

Nervous System Study Guide

| Green Handout        |  |
|----------------------|--|
| Events in Nerve Cell |  |
| 1                    | Acetylcholine placed on Nerve Cell (Dendrite)  |
| 2                    | Charge outside of cell membrane changes from + to –<br>(because $Na^+$ moves into the cell)<br><b>Action Potential</b> – change of cell membrane from positive to negative |
| 3                    | $Ca^{++}$ is released from the synaptic vesicles within the axonal terminals   |

- The nucleus of a nerve cell (neuron) is in what part of the cell? (pg 390) **The Cell Body**
- What carries the impulse away from the nerve cell body? (pg 392) **The Axon**  
 What carries the impulse toward the nerve cell body? **The Dendrite**
- Define Saltatory conduction. (pg 406) **The action potentials are triggered only at the Nodes of Ranvier; the part of the axon not covered with myelin. The electrical signal jumps from node to node in quick succession; drastically increases the speed of the signal**
- What is the Neuroglia that makes myelin sheaths? (pg 389-390) **Schwann Cells in the peripheral nervous system (PNS); Oligodendrocytes in the central nervous system**  
 What is the function of the myelin sheath? **To increase the speed of transmission of nerve impulses**  
 What is the myelin sheath composed of? **Primarily Fat**  
 What are the gaps in the sheath formed between? **Schwann Cells**  
 What are the nodes of Ranvier? **The gaps in the myelin sheath between the Schwann cells**  
 What parts of the neuro may be myelinated? **The Axon (only)**  
 What is the white colored matter of the brain and spinal cord from? **The myelin sheath on the Axons**
- Repair of the axons and dendrites in the peripheral nervous system can occur if the nerve cell bodies are intact and if **the Neurilemma is intact.**  
 Is there repair in the central nervous system? **No regeneration because there is no Neurilemma; the cell body of the Schwann cell located on the myelin**  
 At what age do all neurons lose the ability to undergo mitosis? **Before birth; at 6 months after fertilization**
- What does a buildup of neurotransmitter by a single nerve cell that has fired two or more times result in?  
**Temporal Summation**
- Look at White Handout : Nerve Reflex Arc**  
 In order, name the components of a reflex arc.

|   | Components         | Description / Location / Path                                     |
|---|--------------------|---|
| 1 | Receptor           | Along Dendrite; In through Dorsal Root                            |
| 2 | Sensory Neuron     | Dorsal Root Ganglion; cell body; In Dorsal Root; into Spinal Cord |
| 3 | Association Neuron | Not always present; In Spinal Cord or Brain                       |
| 4 | Integrating Center | Anterior (ventral) horn of grey matter; Site of Polio problems    |
| 5 | Motor Neuron       | Along Ventral Root; out to effector; Down Axon                    |
| 6 | Effector           | Example: Neuro-Muscular Junction                                  |

- Name examples of effectors. **Any Muscle**
- Name examples of receptors. **Merkel's discs; Meissner's corpuscles; Ruffini's corpuscles; Pacinian corpuscles; etc.**
- What is the tapping of the knee an example of? **The Stretch Reflex**
- Motor (efferent) nerve cells conduct impulses in what direction? **Away from the spinal cord**
- Sensory (afferent) nerve cells conduct impulses in what direction? **Toward the spinal cord**
- All spinal nerves are mixed nerves. What does that mean? (pg 480) **They contain Sensory and Motor fibers**
- What part of the spinal nerve only has sensory (afferent) cells? **The Dorsal Root**
- What part of the spinal nerve only has motor (efferent) nerve cells? **The Ventral Root**
- The dorsal root ganglion contains nerve cell bodies of the **sensory** nerve cells.
- What structure does the Polio virus attack? **The Anterior horn of the grey matter**
- What part of the spinal cord is the integrating center between sensory and motor nerve cells? **The Grey Matter**
- What are nerve cell bodies in the peripheral nervous system called? **Ganglion; in the dorsal root**

### Central Nervous System (CNS)

8. What is the cauda equina formed from? (pg 462-63) **The spinal nerves that extend from the end of the spinal cord**  
Between what vertebrae is a needle inserted during a spinal tap (lumbar puncture)? **L<sub>3</sub> & L<sub>4</sub> or L<sub>4</sub> & L<sub>5</sub>**
9. What is found in the central canal of the spinal cord? **Cerebral Spinal Fluid**  
What is the superior end of the central canal continuous with? **The 4<sup>th</sup> Ventricle of the brain**  
What is the color of the matter next to the central canal? **Grey**  
Which foramen in the skull does the spinal cord pass through? **The Foramen Magnum**  
At what vertebra does the spinal cord begin? **C<sub>1</sub>**  
At what vertebra does the spinal cord end? **L<sub>1</sub>**
10. Name and locate the 3 meninges of the central nervous system. (pg 454-455)
1. **Pia mater; clings tightly to Brain and Spinal Cord**
  2. **Arachnoid mater; loose brain covering; creates subarachnoid space between itself and the Pia Mater**
  3. **Dura mater; superficial to and in contact with the Arachnoid Mater; usually double layers**
- In what two general areas of the brain does cerebral spinal fluid (CSF) circulate?
1. **Ventricles & Central Canal**
  2. **Subarachnoid space**
- What does the epidural space contain? **Fat; padding; site for injection of anesthetic during childbirth**  
What is the dura mater composed of? **Dense irregular connective tissue**  
What is the name of the highly vascular, innermost meninx? **The Pia Mater**  
What is the middle avascular meninx? **The Arachnoid Mater**  
The superior sagittal sinus is found between 2 layers of what? **Dura Mater**  
This and all other sinuses in the CNS contain what? **Extra cerebral spinal fluid**
11. Spina Bifida and Anencephaly are defects in what? (pg 468-469) **No formation of the ventricles & canal; called Neural 2 Defects**  
These defects are associated with the lack of what in the diet of the mother? **Folic Acid**
12. What is the connective tissue covering individual nerve cells called? **Endoneurium**

### Spinal Nerves (pg 491 – 493)

13. What is the largest nerve in the body? **The Sciatic nerve**  
What plexus is this nerve a part of? (pg 499) **The Sacral Plexus**  
What nerve stimulates the diaphragm? (pg 494) **The Phrenic Nerve**  
If a patient is on a respirator, this patient has damage to what plexus? (pg 494) **The Cervical Plexus**  
What nerves are involved in this situation? **C<sub>1</sub> – C<sub>4</sub>**  
Vertebrae C<sub>5</sub> through C<sub>8</sub> form what plexus? (pg 496) **The Brachial Plexus – nerves to the arm**

### Brain

14. Describe the function of the arachnoid villi. **They are projections of the Arachnoid Mater through the first layer of Dura Mater that allow the flow of extra CSF into the Dura sinuses; leading to the drainage of extra CSF into the internal jugular vein**
15. Locate the four ventricles of the brain. (pg 432-433)
- 1<sup>st</sup> & 2<sup>nd</sup> – **Left & Right Lateral ventricles; look like horns of big horn sheep; in the cerebral hemispheres**
  - 3<sup>rd</sup> – **at the Thalamus; the Ventricle is surrounded by the Thalamus**
  - 4<sup>th</sup> – **just dorsal of Pons & Medulla**
- What are cavities within the brain called? **Ventricles**  
Where is Cerebral Spinal Fluid made? **In the ventricles; at the choroid plexus, on the roof of several ventricles**  
What does the blockage of the flow of CSF result in? **Hydrocephaly; too much CSF in the ventricles; leads to swelling of the head in infants**

## Human Anatomy & Physiology BIO 163 – Lecture Test 5

16. Locate and name the parts of the human brain. (pg 449) See Table below
- What part is involved in body coordination and balance? **Cerebellum**
- What part is involved in body temperature control? **Hypothalamus**
- What part is involved in habitual or automatic actions in sequence like walking? **Basal Ganglia**
- What part of grey matter in the cerebrum affects muscle tone? **Basal Ganglia**
- What grey matter is the site of crude localization of sensory input? **In the Thalamus**
- What is the relay center between the spinal cord and the cerebral cortex? **Thalamus**
- What is the function of the Thalamus? **Crude sensory perception; relay station between the spinal cord and cerebral cortex**
- What part of the brain affects involuntary emotions? **The Limbic System**
- What does the pineal gland make? **Melatonin**
- What does this hormone promote? **Sleepiness**
- What makes the hormones secreted by the posterior lobe of the pituitary gland? **Hypothalamus**
- What controls the secretion anterior and posterior lobes of the pituitary gland? **Hypothalamus**
- What makes up the brain stem? **Medulla (bottom), Pons (middle), Midbrain (top)**
- What is the significance of the decussation of pyramids? **If there is damage to the left side of the brain the right side of the body is affected; area of crossing**
- What controls the diameter of the blood vessels? **Medulla**
- What controls swallowing, vomiting, and coughing? **Medulla**
- Where are the pneumotaxic and apneustic centers located? **In the Pons; regulate rhythm of breathing**
- What are white fibers that are attached to the opposite cerebral hemisphere? **The Corpus Callosum**
- What does damage to the cerebellum cause? **Ataxia; drunken movements**

| <b>Major Brain Regions and Functions</b> |  |  |   |
|--|--|--|---|
| <b>Cerebral Hemispheres</b>              |  |  |   |
| <b>Cortical Grey Matter</b>              | Localizes and interprets sensory inputs                                    | Controls voluntary and skilled skeletal muscle activity  | Functions in intellectual & emotional processing    |
| <b>Basal Ganglia</b>                     | Subcortical motor centers  | important in initiation of skeletal muscle movements   | Gross motor movement and muscle tone                |
| <b>Diencephalon</b>                      |  |  |   |
| <b>Thalamus</b>                          | Crude sensory perception   | Relay station between the spinal cord and cerebral cortex; cerebral cortex & lower motor centers | Involved in memory processing                       |
| <b>Hypothalamus</b>                      | Aids the Medulla in automatic (involuntary) nervous system                 | Regulates body temperature, food intake, water balance, thirst, bio rhythms & drives             | Regulate hormone output of anterior pituitary gland |
| <b>Hypothalamus</b>                      | Part of the <b>Limbic System</b> along with <b>cerebral structures</b>     | Makes two hormones; mediates emotional “gut” feelings  | Involved in memory processing                       |
| <b>Brain Stem</b>                        |  |  |   |
| <b>Pineal Gland</b>                      | Makes Melatonin  | Helps put you asleep   |   |
| <b>Midbrain</b>                          | Conduction pathway between higher and lower brain centers                  | Visual & auditory reflex centers   | Subcortical motor centers                           |
| <b>Pons</b>                              | Works with Medulla to control respiratory rate and depth                   | Relay information between the cerebrum & cerebellum  |   |
| <b>Medulla Oblongata</b>                 | Site of decussation of pyramids – where left & right functions criss-cross | Controls heart rte, blood vessel diameter, respiratory rate, vomiting, coughing, etc.            | Sensory relay to cerebellum                         |
| <b>Cerebellum</b>                        |  |  |   |
|  | Controls coordination, balance, posture                                    | Controls learned fine motor movements  | Damage results in <b>Ataxia</b> ; drunken movements |

**Cerebral Cortex**

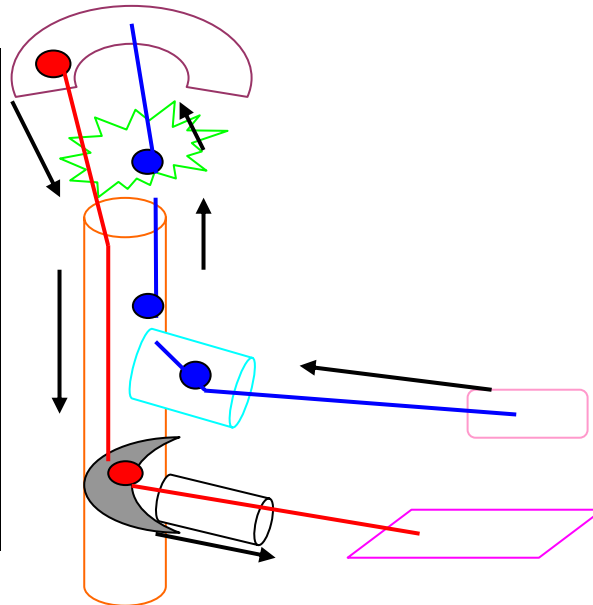
| <b>Cerebral Cortex</b>                  |  |   |  |
|---|--|---|--|
| <b>Frontal Lobe</b>                     |  |   |  |
| <b>Area</b>                             | <b>Location</b>  | <b>Function</b>   | <b>Damaged Behavior</b>  |
| <b>Primary Somatomotor Cortex</b>       | Precentral Gyrus; anterior of central sulcus                                       | Consciously control the precise or skilled voluntary movements of skeletal muscles  | Unable to control movements of skeletal muscles                        |
| <b>Premotor Cortex</b>                  | Just anterior to Precentral Gyrus  | Controls learned motor skills of repetitious or patterned nature (playing instrument); planning movements   | Forget how to play instruments or other planned or learned skills      |
| <b>Broca's Area</b>                     | Anterior to the inferior part of Precentral Gyrus; Usually only in Left Hemisphere | (1) <b>Motor Speech Area</b> – directs the muscles of the tongue, throat, lips involved in speech production; (2)active when prepare to speak; (3)think about many voluntary motor activities | Problems with speech formulation; thinking about other motor functions |
| <b>Frontal Eye Field</b>                | Partially in & anterior to Premotor Cortex; Superior to Broca's Area               | Controls voluntary movement of the eyes   | Unable to look at what you want  |
| <b>Parietal Lobe</b>                    |  |   |  |
| <b>Primary Somatosensory Cortex</b>     | Postcentral Gyrus; posterior of central sulcus                                     | Receive information from sensory receptors in skin & proprioceptors in skeletal muscles; identify the body region being stimulated – <b>Spatial Discrimination</b>                            | Unable to feel stimulation of skin or have spatial awareness           |
| <b>Somatosensory Association Cortex</b> | Just posterior to the primary somatosensory cortex                                 | Integrate different sensory inputs from somatosensory cortex to have comprehensive understanding of an object being felt; i.e. reaching in pocket and recognizing coins or keys               | Can not recognize objects without looking at them                      |
| <b>Gustatory (Taste) Cortex</b>         | Just deep of the Temporal Lobe; in the postcentral gyrus                           | Involved in the perception of taste stimuli   | Unable to taste  |
| <b>Occipital Lobe</b>                   |  |   |  |
| <b>Primary Visual Cortex</b>            | Extreme posterior tip of occipital lobe; most buried in medial aspect of lobe      | Receives visual information that originates on the retinas of the eyes  | Results in functional blindness; unable to see                         |
| <b>Visual Association Area</b>          | Surrounds the primary visual cortex; covers much of the lobe                       | Interprets visual stimuli using past experiences; enable us to recognize & appreciate objects   | Can see but unable to comprehend what we are seeing                    |
| <b>Temporal Lobe</b>                    |  |   |  |
| <b>Primary Auditory Cortex</b>          | Superior margin of temporal lobe abutting lateral sulcus                           | Receives auditory information from cochlear receptors   | Results in functional hearing loss                                     |
| <b>Auditory Association Area</b>        | More posterior of the Primary Auditory Cortex                                      | Permits perception of sound stimulus; to "hear" as speech, music, noise, etc.   | Can hear but unable to comprehend what we are hearing                  |
| <b>Olfactory (smell) Cortex</b>         | Medial aspects of temporal lobe & in Frontal lobe just above the orbits            | Receive input from receptors in nasal cavities; results in conscious awareness of odors   | Unable to process and comprehend odors                                 |

# Human Anatomy & Physiology

## BIO 163 – Lecture Test 5

17. Locate and describe the function of the parts of the cerebral cortex. (pg 434) See above table  
 Predict what might happen to behavior if each lobe was damaged. See table above  
 The somatomotor is in what gyrus? **Frontal (precentral)**  
 The somatosensory is in what gyrus? **Parietal (postcentral); behind the dividing line**  
 Locating sensory information is the function of what part of the cortex? **Somatosensory**  
 Most conscious sensation are interpreted and relayed by what? **The Thalamus**  
 After the Thalamus nerve impulses go to what lobe of the cortex? **The Parietal or Somatosensory part of the Parietal lobe**  
 What are the four kinds of brain waves generated by the cortex?  
     Alpha – just awoken; not really thinking clearly  
     Beta – focusing; thinking; concentration; REM- restorative  
     Theta – having a crisis  
     Delta – when you are asleep; Non-REM sleep
- What are the functions of the reticular activating system? **It helps keep you awake; Reticular Formation**  
 What structures have proprioceptors? **Skeletal Muscle; it is the sense of where your body parts are in relation to your environment; without sight or sound**

| Nerve Arc for Actions that Require the Brain<br>At Least 5 Nerves |                               |                       |                 |                 |
|---|-------------------------------|-----------------------|-----------------|-----------------|
|   |                               | Location of Cell Body | From            | To              |
| 1   | 1 <sup>st</sup> Order Sensory | Dorsal Root           | Receptor (skin) | Spinal Cord     |
| 2   | 2 <sup>nd</sup> Order Sensory | Spinal Cord           | Spinal Cord     | Thalamus        |
| 3   | 3 <sup>rd</sup> Order Sensory | Thalamus              | Thalamus        | Cerebral Cortex |
| 4   | Upper Motor                   | Cerebral Cortex       | Cerebral Cortex | Spinal Cord     |
| 5   | Lower Motor                   | Anterior Horn         | Spinal Cord     | Muscle          |



18. Where are the cell bodies of the first order sensory neuron located? (pg 537) **In the Dorsal Root**  
 What does the first order sensory neuron conduct impulses from to the CNS? **From the Receptor (i.e. skin) to the Spinal Cord**  
 Third order sensory neurons extend from **the Thalamus to the Cerebral Cortex** .  
 Where do synapses between the 2<sup>nd</sup> order and 3<sup>rd</sup> order neuron occur? **In the Thalamus**  
 Where are the cell bodies for the upper motor neurons located? **The Cerebral Cortex**  
 Where are the cell bodies of the lower motor neurons located? **The Anterior Horn (Ventral) of Grey Matter; in the Spinal Cord**  
 The axon of the lower motor neuron may leave by what? **The Ventral Root**
19. What may pain under the right shoulder indicate? (pg 523, Figure 14.8) **Gall bladder Problems**  
 What are the apparent causes for referred pain? **The same spinal segments innervate both areas; we use the same nerves or they are very close to each other for the different things (areas)**

20. List the 4 stages of Non-REM sleep. (pg 549)

| Types and Stages of Sleep |                     |   |                      |                          |                           |   |
|---------------------------|---------------------|---|----------------------|--------------------------|---------------------------|---|
| Stage                     | EEG Pattern         | Description   | Vital Signs          | Dream                    | If Stimulated             | Muscles   |
| 1                         | Alpha waves         | Eyes closed; thoughts flit in & out, drifting sensation; normal   | Normal               |                          | Arousal is immediate      | Relaxation begins   |
| 2                         | More irregular      | Sleep Spindles – sudden, short high voltage wave bursts appear; 12 – 14 Hz  |                      |                          | Arousal is more difficult |   |
| 3                         | Theta & Delta waves | Sleep deepens; usually reached 20 minutes after stage 1   | Begin to Decline     | Common                   |                           | Skeletal muscles very relaxed   |
| 4                         | Delta waves         | Called <b>Slow-wave</b> sleep because of Delta waves dominate; bed-wetting & sleep walking may occur; <b>also a restorative sleep</b> | Lowest normal levels |                          | Arousal is difficult      | Skeletal muscles relaxed; normal turns every 20 min.; digestion increases       |
| REM                       | Beta waves          | EEG reverts through NREM stages to stage 1; lack of REM makes person moody & depressed  | Increase             | <b>Most dreams occur</b> |                           | Skeletal muscles (except for ocular) are inhibited; Digestion activity declines |

What is REM sleep? **Rapid eye movement; dream sleep; restorative sleep**

**Cranial Nerves**

21. List the names, numbers and functions of the 12 cranial nerves. (white Handout)

| Cranial Nerves |                              |  |              |          |         |          |
|----------------|------------------------------|--|--------------|----------|---------|----------|
| #              | Name                         | Function   | Poem 1 (Old) | Poem 2   | Nerve   | Poem     |
| 1              | Olfactory                    | smell  | On           | On       | Sensory | Some     |
| 2              | Optic                        | vision   | Old          | Occasion | Sensory | Say      |
| 3              | Oculomotor                   | movement of eyelid & eyeball   | Olympus      | Our      | Motor   | Marry    |
| 4              | Trochlear                    | movement of eyeball  | Towering     | Trusty   | Motor   | Money    |
| 5              | Trigeminal                   | chewing  | Tops         | Truck    | Both    | But      |
| 6              | Abducens                     | movement of eyeball  | A            | Acts     | Motor   | My       |
| 7              | Facial                       | facial expressions   | Finn         | Funny    | Both    | Brother  |
| 8              | Vestibulocochlear (Auditory) | hearing & equilibrium  | And          | Very     | Sensory | Says     |
| 9              | Glossopharyngeal             | taste & swallowing   | German       | Good     | Both    | Bad      |
| 10             | Vagus                        | lungs, esophagus, airways, heart, stomach, small intestine, most of large intestine, gallbladder | Viewed       | Vehicles | Both    | Business |
| 11             | Accessory (Spinal)           | helps vagus  | Some         | Any      | Motor   | Marry    |
| 12             | Hypoglossal                  | swallowing   | Hops         | How      | Motor   | Money    |

22. The olfactory nerve enters the brain through what bone? **The Cribriform Plate of the Ethmoid bone**

What nerves have only sensory nerve cells? **#1, 2, 8**

What nerves have only motor nerve cells? **# 3, 4, 6, 11, 12**

What are the 3 cranial nerves that cause movement of the eyeball? **Oculomotor/3, Trochlear/4, Abducens/6**

What nerve allows chewing and sensory input from most of the face? **Trigeminal, #5**