NAME _____ LAB TIME/DATE _____

REVIEW SHEET
exercise
21

Spinal Cord, Spinal Nerves, and the Autonomic Nervous System

Anatomy of the Spinal Cord

1. Match the descriptions given below to the proper anatomical term:

Key: a. cauda equina b. conus medullaris c. filum terminale d. foramen magnum

d 1. most superior boundary of the spinal cord

c 2. meningeal extension beyond the spinal cord terminus

b 3. spinal cord terminus

a 4. collection of spinal nerves traveling in the vertebral canal below the terminus of the spinal cord

2. Match the key letters on the diagram with the following terms.

m 1. anterior (ventral) horn

k 2. arachnoid mater

a 3. central canal

h 4. dorsal ramus of spinal nerve

g 5. dorsal root ganglion

n 6. dorsal root of spinal nerve

j 7. dura mater

o 8. gray commissure

d 9. lateral horn

l 10. pia mater

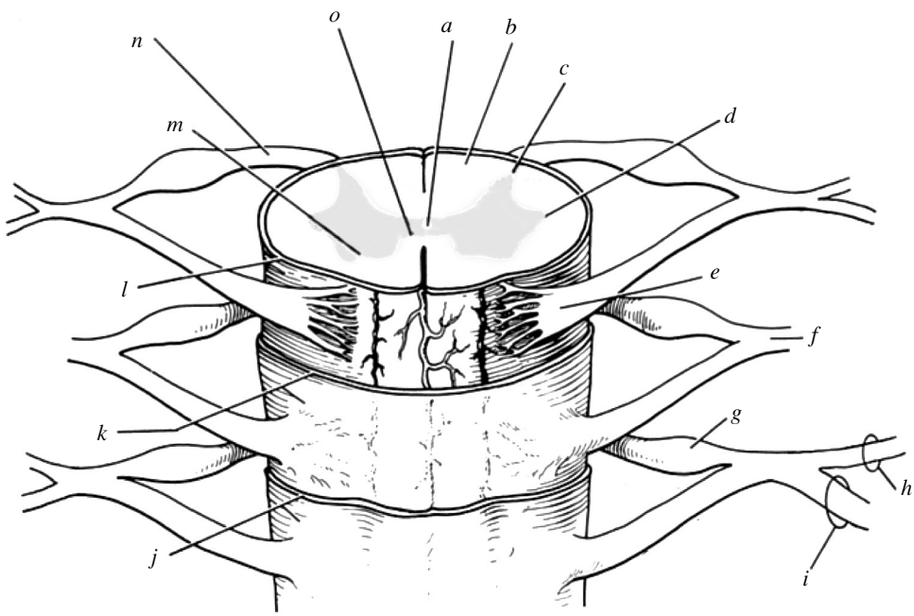
c 11. posterior (dorsal) horn

f 12. spinal nerve

i 13. ventral ramus of spinal nerve

e 14. ventral root of spinal nerve

b 15. white matter



3. Choose the proper answer from the following key to respond to the descriptions relating to spinal cord anatomy.

Key: a. afferent b. efferent c. both afferent and efferent d. association

d 1. neuron type found in posterior horn

b 2. neuron type found in anterior horn

a 3. neuron type in dorsal root ganglion

b 4. fiber type in ventral root

a 5. fiber type in dorsal root

c 6. fiber type in spinal nerve

4. Where in the vertebral column is a lumbar puncture generally done? *Between the third and fourth lumbar vertebrae.*

Why is this the site of choice? *The spinal cord ends at the level of L_2; thus there is little chance of damaging it below that level.*

5. The spinal cord is enlarged in two regions, the *cervical* and the *lumbar* regions.

What is the significance of these enlargements? *Nerves serving the limbs issue from these regions of the spinal cord.*

6. How does the position of the gray and white matter differ in the spinal cord and the cerebral hemispheres?

In the spinal cord, the white matter surrounds the gray matter. In the cerebral hemisphere, there is an outer "rind" of gray matter and deep to that is white matter with a few scattered islands of gray matter.

7. From the key to the right, choose the name of the tract that might be damaged when the following conditions are observed. (More than one choice may apply.)

e, f, g 1. uncoordinated movement

c, d 2. lack of voluntary movement

e, f, g 3. tremors, jerky movements

h 4. diminished pain perception

a, b, i 5. diminished sense of touch

Key:
a. fasciculus gracilis
b. fasciculus cuneatus
c. lateral corticospinal tract
d. anterior corticospinal tract
e. tectospinal tract
f. rubrospinal tract
g. vestibulospinal tract
h. lateral spinothalamic tract
i. anterior spinothalamic tract
j. posterior spinocerebellar tract
k. anterior spinocerebellar tract

8. Use an appropriate reference to describe the functional significance of an upper motor neuron and a lower motor neuron:

upper motor neuron *Pyramidal cells of the motor cortex and neurons in subcortical motor nuclei that give rise to descending motor pathways.*

lower motor neuron *Anterior horn motor neuron that stimulates voluntary muscle.*

Will contraction of a muscle occur if the lower motor neurons serving it have been destroyed? *No* If the upper motor neurons serving it have been destroyed? *Yes* Using an appropriate reference, differentiate between flaccid and spastic paralysis and note the possible causes of each. *Flaccid paralysis occurs when anterior horn neurons are destroyed (e.g. spinal*

cord transection in an auto accident). The muscle receives no stimulation; thus, it becomes flaccid and atrophies. Spastic paralysis occurs as a result of upper motor neuron damage (e.g. from brain hemorrhage). Voluntary motor activity is lost, but reflex movements initiated by spinal cord neurons still occur. The muscle does not become limp (flaccid), but instead becomes more tense and shows hyperactive and uncontrolled movement.

Spinal Nerves and Nerve Plexuses

9. In the human, there are 31 pairs of spinal nerves, named according to the region of the vertebral column from which they issue. The spinal nerves are named below. Indicate how they are numbered.

cervical nerves *$C_1 - C_8$* sacral nerves *$S_1 - S_5$*

lumbar nerves *$L_1 - L_5$* thoracic nerves *$T_1 - T_{12}$*

10. The ventral rami of spinal nerves C_1 through T_1 and T_{12} through S_4 take part in forming *plexuses*, which serve the *limbs and anterior trunk* of the body. The ventral rami of T_2 through T_{12} run between the ribs to serve the *intercostal muscles*. The dorsal rami of the spinal nerves serve *the posterior body trunk*.

11. What would happen if the following structures were damaged or transected? (Use key choices for responses.)

Key: a. loss of motor function b. loss of sensory function c. loss of both motor and sensory function

b 1. dorsal root of a spinal nerve *c* 3. anterior ramus of a spinal nerve

a 2. ventral root of a spinal nerve

12. Define *plexus:* *A complex network of joining and diverging nerves.*

13. Name the major nerves that serve the following body areas:

cervical 1. head, neck, shoulders (name plexus only)

phrenic 2. diaphragm

sciatic 3. posterior thigh

common fibular, tibial, sural, medial and lateral plantar 4. leg and foot (name two)

median ulnar 5. anterior forearm muscles (name two)

radial, musculocutaneous 6. arm muscles (name two)

lumbar 7. abdominal wall (name plexus only)

femoral 8. anterior thigh

ulnar 9. medial side of the hand

Dissection of the Spinal Cord

14. Compare and contrast the meninges of the spinal cord and the brain. *Both the spinal cord and the brain have three meninges: pia mater, arachnoid mater, and dura mater. In the brain the dura mater has two layers—periosteal and meningeal. The spinal cord has only the meningeal layer.*

15. How can you distinguish between the anterior and posterior horns? *The anterior horns are wider than the posterior horns. The posterior horns extend closer to the edge of the spinal cord.*

16. How does the position of gray and white matter differ from that in the cerebral hemispheres of the sheep brain? *White matter is deep to the gray matter of the cerebral cortex, and superficial to the gray matter of the spinal cord.*

The Autonomic Nervous System

17. For the most part, sympathetic and parasympathetic fibers serve the same organs and structures. How can they exert antagonistic effects? (After all, nerve impulses are nerve impulses—aren't they?)

They release different neurotransmitters, which bind to different receptors.

18. Name three structures that receive sympathetic but not parasympathetic innervation.

Adrenal glands, arrector pili muscles, and sweat glands.

19. A pelvic splanchnic nerve contains (circle one):

a. preganglionic sympathetic fibers.
c. preganglionic parasympathetic fibers.
b. postganglionic sympathetic fibers.
d. postganglionic parasympathetic fibers.

20. The following chart states a number of conditions. Use a check mark to show which division of the autonomic nervous system is involved in each.

Sympathetic division	Condition	Parasympathetic division
✓	Secretes norepinephrine; adrenergic fibers	
	Secretes acetylcholine; cholinergic fibers	✓
	Long preganglionic axon; short postganglionic axon	✓
✓	Short preganglionic axon; long postganglionic axon	
	Arises from cranial and sacral nerves	✓
✓	Arises from spinal nerves T_1 through L_3	
	Normally in control	✓
✓	"Fight or flight" system	
	Has more specific control (Look it up!)	✓

Galvanic Skin Response Using BIOPAC®

21. Describe exactly how, from a physiological standpoint, GSR can be correlated with activity of the autonomic nervous system.

The autonomic nervous system controls sweat glands of the skin. Increased moisture on the skin decreases its electrical resistance, which can be recorded.

22. Based on this brief and unprofessional exposure to a polygraph, explain why this might not be an exact tool for testing the sincerity and honesty of a subject.

It is not possible to state with certainty that every subject who lies will have an absolutely predictable autonomic nervous system response. For this reason, although GSR is useful as an investigative tool, it is not accepted as an exact measurement tool.