



황 세 진

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Functional Neuroanatomy Brain

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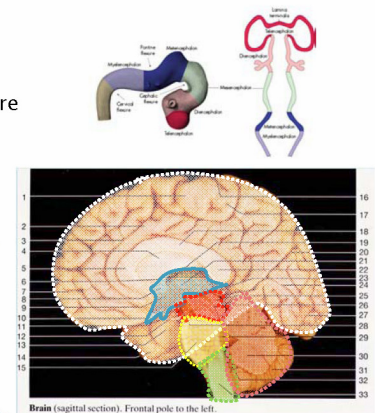
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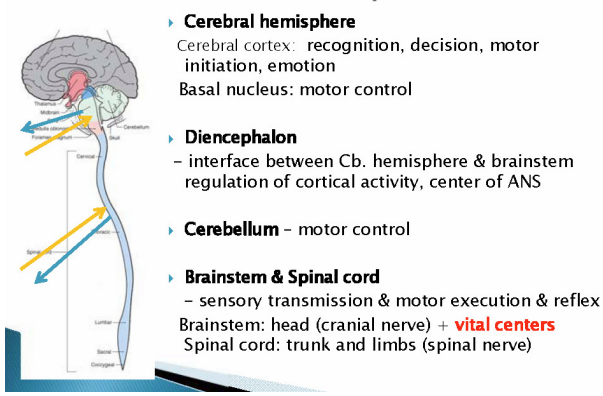
College of Medicine
Hanyang University

Brain

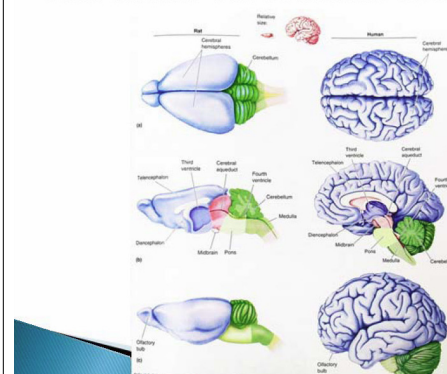
1. Cerebral hemisphere
– telencephalon
2. Diencephalon, >
3. Brainstem
mesencephalon, >
metencephalon, >
myelencephalon >
4. Cerebellum
– metencephalon



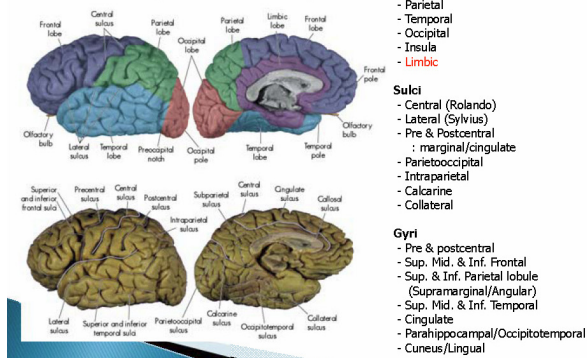
Functions of individual parts of CNS



Rat brain vs. Human brain



Anatomy of Cerebral hemisphere - Lobes, Sulci & Gyri

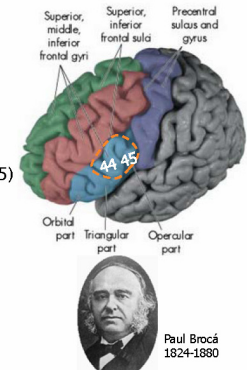


Inferior frontal gyrus

- composed of
- 1) pars orbitalis
- 2) pars triangularis
- 3) pars opercularis

* Broca's area (Brodmann area 44, 45)

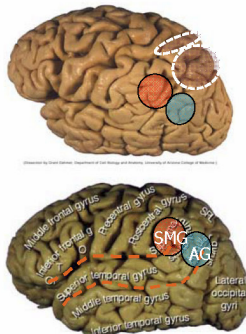
- pars triangularis and
- pars opercularis (of dominant hemisphere)



Superior and Inferior parietal lobule

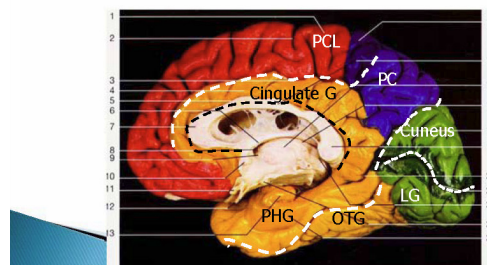
- ▶ Superior parietal lobule
 - area 5 and 7
 - sensory association area
- ▶ Inferior parietal lobule
 - Supramarginal gyrus (40) & Angular gyrus (39)

* Cortical association area



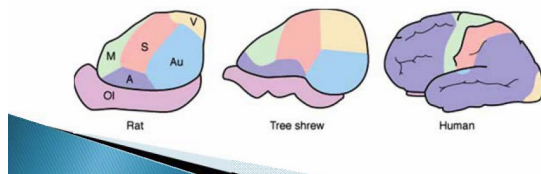
Medial surface of Hemisphere

- ▶ Sulci: callosal, cingulate, marginal (postcentral), parietooccipital, calcarine
- ▶ Gyri: cingulate, paracentral lobule, precuneus, cuneus, lingual, parahippocampal, occipitotemporal (fusiform)



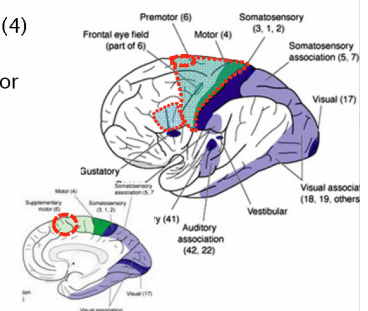
Functional area of Cerebral cortex - Motor, Sensory & Association areas

- ▶ **Motor cortex**
 - evoke somatic movement by electrical stimulus
- ▶ **Sensory cortex**
 - receive thalamocortical projection from ventral tier of thalamic nuclei
- ▶ **Association cortex**
 - receive inputs from various cortical and subcortical area



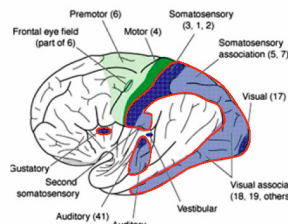
Primary Motor and Motor association areas

- ▶ Primary motor area (4)
- ▶ Premotor area (6)
- ▶ Supplementary motor area
- ▶ Frontal eye fields
- ▶ Broca's area

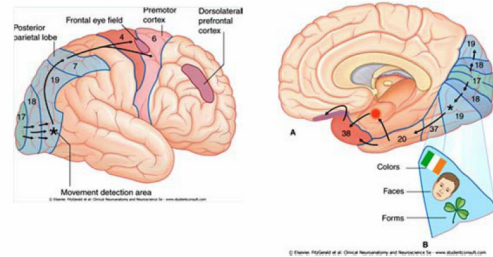


Sensory & Sensory association areas

- ▶ Primary somesthetic area & somatosensory association area
- ▶ Primary visual & visual association area
- ▶ Primary auditory & auditory association area (42, 22)



“Where?” and “What?” Visual Pathway



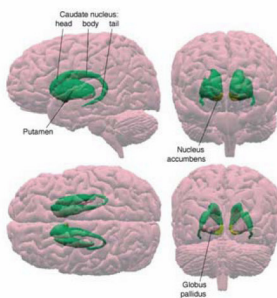
- Threatening sights or faces cause area 20 and 38 to activate right amygdala, then right orbitofrontal cortex

Basal Ganglia (Nucleus)

- ▶ Subcortical nuclear mass derived from **telencephalon**

1. Caudate nucleus
2. Putamen
3. Globus pallidus
4. Nucleus accumbens
5. Amygdala

* Functionally and clinically, subthalamus (diencephalon) & substantia nigra (midbrain) are included in basal ganglia



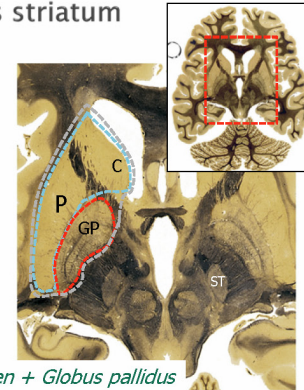
Basal ganglia/Corpus striatum

Corpus striatum

- Caudate nucleus
- Nucleus accumbens
- Putamen
- Globus pallidus (=pallidum)

Subthalamic nucleus (ST)

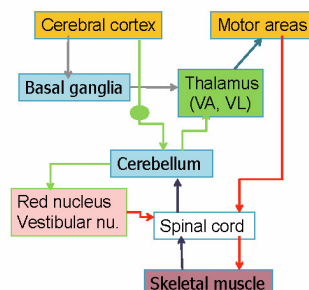
Substantia nigra



* **Lenticular nucleus = Putamen + Globus pallidus**

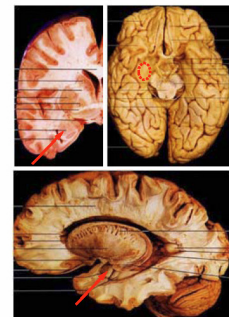
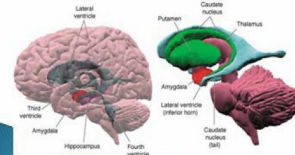
Basal ganglia and Cerebellum in Motor control

- ▶ Basal ganglia
 - storehouse of routine motor program
- ▶ Cerebellum
 - storehouse of motor adaptation to novel condition



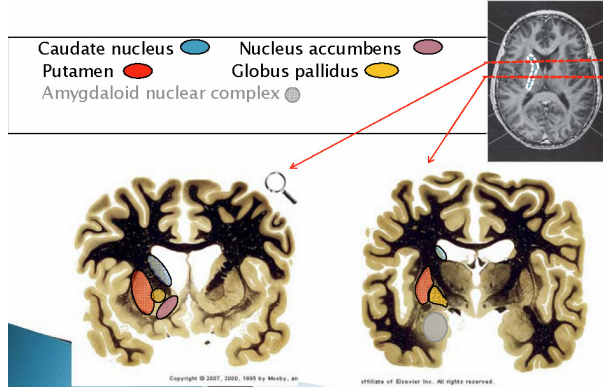
Amygdaloid Nuclear Complex

- ▶ Location
 - dorsomedial portion of the temporal lobe
 - anterior & superior to the tip of inferior horn of the lateral ventricle



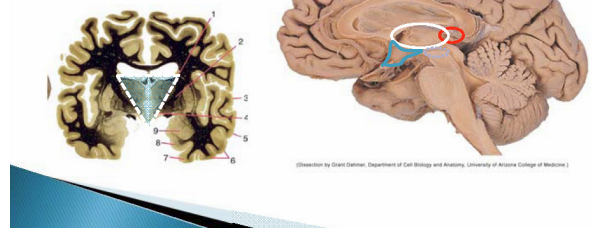
Basal Ganglia in coronal section

Caudate nucleus (blue circle) Nucleus accumbens (pink circle)
 Putamen (red circle) Globus pallidus (yellow circle)
 Amygdaloid nuclear complex (grey circle)



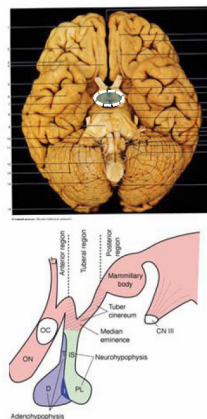
Diencephalon

- ▶ Thalamus
- ▶ Epithalamus
- ▶ Hypothalamus
- ▶ Subthalamus



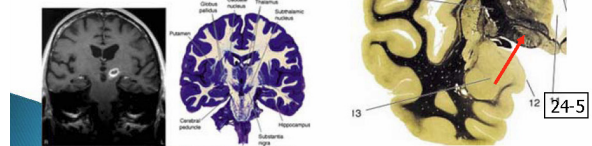
Hypothalamus

- ▶ ventral to hypothalamic sulcus
- ▶ Part of inferior & lateral wall of 3rd ventricle
- ▶ 3 regions
 - 1) Supraoptic (anterior)
 - 2) Tuberal
 - 3) Mammillary (posterior)
- * Preoptic area



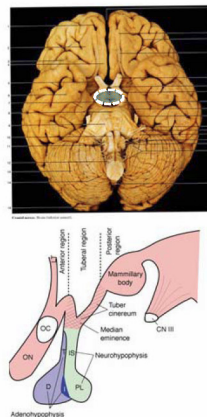
Subthalamic nucleus

- ▶ Ventral to thalamus
- ▶ Lateral and caudal to hypothalamus
- ▶ inner surface of peduncular portion of internal capsule
- ▶ Thick biconvex lens shape



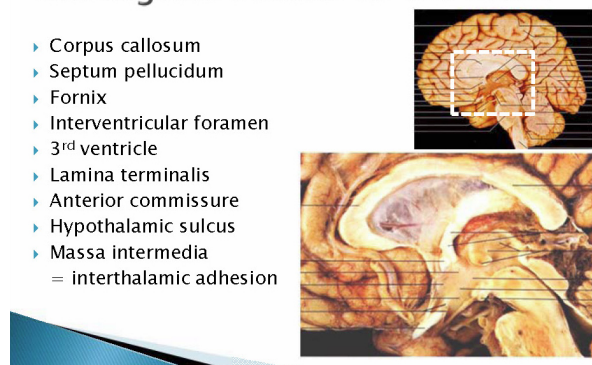
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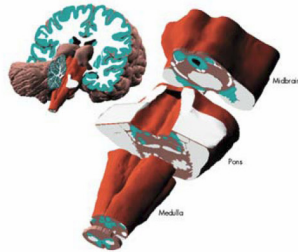
Midsagittal section of the Brain

- ▶ Corpus callosum
- ▶ Septum pellucidum
- ▶ Fornix
- ▶ Interventricular foramen
- ▶ 3rd ventricle
- ▶ Lamina terminalis
- ▶ Anterior commissure
- ▶ Hypothalamic sulcus
- ▶ Massa intermedia = interthalamic adhesion

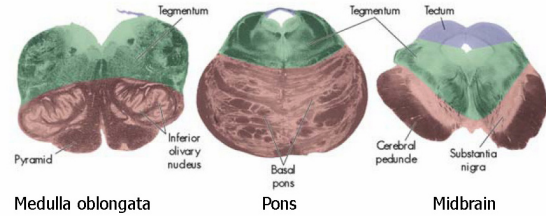


Brainstem –Midbrain, Pons & Medulla oblongata

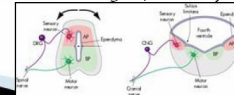
- ▶ Tectum – dorsal to ventricular system
- ▶ Tegmentum – ventral to ventricular system
- ▶ Basal part – descending fiber and pontine nuclei



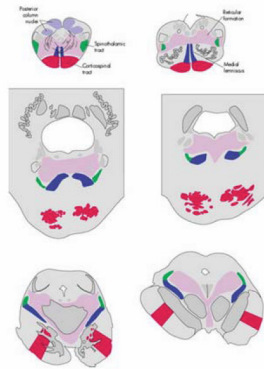
Tectum, tegmentum and basal part of the brainstem



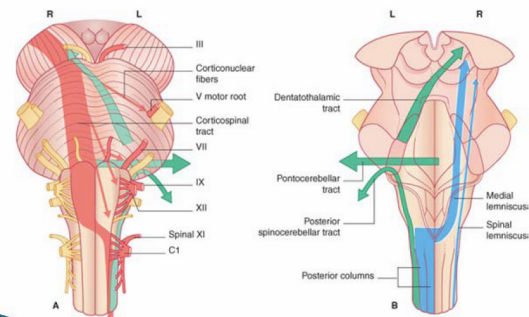
* No tectum in pons and medulla oblongata, due to opening of 4th ventricle



- ▶ **Tectum** – only in the midbrain
- ▶ **Tegmentum** – nuclei of motor and sensory cranial nerve
– major ascending tracts
– descending tracts
– **reticular formation**
- ▶ **Basal part** – descending tracts: **pyramidal tract**
nuclei related with input to the cerebellum

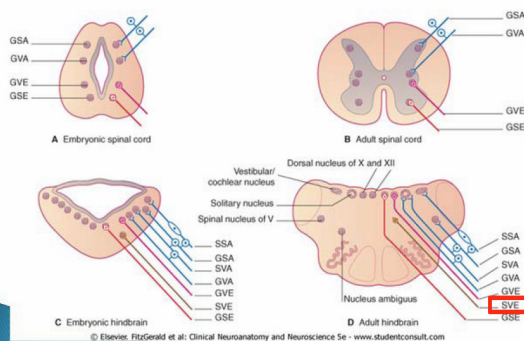


Major sensory and motor tracts



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Arrangement of cranial nerve nuclei in brain stem



Cranial nerve nuclei

