

## Chapter 13 Central Nervous System

- I. Composed of Brain and Spinal Column
- II. Coverings of Brain and Spinal Cord
  - a. 2 outer coverings
    - i. cranial bones
    - ii. vertebrae
  - b. Inner Covering - membranes or meninges
    - i. 3. layers
      1. dura mater - outer layer
        - a. strong white fibrous tissue
        - b. inner periosteum of cranial bones
      2. Arachnoid Membrane - inner layer
        - a. Cobweb-like layer
      3. Pia Mater - inner most layer

- a. Adheres to outer surface of brain and spinal cord
- b. Contains blood vessels

### III. Cerebrospinal Fluid (CSF)

- a. Provides a cushion for the organs; Reservoir for fluid and blood - helps maintain internal environment (ex. pH)
- b. Fluid Spaces
  - i. CSF is found in subarachnoid space around brain and spinal cord within the cavities and canals of brain & spinal cord
    - 1. ventricles - large, fluid filled spaces
- c. Formation and Circulation of CSF
  - i. Formation occurs by separation of fluid from blood in the choroids plexuses

1. choroids plexuses are networks of capillaries that project from pia mater into lateral ventricles
- ii. Fluid circulates in subarachnoid space and is absorbed into venous blood through arachnoid villi

#### IV. Spinal Cord

- a. Structure
  - i. Extends from foramen magnum to lower border of the first lumbar vertebra
  - ii. Oval-shaped cylinder that tapers slightly with 2 bulges - 1 in the cervical area & 1 in the lumbar region
  - iii. Symmetrical halves - almost completely formed due to 2 deep grooves - anterior median fissure and posterior median sulcus

1. Anterior fissure is deeper and wider
- iv. Nerve roots - bundles of nerves project from each side of the spinal cord
  1. spinal nerve - on each side of the spinal cord, dorsal & ventral nerve roots join; component of PNS
- v. Contains core of gray matter
  1. extends length of cord
  2. looks like an 'H'
- vi. White matter surrounds gray matter
  1. subdivided into anterior, posterior & lateral white columns

- b. Functions of spinal cord
  - i. Two functions
    - 1. provides conduction routes to and from brain
      - a. Ascending tracts conduct sensory impulses up the cord to the brain
        - i. Five tracts
          - 1. Lateral Spinothalamic - crude touch, pain and temperature
          - 2. Anterior Spinothalamic - touch & pressure
          - 3. Fasciculi Gracillis & Cuneatus - discriminating touch &

sensation of  
movement

4. Spinocerebellar -

subconscious  
kinesthesia

5. Spinotectal -  
touch,

triggering visual  
reflexes

b. descending tracts -  
conducts motor  
impulses down the  
spinal cord from the  
brain

i. Six Tracts

1. Lateral  
Cortico-Spinal -  
voluntary  
movement of  
contraction of  
individual or  
muscle groups

on opposite side  
of body

2. Anterior Corticospinal - voluntary movement of individual or groups of muscles on the same side of the body
3. Reticulospinal - helps maintain posture during skeletal muscle movements
4. Rubrospinal - transmit impulses that coordinate body movement and

- 5. maintenance of posture
- 5. Tectospinal - head and neck movement, related to visual reflexes
- 6. Vestibulospinal - coordination of posture & balance
- 2. Integrator or reflex center, for all spinal reflexes
  - a. Center of a reflex arc or place in the arc where secondary impulses become outgoing
  - b. Switch impulses from afferent to efferent neurons

## V. Brain

(Structures will be covered in lab)

- a. Functions of Brainstem
  - i. Sensory motor and reflex functions
    - 1. medulla - cardiac and respiratory centers
    - 2. medulla - vomiting, coughing, sneezing, hiccupping, swallowing
    - 3. midbrain - papillary reflexes and eye movements
    - 4. pons - regulates respiration
  - b. Functions of Cerebellum
    - i. Acts with cerebral cortex to produce skilled movements; coordinates groups of muscles
    - ii. Helps control posture, functions below level of consciousness - helps to make movements smooth

- iii. Controls skeletal muscles to maintain balance
- c. Functions of Diencephalon
  - i. Thalamus
    - 1. responsible for sensations
    - 2. emotions
    - 3. arousal or alerting mechanism
    - 4. complex reflex movements
  - ii. Hypothalamus
    - 1. controls and integrates responses from autonomic (visceral) effectors
    - 2. Link between cerebral cortex and lower autonomic centers
    - 3. Synthesizes hormones
    - 4. indirectly controls function of cells (endocrine functions)
    - 5. maintains waking state

6. regulates appetite
  7. maintains normal body temperature
- d. Cerebral Cortex
- i. Thin layer of gray matter that compose the surface of the cerebrum
  - ii. Function of each region depends on the structures with which it communicates
    1. postcentral gyrus - somatic sensory area
      - a. receives impulses from receptors activated by heat, cold & touch
    2. precentral gyrus - somatic motor area
      - a. impulses stimulate somatic effectors (skeletal muscles)
    3. transverse gyrus - primary auditory area

- iii. Integrative Functions - all events between reception of sensory impulses sending out motor impulses
  - 1. consciousness
  - 2. use of language
  - 3. emotions
  - 4. memory

## VI. Somatic Sensory Pathways in CNS

- a. Impulses are conducted to cerebral cortex by relays of neurons
  - i. Travel through three pools of sensory neurons
    - 1. primary - conduct from periphery to CNS
    - 2. secondary - conduct from spinal cord or brain stem to thalamus
      - a. dendrites & cell bodies are in gray matter
    - 3. tertiary - conduct from thalamus to postcentral gyrus in parietal lobe
  - ii. These pathways are cross pathways (cross from one side to the other)

## VII. Somatic Motor Pathways in the CNS

- a. Somatic Motor Pathways consist of motor neurons that conduct impulses from the CNS to the somatic effectors (skeletal muscles)
- b. Multiple pathways exist - some are complex and some are simple