[http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/nerve%20and%20sensory%20index.htm](http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve%26Sensory/nerve%20and%20sensory%20index.htm)

**Lab Topic 31**
**Investigating Nervous and Sensory Sytems**

**General Background**

What are the 3 functions of the nervous system?

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| **Microanatomy of the Nervous System** |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/microanat/o-neurons1photo | http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/microanat/neuron25 |

**Low and high magnification views of cow spinal cord smear showing neurons and glial cells**

* What are the long, narrow, string-like extensions from the cell bodies (somas) of these neurons?
* How does a neuron's shape reflect its function?
* Why is white matter white?
* What type of cell is at the end of the pointer? What are the dark-stained dots outside of this cell?
* Which direction to axons conduct action potentials - toward their cell body or away from their cell body? How about dendrites?
* Where is the soma and what function does it serve?
* If you observed neurites on a slide, how can you tell which are axons and which are dendrites?
* What does an action potential have to do with a nerve impulse?
* Name three types of neurons, and identify the function of each.

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/microanat/spcrdxshi |
| **High magnification of cross section of spinal cord, showing white and gray matter with nerve tracts leaving gray matter.*** Where in this photo is the gray matter? White matter?
* Identify an axon, and its surrounding myelin sheath in this picture.
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 What is the general organization of the spinal cord?

 What is the structural difference between white and gray matter?

 What is myelin?

 What is an afferent nerve? Efferent? Motor? Sensory?

 What is the difference between a neuron and a nerve?

 What is a ganglion?

 Describe a cross section of spinal cord.

 Do sensory nerves enter the spinal cord in the ventral or dorsal horn?

 Do motor nerves leave the spinal cord through the ventral or dorsal horn?

 Why is gray matter gray and not white?

 Mammals are considered chordates. Why?

 Would the speed of neural transmission in a neuron increase, decrease, or stay the same if the myelin was removed from the axon?

 How does the dorsal horn differ from the ventral horn?

 In a knee jerk reflex (or reflex arc) which is the correct sequence:

                  sensory nerve -- spinal cord -- motor nerve
                  sensory nerve -- spinal cord -- brain -- spinal cord -- interneuron -- motor nerve
                  motor nerve -- spinal cord -- interneuron -- sensory nerve
                  sensory nerve -- interneuron -- motor nerve -- spinal cord -- motor nerve

 Which is NOT included in a pain reflex arc? a) interneuron  b)sensory nerve c) cerebral cortex d) motor nerve e) gray matter

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| Mammalian Nervous System |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/brain/braindorsl | http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/brain/vennumber |
| **Dorsal view of pig brain** | **Ventral view of pig brain** |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/brain/sagnumber |

**Sagitally sectioned pig brain**

* Is the cerebellum anterior or posterior to the cerebrum?
* In the above photos, identify the cerebrum, cerebellum, medulla obongata, spinal cord, pons, pituitary, ventricles of brain, hypothalamus, and meninges. What are their functions?
* The brain and the spinal cord are surrounded by a membranous layer. What are these membranes called and what purpose do they serve?
* What region of the brain contains the cardiac and respiratory centers?
* What region of the brain controls the interpretation of sensory impulses and coordination of voluntary movements?
* Higher functions such as memory and learning are located in which brain region?
* The \_\_\_\_\_\_\_ controls skeletal muscle movements, coordination and balance.
* A brain tumor affecting the medulla oblongata might manifest what kind of symptoms in a patient?
* Describe the difference between peripheral and central nervous systems.
* In which of these images can you see cranial nerves? What cranial nerves can you identify, and what are the remaining cranial nerves that are not shown clearly?

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/microanat/spcrdxs.jpg |

**Cross section of mammalian spinal cord, low magnification**

* What is the difference between gray(dark) area and white(light) area of the spinal cord?
* If you wanted to study myelinated cells where would you look in the spinal cord?

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/brain/spnervclose |
| **View inside fetal pig body cavity showing sympathetic trunks to either side of vertebral column.** Where in this image is the spinal cord located? Can you see it, or is it covered up? If it is covered, by what is it covered?  Locate the sympathetic trunk in the photo above.  Locate at least two spinal nerves on each side of the spinal cord.  |

* How is the vertebrate nervous system conventionally divided?
* What is the difference between the central and peripheral nervous systems? What elements belong to each?
* How do the somatic (voluntary) and autonomic nervous systems differ in anatomy and in what they control?
* Why is the somatic nervous system often called voluntary?
* What 2 systems make up the autonomic nervous system?
* Sympathetic and parasympathetic systems control what?
* Locate the sympathetic trunk in the diagram above.

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| **Sensory Systems** |

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| Eye Anatomy |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/eye/coweye.jpg  | http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/IMAG0005.jpg  | http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/eye/eyecloseColor Vision |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/eye/retina3.5X |
| **Cross section of eye wall at back of eye**What three layers are visible in this section? Point out the sclera and choroid, the sensory cells (rods and cones) and nerve cells (mostly bipolar and ganglion cells  |

* Sketch a cross-section of a mammalian eye. Label the cornea, the anterior chamber, the lens, the posterior chamber, the retina, and the sclera.
* Does light pass through the iris? What is the pupil of your eye?
* Create a flow chart tracing the structures that  a photon of light passes through before striking the retina. What eye structures did the light not pass through? What are their functions?
* What structures focuses images on the retina? What structure is responsible for adjusting focus in your eyes?
* What two general kinds of sensory cells in the retina of animals detect light?
* How do rods and cones differ in the wavelengths of light (colors) to which they respond?
* How do the neural connections of rods and cones differ? What is meant by convergence in discussions of such neural connections?
* How do rods and cones differ in sensitivity to light, and in resolution of objects very close together? What are the mechanisms that result in those differences in performance?
* What kind of photoreceptor cells are responsible for color vision? Why can't rod cells tell us about the color of incoming light?
* How are rods and cones distributed in your retina? What is the functional significance of that distribution?
* Why can't you see when you walk from a bright street into a dark theater? After a short period you can see. Why?
* I've been in a movie theater and I walk out into the bright light. Why can't I see well for a minute or so?
* What is the name of the layer of tissue in which rods and cones are found?
* In the retina, light first hits which layer of cells? a) cones and rods  b) ganglion cells  c) bipolar cells  d) pigmented epithelium
* Why do you  have a blind spot?

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| **Color Vision Physiology- after images** |

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| http://www.biology.iastate.edu/Courses/Leon/212L%20Docs/Nerve&Sensory/eye/afterimage |

* How can you explain afterimages of different colors?
* What color is the afterimage which forms after staring at something red and then something white?
* How many different kinds of cone cells does a person with normal color vision have?
* How do we identify colors that do not match the most sensitive wavelengths of any of the 3 kinds of cone cells?

**General and Comparative Questions**

* How does a neuron's form reflect its function?
* Discuss functions of the major parts (cerebrum, cerebellum, medulla) of the brain.
* What is a transducer? Give an example. Identify the transducers in your visual system, hearing system, and balance system. Which of these are mechanoreceptors, and which are not?
* Differentiate between sensory cells that are transducers and nerve cells that are conductors.
* An amputee may feels "phantom pain" which they interpret as coming from the missing limb. How do you explain this?
* If you wanted to study nerve cell bodies, where would you look?
* If nerve cells conduct action potentials in an all or none fashion, how is it that we can  distinguish the intensity  of light sound, odor, taste, and temperature?
* How is the nervous system of hydra different from that of an earthworm and a human?
* Explain the difference between a nerve net and a nerve tract or nerve center. Give examples.
* Describe how sound waves pass from the outer to the inner ear.
* Briefly describe what happens when light enters the eye and strikes the retina.
* Draw a neuron. Label clearly the soma, an axon, and  a dendrite. Show in which directions signals move in the axon and dendrite.

**Credits**

Photos and Layout by Linda Westgate, Warren D. Dolphin, and Mark A. Mangum

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