Chapter 14: The Brain and Cranial Nerves
Videos

- ASAP “7 myths”: http://youtu.be/DfgkAJmp9-A
- Crash course the brain - https://youtu.be/q8NtmDrb_qo
- Bozeman: http://youtu.be/kMKc8nfPATI
- Cranial Nerves: http://youtu.be/-J9QEddbJAU
- One more reason to get a good nights sleep: http://youtu.be/MJK-dMIATmM
- Scishow: how the teenage brain works: https://youtu.be/hiduiTq1ei8
- Scishow Addiction: https://youtu.be/ukFjH9odsXw
- Scishow How dreaming works: https://youtu.be/XB7HqZc2p2Y
- Scishow why we need sleep: https://youtu.be/pwNMvUXTgDY
- Vsauce, Déjà vu: https://youtu.be/CSf8i8bHIns
- Tumor 1: https://youtu.be/s5RM81_6vC8
- Tumor 2: https://youtu.be/yhORvX-4Bx4
- Tumor 3: https://youtu.be/bymg_2GQQb0
Videos 2

- The divided brain: [https://www.ted.com/talks/iain_mcgilchrist_the_divided_brain](https://www.ted.com/talks/iain_mcgilchrist_the_divided_brain)
1. Brainstem
2. Medulla oblongata
3. Pons
4. Midbrain
5. Reticular formation
6. Thalamus
7. Cerebrum
8. Basal ganglia
9. Limbic system
10. Cerebellum
Major Parts of the Brain

- Brain stem - continuation of the spinal cord; consists of the medulla oblongata, pons and midbrain.
- Cerebellum - second largest part of the brain.
- Cerebrum - largest part of the brain.
- Diencephalon - gives rise to thalamus, hypothalamus and epithalamus.
Major Parts of the Brain

The notable structures of the brain include:

- The lobes of the brain are as follows:
  - frontal lobe: information processing relating to organization of thought
  - temporal lobe: memories of sounds and vision
  - occipital lobe: vision
  - parietal lobe: emotions and sensory interpretation

- Major landmarks include: central sulcus, lateral fissure, cerebrum, and spinal cord
Protective Coverings of the Brain

The cranial meninges:
- **dura mater**
- **arachnoid mater**
- **pia mater.**
Blood-Brain Barrier

- Brain receives approximately 20% of the total blood supply.
- **Blood-brain barrier (BBB)** protects brain from harmful substances.
Cerebrospinal Fluid (CSF)

- Circulates through cavities in the brain (ventricles) and the spinal cord (central canal).
- Absorbs shock and protects the brain and the spinal cord.
- Helps transport nutrients and wastes from the blood and the nervous tissue.
Brain Stem
Midbrain or Mesencephalon
Midbrain

- **Substantia nigra**: large area with dark pigments.
- Helps control subconscious muscle activities.
Midbrain

Red nucleus: Help control voluntary movements of the limbs.
**Midbrain**

- **Reticular activating system (RAS)** consists of sensory axons that project to the cerebral cortex.
- Helps maintain consciousness.

![Diagram of midbrain](image)
The Cerebellum

- Second largest part of the brain.
- Controls equilibrium and balance.
- Coordinate movements, regulate posture and balance.
Thalamus

- Major relay station for most sensory impulses.
- Moderates sleep and alertness.
Thalamus

(a) Lateral view of right cerebral hemisphere
(b) Medial view of left cerebral hemisphere

(c) Superlateral view of thalamus showing locations of thalamic nuclei (reticular nucleus is shown on the left side only; all other nuclei are shown on the right side)
(d) Transverse section of right side of thalamus showing locations of thalamic nuclei

Figure 14.03 Tortsx • PAI 13x
Copyright © John Wiley and Sons, Inc. All rights reserved.
Hypothalamus

- Control of the ANS.
- Production of hormones
- Regulation of emotional and behavioral patterns, eating and drinking, body temperature, and circadian rhythms.
Epithalamus

- Consists of pineal gland which secretes a hormone called melatonin.
- Melatonin induces sleep.
The Cerebrum

- White Matter
  - Axons of neurons

Cerebral Cortex

- Gray matter
  - Cluster of neurons

Figure 14.11ab: Tortora - PAP 12/e
Copyright © John Wiley and Sons, Inc. All rights reserved.
The Cerebrum

- **Cerebral cortex** - gray matter.
- **Gyri** - ridges
- **Sulci** – grooves or depressions
The Cerebrum

- Cerebral hemispheres - right and left sections.
- Longitudinal fissure – sulci that splits the two spheres.
The Cerebrum

(c) Right lateral view with temporal lobe cut away
Lobes of the Cerebrum

- **Four lobes:** frontal lobe, parietal lobe, temporal lobe and occipital lobe.
- **Central sulcus** separates the frontal and parietal lobes.
Lobes of the Cerebrum

- **Precentral gyrus** - primary motor area.
- **Postcentral gyrus** - primary somatosensory area.
Cerebral white matter

- **Corpus callosum:** Connects the two hemispheres of the brain.
Basal Ganglia

- Three nuclei deep within each cerebral hemisphere make up basal ganglia: globus pallidus, putamen, and caudate nucleus.
Help initiate and terminate movements, suppress unwanted movements and regulate muscle tone.
Basal Ganglia
The Limbic System

- Includes cingulate gyrus, hippocampus, dentate gyrus, amygdala, mammillary bodies, thalamus, and the olfactory bulb.
The Limbic System

- **Emotional brain** - it governs emotional aspects of behavior.
- Also involved in olfaction and memory.
Functional Organization of the Cerebral Cortex: Motor Areas

Figure 14.15: Functional Organization of the Cerebral Cortex: Motor Areas

Copyright 2009, John Wiley & Sons, Inc.
Cerebral Cortex: Sensory Areas

- Primary somatosensory area - postcentral gyrus.
- Primary visual area - occipital lobe.
- Primary auditory area - temporal lobe.
- Primary gustatory area - base of the postcentral gyrus.
- Primary olfactory area - temporal lobe.
Cerebral Cortex: Motor Areas

- Primary motor area- precentral gyrus.
- Broca’s speech area- left cerebral hemisphere.
Cerebral Cortex: Association Areas

- Somatosensory association area - posterior to primary somatosensory area.
- Visual association area - occipital lobe.
- Auditory association area - temporal lobe.
- Wernicke’s area - left temporal and parietal lobes.
- Prefrontal cortex - anterior portion of the frontal lobe.
Olfactory (I) Nerve

- **Sensory nerve.**
- **Sense of smell.**
- Olfactory cells converge to become olfactory nerve.
Optic (II) Nerve

- **Sensory nerve.**
- **Nerve of vision.**
- Ganglion cells in the retina of each eye join to form an optic nerve.
Oculomotor (III) Nerve

- **Motor cranial nerve.**
- Originates in the midbrain.
- Supply extrinsic eye muscles to control movements of the eyeball and upper eyelid.
Trochlear (IV) Nerve

- **Motor cranial nerve.**
- Smallest of the 12 cranial nerves.
- Origin: midbrain.
- **Controls movement of the eyeball.**
Trigeminal (V) nerve

- Largest cranial nerve.
- **Mixed nerve.**
- Three branches: ophthalmic, maxillary and mandibular.
- **Deal with sensation of touch, pain and temperature.**
- Motor axons supply muscles of mastication.
Abducens (VI) Nerve

- **Motor cranial nerve.**
- **Originates from the pons.**
- **Cause abduction of the eyeball (lateral rotation).**
Facial (VII) Nerve

- **Mixed cranial nerve.**
- Sensory portion extends from the **taste buds of the anterior two-thirds of the tongue.**
- Motor portion arises from the pons and deal with facial expression.
Vestibulocochlear (VIII) Nerve

- **Sensory cranial nerve.**
- Originates in the inner ear.
- Vestibular branch carries impulses for **equilibrium.**
- Cochlear branch carries impulses for **hearing.**
Glossopharyngeal (IX) Nerve

- **Mixed cranial nerve.**
- Sensory axons carry signals from the taste buds of the posterior one-third of the tongue.
- Motor neurons arise from the medulla and deal with the release of saliva.
Vagus (X) Nerve

- **Mixed cranial nerve.**
  - Sensory neurons deal with a variety of sensations such as proprioception, and stretching.

- Motor neurons arise from the medulla and supply muscles of the pharynx, larynx, and soft palate that are involved in swallowing and vocalization.
Accessory (XI) Nerve

- **Motor cranial nerve.**
- Divided into cranial accessory and spinal accessory nerves.
- Supplies sternocleidomastoid and trapezius muscles to coordinate head movements.
Hypoglossal (XII) Nerve

- Motor cranial nerve.
- Conduct nerve impulses for speech and swallowing.
Mnemonics for the nerves

- On old Olympus' towering top a Fin and German viewed some hops
- Ooh, Ooh, Ooh, to touch and feel very good velvet. Such heaven!
- O: olfactory nerve (CN I)
- O: optic nerve (CN II)
- O: oculomotor nerve (CN III)
- T: trochlear nerve (CN IV)
- T: trigeminal nerve (CN V)
- A: abducens nerve (CN VI)
- F: facial nerve (CN VII)
- A: auditory (or vestibulocochlear) nerve (CN VIII)
- G: glossopharyngeal nerve (CN IX)
- V: vagus nerve (CN X)
- S: spinal accessory nerve (CN XI)
- H: hypoglossal (CN XII)
Mnemonics for the types

- **Some say marry money but my brother says big brains matter more**
- **S**: sensory (olfactory nerve - CN I)
- **S**: sensory (optic nerve - CN II)
- **M**: motor (oculomotor nerve - CN III)
- **M**: motor (trochlear nerve - CN IV)
- **B**: both (trigeminal nerve - CN V)
- **M**: motor (abducens nerve - CN VI)
- **B**: both (facial nerve - CN VII)
- **S**: sensory (vestibulocochlear nerve - CN VIII)
- **B**: both (glossopharyngeal nerve CN IX)
- **B**: both (vagus nerve - CN X)
- **M**: motor (spinal accessory nerve - CN XI)
- **M**: motor (hypoglossal nerve - CN XII)