

Questions from 9.14 students in 2008 on Study Questions

Questions are in bold italics. Answers are in regular font. Instructor's answers are in blue.

Describe the area of the body surface rostral to the dermatomes for the spinal nerves. What innervates this region?

I assume this is dealing with the trigeminal nerves, but I'm not sure.

Yes. The trigeminal nerve (5th cranial nerve) innervates this area, but not the back of head and most of the neck.

What are the spinal enlargements? Where are they, and why did they develop?

I can't find this in my notes for some reason.

These were mentioned several times and they are in the readings as well. The cervical enlargement includes the secondary sensory and the motor neurons innervating the arms and hands (front legs and front feet). The lumbar enlargement is for the hind legs and feet. Many more neurons are needed for the greater number of muscles and the highly innervated skin areas of the limbs compared to what is needed for the rest of the body below the head.

Summarize the difference in locations of preganglionic motor neurons of the sympathetic and the parasympathetic nervous systems.

I believe the preganglionic motor neurons of the sympathetic are in the lateral horn, but I can't find where the ones of the parasympathetic are.

The parasympathetic system is called the cranio-sacral system because the preganglionic motor neurons are in the brain (midbrain and hindbrain) and in the sacral spinal cord.

The ventrobasal thalamic nucleus, also called the ventral-posterior nucleus, receives somatosensory input from lemniscal channels. Two CNS tracts that carry this input from the spinal cord are known as _____ and _____.

No clue.

Wake up! Spinothalamic tract and medial lemniscus (dorsal column to medial lemniscus). A third tract is the spinoreticular.

Which part of the brain develops the earliest? (Think about where the neural tube first closes)

There was some debate about this in the review session. Some of us say the midbrain, since the tube “zips” from the center to the ends, while others say it is the spinal cord. Which of these (if any) is it?

The cervical cord develops first. That is the “center”. Therefore, the hindbrain is the earliest part of the brain to develop, relatively speaking.

The mesencephalon, diencephalon, and telencephalon (midbrain, ‘tweenbrain, and endbrain) can each be divided into the same two types of regions, namely _____ and _____.

Again, there was a suggestion that the words should be “somatic” and “limbic.” Which pair is right?

Somatic and limbic are correct. The outputs from the endbrain for these two regions are the axons of the lateral and medial forebrain bundles, respectively.

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?

Non-olfactory sensory inputs led to an expansion of the neocortex, particularly the “association cortex.” The need for anticipating events and planning actions led to a later expansion of the endbrain.

(Is this an adequate answer?)

Your answer is OK, but the earliest expansion was the evolution of the olfactory system. Later expansions are the two you have stated except that the non-olfactory inputs reaching the endbrain resulted first in the evolution of expansions of the dorsal striatum and the sensory areas of the neocortex. The association areas expanded later.

Motor neurons that innervate striated muscles are located in the spinal cord and in which brain subdivisions.

Not quite sure about this one.

Hindbrain and Midbrain. (See the Shmoo brains and Swanson.)

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?

It has close connections with the cortex and subcortex. It is associated with the dorsal column-medial lemniscus pathway and the corticospinal tract.

(Is this correct?)

NO! It is defined by close connections with the hypothalamus. The most direct sensory inputs are the olfactory and the visual: The olfactory cortex connects to hypothalamus (an old name for limbic forebrain was the rhinencephalon, or smell brain), and the retina connects directly to the hypothalamus (mostly to the suprachiasmatic nucleus).

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. Contrast the functions of these two systems in their innervation of one organ.

This is related to the previous question about the location of the preganglionic motor neurons of the parasympathetic and sympathetic nervous systems. I know the functions each one does.

Yes. The ganglionic motor neurons of the parasympathetic are always near the end organ being innervated. Those for the sympathetic are in the paravertebral and the prevertebral ganglia, nearer to the spinal cord.

Which primary sensory neurons are in a surface layer of the body in adult mammals?

I want to say the trigeminal nerve, but I think I'm wrong since the primary sensory neurons of that nerve are in the ganglia, not on the surface.

The olfactory receptors are primary sensory neurons in the nasal epithelium, in the surface layer of cells.

What becomes of the "rhombic lip" of the hindbrain in embryogenesis? Where is it located?

The rhombic lip plays a part in the formation of the cerebellum. It is located near the cerebellum.

Yes. Its cells, born in the alar plate of the rostral hindbrain, migrate into the roof plate and form the cerebellar cortex. Other cells migrate ventrally and form pre-cerebellar cell groups like the gray matter of the pons (the pontine gray).

What is the basic spatial layout of motor neurons at one of the spinal cord enlargements?

I couldn't find a good explanation of this in the lecture notes. It is in several of the figures (slides and book chapter figures). Axial muscles are innervated by medial motor neurons, limb muscles by more lateral motor neurons, with the fingers innervated by the most lateral (dorsolateral) ones.

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9.14 Brain Structure and Its Origins

Spring 2014

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