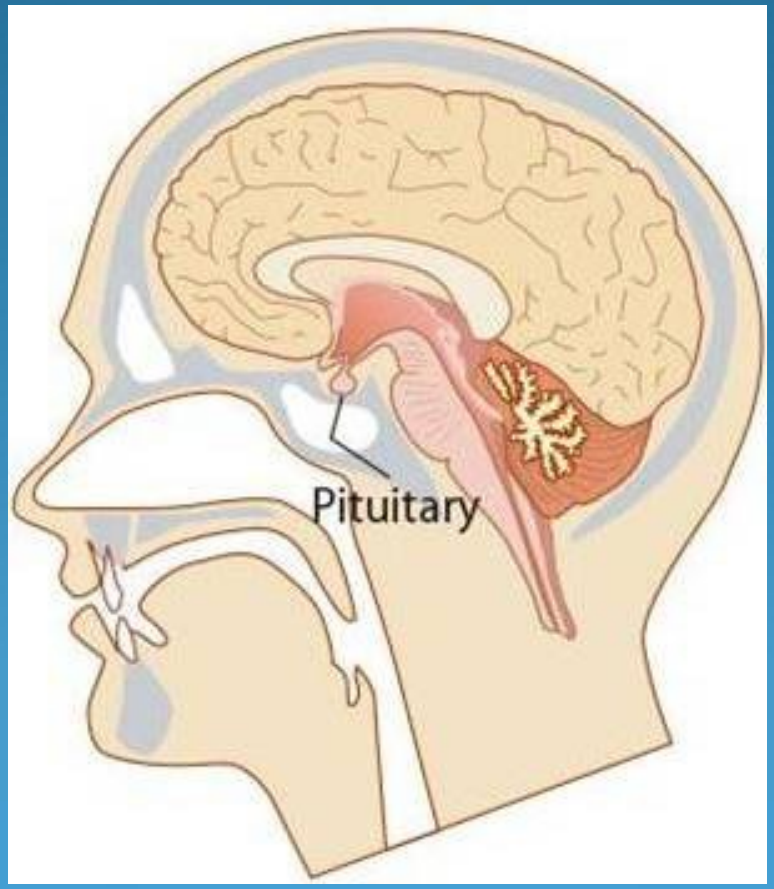
Pituitary gland



Dr. Rizvi Hasan

- Once it was believed that the pituitary is the pathway to drain phlegm from the brain to the nasopharynx. (Galen in 150 AD)

- This fact was in belief until the late 19th to early 20th century, when connections were found between the pituitary and a variety of important body processes such as growth.

- It is fascinating to learn that a tiny gland (size of a nelli fruit) controls the entire body by sending signals through HORMONES.

- That is why the gland is called the “master of the endocrine orchestra”.

Objectives

- Location of the gland
- Morphological features
  - Anatomical lobes / Physiological lobes
  - Cell types
- Development of the gland
- Hormones secreted by the gland
- Pituitary blood supply
- Clinical anatomy

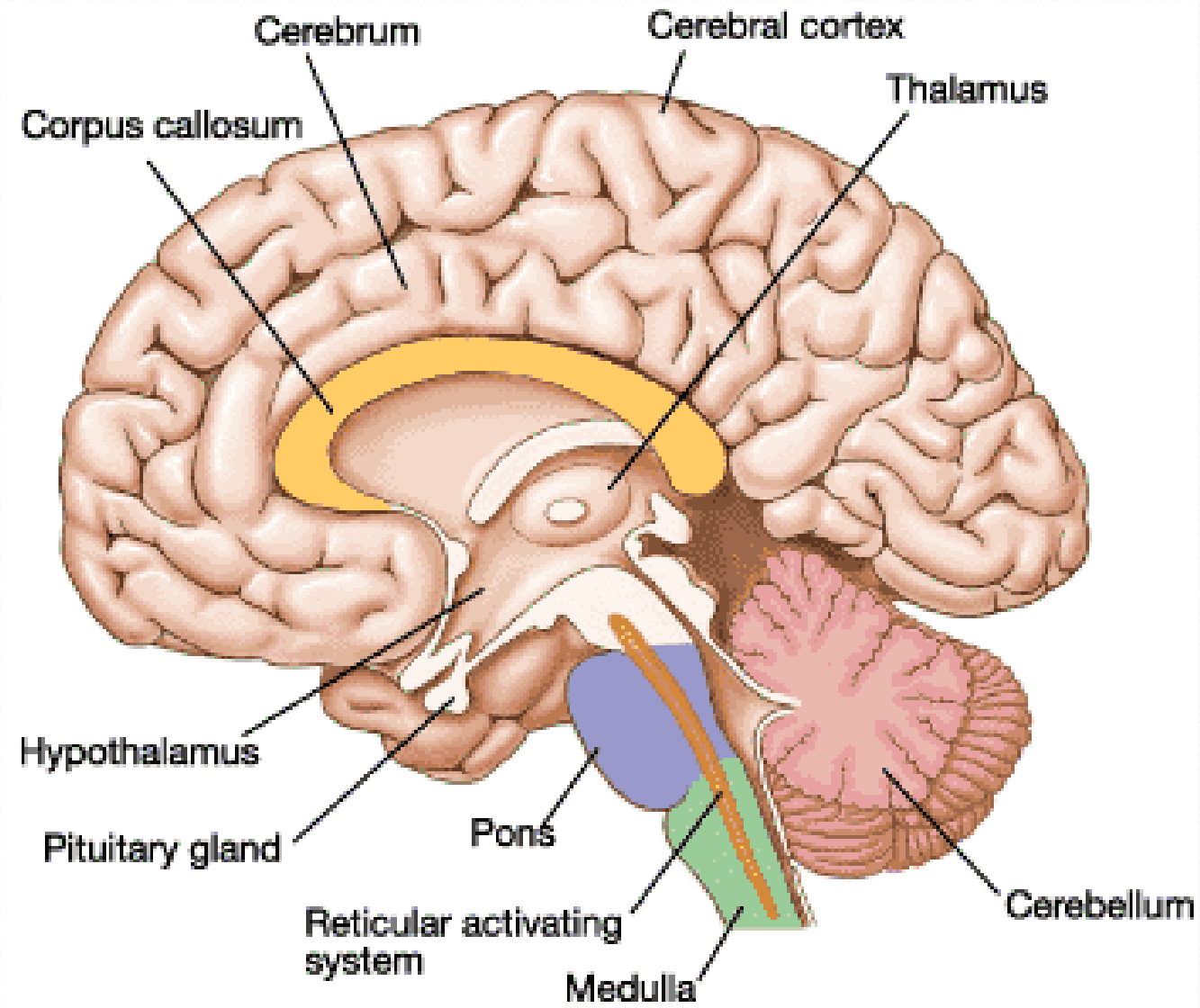
PITUITARY GLAND

- Pituitary is an endocrine gland
- It is often called “the master gland”
- Lies in the pituitary fossa (sella turcica) of sphenoid bone in the skull base
- Pituitary fossa is covered by a fold of dura - diaphragma sellae
- It is pierced by the pituitary stalk, which is attached to the floor of the third ventricle.
- Gland size is of a flattened nelli fruit.
- Enlarges in size in pregnancy, tumours.

Relations of the gland

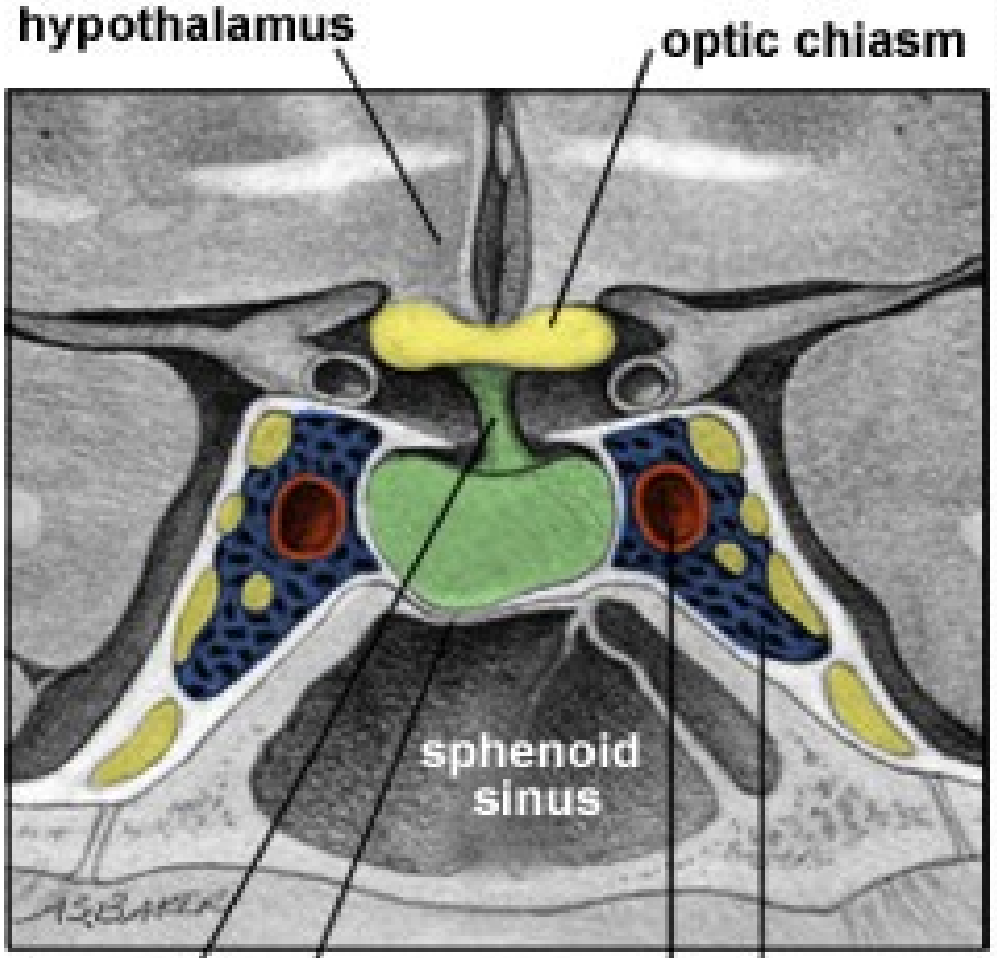
- Superiorly
  - Diaphragma sellae
  - Optic chiasma
  - Tuber cinereum
  - Infundibular recess of third ventricle

Sagittal section of the brain



- Inferiorly
  - Irregular venous channels between two layers of dura
  - Hypophyseal fossa
  - Sphenoid air sinuses
- On each side
  - Cavernous sinus and its contents

Inferior relatons of the pituitary



Morphological features

Made up of 2 parts.

Differ embryologically, morphologically and functionally

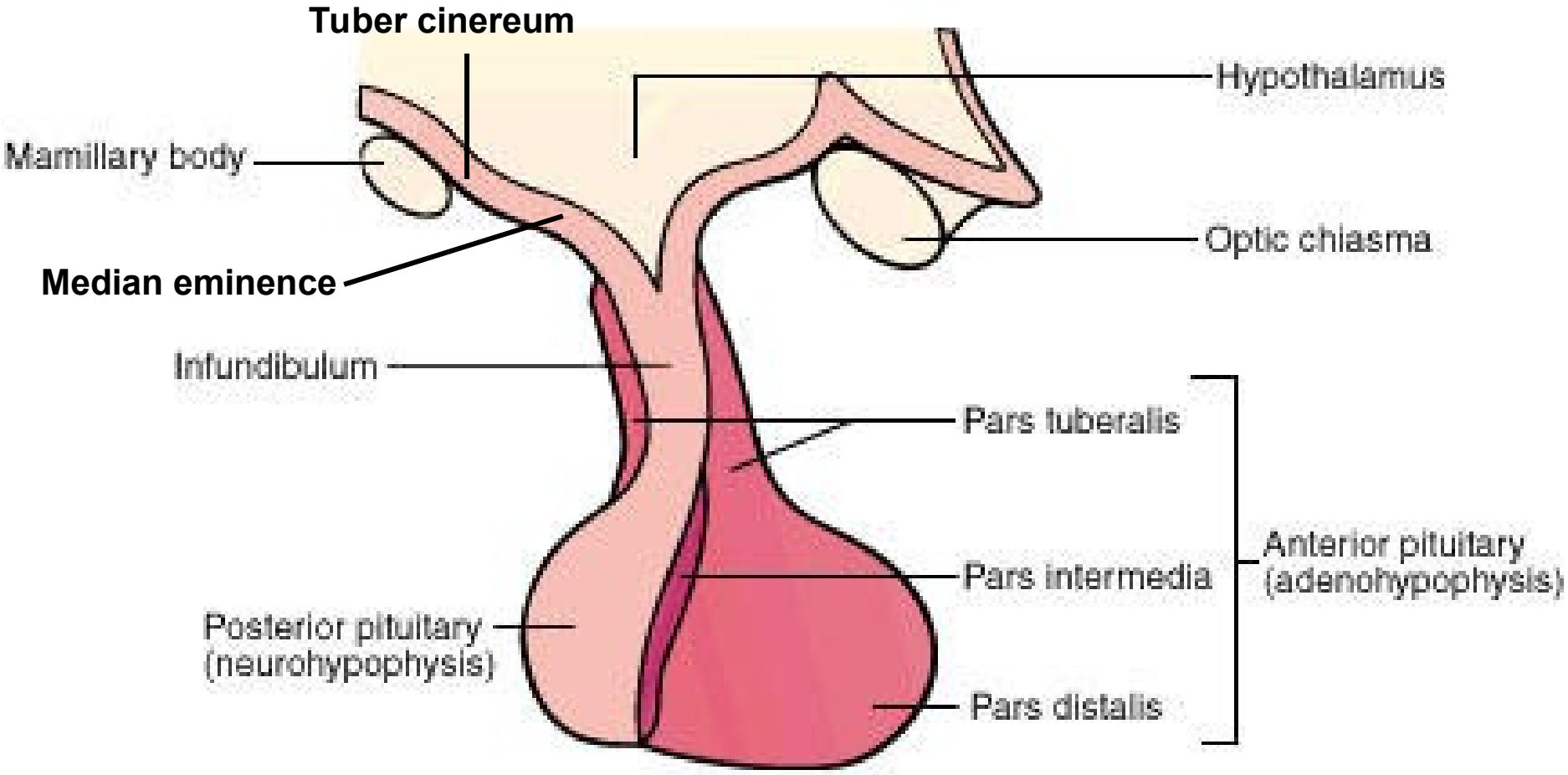
- Adenohypophysis
- Neuro hypophysis

Development of the Pituitary Gland

- Adenohypophysis - Derived from roof of the oral ectoderm which migrates upward as Rathke pouch.

- Neurohypophysis - Develops as a downward growth from the floor of the diencephalon.

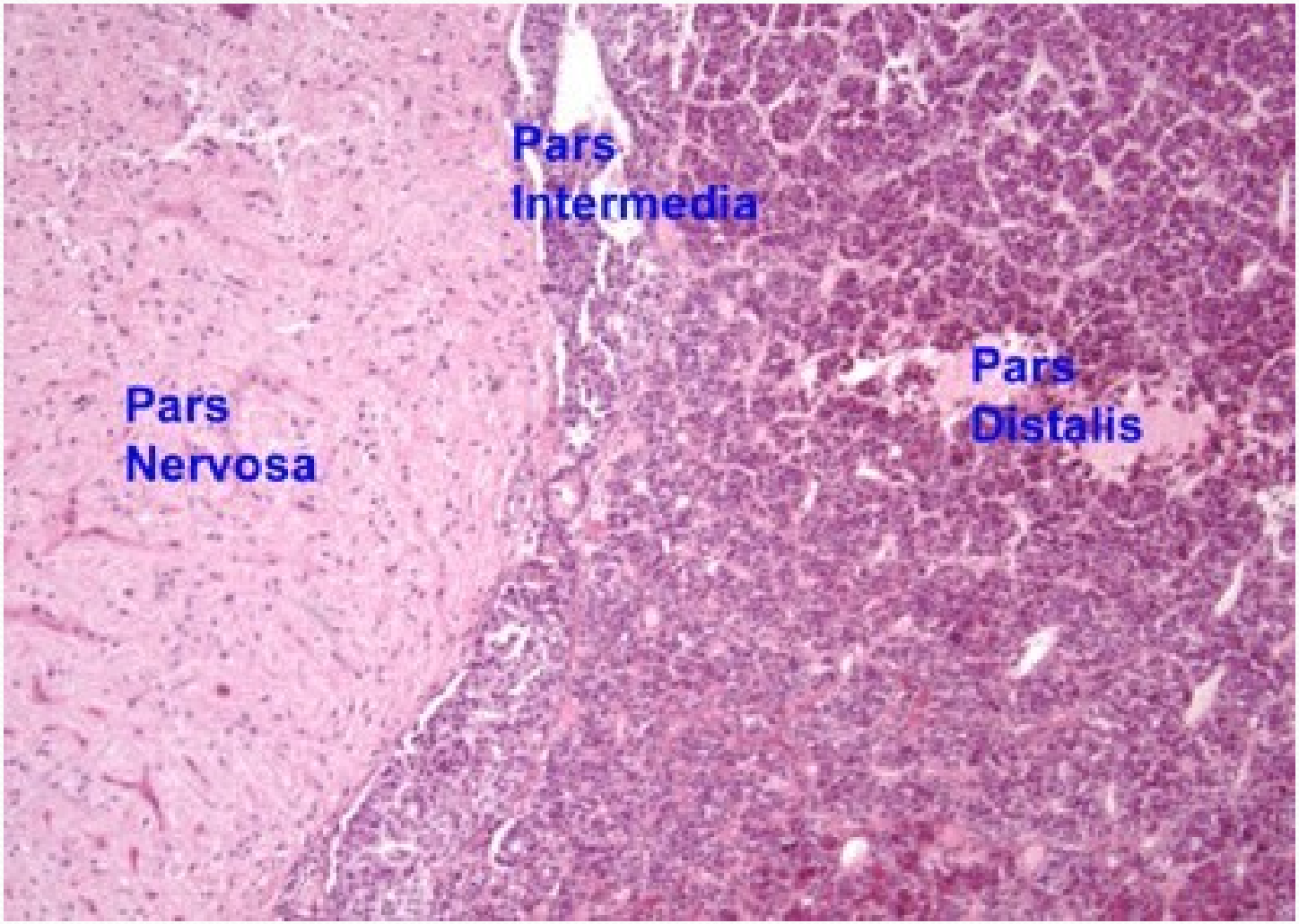
Sagittal section of Pituitary Gland



Subdivisions of the pituitary gland

- Adenohypophysis
  - Anterior lobe/ pars distalis/ pars glandularis
  - Intermediate lobe/ pars intermedia
  - Tuberal lobe/ pars tuberalis
- Neurohypophysis
  - Posterior lobe/ pars nervosa
  - Infundibular stem
  - Median eminence of the tuber cinereum

Microscopic view of the pituitary



Adenohypophysis

Pars Distalis

- 75 % of pituitary gland.
- Enclosed by a dense fibrous capsule.
- Parenchyma contains anastomosing cords and clusters of epithelial cells supported in a network of reticular fibers.
- Between parenchymal cells are sinusoidal capillaries.
- Parenchyma - 2 types of cells

  Chromophobic cells (C cells)

  Chromophilic cells
- This classification depends on the presence or absence of secretory granules and staining properties.

Chromophobic cells / c cells

- 50% of cells
- Very little affinity for dyes.
- Small / rounded / polygonal cells with little cytoplasm, poorly defined cell boundaries.
- Represents the non secretory phase.
- Light microscopy – very few secretory granules +
- EM – small secretory granules +

Chromophilic cells

- High affinity for dyes
- Two different types
  - Acidophil (α) cells – take up acid stain
  - Basophil (β) – take up basic stain

Acidophils / α cells

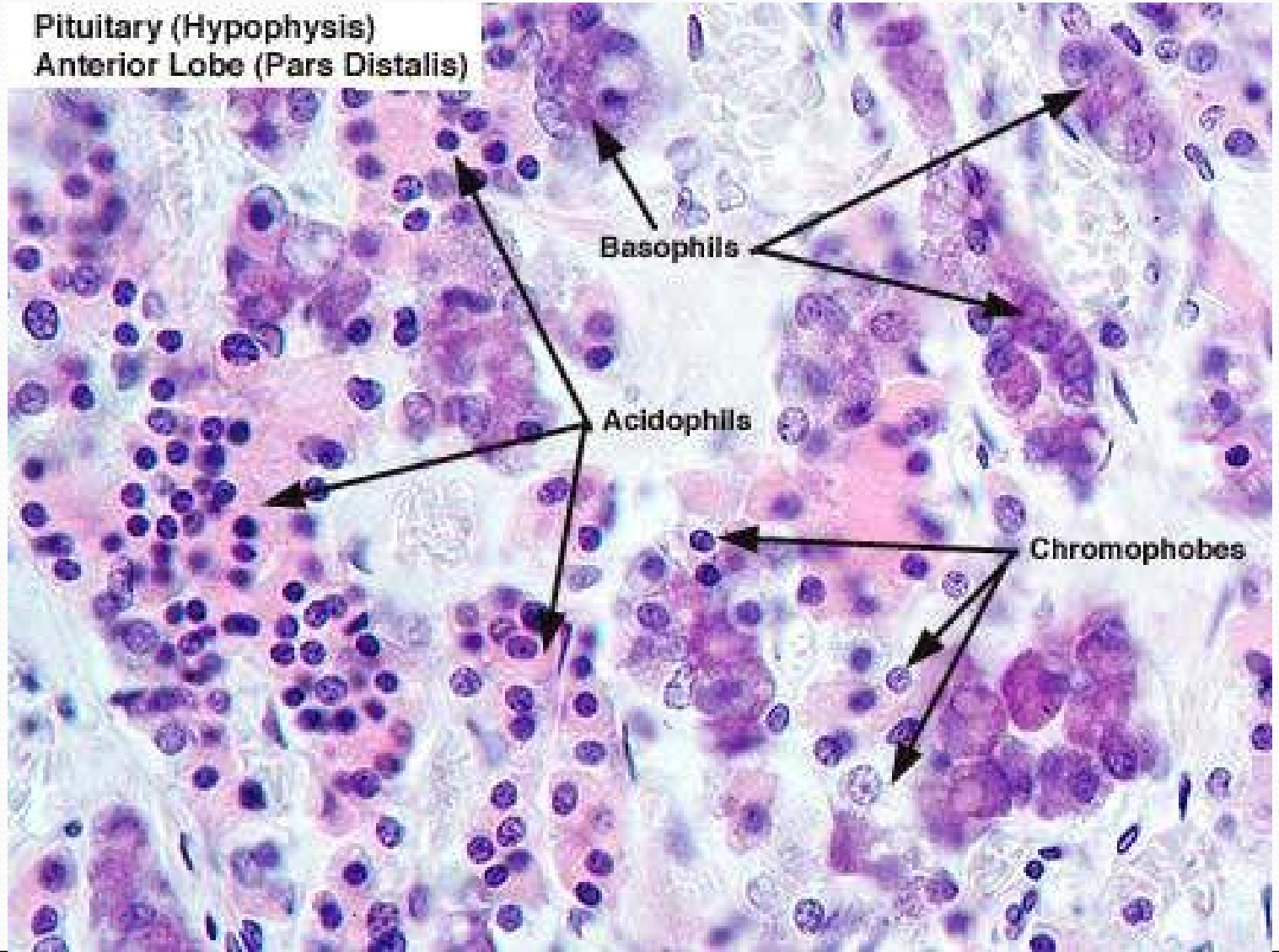
- 35% of cells
- Larger than chromophobes.
- Distinct cell boundaries
- Crowded cytoplasm with small granules which stain with eosin, acid fuchsin.
- Types of α cells,
  - Somatotrophs – secrete GH
  - Mammotrophs – secrete Prolactin

Basophils / β cells

- 15% of cells
- Larger than acidophil cells
- Cytoplasmic granules
  - Are smaller, less in number
  - Stain poorly with haematoxylin / deeply methylene blue.
  - Best demonstrated by periodic acid schiff (PAS) techniques.
  - Stain strongly + ve (deep pink).

- Types of β cells
  - Thyrotrophs – secrete TSH
  - Gonadotrophs – secrete FSH, LH
  - Corticotrophs – secrete ACTH

Cell types in pars distalis



Pars intermedia

- Poorly developed in man.
- 2 % of total pituitary gland.
- Made up of – thin layer of cells and vesicles containing colloid.
- Cells are polyhedral shaped, small and pale staining, resembling chromophobes.
- Some cells – layered arrangement, contain many secretory granules, basophillic and thought to synthesize MSH in man.

Pars tuberalis

- Collar of cells around infundibular stalk.
- Cells are closely associated with nerves
- Arranged in groups / short cords
- Cells – Acidophils / Basophils / Chromophobe like cells
- Function ?

Neurohypophysis

- Made up of
  - Posterior lobe
  - Median eminence of tuber cinereum
  - Infundibular stem

- All 3 have identical cells & same neurovascular supply.
- Consist of
  - non myelinated fibres –
    - hypothalamo- hypophyseal tract
  - Pituicytes – modified neurological cells

- Hypothalamo hypophyseal tract begins in the SON and PVN of the hypothalamus

- pass through the Infundibular stem to terminate in pars nervosa.

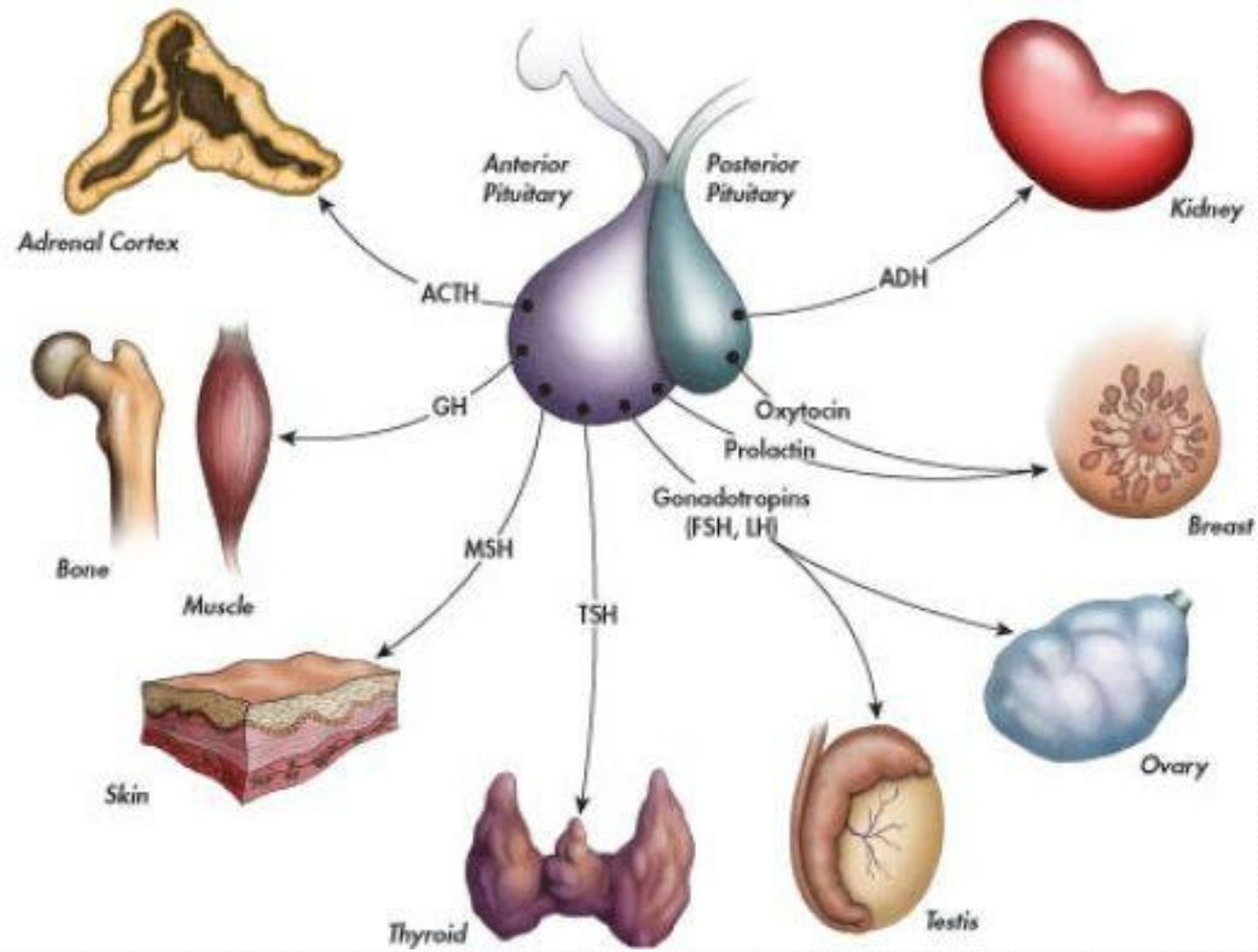
Pituicytes

- Similar to neuroglial cells of CNS.
- Small cells, have dendrites ending on blood vessels or on CT septa.
- Cytoplasm with fat droplets, pigment granules.
- Cells are most abundant in P. nervosa
- No secretory function.
- Thought to function as supporting cells as neuroglia of CNS.

Hormones secreted by neurohypophysis

- Vasopressin - (antidiuretic hormone/ ADH) secreted by PVN
- Oxytocin - secreted by SON
- Oxytocin
  - contraction of smooth muscle of uterus, alveoli and ducts of mammary glands.
- Vasopressin
  - contraction of vascular smooth muscle → ↑ PR → ↑ B/P
  - ↑Reabsorption of H2O in kidneys → ↑ urine concentration

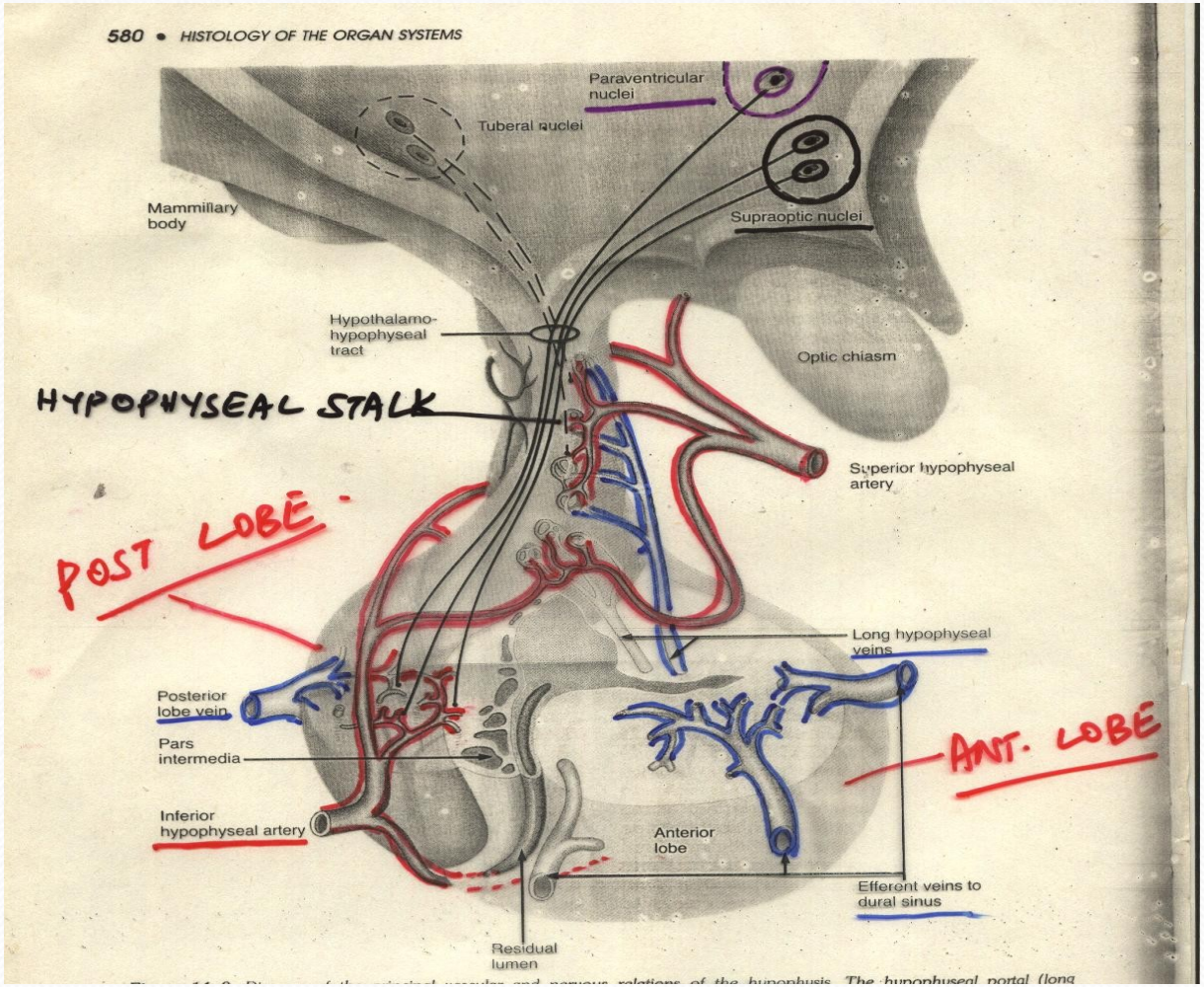
Hormones secreted by the pituitary



Blood supply

- Superior hypophyseal arteries
  - Branches of the internal carotid artery and posterior communicating artery.
- Inferior hypophyseal arteries
  - Branches of the internal carotid artery.
- Superior hypophyseal artery supplies,
  - Ventral part of the hypothalamus
  - Upper part of the infundibulum
  - Lower part of the infundibulum through trabecular artery

- Inferior hypophyseal artery forms an arterial ring around the posterior lobe and supply the posterior lobe.

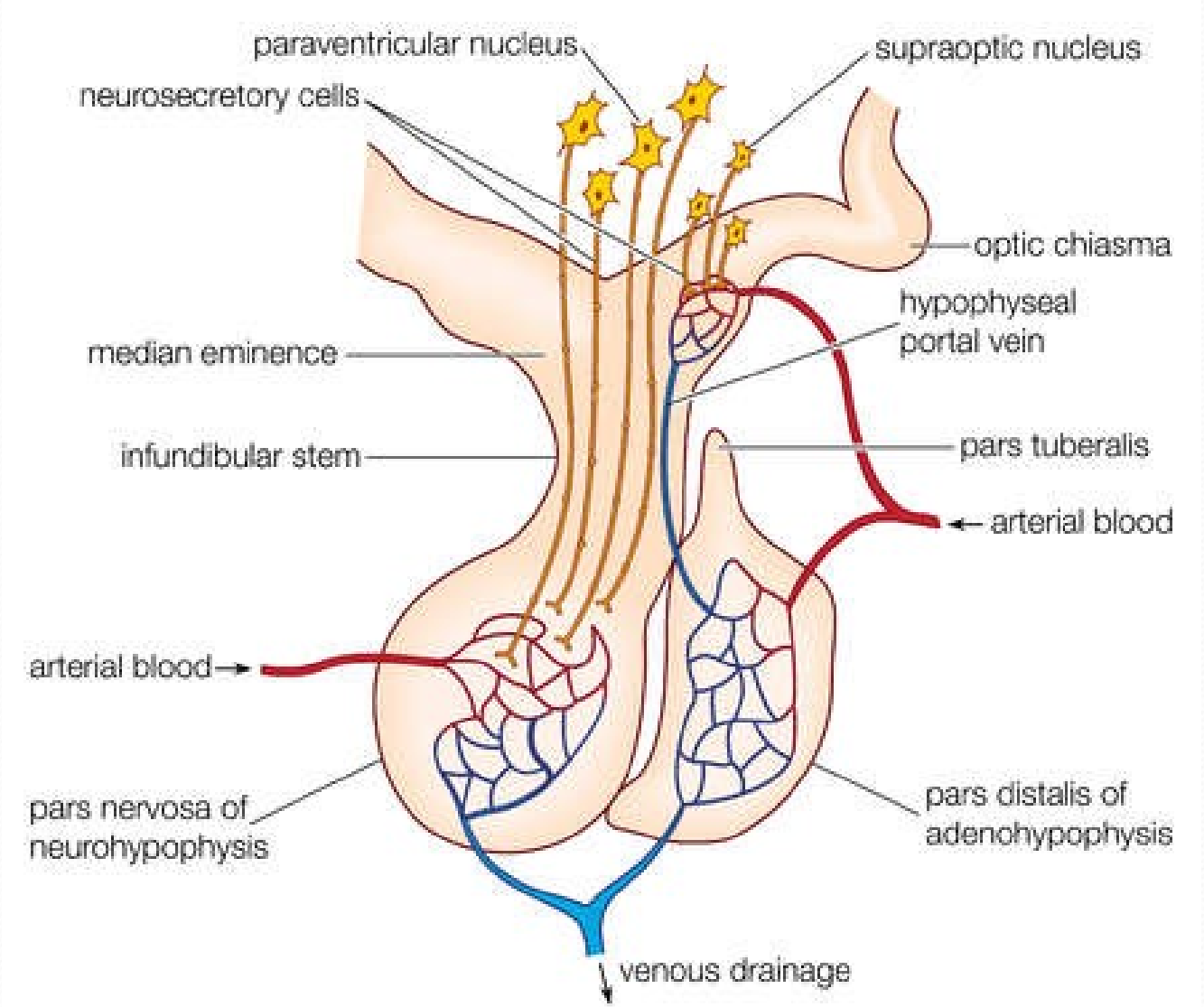


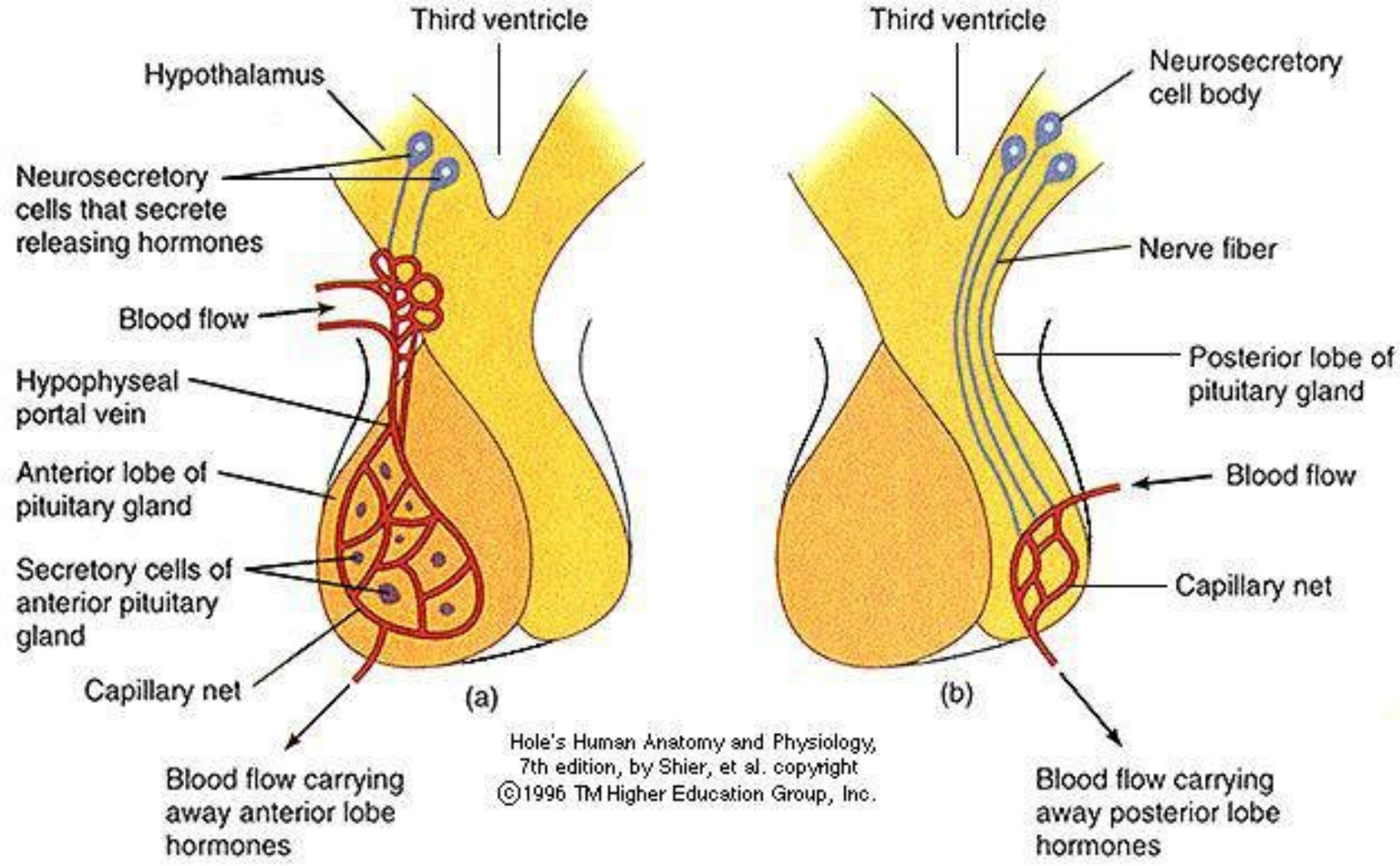
Blood supply to the pituitary gland

Portal system of the Pituitary Gland

- There is a portal system formed by the capillary tufts of the superior hypophyseal artery.
- From the 2 sets of capillaries, one is in the hypothalamus, the other is in the anterior pituitary.
- Long portal vessels drain the median eminence, upper infundibulum.
- Short portal vessels drain the lower infundibulum.
- Carry releasing hormones and release inhibiting hormones from hypothalamus to anterior pituitary.
- Pars distalis is exclusively supplied by the portal vessels

Portal system of the pituitary




Third ventricle
Hypothalamus
Neurosecretory cells that secrete releasing hormones
Blood flow
Hypophyseal portal vein
Anterior lobe of pituitary gland
Secretory cells of anterior pituitary gland
Capillary net
Blood flow carrying away anterior lobe hormones
(a)
Third ventricle
Neurosecretory cell body
Nerve fiber
Posterior lobe of pituitary gland
Blood flow
Capillary net
Blood flow carrying away posterior lobe hormones
(b)
Hole's Human Anatomy and Physiology, 7th edition, by Shier, et al. copyright ©1996 TM Higher Education Group, Inc.

- Short veins emerge on the gland surface
- Drain into neighbouring dural venous sinuses
- Hormones pass out of the gland through the veins.

Clinical Features

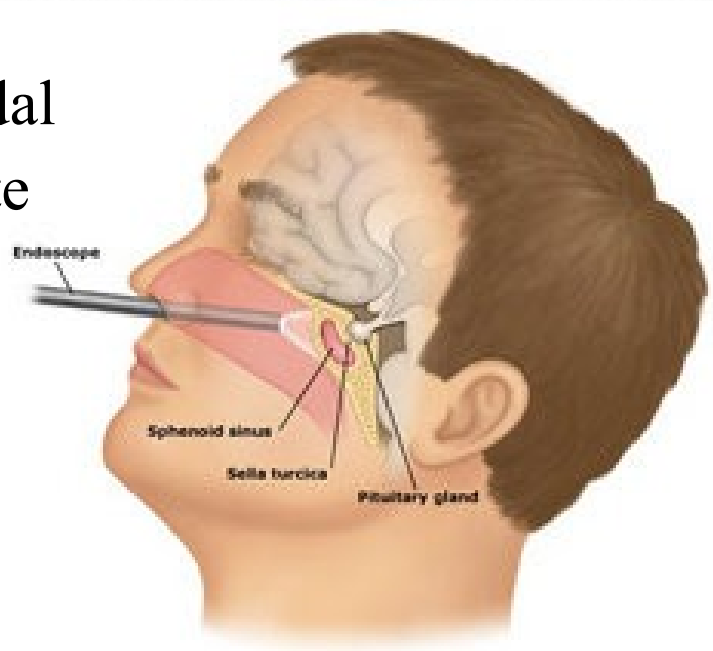
- Pituitary tumours – Macro/Microadenomas
- Symptoms are due to,
  - The mass effect by the tumour
  - Endocrine disturbances - Hyperpituitarism / Hypopituitarism

- Commonest – chromophobe adenoma
- Symptoms due to mass effect - Bitemporal hemianopia
- Bony erosion - double floor in skull X ray
- Destroy the normal parts in the gland – Hypopituitarism
  - Hypothyroidism, hypoadrenalism, loss of sexual characteristics
  - In children – growth arrest/ **dwarfism**

- Eosinophil adenoma
  - Secrete GH
  - Before puberty – gigantism
  - After puberty – acromegaly
- Basophil adenoma
  - Cushing syndrome

- Routine investigations
  - Hormone profile
  - Radiological Ixs
  - Other routine tests

- Management
  - Surgical approach – Trans-sphenoidal via hard palate



Thank You