



Gaza Ophthalmic Centre

## 27.2.1 Basal Nuclei Part 1 Neurosciences I

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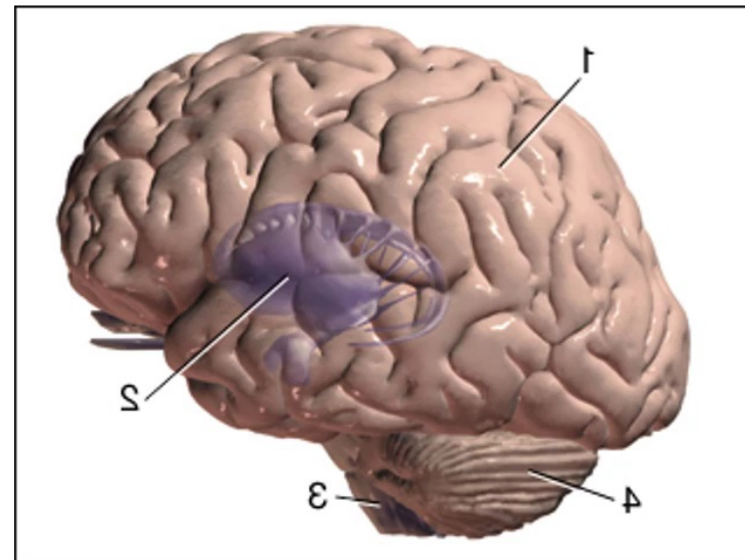
Gaza Ophthalmic Centre

Dr. Maged Awni Abu-Ramadan, MD, FRCSEd



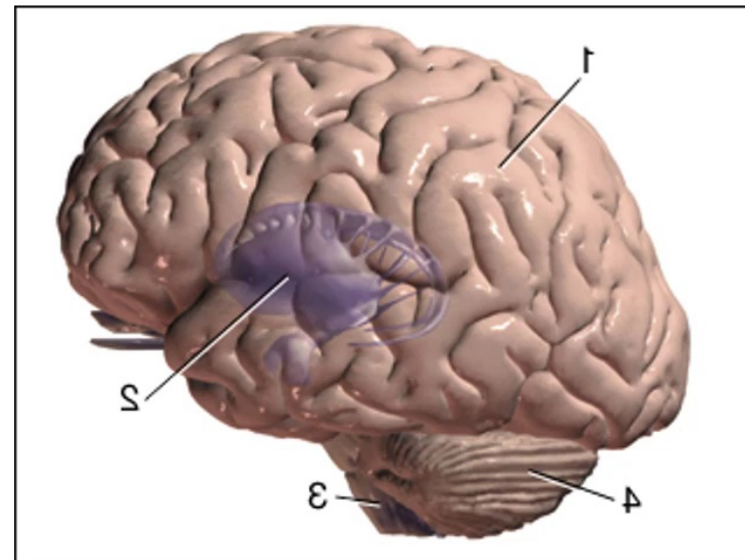
# Overview

- Anatomy
  - Not a Ganglia!
  - 4 Deep Nuclei
    1. Caudate
    2. Lentiform
    3. Amygdaloid
    4. Claustrum
- Loops & Pathways
- Motor Disorders



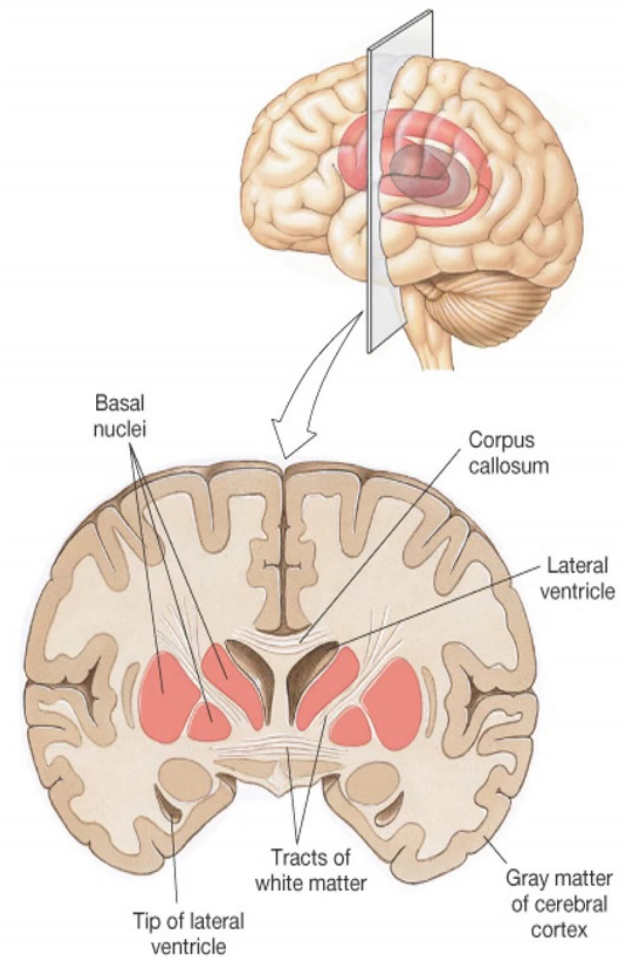
# Overview

- **Physiology**
  - 3 physiologic groups
    1. **Corpus Striatum**
      1. Caudate
      2. Lentiform
        1. Putamen
        2. Globus Pallidus
    2. **Subthalamic Nucleus**
    3. **Substantia Nigra of MB**
      1. Pars compacta
      2. Pars reticulata



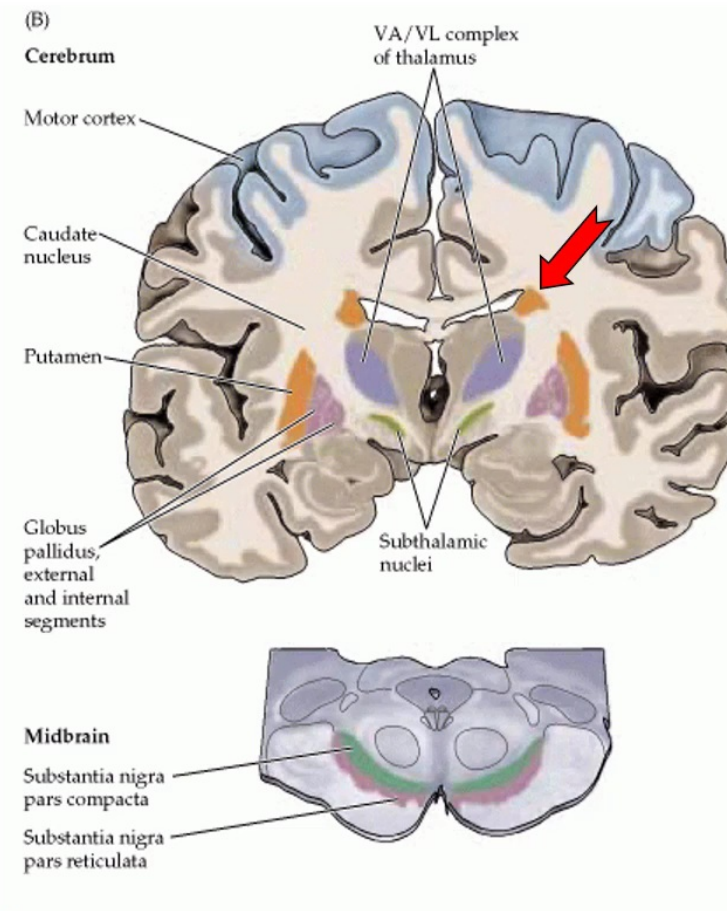
# Components of the Basal Nuclei

1. Input Nuclei
2. Output Nuclei
3. Intermediate Nuclei



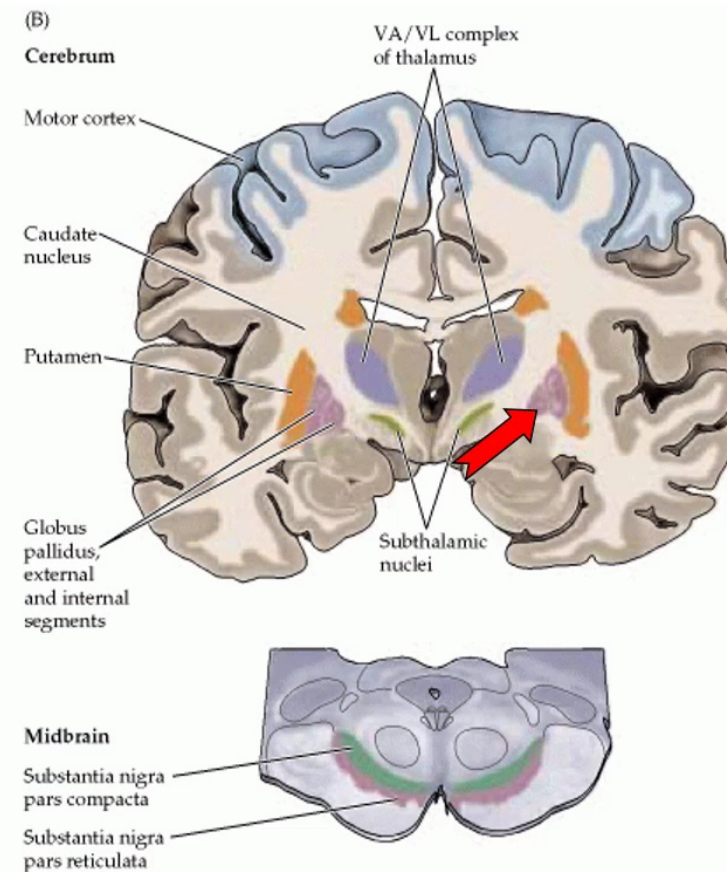
# Components of the Basal Nuclei

- Input Nuclei
  - Corpus Striatum
    1. Caudate
    2. Putamen



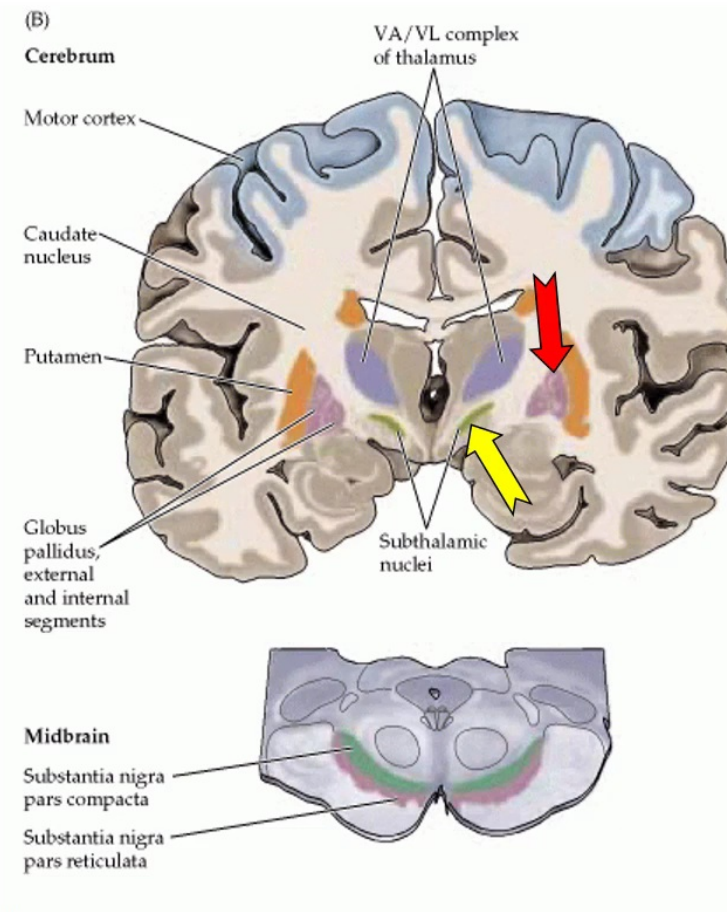
# Components of the Basal Nuclei

- Output Nuclei
  1. Globus Pallidus Interna
  2. Substantia Nigra
    - Pars Reticulata\*



# Components of the Basal Nuclei

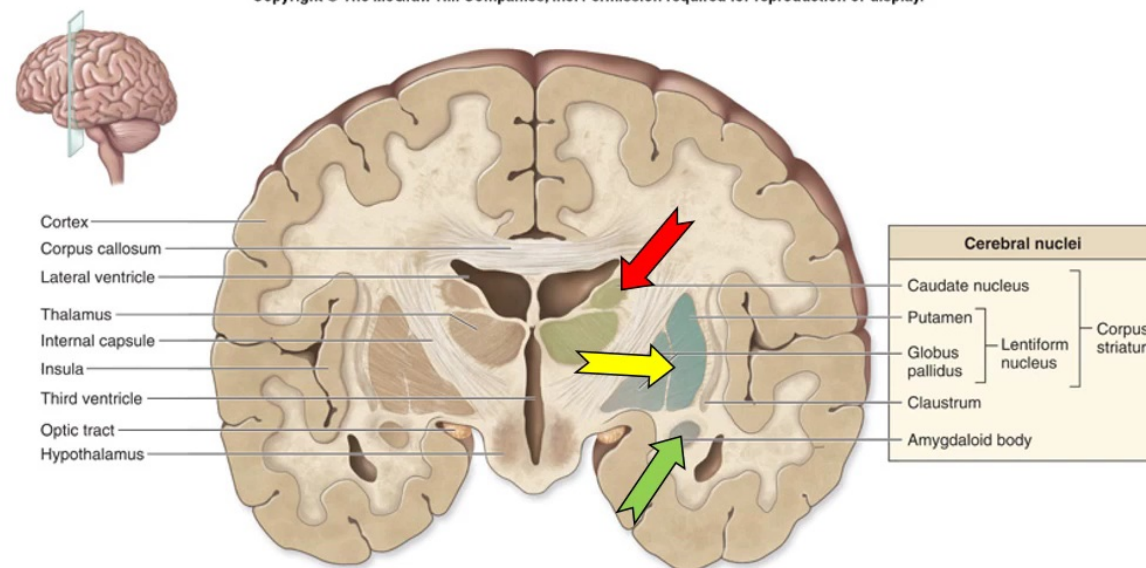
- Intermediate Nuclei
  1. Globus Pallidus Externa
  2. Subthalamic Nucleus\*
  3. Substantia Nigra
    - Pars Compacta\*



# Basal nuclei

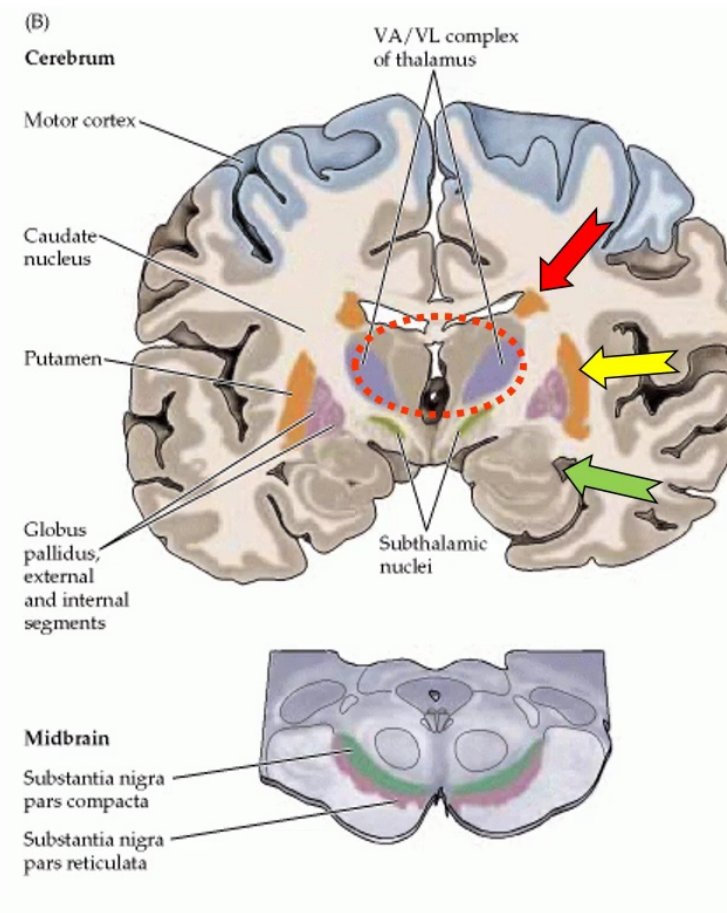
1. Caudate nucleus – arches over the thalamus
2. Lentiform nucleus – “lens shaped” – 2 parts
3. Amygdala – sits on top of the tail of caudate nucleus

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# Basal Nuclei : Anatomy

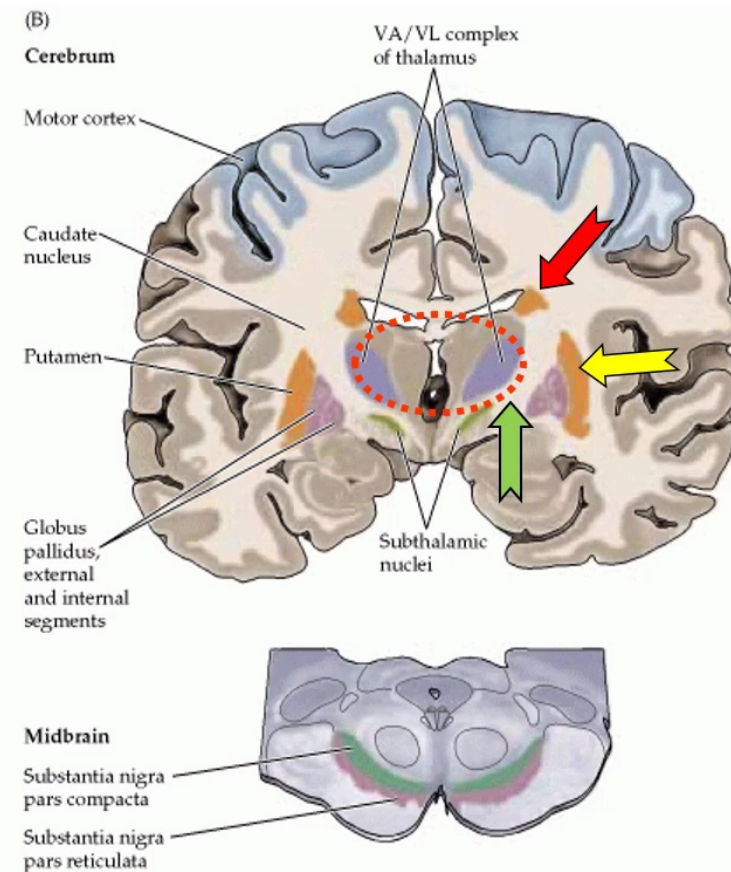
- Lateral to the Thalamus
- 4 Nuclei
  1. Caudate Nc → Extra pyramidal
  2. Lentiform Nc → Extra pyramidal
    1. Putamen
    2. Globus Pallidus
  3. Amygdaloid Nc → Smell
  4. Claustrum →?



# Basal Nuclei : Anatomy

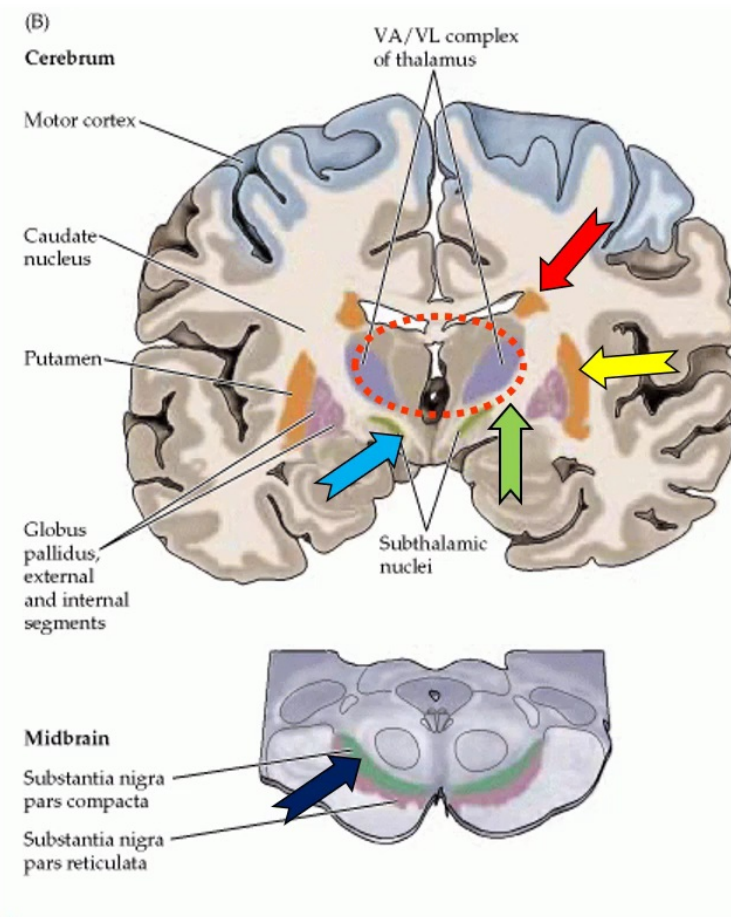
- **Corpus Striatum =**

1. **Caudate Nc**
2. **Lentiform Nc**
3. **Internal Capsule**

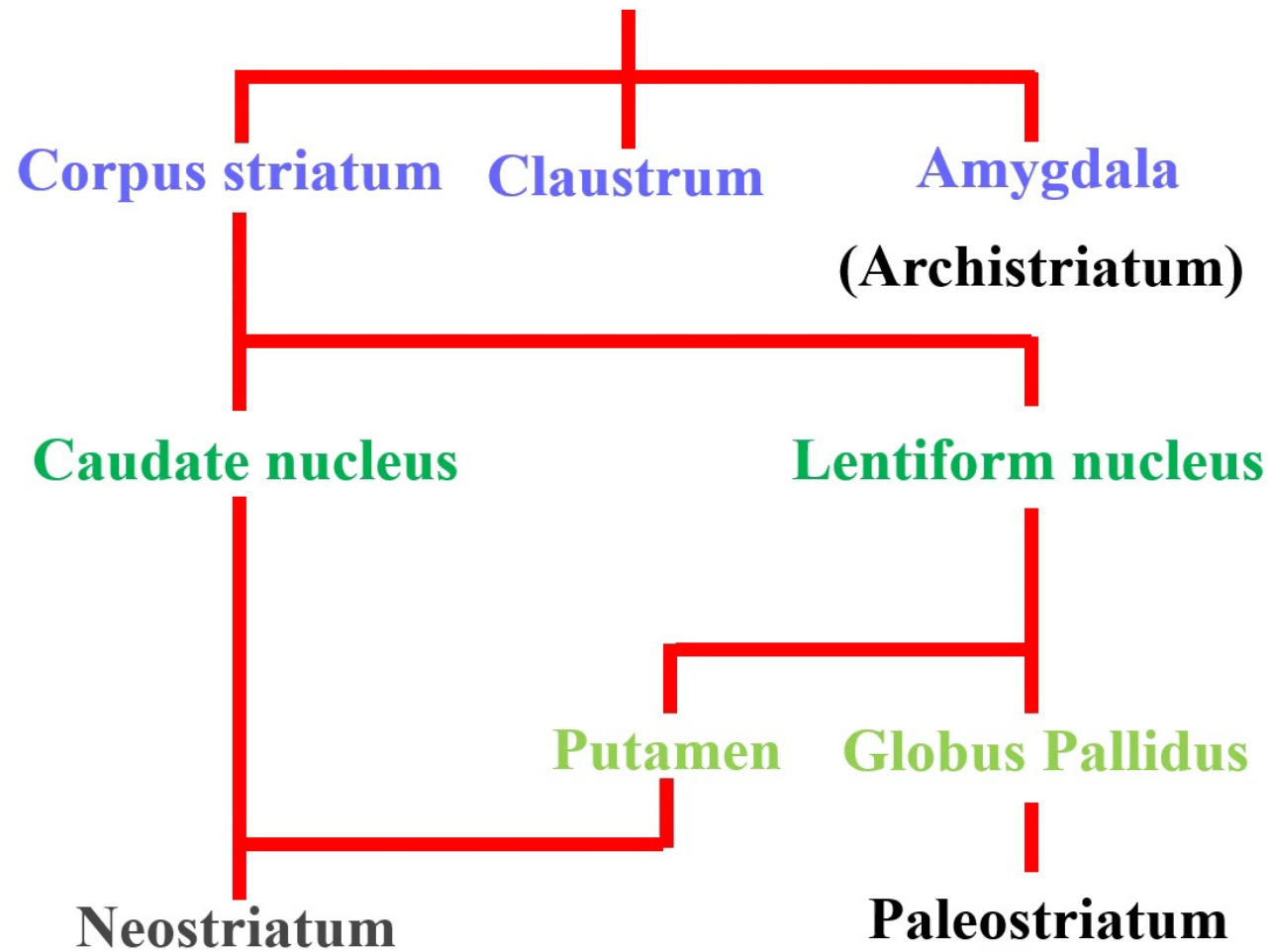


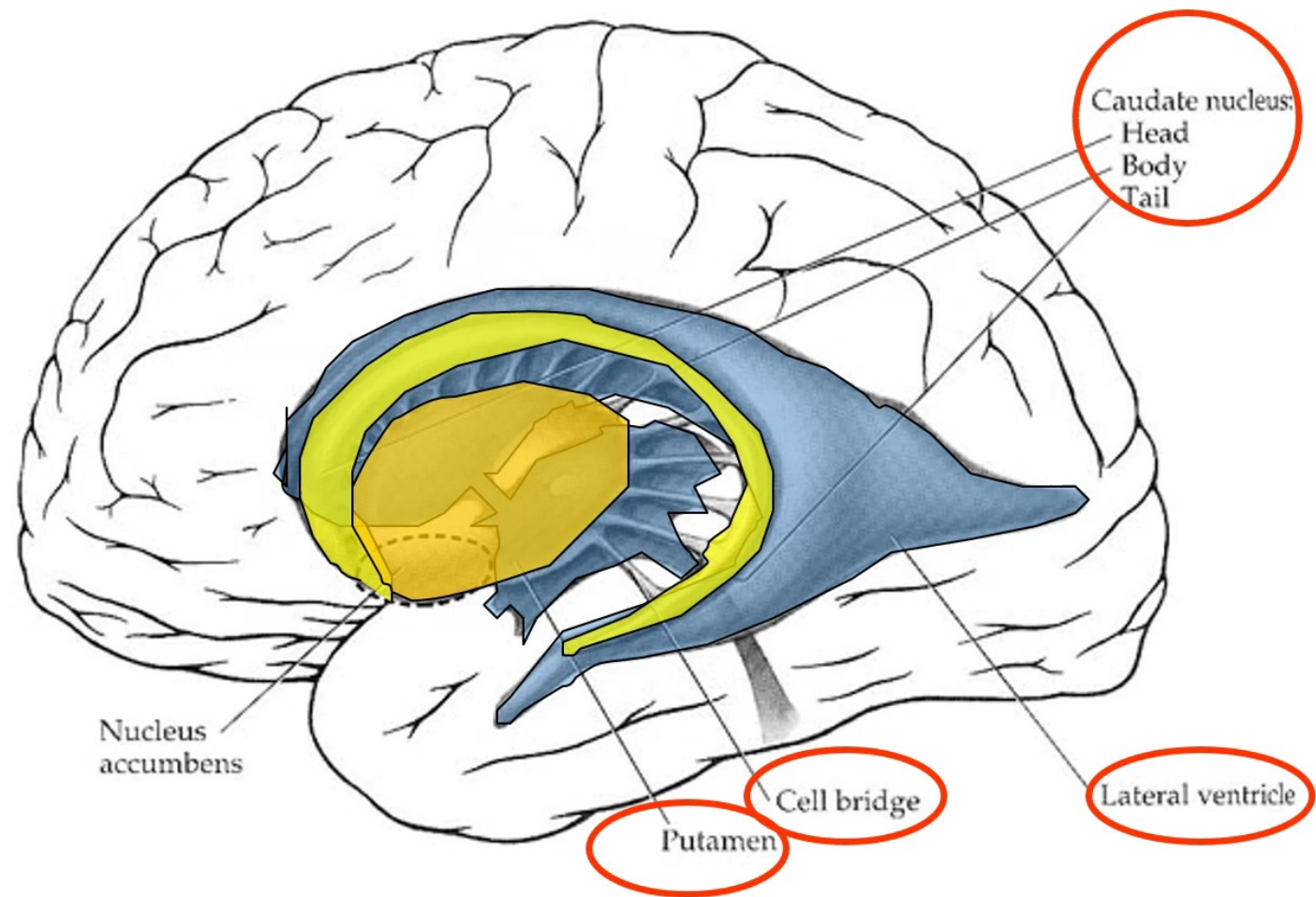
# Basal Nuclei : Anatomy

- Subthalamic Nc
- Substantia Nigra



# Basal Nuclei





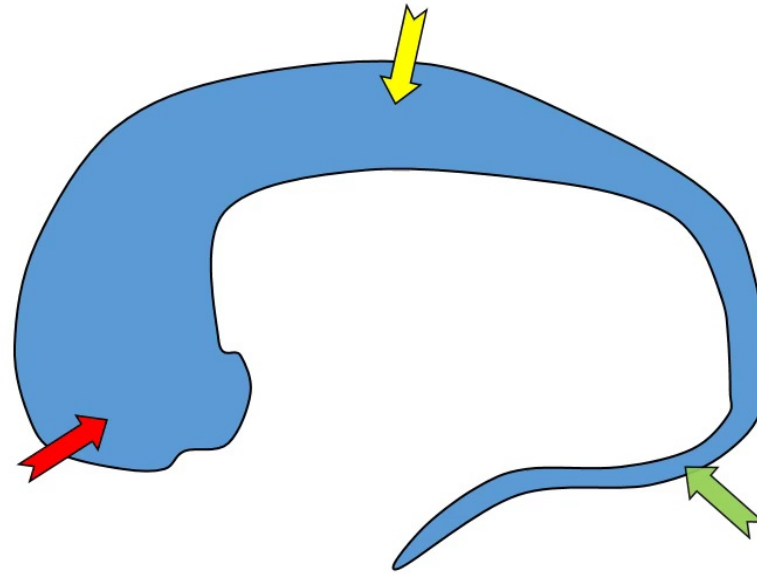
# Caudate Nucleus

- C shaped mass of Grey Matter
- Encircles most of the Diencephalon

1 Head

2 Body

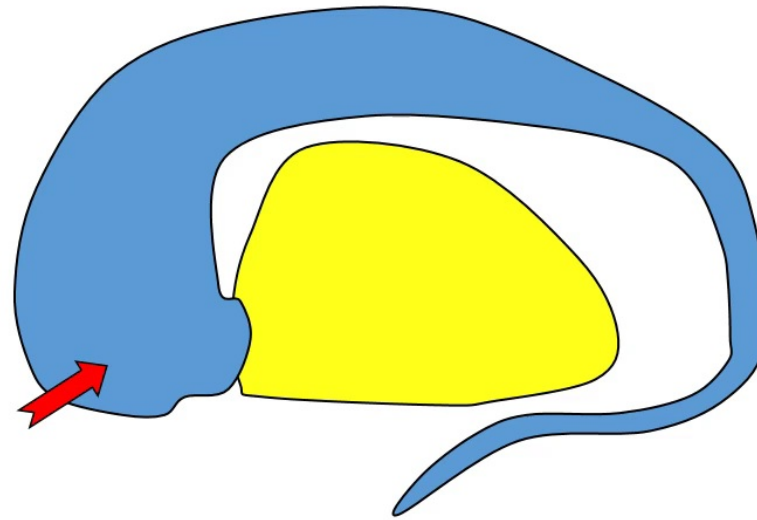
3 Tail



# Caudate Nucleus

## 1) Head

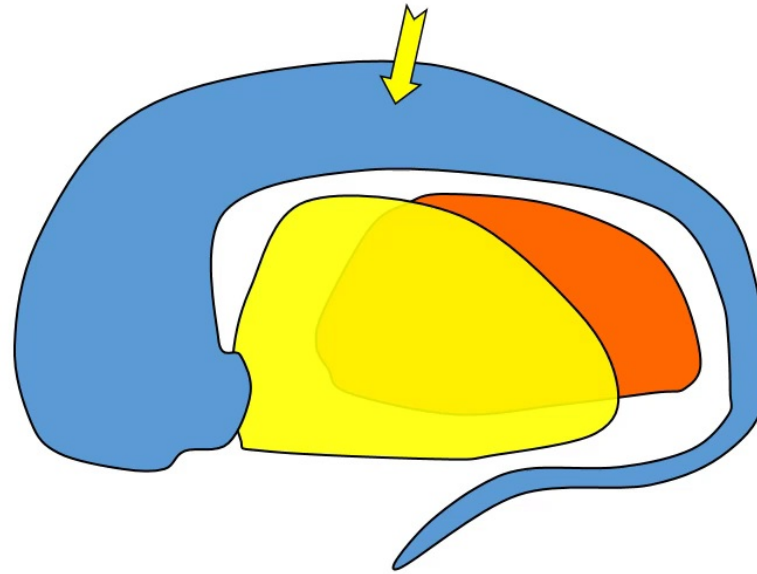
- Large anterior end
- Lat wall of
- Ant horn of
- Lat ventricle
- Fused with
  1. Lentiform Nc (Putamen)
  2. Ant Perforated Substance



# Caudate Nucleus

## 2) Body

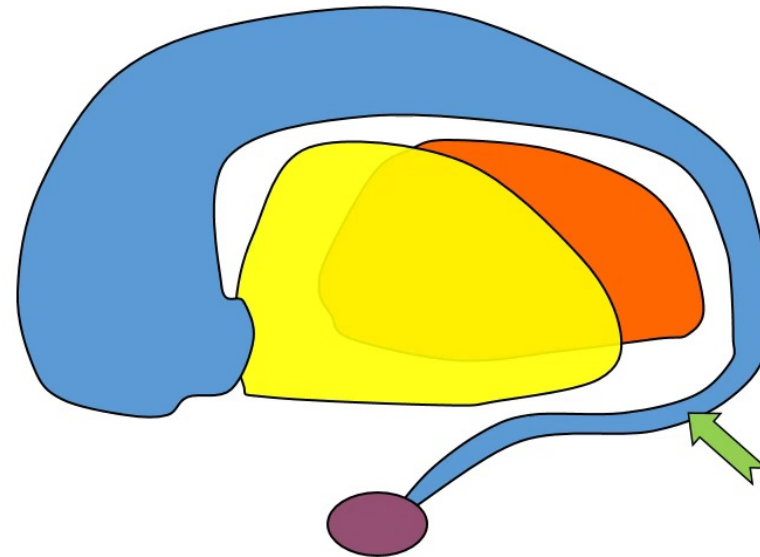
- Passes backward
- → side of Thalamus
- → floor of body of lat ventricle



# Caudate Nucleus

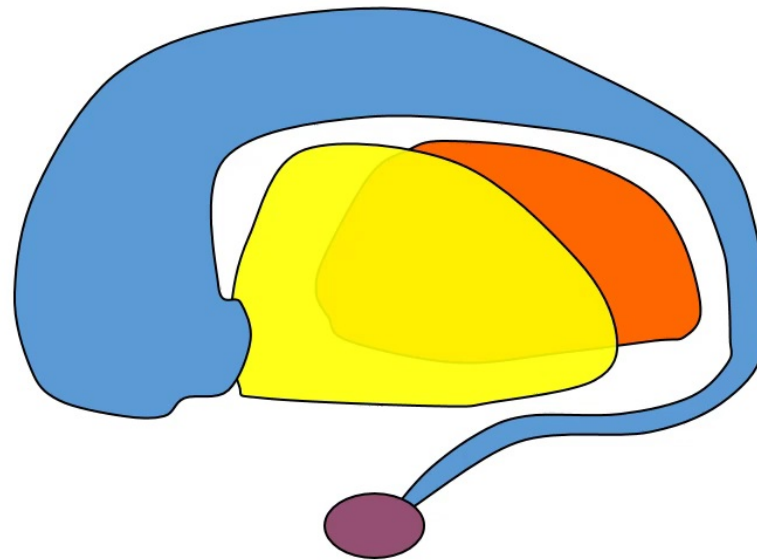
## 3 Tail

- Curves ventrally
- Follows roof of the
- Inferior horn of
- LV
- → temporal lobe (Pole)
- Ends at Amygdaloid Nc



# Lentiform Nucleus

- Triangular mass of
- Grey Matter
- 3 surfaces
  1. Medial
  2. Lateral
  3. Ventral
- Ventral surface
  - ~ roof of inf horn of LV
  - Ant → fused with Ant Perf Sub



# Lentiform Nucleus

- Divided by the
- External Medullary Lamina
- → 2 parts

## 1. Putamen =

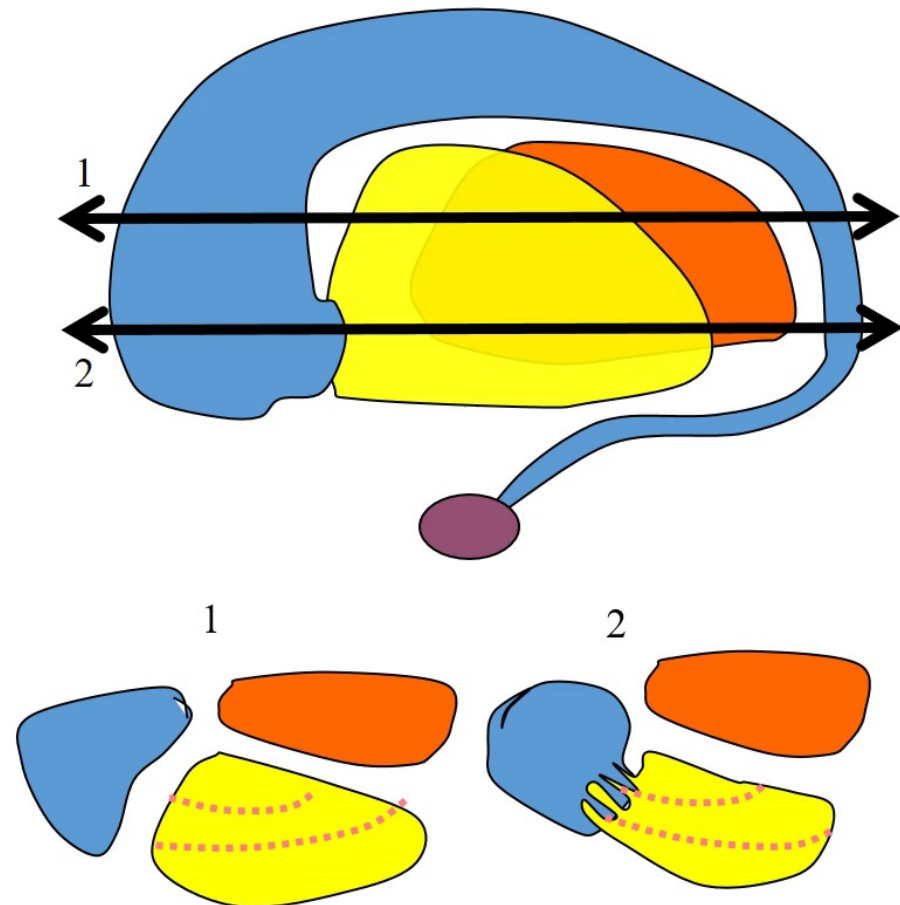
- large lat part

## 2. Globus Pallidus =

- pale med part

- Divided by the
- Internal Medullary Lamina

1. GP Externa
2. GP Interna



# Lentiform Nucleus

- 2 white matter capsules

1. Medial Capsule

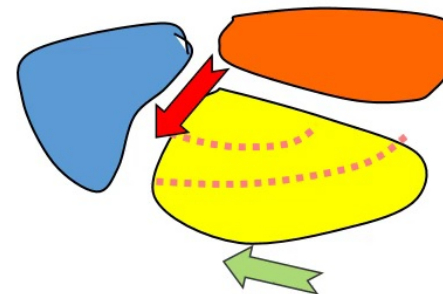
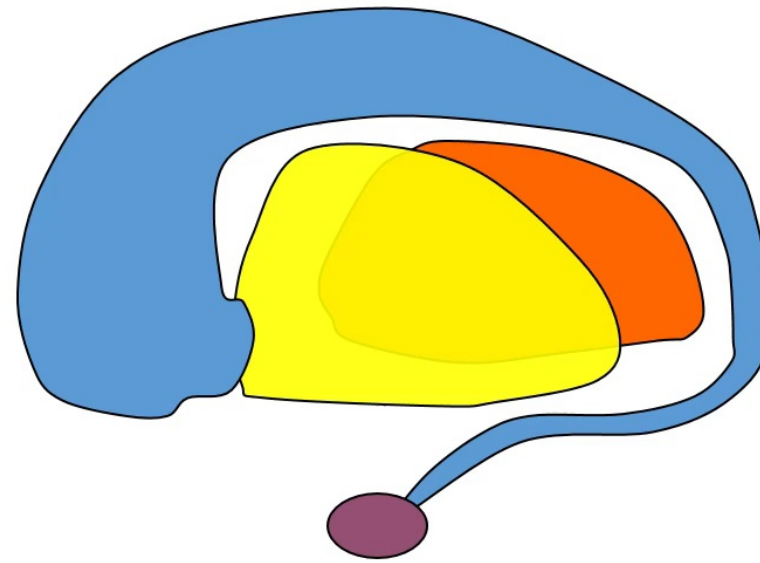
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1. Med surf of LnNc &
2. Cd Nc

2. Lateral Capsule

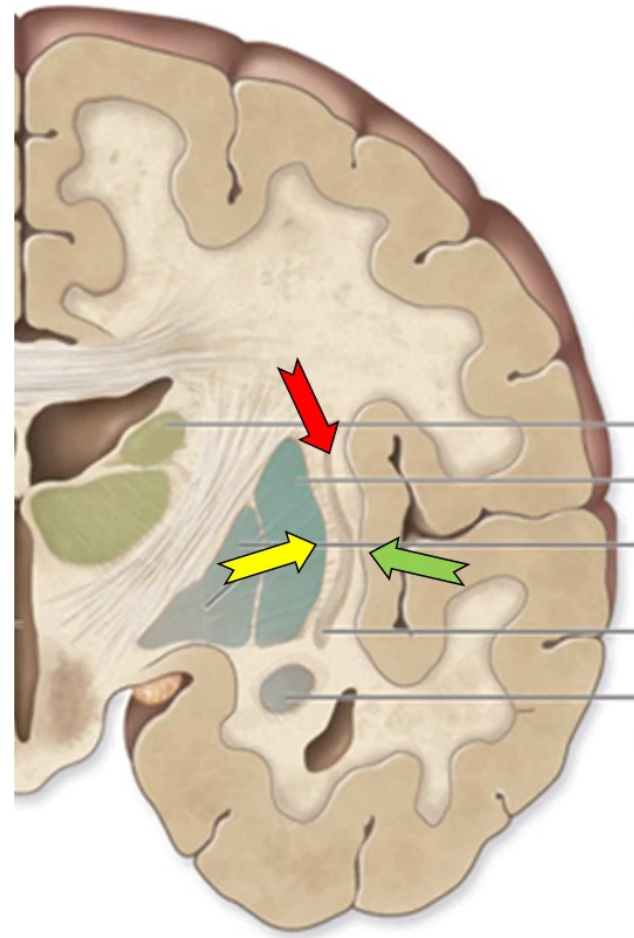
- <>

1. Lat surf of Ln Nc &
2. Insula



# The Claustrum

- Thin layer of grey matter
- Lateral and parallel to the
- Lentiform Nc
- Between
  1. lateral surface of Lentiform Nc
  2. Insula



# Clastrum

- Thin sheet of Grey Matter

- 2 Capsules

1. External Capsule

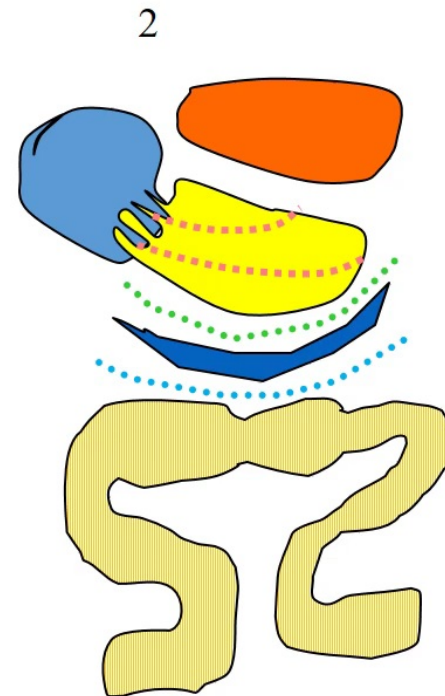
- $\leftrightarrow$

1. Claustrum from
2. Lentiform Nc

2. Extreme Capsule

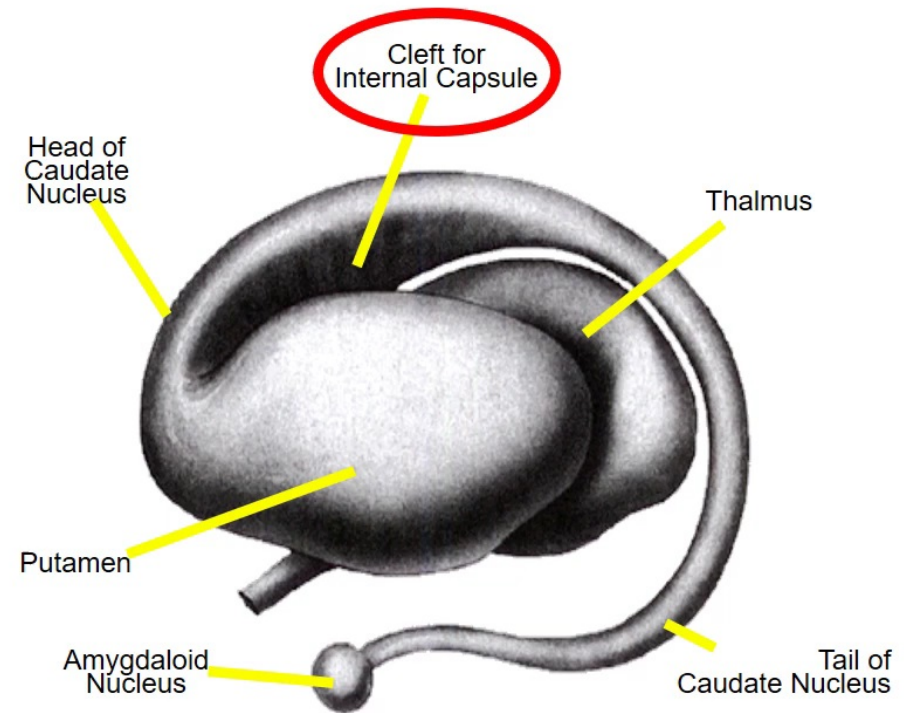
- $\leftrightarrow$

1. Claustrum from
2. Insula



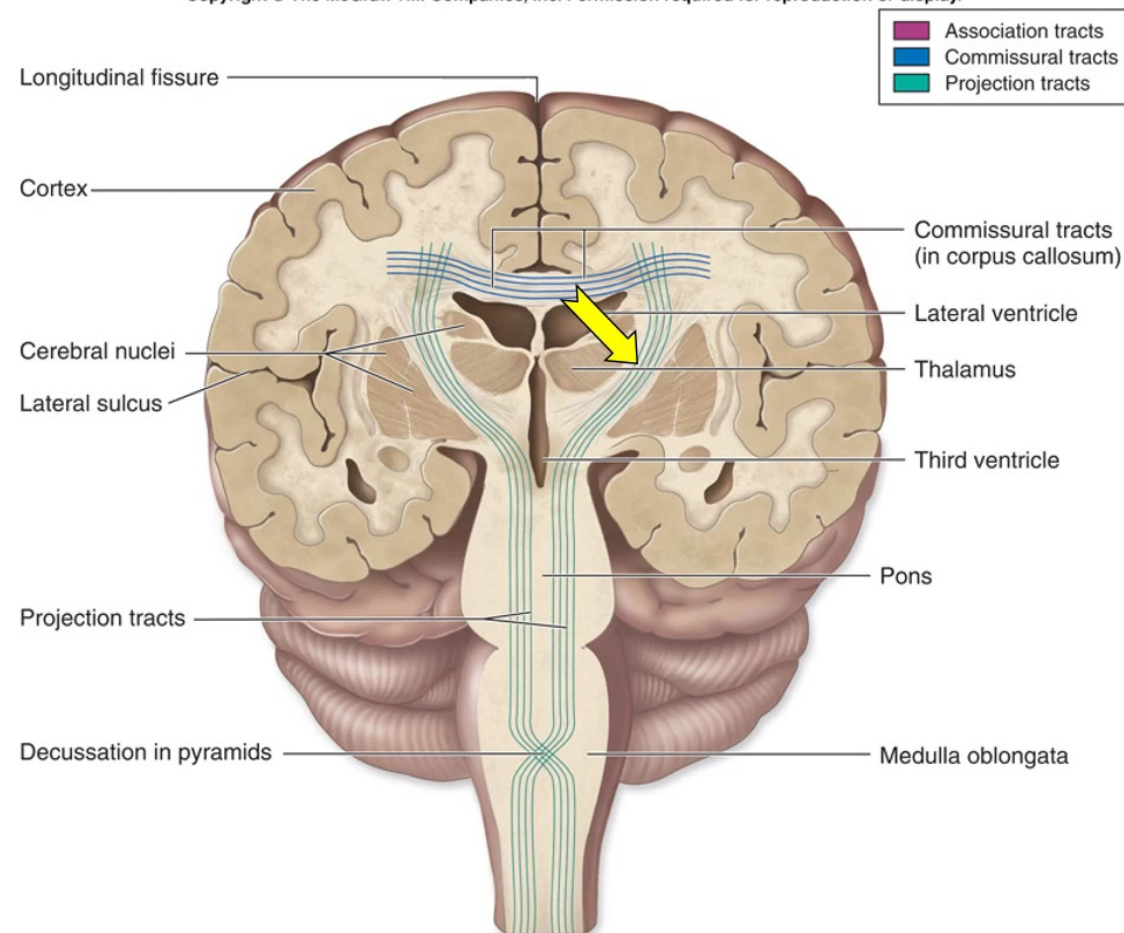
# Striatum

1. Caudate nucleus
2. Lentiform nucleus
3. Internal capsule



# Basal Nuclei & Internal Capsule

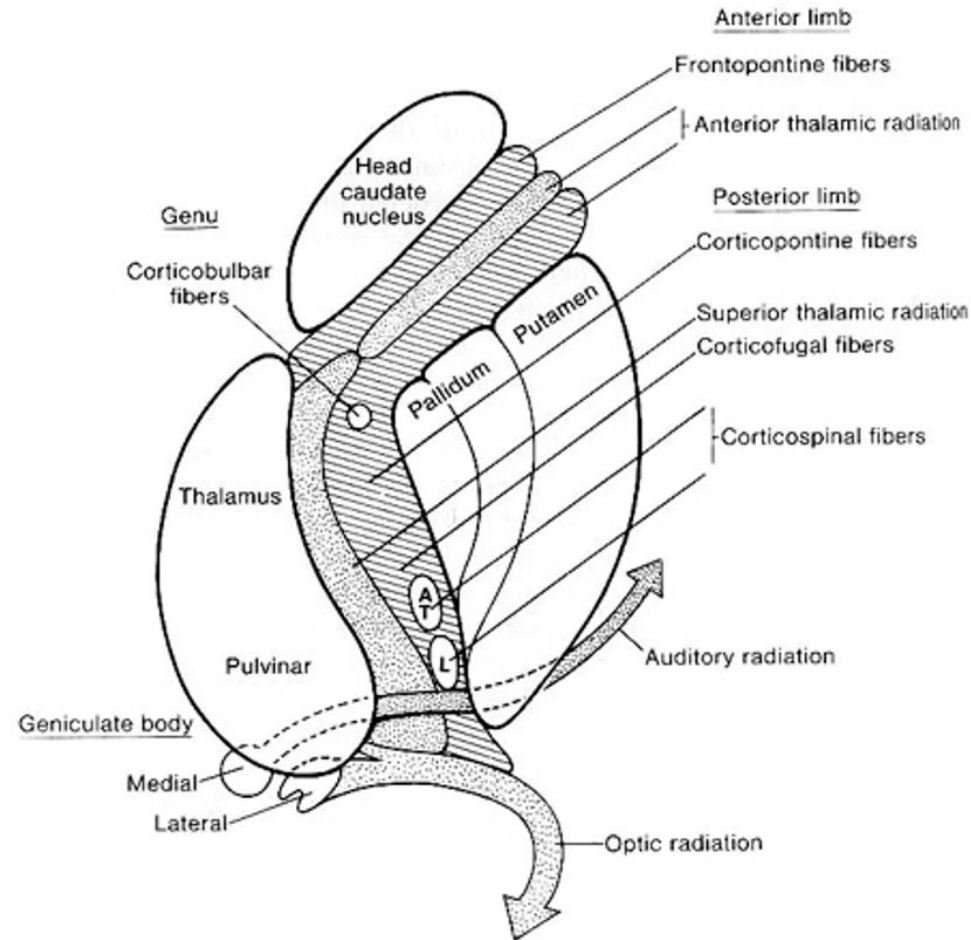
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(b) Coronal section

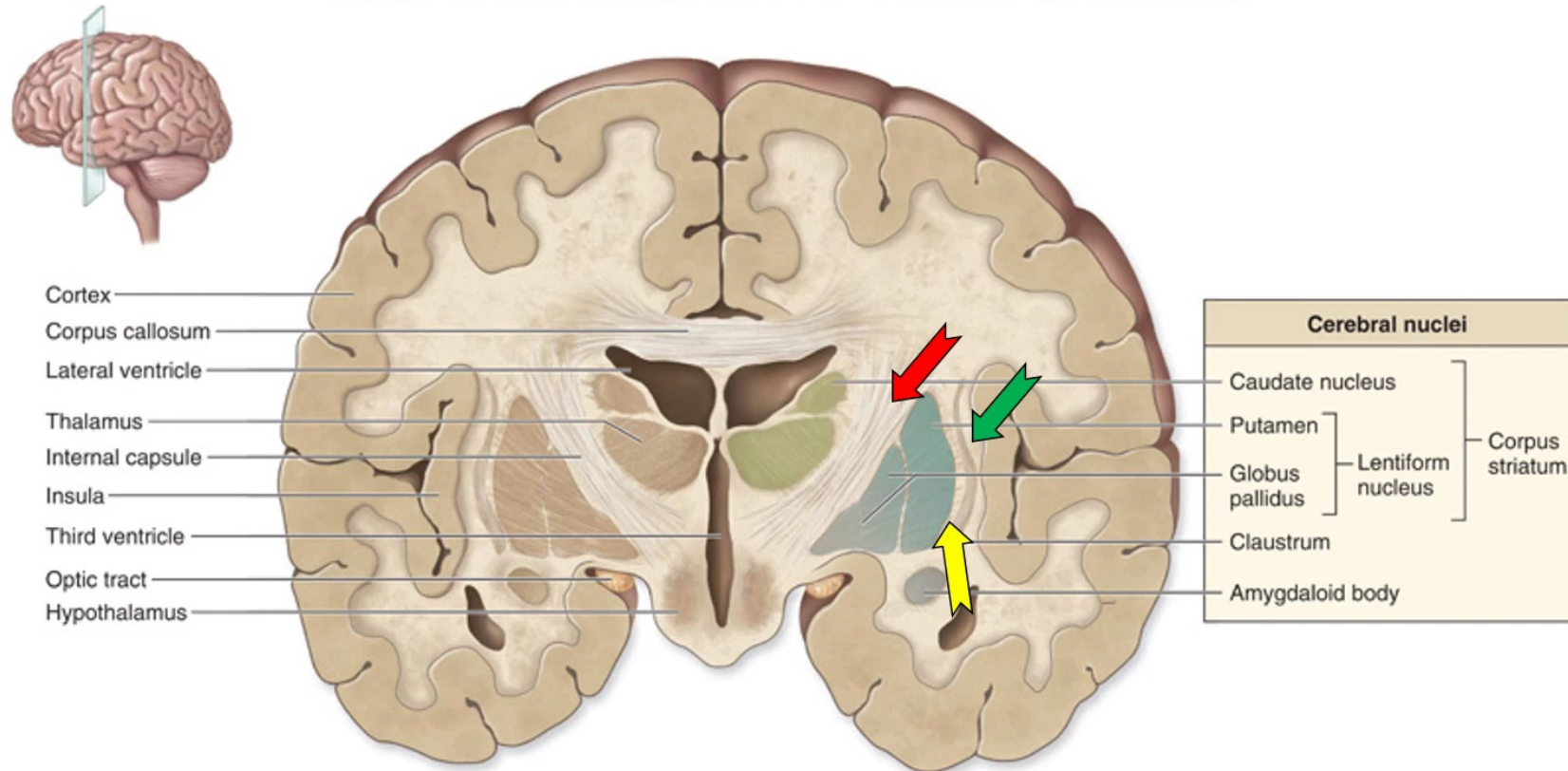


# Basal Nuclei & Internal Capsule



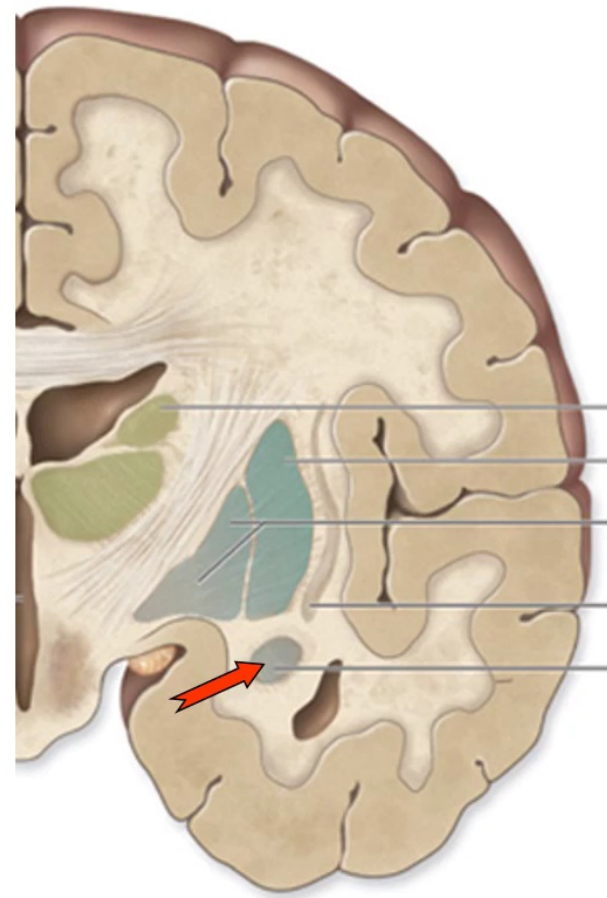
# • Basal Nuclei & Internal Capsule

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# The Amygdaloid Nucleus

- Small rounded mass
- Lies mostly in the Uncus
- Joined to the tail of the Caudate Nc
- Fuses with the
  - Cerebral Cortex lateral to the
  - Anterior perforated substance
- Smell Centre



# Basal Nuclei Function

- Cooperate with the cerebral cortex in controlling movements
- Receive input from many cortical areas
- Evidence shows that they:
  1. Start,
  2. stop, and
  3. regulate intensity of
  4. voluntary movements
  5. In some way estimate the passage of time



# Basal Nuclei Function

1. Inhibition of Muscle Tone
2. Control complex pattern voluntary movement
3. Planning & programming of movement

1. Caudate circuit

2. Putamen circuit

- BN control opposite side of the body



# Basal Nuclei Function

- **Caudate circuit**

1. **Cognitive control**

1. Thoughts → planned motor activity
2. Pattern
3. Together
4. Sequence

2. **Time control**

- How rapid

3. **Scale control**

- How large



# Basal Nuclei Function

- **Putamen circuit**
  - Subconscious learned pattern movement
    1. Alphabet writing
    2. Familiar automatic movement



# Basal Nuclei Functions

1. Motor planning, sequencing, learning, maintenance
2. Rule-based and habit (reinforcement) learning
3. Predictive control
4. Working memory
5. Attention
6. Switches in behavioral set



# Connection of Neostriatum (Caudate & Putamen)

## 1) Input

### 1. Cortico Striate

1. Cholinergic
2. From all lobes including
3. Motor & Premotor cortices

### 2. Nigro Striate

1. Dopaminergic
2. From Pars Compacta of Substantia Nigra



# Connection of Neostriatum (Caudate & Putamen)

## 2) Output

### 1. Striato Pallidal

#### 1. To Globus Pallidus

### 2. Striato Nigral

#### 1. To Pars Reticulata of Substantia Nigra



# Connection of Globus Pallidus

## 1) Input

1. Striato Pallidal
2. Subthalamico Pallidal



# Connection of Globus Pallidus

## 2) Output (3 Bundles)

1. Ansa Lenticularis +
2. Fasciculus Lenticularis

→ To Anterior Ventral Nc of Thalamus

1. Fasciculus Subthalamicus

→ To Subthalamic Nc



# Connection of Subthalamic Nucleus

1. Functionally interposed between the
  1. External & Internal segments of
  2. Globus Pallidus
2. Indirect motor loop of the Basal Nuclei



# Connection of Substantia Nigra

## 1. Pars Compacta

### 1. Ascending Nigro Striatal F

1. Dopaminergic
2. To Neostriatum

## 2. Pars Reticulata

1. Similar to Globus Pallidus
2. Oculomotor loop of BN



# Thank You

