Chapter 10 – Spinal cord, somatic reflexes

I. Overview
   a. Information highway between brain and body, has coverings like brain
   b. Motor signals sent to muscles and glands
   c. Spinal cord = Central Nervous System; spinal nerves = Peripheral Nervous System

II. Functions of spinal cord
   a. Conduction
   b. Locomotion – flexors and extensors fired by central pattern generators
   c. Reflexes – involuntary responses to stimuli, involving brain, spinal cord, peripheral nerves

III. Composition of spinal cord
   a. Gray matter (butterfly shape) – little myelin
      i. Dorsal – motor
      ii. Ventral – sensory
   b. White matter – axons (conduction) surrounded by myelin

IV. Disorders
   a. Poliomyelitis
      i. Destruction of motor neurons
      ii. Virus spread (fecally contaminated water)
   b. ALS – Amyotrophic lateral sclerosis
      i. Scarring due to failure to reabsorb neurotransmitters
   c. Shingles – chicken pox virus
   d. Spinal cord trauma – 55% car accidents

V. Nerves
   a. Axons
   b. Dendrites

VI. Reflexes
   a. Stretch (myotatic) reflex – muscle stretches & it contracts, maintains tonus
      i. Very sudden stretch causes tendon reflex (patellar)
   b. Flexor (withdrawal) reflex – pain response
   c. Crossed extensor reflex – maintains balance by extending opposite leg
   d. Golgi tendon reflex – excessive tension on tendon inhibits contraction

The Central Nervous System – Chapter 11

I. Meninges (coverings)
   a. Dura mater
      i. Outermost
      ii. Separated in places from inner to form sinuses – drains blood
   b. Arachnoid mater
      i. Spider web filamentous layer
   c. Pia mater
      i. Vascular layer
      ii. Adheres to brain
   d. Meningitis
      i. Inflammation due to bacteria or virus
      ii. Affects pia mater & arachnoid mostly
      iii. Fever, stiff neck, drowsiness, intense headache – coma
      iv. Diagnose through CSF sample
         1. fluid for brain buoyancy
         2. chemical stability (waste disposal)
         3. protection - cushion

II. Brain structures – 83% volume = cerebrum; 50% neurons = cerebellum; 3 – 3.5 lbs total mass
   a. Hindbrain
      i. medulla oblongata
         1. Cardiac center – rate & force of heart beat
         2. Vasomotor – diameter of blood vessels
         3. Respiratory – rate & depth of breathing
         4. Reflexes – cough, sneeze, gag, swallow, vomit, salivate, sweat, tongue/head movements
      ii. Pons
         1. ascending sensory tract
         2. descending motor tract
         3. path in/out of cerebellum
         4. sleep, hearing, balance, taste, eye movements, facial expression & sensation, respiration, swallow, bladder control, posture
      iii. cerebellum

b. midbrain
    i. mesencephalon – various coordination, inhibits signals to ganglia & thalamus
        1. degeneration leads to tremors & Parkinson disease
    ii. reticular activating system
        1. gray matter clusters in pons, midbrain, medulla
        2. balance & posture
        3. info relaying (sight, cardiac, hearing, etc)
        4. sleep regulator & conscious attention (coma)
c. diencephalons
    i. thalamus
        1. integrates & directs sensory info to appropriate area
        2. limbic system – emotional & memory functions
    ii. hypothalamus
        1. hormone secretion & pituitary
        2. autonomic control
        3. thermoregulation
        4. hunger & thirst satiety
        5. sleep & circadian rhythms
        6. memory – mammillary bodies
        7. emotional behavior
            a. fear, anger, pleasure, love, parental affection, etc
    iii. epithalamus
d. cerebrum
    i. cortex – 3 mm layer of gray matter divided into lobes
        1. frontal – voluntary motor fxns, planning, mood, smell, social judgment
        2. parietal – sensory reception, integration of senses
        3. occipital – visual center
        4. temporal – hearing, smell, learning, memory, emotional
        5. insula – little is known
    ii. white matter – majority of cerebrum
        1. exists in tracts
            a. projection – vertical connection to spinal cord

b. commissural – crosses hemispheres
    i. corpus collosum – major rt/lt connection
c. association – connect lobes & gyri to each other

iii. limbic system (types of gyrus)
1. loop of structures surrounding deep brain
    a. amygdala – emotions
    b. hippocampus – memory
    c. fornix & cingulated - ???? fxn

iv. brain waves – EEG
1. alpha – awake & resting w/ eyes closed
2. beta – eyes open, performing mental tasks
3. theta – sleep or emotional stress
4. delta – deep sleep

v. sleep stages
1. non REM - 4 stages, 1st 30-45 minutes of sleep
    a. 1 – drifting (sleep?)
    b. 2 – easily aroused
    c. 3 – vital signs change (w/i 20 minutes)
    d. 4 – deep, difficult to arouse
2. REM - ~ 5 times per night
    a. Vital signs increase
    b. EEG resembles awake person
    c. Dreams & penile erections occur
    d. May help sort & strengthen information from memory

vi. Awareness – cognition; effects of brain lesions
1. parietal lobe – contralateral neglect syndrome
2. temporal lobe – agnosia (can't recognize objects) or prosopagnosia (faces)
3. frontal lobe – personality (inability to plan & execute appropriate behavior)
    a. accidental lobotomy of Phineas Gage
        i. memory – amnesia
            1. anterograde – new data
            2. retrograde – old data
        ii. emotion – how emotions are expressed

vii. language centers – aphasia
    1. Broca's center damage (nonfluent aphasia)
        a. Slow speech, difficulty in word choice
        b. Entire vocabulary ~ 2-3 words
    2. Wernicke's (fluent aphasia)
        a. Speech normal & excessive, little sense
    3. anomic – speech/understanding normal, text & pictures make no sense
    4. others – understanding only 1st ½ of words, writing only consonants

viii. Cerebral lateralization – develops w/ age; trauma worse in males since females have more communication between hemispheres
    1. left brain – categorical hemisphere
        a. specialized for spoken & written language
        b. sequential & analytical reasoning (math/science)
        c. analyze data in a linear way
    2. right brain – representational hemisphere
        a. perceives info more holistically
        b. perception of spatial relationships, pattern
        c. comparison of special senses
        d. imagination & insight
        e. music & artistic skill

Autonomic Nervous System – Chapter 12

I. General properties
    a. Controls glands, cardiac & smooth muscle (visceral motor system)
    b. Regulates unconscious processes of homeostasis – bp, temp, resp
    c. Run by biofeedback – stretching, blood chemicals, temp, etc
    d. Usually 2 sets leading to organ
        i. Afferent – connects to CNS
        ii. Efferent – connects to effectors (glands, muscles)
        iii. May be sympathetic (prepares body for activity) or parasympathetic (calming effect on many body fxns)