ANATOMY & DEVELOPMENT OF PITUITARY GLAND

Department of human Anatomy and Embryology
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By

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Intended Learning Outcomes (ILOs)

1. Describe anatomy of pituitary gland (parts, relation & blood supply).
2. Describe development of pituitary gland.
3. Summarize congenital anomalies of pituitary gland.

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Agenda

1. Anatomy of pituitary gland (parts, relation & blood supply).
2. Development of pituitary gland.
3. Congenital anomalies of pituitary gland.

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Anatomy of Pituitary Gland

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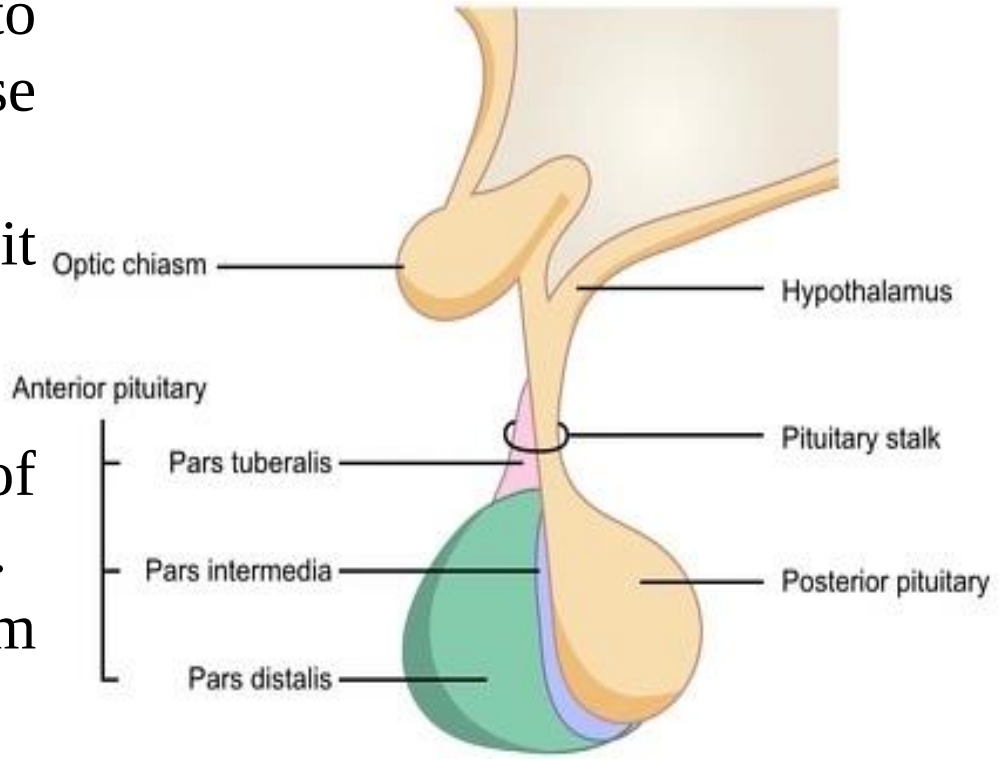
Introduction

- The pituitary gland is an endocrine gland that works to maintain cellular **homeostasis** in the body by the release of different hormones.
- The pituitary gland is also called the **master gland** as it regulates the other endocrine glands.
- **Regulated by the secretions of the hypothalamus**.
- The pituitary gland is attached to the hypothalamus of the forebrain by a single stalk called the i**nfundibulum**.
- The term ‘pituitary’ is derived from the Latin term ‘**pituita**’, meaning **phlegm** or **slime**.
- The gland is present posterior and superior to the sphenoidal sinus in the depression called the **Sella turcica**.



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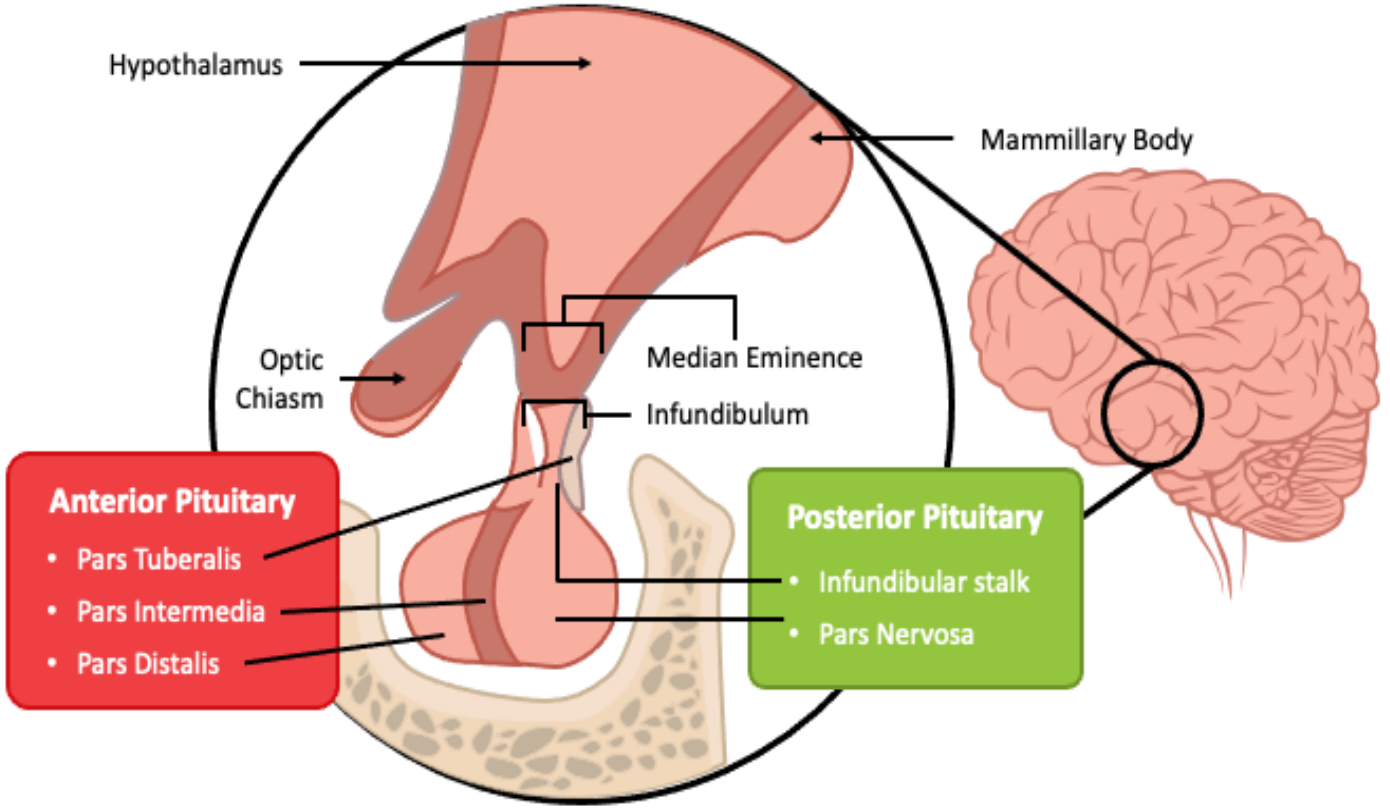
Site: Hypophyseal fossa (**Sella turcica**) covered by Diaphragma Sella

Shape & Size: **oval** in outline (12mm X 8mm)

Connected to hypothalamus by infundibulum



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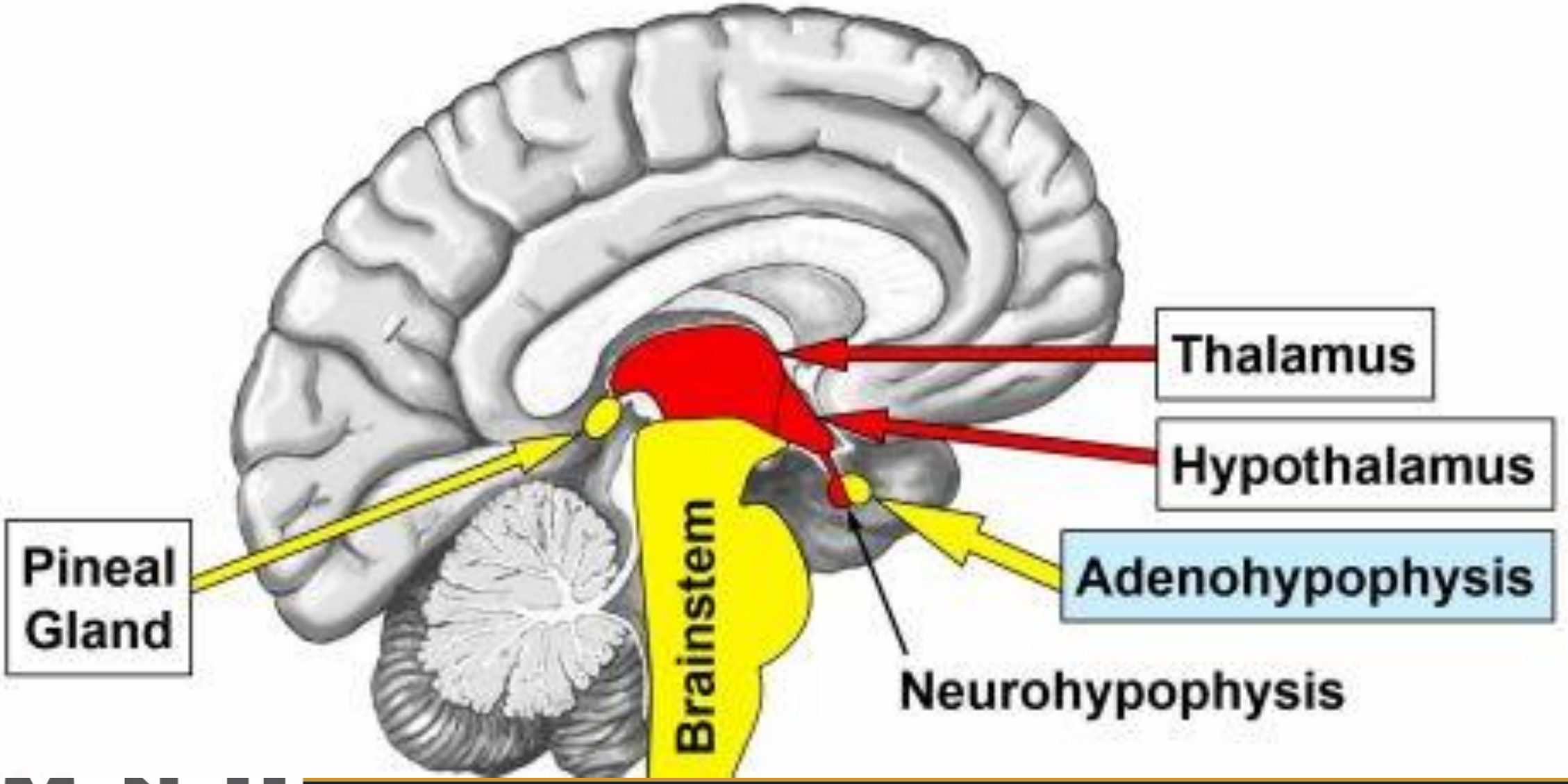

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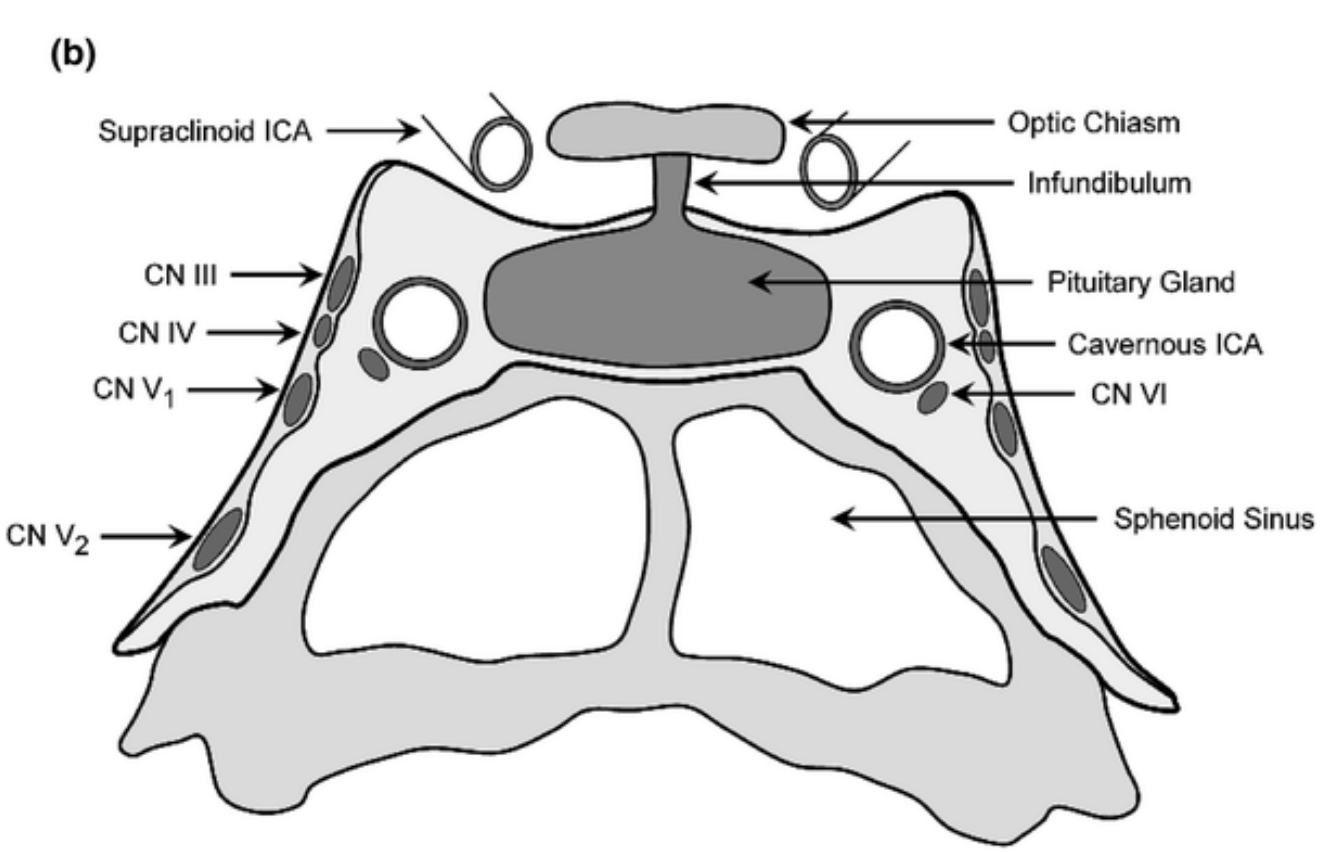
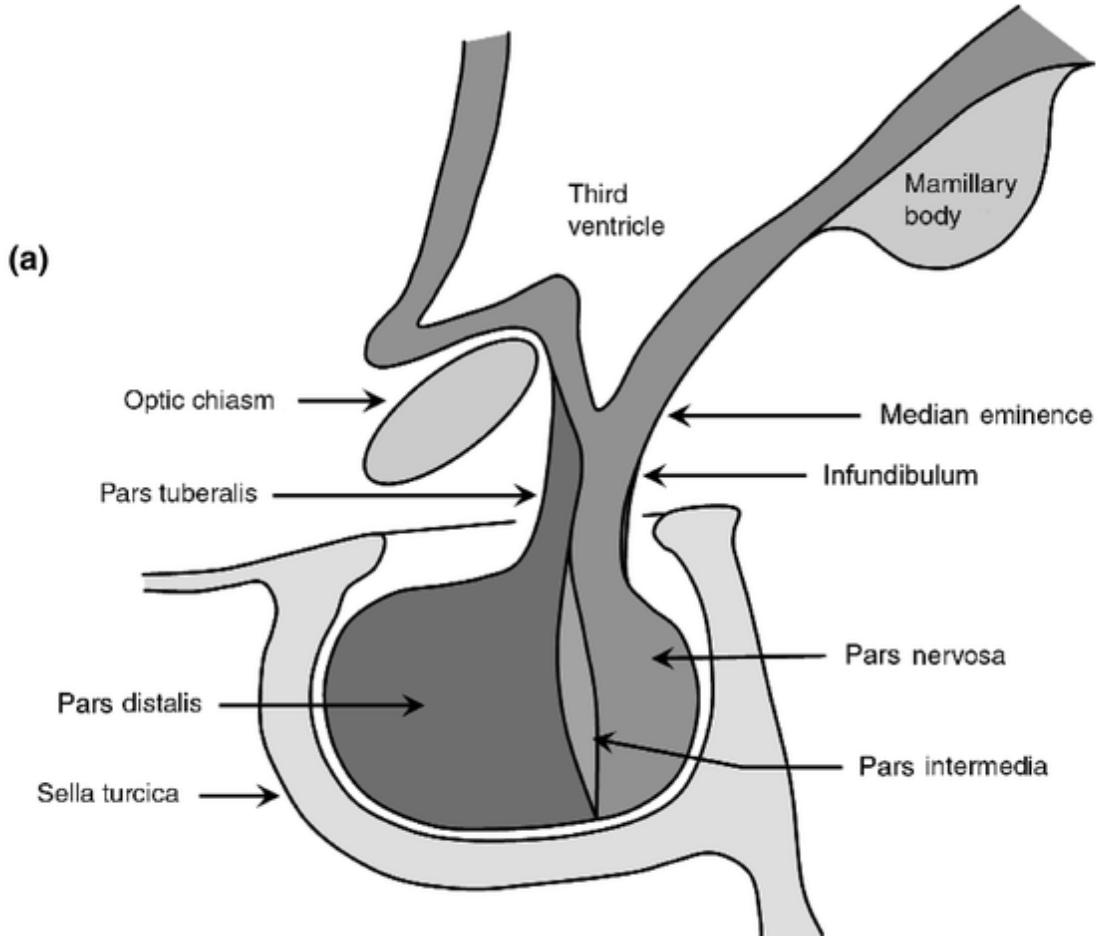

(b)
Supraclinoid ICA
Optic Chiasm
Infundibulum
CN III
Pituitary Gland
CN IV
Cavernous ICA
CN V1
CN VI
CN V2
Sphenoid Sinus


(a)
Third ventricle
Mamillary body
Optic chiasm
Median eminence
Pars tuberalis
Infundibulum
Pars nervosa
Pars distalis
Pars intermedia
Sella turcica

Lobes of pituitary gland

It is composed of two lobes:

anterior and posterior

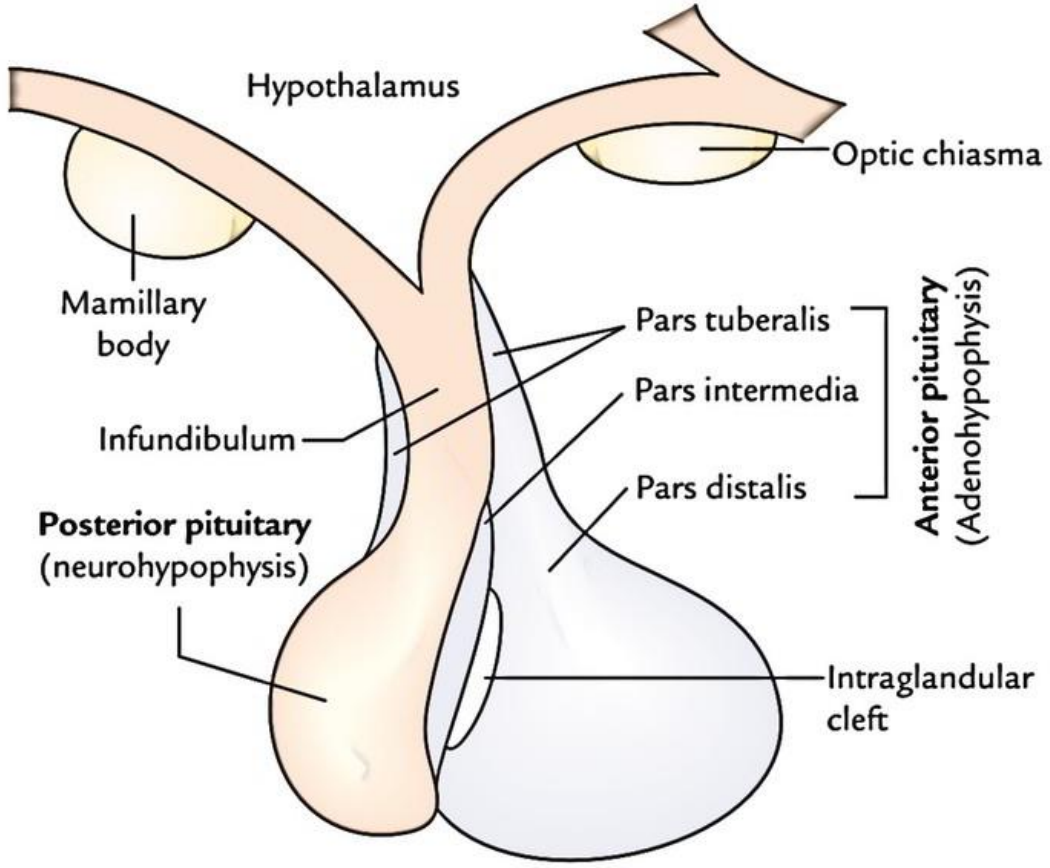
1. **Adenohypophysis (anterior lobe):**

composed of:

A. Pars tuberalis: upwards in front of the infundibulum

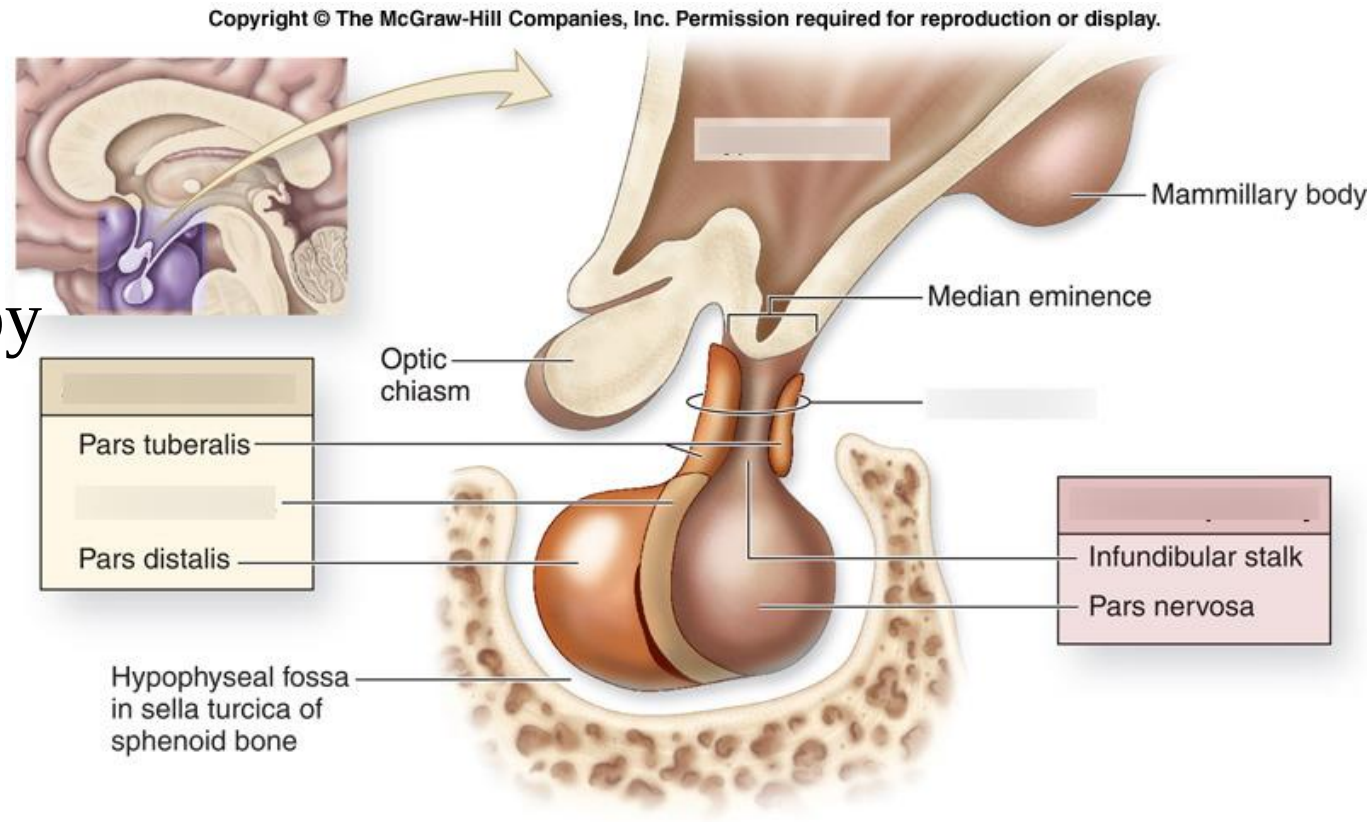
B. Pars intermedia: (at the back of the cleft)

C. Pars distalis: (in front of the cleft)



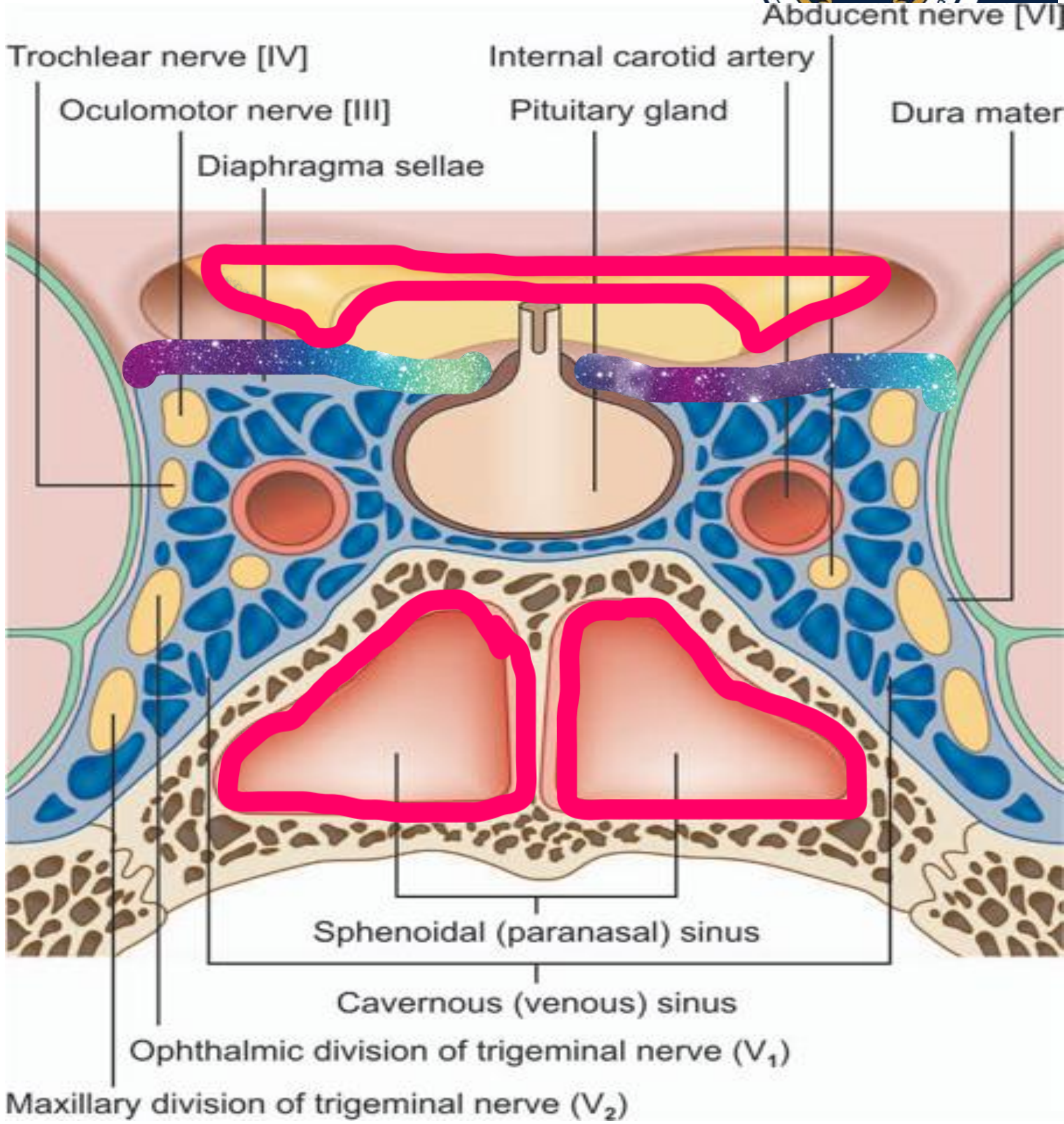
2. Neurohypophysis (posterior lobe):

- Small and lies at the back of the anterior lobe.
- Connected with the hypothalamus by the **infundibulum** (stalk).
- The stalk pierces the central part of Diaphragma Sellae.
- Its lower end is called **pars nervosa.**



Relations

- **Superiorly:** Diaphragma sellae separating it from the Optic chiasma
- **Inferiorly:** body of the sphenoid & sphenoidal air sinuses. (separating it from the nasopharynx)

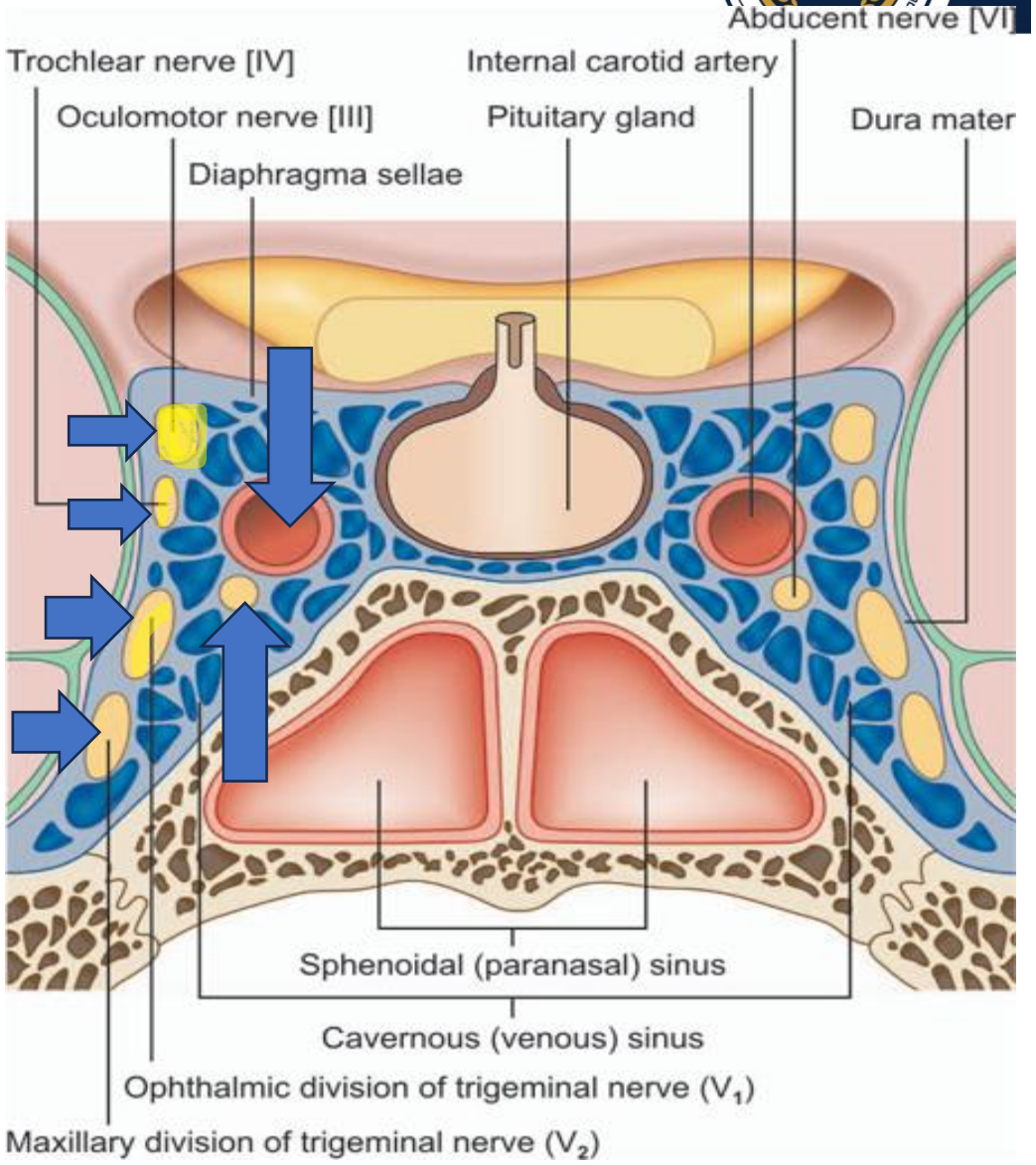


Relations

- **On each side:** the **cavernous sinus** and its contents.

1. In its lateral wall (Nerves): oculomotor, trochlear, abducent, ophthalmic (V1) and maxillary (V2).

2. In the floor (Artery & nerve): internal carotid artery and abducent nerve.



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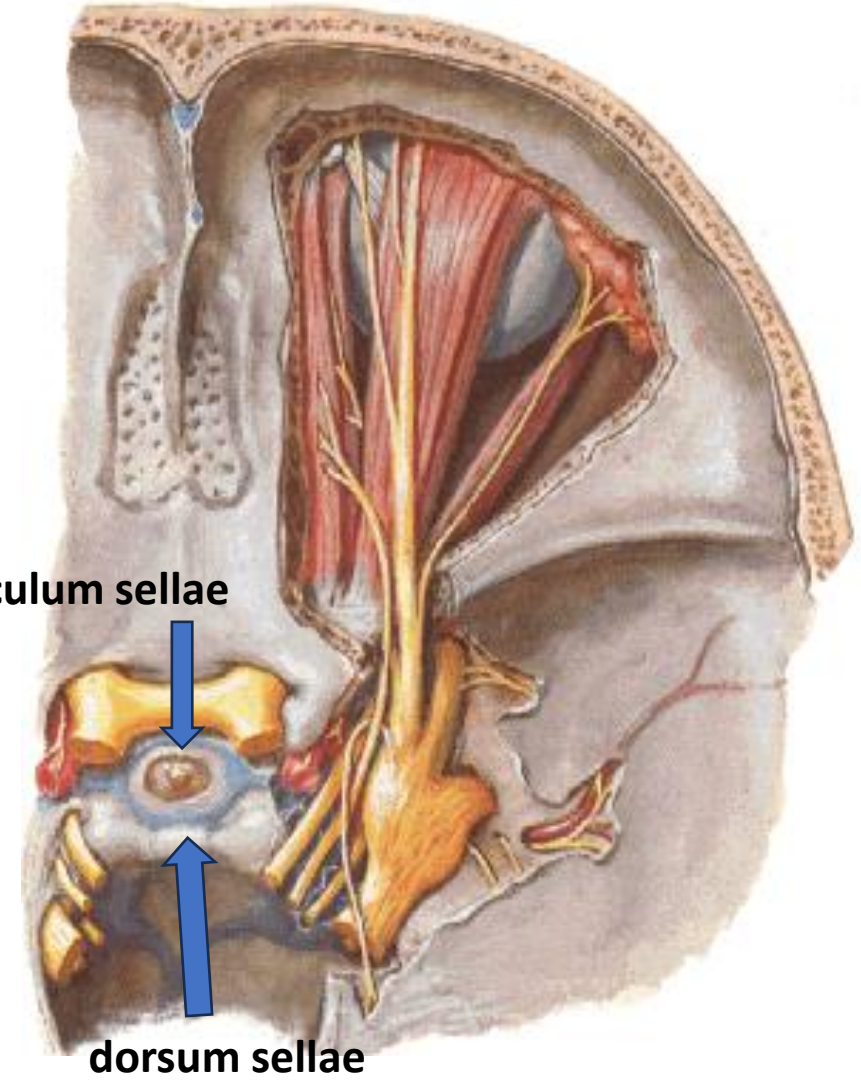
Relations

- **Anteriorly:** the tuberculum sellae (separating it from the optic chiasma)
- **Posteriorly:** the dorsum sellae (separating it from the pons)



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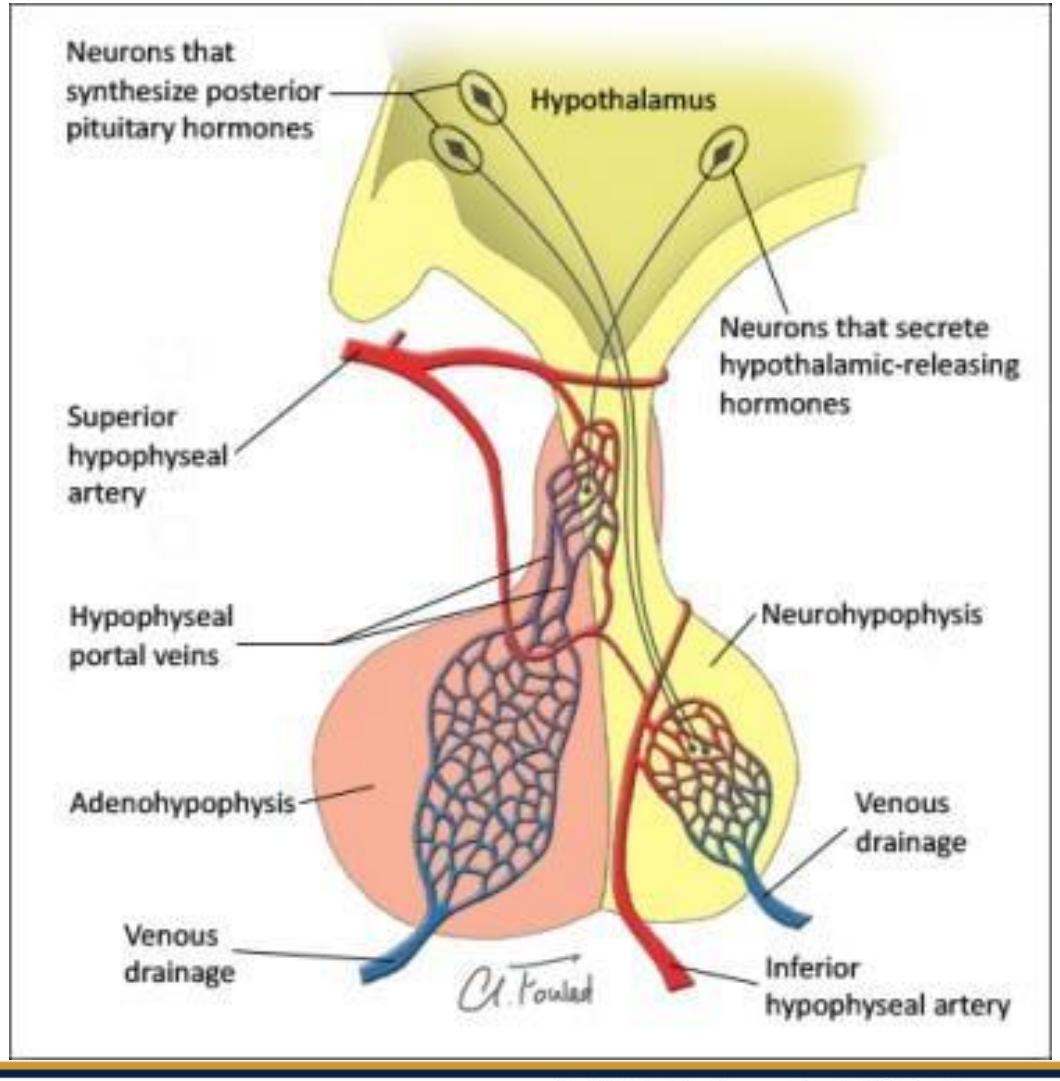
Arterial supply

1. Superior hypophyseal artery: branches from the **internal carotid artery,** supplies the **anterior lobe**

2. Inferior hypophyseal artery: branches from the **internal carotid artery,** supplies the **posterior lobe**.



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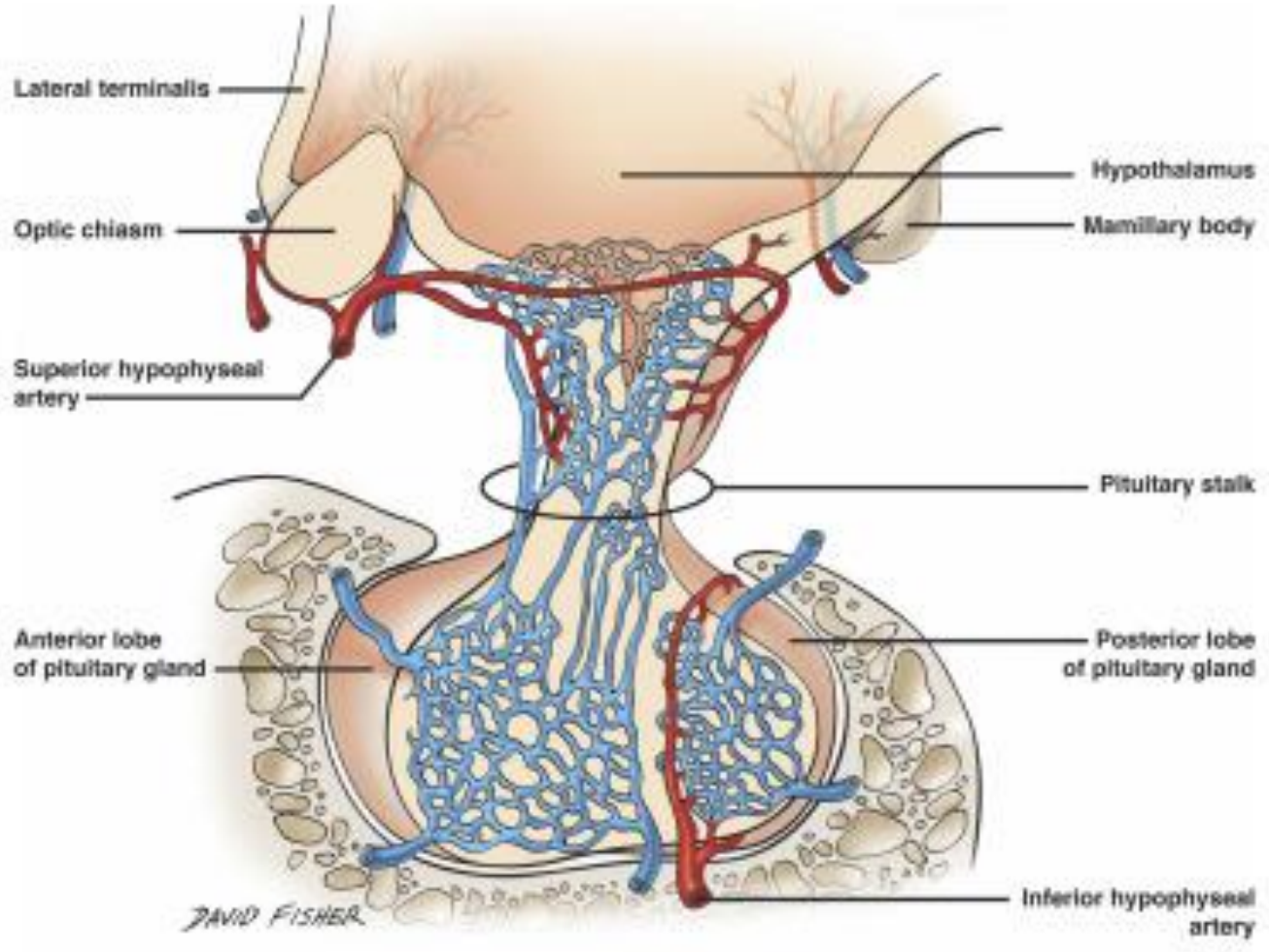
Venous drainage:

Short veins drain in the surrounding venous sinuses (**cavernous and intercavernous sinuses**).



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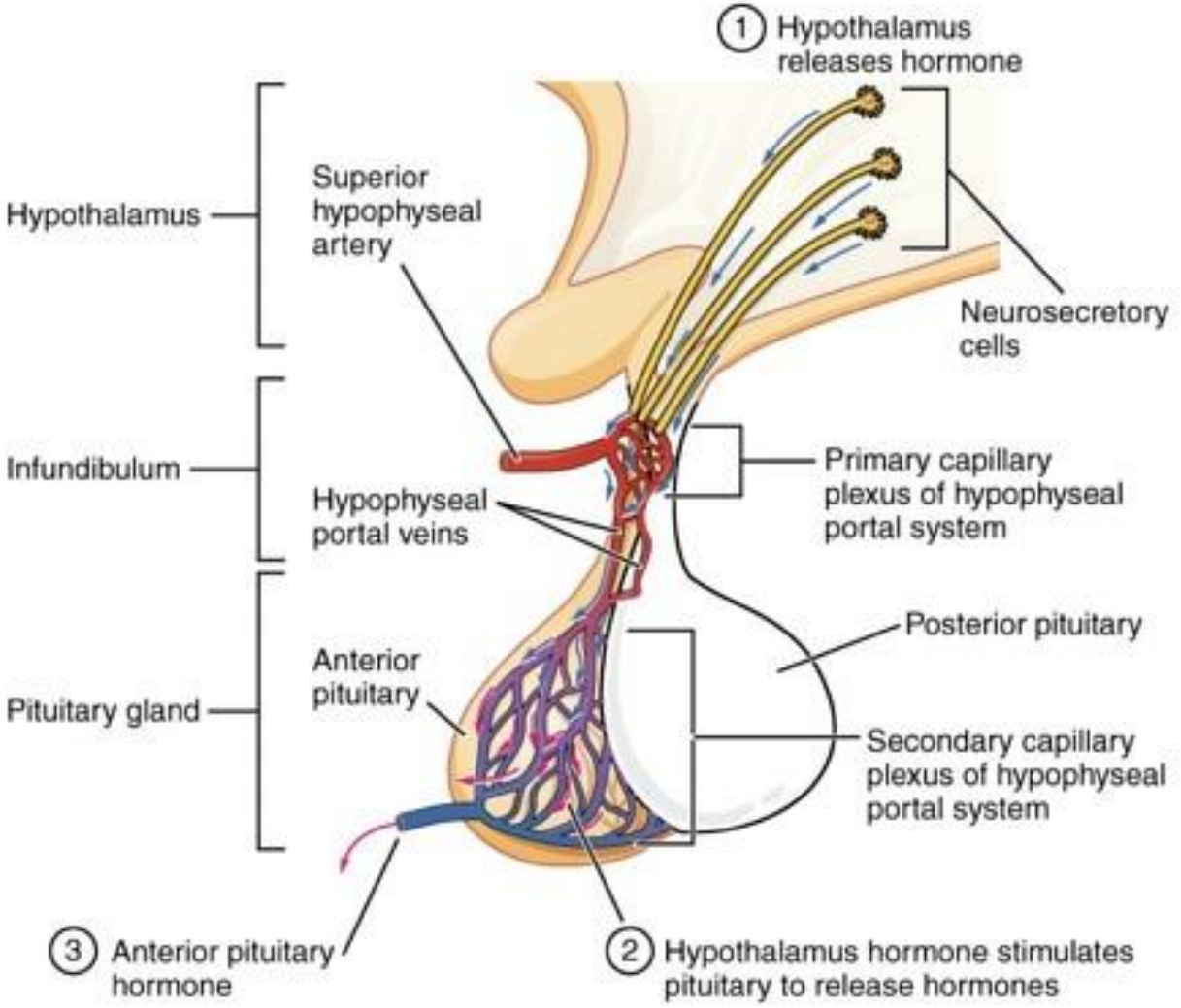
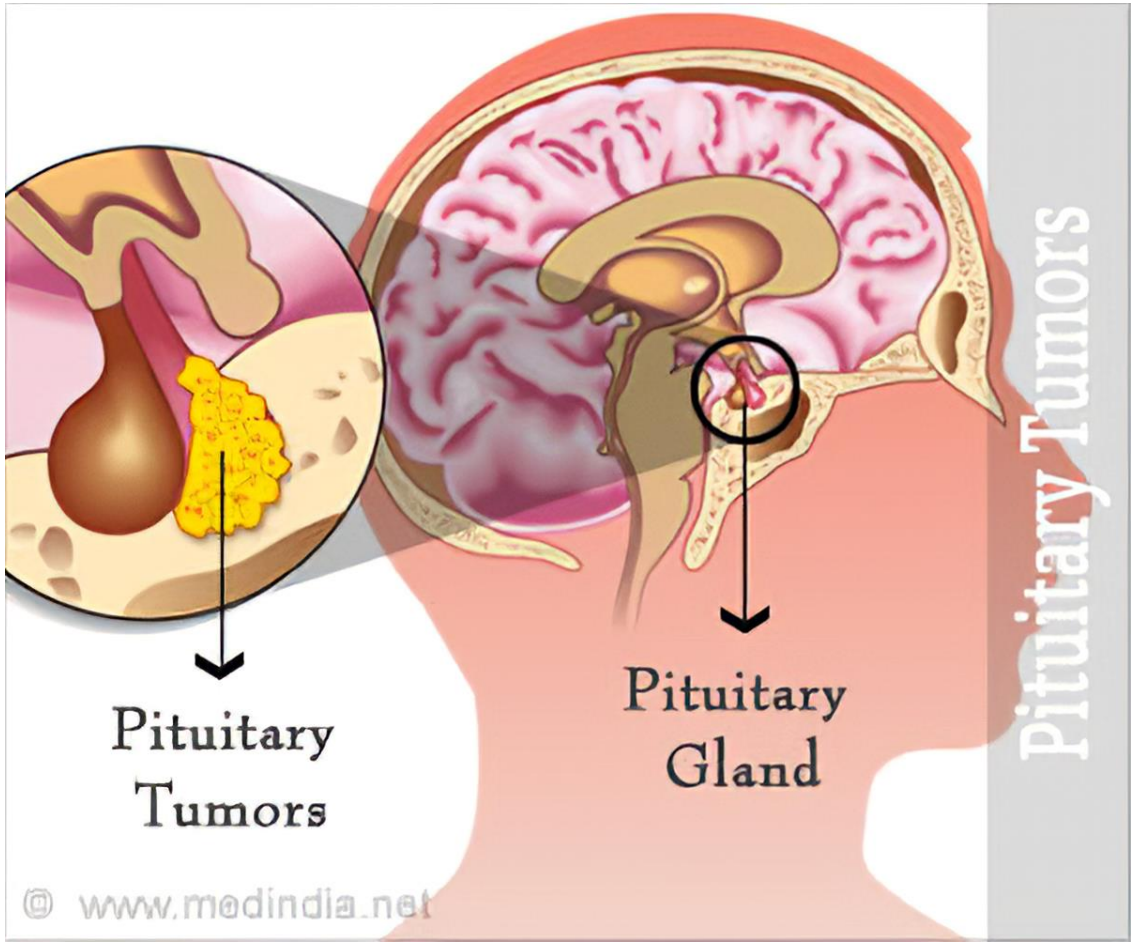
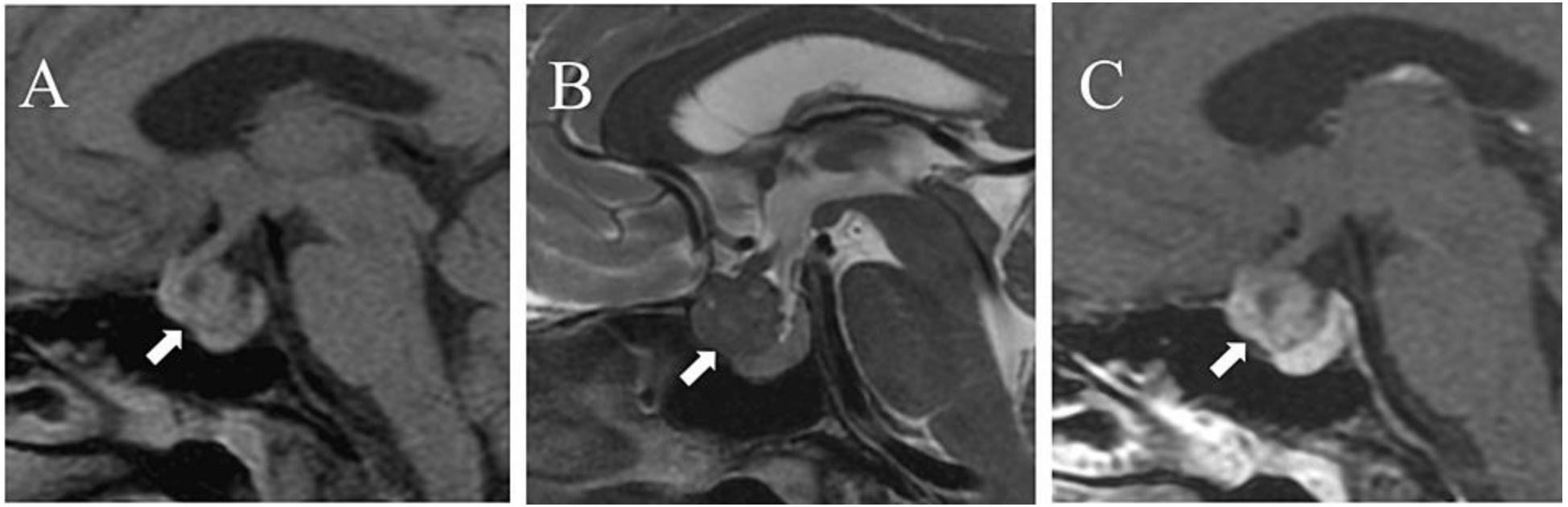

1 Hypothalamus releases hormone
Hypothalamus
Superior hypophyseal artery
Neurosecretory cells
Infundibulum
Primary capillary plexus of hypophyseal portal system
Hypophyseal portal veins
Posterior pituitary
Anterior pituitary
Pituitary gland
Secondary capillary plexus of hypophyseal portal system
3 Anterior pituitary hormone
2 Hypothalamus hormone stimulates pituitary to release hormones

Clinical Note

Tumors of the pituitary gland tend to occlude the **internal carotid artery** and press the **abducent nerve** before affecting the other cranial nerves in the sinus.



Ectopic Pituitary Neuroendocrine Tumor



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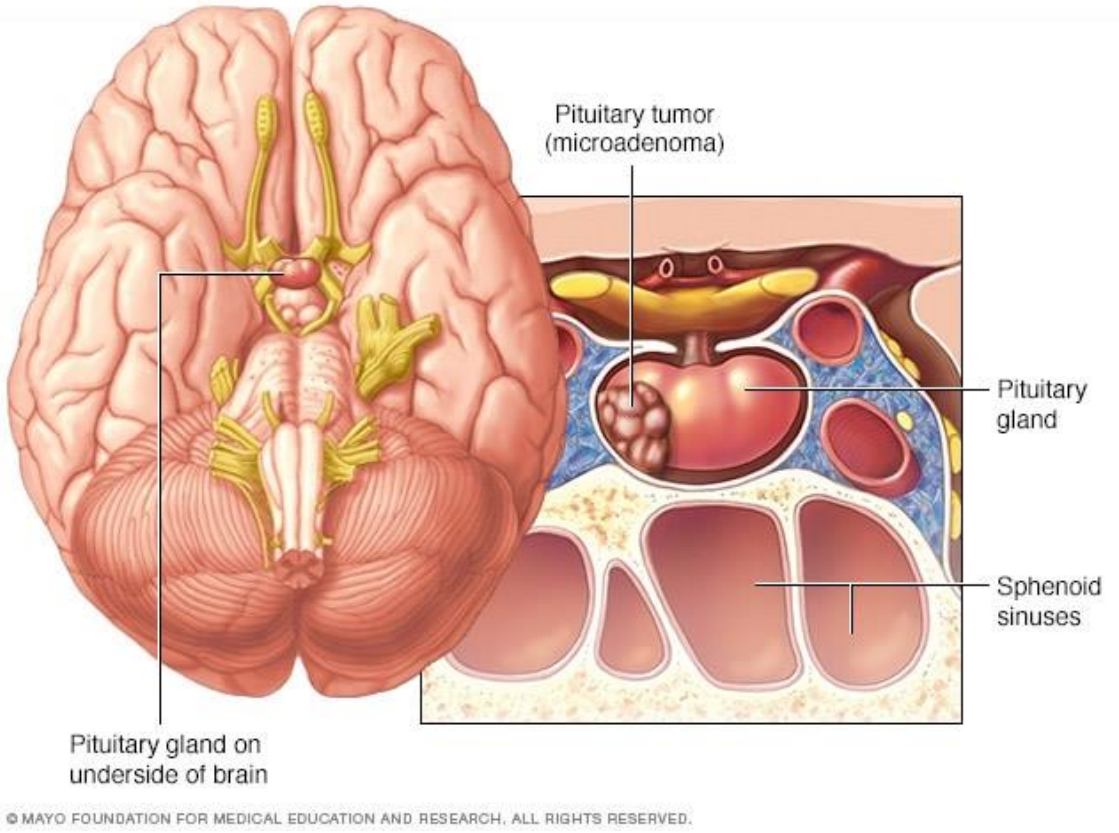
Surgical Considerations

- A nonfunctioning adenoma only gets surgically resected when the tumor causes compression or mass effect to the adjacent structures like the **optic chiasm** causing **bitemporal hemianopsia** field defect.
- **Transsphenoidal surgery** is a commonly chosen procedure for resection,



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Development of Pituitary Gland

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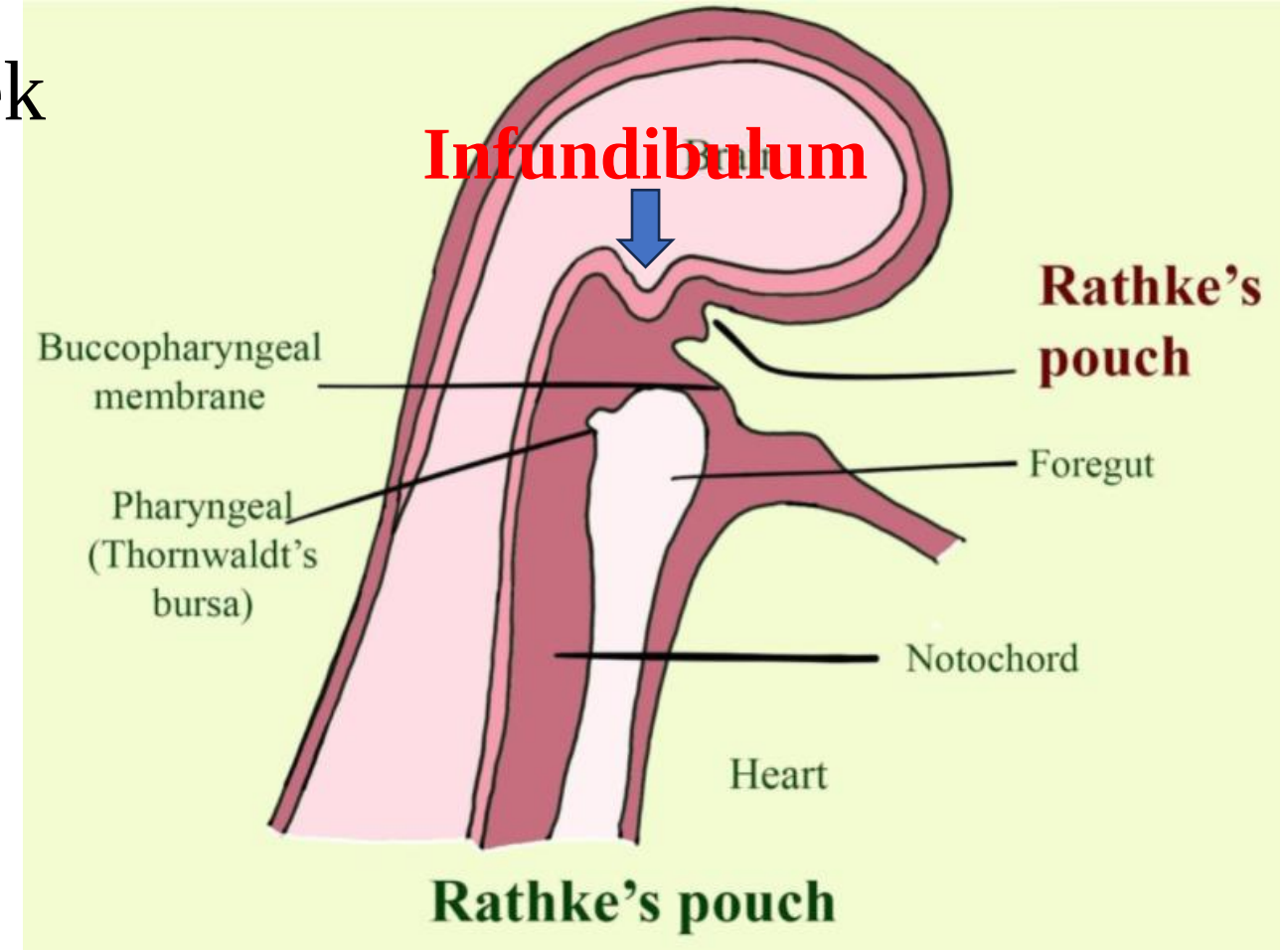
Development of Pituitary Gland

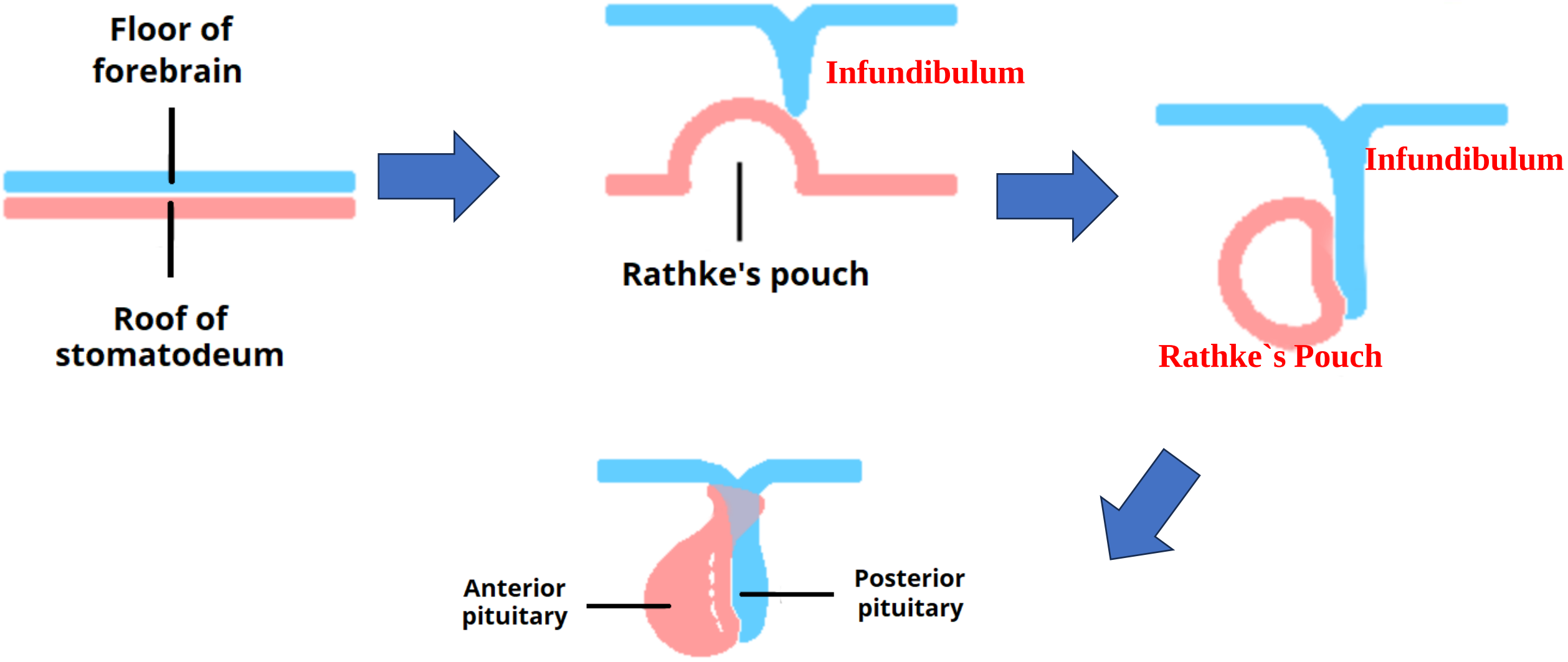
Time: at the middle of the 4th week

Sources: hypophysis cerebri develops from **two ectodermal sources:**

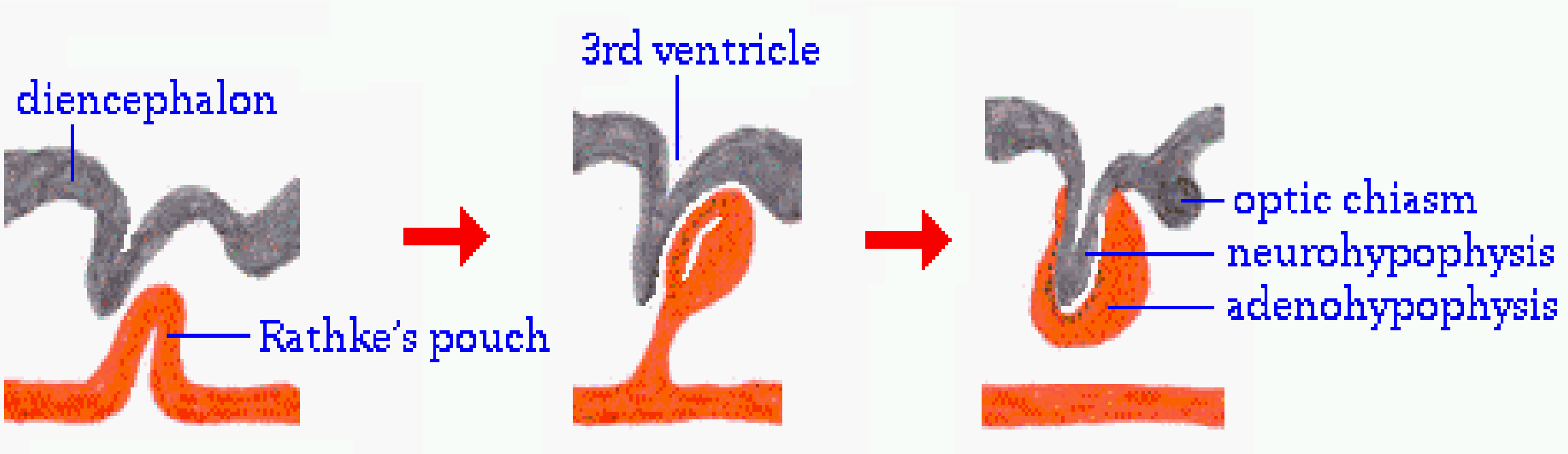
I. Adenohypophysis (Rathke`s pouch)

II. Neurohypophysis (Infundibulum)

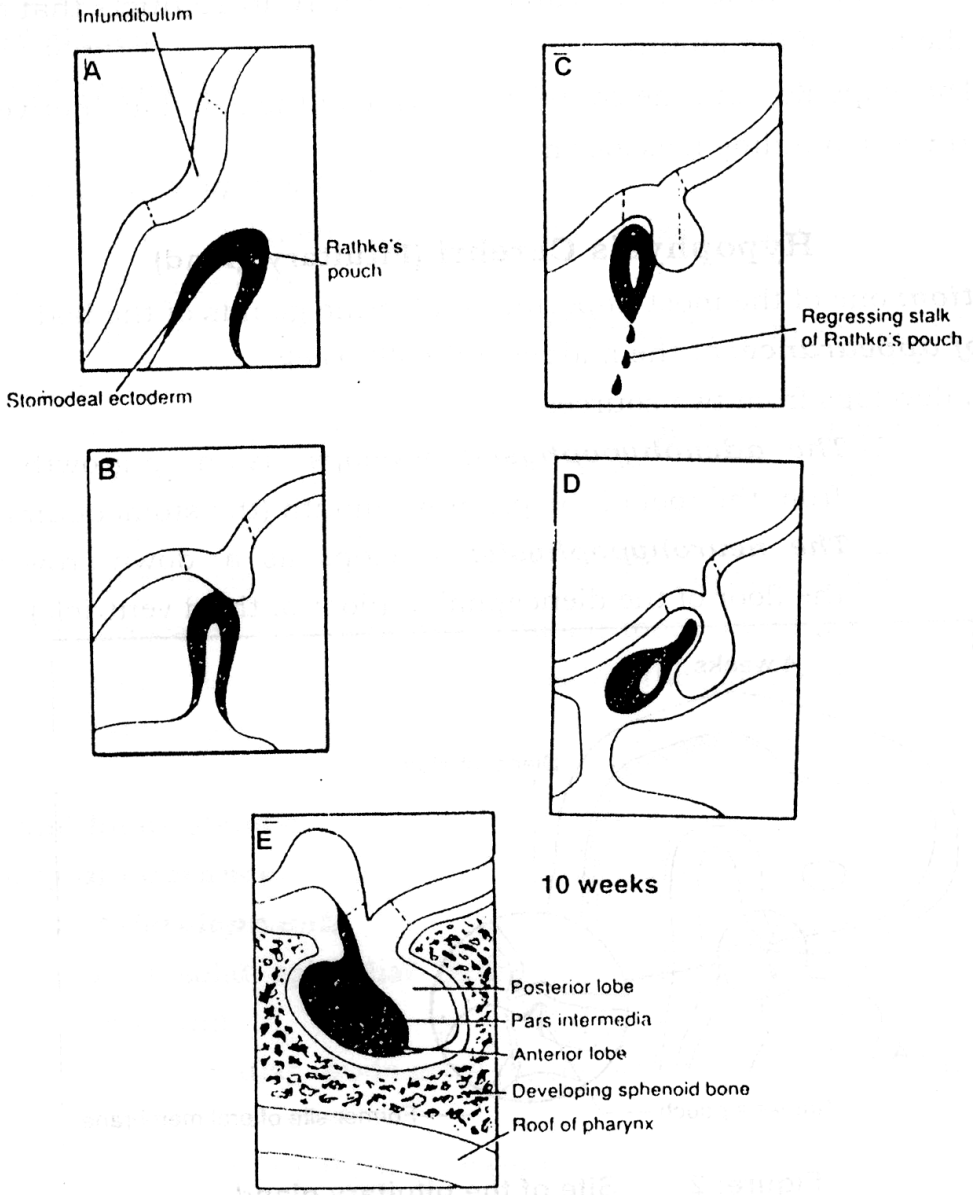



Floor of forebrain
Roof of stomatodeum
Infundibulum
Rathke's pouch
Infundibulum
Rathke`s Pouch
Anterior pituitary
Posterior pituitary

Stages of development of pituitary gland



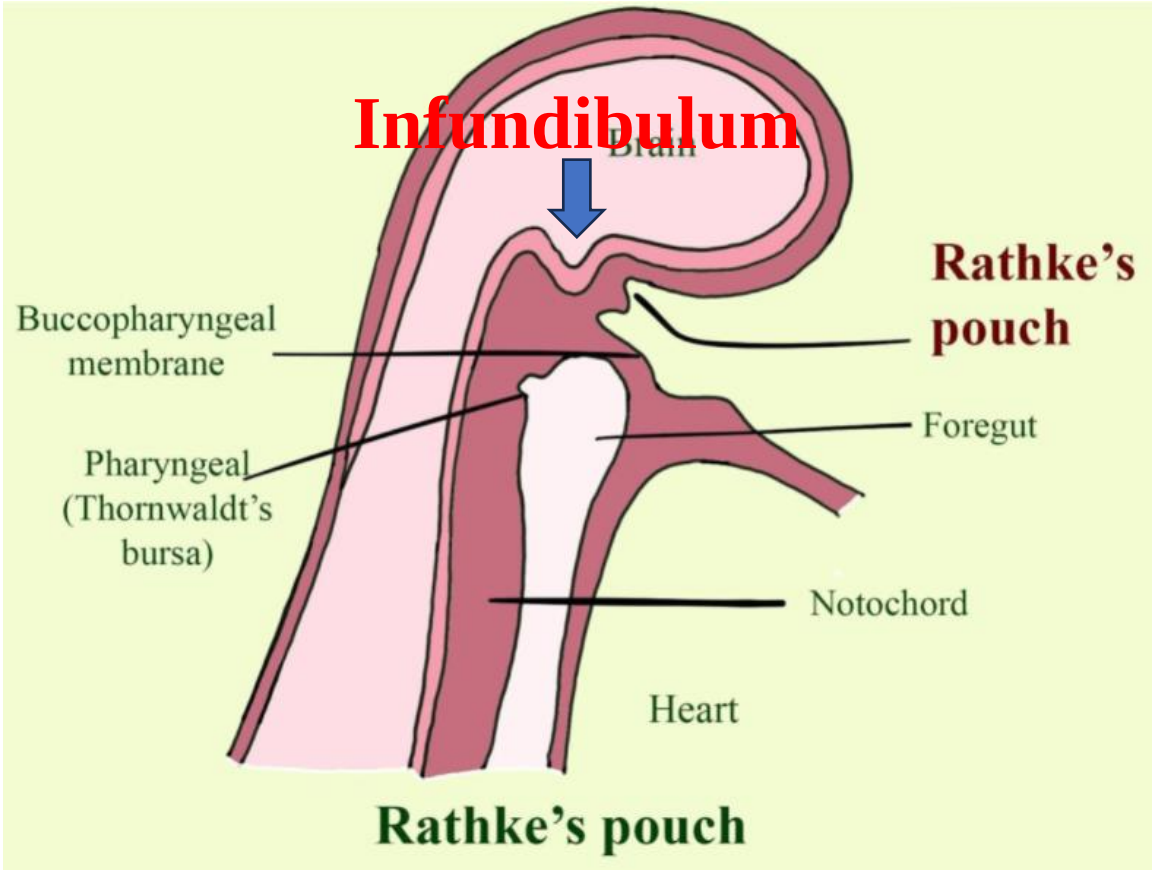
Stages of development of pituitary gland



Development of pituitary gland

I. Adenohypophysis :

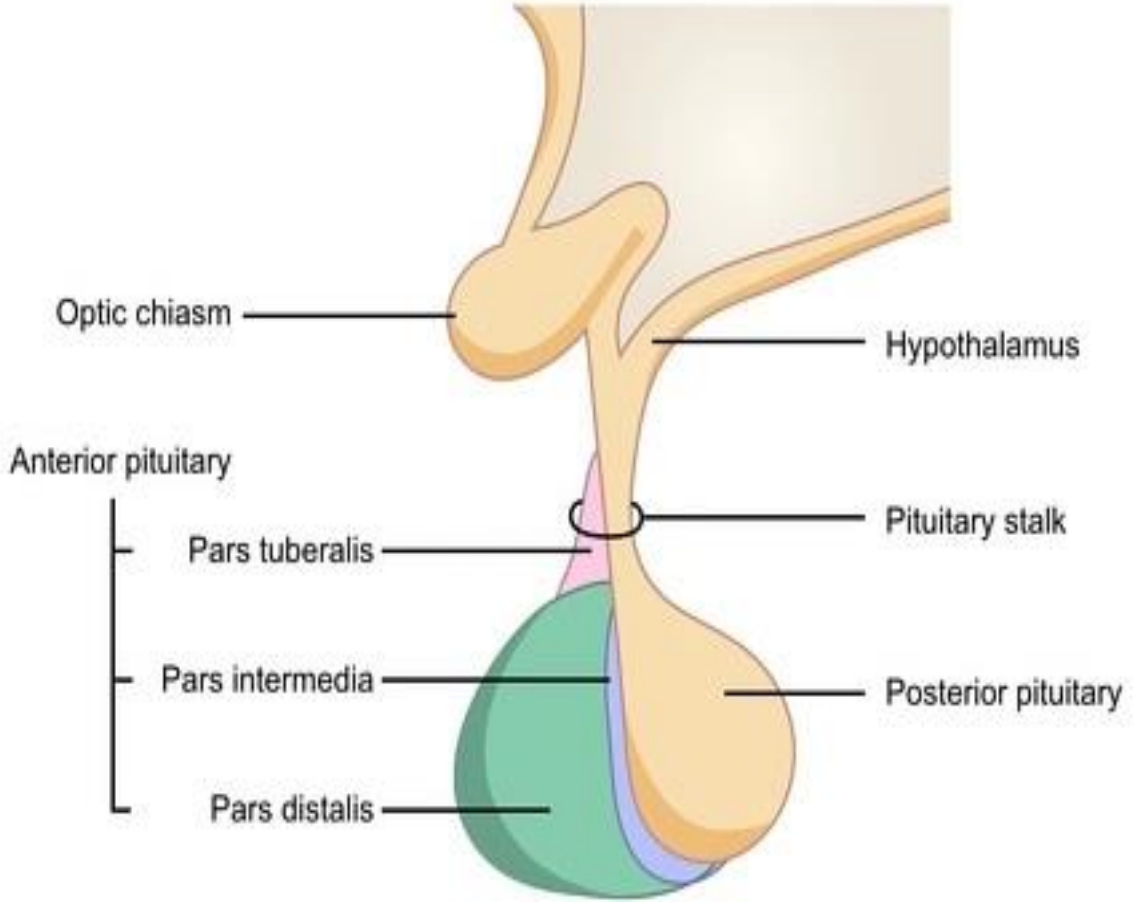
- It is an **ectodermal** diverticulum (upgrowth), arises from the **roof of the stomodeum.**
- It **ascends towards the floor of the diencephalon** where it swells to form a vesicle.



The stem connecting this vesicle to the roof of the stomodeum degenerates

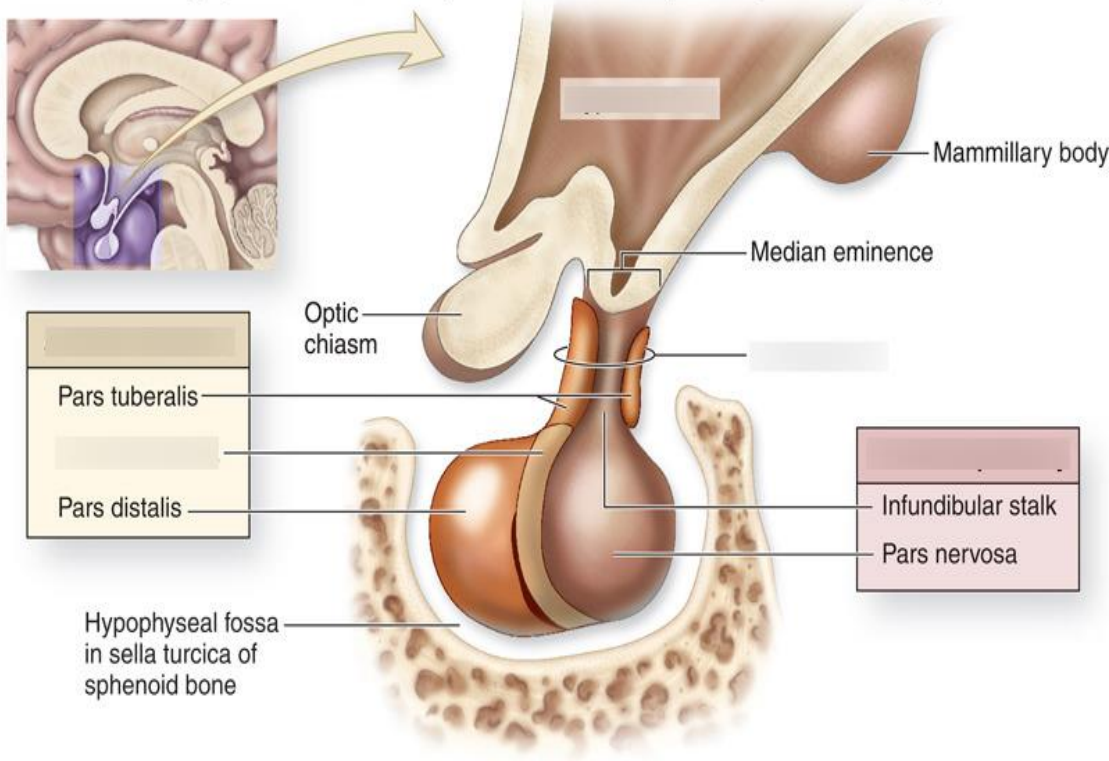
The vesicle differentiate to form the anterior lobe of pituitary gland (adenohypophysis), as follows:

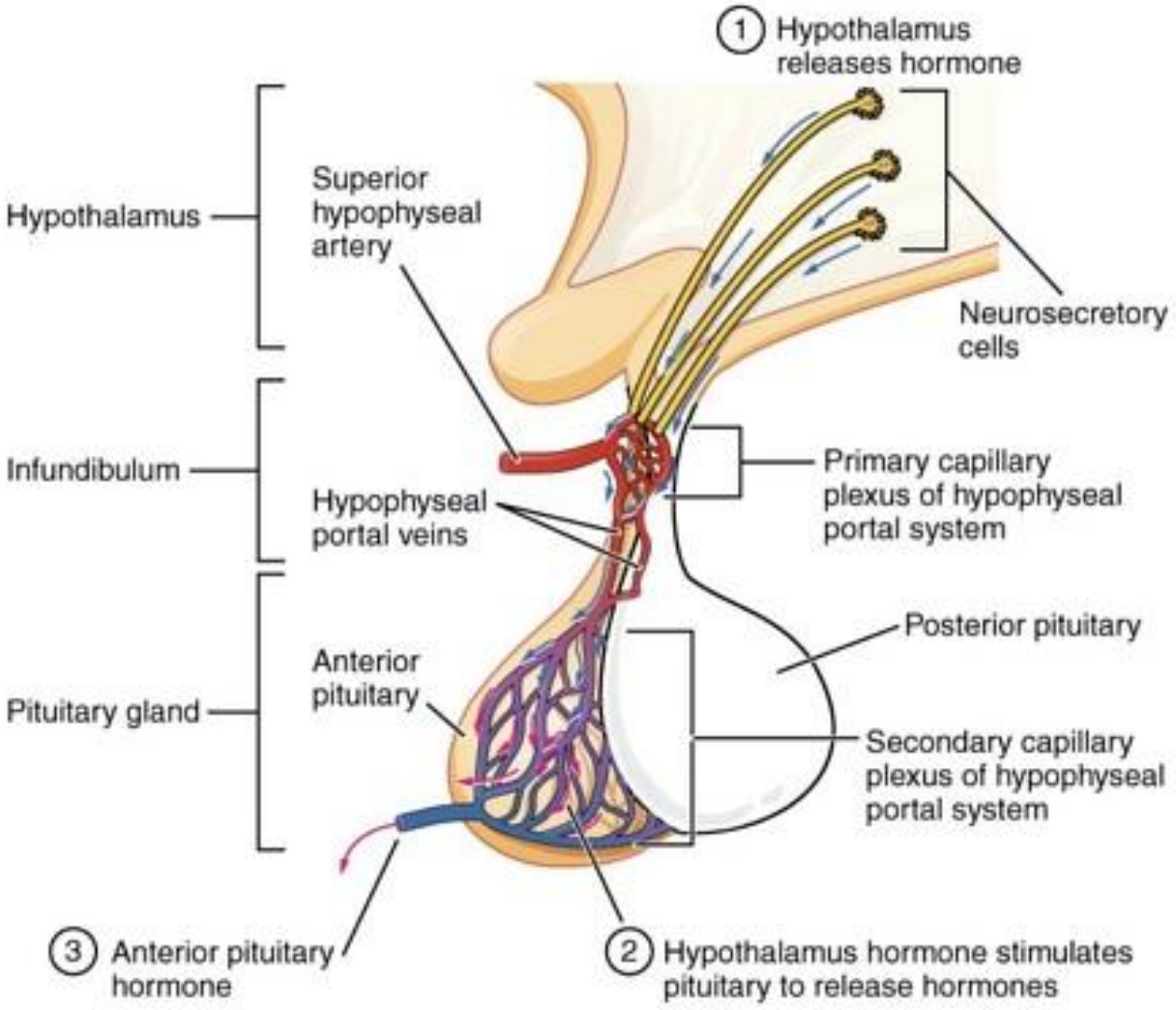
a. **Pars anterior (pars distalis)**: is derived from the anterior wall of the vesicle
b. **Pars intermedia**: is derived from the posterior wall of the vesicle
c. **Pars tuberalis**: is an upward extension of the wall of the vesicle to surround the stalk of the infundibulum which descends from the diencephalon.

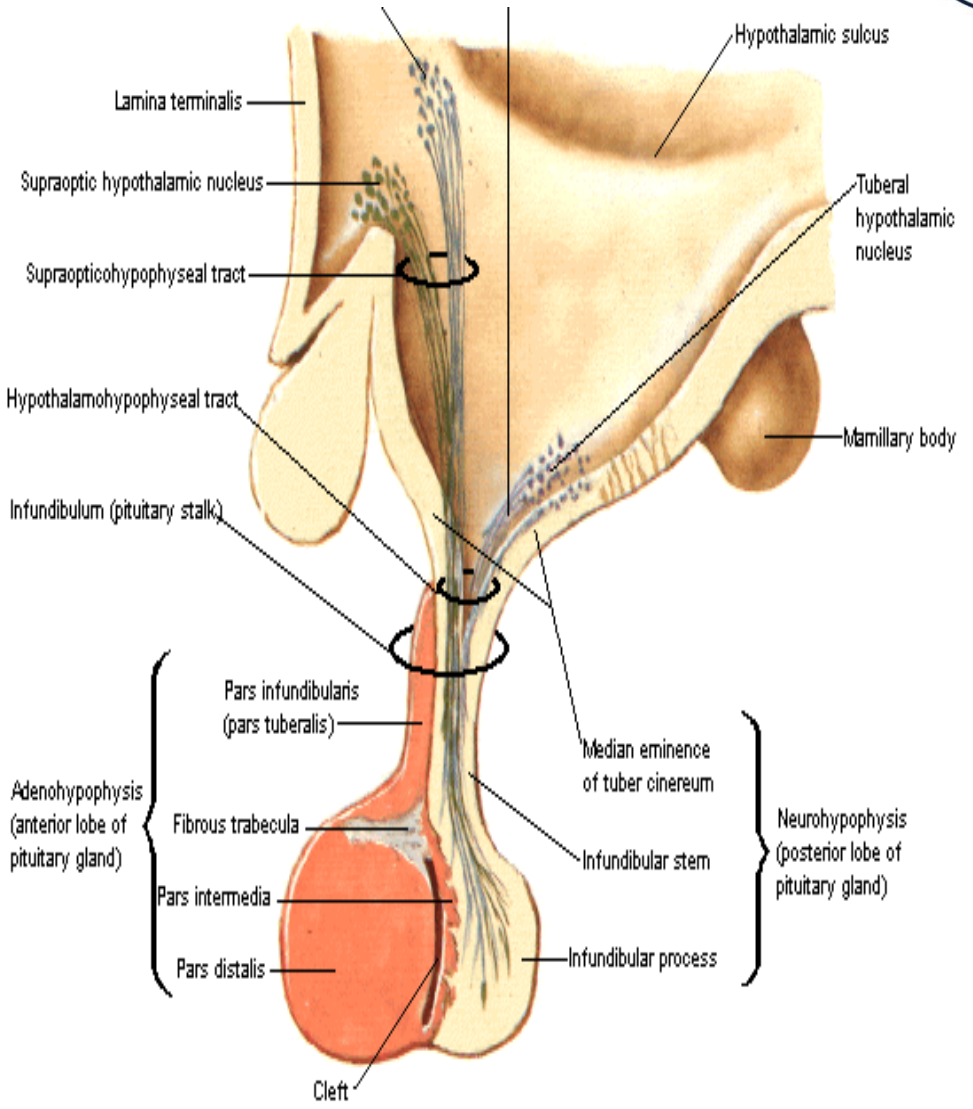


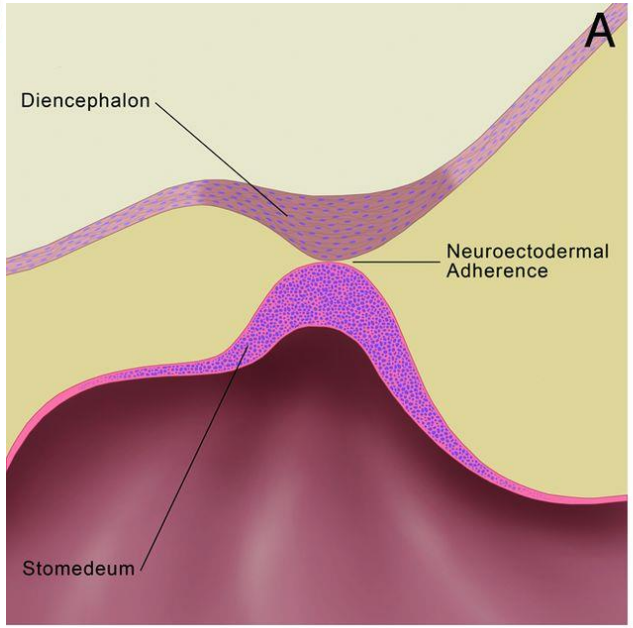
II. Neurohypophysis:

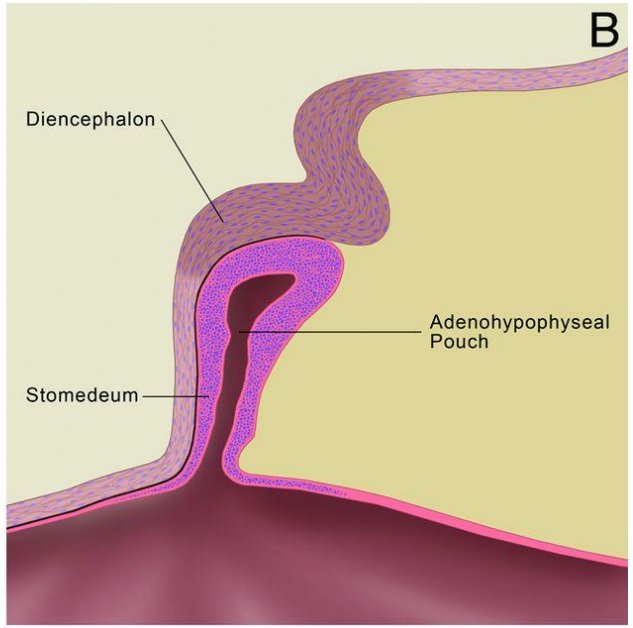
- It is an **ectodermal diverticulum (downgrowth)** which arises from the **floor of the diencephalon (future hypothalamus)**
- It descends caudal to the **Rathke`s** pouch and forms:
  a. **Infundibulum (**the infundibular recess of the 3rd ventricle**)**
  b. **Posterior lobe** of the pituitary gland (**pars nervosa**)
- Contains the nerve cells and nerve fibers which belong to the nuclei of the hypothalamus

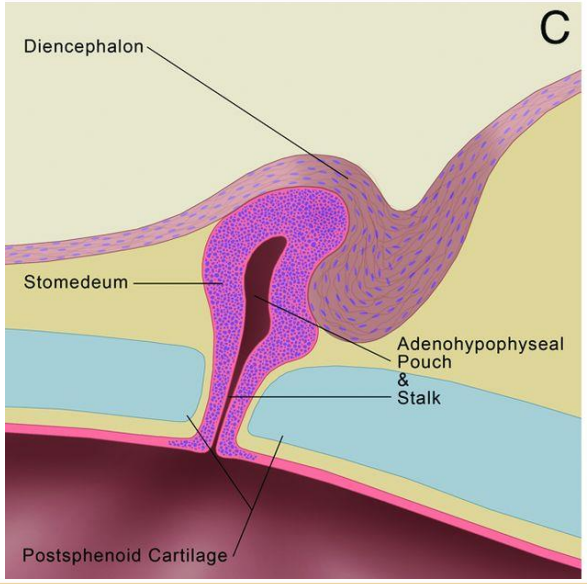


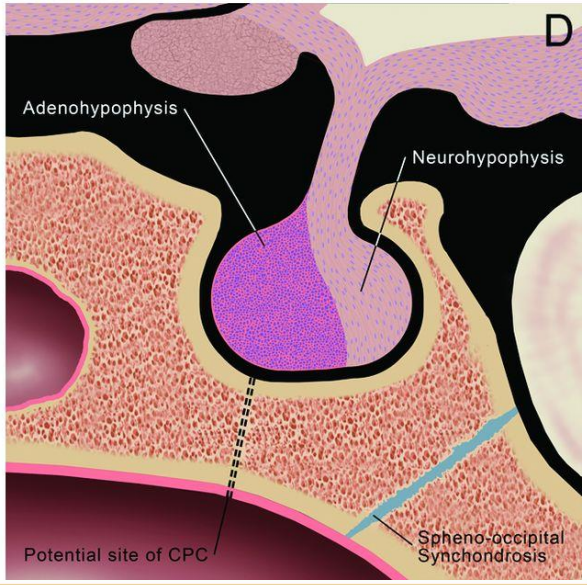

1 Hypothalamus releases hormone
Hypothalamus
Infundibulum
Pituitary gland
Superior hypophyseal artery
Neurosecretory cells
Primary capillary plexus of hypophyseal portal system
Hypophyseal portal veins
Posterior pituitary
Anterior pituitary
Secondary capillary plexus of hypophyseal portal system
3 Anterior pituitary hormone
2 Hypothalamus hormone stimulates pituitary to release hormones


Hypothalamic sulcus
Lamina terminalis
Supraoptic hypothalamic nucleus
Tuberal hypothalamic nucleus
Supraopticohypophyseal tract
Hypothalamohypophyseal tract
Mamillary body
Infundibulum (pituitary stalk)
Pars infundibularis (pars tuberalis)
Median eminence of tuber cinereum
Adenohypophysis (anterior lobe of pituitary gland)
Fibrous trabecula
Infundibular stem
Neurohypophysis (posterior lobe of pituitary gland)
Pars intermedia
Pars distalis
Infundibular process
Cleft


A
Diencephalon
Neuroectodermal Adherence
Stomedeum


B
Diencephalon
Adenohypophyseal Pouch
Stomedeum


C
Diencephalon
Stomedeum
Adenohypophyseal Pouch & Stalk
Postsphenoid Cartilage


D
Adenohypophysis
Neurohypophysis
Potential site of CPC
Spheno-occipital Synchondrosis

Congenital anomalies of pituitary gland

1-Pharyngeal pituitary gland:

Due to: persistence of a remnant of the stalk of Rathke`s pouch.

Features: accessory masses of the anterior lobe of the pituitary gland in the roof of oropharynx.

Congenital anomalies of pituitary gland

2-Aplasia & hypoplasia of pituitary gland:

Due to: **Failure or incomplete** development of the anterior wall of Rathke`s pouch.

Features: Hypofunction of pituitary gland.

Quiz 1

1- Which of the following NOT share in the development of pituitary gland

A- Rathke`s pouch

B- Infundibulum

C- Roof of the stomodeum

D- Buccopharyngeal membrane

ANSWER: D

Quiz 2

2- Which of the following NOT part of Rathke's pouch

A- Pars anterior

B- Pars intermedia

C- Pars tuberalis

D- Infundibulum

ANSWER: D

References for further readings

- Oxford Handbook of Clinical Medicine (3rd edition).
- Gray's anatomy for students
- Longman`s medical embryology 10th edition , T.W.Sadler
- Chen CJ (2001) Suprasellar and infrasellar craniopharyngioma with a persistent craniopharyngeal canal: Case report and review of the literature. Neuroradiology 43:760–762
- Chong BW, Newton TH (1993) Hypothalamic and pituitary pathology. Radiol Clin North Am 31:1147–1183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