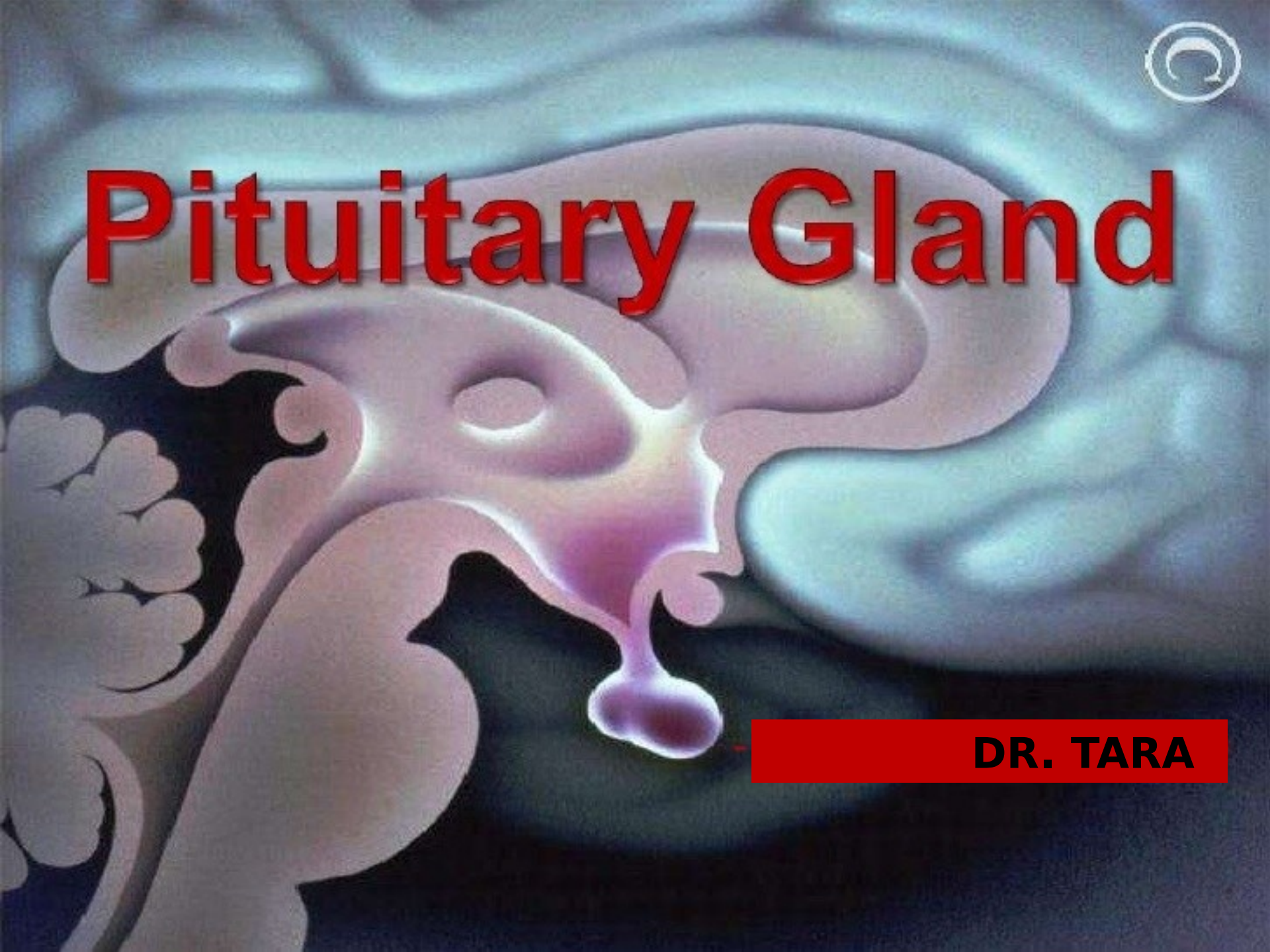

Pituitary Gland
DR. TARA

- Introduction
- Measurements
- Situation
- Relations
- Presenting parts
- Anterior Lobe- Gross Anatomy , Histology , Function
- Posterior Lobe- Gross Anatomy , Histology , Function
- Development
- Blood Supply
- Pharyngeal Hypophysis
- Applied Anatomy

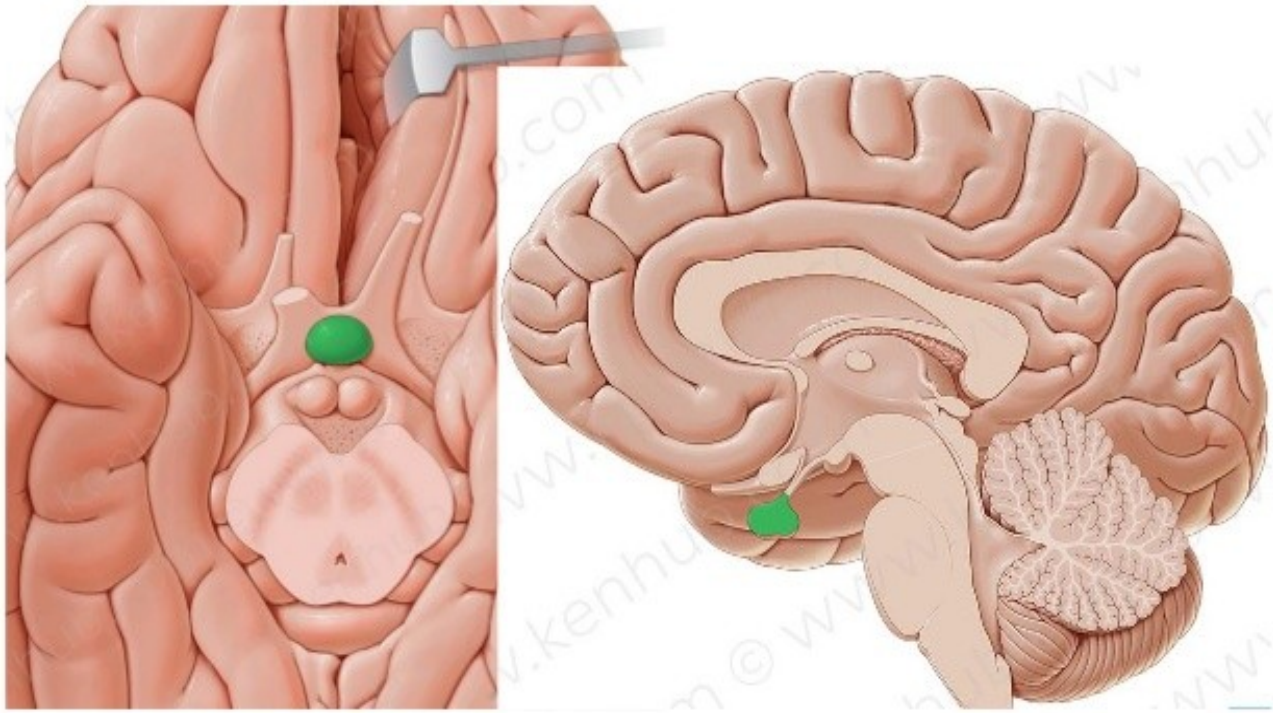
Introduction

- The pituitary gland is a pea-shaped structure measuring about 0.5 inch in diameter that lies in the **hypophysial fossa** of the sphenoid bone and attaches to the hypothalamus by a stalk, the **infundibulum**.
- For long time pituitary gland was regarded as master endocrine gland due to its control over other gland, but we now know that pituitary itself has master that is hypothalamus.
- Pituitary gland is also called as 'hypophysis cerebri'.

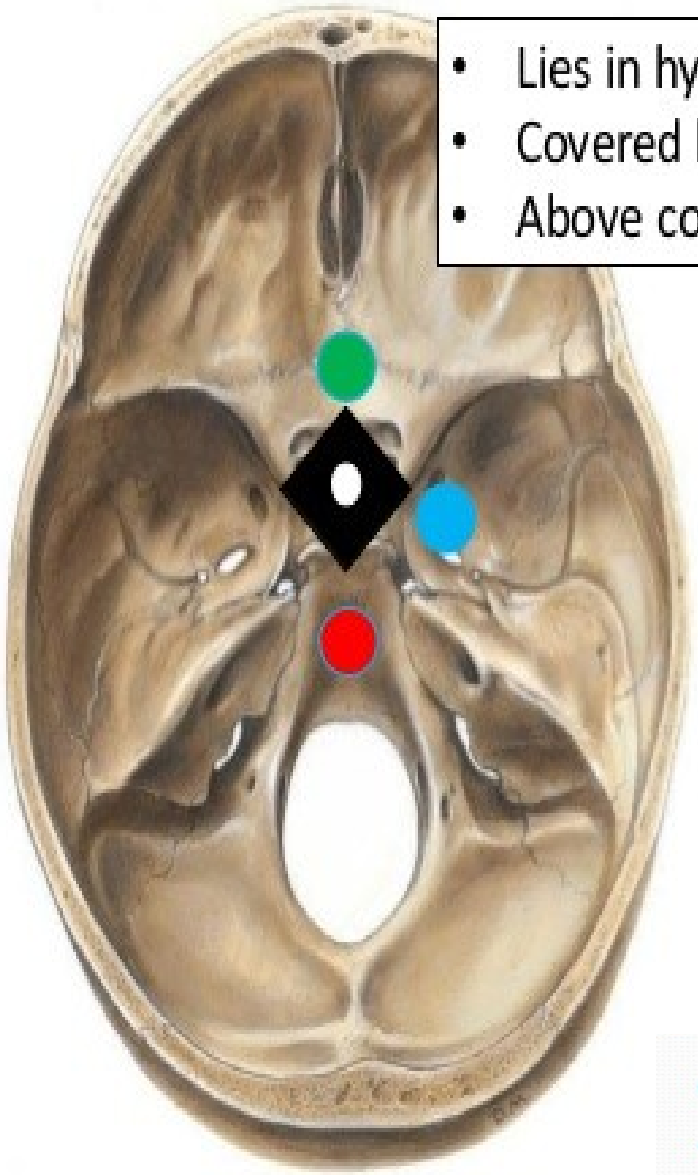
  (Hypo=under, physis= growth, cerebri=cerebrum)

Measurements

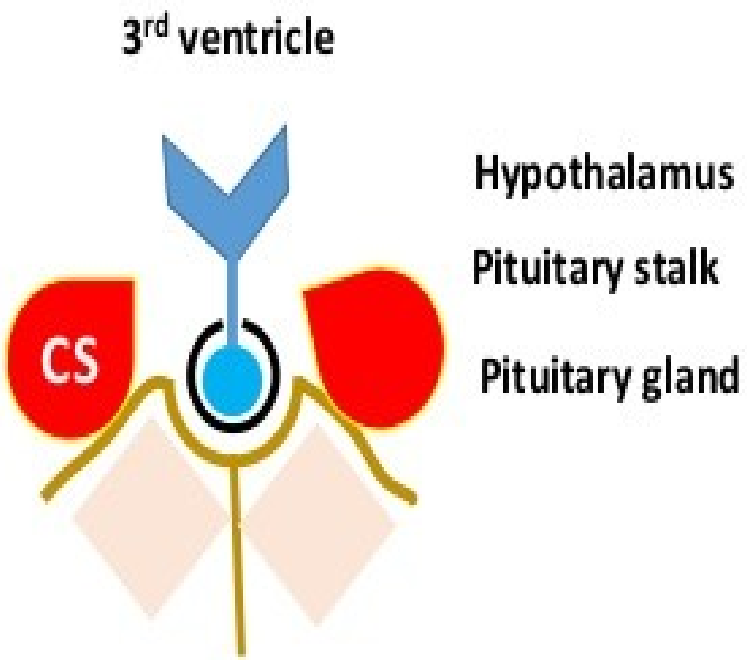
- Small size
- Reddish- Grey, ovoid body
- Transverse - 12 mm
- Antero-posterior - 8 mm
- Weight- 500 mg



Situation



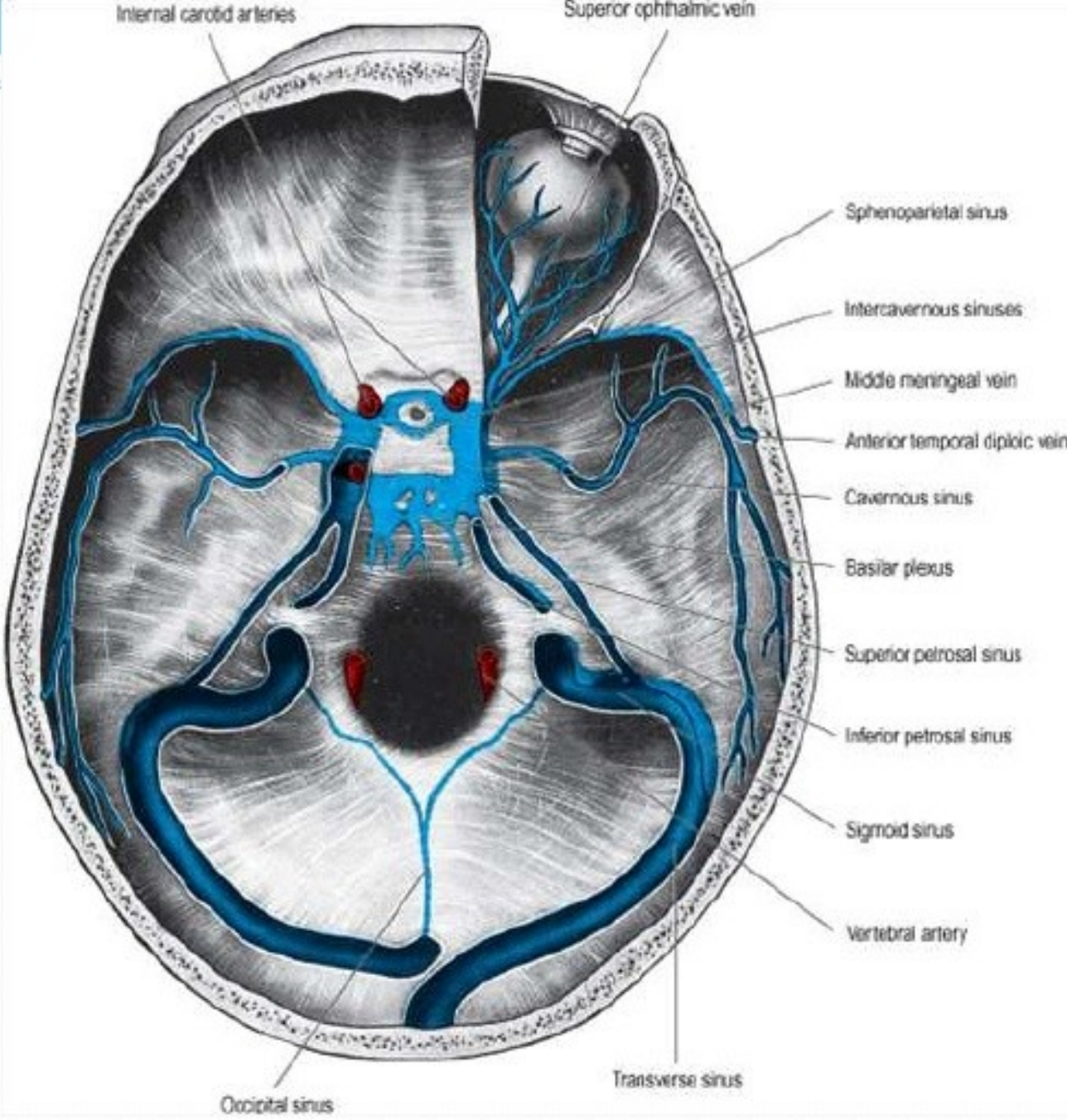
- Lies in hypophyseal fossa of sphenoid bone
- Covered by dural fold (**diaphragm sellae**)
- Above connected with hypothalamus by **infundibulum.**



- Capsule adherent to dura.
- No CSF around Gland

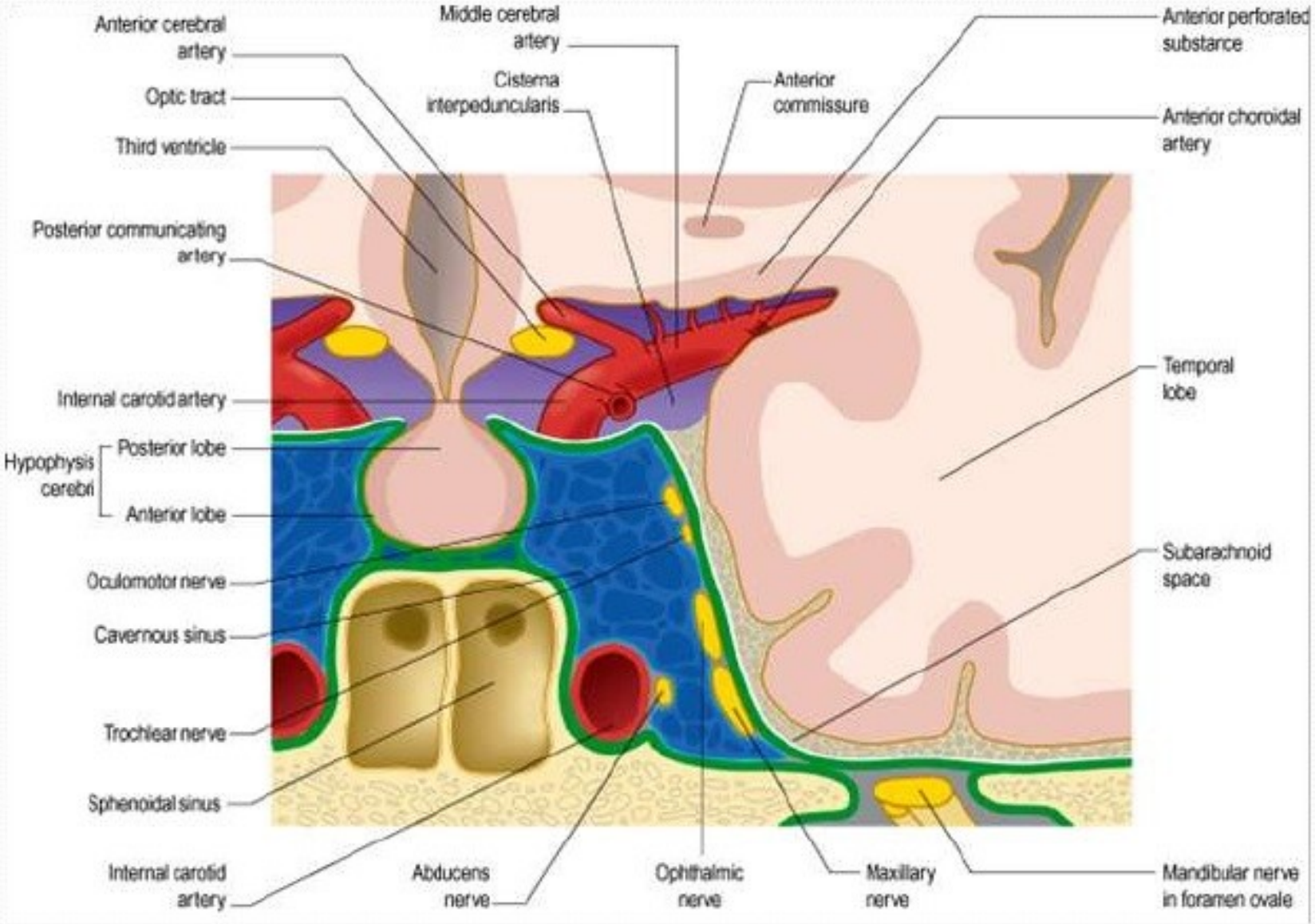
Relations

- **Anterior –** Anterior intercavernous sinus
- **Posterior-** Posterior intercavernous sinus



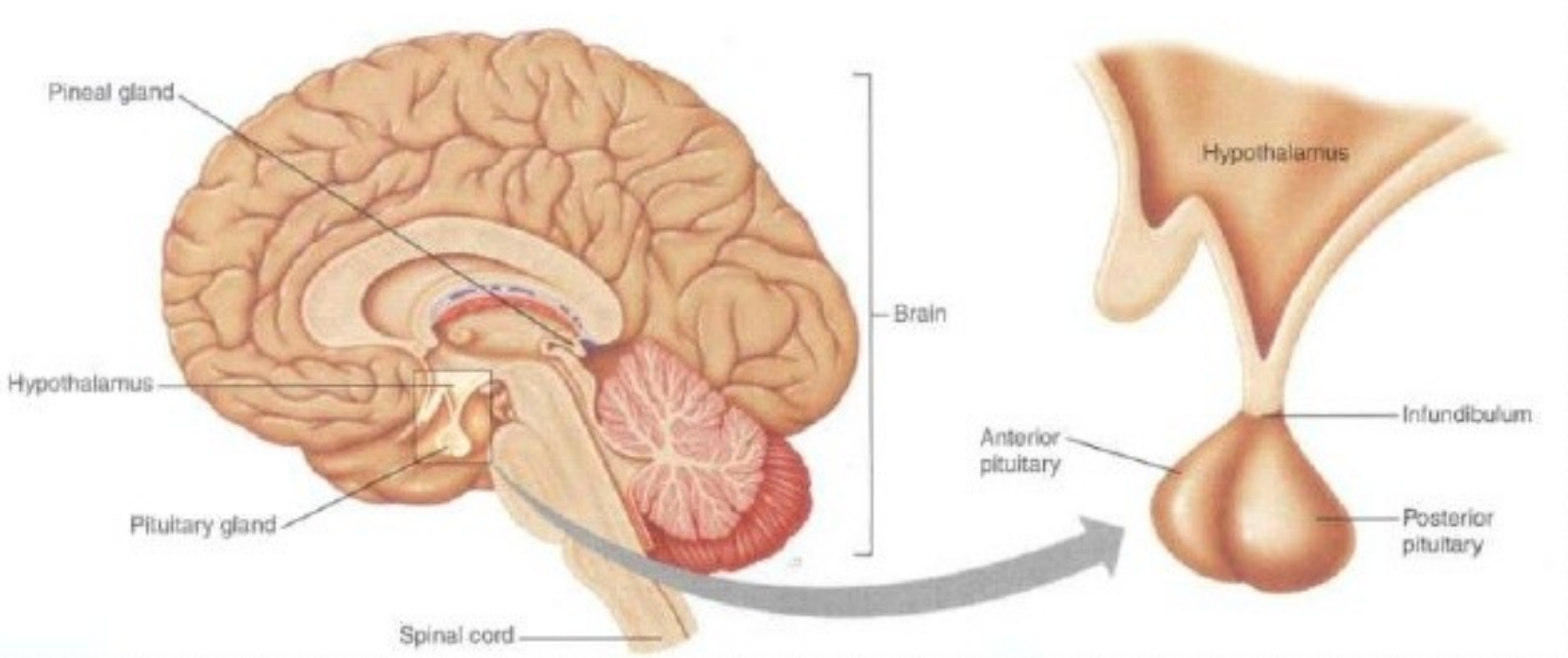
- **Superior-**
  - a) Diapragma sellae
  - b) Optic chiasma
  - c) Tubercinerium
  - d) Infundibular recess of 3rd ventricle
- **Inferior-**
  - a) Irregular venous channels Between two Layers Of Dura Mater
  - b) Hypophyseal fossa
  - c) Sphenoidal Air sinuses

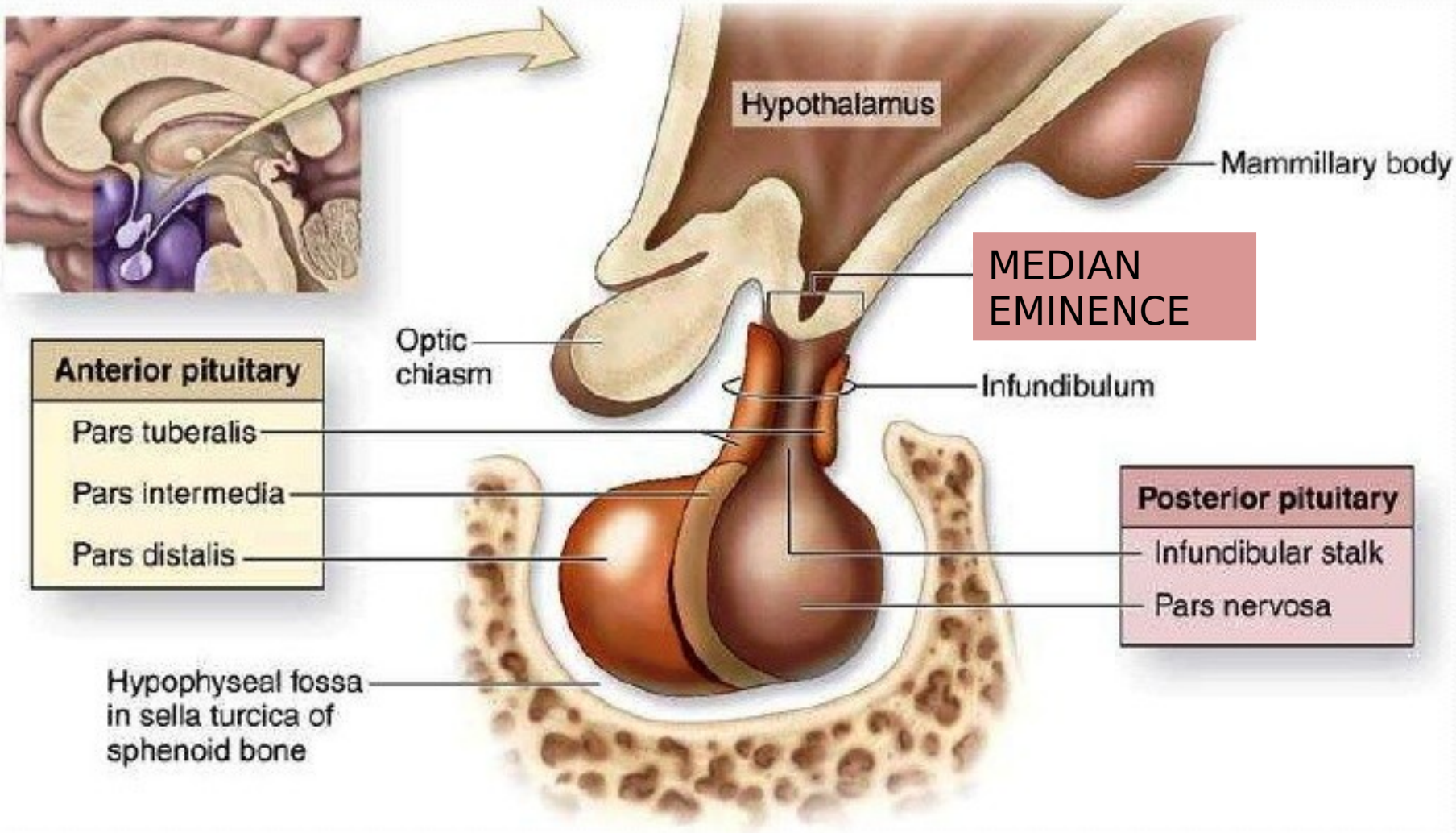
- **On Each Side**- Cavernous sinus & Structures passing through it



Presenting parts

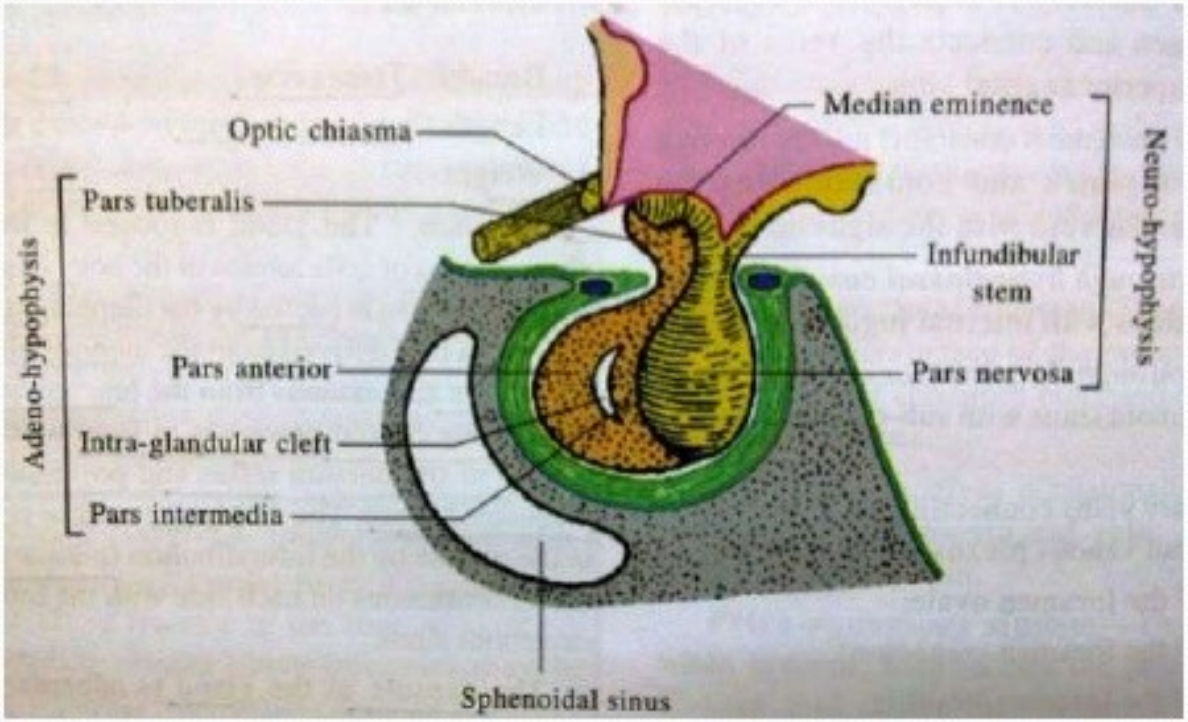
- The pituitary has two major parts
- Anterior Lobe / Adenohypophysis
- Posterior Lobe / Neurohypophysis
- Differ in their Origin, Structure & Function

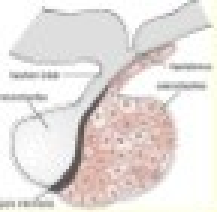



Hypothalamus
Mammillary body
MEDIAN EMINENCE
Optic chiasm
Infundibulum
Anterior pituitary
Pars tuberalis
Pars intermedia
Pars distalis
Posterior pituitary
Infundibular stalk
Pars nervosa
Hypophyseal fossa in sella turcica of sphenoid bone

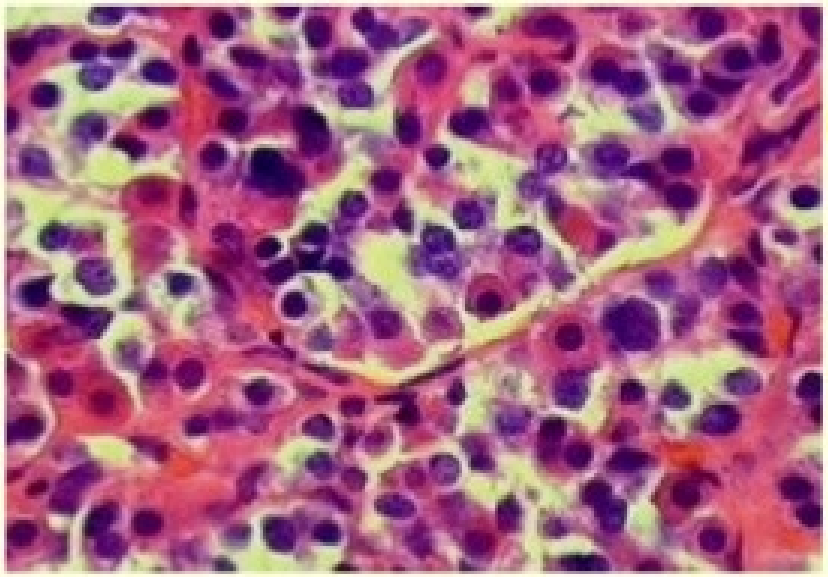
Anterior Lobe / Adenohypophysis

- Ectodermal derivative of the stomatodeum.
- Highly cellular.
- Pars Anterior (Pars Distalis Or Glandularis).
- Pars Intermedia.
- Pars Tuberalis.





Histology of the Adenohypophysis



- Three distinct cell types are seen among epithelial cells:
  - Acidophils have cytoplasm that stains red or orange.
  - Basophils have cytoplasm that stains a bluish color.
  - Chromophobes have cytoplasm that stains very poorly.

chromophobe cells

- 50% of population
- Inactive precursor or degranulated after release of their most of hormonal content
- EM shows few granules inside.

Chromophil cells

- 50 % population
- Contains cytoplasmic granules
- The contents of the secretory vesicles are responsible for the staining characteristics of the chromophil cells.

A. Acidophil cells (or acidophils)
B. Basophil cells (or basophils)

A) Acidophil cells (or acidophils)

- 40 % of parenchyma
- Stains with Eosin, Acid Fuschin, Orange G of Azan, azocarmine
- frequent subtype of acidophils are the **somatotrophs** *(stained with the dye orange G)*.
- Somatotrophs produce growth hormone (GH or somatotropin), which e.g. stimulates liver cells to produce polypeptide growth factors which stimulate growth (e.g. somatomedin which stimulates epiphyseal cartilage)
- overproduction of this hormone may result in gigantism or acromegaly

- **Mammotrophs (or lactotrophs) ,** the second group of acidophils, secrete prolactin. Their number increases significantly in late pregnancy and the early months of lactation

B) Basophil cells (or basophils)

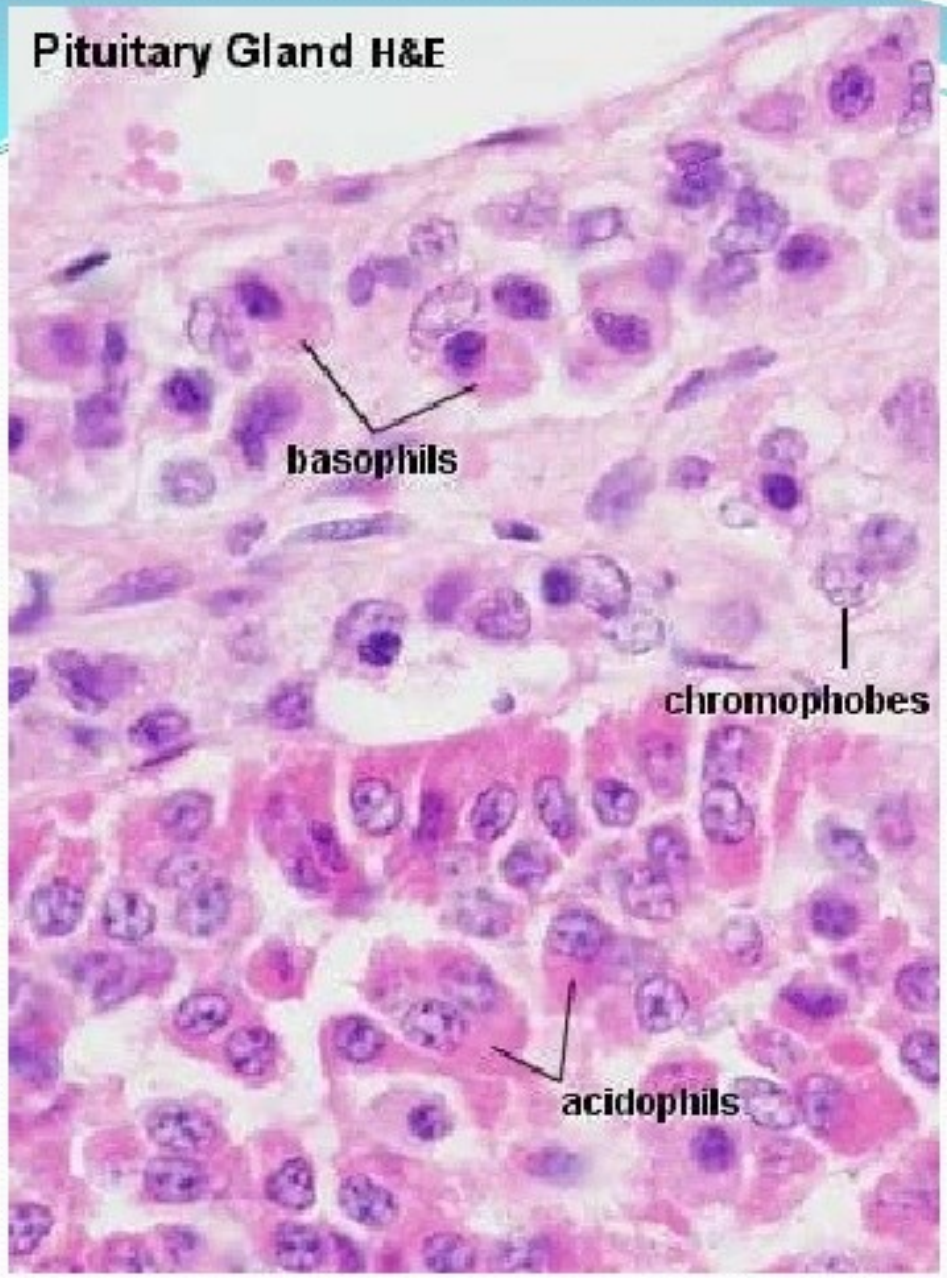
- 10 % of Parenchyma
- Stains poorly with Haematoxylin
- PAS staining
- Secrete *Trophic hormones*

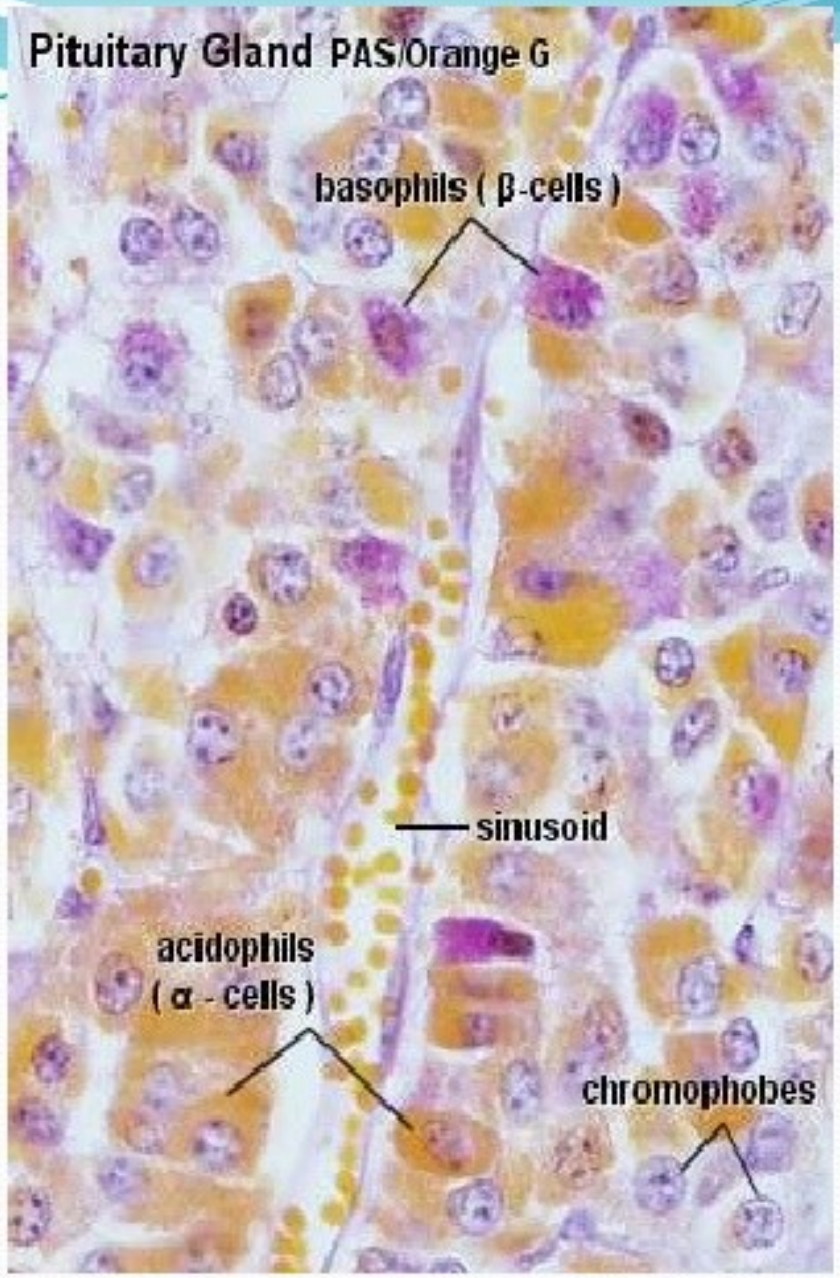
Thyrotrophs produce thyroid stimulating hormone (TSH or thyrotropin).

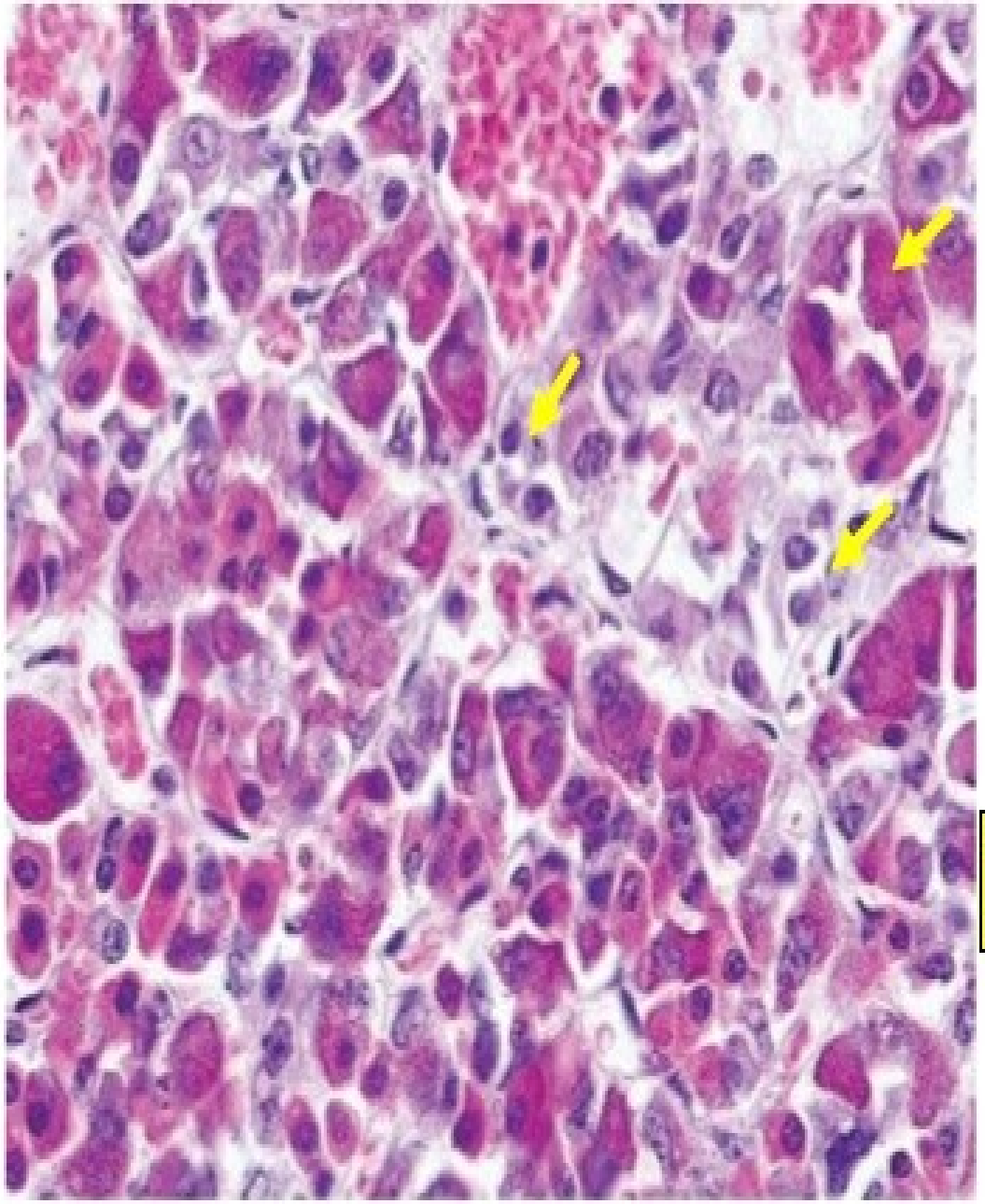
Gonadotrophs produce follicle stimulating hormone (**FSH**), which stimulates the seminiferous epithelium in males in addition to early follicular growth in females. Gonadotrophs also produce luteinizing hormone (**LH**), which stimulates production of testosterone by Leydig cells in males in addition to late follicular maturation, oestrogen secretion and formation of corpus luteum in females.

Corticotrophs (or adrenocorticolipotrophs) secrete adrenocorticotropic hormone (**ACTH** or corticotropin) and lipotropin (LPH, no known function in humans).

- Corticotropes are the most frequent cell type in the pars intermedia.
- In the pars intermedia, the precursor of ACTH and LPH undergoes further hydrolysis into melanocyte stimulating hormone (MSH, increased pigmentation in patients with Addison's disease) and a number of other peptides (among them endogenous opioids e.g endorphin).


Pituitary Gland H&E
basophils
chromophobes
acidophils


Pituitary Gland PAS/Orange G
basophils (β-cells)
sinusoid
acidophils
(α - cells)
chromophobes

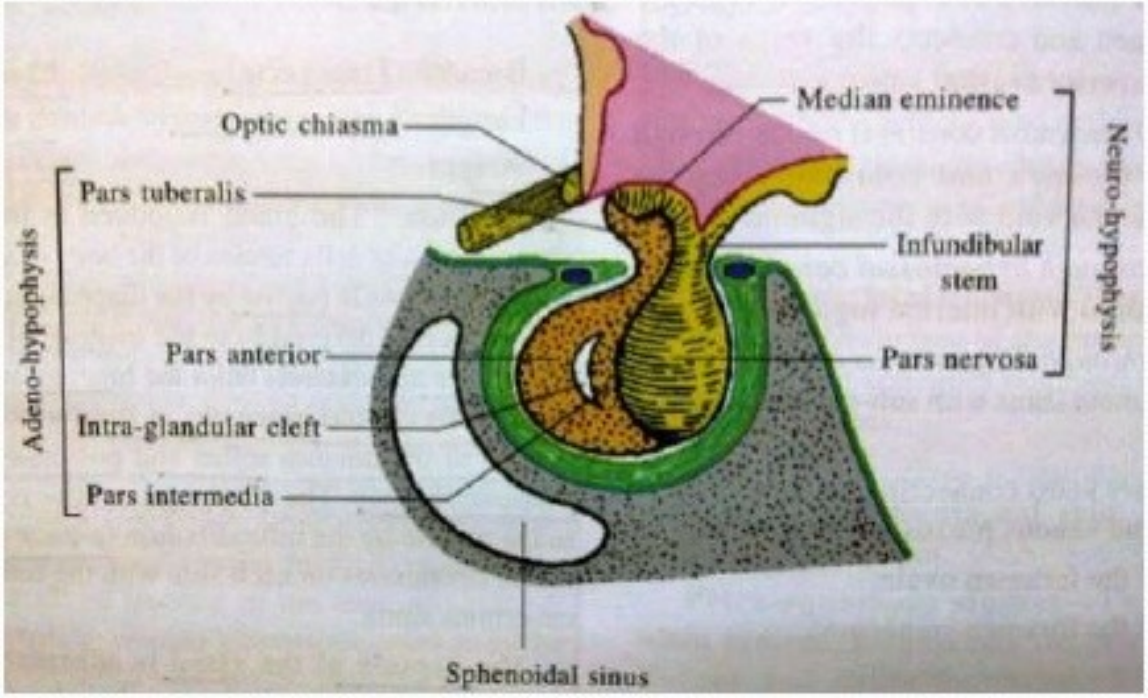


1. Basophilic cells-10%
2. Acidophilic cells-40%
3. Chromphobes cells-50%

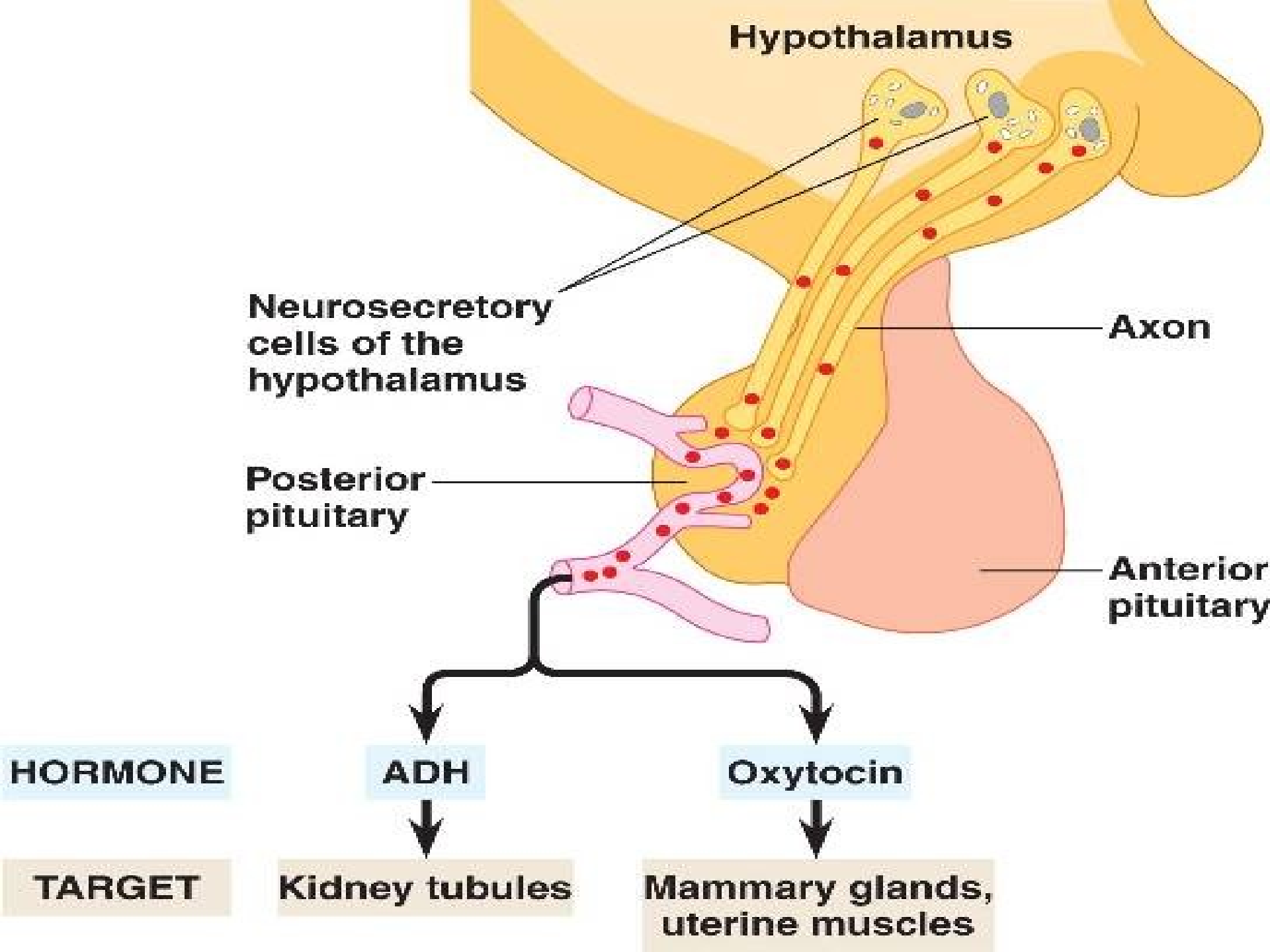
Pars anterior

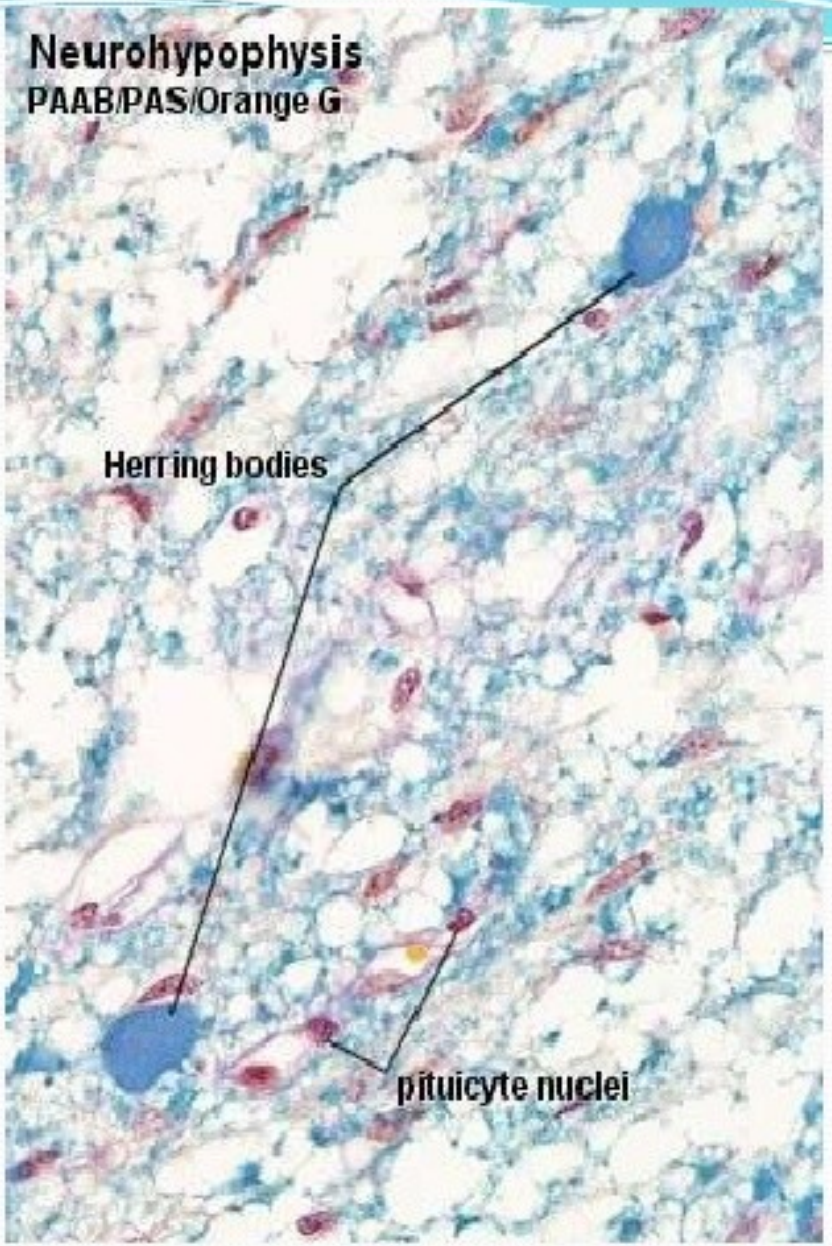
Posterior Lobe / Neurohypophysis

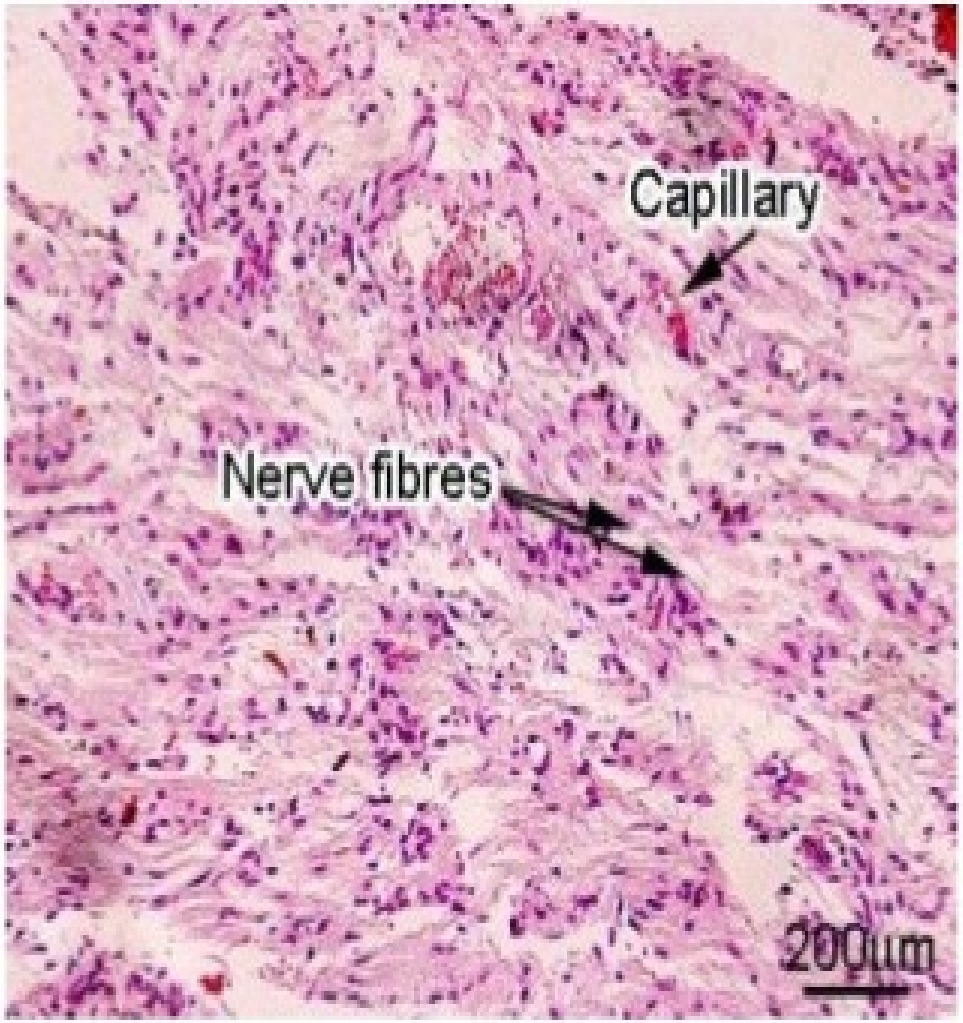
- Neurohypophysis is a diencephalic downgrowth connected with the hypothalamus
- Neural Lobe Or Pars Posterior
- Median Eminence
- Infundibular Stem

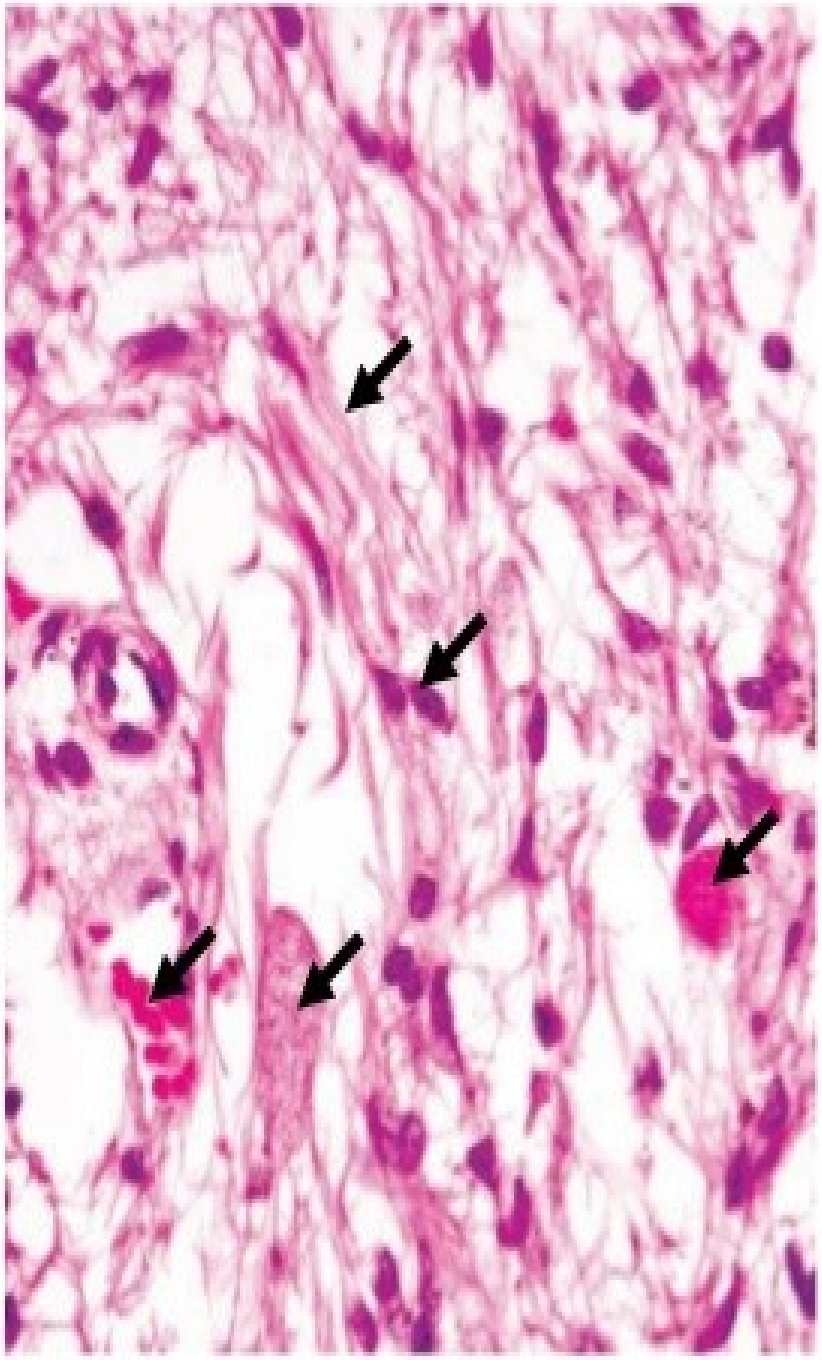


- consists of unmyelinated nerve fibers derived from neurosecretory cells of the supraoptic & paraventricular hypothalamic nuclei and pituicytes.(Near the posterior lobe, astrocytes are replaced by pituicytes)
- oval or round nuclei of the pituicytes are visible
- Hypothalamic nerve fibers typically terminate close to capillaries
- **Herring bodies** - Scattered, large, and bluish-violet (in PAS/Orange G stained sections) masses represent dilations of these nerve fibers .
- Contain neurosecretory products of the hypothalamic cells.


Hypothalamus
Neurosecretory cells of the hypothalamus
Axon
Posterior pituitary
Anterior pituitary
HORMONE
ADH
Oxytocin
TARGET
Kidney tubules
Mammary glands, uterine muscles


Neurohypophysis
PAAB/PAS/Orange G
Herring bodies
pituicyte nuclei





- Pituicytes
- Nerve fibers
- Herring Bodies
- Capillaries

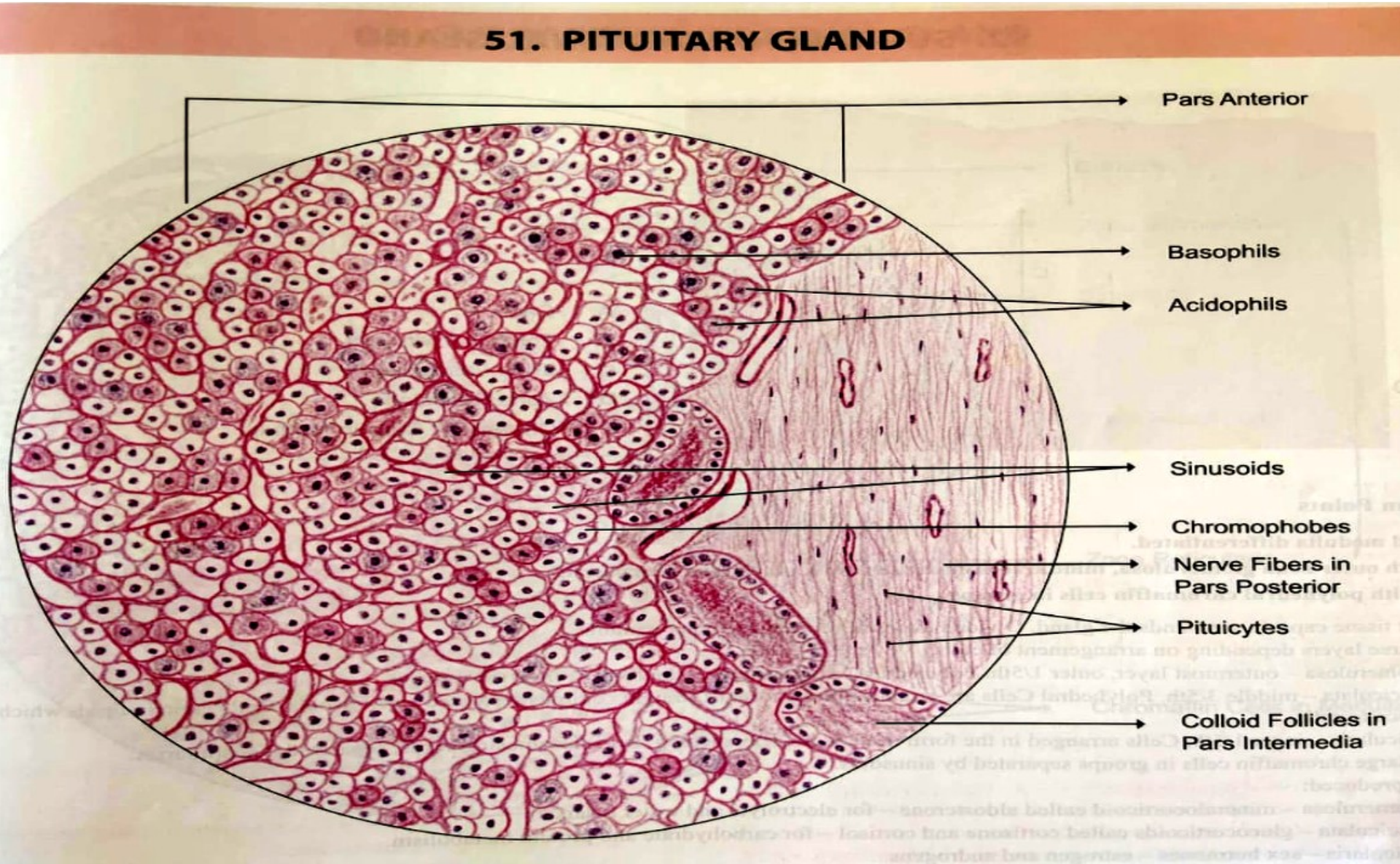
Pars nervosa

- In early fetal life the neurohypophysis contains a cavity continuous with the third ventricle
- Axons arising from groups of hypothalamic neurones (e.g. the magnocellular neurones of the supraoptic and paraventricular nuclei) terminate in the neurohypophysis.
- The long magnocellular axons pass to the main mass of the neurohypophysis
- They form neurosecretory hypothalamohypophyseal tract and terminate near the sinusoids of the posterior lobe.

- Some smaller parvocellular neurones in the periventricular zone have shorter axons, and end in the median eminence and infundibular stem among the superior capillary beds of the venous portal circulation.
- These small neurones produce releasing and inhibitory hormones, which control the secretory activities of the adenohypophysis via its portal blood supply.

- The neurohormones stored in the main part of the neurohypophysis are **vasopressin** (antidiuretic hormone; ADH), which controls reabsorption of water by renal tubules , and **oxytocin**, which promotes the contraction of uterine smooth muscle in childbirth and the ejection of milk from the breast during lactation.
- Storage granules containing active hormone polypeptides bound to a transport glycoprotein, neurophysin, pass down axons from their site of synthesis in the neuronal somata. The granules are seen as swellings along the axons and at their terminals, which can reach the size of erythrocytes

HISTOLOGY

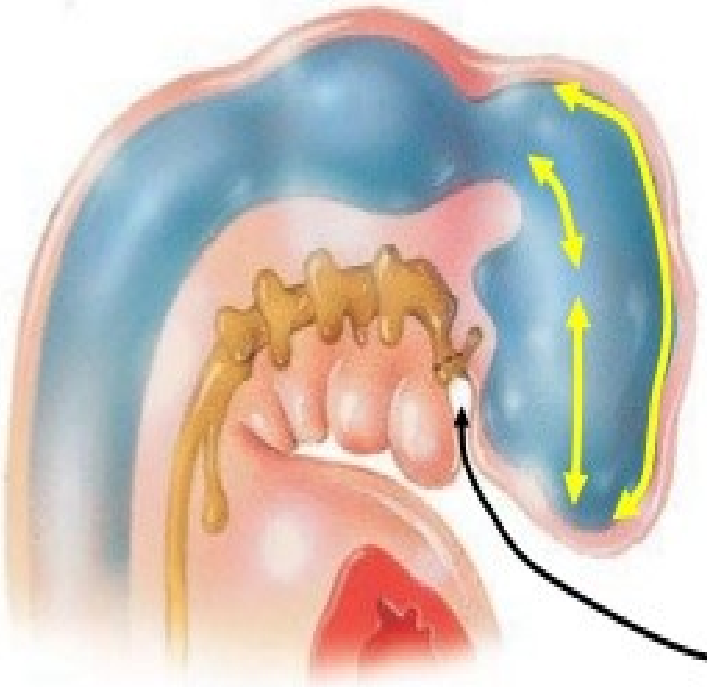

51. PITUITARY GLAND
Pars Anterior
Basophils
Acidophils
Sinusoids
Chromophobes
Nerve Fibers in Pars Posterior
Pituicytes
Colloid Follicles in Pars Intermedia

POINTS TO REMEMBER :

- The parts of pituitary gland are adenohypophysis and Neurohypophysis
- The adenohypophysis is subdivided into three parts by a cleft1. pars distalis the main anterior part, Pars tuberalis, and pars intermedia. Neuro hypophysis is divided into pars posterior and infundibulum,
- Adenohypophysis: The cells are arranged in the form of irregular cords or clusters between secondary capillary plexus of hypothalmo hypophyseal portal system. These cells are classified into chromophils [affinity to stains]and chromophobes [light stained]. Chromophils are further classified into
- Acidophils : Take up acidic dye include
- somatotrophs which are round or oval and secrete growth hormone.
- Lactotrophs are small irregular which secrete prolactin

- Basophils : Take up basic dye include, gonadotrophs which are large round cells secrete LH and FSH,
- Thyrotrophs are polyhedral, secrete TSH
- Corticotrophs are polygonal cells secretes ACTH and MSH
- Neurohypophysis does not contain secretory cells. It is composed of unmyelinated axons and highly branched glial cells called pituicytes. Pituicytes are supporting cells. These cells have long dendritic process many of which lie parallel to the nerve fibres.
- Nerve terminals end in membrane bound secretory vesicles called Herring Bodies.

Development



Prosencephalon (Forebrain)

1. Diencephalon
2. Telencephalon

Primitive oral cavity (stomodeum)

Floor of diencephalon

Neuroectodermal diverticulum

Rathke's pouch

Roof of stomodeum

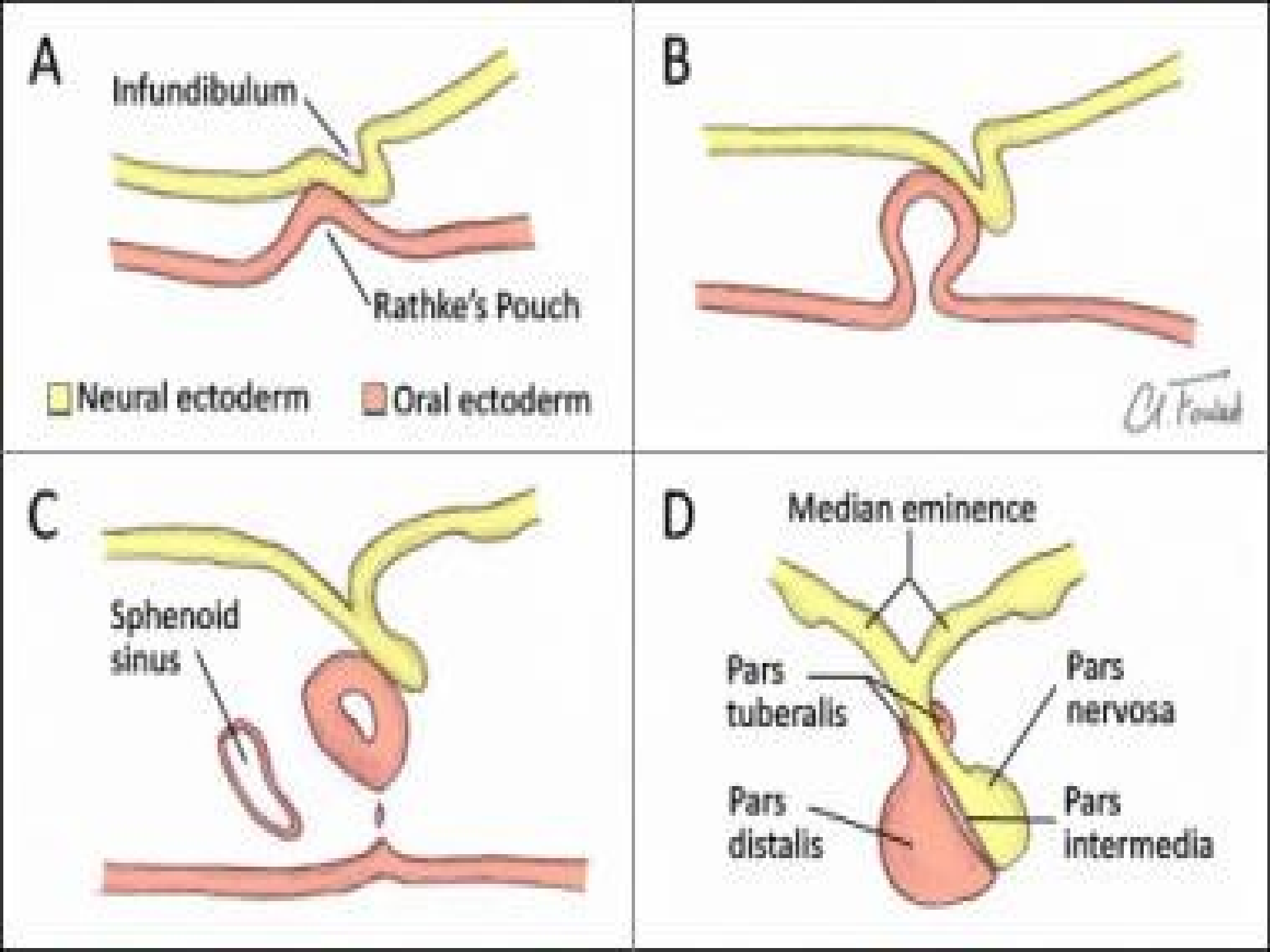
Infundibulum

Neurohypophysis

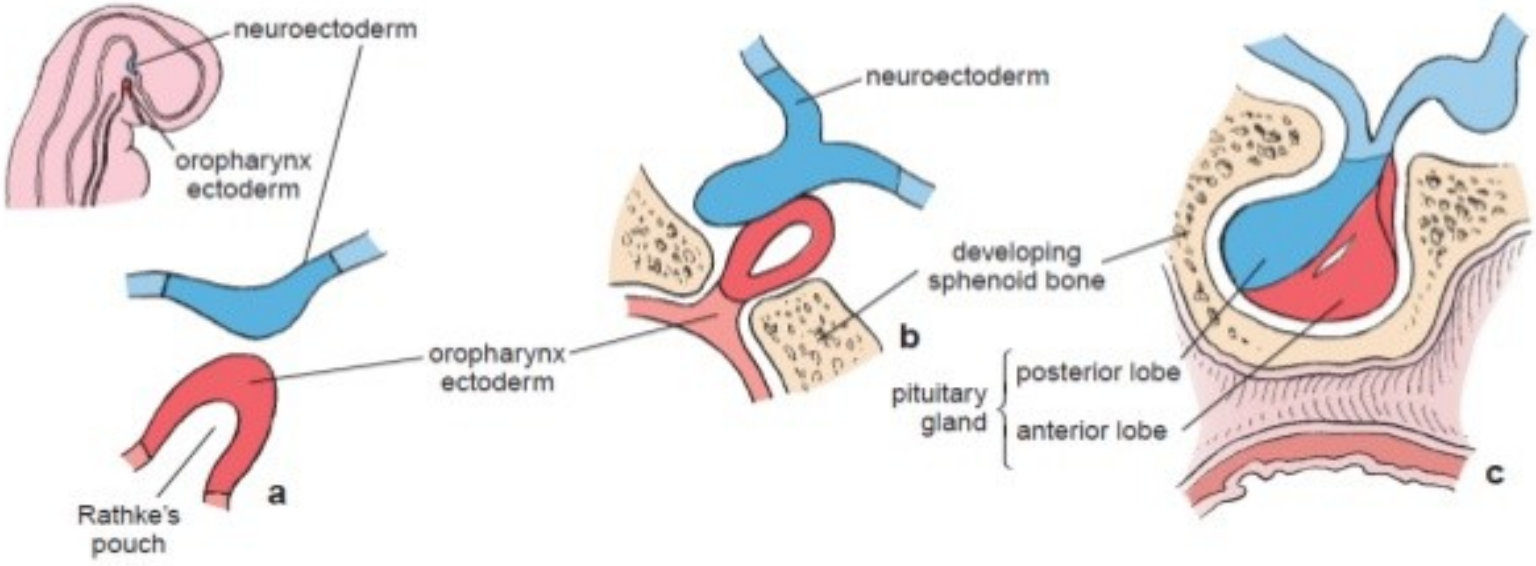
Adenohypophysis

Ant pituitary

Intermediate pituitary


A
Infundibulum
Rathke's Pouch
Neural ectoderm
Oral ectoderm
B
C
Sphenoid sinus
D
Median eminence
Pars tuberalis
Pars nervosa
Pars distalis
Pars intermedia

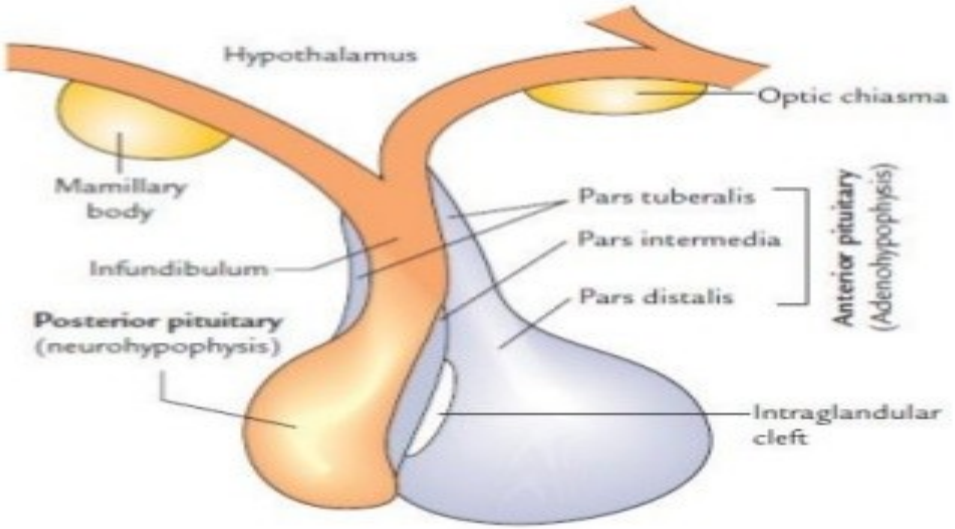
- Just caudal to, but in contact with, the adenohypophyseal recess, a hollow diverticulum elongates towards the stomodeum from the floor of the neural plate just caudal to the hypothalamus **this region of neural outgrowth is the neurohypophysis.**



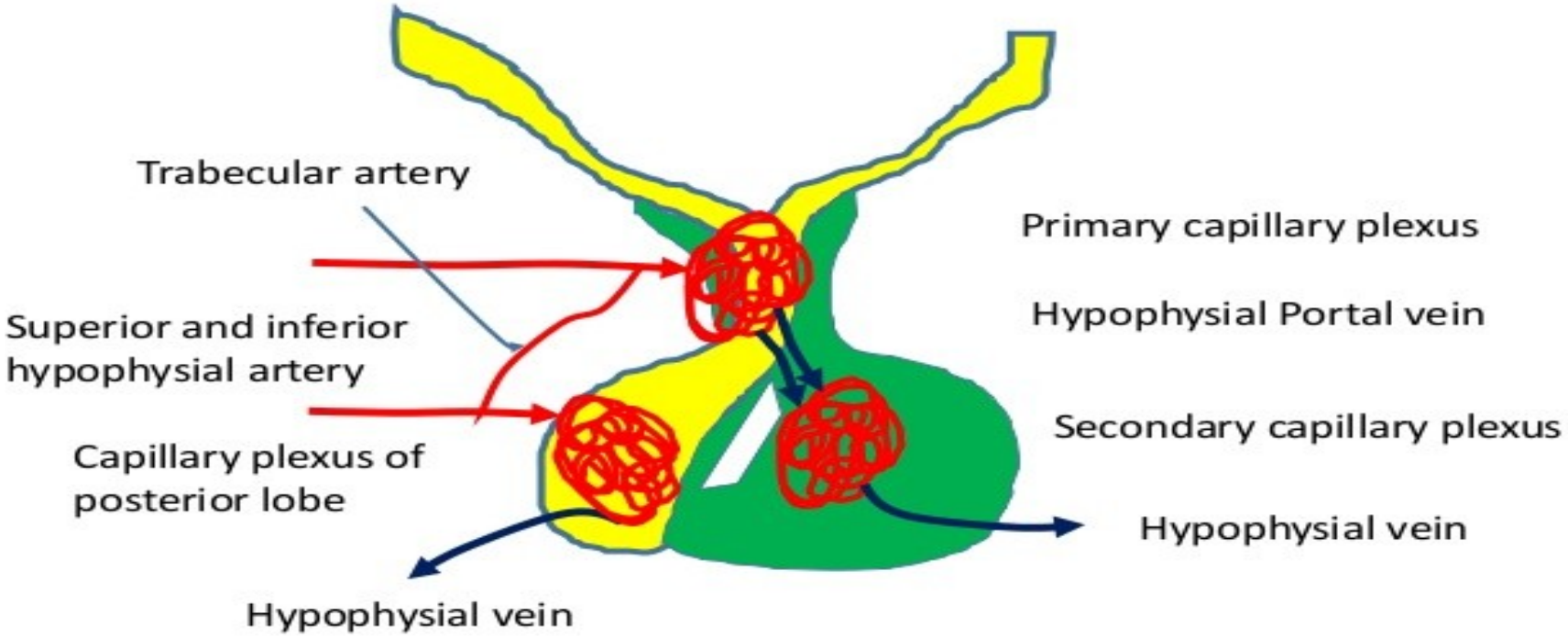
Development of pituitary gland

- 3rd week- hypophyseal diverticulum
- 5th week – diverticulum elongates & lower end constricted
- 6th week- connection with oral cavity cut off.
- At birth the hypophysis is about one-sixth the weight of the adult gland
- about one-half the weight of the adult gland at 7 years,
- attains adult weight at puberty.
- Throughout postnatal life the gland appears larger in females, in both size and weight.

Craniopharyngioma
Remnants of Rathke's pocuh



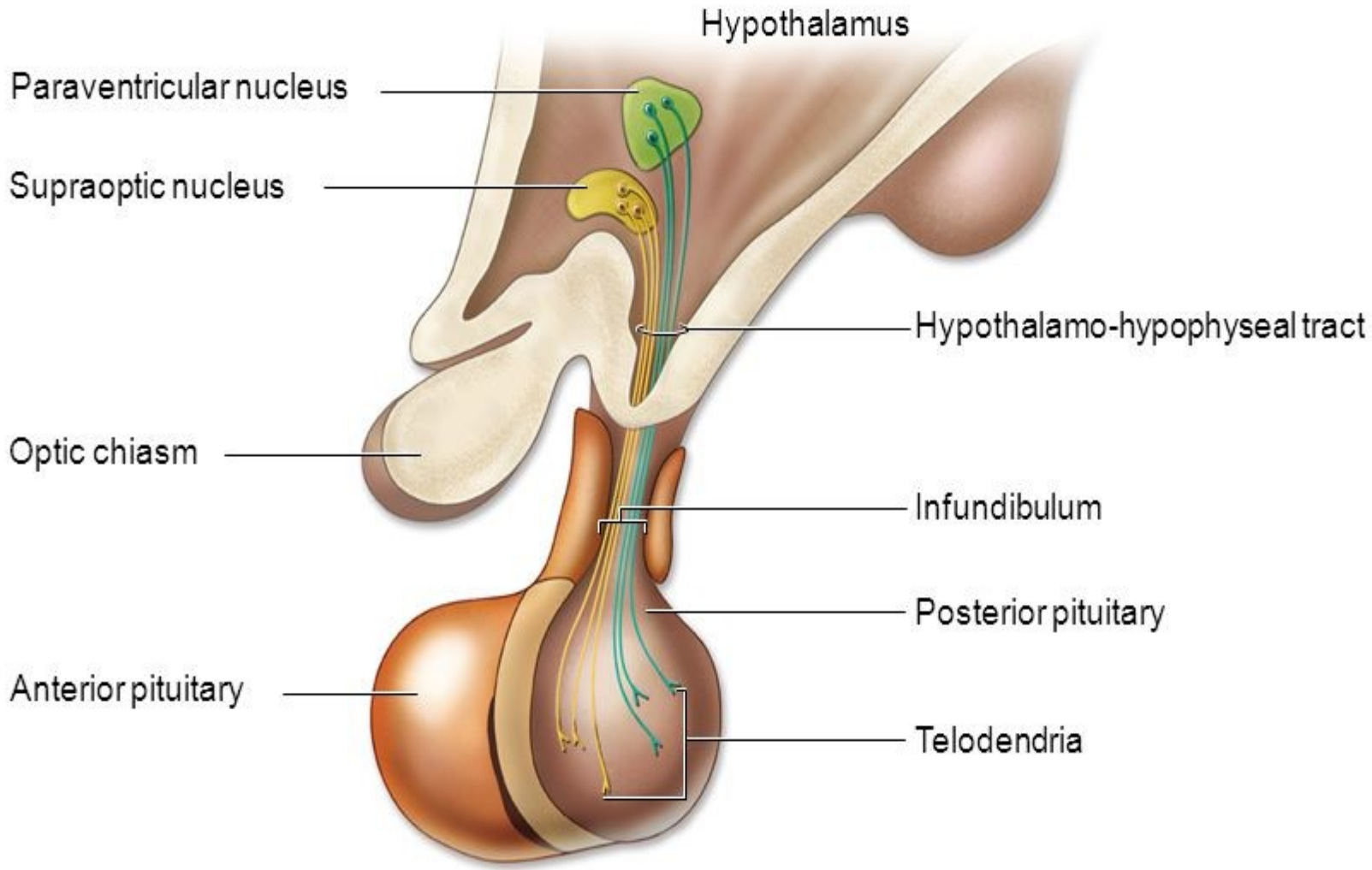
BLOOD SUPPLY OF PITUITARY GLAND



ARTERIES: Superior & inferior hypophyseal arteries (branches of internal carotid artery)

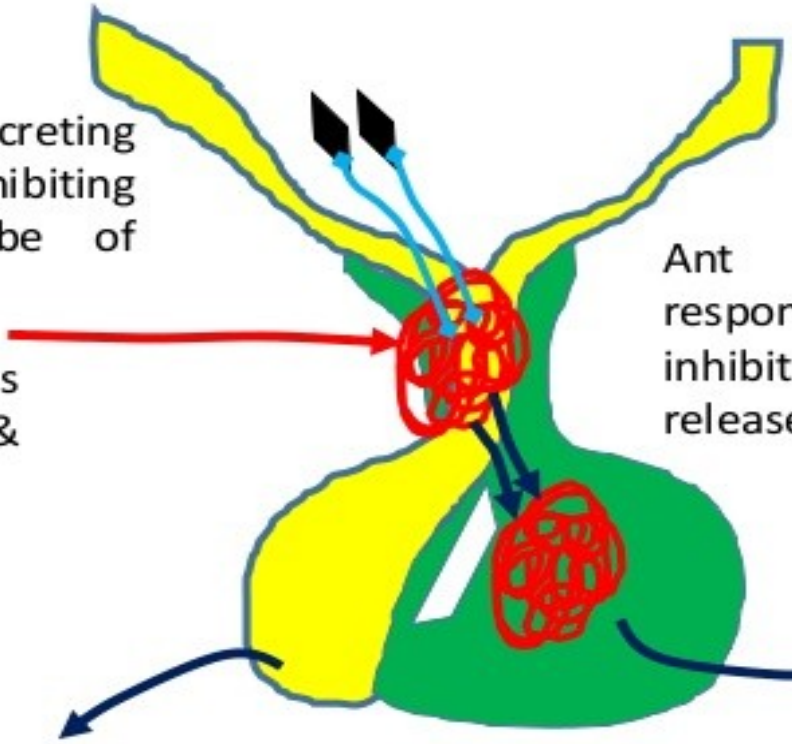
VEINS: hypophyseal veins drain into cavernous sinuses.

Hypothalamo-Hypophyseal Tract



Hypothalamic control

- Hypophysiotropic area of hypothalamus
- Cresentic band- from preoptic area to arcuate nucleus
- Axons of neurons from this area conveys releasing or inhibitory hormones to fenestreated upper radicals of portal vessels in median eminance & infundibular stem



Hypothalamic nuclei secreting releasing and inhibiting hormone to ant lobe of pituitary.

Primary capillary plexus receiving releasing & inhibiting hormone.

Ant pituitary cells respond to releasing or inhibiting factors and release its hormones.

1. ADH
2. Oxytocin

1. GH
2. TSH
3. FSH & LH
4. ACTH
5. Prolactin

Pharyngeal hypophysis

- A small collection of adenohypophyseal tissue lies in the mucoperiosteum of the human nasopharyngeal roof
- By 28 weeks *in utero it is well vascularized and capable of secretion, receiving* blood from the systemic vessels of the nasopharyngeal roof. covered posteriorly by fibrous tissue
- This is replaced in the second half of fetal life by venous sinuses, and a transsphenoidal portal venous system develops
- The peripheral vascularity of pharyngeal hypophysis persists until about the fifth year
- Though it does not change in size after birth in males, in females it becomes smaller, returning to natal volume during the fifth decade

- Reserve of potential adenohypophyseal tissue
- may be stimulated, particularly in females, to synthesize and secrete adenohypophyseal hormones in middle age, when intracranial adenohypophyseal tissue is beginning to fail.

Disorders of Pituitary Gland

Parts involved	Hyperactivity	Hypoactivity
Anterior Pituitary	1. Gigantism 2. Acromegaly 3. Acromegalic gigantism 4. Cushing's disease	1. Dwarfism 2. Acromicria 3. Simmond's disease
Posterior Pituitary	Syndrome of inappropriate hypersecretion of ADH (SIADH)	Diabetes insipidus
Anterior and Posterior Pituitary	…….	Dystrophia adiposogenitalis

Gigantism

Pituitary disorder characterized by:

- Excess growth of body
- Average height is approximately 7 – 8 feet

Continued…

Causes of Gigantism

- Hypersecretion of GH in childhood or in pre – adult

- Tumor of acidophilic cells of Anterior pituitary

Continued…

Signs and Symptoms

- Huge stature : 7 or 8 feet height
- Hyperglycemia , develop glycosuria , pituitary diabetes mellitus
- Headache due to tumor of pituitary

Acromegaly

Anterior pituitary disorder characterized by:

- Enlargement, thickening, and broadening of bones
- Particularly extremities of the body

Continued…

Causes of Acromegaly

- Hypersecretion of GH after fusion of epiphysis with shaft of bone
- Adenomatous tumor of anterior pituitary involving the acidophilic cells.


BX Main Mall

Continued…

Signs and symptoms

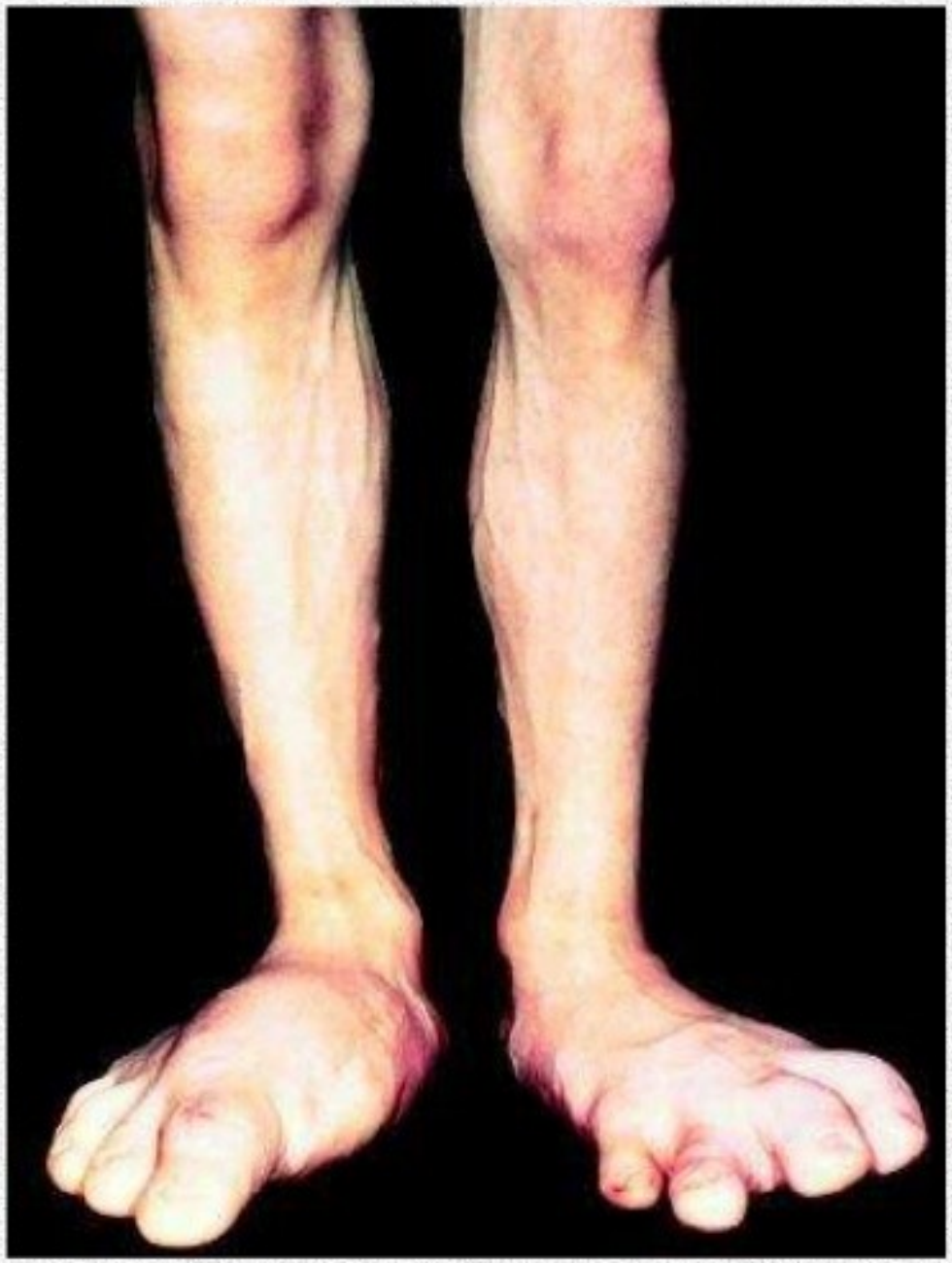
- Kyphosis : enlargement of hands and feet with bowing spine
- Scalp is thickened and thrown into folds
- Overgrowth of body hair
- Visceral organs are enlarged

Continued...

Signs and symptoms

- Striking features are protrusion of :
  - Supraorbital ridges
  - Broadening of nose
  - Thickening of lips
  - Thickening and wrinkles formation on forehead
  - Lower jaw (prognathism)

Face with these features called as acromegalic or guerilla face



Continued…

Signs and symptoms

- Thyroid , parathyroid and adrenal glands shows hyperactivity
- Hyperglycemia and glucosuria
- Hypertension
- Headache
- Visual disturbance – Bitemporal hemianopia

Cushing's Disease

- Rare disease characterized by obesity

Thinning of extremities

Thinning of skin and subcutaneous tissues

Darkening of skin on neck (aconthosis)

Pigmentation of skin

Facial redness (facial plethora)

Weakening of muscle


Thank you...!!!