

9.14

Classes #7-8: Spinal cord development and anatomy

Questions on Schneider chapter 8:

- 1) What are the four basic cellular events that result in transformation of the very early embryo from fertilized cell to morula to blastula to gastrula? (These were summarized by Lewis Wolpert in his book, *Triumph of the Embryo*.) Give examples of what is meant by each event.
- 2) What is the notochord, and what is its role in neurulation? Describe the process of neurulation.
- 3) Who discovered the phenomenon of induction of CNS formation? (One of them received most of the recognition. Why?)
- 4) What are neural crest cells, and what do they become?
- 5) Where does closure of the neural tube begin? What are the last regions to close?
- 6) Define the terms: neural plate, neural groove, alar plate, basal plate, roof plate and floor plate, sulcus limitans.
- 7) What is sonic hedgehog, and what are two major roles it plays in spinal cord development?
- 8) Describe the two types of cell division that occur adjacent to the ventricular surface of the neural tube.
- 9) How did neuroscientists come to know that there are at least two major modes of cell migration in the embryonic central nervous system? Describe the two modes.
- 10) In his studies of development of the embryonic chick CNS, how did Ramon y Cajal recognize the initial stages of dorsal and ventral root development?

Questions on Schneider chapter 9:

- 1) How do the dorsal, lateral and ventral columns of the spinal cord change from cervical to sacral levels? Why?
- 2) What did Bror Rexed add to the way anatomists describe spinal cord sections stained for cell bodies?
- 3) Describe some differences in cytoarchitecture of the dorsal horn and the ventral horn of the spinal cord. At what levels are these differences greatest?
- 4) What is the lateral horn?

- 5) Where do the largest axons in the dorsal roots originate? Describe two of their terminate sites within the spinal segment of their dorsal root.
- 6) Describe the axons and connections of a withdrawal reflex (flexion reflex).
- 7) Describe the origins of the spinothalamic tract within a section of the spinal cord. Contrast this with the origins of the spinoreticular tract.
- 8) Where do the longest axons of the dorsal columns originate and where do they terminate?
- 9) Explain how there is an organized representation of the surface of the entire body in cell groups at the dorsal-most end of the spinal cord.
- 10) Describe the sources of axons terminating in Clarke's column (nucleus dorsalis) of the spinal cord from the lower limbs. What ascending fiber tract originates in Clarke's column?
- 11) What are propriospinal fibers?
- 12) Movements of the limbs and other movements are controlled by a number of axonal groups that descend from the brain. What can you remember about these? (such as names and where they originate, and how many such pathways there are)
- 13) The peripheral nervous system innervates glands and smooth muscles, also cardiac muscle, as well as skin and striated muscles. What is the system called that innervates the visceral tissues? What are the two divisions of that visceral nervous system?
- 14) Contrast the functions of the two systems. Briefly describe some examples.

- 15) Striated muscles have synaptic innervation, whereas smooth muscles and glands have paracrine innervation. Explain the difference. Where are the neurons located that give rise to the axons that innervate the glands and smooth muscle?
- 16) Compare and contrast the neurotransmitters used by the two divisions of the visceral nervous system.
- 17) What is meant by the enteric nervous system? Why is it considered to be a separate system?
- 18) Briefly describe the hierarchy of central control of body temperature.

Questions on Schneider "Intermission" after chapter 9:

- 1) What are the names of the three layers of the meninges that surround the brain and spinal cord?
- 2) What cells make the cerebrospinal fluid (CSF)? How does the CSF get from the ventricles of the brain into the subarachnoid space surrounding the brain?
- 3) Where is the Aqueduct of Sylvius?
- 4) What is the pia-glial membrane? What cell types participate in its formation?

Questions on supplementary readings: Swanson

- 1) What are the four elements of the fundamental body plan of all members of the phylum Chordata, from the worm-like Amphioxus to the Primates, Elephants and Cetaceans?
- 2) Vertebrate embryos at early stages consist of what three layers? Which of these layers is the last to form, by cell migration from which one of the earlier-formed layers?
- 3) What is Baer's Law, from Karl von Baer (1828)?
- 4) Which layer forms a thickened region called the neural plate – which later becomes the nervous system? What causes the neural plate to form?
- 5) What are sensory placodes?

Questions on supplementary readings: Purves & Lichtman

- 6) Explain why Wilhelm Roux is considered the founder of experimental embryology, even though his major experimental contribution was soon proved to be invalid.
- 7) "Ontogeny recapitulates phylogeny": How is this phrase both useful and misleading?

- 8) What is the fate of the three germ layers of the gastrula ?
- 9) What is an epidermal placode or sensory placode?
- 10) Why is the wall of the neural tube described as a "pseudostratified epithelium "?

Question on supplementary readings: Striedter

- 11) What is "epigenetic population matching"? How is it related to trophic factors ?

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