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Today's topics

- Neuroanatomy
  - Forebrain
  - Spinal cord
  - Cranial nerves
  - Autonomic nervous system (ANS)

Organization of the brain

Major division	Ventricular Landmark	Embryonic Division	Structure
Forebrain	Lateral	Telencephalon	Cerebral cortex
			Basal ganglia
			Hippocampus, amygdala
	Third	Diencephalon	Thalamus
			Hypothalamus
Midbrain	Cerebral Aqueduct	Mesencephalon	Tectum, tegmentum

Organization of the brain

Major division	Ventricular Landmark	Embryonic Division	Structure
Hindbrain	4th	Metencephalon	Cerebellum, pons
	–	Mylencephalon	Medulla oblongata

Basal ganglia

- Skill and habit learning
- Sequencing of movement
- Example: Parkinson's Disease

Basal ganglia

Basal ganglia

- Striatum
  - Dorsal
    - Caudate nucleus
    - Putamen
  - Ventral
    - Nucleus accumbens (NAcc)

Basal ganglia

- Globus pallidus
- Subthalamic nucleus
- Substantia nigra (in tegmentum)

Hippocampus

- From Greek for "sea horse"
- Immediately lateral to lateral ventricles
- Memories of specific facts or events, spatial locations
- Implicated in Alzheimer's Disease
- Fornix projects to hypothalamus
- Mammillary bodies

Hippocampus

Amygdala

- "almond"
- Physiological state, behavioral readiness, affect
- NOT the fear center! (LeDoux 2015).

Cerebral Cortex

- Cerebral hemispheres
- Groove (sulcus or sulci)
- Bumps (gyrus or gyri)
- Grey vs. white matter
- Lobes

Cortical Gyri – Lateral

Cortical Gyri – Medial

Grey vs. White Matter

- Grey matter
  - Cell bodies, dendrites, axons, glia, vessels
- White matter
  - Mostly axons (covered in myelin)

Lobes of the cerebral cortex

- Frontal
- Temporal
- Parietal
- Occipital
- Related to cranial bones of the skull

Rotating image of cranial bones.

Landmarks of the cortex

Landmark	Identifies/separates
Medial longitudinal fissure (longitudinal fissure)	Divides hemispheres
Lateral sulcus/fissure	Divides temporal lobe from frontal & parietal
Central sulcus	Divides frontal from parietal lobe

Medial longitudinal fissure (longitudinal fissure)

Lateral sulcus/fissure

Central sulcus

Representative interhemispheric fiber tracts in the cortex

- Connect left and right hemispheres
- Corpus callosum
- Anterior, Posterior Commissures

Corpus callosum

Anterior, Posterior Commissures

Lobes of the Cerebral Cortex

Frontal lobe

- Where is it?
  - Anterior to central sulcus
  - Superior to lateral fissure
  - Dorsal to temporal lobe

Frontal lobe

- What does it do/contain?
  - Primary motor cortex (M1)
  - Pre-central gyrus (pre/anterior to central sulcus)

Image of pre and post-central gyri from Wikipedia.

Frontal lobe

- What does it do/contain?
  - Prefrontal cortex
    - Planning, problem solving, working memory…?
  - Anterior cingulate cortex (ACC)
  - Primary olfactory cortex
  - Gustatory cortex

Cingulate Gyrus

Temporal lobe

- Where is it?
  - Ventral to frontal, parietal lobes
  - Inferior to lateral fissure

Temporal lobe

- What does it do/contain?
  - Primary auditory cortex (A1)
  - Object, face recognition
  - Amygdala, hippocampus
  - Storage of memories about events, objects
  - Olfactory cortex

Parietal lobe

- Where is it?
  - Caudal to frontal lobe
  - Dorsal to temporal lobe
  - Posterior to central sulcus

Parietal lobe

- What does it do/contain?
  - Primary somatosensory cortex
  - Perception of spatial relations, action planning

Post-central gyrus

- Post-central -> “posterior to” central sulcus
- Primary somatosensory cortex (S1)

Image of pre and post-central gyri from Wikipedia.

Occipital lobe

- Where is it?
  - Caudal to parietal & temporal lobes
- What does it do/contain?
  - Primary visual cortex (V1)

Visual Cortex

Insular cortex (insula)

- Where is it?
  - medial to temporal lobe
  - deep inside lateral fissure

Insula

Insula

- What does it do/contain?
  - Primary gustatory cortex
  - self-awareness, interpersonal experiences, motor control

Lobes, landmarks, areas

Lobe	Sulci	Gyri	Areas
Frontal	Central sulcus Corpus callosum	Precentral gyrus Cingulate gyrus	motor cortex anterior cingulate cortex olfactory cortex gustatory cortex

Lobes, landmarks, areas

Lobe	Sulci	Gyri	Areas
Temporal	Lateral fissure		auditory cortex olfactory cortex hipppocampus amygdala

Lobes, landmarks, areas

Lobe	Sulci	Gyri	Areas
Parietal	Central sulcus	Postcentral gyrus	somatosensory ctx
Occipital			visual ctx
Insula	Lateral fissure		gustatory ctx

Brodmann Areas

- Korbinian Brodmann
- Cytoarchitectonic differences in cerebral cortex

Brodmann Areas

Brodmann Areas

Spinal cord

- Rostral/Caudal axis
  - Spinal column w/ vertebrae
  - Cervical (8), thoracic (12), lumbar (5), sacral (5), coccygeal (1)
  - Spinal segments & 31 nerve pairs
  - Cauda equina

Spinal cord

Spinal cord

- Organization of the spinal cord
  - Dorsal/Ventral
    - Dorsal root (sensory)
    - Ventral root (mostly motor)
  - Grey (interior) vs. white matter (exterior)

Organization of the PNS

- Somatic division
- Autonomic division
- Cranial nerves
- Spinal nerves

Cranial nerves

- Afferents (input), efferents (output), or mixed
- Innervate head and neck
- Olfactory (I), optic (II), (VIII) auditory, vagus (X), etc.
- Spinal nerves

Cranial nerves

Autonomic nervous system

- CNS & PNS components
- Controls "vegetative functions""
  - Limited voluntary control
- Two divisions

  - Sympathetic
  - Parasympathetic

ANS

Sympathetic division

- Prepares body for action
- "Fight or flight""
- Spinal cord
  - ganglion chain along spinal column to End organs
- NTs
  - Preganglionic: ACh
  - Post: NE

Parasympathetic division

- Para -> "around"
- Restorative function
- "Rest & digest"
- Spinal cord -> ganglia near end organs -> end organ
  - NT: ACh

References

LeDoux, Joseph. 2015. "The Amygdala Is NOT the Brain's Fear Center." *Psychology Today*. https://www.psychologytoday.com/blog/i-got-mind-tell-you/201508/the-amygdala-is-not-the-brains-fear-center.