

Date 6 June 2012

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 68 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.**

## 40 SHORT ANSWER QUESTIONS

1. Where in the central nervous system do we find the three main groups of neurons that originate the parasympathetic component of the autonomic nervous system? (3)
2. Give a short but complete definition of what is meant by primary motor cortex. (2)
3. Give the name of the cranial nerve that carries somatosensory information from the face to the brain. (1)
4. What is the name of the specific thalamic nucleus that receives somatosensory information? (1)
5. Describe the pathways that directly connect the retina to the primary visual cortex and indicate where in the brain signals from the left and right retina are really integrated. (4)
6. Give a short definition of a motor unit. (1)
7. There are three types of light-sensitive elements in the retina. Give the names of all three and describe the main characteristic differences between the three elements. (3)
8. What is actually measured with BOLD fMRI? (1)
9. Describe the main mechanisms that are responsible for the resting membrane potential (ca.  $-65$  mV) in neurons. (2)
10. Which two main types of receptors exist in the central nervous system? (2)
11. Why does an axon potential normally travel only in one direction that is away from the soma? (2)
12. We know a lot about functions in the brain due to the study of patients that have lesions. Describe two examples briefly, indicating the location of the lesion and the resulting behavioral deficit. (4)
13. Where in the cortex of the telencephalon brain is the main representation of olfactory information localized? Describe or make a drawing (1)
14. A similar morphology of olfactory sensory neurons has been found across various species. Make a drawing of a typical olfactory sensory neuron and name the most important sub-structures. (2)
15. What is the name of the system particularly devoted to processing information about pheromones? (1)

16. The perceptual thresholds for detecting bitter and sweet substances are substantially different. Which one of these basic tastes has the highest threshold? (1)
17. Where in the telencephalic cortex do we find the representation of taste information (gustatory cortex)? Describe or make a drawing. (1)
18. Name the two main transmitters in the brain and describe how they differ from each other in their functional outcome. (2)
19. Which two receptors are most commonly involved in the effects of anesthesia? (1)
20. What is the functional relevance of the stapedius reflex? (1)
21. What is the name of the main structure in the brain responsible for our circadian rhythm? Describe the overall functional organization of this structure and its relationships to other parts of the central nervous system. (4)
22. Within the ascending pathways of the spinal cord that carry somatosensory information to the brain, two different components are differentiated. Describe the main differences between these two with respect to type of information carried by them and their routes by which they reach the somatosensory cortex. (4)
23. Describe the pathways from the retina that are involved in the pupillary light reflex. (3)
24. Name three metals which may cause neurodegenerative effects. (1)
25. What is the shared neurotoxic mechanism of malathion and parathion? (1)
26. What is meant by the statement that the visual cortex is retinotopically organized? (1)
27. Different frequencies of sound are represented at different positions along the basilar membrane. Where do we find low frequency representations, closer to the apex or closer to the oval window? (1)
28. Give a brief description or drawing of the main connectivity of the hippocampus. (3)
29. Give the names of two of the three cranial nerves involved in oculomotor control. (2)
30. Where in the cerebral cortex is the main location of our attention system? (1)
31. In the central nervous system, oligodendrocytes lay down myelin; what are the cells called that have a similar function in the peripheral nervous system? (1)
32. What is the name of the sulcus that provides the divide between the sensory (afferent) and the motor (efferent) domains of the cerebral cortex? (1)
33. Give a definition of the enteric nervous system. (1)

34. Where precisely in the central nervous system do we find the cell bodies that innervate the muscles of the body? (1)
35. During the formation of the neural tube, a number of embryonic cells differentiate into the so-called neural crest. Name two derivatives of neural crest cells. (2)
36. The developing neural tube initially differentiates into four different plates that eventually form the final functional components seen in the spinal cord and brainstem. Name the plate from which motor neurons in the spinal cord derive. (1)
37. The rhombencephalon of the vertebrate brain differentiates into two brain parts (secondary brain vesicles). What are these two secondary brain vesicles called? (2)
38. What is meant by the statement that an animal habituates? (1)
39. What is neurophilosophy? (3)
40. Describe a neural correlate of consciousness. (2)

**28 TRUE or FALSE QUESTIONS (each question is 1 point; total points for this part: 28)**

41. The sympathetic cell bodies that provide the major sympathetic innervations of the gonads are located in the spinal cord at sacral levels. *True or False*
42. Motoneurons in the brain stem derive from the neural crest. *True or False*
43. The membrane of a presynaptic element of a chemical synapse does contain receptor molecules. *True or False*
44. Oligodendrocytes are glia cells that are specific for the peripheral nervous system. *True or False*
45. With Nodes of Ranvier we indicate the branching points of neuronal dendrites. *True or False*
46. Acetylcholine is a neurotransmitter. *True or False*
47. The cerebral cortex of the brain is defined as the outer portion that is covered by meningeal layers. *True or False*
48. The depolarization phase of an action potential is characterized by the opening of  $\text{Na}^+$  channels in the membrane. *True or False*
49. Extracellular sodium increase leads to inhibition of the neuron. *True or False*

50. Overexpression of beta-amyloid is a hallmark of Alzheimer's disease. *True or False*
51. Cytochrome c oxidase is affected in hydrogen sulfide neurotoxicity. *True or False*
52. Neuronal activity as detected with BOLD fMRI correlates best with spiking activity. *True or False*
53. The two internal carotid arteries are the main blood supply of the forebrain. *True or False*
54. The citric acid cycle is a process that takes place in the cell membrane. *True or False*
55. The mammillary bodies of the hypothalamus are involved in maintaining postural balance. *True or False*
56. Ketamine is an anaesthetic that selective targets GABA receptors. *True or False*
57. Amacrine neurons in the retina are light sensitive. *True or False*
58. Spinal cord segments at the cervical level contain neurons that originate part of the parasympathetic nervous system. *True or False*
59. The notochord or chorda forms the ventral portion of the neural tube. *True or False*
60. The pituitary develops solely as a derivative of the neural tube. *True or False*
61. The pineal gland or epiphysis is the main site for the production of adrenalin. *True or False*
62. Energy is needed to maintain the resting membrane potential. *True or False*
63. The olfactory bulb is the target area of the olfactory nerve. *True or False*
64. All neurons in the hippocampus are place cells. *True or False*
65. The facial muscles on the left side are innervated by neurons in the right facial nucleus. *True or False*
66. The primary auditory cortex is tonotopically organized. *True or False*
67. Bitter substances bind specifically to the T2R receptor. *True or False*
68. All sensory information reaches the cerebral cortex by way of a synaptic relay in the thalamus. *True or False*