MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

Review File

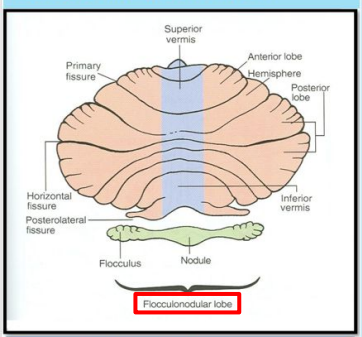
Final lectures

وَمَن يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ

L14: Cerebellum

Characteristics	Cerebellum		
Origin	From **hindbrain**		
Position	Lies behind the pons and medulla, separated from them by **4th ventricle**		
External structures	Consists of two **cerebellar hemispheres** joined in the midline by **vermis**	Its surface is highly convoluted forming **folia**, separated by **fissures**	
Internal structures	Outer grey matter: **cerebellar cortex** Inner white matter: **cerebellar medulla**	Deep seated nuclei in white matter: (from medial to lateral) 1. **Fastigial nnucles** 2. **Globose nucleus** 3. **Emboliform nucleus** 4. **Dentate nucleus**	
Anatomical subdivisions	**Anterior lobe:** In front of primary fissure	**Posterior (middle) lobe:** Between primary and secondary (postero-lateral) fissures	**Flocculonodular lobe:** In front of secondary fissure

- **Climbing fibers: <u>from</u> inferior olivary nucleus,** relay to purkinje cells

Characteristics	Cerebellum		
Functional subdivisions	**Archicerebellum:** Fastigial nucleus relation	**Paleocerebellum:** Globose and emboliform nuclei relation	**Neocerebellum:** Dentate nucleus relation
	**Afferent:** from vestibular nuclei *(vestibulocerebellar fibers)* through ICP **Efferent:** cortical *(purkinje cell)* fibers project to fastigial which project to vestibular nuclei ± reticular formation **Function:** Control body balance and eye movement	**Afferent:** from spinal cord *(dorsal and ventral spinocerebellar tracts through ICP and SCP respectively)* **Efferent:** to globose and emboliform nuclei which projects to red nucleus *(through SCP)* **Function:** Control posture and muscle tone	**Afferent:** from pons *(pontocerebellar tract)* through MCP **Efferent:** to red nucleus but mostly to ventral lateral nucleus of thalamus through SCP then to motor cortex **Function:** Coordination of voluntary movements
Green = Archi-cerebellum, Blue= Paleo-cerebellum. Pink= Neo-cerebellum.			

Cerebellar lesions

MIDLINE LESION: *Loss of postural control.*
UNILATERAL LESION: *"Cerebellar ataxia"*
causes *ipsilateral* :
1. **Incoordination of arm:** *intention tremors (on performing voluntary movements)*
2. **Incoordination of leg:** *unsteady gait*
3. **Incoordination of eye movements:** *nystagmus*
4. **Slowness of speech:** *dysarthria (difficulty of speech).*

L15: Cerebrum

- **3 surfaces:** Superolateral, Medial & Inferior (Tentorial & Orbital)
- **3 main sulci:**

Central sulcus	separates frontal & parietal lobes
Lateral sulcus	separate frontal, parietal & temporal lobes
Parieto-occipital	separate parietal & occipital lobes

- **Anatomically** (positions) **4 lobes:** Frontal, Parietal, Temporal & Occipital
- **Physiologically** (Functionally) **5 lobes**: Frontal, Parietal, Temporal, Occipital & Limbic

Frontal	motivation, motor function, smell, mood & aggression
Parietal	reception and evaluation of sensory information
Temporal	smell, hearing, memory and abstract thought
Occipital	visual processing

- **Medial surface: 2 main gyri** (cingulate & parahippocampal) & **3 main sulci** (paraitoocititał, calcrine & cingulate)

Frontal lobe	**Primary motor cortex** (Brodmann's area **4**) in precentral gyrus **Premotor cortex** (Brodmann's area **6**) anterior to precentral gyrus **Frontal eye field** (Brodmann's area **8**) in the middle frontal gyrus **Broca's "motor speech"** (Brodmann's areas **44,45**) in inferior frontal gyrus
Parietal lobe	**Primary somatosensory cortex** (Brodmann's areas **3,1,2**) in postcentral gyrus **Parietal association cortex** posterior to primary somatosensory
Occipital lobe	**Primary visual cortex** (Brodmann's area **17**) surrounding the calcarine sulcus **Visual association cortex** (Brodmann's area **19**) around primary visual cortex
Temporal Lobe	**Primary auditory cortex** (Brodmann's areas **41,42**) in superior temporal gyrus **Wernicke's area** end of lateral sulcus

- **White Matter (Association, Commissural & Projection fibers):**
- **Association fibers:** Unite different parts of the same hemisphere,
  2 types (**short**: adjacent gyri & **long:** more distant parts)
- **Commissural fibers:** Connect the corresponding regions of the two hemispheres.
  4 types: **(Corpus callosum, Anterior, Hippocampal & Posterior)**
- **Corpus Callosum** connects the **corresponding regions of the two hemispheres** except **the temporal lobes**, that are connected by **anterior commissure**
- **Projection fibers:** Afferent/Efferent fibers conveying impulses to/away from the cerebral cortex
- **Internal Capsule:** bundle of projection fibers, passes through the interval between the thalamus & the basal ganglia. Parts:
  1. Anterior limb: Thalamocortical & Frontopontine fibers
  2. Genu: Corticobulbar fibers
  3. Posterior limb: Corticospinal, Corticobulbar & Thalamocortical fibers
  4. Retrolenticular part: Geniculocalcarine fibers
  5. Sublenticular part: Geniculo-temporal fibers

L16: Blood Cerebral Circulation

- The arterial supply of the cerebrum is composed 2 arterial systems:

1) Carotid system (Anterior cerebral circulation): Supply anterior portion of brain **Internal carotid artery** and its branches: **ACA (smaller)** & **MCA (bigger)**

2) Vertebro-Basilar system (Posterior cerebral circulation): Supply posterior portion of brain. The two vertebral arteries (from the subclavian artery) unite to form **basilar artery**

It divides at the upper border of pons into two **PCA**

ACA	Orbital & medial surfaces of frontal & parietal lobes A narrow part on the superolateral surface
ACA occlusion	Motor disturbance (weakness) in contralateral distal leg Difficulty in prefrontal lobe functions: Cognitive thinking, Judgement, Motor initiation & Self monitoring
MCA	Entire Superolateral surface: Somatosensory Cortex, Motor Cortex, Language areas (Broca's "Motor area" & Wernicke's "Sensory area") & Auditory areas (Primary auditory area & Heschl's Gyrus)
MCA occlusion	Contralateral weakness & sensory loss of all body except lower limb & perineum Visual field cut (damage to optic radiation) Aphasia (language disturbance): In Broca's area: motor aphasia production & In Wernicke's area: sensory aphasia comprehension
PCA	Anterior & inferior temporal lobes (Uncus) Inferior & Medial Occipital lobe (visual area)
PCA occlusion	Visual disturbances: homonymous hemianopsia & cortical blindness, patients unaware they cannot see (Anton's Syndrome) Memory impairment: if temporal lobe is affected

- **Circulus Arteriosus (Circle of wills)**: joins the carotid and vertebrobasilar systems
- It is located on the base of the brain to supply deep structures:

1. Optic chiasma. 2. Hypothalamus. 3. Midbrain. 4. Pituitary gland

- It is formed by:

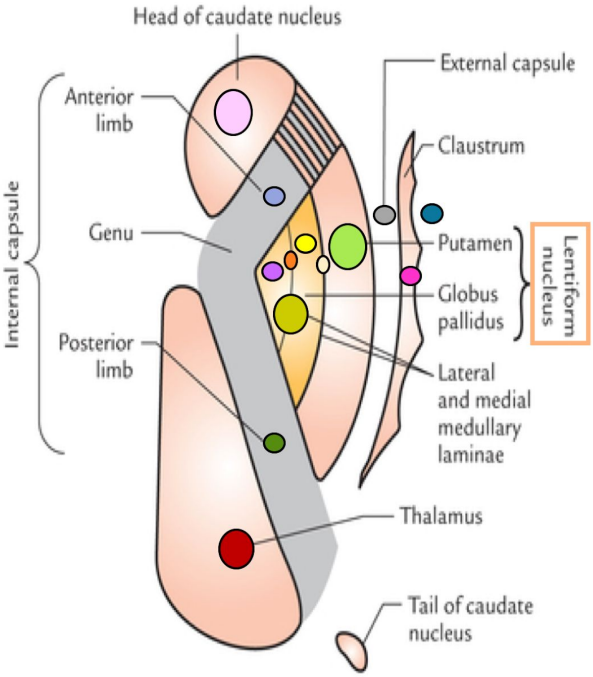
Two internal carotid arteries **Two anterior cerebral arteries**
Two posterior cerebral arteries **Two posterior communicating arteries**
One anterior communicating artery

- **Anterior Perforating Arteries** supplies:
  Large part of **basal ganglia,** **Optic chiasma,** **Internal capsule &** **Hypothalamus**
- **Posterior Perforating Arteries** supplies:
  Ventral portion of **Midbrain**, Parts of **Subthalamus** & **Hypothalamus**

L17: Basal Ganglia

Basal Ganglia			
Corpus Striatum			Amygdaloid
Caudate	Lentiform		
	Putamen	Globus Pallidus	
Neostriatum		Paleostriatum	

Structure	Separates	
Claustrum	Extreme capsule	External capsule
Lateral medullary lamina	Putamen	Globus pallidus
Medial medullary lamina	Lateral segment of globus pallidus	Medial segment of globus pallidus
Anterior limb of internal capsule	Lentiform	Caudate (head)
Posterior limb of internal capsule	Lentiform	Thalamus



Corpus striatum are primarily concerned with control of posture & movement.

The **striatum** is the **input** region of corpus striatum,

while the medial segment of **globus pallidus** & pars reticulata of **substantia nigra** are the **output** portion.

Afferent fibers of striatum come from:
1. cerebral cortex.
2. intralaminar nucleus of thalamus.
3. pars compacta of substantia nigra.

Afferent fibers of both lateral & medial segments of globus pallidus come from:
1. Striatum
2. Subthalamic nucleus.

Efferent fibers of striatum is directed to
1. globus pallidus.
2. pars reticulata of substantia nigra.

Efferent fibers of **lateral** segment is directed to subthalamic nucleus.

Efferent fibers of **medial** segment is directed to
1. ventral lateral,
2. ventral anterior &
3. centromedian nucleus of thalamus.

- **Dysfunction does NOT cause paralysis, sensory loss or ataxia**
- **Its leads to: dyskinesias, Alteration in muscle tone: hypertonia/hypotonia Soft speech, slow steps, tremor at rest**

L18: Thalamus & Limbic System

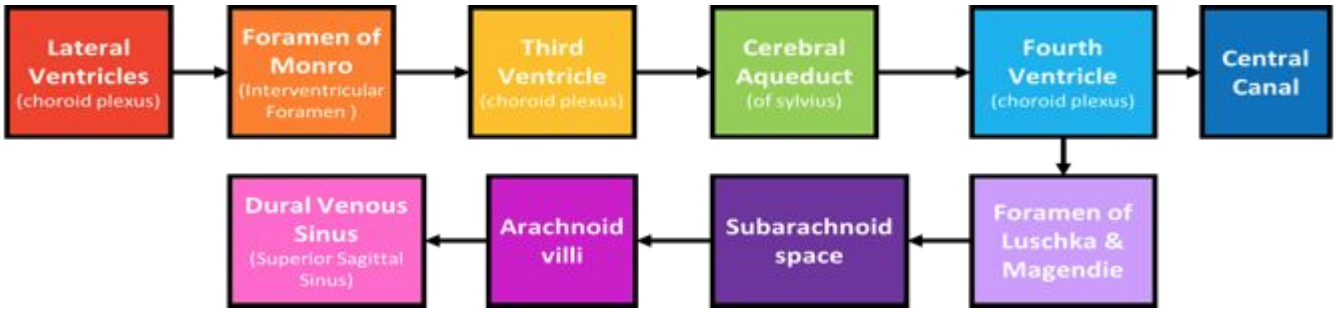
- **Thalamus**: **largest nuclear mass** of the **whole body** & **largest part** of the **diencephalon** ,It is formed of **two oval masses** of **grey matter**
- Together with the hypothalamus they form the lateral wall of the 3rd ventricle

Anterior Thalamic Nucleus	**Afferent**	**Mammillary body**
	Efferent	**Cingulate gyrus**
Medial Nucleus	**Afferent**	Hypothalamus
	Efferent	Frontal cortex & Prefrontal cortex
Ventral Anterior Nucleus	**Afferent**	Globus pallidus & substania nigra
	Efferent	Premotor cortex
Ventral Lateral Nucleus	**Afferent**	**Dentate Nucleus**
	Efferent	**Primary Motor Cortex**
Ventral Posterior Lateral Nucleus	**Afferent**	Medial & Spinal lemnisci
	Efferent	Sensory Cortex
Ventral Posterior Medial Nucleus	**Afferent**	Trigeminal Leminiscus
	Efferent	Sensory Cortex
Lateral Geniculate Nucleus	**Afferent**	Optic tract
	Efferent	Visual Cortex
Medial Geniculate Nucleus	**Afferent**	**Lateral Leminiscus**
	Efferent	**Auditory Cortex**

- **limbic system:** separates the medial surface of the cerebral cortex from the diencephalon important in the control of the emotional responses, it is composed of four main structures **(Limbic lobe, Amygdala, Hippocampus & Septal area)**, it form connections between the limbic system & the hypothalamus, thalamus and cerebral cortex.
- **Limbic lobe:** C-shaped ring of grey matter on the medial side of each cerebral hemisphere, includes: **(Subcallosal area, Cingulate gyrus, Isthmus, Parahippocampal gyrus & Uncus)**
- **Hippocampus:** important in memory **(consolidation of new short-term memories)** & learning
- **Fornix**: C-shaped group of fibers, Its principal efferent pathway
- In **Alzheimer's disease:** the **hippocampus** is one of the first brain areas to show damage.
- **Korsakoff's psychosis** syndrome is a **chronic memory disorder** caused by **severe deficiency of thiamine (Vit. B1)** & alcoholic intoxication.

L19: Meninges, Ventricles & CSF

o The brain & spinal cord are covered by **3 layers** of meninges :
(1) dura, (2) arachnoid & (3) pia mater.
o The important **dural folds** inside the brain are the **falax cerebri** & **tentorium cerebelli**.
o CSF is **produced by the choroid plexuses** of the ventricles of the brain : lateral ,3rd & 4th ventricles.
o CSF **circulates** in the subarachnoid space.
o CSF is **drained into the dural venous sinuses** principally superior saggital sinus.
o The **subarachnoid space** in the spinal cord **terminates at the 2nd sacral** vertebra while the spinal cord terminates at L1-L2
o Obstruction of the flow of CSF as in tumors of the brain leads to **hydrocephalus**.



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GOOD LUCK ♡

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وَمَا تَوْفِيقِيٓ إِلَّا بِٱللَّهِ