Class 4: The Brain Part (II)

4 Lobes of the cerebral cortex:

- Frontal
- Parietal
- Temporal
- Occipital

- Longitudinal Fissure
- Central Sulcus
- Lateral Fissure
- Superior temporal gyrus
Sensory-Motor Division:

Central Fissure:
- Doing vs. Perceiving
- Motor vs. Sensory

Sensory Processing:
Lateralization - Right vs. Left
Convergence - From simple features to more complex ones

- Primary Auditory Cortex (Basic features of hearing)
- Primary Somatosensory Cortex (Basic features of touch/feelings)
- Primary Motor Cortex (Basic features of movement)
- Primary Visual Cortex (Basic features of vision)

◆ (Olfactory System) Smell is the only sense that does not cross the hemisphere.

Primary Sensory Map:
- “Sensory Homunculus”:
  - Different parts of the brain are represented by different groups of neurons. The number of neurons are ‘in charge’ of a body part is not proportional to the size of that part.
  - In regards to neighboring ‘body parts’, neurons tend to interact with each other.

(“Phantom Limb Ramachandran” → ”Grow axons to find sensory inputs”)
Limbic System:

- A group of brain regions including the anterior thalamic nuclei, amygdala, hippocampus, limbic cortex, and parts of the hypothalamus, as well as their interconnecting fiber bundles.
- Primary function: Motivation and Emotion

Fornix:

- A fiber bundle that connects the hippocampus with other parts of the brain, including the mammillary bodies of the hypothalamus.

Mammillary body:

- Protrusions on the base of the brain that contain parts of the hypothalamus.

Amygdala:

- (Emotions) located next to the lateral ventricle in the temporal lobe

Hippocampus

- (Learning and Memory) A forebrain structure of the medial temporal lobe.

Basal Ganglia:

- (important part of the motor system) A group of subcortical nuclei in the telencephalon, the caudate nucleus, the globus pallidus, and the putamen.
- Control basic movements
- Responsible for “Parkinson’s Disease” which is caused by degeneration of certain neurons located in the midbrain that sends axons to the caudate nucleus
and the **putamen**. Symptoms include: weakness, tremors, rigidity of limbs, poor balance, and difficulty in initiating movements.

**The 6 Divisions:**

**Neuroanatomy:**
- The anatomy of the nervous system

**Diencephalon:**
- (Thalamus + Hypothalamus)

**Thalamus:**
- 2 lobes linked by the massa intermedia major sensory structure made of specialized nuclei (L.G.N-M.G.N)
- Ears: Medial Geniculate Nucleus
- Eyes (Retina): Lateral Geniculate Nucleus

**Cerebellum:**
- (Important to motor system) Located dorsal to the pons
- Contain two major cerebellar hemispheres
- Covered with the cerebellar cortex

**Hypothalamus:**
- Controls the autonomic (heart, lungs) and endocrine (hormones) systems
- Specific behaviors (four F’s)
- (Pituitary Gland): Under hypothalamus

**Posterior Pituitary Gland:**
- Oxytocin (childbirth), vasopressin (anti-diuretic hormonal urinal output) Both involved in attachment behaviors
- Hypothalamus→Posterior Pituitary→Hormones in Blood
- Anterior Pituitary Gland (Prolactin, production of milk)

**Brain Stem= Diencephalon, Midbrain, Hindbrain**

**The Hypothalamus:**
- Psychosocial Dwarfism: Failure of the hypothalamus

**Midbrain=Mesencephalon**

**Tectum:**
- Sensory reflexes (eye movements)
• Pineal Gland (sleep cycle)
• Colliculi:
  ▪ Superior-colliculus (vision)
  ▪ Inferior-colliculus (Audition)

Tegmentum:
• Reticular Formation
  ▪ Sleep, attention, movement, reflexes
  ▪ Many nuclei

Hindbrain:
• Metencephalon=Cerebellum + Pons
• Myelencephalon= Medulla (Oblongata)

Cerebellum:
• Dense and specialized structure (little brain)
• Made of cerebellar cortex, deep nuclei and peduncles
• Coordination of complex movements (walking/jumping)
• Smooth precise movements

Pons:
• Relay between the cortex and the cerebellum (through the peduncles)
• Many nuclei

Medulla:
• Functions: heart and lungs
• Many nuclei

Spinal Cord:
• Sensory-motor flow
• Sensory information enters dorsally (back) and motor information exits

Flow of Information:
• Ascending fiber to brain
• Afferent Axon→Enter Ganglion
• Efferent Axon→Exit Ganglion
• Ventral root (spinal nerve)

Spinal Cord Functions:
• Control glands and muscles (low-level reflexes)
• Collect somatosensory information
- Ventral vs. Dorsal roots
- Afferent vs. Efferent
- Gray matter (inside); white matter (outside)

**Brain Interactions:**
- Brain and spinal cord are in constant 2-way interactions through specialized groups of neurons

**Peripheral Nervous System:**
- 12 cranial nerves
- Olfactory nerve → Smell
- Optic nerve → Vision
- (3 nerves) Oculomotor, trochlear, abducens → Eye movement
- Trigeminal nerve → Jaw muscles
- Facial → Face muscles
- Auditory → Hearing balance
- Glossopharyngeal → Taste/muscle of the throat and larynx
- Vagus → Internal organs
- (11 & 12) Spinal Accessory → Tongue movements
- Hypoglossal → neck muscles-under the tongue

- Somatic nervous system
  - Sensory communication and local control of body skeletal muscles
  - Spinal nerves
  - Cranial nerve (12)

- Autonomic nervous system
  - Sympathetic: Thoracic + Lumbar
  - Parasympathetic: Cranial + Sacral

- Sympathetic Ganglion Chain:
  - Coordinate energy expenditure
  - Across spinal levels
  - Preganglionic vs. Postganglionic