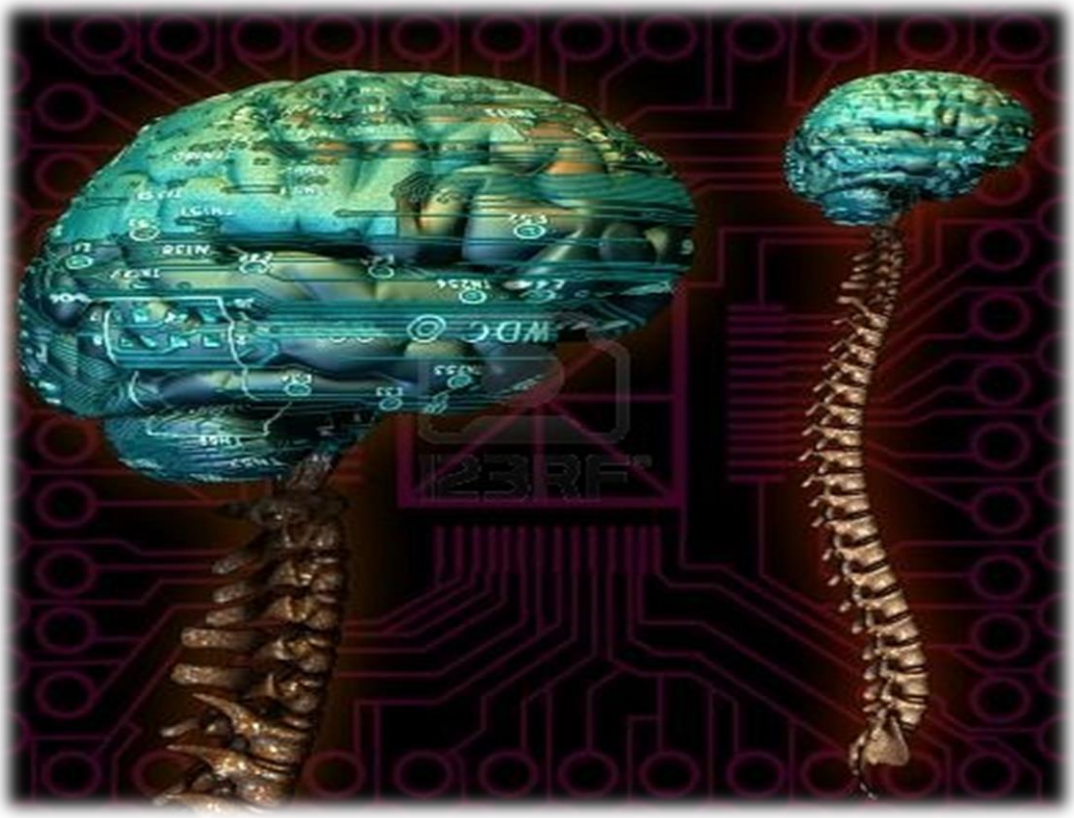
CNS Block



LECTURE (20)

ANATOMY OF BASAL GANGLIA & CONNECTIONS

Done by:Lama alFaraidi

Reviewed by : Majed Al-Asheikh

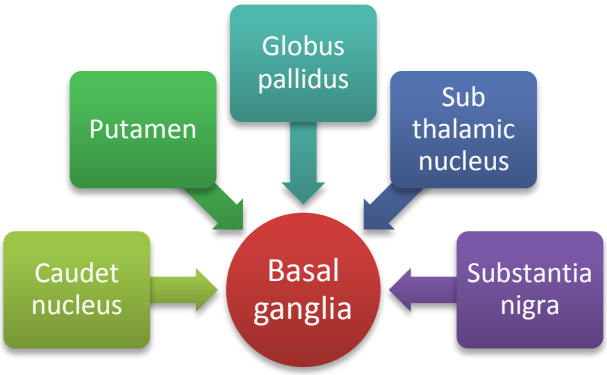
If there is any mistake please feel free to contact us:

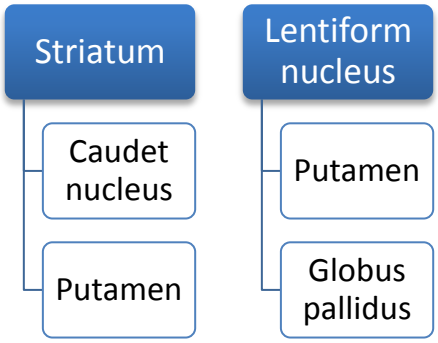
Anatomyteam32@gmail.com

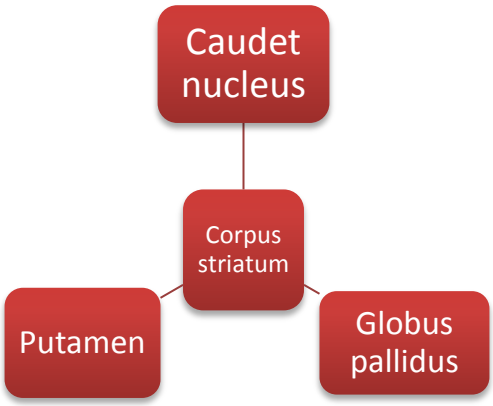
Both - Black
Male Notes - BLUE
Female Notes - GREEN
Explanation and additional notes - ORANGE
Very Important note - Red

Objectives:

- Define "basal ganglia" and enumerate its components.
- Enumerate parts of "Corpus Striatum" and their important relations.
- Describe the structure of Caudate and Lentiform (Putamen & Globus Pallidus) nuclei.
- Differentiate between striatum & paleostriatum in terms of connections.
- State briefly functions & dysfunctions of Corpus Striatum.

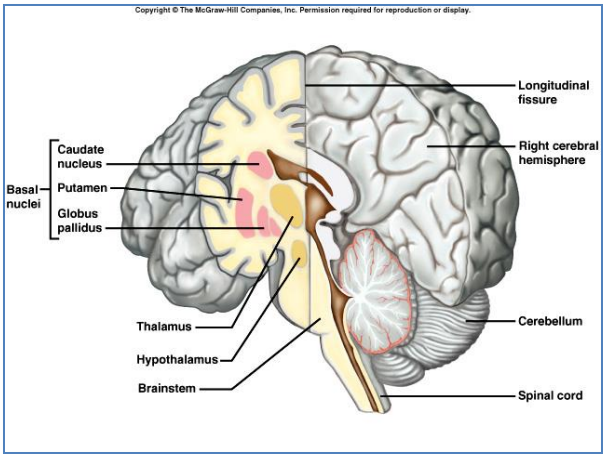

Globus pallidus
Putamen
Sub thalamic nucleus
Caudet nucleus
Basal ganglia
Substantia nigra

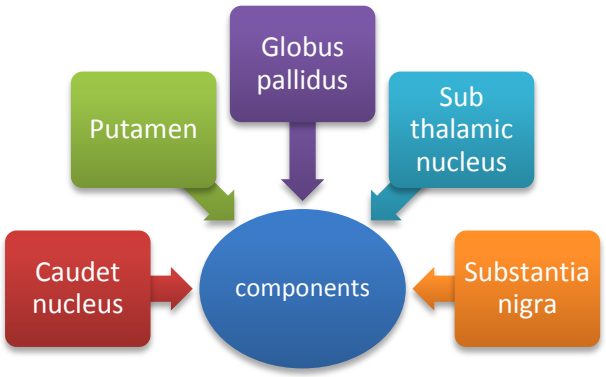

Striatum
Caudet nucleus
Putamen
Lentiform nucleus
Putamen
Globus pallidus

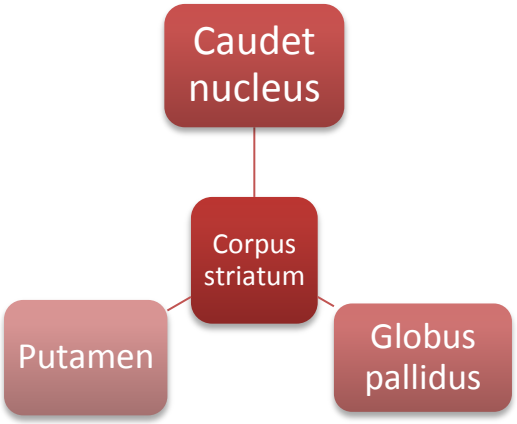

Caudet nucleus
Corpus striatum
Putamen
Globus pallidus

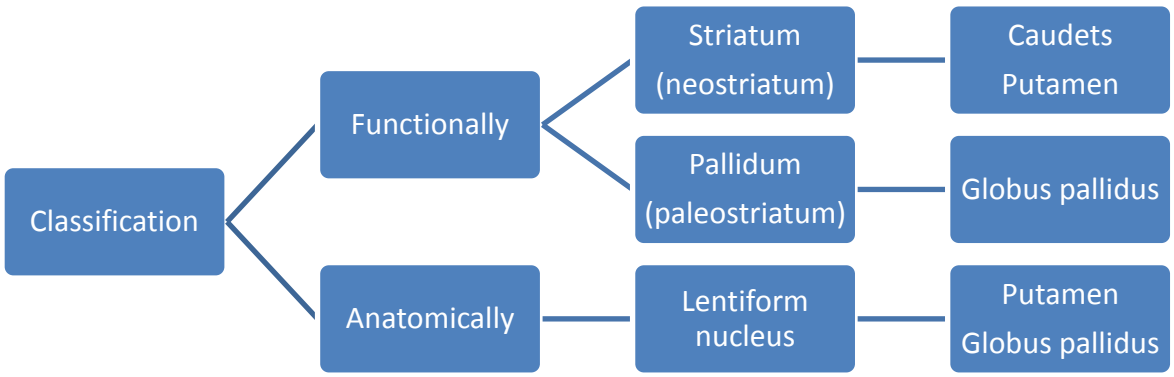
Basal Ganglia

- Refer to a group of nuclei, located deep within cerebral hemispheres.
- Part of extrapyramidal motor system, principally involved in the control of posture and movements (primarily by inhibiting motor functions).







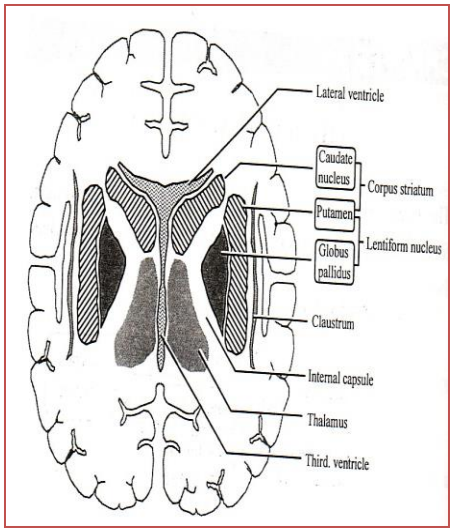


- The **Amygdala**, located within the temporal lobe has a similar embryologic origin but functionally is part of the limbic system.

Corpus striatum

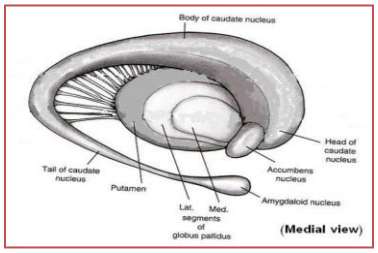
- Lies lateral to thalamus.
- It is divided completely by internal capsule into **caudate nucleus** and **lentiform nucleus.**

  Bands of grey matter pass from lentiform nucleus across the internal capsule to the caudate nucleus, giving the striated appearance hence, the name **corpus striatum.**



Caudate nucleus

- Large C-shaped or comma-shaped grey mass
- It has a Head, Body, and Tail.



Head

- **(Anterior) Large, & rounded and forms the lateral wall of anterior(frontal) horn of lateral ventricle.**
- **Completely separated from the putamen by the internal capsule except rostrally where it is continuous with the putamen through and beneath the anterior limb of internal capsule.**
- **The most ventral part of the corpus striatum is called the nucleus accumbens, which has connections with the limbic system.**

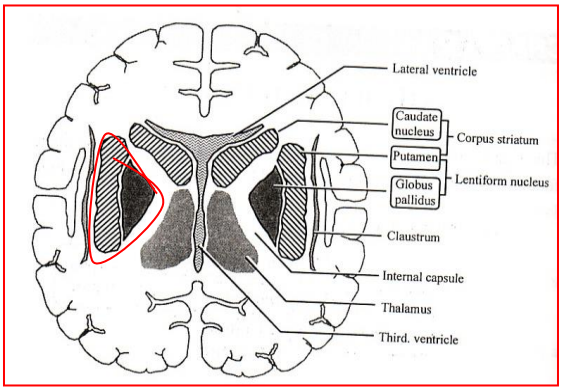
Body

- **Long &narrow continuous with head, lies in the floor of body of lateral ventricle.Extends above thalamus (in parietal lobe)**

Tail

- **Long, narrow & tapering, descends posteriorly into the temporal lobe and lies in the roof of inferior(temporal) horn of lateral ventricle.**

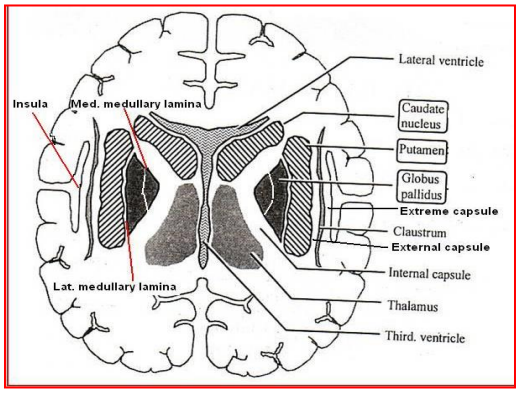
Lentiform nucleus



- It is a three sided, wedge-shaped mass of grey matter, with a convex outer surface and an apex which lies against the genu of the internal capsule.
- It is divided into:

Putamen	• Larger darker lateral portion
Globus Pallidus	• Smaller, lighter medial portion

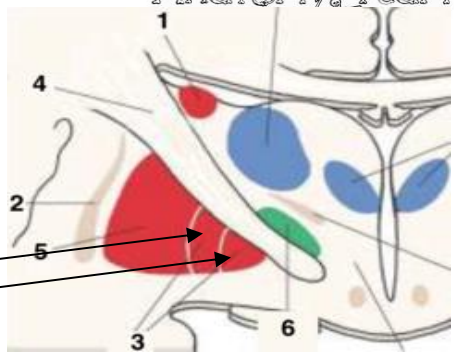
Putamen



- Lies lateral to the internal capsule and globus pallidus.
- Separated from globus pallidus by a thin sheath of nerve fibers, the **lateral medullary lamina.**
- The white matter lateral to putamen is divided, by a sheath of grey matter, the **claustrum** into two layers:

External capsule	Between the putamen and claustrum
Extreme capsule	Between the claustrum and the cortex of **insula,** deep within the lateral fissure.

Globus Pallidus



- Lies medial to putamen, separated from it by **Lateral medullary lamina**.
- Consists of two divisions, **the lateral (external) & the medial (internal) segments**, separated by a thin sheath of nerve fibers, the **medial medullary lamina.**
- The medial segment is similar, in terms of cytology and connections with the pars reticulata of substatia nigra.

Connections of the Striatum

Striatum is the input portion of corpus striatum

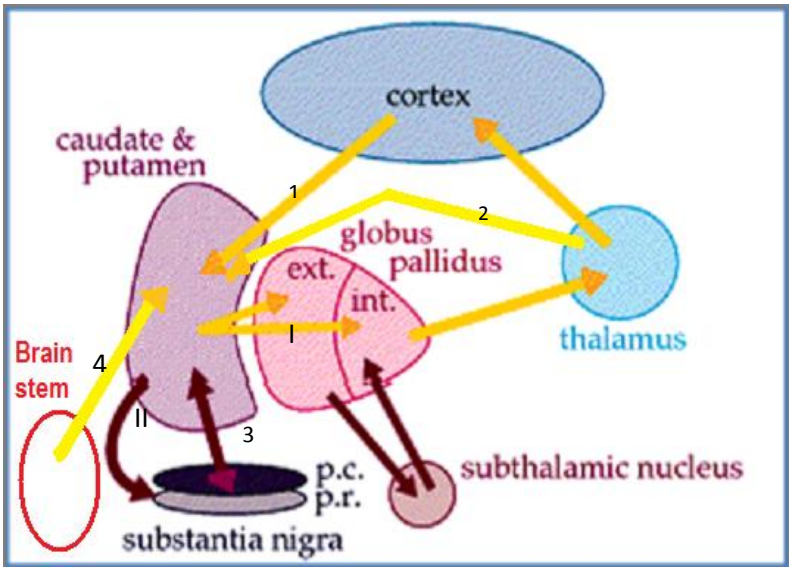
Afferent Fibers (Input):

1. Corticostriatal
2. Thalamostriatal
3. Nigrostriatal
4. Brainstem striatal

Efferent Fibers (Output):

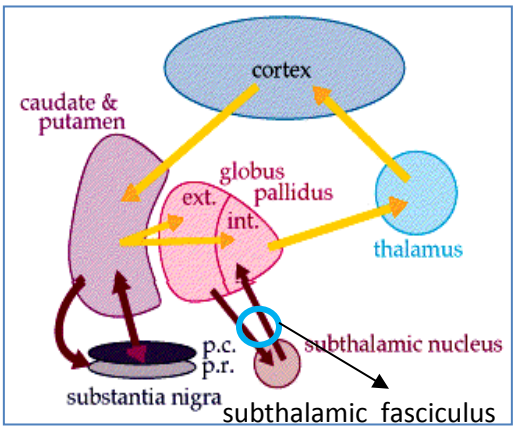
I. Striatopallidal

II. Striatonigral



Connections of the Globus pallidus (F)

- Together with the pars reticulata of substatia nigra, the **medial segment is regarded as output part of the basal ganglia.**



Afferent Connections:

- Striatopallidal fibers
- Subthalamopallidal fibers:

Originate	•From **subthalamic nucleus** of the diencephalon
Pass	•Laterally through the internal capsule as **subthalamic fasciculus.**
Terminate	•In both segments of globus pallidus (more in the medial segment).

Efferent connections: The two segments have different projections

- The **lateral segment** principally projects to subthalamic nucleus via the **subthalamic fascicle.**
- The **medial segment** together with the pars reticulata of substatia nigra projects:
  - primarily to the thalamus **(pallidothalamic fibers)**
  - to the brain stem tegmentum **(pallidotegmental fibers)**

Pallidothalamic fibers: take two routes:(F)

Ansa lenticularis	• Pass around the anterior margin of the internal capsule.
Lenticular fasciculus.	• Pass through the internal capsule.

- Both set of fibers continue to course medially and then loop dorsally and laterally as **thalamic fasciculus** to enter the thalamus (VA, VL and centromedian nuclei).

Pallidotegmental fibers:

- Pass caudally to terminate in the **pedunculopontine nucleus** of the brain stem tegmentum

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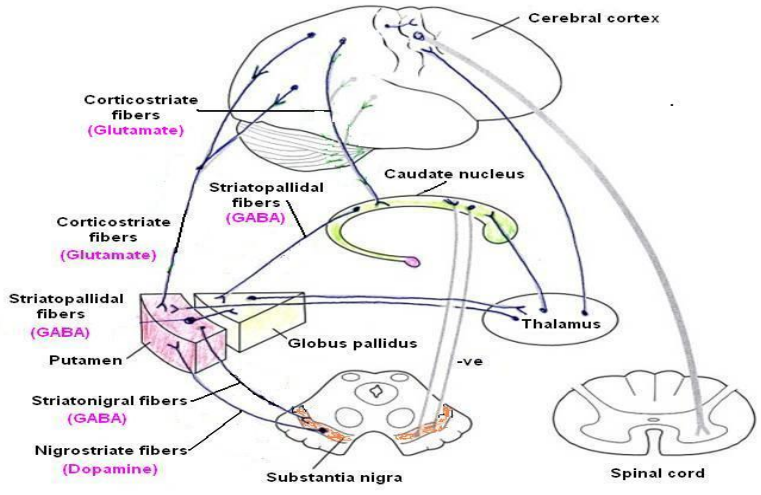
- **All of this circuitry is on the same side of the brain—uncrossed.**
- Thus, the basal ganglia affect function mediated by the **ipsilateral motor cortex.**
- Since **motor cortex controls** the movements of the contralateral body, the **basal ganglia** affects movements of the contralateral side of the body.



Basal Ganglia: *Function – Dysfunction*

Function

The corpus striatum assists in regulation of voluntary movement and learning of motor skills.

- **Facilitate behavior and movement that are required and appropriate**
- **Inhibit unwanted or inappropriate movement**

Dysfunction

Its dysfunction Does NOT cause paralysis, sensory loss or ataxia

- **Abnormal motor control: emergence of abnormal, involuntary movements (dyskinesias) e.g. tremors, chorea, athetosis, myoclonus, tic or dystonia..**
- **Alteration in muscle tone (hypertonia /hypotonia).**

Notes:

- The rostral part of the caudet nucleus is connected to the putamen through bands of grey matter.
- Subthalamic fascicle contain subthalamopallidal fibers as well as pallidosubthalamic fibers.
- Subthalamic and lenticular fascicles pass through the internal capsule.
- All the connections of the basal ganglia are on the same side – uncrossed.
- Basal ganglia affect the ipsilateral cortex therefore the basal ganglia controls the movement on the contralateral part of the body.

- Afferent fibers of striatum come from: cerebral cortex, intralaminar nucleus of thalamus & pars compacta of substantia nigra.
- Efferent fibers of striatum is directed to globus pallidus & pars reticulata of substantia nigra.

- Afferent fibers of both lateral & medial segments of globus pallidus come from: striatum and subthalamic nucleus.
- Efferent fibers of lateral segment is directed to subthalamic nucleus.
- Efferent fibers of medial segment is directed to ventral lateral, ventral anterior & centromedian nucleus of thalamus.

Quiz:

1- All of the following are parts of basal ganglia EXCEPT:

A- Caudate Nucleus
B- Lentiform Nucleus
C- Hippocampus
D- Amygdaloid

2- The lentiform is separated from caudate by:

A- Anterior limb of internal capsule
B- Posterior limb of internal capsule
C- lateral medullary lamina
D- Medial medullary lamina

3- The lentiform is separated from Thalamus by:

A- Anterior limb of internal capsule
B- Posterior limb of internal capsule
C- lateral medullary lamina
D- Medial medullary lamina

4- Lentiform nucleus consist of :

A- Caudate and Thalamus
B- Putmen and caudate
C- Caudate and globus pallidus
D- Putmen and globus pallidus

5- STRIATUM:

A- Caudate and Thalamus
B- Putmen and caudate
C- Caudate and globus pallidus
D- Putmen and globus pallidus

6- Body of caudate located in the:

A- Frontal lobe
B- parietal lobe
C- Temporal lobe
D- Occipital lobe

7- Which part of CAUDATE NUCLEUS continue with Amygdaloid Nucleus:

A- Head
B- Body
C- Tail
D- B and C

8- What is the best team in the world:

A- Anatomy team
B- A
C- A and B
D- All of them

9- Lentiform Nucleus:

A- Lateral to thalamus
B- Medial to thalamus
C- Medial to Spinal cord
D- Posterior to thalamus

10- Putamen Separated from globus pallidus by:

A- Anterior limb of internal capsule
B- Posterior limb of internal capsule
C- lateral medullary lamina
D- Medial medullary lamina

11- Extreme capsule between:

A- claustrum and insula
B- claustrum and putamen
C- claustrum and globus pallidus
D- globus pallidus and putamen

Number of Q	ANS
1	C
2	A
3	B
4	D
5	B
6	B
7	C
8	D
9	A
10	C
11	A

GOOD LUCK

Anatomy Team Leaders:

Fahad AlShayhan & Eman AL-Bedica.