CNS

Anatomy of the Brain
Support and Protection

- Meninges encase brain & SC
- Three layers:
  - Dura mater
  - Arachnoid
  - Pia mater
- Between layers:
  - Cerebrospinal fluid (CSF; airbag for brain)
• CSF produced in choroid plexus
• Secreted and circulated by ependymal cells
Ventricles

Lateral ventricle (anterior horn)

Third ventricle

Lateral ventricle (inferior horn)

Lateral ventricle (posterior horn)

Cerebral aqueduct

Fourth ventricle

Central canal of spinal cord

Lateral view
Major Regions

CEREBRUM
- Conscious thought processes, intellectual functions
- Memory storage and processing
- Conscious and subconscious regulation of skeletal muscle contractions

DIENCEPHALON
THALAMUS
- Relay and processing centers for sensory and motor information

HYPOTHALAMUS
- Centers controlling emotions, autonomic functions, and hormone production

MESENCEPHALON
- Processing of visual and auditory data
- Generation of reflexive somatic motor responses
- Maintenance of consciousness

PONS
- Relays sensory information to cerebellum and thalamus
- Subconsciously somatic and visceral motor centers

MEDULLA OBLONGATA
- Relays sensory information to thalamus and to other portions of the brain stem
- Autonomic centers for regulation of visceral function (cardiovascular, respiratory, and digestive system activities)

CEREBELLUM
- Coordinates complex somatic motor patterns
- Adjusts output of other somatic motor centers in brain and spinal cord

Brain stem
Spinal cord
Gyri
Sulci
Fissures
Left cerebral hemisphere
Brainstem

- Cranial nerves 3-12
- Medulla oblongata
- Pons
- Mesencephalon
  - Thalamus
  - Hypothalamus
Brainstem

- **Diencephalon**: Thalamus (sensory info. filter) & hypothalamus (eating & drinking reflexes)
- **Mesencephalon**: Visual and Auditory reflex centers (head-turning)
- **Pons**: Relay station for sensory info.
- **Medulla oblongata**: Regulate cardio, respiratory, digestive activities
Medulla Oblongata

- **Regulatory Nuclei:**
  - heart & respiratory rate, blood pressure, coughing, sneezing, vomiting, swallowing, balance, coordination, digestion

- **Pyramids:**
  - Descending motor nerves; conscious control of skeletal muscle
Pons

- **Ascending & descending tracts**
- **Relay nuclei:**
  - Share info between cerebrum & cerebellum
- **Regulatory nuclei:**
  - Chewing & salivation; respiration
Midbrain

- Superior colliculi
  - Visual reflex
- Inferior colliculi
  - Auditory reflex & nerve tracts
- Regulatory nuclei
  - Lens shape, pupil diameter
- Substantia nigra
  - Regulates body movements
Diencephalon

- **Thalamus**
  - Ascending sensory neurons synapse here; project to cerebrum

- **Epithalamus**
  - Emotional & visceral response to odors; *pineal body* regulates long-term cycles

- **Hypothalamus**
  - Maintaining homeostasis via hormone release
Diencephalon

Thalamus
Interthalamic adhesion
Hypothalamus
  Mammillary body
  Optic chiasm
  Infundibulum
  Pituitary gland

Diencephalon
  Pons

Corpus callosum
Epithalamus
  Pineal body
Cerebellum

Thalamic nuclei
Cerebellum

• Gray and white matter
• Balance; maintains muscle tone; coordinates fine muscle movement
• Comparator: integrates proposed movements with current body position to produce smooth, exact movement
• Involved in learning new balance-intensive activities
  - Riding a bike, yoga, climbing
1. The motor area of the cerebral cortex sends action potentials to lower motor neurons in the spinal cord.

2. Action potentials from the motor cortex inform the cerebellum of the intended movement.

3. Lower motor neurons in the spinal cord send action potentials to skeletal muscles, causing them to contract.

4. Proprioceptive signals from the skeletal muscles and joints to the cerebellum convey information concerning the status of the muscles and the structure being moved during contraction.

5. The cerebellum compares the information from the motor cortex to the proprioceptive information from the skeletal muscles and joints.

6. Action potentials from the cerebellum to the spinal cord modify the stimulation from the motor cortex to the lower motor neurons.

7. Action potentials from the cerebellum are sent to the motor cortex, which modify its motor activity.
Limbic System

• Facilitates memory storage & retrieval
• Establishes & drives emotional states
• Links conscious with unconscious and autonomic functions of the brain stem
Cerebral Space

Motor cortex (precentral gyrus)

Somatic sensory cortex (postcentral gyrus)

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Ascending somatosensory pathway

- Crossover in MO, to opposite side of body
- Synapse in thalamus
- Projection to cerebral cortex
Descending Motor pathway

- Project from motor cortex
- Crossover @ lower MO
- Synapse in spinal cord
- Project to effector
Axons connect CNS - CNS and CNS - PNS

Association, commissural, projection
Axons connect CNS - CNS and CNS - PNS
Cerebellum

Controls skeletal muscle contractions
Cerebrum & its Regions

Complex info. Processing
• Conscious thought
• Reasoning
• Memory creation & storage