Ch 13: Central Nervous System
Part 1: The Brain  p 378

- Discuss the organization of the brain, including the major structures and how they relate to one another.
- Review the meninges of the spinal cord and brain, and integrate the formation and flow of CSF with this information.

If people only knew how hard I work to gain my mastery, it wouldn’t seem so wonderful at all.

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Ventricles of the Brain p 381

CSF filled chambers
Communicating with central canal of spinal cord
Lined by ependymal cells
Central Canal of Spinal Cord

Fig 13.9
Four Major Brain Subdivisions

1. **Brain Stem**
   - a. Medulla oblongata
   - b. Pons
   - c. Midbrain
2. **Cerebellum**
3. **Diencephalon**
   - a. Hypothalamus
   - b. Thalamus
   - c. Epithalamus
4. **Cerebral Hemispheres**
   AKA Cerebrum

Fig 13.11
1) **Brain stem**

   a. Medulla oblongata  
   b. Pons  
   c. Midbrain

- Location of autonomic nuclei involved in respiratory and cardiovascular control
- Relay stations for sensory and motor neurons
- **Decussation**
1a) Medulla oblongata

- Pyramids
  - Motor output to spinal cord
  - Decussation
- Reticular formation
  - Lower functions
  - Respiration, sleep, etc.
- Cranial nerves
  - VIII, IX, X, XI, XII
1b) Pons

- Pons = bridge
- Connects to cerebellum
  - Via cerebellar peduncles
- Cranial Nerves
  - V, VI, VII
1c) Midbrain

- Cerebral aqueduct
  - Old term: Aqueduct of Sylvius
- Several nuclei (ganglia)
  - Substantia nigra
- Sensory reflexes
  - Aural, visual
2) Cerebellum

- Dorsal to the Pons
- Two hemispheres
  - Connected by the vermis
- Maintains posture and equilibrium
  - Smooths motor activities
  - Some cognitive function
- **Cortex - gray surface**
  - Purkinje cells (p 354), axons of which become arbor vitae (white matter) in center
    - Large cell bodies visible in gray matter of cerebellum
    - Use GABA as NT
    - Motor output from cerebellum
- **White matter: Arbor Vitae**
3) Diencephalon p 390

3a. Hypothalamus

3b. Thalamus

3c. Epithalamus
3a. Hypothalamus

- Just superior to optic chiasma
- Infundibulum - connects to pituitary gland
- **Some functions:**
  - Control of autonomic nervous system
  - Coordination of nervous and endocrine systems
  - Manufacture of hormones - ADH and oxytocin (Ch 17)
3b. Thalamus

- (80% of diencephalon)
- Next to 3rd ventricle
- Communication with hemispheres
3c. Epithalamus

- Pineal gland - produces melatonin,
- sets diurnal cycles
- Choroid Plexus – produces CSF
4) Cerebrum (Telencephalon)

- 83% of total brain mass
- The right and left halves (cerebral hemispheres)
  - are separated by the Longitudinal Fissure
  - and connected by the Corpus Callosum and Anterior Commissure
  - are separated from the cerebellum by the transverse fissure
- Sulcus and Gyrus
  - Central Sulcus
- Gray Matter vs. White Matter
- The cortex (gray matter) of the cerebrum is the site of conscious thought
4) Cerebral Hemispheres, cont’d

- **have functional regions**
  - Sensory and motor areas
    » e.g. Broca’s area (speech)
    » Prefrontal Cortex (Cognitive functions)

- **have some functional differences** (in spite of anatomical resemblance) → Lateralization of cortical functioning
  - Right brain: artistic skill
  - Left Brain: math, logic

- **receive sensory information and generate commands for opposite side of body**
  - Decussation of sensory input is in the spinal cord
  - Decussation of motor output is in the pyramids
An fMRI of the brain. Green areas were active while subjects remembered information presented visually. Red areas were active while they remembered information presented aurally. Yellow areas were active for both types.
4) Cerebrum, cont’d
Regions of the Cortex

- Lobes named after the bones of the calvarium
- Sensory vs. Motor Areas
  - Homunculus
- Gyrus and Sulcus
  - Central Sulcus
4) Cerebral Cortex and Central White Matter

Gray surface (cortex), 2-4 mm thick, is mostly neuron cell bodies with white tracts internally.

**Projection tracts (fibers)** – connect more or less vertically.

**Association tracts (fibers)** – connect one gyrus to another in the same hemisphere.
Basal Ganglia p 402

More proper term: basal nuclei

A collection of several nuclei

Gray matter deep to the cerebral cortex, below floor of lateral ventricles.

Function: modulate motor output from cerebral cortex. Subconscious control of skeletal muscle tone and coordination of learned movement patterns.

Parkinson’s disease is caused by the loss of at least 80% of the dopaminergic neurons in basal nuclei and substantia nigra of the midbrain (resting tremor)
Gray & White Matter Organization

In **brain stem** similar to spinal cord (nuclei around ventricles, tracts on outside)

In **cerebrum and cerebellum**: white matter covered with layer of neural cortex (grey)
sagittal image showing brain and normal pituitary with bright spot in posterior, neurohypophysis, which is secretory granules which are made in base of brain and transported down infundibulum or pituitary stalk.
Contrast enhanced MRI

Contrast enhances pituitary because of no blood brain barrier, the adenoma has less blood supply and is therefore less enhanced.

The Pit. is an endocrine organ so it is highly vascular to release various endocrine hormones into the circulation quickly.