Study Guide: Nerve Cells. Nerve Impulses

1. Name the three major types of functions of the nervous system, and give examples of each. How is the control exerted by the nervous system different from that exerted by endocrine system?

2. What structures make up the Central Nervous System (CNS)? What structures make up the Peripheral Nervous System (PNS)?

3. What is a nerve (as opposed to a neuron)? What is a mixed nerve? A sensory nerve? A motor nerve? Which type is most common?

4. What is another term for sensory pathways? For motor pathways? What is the role of a sensory receptor in a sensory pathway? Give examples. What is the role of the effector organ? Give examples. What is the role of the CNS in these pathways?

5. Name the two motor divisions of the PNS. What are the effector organs of each? To what extent is it accurate to describe one motor system as voluntary, and the other as involuntary. In what ways are those descriptions inaccurate? What is a visceral effector? What are the two subdivisions of the autonomic nervous system? How can you summarize the effects of each of these divisions?

6. What are the 2 kinds of cells which make up the nervous system? Which are specialized to conduct impulses? What do the other cells do in general? Give a brief description of each type of glial cell. Which produce myelin sheaths in the CNS? in the PNS? What is a myelin sheath made of and what are its functions? What is a neurilemma, and what does it enable the cell it covers to do? What are nodes of Ranvier, and what takes place there? What is Saltatory Conduction?

7. Name and describe the three major structures of a neuron. What is a nerve fiber? How long may an axon be? What is the normal pathway of an impulse as it moves through a neuron? Describe the structures at the terminal end of an axon.

8. Classify neurons by structure and by function. How do these categories overlap? What is a sensory neuron? a motor neuron? an association neuron?

9. What is meant by a membrane potential? resting potential? How is the resting potential established by the cell? What is concentrated outside the cell? inside the cell? What is the voltage associated with the resting potential? What is a pump? What is a channel in the membrane?

10. Explain what is meant by the terms depolarized, hyperpolarized and repolarized. What happens when the neuron is stimulated, and how is it stimulated? Describe the steps in the generation of an impulse.

11. What is the all or none principle? Try to put in your own words. How are differences in stimulus strength translated by the nervous system?

12. What determines the speed of an impulse in different axons?

13. What is a synapse? Where is the presynaptic membrane? the post-synaptic membrane? What is a synaptic cleft? Describe how an impulse may be transmitted across the synaptic cleft. What is an excitatory synapse? an inhibitory synapse? What determines if an impulse will be generated in the post-synaptic membrane? What is the importance of inhibitory synapse? What is a neurotransmitter? Name two. What is meant by summation of impulses? What is facilitation?

14. How many axons can synapse with a single post-synaptic neuron? (one? few? many?) What do you call the junction of a motor neuron and a muscle cell? a motor neuron and a gland?

15. What happens to neurotransmitters after they cross the synaptic cleft?

16. Can an impulse flow in both directions in an axon? across a synapse?

17. Rest

Study Guide: Spinal Cord. Spinal Nerves

1. What do you call a cluster of gray matter in the brain? In the spinal cord? In the PNS? What do you call a bundle of axons (usually myelinated) in the CNS? In the PNS?

2. Where does the spinal cord begin and end? Name and locate the two enlargements of the spinal cord. Why are they there? What is the conus medullaris? The cauda equina?

3. Draw a transverse section of the spinal cord. Label the horns (anterior, posterior and lateral), and the columns (anterior, posterior and lateral). Which parts are composed of gray matter? of white matter? Now draw a spinal nerve attaching to the cord via dorsal and ventral roots. Which is sensory and which is motor? What and where is the dorsal root ganglion?

4. Who many pairs of spinal nerves are there? How many segments of the cord? What is a dermatome, myotome, scleratome? Where do spinal nerves exit from the vertebral column?

5. What are ascending tracts? Descending tracts? Describe the differences between long tracts and short tracts. What are their functions?

6. What occurs in the gray matter of the cord? What is found in the anterior horn? In the posterior horn? In the lateral horn? Does every segment of the cord contain lateral horns (think thoracolumbar vs. craniosacral)?

7. What are meninges? Name and describe the three different layers starting from the outermost layer. Where in these layers is the cerebrospinal fluid found? What are the filum terminale and denticulate ligaments? Which layer do they come off of?

8. Are spinal nerves mixed nerves? How are spinal nerves grouped? How many pairs are in each group? Why are there 8 pairs of cervical nerves? Where does the first pair emerge from the vertebral canal?

9. Name the rami of a spinal nerve. What area of the body does each branch innervate? Which are the only branches to enter into the nerve plexus? Name the four major plexuses formed by the anterior rami of the spinal nerves. What is a plexus? Do thoracic nerves form a plexus?

10. For each plexus, describe the general area of the body it will innervate. Name the spinal nerves which enter into each plexus. Name the major terminal branches which emerge out of each plexus. For each of the following nerves, name the plexus it emerges from, possible entrapment sites, and the muscles which are innervated by it: phrenic, axillary, musculocutaneous, radial, ulnar, median, obturator, femoral, sciatic, tibial, common peroneal.

11. What are the five components of a reflex arc? Describe each reflex (stretch, golgi tendon, flexor, and crossed extensor) from sensory receptor through the spinal cord to the effector organ. How would you characterize reflex activity in general? Is it something you think about first? What is the function of reflex activity? What wiring do all movements (voluntary, involuntary, and reflexive) have in common?

12. Define the following terms: spinal reflex, monosynaptic reflex, polysynaptic reflex, monosegmental reflex, inter/polysegmental reflex, somatic reflex, autonomic (visceral) reflex, viscero-somatic reflex, somato-visceral reflex, ipsilateral reflex, contralateral reflex. Use these terms (only the ones that apply) to describe the four main reflexes discussed in class (stretch, golgi tendon, flexor, and crossed extensor).

13. Describe the pathway of a stretch reflex and the golgi tendon reflex. How and do inhibitory synapses fit into these reflexes? Where and how do the following techniques affect the spinal reflexes: Strain/Counterstrain, Muscle approximation, Tense & Release, CRAC (contract relax antagonist contract), Reciprocal Inhibition Technique, Golgi Tendon Organ Release Technique, Origin Insertion Technique.

Study Guide: Brain and Cranial Nerves: Pathways

1. Name and locate the four major structural divisions of the brain. What are the subdivisions of the brain stem? of the diencephalon? Which part of the brain is the largest? How does function change as you move up through the different portions of the CNS?

2. Name and locate the four ventricles of the brain. What and where are choroid plexuses? Which type of glial cell is associated with them? Where is cerebrospinal fluid (CSF) formed?

3. Name the meninges of the brain. How and where does the CSF circulate? Where does the CSF return to blood circulation?

4. Where does the medulla begin? Name three vital reflex centers in the medulla. What other less vital reflex centers also exist in the medulla?

5. Name the major descending tracts which cross on the anterior surface of the medulla. What is another term for the crossing of tracts? What is the significance of the crossing of these tracts from the functional point of view? What type of movement is activated by impulses through the pyramidal tracts? What are these tracts called after they decussate? Where do the pyramidal tracts arise, and where do they terminate. What is meant by an extrapyramidal tract? Give an example.

6. Locate the pons relative to other parts of the brain. What does the word pons mean, and why is it called that? What lies just posterior to the pons? What are the pneumotaxic center and the apneustic center? Is the pons composed mostly of white matter or gray matter?

7. What and where is the corpora quadrigemina? The red nucleus? The substantia nigra? What types of information pass through these nuclei?

8. Locate the thalamus and the hypothalamus in the diencephalon. Name the major functions of the thalarnus. Which sense does not pass through the thalamus? Where are impulses relayed from the thalamus? How are sensations experienced in the thalamus?

9. What gland (and system) is intimately related to the hypothalamus? Which efferent system is also largely controlled by the hypothalamus? Sensory impulses come into the hypothalamus from where? What is the significance of these centers: temperature, hunger, satiety, thirst, sleep and waking. Explain how each might work. What is the name for the “emotional brain”? What other parts are included in the limbic system besides the diencephalon?

10. What and where is the reticular activating system? What does it control?

11. Locate the cerebrum. How does it compare in size to the rest of the brain? What and where is the cerebral cortex? About how thick is it? What color is the cortex? What does that represent? What color is most of the rest of the cerebrum? Name the important group of nuclei located deep in the cerebrum. What is their main function? What type of tracts originate here? What pathology is associated with the basal ganglia and the substantia nigra.

12. Define a fissure, a sulcus, a gyms, a hemisphere and a lobe. What does the longitudinal fissure divide? Name the five lobes of each hemisphere. What white matter interconnects the two hemispheres? Name the sulcus which separates the frontal and parietal lobes. What are the three types of tracts which run within the cerebrum? What does each type interconnect? In which direction is each oriented?

13. What and where are the primary motor area and the premotor area of the cerebral cortex? What type of tracts originate here? Impulses for what type of movement originate here? Where do these tracts terminate? Which hemisphere controls motor activity on the left side of the body?

14. How is the primary motor area organized? What does it imply if a large area of motor cortex is assigned to a small portion of the body? What does this imply about motor units to that part of the body?

15. Where is the general sensory (somesthetic) area of the cortex? Which sensations are interpreted here? Which areas of the body receive disproportionate representation in this area? What does that indicate about those body parts?

16. Where is the primary visual area; the primary auditory area; the olfactory area; The gustatory area? What occurs m these areas? What occurs in the surrounding association areas?

17. In what important way are the two cerebral hemispheres asymmetrical? What important function is localized only in the left hemisphere in most people?

18. Locate the cerebellum. What and the arbor vitae? What are the major functions of the cerebellum? Describe the pathways of the cerebellar peduncles (superior, middle and inferior). What do they interconnect? What information must be received by the cerebellum in order for it to perform its functions? What are proprioceptors?

19. How are tracts named? How can you tell from the name if these tracts are ascending or descending?

20. How do pyramidal and extrapyramidal tracts affect lower motor neurons? What are upper and lower motor neurons? What is a final common pathway, and why is it called that?

21. Describe a typical sensory pathway all the way from the receptor to the cortex. What is meant by a first order sensory neuron? A second order? A third order? Where does each tend to begin and end?

22. Be able to list all 12 pairs of cranial nerves by name and number. Describe the major functions of each. Which are all sensory nerves? Which contain parasympathetic pathways? In general, where and how do cranial nerves attach to the brain? (See handout on cranial nerves)

STUDY GUIDE: AUTONOMIC NERVOUS SYSTEM (ANS)

1. What is a visceral effector? Give examples of where you find smooth muscle, cardiac muscle and glands in the body.

2. Which parts of the brain are especially active in regulating the ANS?

3. A preganglionic neuron begins and ends where? What color is it? Where will it begin if it is a sympathetic fiber? A parasympathetic fiber? Where does a postganglionic fiber begin and end? What color is it?

4. Name the 3 types of autonomic ganglia. Which are sympathetic? Which are parasympathetic? Where is each type of ganglion located (generally)? What is located in these ganglia, and what synapses there?

5. What is a white ramus? What kind of fibers pass through it; sympathetic? parasympathetic? motor? sensory? preganglionic? postganglionic?

6. Name the three possible pathways that a preganglionic sympathetic fiber may follow. In which case is a splanchnic nerve formed? Where are Pelvic Splanchnic nerves found?

7. What is a gray ramnus? Which fibers are in it? What are three possible pathways for postganglionic sympathetic fibers?

8. Name the three prevertebral (collateral) ganglia. (These are sympathetic)

9. What is meant by the thoracolunibar division of the ANS? The craniosacral division? Which nerves make up the parasympathetic system?

1O. Describe the origins and terminations of parasympathetic pre and post ganglionic fibers. What is the consequence of having terminal ganglia (parasympathetic) so close to the visceral effectors?

11. What is meant by dual innervation? Which visceral effectors receive only sympathetic stimulation (i.e. are NOT dually innervated).

12. Describe the different effects of the sympathetic system and the parasympathetic system on each of the following: SA node of heart, iris and ciliary muscle of the eye, salivary glands, lungs, blood vessels in skeletal muscle and in skin, smooth muscle of the digestive tract, sweat glands, smooth muscle of the bladder.

13. What is the neurotransmitter at most sympathetic neuroeffector junctions? At parasympathetic neuroeffector junctions? At sympathetic ganglia? At parasympathetic ganglia? What is meant by the term “adrenergic fiber”? “Cholinergic fiber”?

14. Describe the general overall effects of the sympathetic system, and of the parasympathetic system. (What is the code phrase to describe each?) When is one system likely to overrule the other?

Study Guide: Sensory Reception

1. What is the function of a sensory receptor? Trace the usual pathway of a sensory impulse from receptor to cerebral cortex. At what level is a sensation experienced in a non-discriminating way? At what level in a discriminating way?

2. What is the phenomenon known as projection? What is adaptation? What is meant by afterimage? How are adaptation and afterimage opposites?

3. What is meant by a general receptor? Name three major types of general receptors. Give examples of cutaneous receptors? Name three kinds of proprioceptors. What is each kind of proprioceptor responsive to? What is proprioception, and why is it necessary for performing movements? Give examples of visceral receptors.

4. Where do we have pain receptors? To what kind of stimulation are they responsive? What is true about the structure of all pain receptors? What is meant by referred pain? What are the different types of referred pain? Give examples of each. What is Phantom pain?

5. What is a special sense? Give examples of special senses. What nerves transmit impulses for these senses?

6. What is olfaction? Why is it considered to be a chemical sense? What is the pathway for olfactory impulses going into the cortex?

7. What is gustation? What and where are the receptors for taste? What are the four basic tastes? How do we account for other tastes? What is the function of saliva in tasting food? Describe the chemical basis of each taste. Is taste a chemical sense? Why? Trace the pathway for taste from tongue to cortex.

8. Draw a picture of the eye. Include: sclera, cornea, lens, iris, pupil, choroid, ciliary body, retina, optic nerve, optic disc, fovea, vitreous humor, aqueous humor. Can you describe the basic function of each part of the eye?

9. What is the accommodation reflex? How do we achieve near vision? Far vision? What is the sympathetic/parasympathetic control? How and why does the pupil dilate and constrict? What is the nervous control?

10. Name the two kinds of photoreceptors in the retina. Of the rods and cones, which are more sensitive to light (used for night vision)? Which are able to detect colors? Which give a clearer image? Which are the only ones found in the fovea? Overall, are there more rods or cones in the retina? Trace the visual pathway from the retina to the cortex.

11. Briefly describe the structures of the external, middle and inner ear. Where are the hearing receptors (hair cells) found? See if you can describe how a sound wave in the air travels through the ear then to impulses in the brain. Where are they interpreted? What is the function of the eustachian tube?

12. What stimuli do the semicircular canals respond to? Where is the information for equilibrium relayed?