LAB 1 – Spinal Cord and Spinal Nerves Notes:

CNS = Central nervous system ; PNS = Peripheral Nervous System

Motor (or **effector**) neurons: carry nerve impulses away from the CNS to effectors such as muscles or glands
-Sometimes called **efferent neurons**

Sensory (or **receptor**) neurons: carry nerve impulses from receptors or sense organs towards the CNS
-Sometimes called **afferent neurons**

Mnemonic: **A**fferent connection **A**rrives || **E**fferent connection **E**xits

SAME (Sensory = Afferent, Motor = Efferent) DAVE (Dorsal = Afferent, Ventral = Efferent) [for roots]

More Learning Aids:

a. Some students can get really confused on lab exams with which side of the model is anterior or posterior (or dorsal/ventral). I suggest that you find a quick and easy way to orient yourselves to avoid mistakes.
    i. For example, you can look for the spinous processes of the vertebral column on the posterior side of the model or you can look for the "bulb" of the dorsal root ganglion.
b. Spinal nerve identification – On the models, the spinal nerve is represented by a very small space (a few millimeter's worth) between the dorsal/ventral roots and the various rami. Some students get confused and think that the spinal nerve should be represented by a larger portion of the model, but it is not.

c. Mnemonics
    i. Dorsal root: dorsal fin of shark = exposed to sensory elements = sensory neurons
    ii. Ventral root: baby crawling around on belly (the ventral side) = "motoring around" = motor neurons
    iii. Corticospinal tract = descending pathway = 2 neuron types (coming from the brain = smart, only needs two neurons to complete the task)
    iv. Spinothalamic tract = ascending pathway = 3 neuron types (hasn't reached brain yet, so it's not as smart and needs 3 neurons to complete the task)
d. In general, when determining a neuronal pathway:
    i. Choose a root. Think sensory or motor.
        1. Dorsal root (sensory)
        2. Ventral root (motor)
    ii. Choose a horn. Think sensory or motor (from above) and then think somatic (bones, skeletal muscles, skin) or visceral (digestive, respiratory, cardiovascular).
        1. Dorsal horn (somatic and visceral sensory)
        2. Ventral horn (somatic motor)
        3. Lateral horn (visceral motor)
    iii. Choose a location. → pick a point on your body and trace pathway to brain and back
        1. Posterior body wall (somatic) – dorsal ramus
        2. Lateral/anterior body wall (somatic) – ventral ramus
        3. Internal organs (visceral) – communicating rami

e. Remembering the number of Vertebrae: MEALS OF THE DAY
    i. 7, 12 ,5 = typical times one might eat breakfast, lunch and dinner
    ii. 7 Cervical, 12 Thoracic, 5 Lumbar
    iii. (Also don't forget 5 Sacral vertebrae that fuse to form the sacrum, and 3-5 coccygeal vertebrae)

→Useful to be able to count the vertebrae on some models to orient yourself

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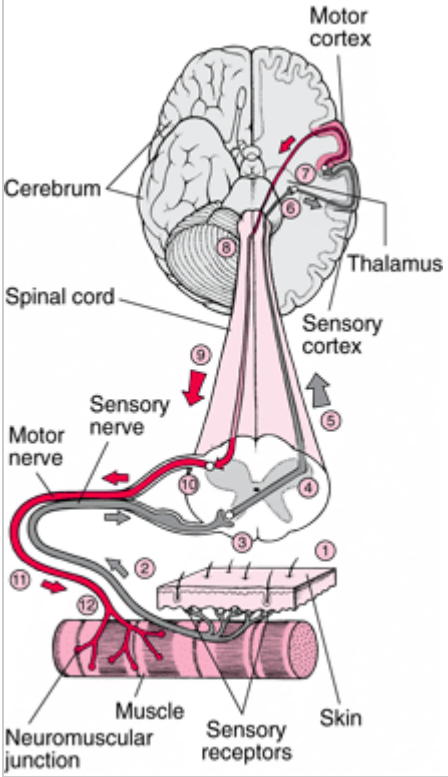
DON'T FORGET TO USE THE **QUIZLETS** AVAILABLE ON SAKAI TO YOUR ADVANTAGE TO BETTER LEARN TERMS AND TO PREPARE FOR EXAMS!! THESE ARE AVAILABLE FOR EACH LAB UNDER **RESOURCES > FLASHCARDS**

Using the Brain to Move a Muscle

Moving a muscle usually involves communication between the muscle and the brain through nerves. The impetus to move a muscle may originate with the senses. For example, special nerve endings in the skin (sensory receptors) enable people to sense pain, as when they step on a sharp rock, or to sense temperature, as when they pick up a very hot cup of coffee. This information is sent to the brain, and the brain may send a message to the muscle about how to respond. This type of exchange involves two complex nerve pathways: the sensory nerve pathway to the brain and the motor nerve pathway to the muscle.

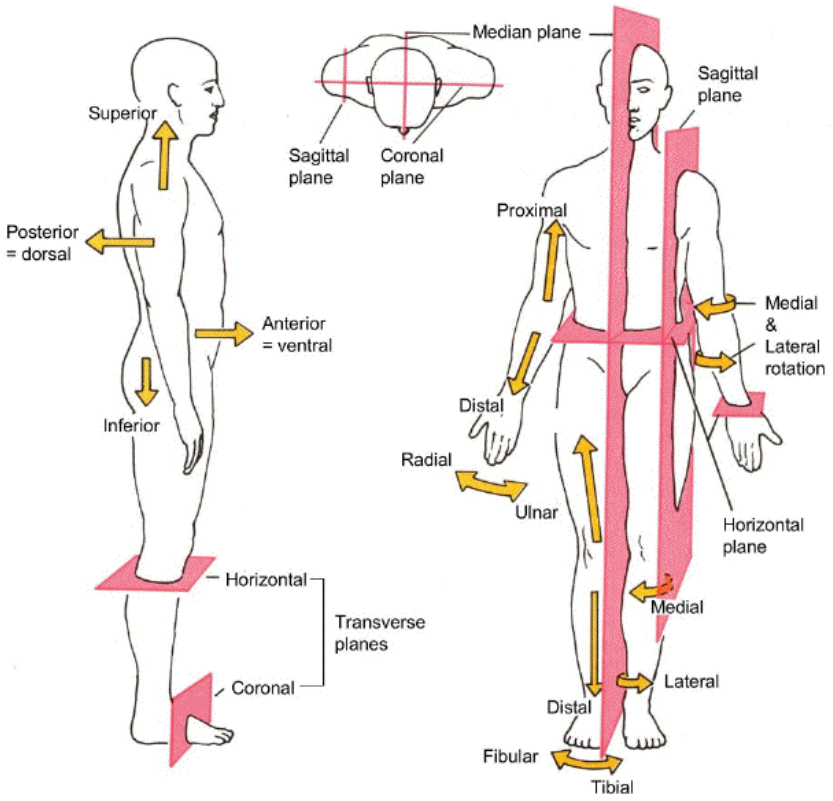


1. If sensory receptors in the skin detect pain or a change in temperature, they transmit an impulse (signal), which ultimately reaches the brain.
2. The impulse travels along a sensory nerve to the spinal cord.
3. The impulse crosses a synapse (the junction between two nerve cells) between the sensory nerve and a nerve cell in the spinal cord.
4. The impulse crosses from the nerve cell in the spinal cord to the opposite side of the spinal cord.
5. The impulse is sent up the spinal cord and through the brain stem to the thalamus, which is a sensory processing center deep in the brain.
6. The impulse crosses a synapse in the thalamus to nerve fibers that carry the impulse to the sensory cortex of the cerebrum (the area that receives and interprets information from sensory receptors).
7. The sensory cortex perceives the impulse. A person may then decide to initiate movement, which triggers the motor cortex (the area that plans, controls, and executes voluntary movements) to generate an impulse.
8. The nerve carrying the impulse crosses to the opposite side at the base of the brain.
9. The impulse is sent down the spinal cord.
10. The impulse crosses a synapse between the nerve fibers in the spinal cord and a motor nerve, which is located in the spinal cord.
11. The impulse travels out of the spinal cord along the length of the motor nerve.
12. At the neuromuscular junction, the impulse crosses from the motor nerve to the motor end plate on the muscle, where it stimulates the muscle to move.

Other questions/concerns from lab:

1. **Denticulate ligaments** –
    a. They are extensions of the pia mater that connect to the dura mater to anchor the spinal cord in place
    b. ONLY the blue extensions on the SIDES of the diagram on page 6 of manual = denticulate ligaments
        i. Other blue extensions = just part of arachnoid matter
            1. Specifically, these are prolongations of connective tissue that connect pia mater to dura mater along posterior side of spinal cord)
    c. As the manual states, there are 20+ pairs of these denticulate ligaments along the length of spinal cord
    d. They're named for their (shark) tooth like appearance [can be seen on laying down model in lab]
2. **Cervical Enlargement**: technically runs from C3 vertebrae to T2 vertebrae
3. **Lumbar Enlargement**: technically runs from T9 vertebrae to L1 vertebrae (stops short of conus medullaris)
4. Arachnoid mater and Dura mater do actually continue down filum terminale and cauda equina, though this is not necessarily determinable from the models in lab. Just an interesting fact to know
5. Some students asked about what appears to be an extra cervical vertebrae in the laying down model; This is actually the occipital lobe of the skull. Just remember that there are 7 Cervical vertebrae, and the atlas (C1) happens to start at lower case 'c' on this model. Count downward from there. (or just count upward from T1, which is the first vertabra associated with a rib)

Useful Diagram of Anatomical terms:



Ways to remember:

Dorsal -> think dorsal fin of shark is on its back
Posterior -> think of 'post' as after or *Behind*
Ventral -> side you 'vent' air
Anterior -> ANT crawls on its stomach side
Distal -> farther from (more DISTant from)
Superior -> above
Inferior -> below
Medial -> toward the middle
Lateral ->toward the side

Can you think of your own?:

Sample Exam 1 Questions

(NOTE: These exact questions will NOT be used on your Exam)

1) The _____ is a specialized capillary bed found in the ventricles that produces cerebrospinal fluid.
2) The innermost meninx directly covering the brain is the _____.
3) The multimodal association area that is important in social interactions and personality is the _____.
4) What plane (section) through the body would include both thumb and pinky?
5) The plural of vertebra is ___, and the pleural of foramen is ___.
6) Use proper directional terms: Your collarbone is ___ to your shoulder. Your hand is ___ to your elbow.
7) The "central pattern generator" located in the spinal cord coordinates the repetitive aspects of _____.
8) The ___ is the passageway through the vertebral column that houses the spinal cord and it's meninges.
9) Identify the location of the three neurons within an ascending pathway.
   1st order: begins at sensory structure (skin), terminates at __a__.
   2nd order: begins at __a__, terminates at __b__.
   3rd order: begins at __b__, terminates at __c__.

Answers:

1. Choroid plexus,
2. Pia mater
3. Prefrontal cortex
4. Frontal
5. Vertebrae, foramina
6. Medial, distal
7. Locomotion/walking
8. Vertebral column (foramen)
9. (a)Dorsal horn, (b) thalamus, (c) postcentral gyrus / somatosensory cortex

Note that Exam #1 will cover material from Labs 1-3.

Remember:

EXAM STRUCTURE: 25 stations {2 ID questions per station, 1.5min total per station} + 50 minutes for 50 pts of word questions

➔ OPEN LAB is held weekend before Exam week