Objectives

To orient the student to the major regions of the brain.
To briefly identify the functional roles of each lobe of the cerebrum.
To outline the regions of cerebral motor activity & sensory activity.
To define the association areas of the brain and provide an example.
To address the phenomena of lateralization.
To explain the association between white matter and basal nuclei.

Regions and Organization of the CNS

I. Adult brain regions
1. Cerebral hemispheres
2. Diencephalon
3. Brain stem (midbrain, pons, and medulla)
4. Cerebellum

II. Spinal Cord
1. Central cavity surrounded by a gray matter core.
2. Fiber tracts - external white matter/myelin.

Ventricles

A lumen/space- derived from the neural tube
Filled with spinal fluids.

> Lateral
> Third ventricle
> Fourth ventricle.

Cerebrum

Most superior part of the brain.
83% of the brain mass
Divided into two hemispheres.
....connected by the longitudinal fissure.
Cerebral cortex – gray matter
Contra lateral control - opposite side of the body
Tour of the Brain - CNS

Cerebrum - Responsible for consciousness. Divided into hemispheres & association areas.

Controls: conscious mind, communication, memory and understanding, voluntary movements, creativity.

Composed of primarily gray matter i.e. numerous cell bodies of neurons.
- Convolutions called gyri
- Grooves are called sulci
- Deep grooves are called fissures.

Lobes of the Brain

> Frontal
> Parietal
> Temporal Lobe
> Occipital

Cerebral Motor Activity

I. Primary (somatic) motor cortex – conscious motor control. Stroke paralyzes the body muscles controlled by those areas.

II. Premotor cortex - Learned motor skills of a repetitious or patterned nature e.g. typing

III. Broca’s area – associated with language and sound

IV. Frontal eye field – voluntary eye movement
Figure 12.9  Body maps in the primary motor cortex and somatosensory cortex of the cerebrum.

Genitals

Toes

Intra-abdominal

Swallowing

Tongue

Jaw

Primary motor cortex (precentral gyrus)

Primary somatosensory cortex (postcentral gyrus)

Motor map in precentral gyrus

Sensory map in postcentral gyrus

Posterior

Anterior

The motor homunculus

The sensory homunculus

Sensory Activity of the Cerebrum

- Primary somatosensory cortex
  - Receives sensory information from the skin, skeletal muscles, and joints
  - Spatial discrimination
- Primary visual cortex
- Primary auditory cortex

Association Areas

Regions of the brain that communicate i.e. “associate” with primary regions of the brain.

Act with other sensory association areas to analyze/interpret and act on sensory inputs based on past experiences.

Multiple inputs & multiple outputs i.e. complex

Cerebral Lateralization

Left – controls:
  - Speech, writing, reading and math
  - “Analytical and sequential”

Right – controls:
  - Recognition of space, patterns, music and emotion, non-verbal language, “tone.”
  - “Holistic and recognition”

End

White matter

Material responsible for communication between cerebral cortex and lower CNS centers.

Composed of myelinated fibers bundled into large tracts.

Commissures: fibers connecting gray areas of the 2 hemisphere.
  - Corpus callosum (largest)
Basal nuclei

Associated with subthalamic nuclei (the floor of the diencephalon).

Composed of distinctive cell groups: e.g. Caudate & lentiform

Play a role in motor control, may be involved with attention and cognition.

Disorders of the basal nuclei show up as too much or too little movement such as Huntington’s or Parkinson’s diseases.

Dienchephalon

Gray matter of the third ventricle (located at the core of the forebrain)

I. Thalamus – relay station
II. Hypothalamus – homeostasis regulator
III. Epithalamus – pineal gland & choroid plexus.

Brain Stem (intro)

Superior to Inferior –

> Midbrain – visual & auditory reflex centers & fear
> Pons – regulation of respiration
> Medulla Oblongata – respiratory rhythm & heart rate

Histology: similar to the spinal cord i.e. gray matter is deep and white matter surrounds it.

Controls –
Automatic behaviors for survival
Heavily involved with the innervation of the head