

9.14 Selected Qs based on lectures

- 1) How do we define and recognize specific cell groups in the CNS? (What are the types of methods called?)
- 2) How do we know about connections between cell groups, e.g., what methods are required? Give examples.
- 3) Three different basic types of multipurpose actions (movement patterns) by all vertebrates were described in class. Give one example of each, for any animal that you are familiar with.
- 4) Define the following terms:
 - a. notochord
 - b. primary sensory neuron
 - c. secondary sensory neuron
 - d. interneuron,
 - e. motor neuron
 - f. dermatome
 - g. the sulcus limitans
 - h. the basal plate
 - i. the alar plate
 - j. the ventral roots
 - k. propriospinal axons
- 5) Amphioxus, the primitive protochordate, has visual inputs. These inputs enter what division of the CNS? In mammals is this the same or different?
- 6) Give an example of a sensory function that has led to great expansions of specific parts of the hindbrain in certain species of fish. Also, describe the function.
- 7) In comparisons of different species, the midbrain shows much quantitative variation. Select two species where it is different and describe the main differences.
- 8) In chordate evolution, what sensory input or inputs led to the early (perhaps the earliest) expansion of the endbrain? What was a major factor that led to a later expansion of the endbrain in chordates? (For the second question there is more than one possible answer.)
- 9) A great expansion of the neocortex in mammals was correlated with expansion of other brain structures as well. Name or describe two specific non-endbrain structures that showed such expansion in evolution.
- 10) Motor neurons that innervate striated muscles are located in the spinal cord and in which brain subdivisions?

- 11) Contrast spinoreticular and spinothalamic tracts.
- 12) What is spinal shock? How is it an example of diaschisis? Explain the meaning of "corticospinal diaschisis."
- 13) What are two known mechanisms of recovery from deafferentation depression (diaschisis)?
- 14) The limbic system can be defined as a group of structures with close connections with what part of the CNS? What two sensory pathways project most directly to the limbic system? (These pathways enter *via* cranial nerves that enter the forebrain.)
- 15) Describe one long-axon decussating pathway found in mammals and not in non-mammals. Where are the cells of origin, where is the decussation, and where are the terminations?
- 16) What was Otto Loewi's great discovery?
- 17) What is the neural plate? What is its fate in embryogenesis?
- 18) What are neural crest cells? During vertebrate development, what do these cells become? Name two examples.
- 19) Contrast symmetric and asymmetric cell division in the CNS.
- 20) Where are Schwann cells and oligodendrocytes, and what is the main function of each of these cell types?
- 21) Where is cerebrospinal fluid made, and how does it get both inside and outside the CNS?
- 22) What are the meninges? Describe the positions of each of the three meningeal layers.
- 23) How are astrocytes (astroglial cells) related to the blood vessels in the brain?
- 24) Contrast the sympathetic and the parasympathetic nervous systems by naming or describing the locations of the preganglionic motor neurons and the locations of the ganglionic motor neurons for one specific organ, or in general. Contrast the functions of these two systems in their innervation of one organ.
- 25) What is the "enteric nervous system", and why is it considered to be a separate system?
- 26) Which primary sensory neurons are in a surface layer of the body in adult mammals?

- 27) Are the animals with the largest brains the most intelligent animals? What is at least one other factor that influences brain size?
- 28) Distinguish the terms “phylogeny” and “ontogeny”.
- 29) Give three examples of sensory specializations in particular vertebrate species, specializations that include expanded representations in the CNS.
- 30) Name or describe the area of the body surface rostral to the dermatomes for the spinal nerves. What cranial nerve innervates this region? Give the number of the nerve as well as its common name. Where are the primary sensory neurons of this nerve? Where are the secondary sensory neurons?
- 31) Name three types of channels of conduction for sensory information entering the CNS.
- 32) Why are some mammals more helpless after neocortex ablation than others, with long-lasting deficiencies in spinal and brainstem reflexes and action patterns?
- 33) The telencephalon, or endbrain, contains major structures in addition to neocortex. What are two of these structures, present in all vertebrates? Give an example of the functions of each of them.
- 34) Describe a major difference in appearance, in a frontal section, of the cervical spinal cord and the sacral spinal cord.
- 35) Which part of the brain develops the earliest? (Think of where the neural tube first closes.)
- 36) Explain nuclear translocation as a mechanism of cell migration, and give an example of it.
- 37) How is the hindbrain embryologically very similar to the spinal cord?
- 38) Where is the “rhombic lip” of the hindbrain located? What becomes of it in embryogenesis?
- 39) The “pons” (meaning: bridge) is a prominent structure visible in mammalian brain dissections, located on the ventral side of the rostral hindbrain. What is a major input of the cells of the pontine gray matter? What is the major output?
- 40) At the surface of the midbrain the "colliculi" or little hills can be seen in a brain dissection. The colliculi include the anterior or superior colliculi and the posterior or inferior colliculi. With what sensory modalities do we usually associate the superior and the inferior colliculi? What are two other sensory systems that connect with the superior colliculi?

- 41) Name two pathways that originate in the midbrain and descend to the spinal cord.
- 42) What is the major distortion of the basic structural layout of the hindbrain that occurs in the development of this part of the brain of humans and other primates?
- 43) The largest bundle of myelinated axons coursing through the human midbrain is the _____ . These fibers come from the _____ .
- 44) The mesencephalon, diencephalon, and telencephalon (midbrain, 'tweenbrain and endbrain) can each be divided into the same two types of regions, namely _____ and _____ .
- 45) Developmental and comparative neuroanatomists refer to two major groups of axons that carry outputs of these two regions of the forebrain. These are called the _____ and _____ .
- 46) Name two major sources of axons in each of these two bundles.
- 47) Contrast two major possible purposes in naturally occurring neuronal death.
- 48) Give an example of innervation-dependent neuronal death/survival.
- 49) What is the basic spatial layout of motor neurons at one of the spinal cord enlargements?
- 50) Grasping with the hands in large primates is largely controlled by neocortex. What brainstem structure appeared earlier in evolution and controlled this kind of movement?
- 51) Describe the three types of lesions in the Lawrence and Kuypers lesion study of the descending motor system pathways.
- 52) Describe the functional effects of two of the above lesions in monkeys.
- 53) What was the major conclusion in Karl Lashley's paper in 1917 called "The problem of serial order in behavior"?
- 54) Maintaining balance of the body during standing or locomotion depends on reticulospinal pathways from the hindbrain, and on two other descending pathways from the hindbrain. What are they?
- 55) What is Deacon's rule? What does it predict about differences in the projections (outputs) of the optic tectum in birds with a very large tectum, and nocturnal mammals with a much smaller tectum?

- 56) Name a movement pattern in an animal or human that is largely under the control of hindbrain and spinal cord structures and is centrally generated once it is triggered.
- 57) Name two cell groups or types located caudal to the forebrain that have very widespread projections to other parts of the central nervous system. What kind of functions are these projections involved in?

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