In the 6 layered cortex, neurons in layer 2 are the oldest neurons (outside in migration). **True/false**
11. The olfactory sensory neurons project directly to the brain. **True/false**

12. The vomeronasal system is mainly devoted to processing odor information about food. **True/false**
13. The orientation of the somatotopic representation in the primary somatosensory cortex differs 180 degrees from that seen in the primary motor representation. **True/false**
14. The muscle spindle is solely composed of nerve tissue. **True/false**
15. The major circadian clock in the brain is localized in the reticular formation of the mesencephalon. **True/false**
16. The superior colliculus is relevant for vestibulo-ocular reflexes. **True/false**
17. Food intake is strongly regulated by nuclei in the hypothalamus. **True/false**
18. Sensory neurons in the dorsal root ganglia are neurons that migrated out of the dorsal horn of the spinal cord during development. **True/false**
19. Color is perceived in the primary visual cortex. **True/false**
20. The amygdala is essential for episodic memory. **True/false**
21. Parts of the insular cortex in humans are involved in motivational memory. **True/false**
22. The facial muscles on the left side are innervated by neurons in the right facial nucleus. **True/false**
23. The cerebral cortex of the brain is defined as the outer portion that is covered by meningeal layers. **True/false**
24. The depolarization phase of an action potential is characterized by the opening of Na^+ channels in the membrane. **True/false**
25. Acetylcholine is a neurotransmitter. **True/false**
26. The membrane of a presynaptic element of a chemical synapse does contain receptor molecules. **True/false**
27. Lesion of the auditory cortex disrupts classical tone-based fear conditioning. **True/false**
28. The two internal carotid arteries are the main blood supply of the forebrain. **True/false**
29. Energy is needed to maintain the resting membrane potential. **True/false**
30. Ketamine is an anaesthetic that selective inhibits NMDA receptors. **True/false**

Total 30 points