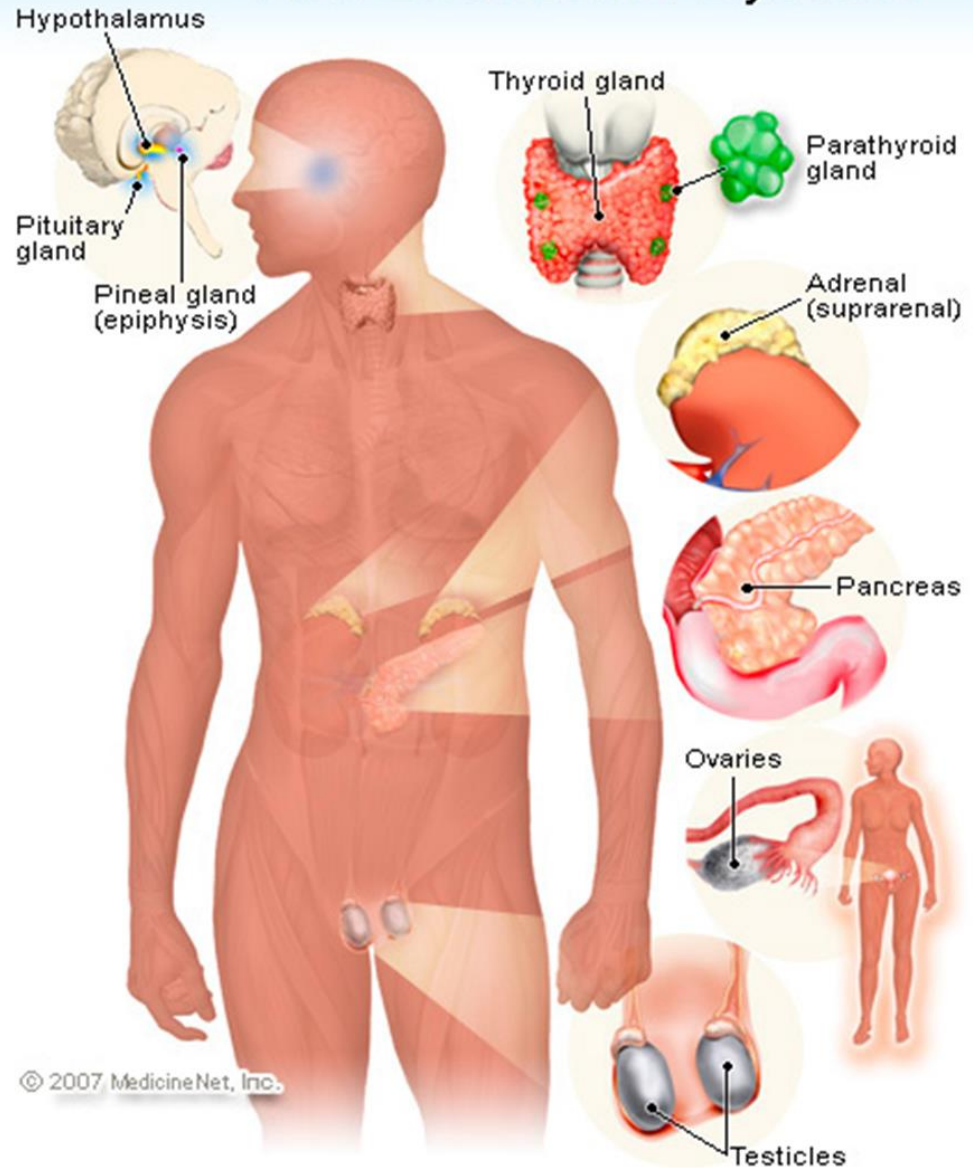


Endocrine system:
anatomy, Histology and
Embryology



General Principles

The Endocrine System



General considerations..1

Histologically, the endocrine cells are epithelial cells performing special functions.

Endocrine glands may be:

- Unicellular (DNES = APUD)
- Multicellular (thyroid, adrenal.....)

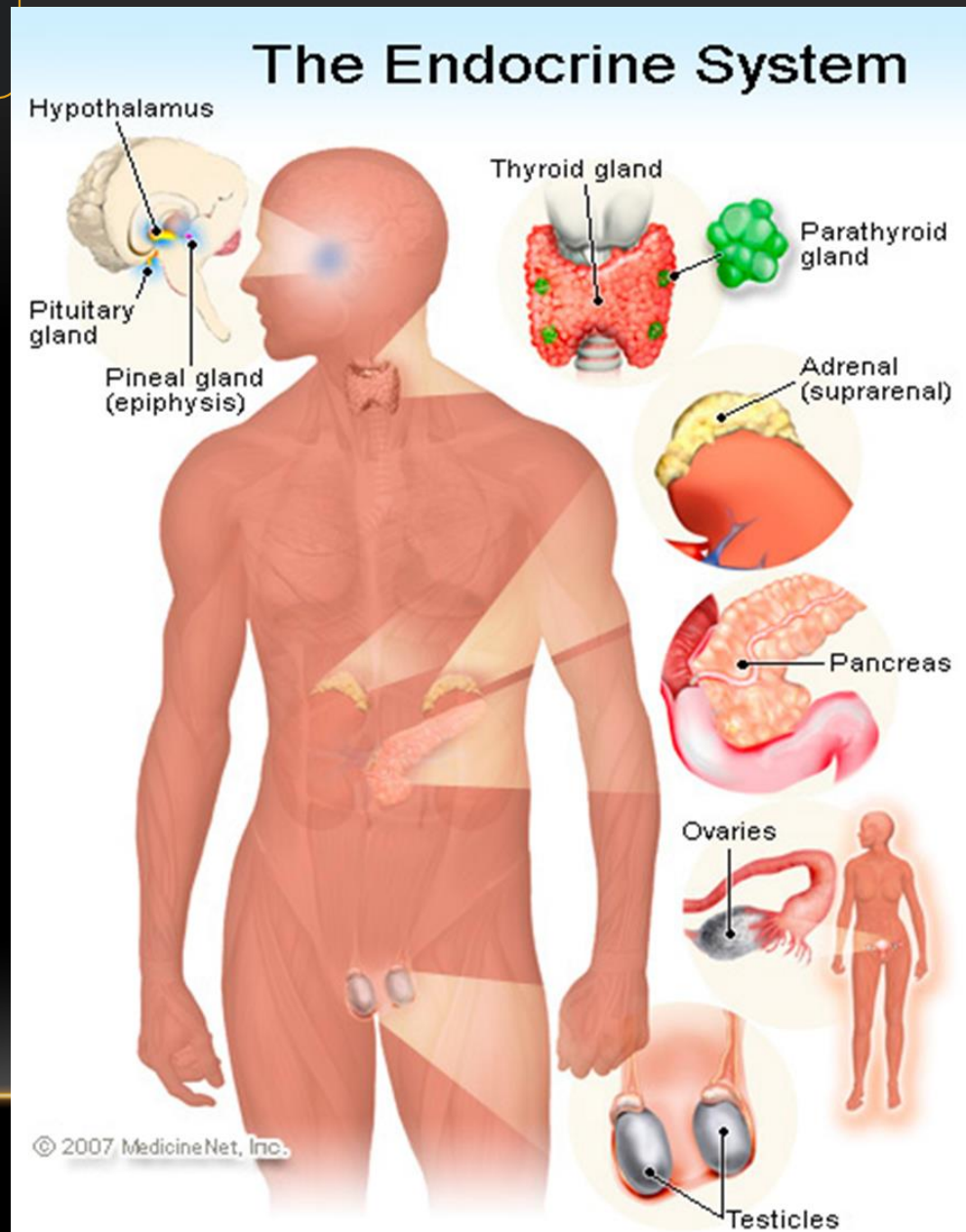
Each endocrine gland has two different embryological origins.

General considerations..2

Endocrine glands and the nervous system share in regulating body activities.

The effects of hormones is slow but long lasting when compared to the nervous response.

A hormone is a substance secreted by an endocrine gland into the blood that targets distant tissues to produce specific response.



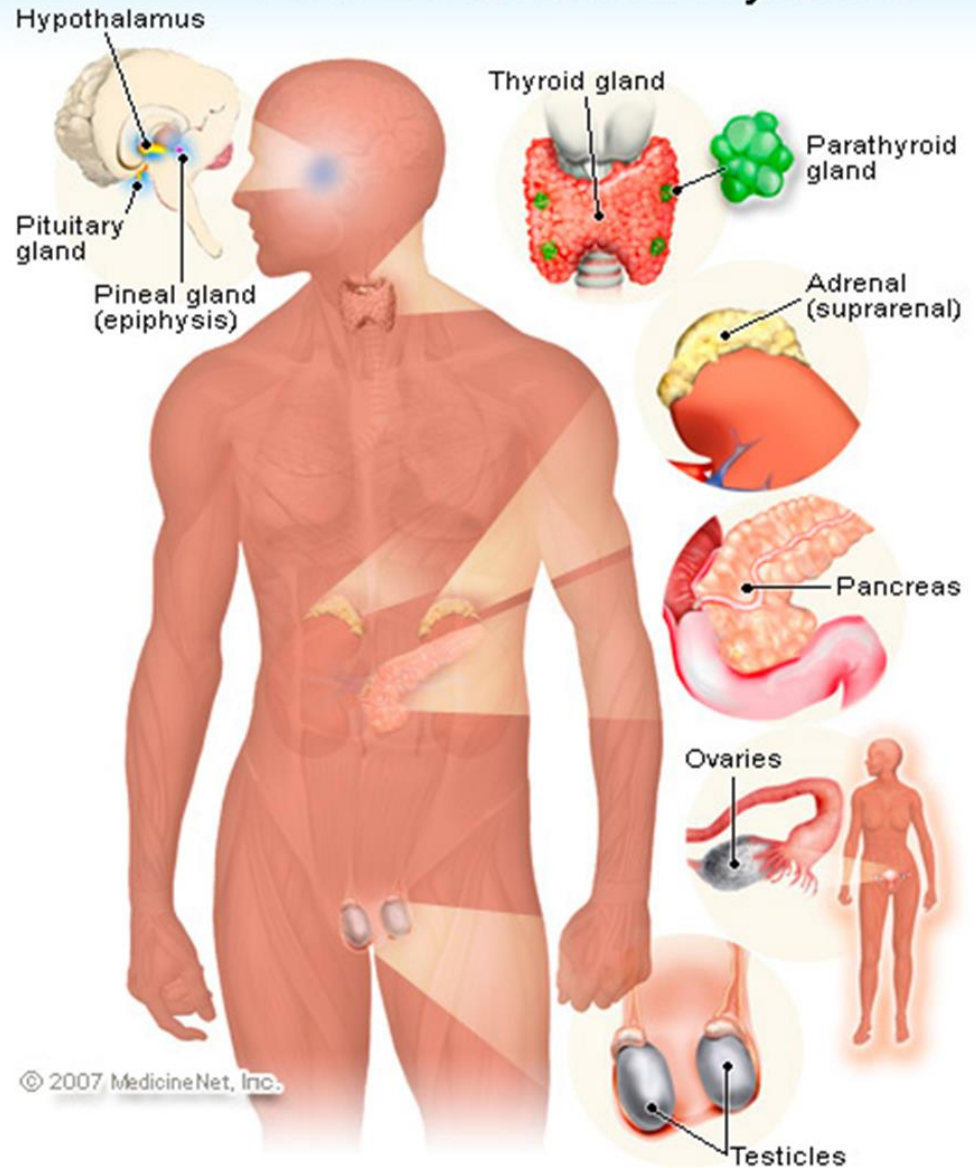
General considerations..3

Chemically, hormones belong chiefly to, either:

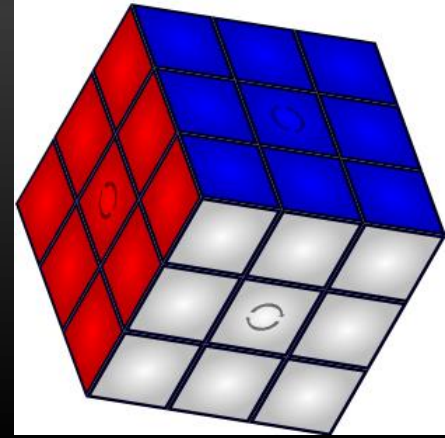
- steroids
- Amino acid-based

Hormones bind to specific receptors on target cells to produce a response.

The Endocrine System



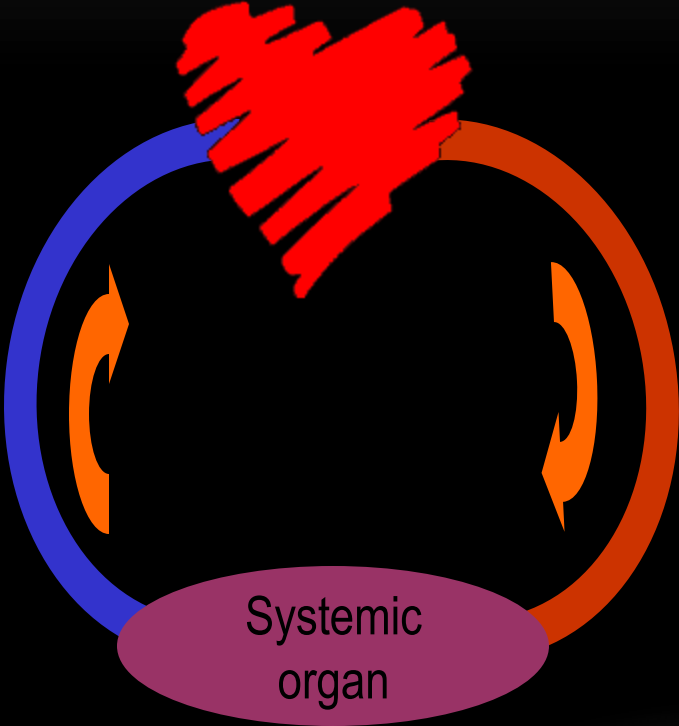
Endocrine glands, in general, receive blood supply from more than one source.



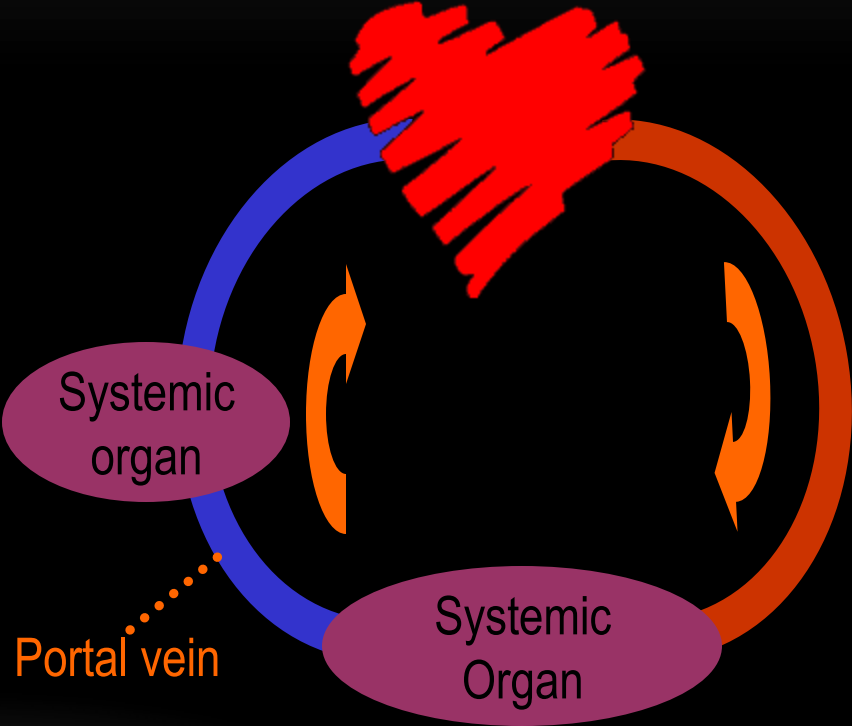
Histology is a two
dimensional study
of a three
dimensional reality

Circulation

Ordinary



Portal



The ultrastructure and many general histological aspects of a cell are determined by the nature of the most prominent product the cell is making.

Cells that make few or no proteins for secretion have very little rER. All polyribosomes are free in the cytoplasm.

Cells that synthesize, segregate, and store various proteins in specific secretory granules or vesicles always have rER, a Golgi apparatus, and a supply of granules containing the proteins ready to be secreted.

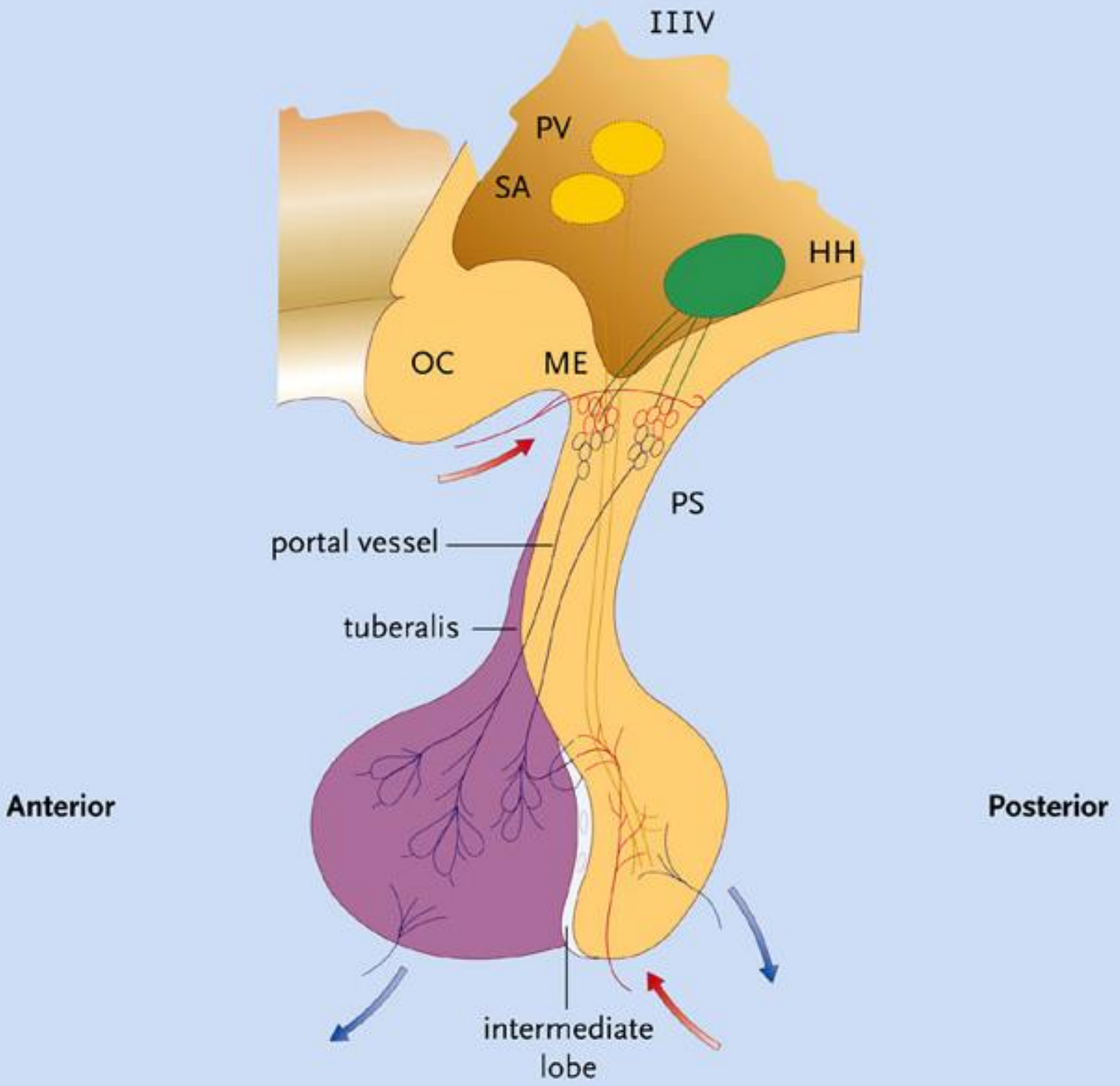
Cells with extensive rER and a well-developed Golgi apparatus show few secretory granules because the proteins undergo exocytosis immediately after Golgi processing is complete.

Steroid synthesizing cells are characterized by many profiles of smooth endoplasmic reticulum in their cytoplasm, the cytoplasm appears acidophilic.

Steroids are lost during preparation of the tissue for H&E staining; many white areas are observed.

Pituitary gland hypophysis cerebri

Gr. *Hypo*, under, + *physis*, growth



EMBRYOLOGY OF THE PITUITARY GLAND

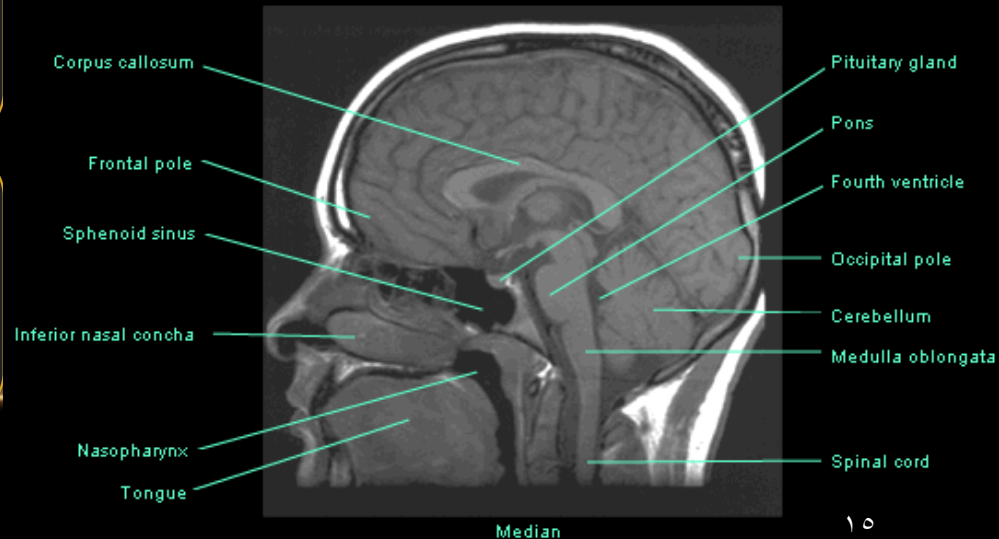
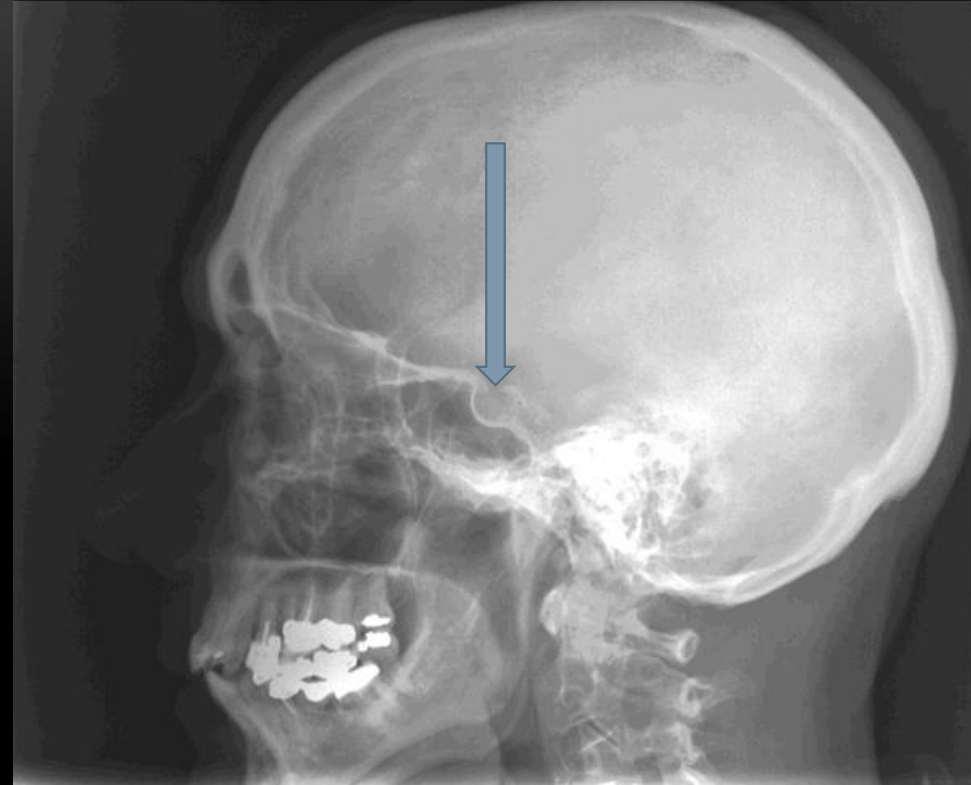


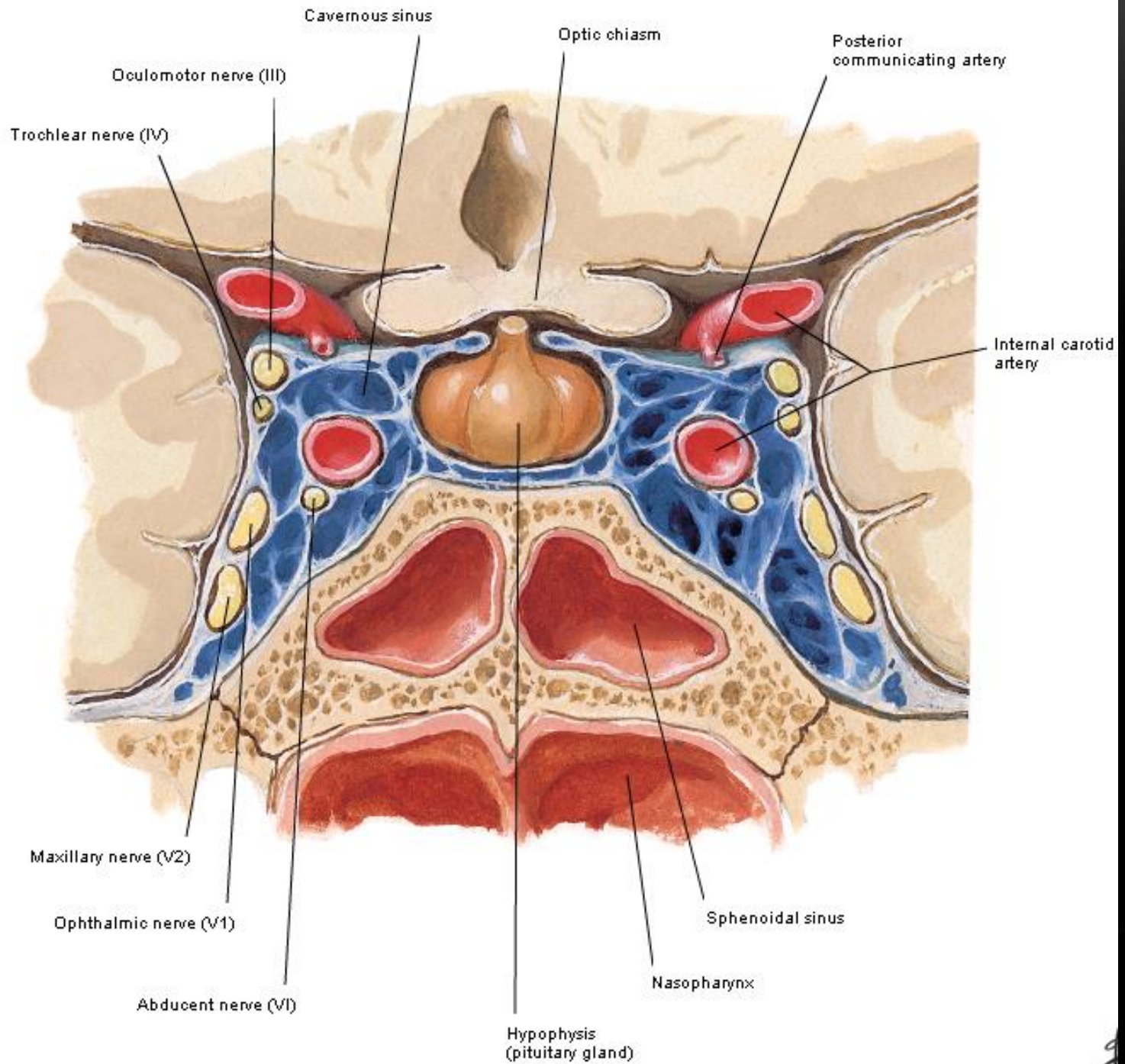
About 12 mm in transverse and 8 mm anteroposterior diameter in adults.

Weight 0.5 g in adults.

Lies below the brain in the *sella turcica* (*hypophyseal fossa*), of the sphenoid bone.

Covered superiorly by the *diaphragma sellae* of the dura matter.



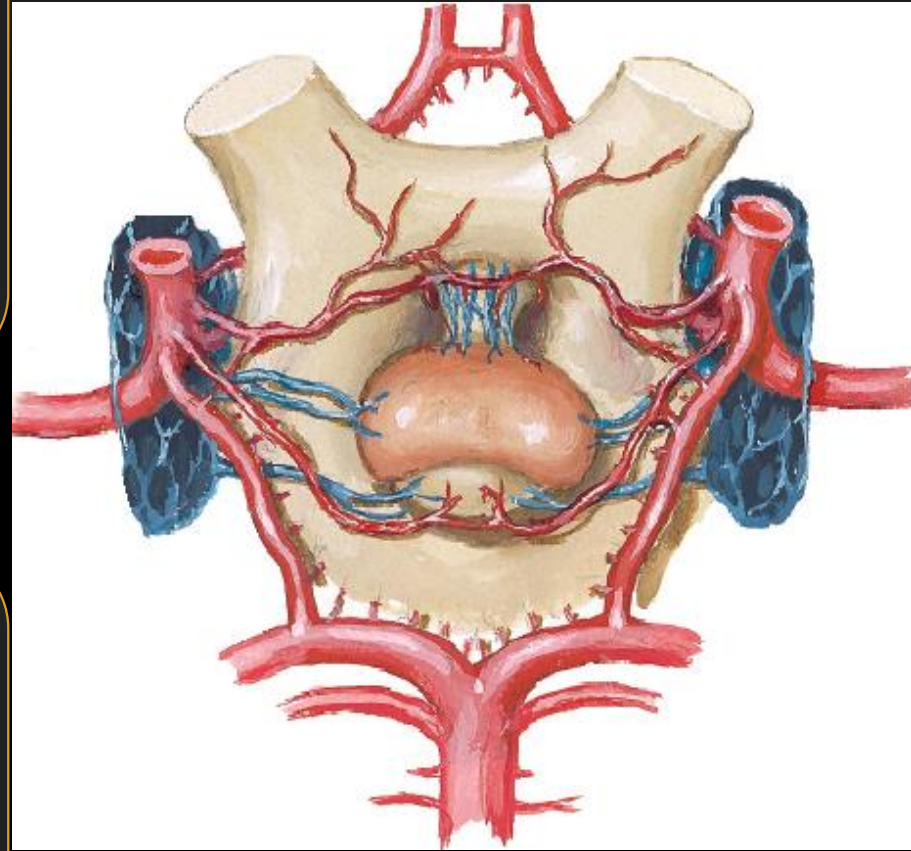


Blood Supply of the Pituitary Gland

The pituitary is supplied by the:

- Superior hypophyseal artery
- Inferior hypophyseal artery

Both are branches from the internal carotid artery, in the cavernous sinus.

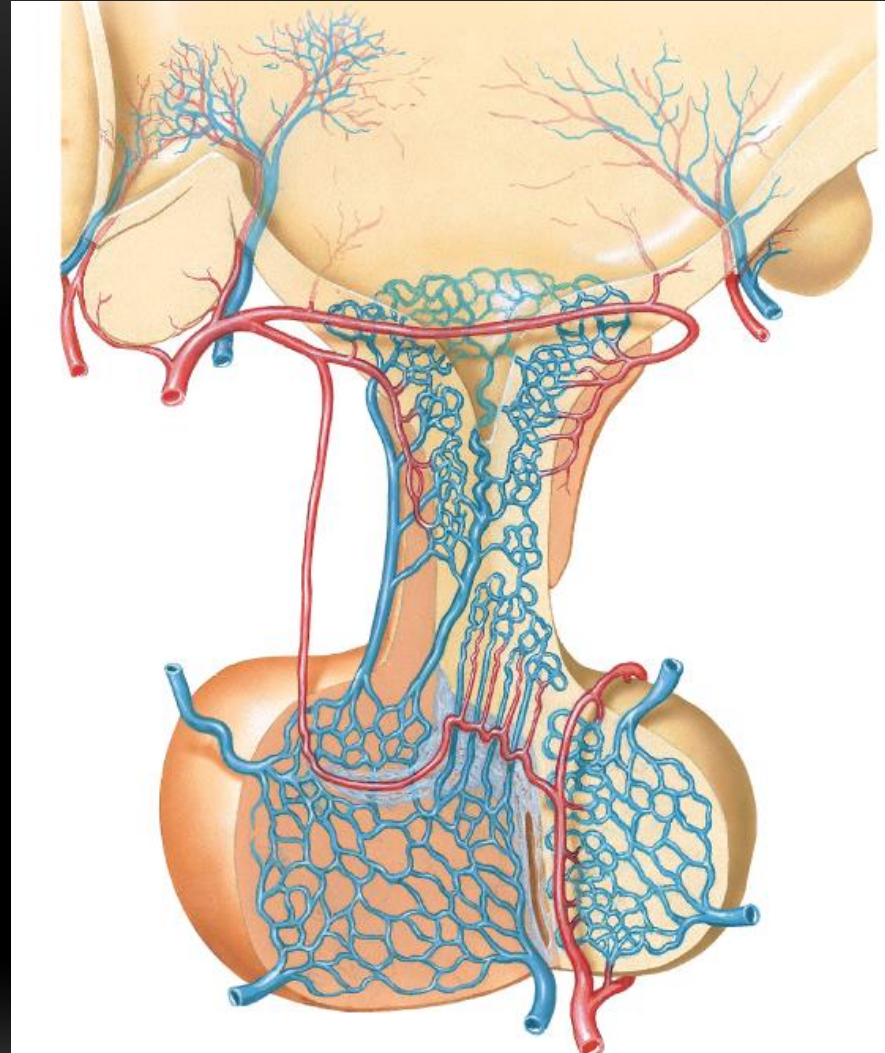


Superior hypophyseal a. Supplies the pars tuberalis and infundibulum

primary capillary plexus (in the median eminence)

hypophyseal portal vein

secondary plexus (in the pars distalis)

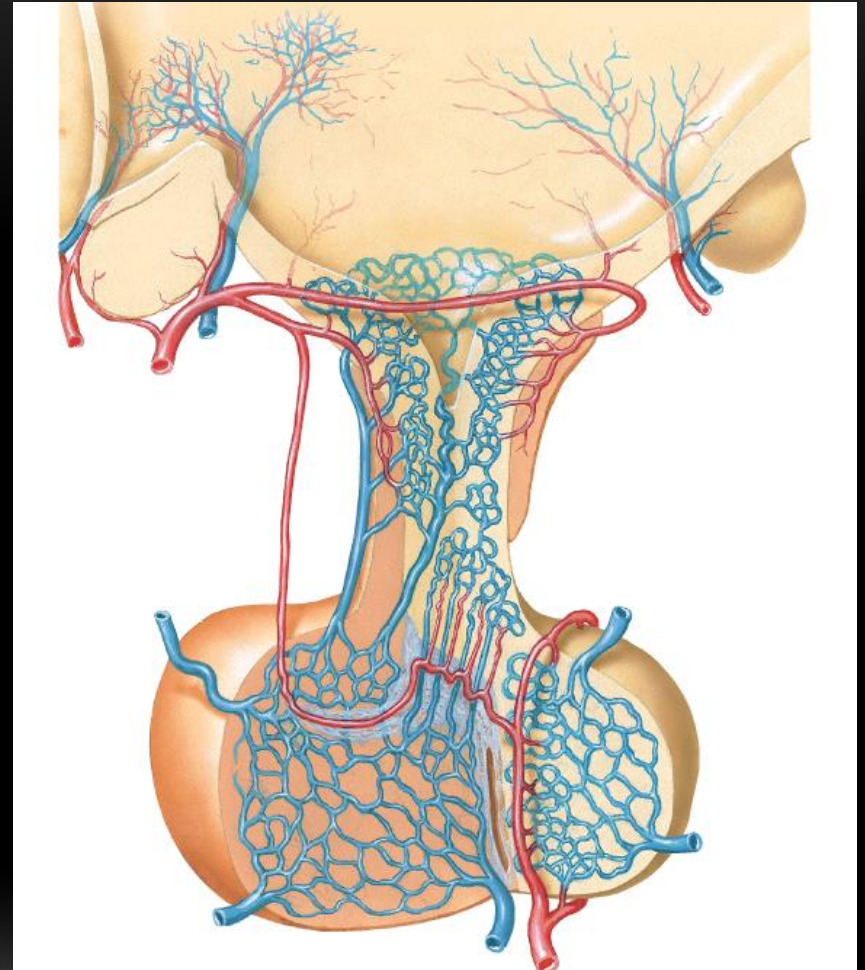


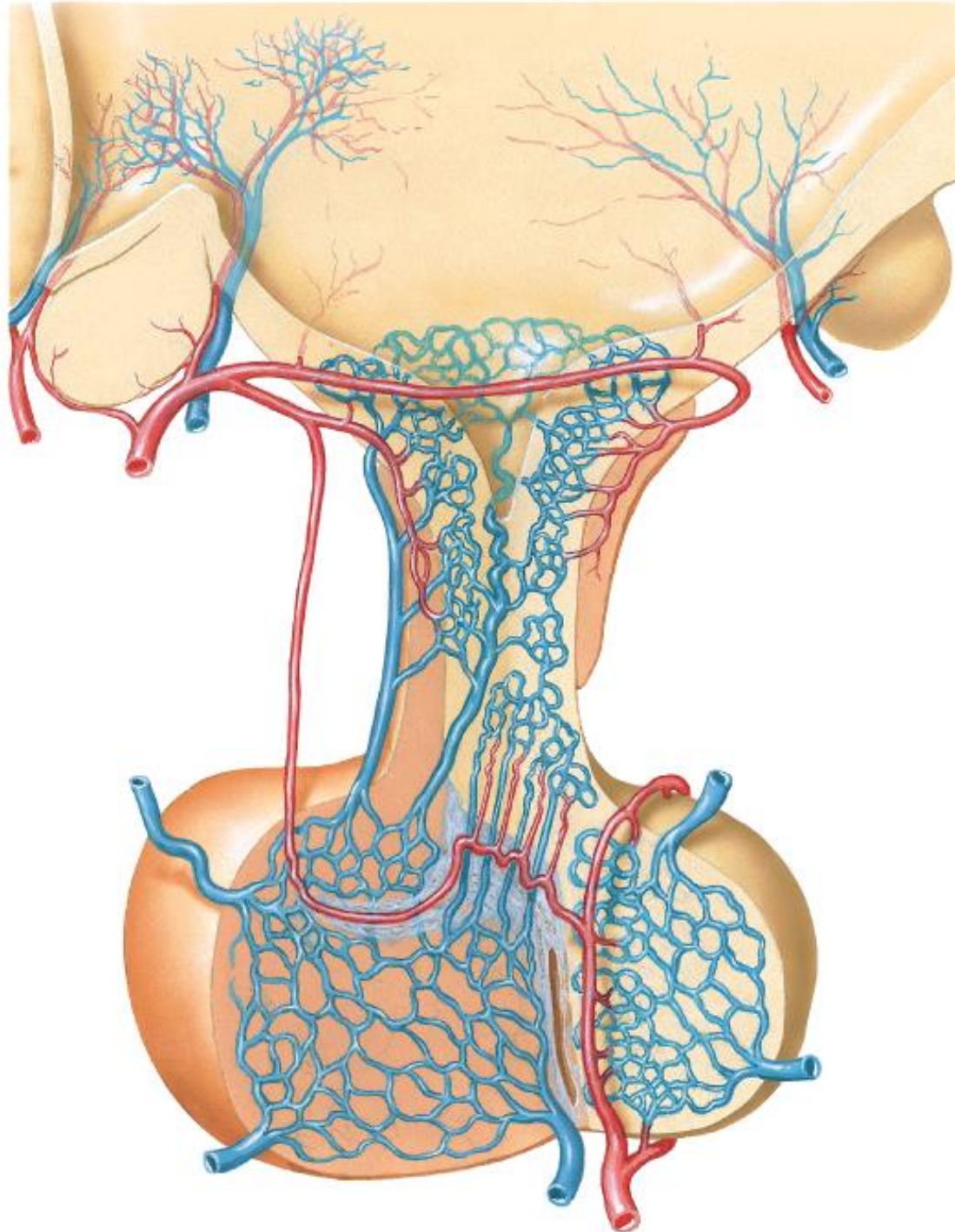
Inferior hypophyseal artery

Divides into medial and lateral arteries

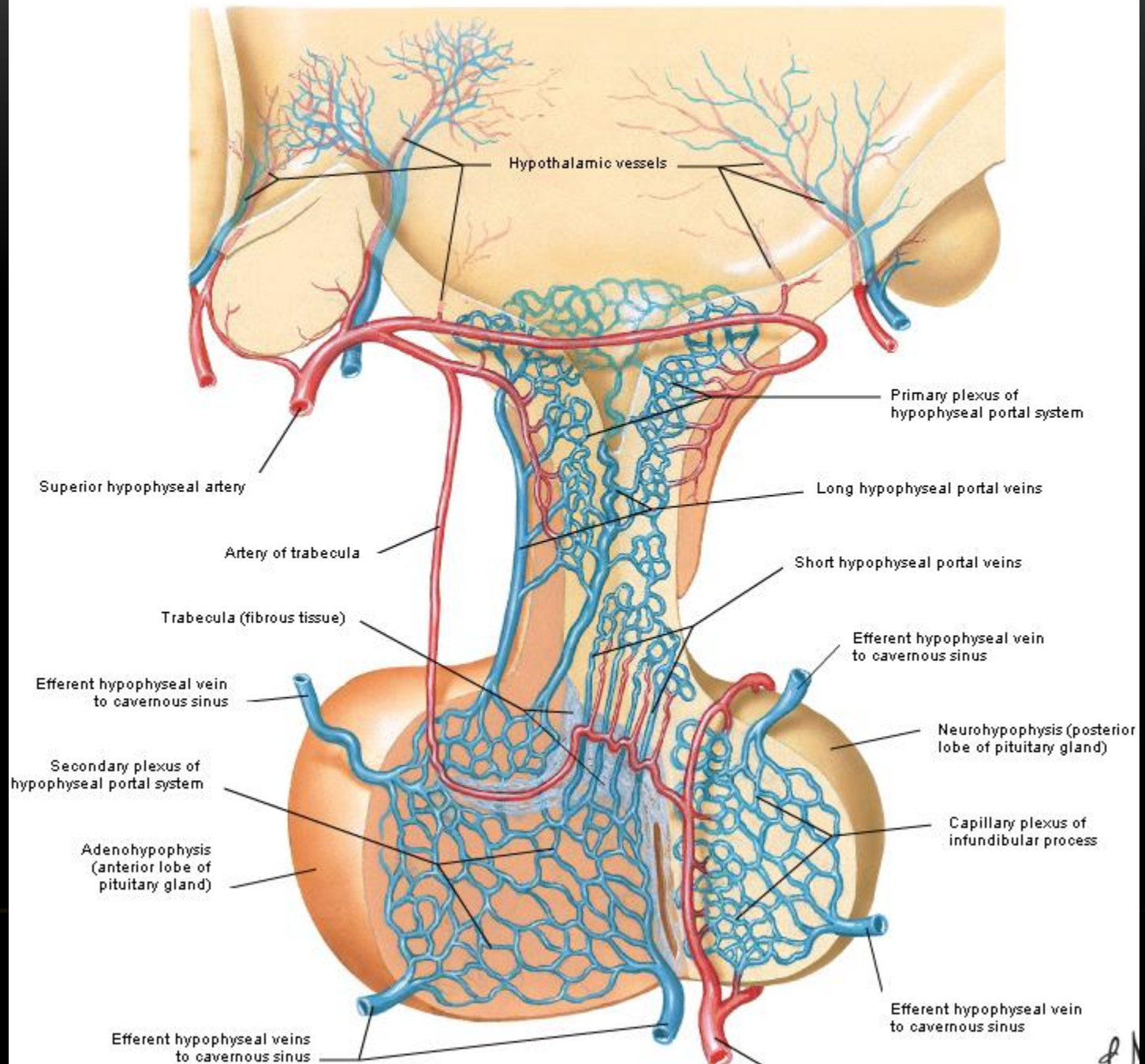
Form an arterial ring around the infundibulum

Supply the neurohypophysis



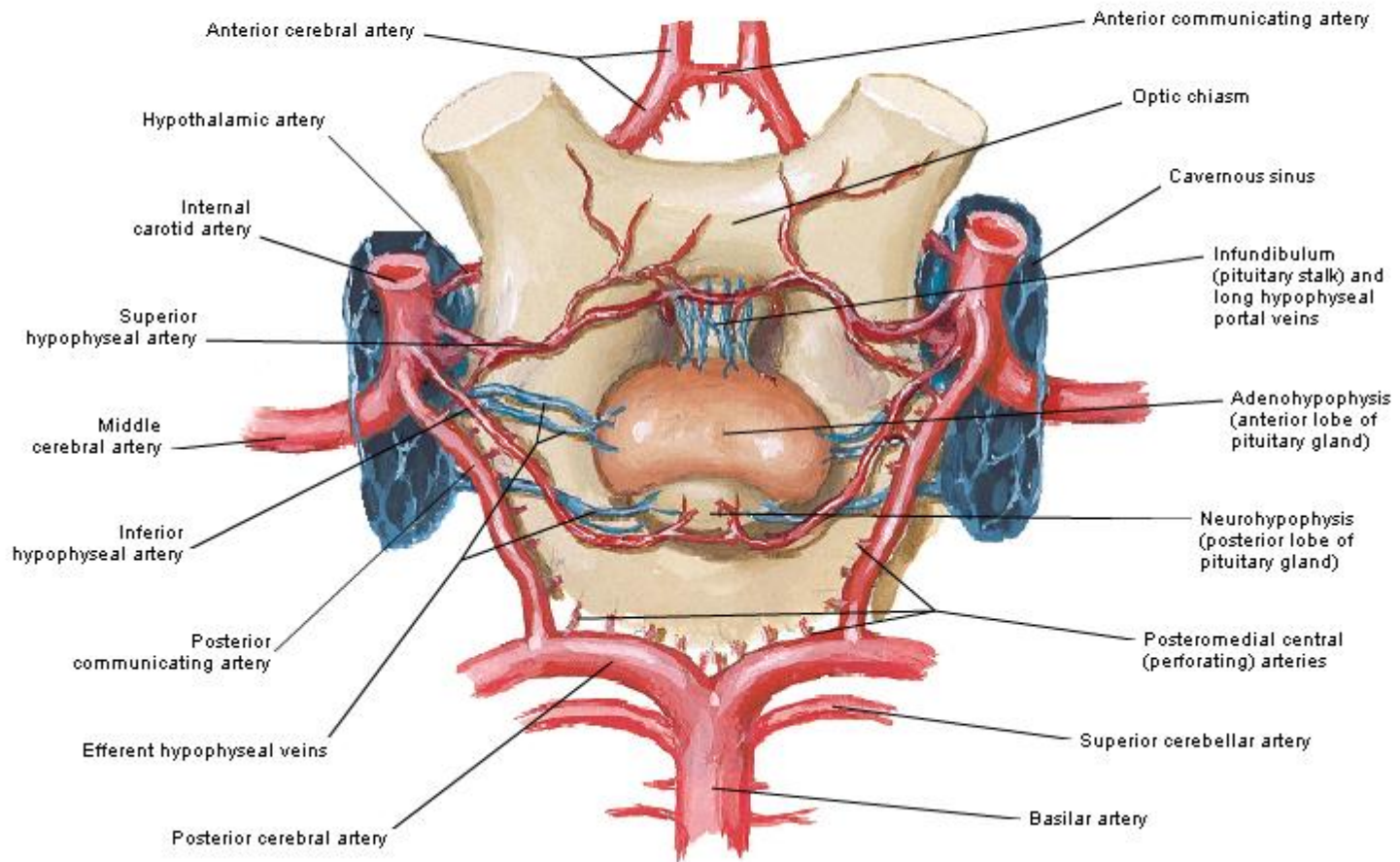


Arteries and Veins of Hypothalamus and Hypophysis

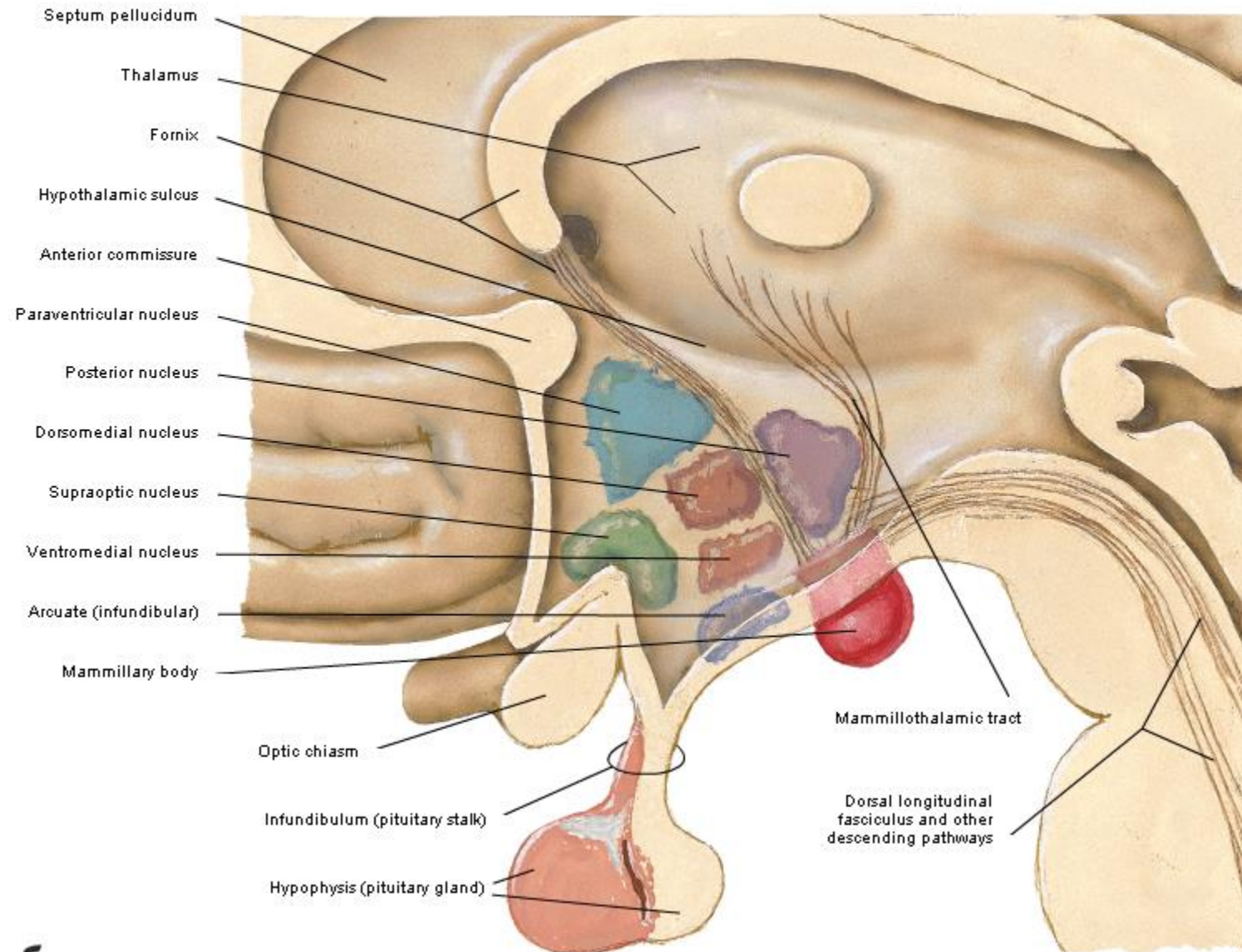


Cerebral Arterial Circle (Willis) - Vessels In Situ

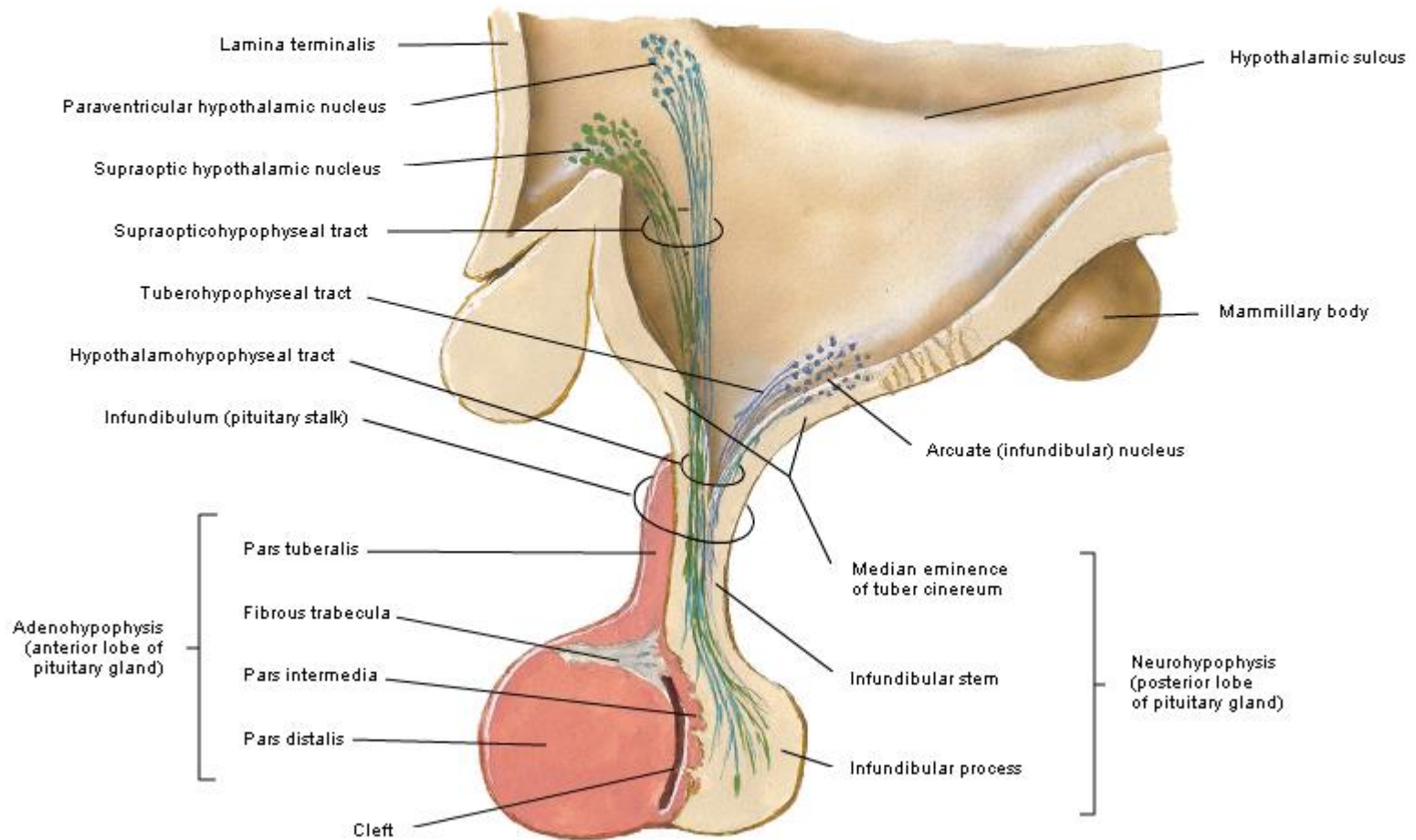
Inferior View



Hypothalamus - Principal Nuclei



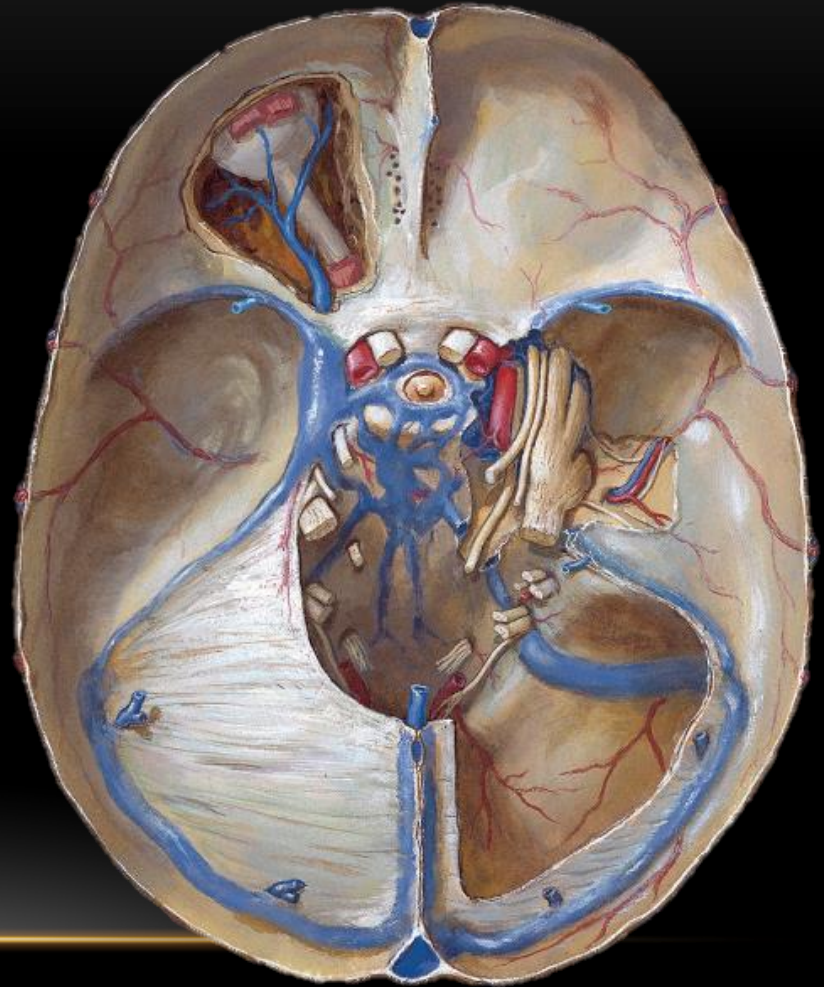
Adenohypophysis and Neurohypophysis

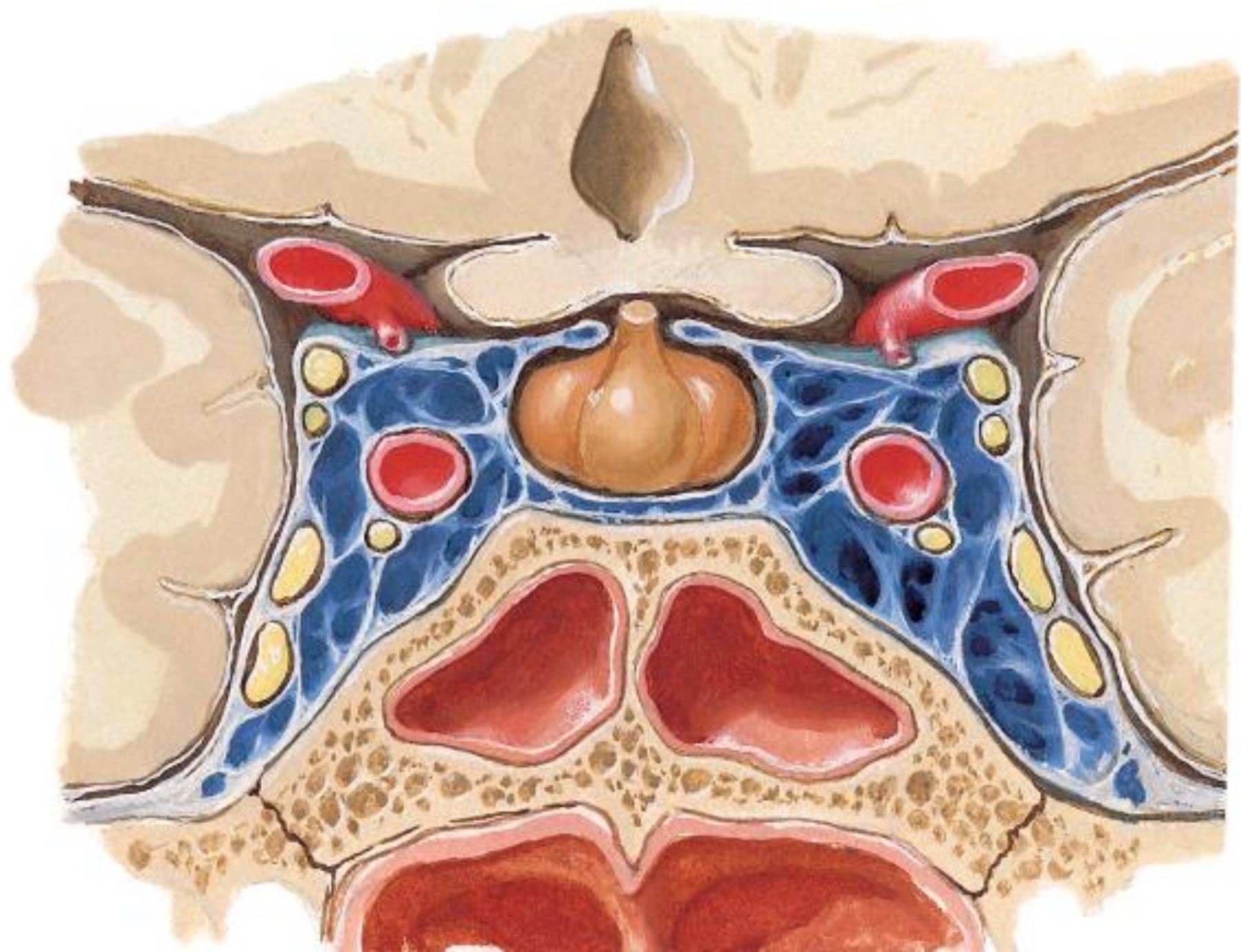


Venous drainage of the pituitary gland

Most of the blood from the pituitary is drained into the cavernous sinus.

There is some evidence that some blood from the pars nervosa may flow towards the hypothalamus.





Histology of the pituitary gland

Adenohypophysis (Anterior Pituitary)

- Pars Distalis
- Pars Intermedia
- Pars Tuberalis

Neurohypophysis (Posterior Pituitary)

- Median Eminence
- Infundibulum
- Pars Nervosa

Cells of the adenohypophysis

Chromophils

Chromophobes

Acidophils

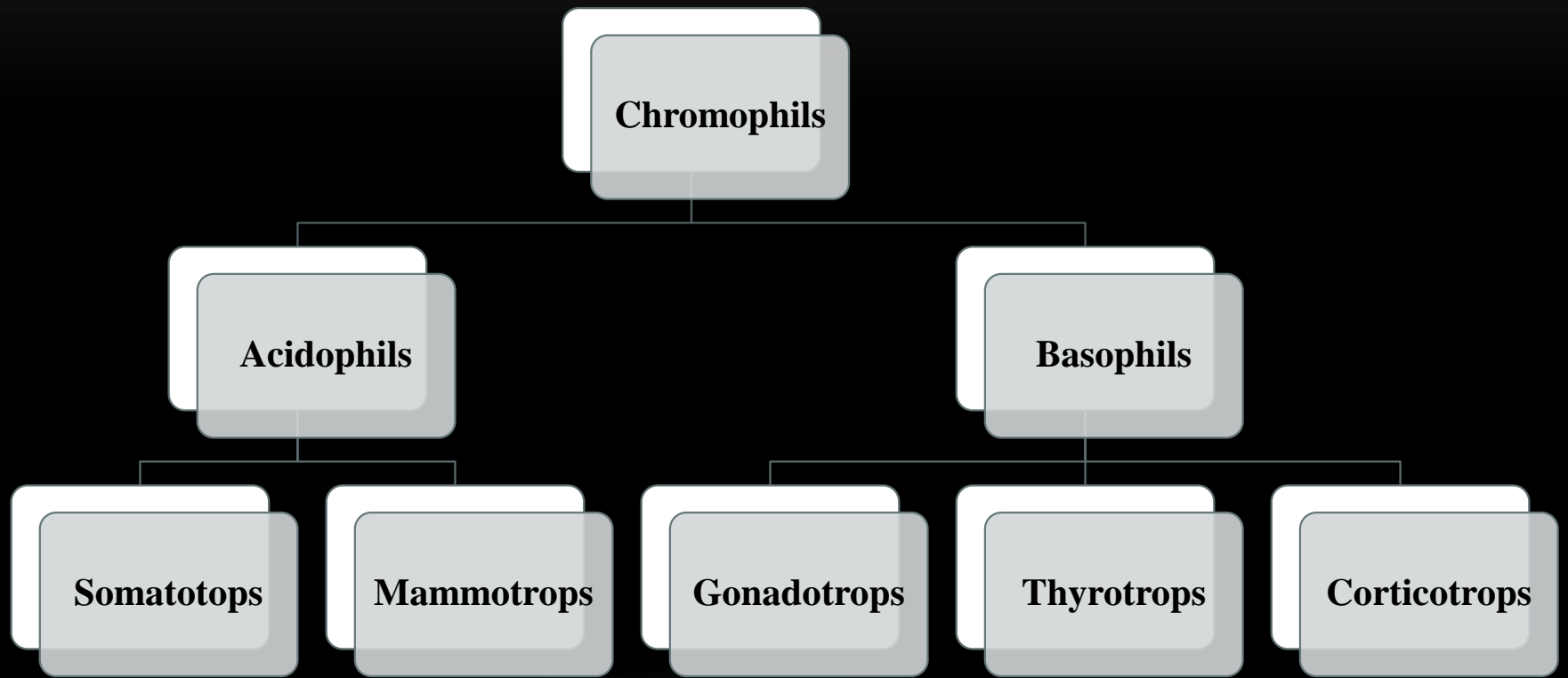
Basophils

Cells of the Adenohypophysis

1- Chromophobes

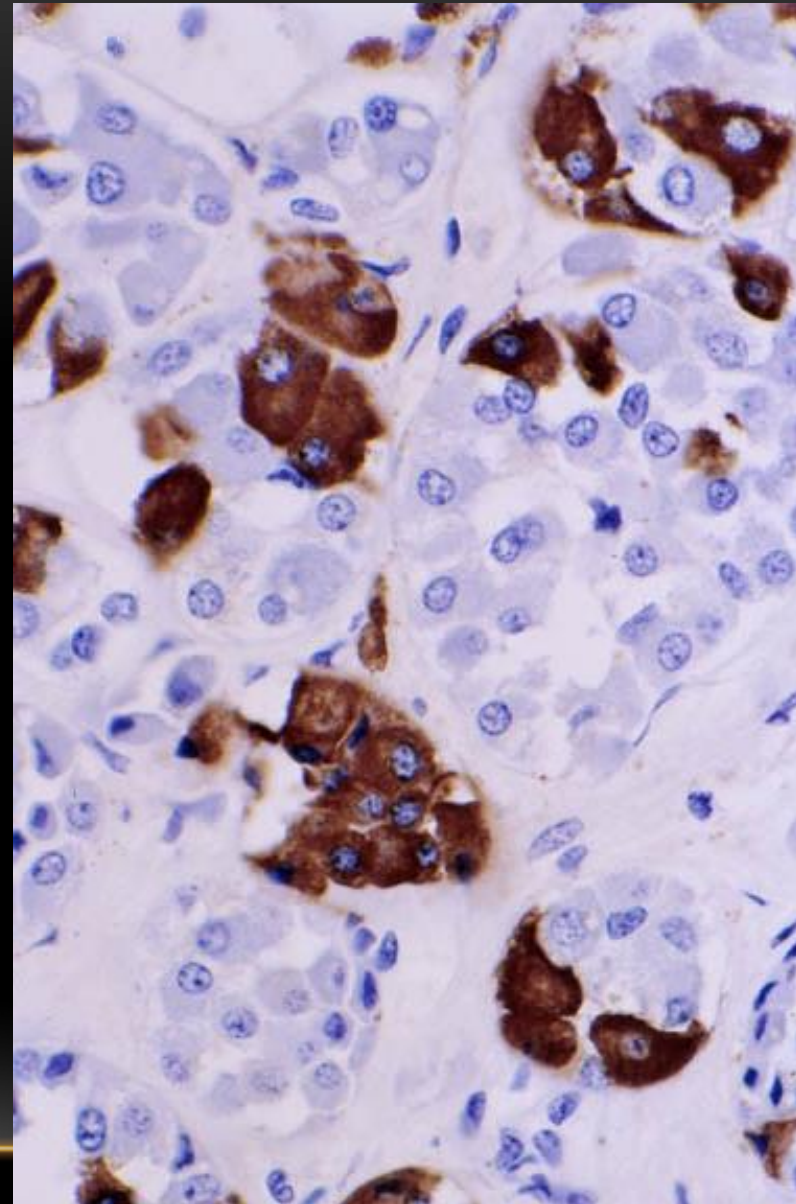
- small weakly stained cells
- represent stem cells or (most likely)
- partially degranulated chromophils

* Folliculostellate cells: large cells with many processes of unknown function



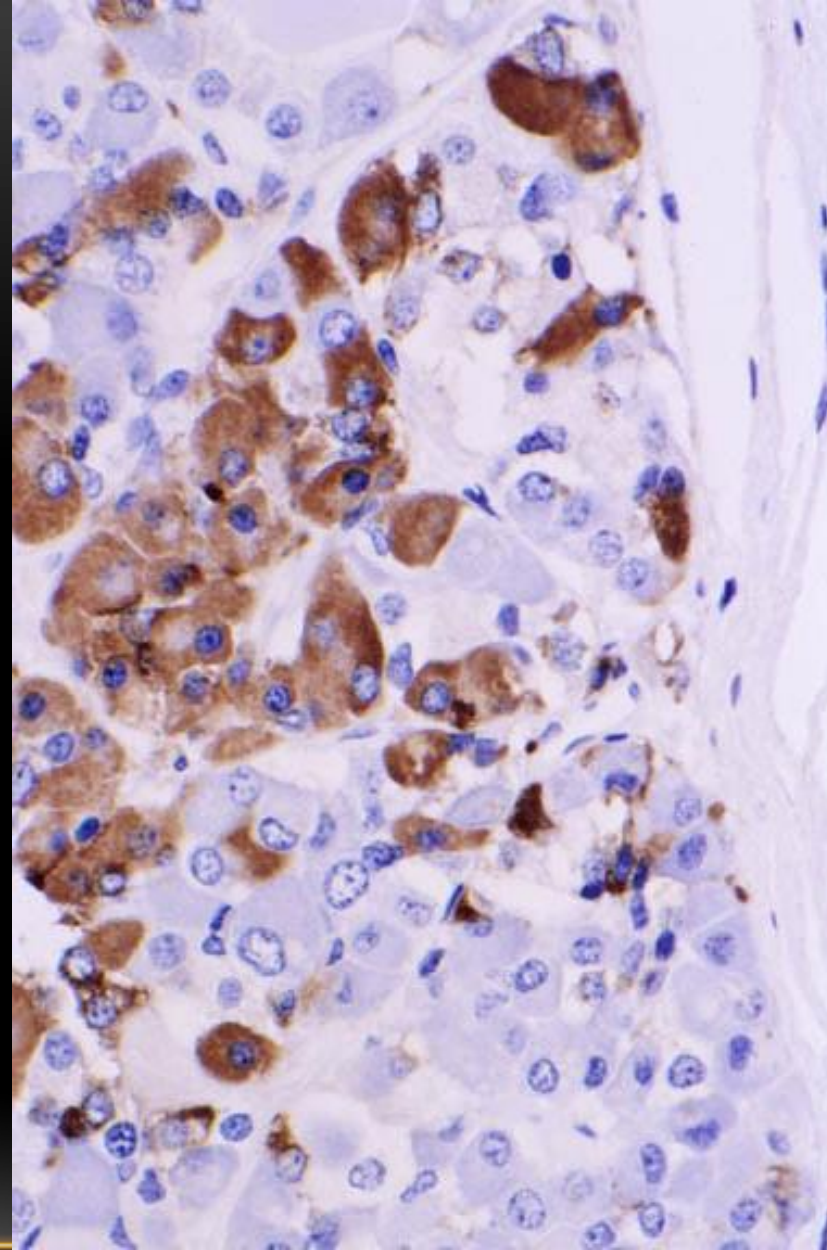
1- Somatotrops:

- Form ~ 50% of the total number of chromophils.
- Occur in clumps and clusters
- Central nucleus
- Rod shaped mitochondria
- Many rER
- Many secretory granules (secrete GH)
- Moderate Golgi
- *Action of GH*: acts on growth of long bones via insulin-like growth factors synthesized in the liver.



2- Mammotrops

- Form 15-20% of chromophils
- Occur singly
- Small polygonal cells
- Organelles are ill-defined
- During lactation organelles increase in size and number
- Secrete prolactin
- *Action of prolactin:* promotes milk secretion.



3- Gonadotrophs

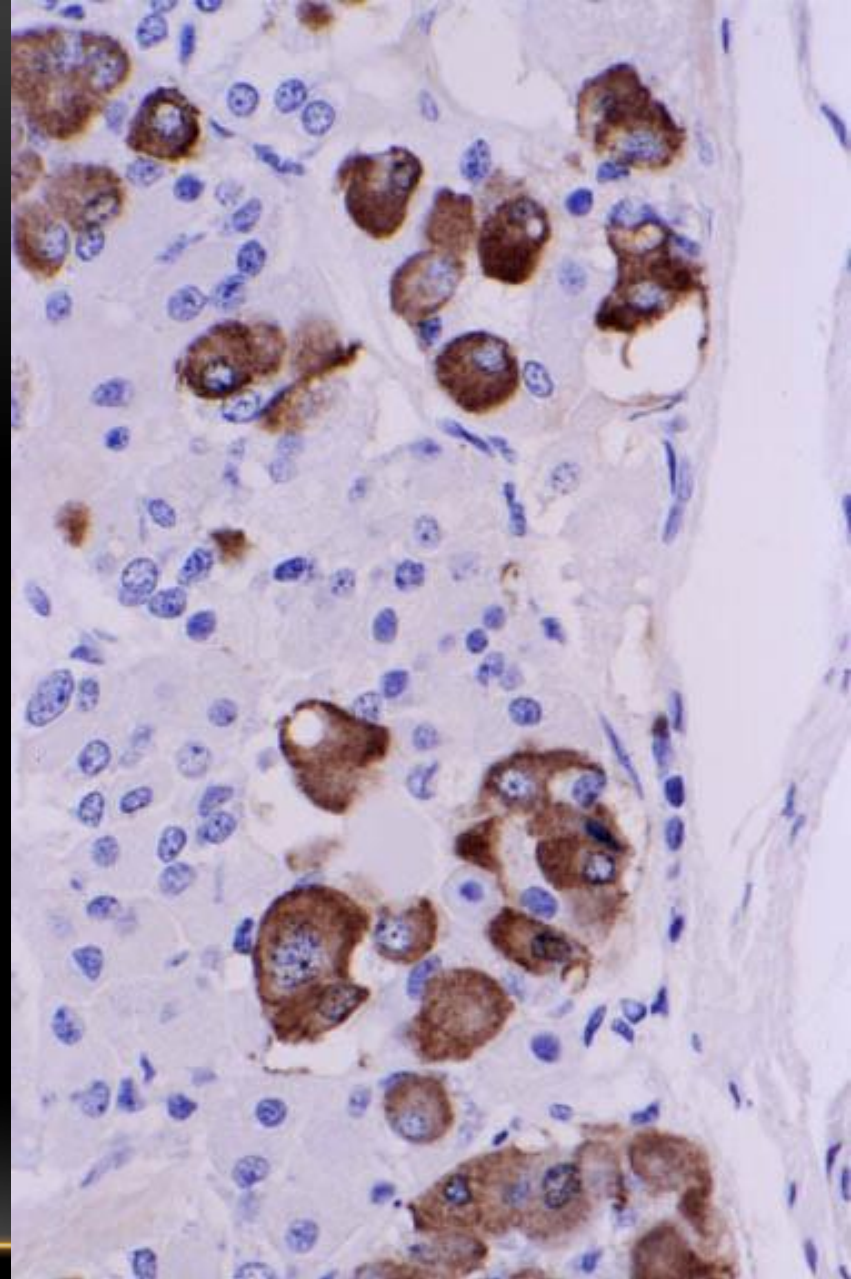
- Form ~ 10% of chromophils.
- Rounded cells.
- Prominent nucleus.
- Many granules with variable size.
- Cytoplasm contains well developed Golgi, many rER.
- Secrete FSH and LH.
- *Action of FSH*: promotes ovarian follicle development and estrogen secretion in women, and spermatogenesis in men.
- *Action of LH*: promotes follicular maturation and progesterone secretion in women and Leydig secretion in men.

4- Thyrotrops

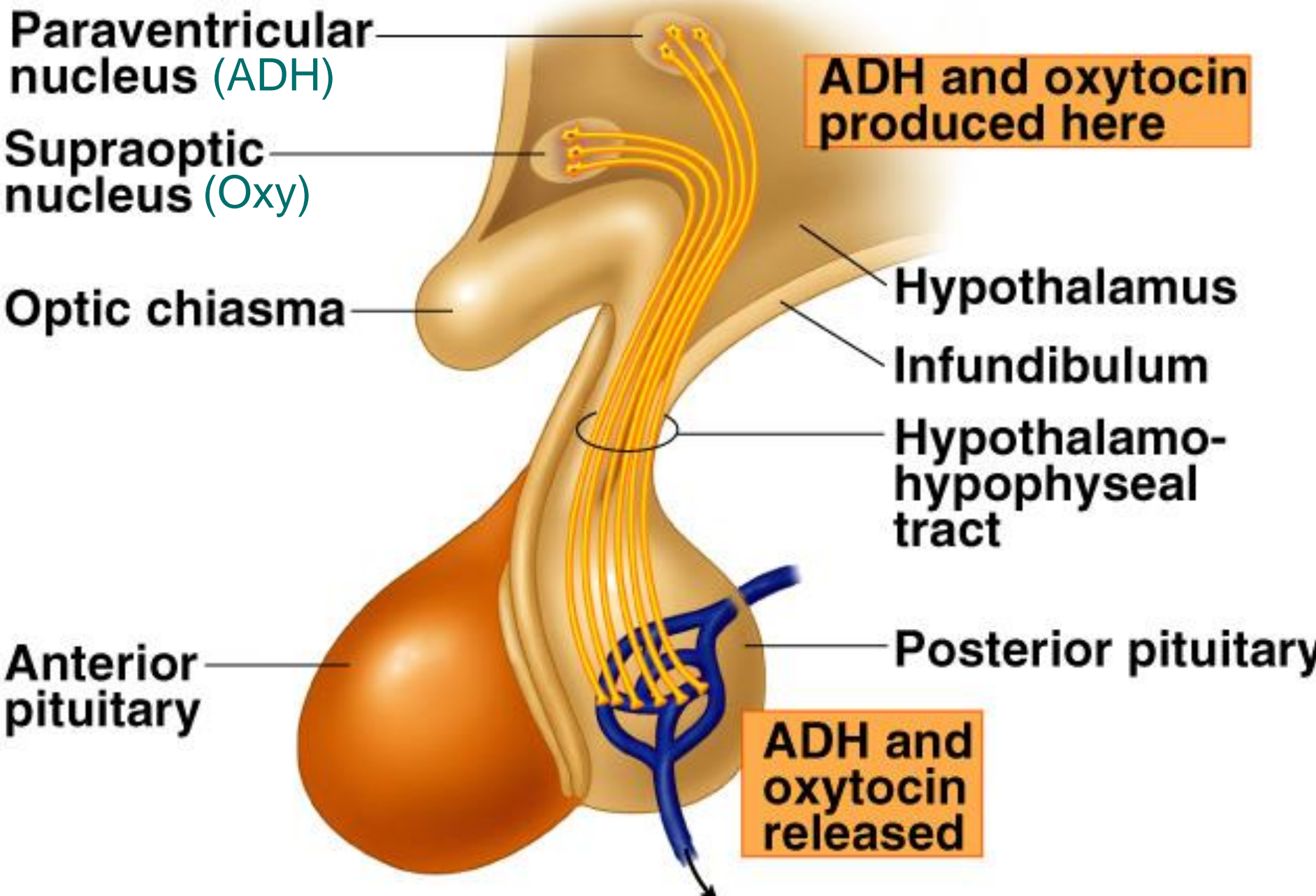
- Form ~ 5% of chromophils.
- Located away from sinusoids.
- Cytoplasm contains many small organelles.
- Secrete TSH.
- *Action of TSH*: stimulates thyroid hormone synthesis, storage, and liberation.

5- Corticotrops

- Form 15-20% of chromophils.
- Round-ovoid cells scattered through pars distalis.
- Eccentric nucleus with few organelles.
- Secrete ACTH.
- *Action of ACTH*: stimulates secretion of adrenal cortex hormones and regulated lipid metabolism.

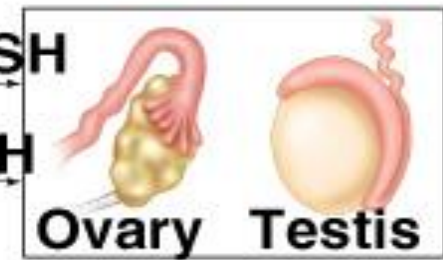
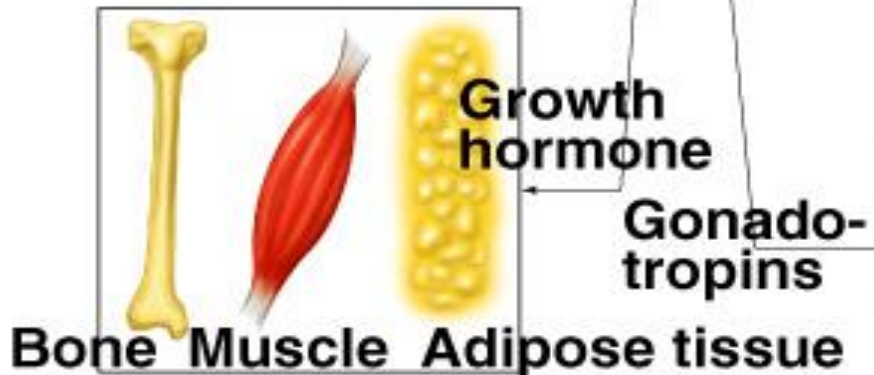
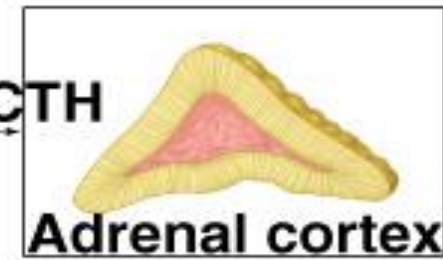
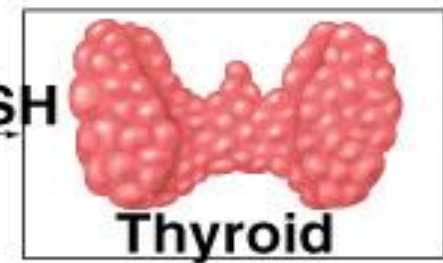
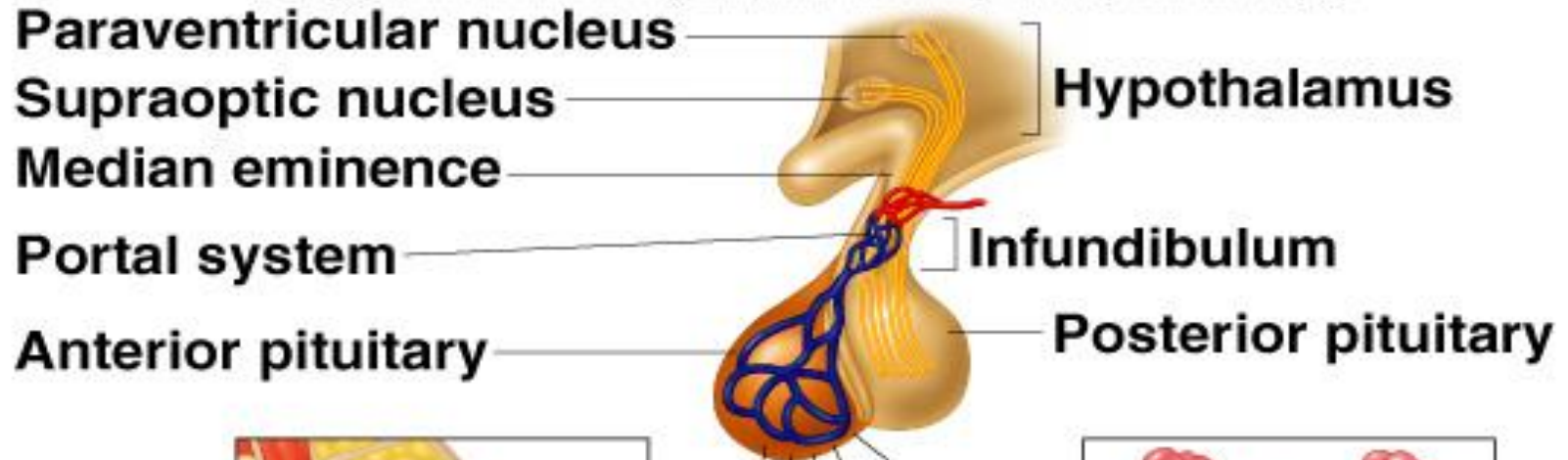


Hypothalamic Control of Posterior Pituitary

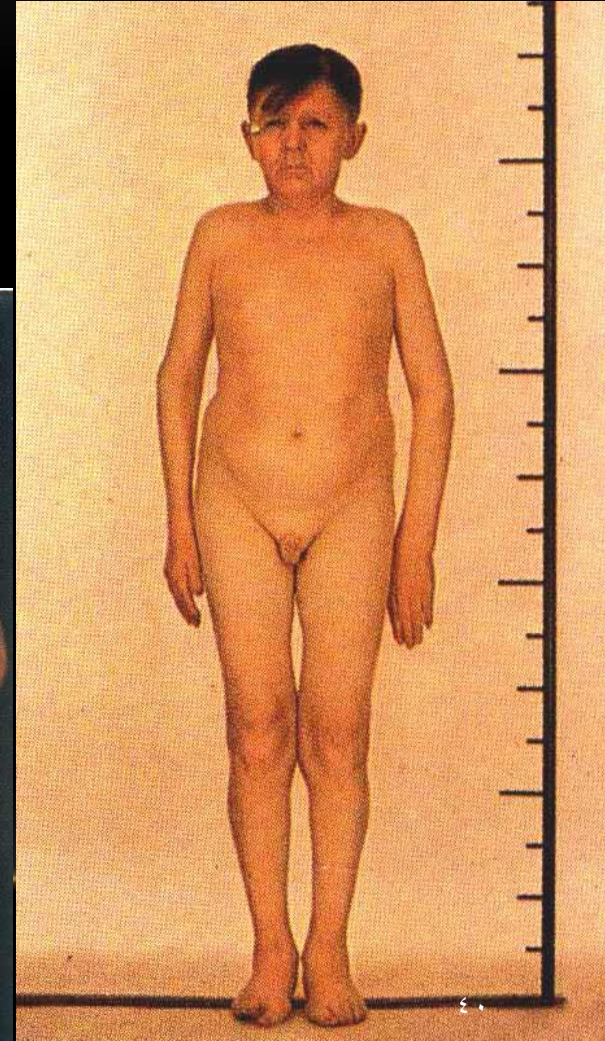
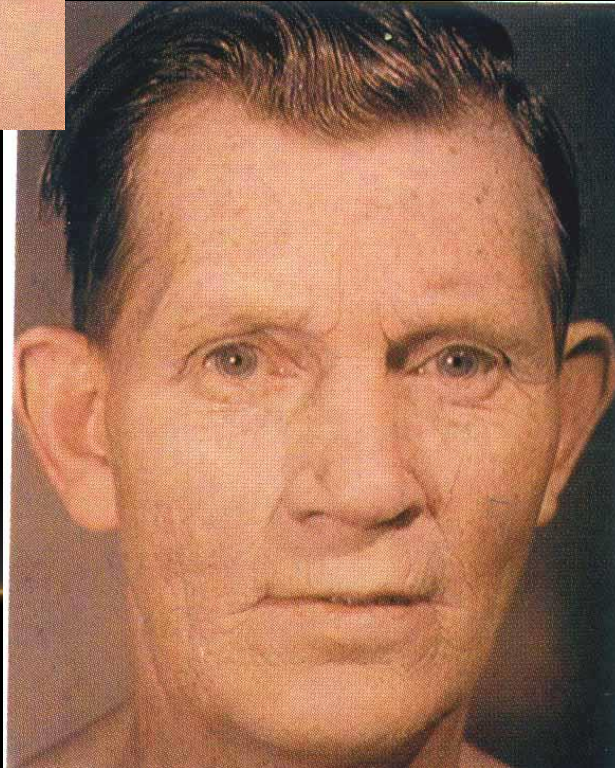


Hormones of the anterior lobe

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Hypogonadism



Hypopituitarism:

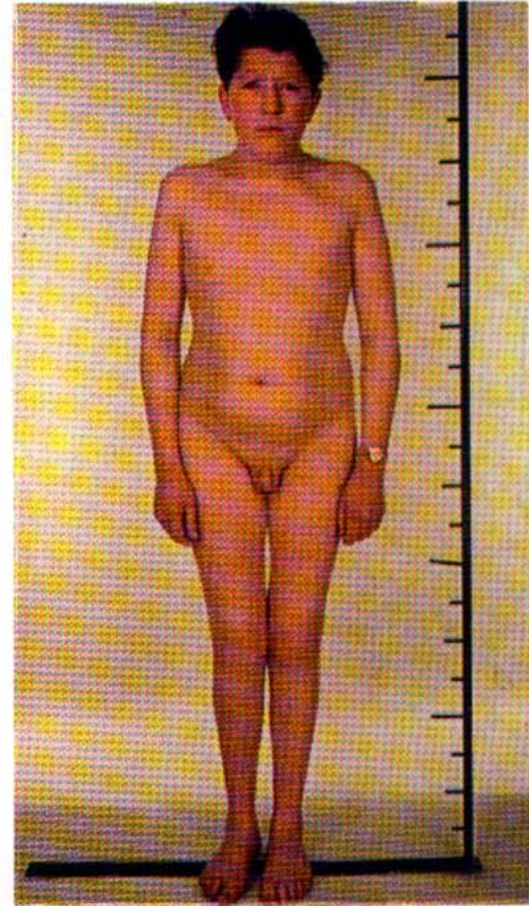
Infertility

Pallor

Low BMR

Intolerance to stress

Dwarfism



Growth hormone deficiency leads to dwarfism (14) and delayed skeletal development in the child. Plumpness is common and fine wrinkling of the skin may be seen in the adult even if gonadotrophin deficiency is not present. Growth hormone deficiency can be confirmed by low growth hormone levels, which do not rise in response to hypoglycaemia, arginine, exercise or Bovril (meat extract).

Acromegaly





Giantism

MSH (melanotropin; melanocyte-stimulating hormone)

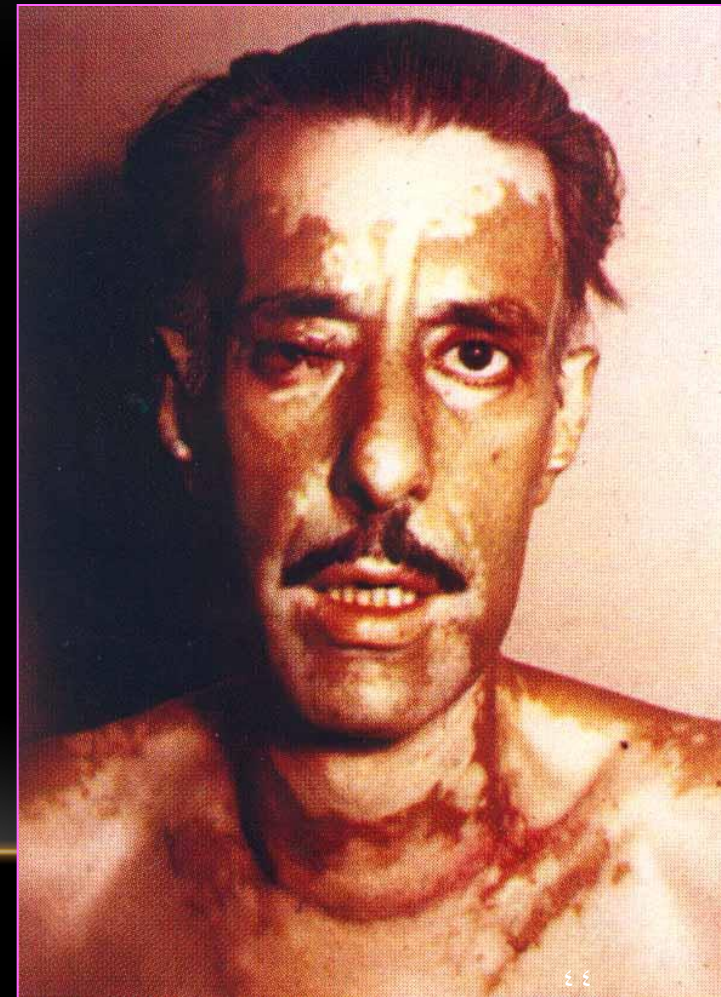
melanocytes $\xrightarrow{\text{MSH}}$ Melanin synthesis

2 types — {
Eumelanin : black, brown
Pheomelanin : yellow, red

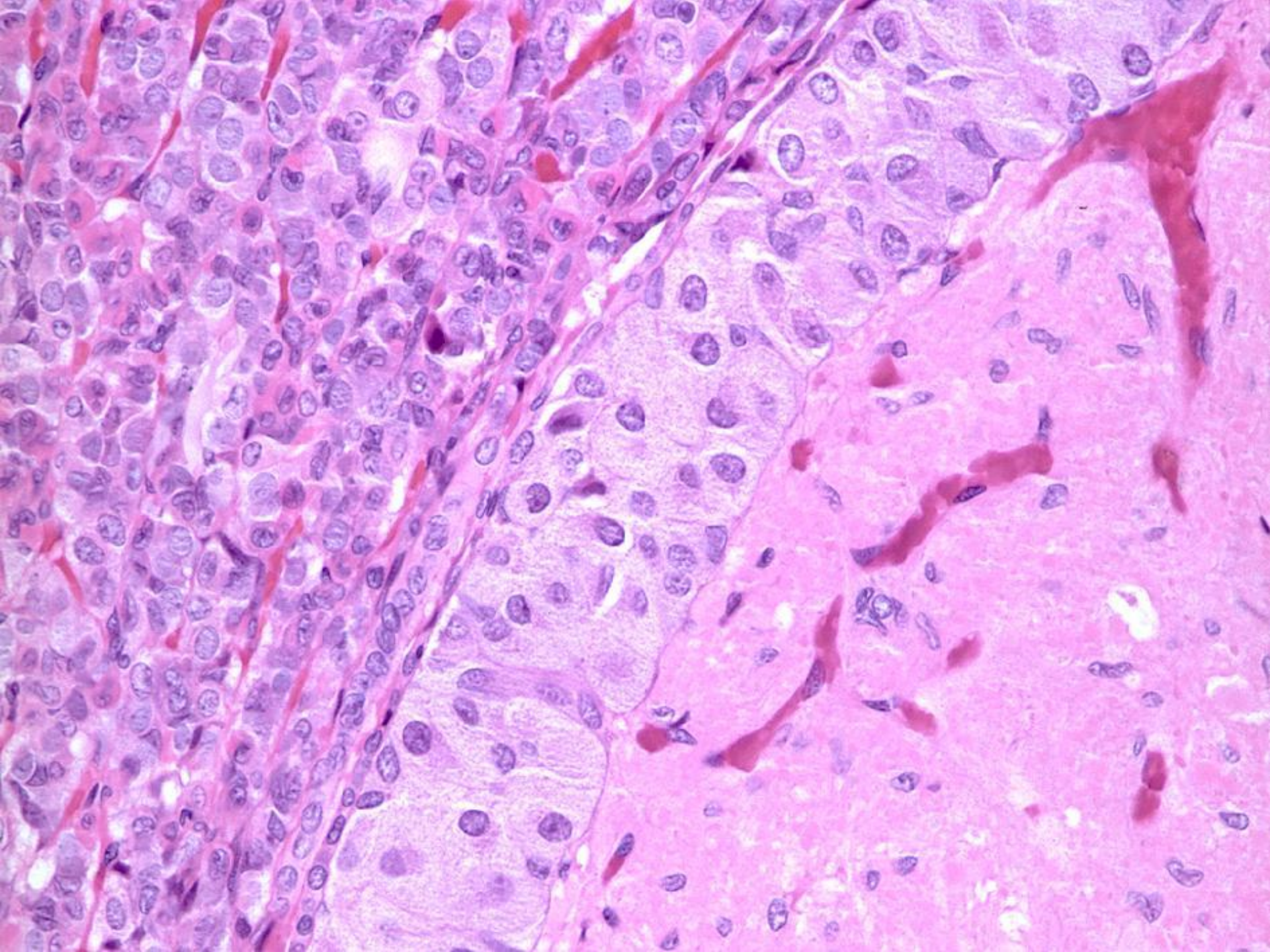
Pigment abnormalities in humans:

1. Hypopigmentation & Hyperpigmentation
(ACTH has MSH activity)
2. Albinos (inability to synthesize melanin)
3. Vitiligo (Progressive)

"Vitiligo"



Neurohypophysis

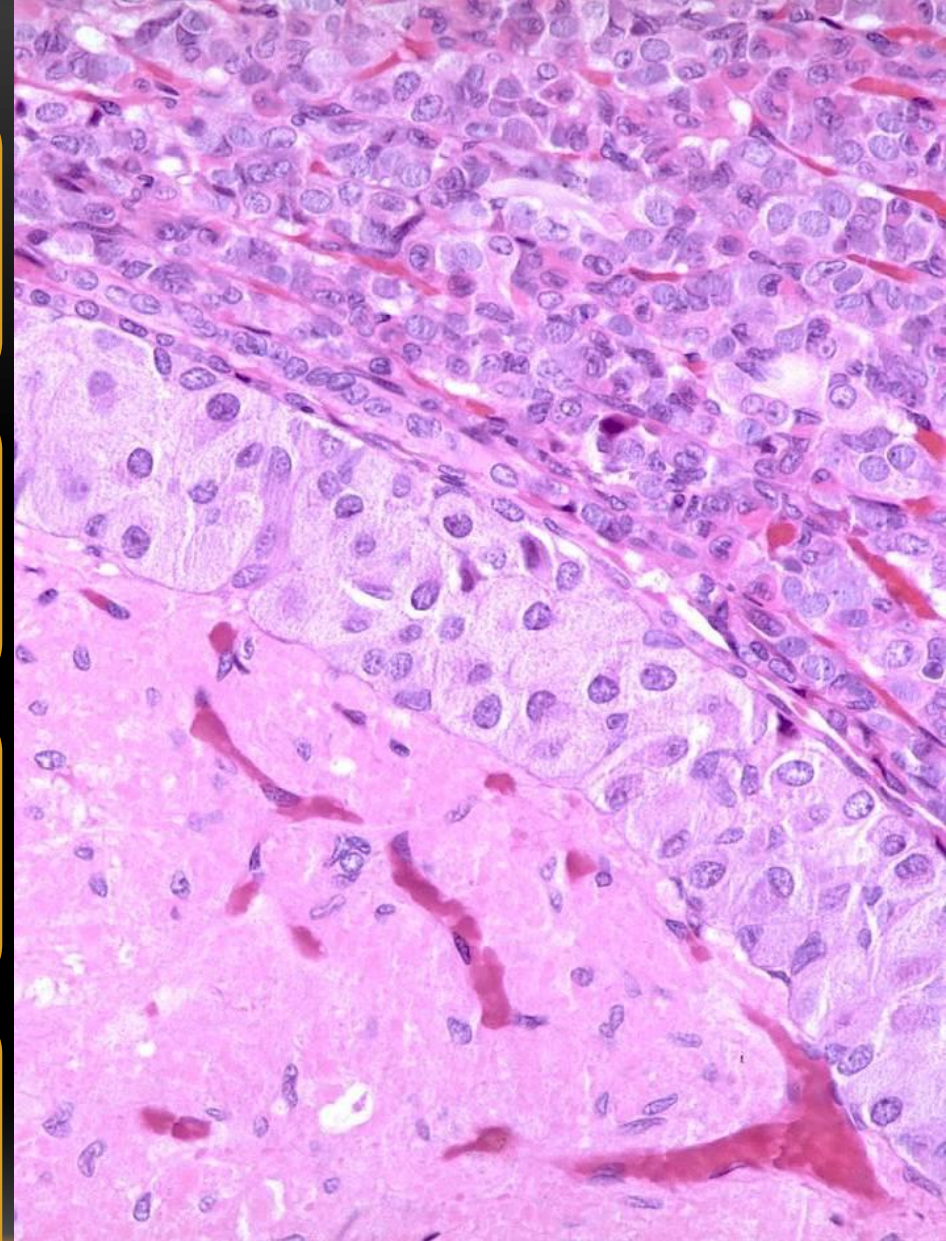


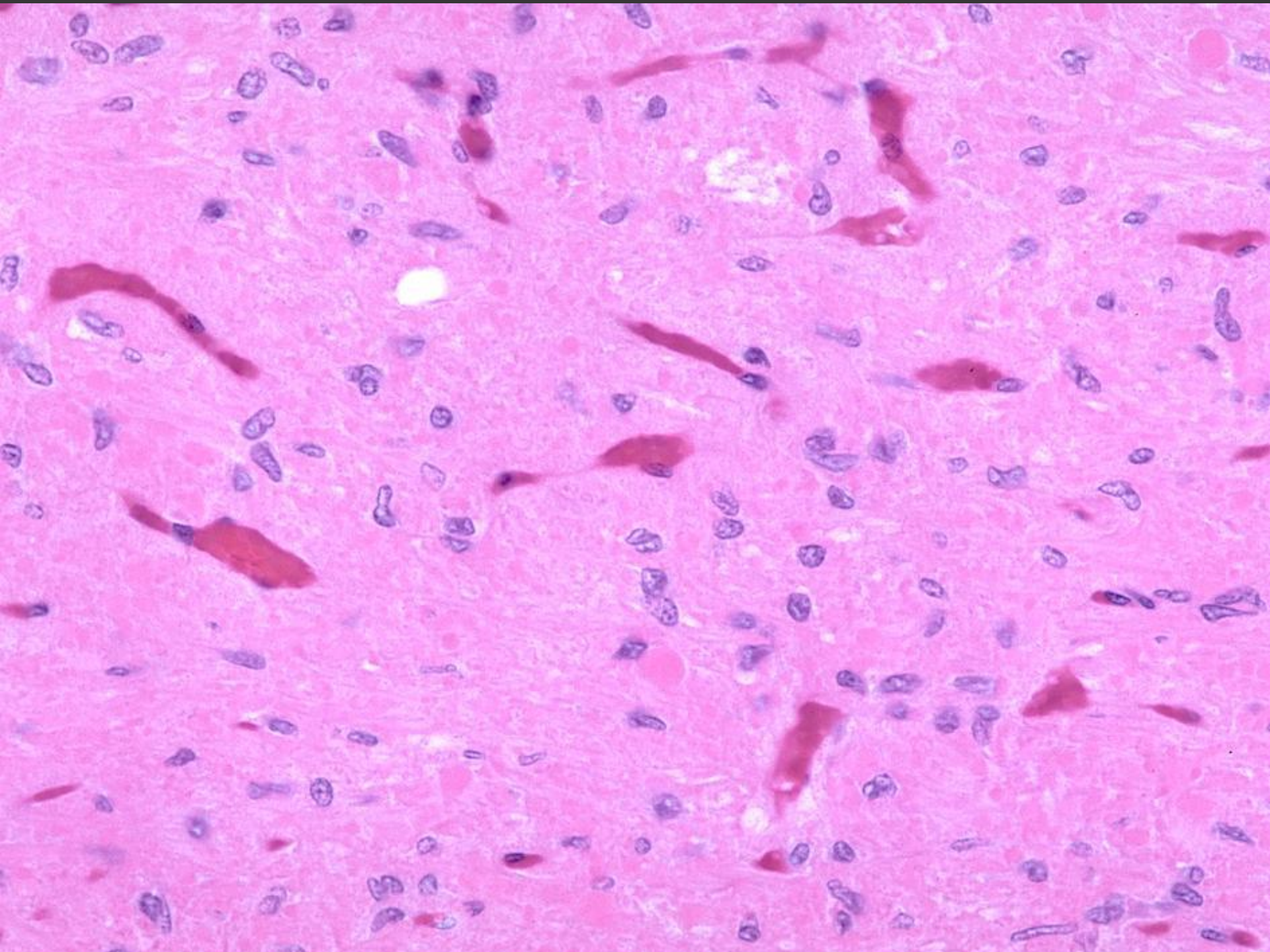
Does not contain secretory cells.

Contains axons of secretory nerves; their mother cells are present in the paraventricular and supraoptic hypothalamic nuclei.

Pituicytes are the most numerous cells.

Pituicytes resemble astrocytes.

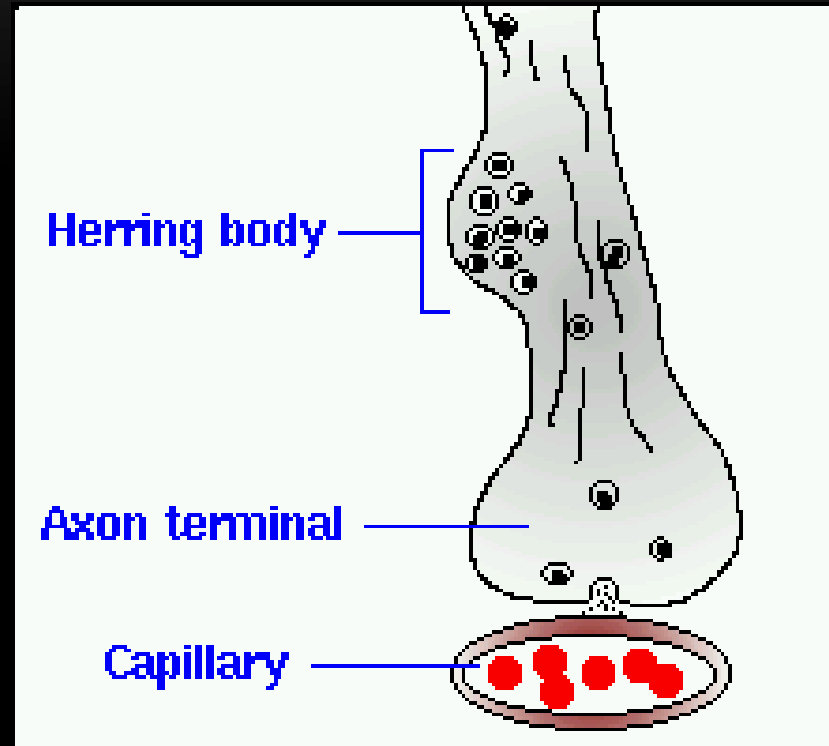




Secretory neurons have larger diameter but are histologically and functionally similar to other neurons.

Axons of neurons transport ADH and oxytocin into the pars nervosa.

- Secretory products accumulate in the distal part of the axon in Hering bodies.
- Hering bodies appear slightly acidophilic.
- Secretory products are surrounded by a membrane and bound to neurophysin.
- Nerve impulses trigger the release of peptides from neurosecretory bodies.

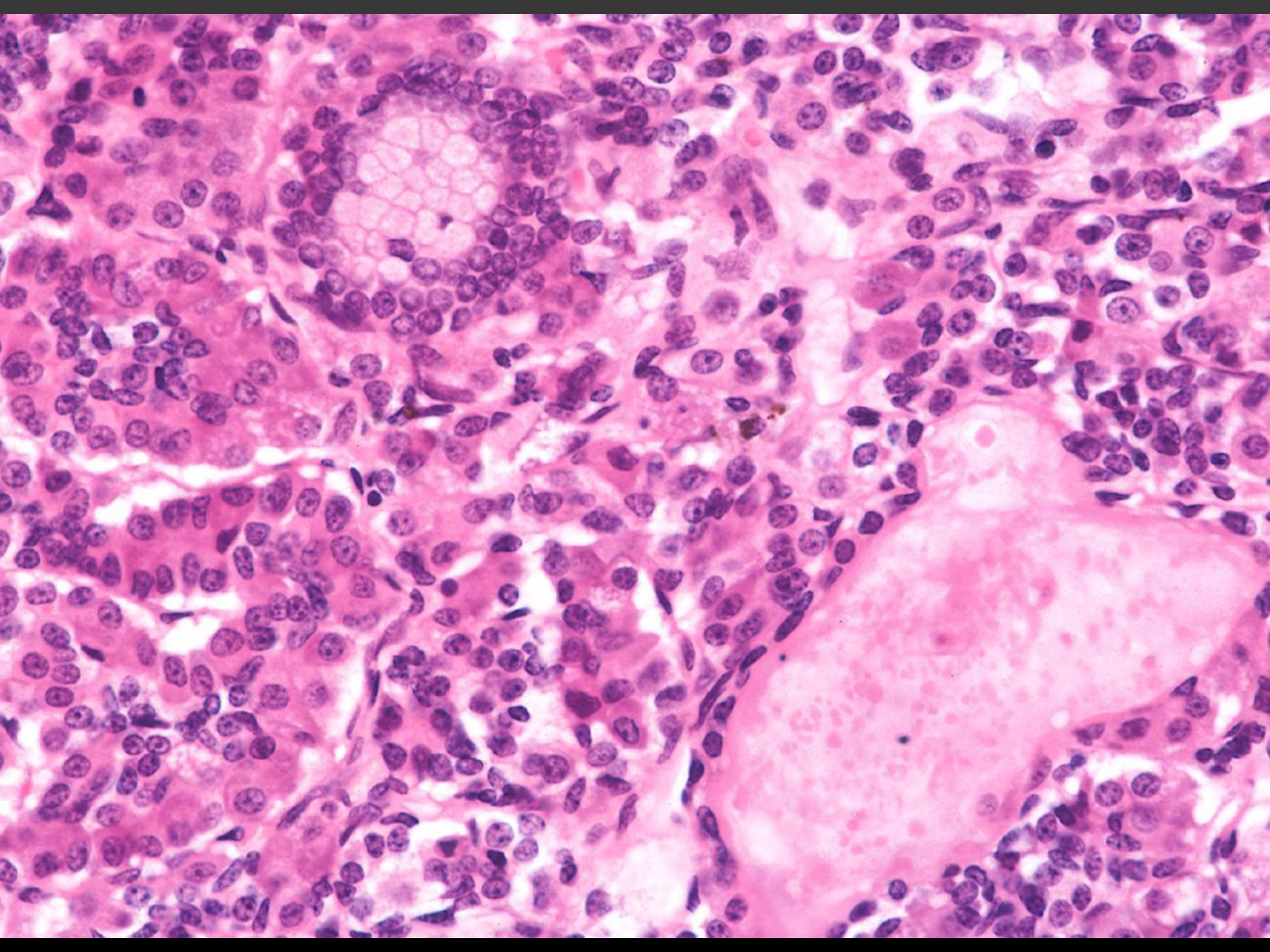


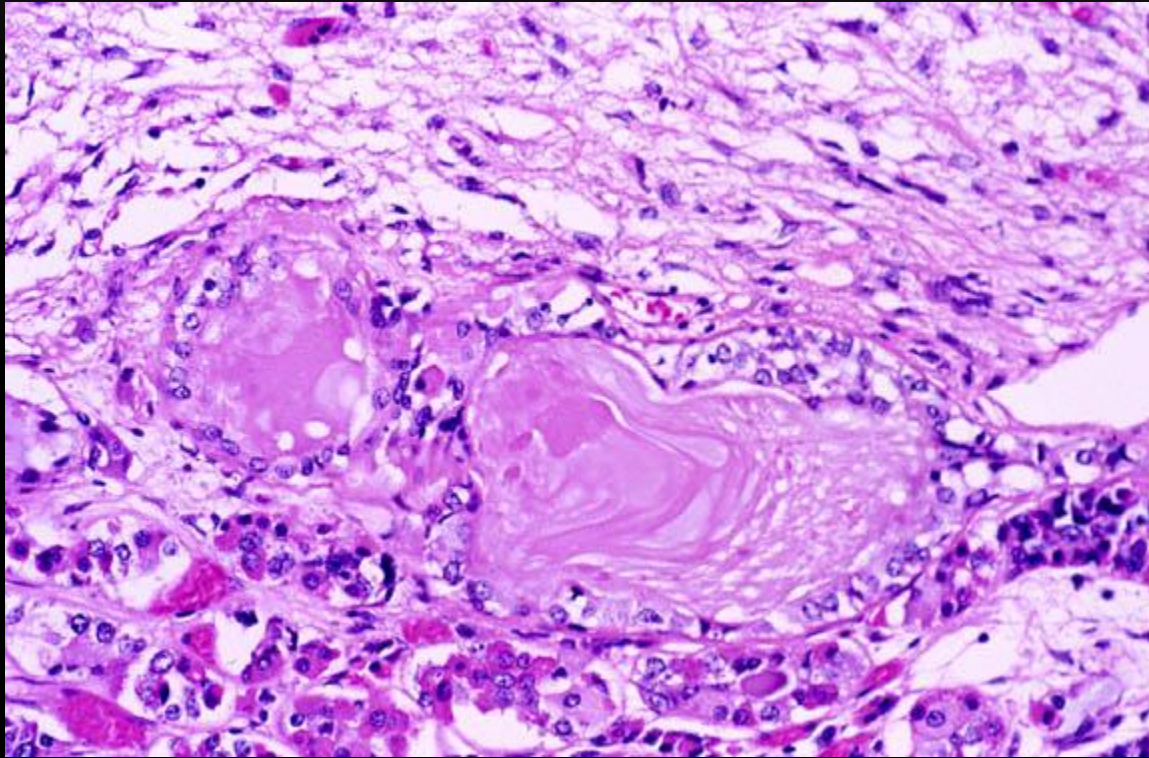
Most Oxytocin is released from paraventricular nuclei.

Most ADH is released from supraoptic nuclei.

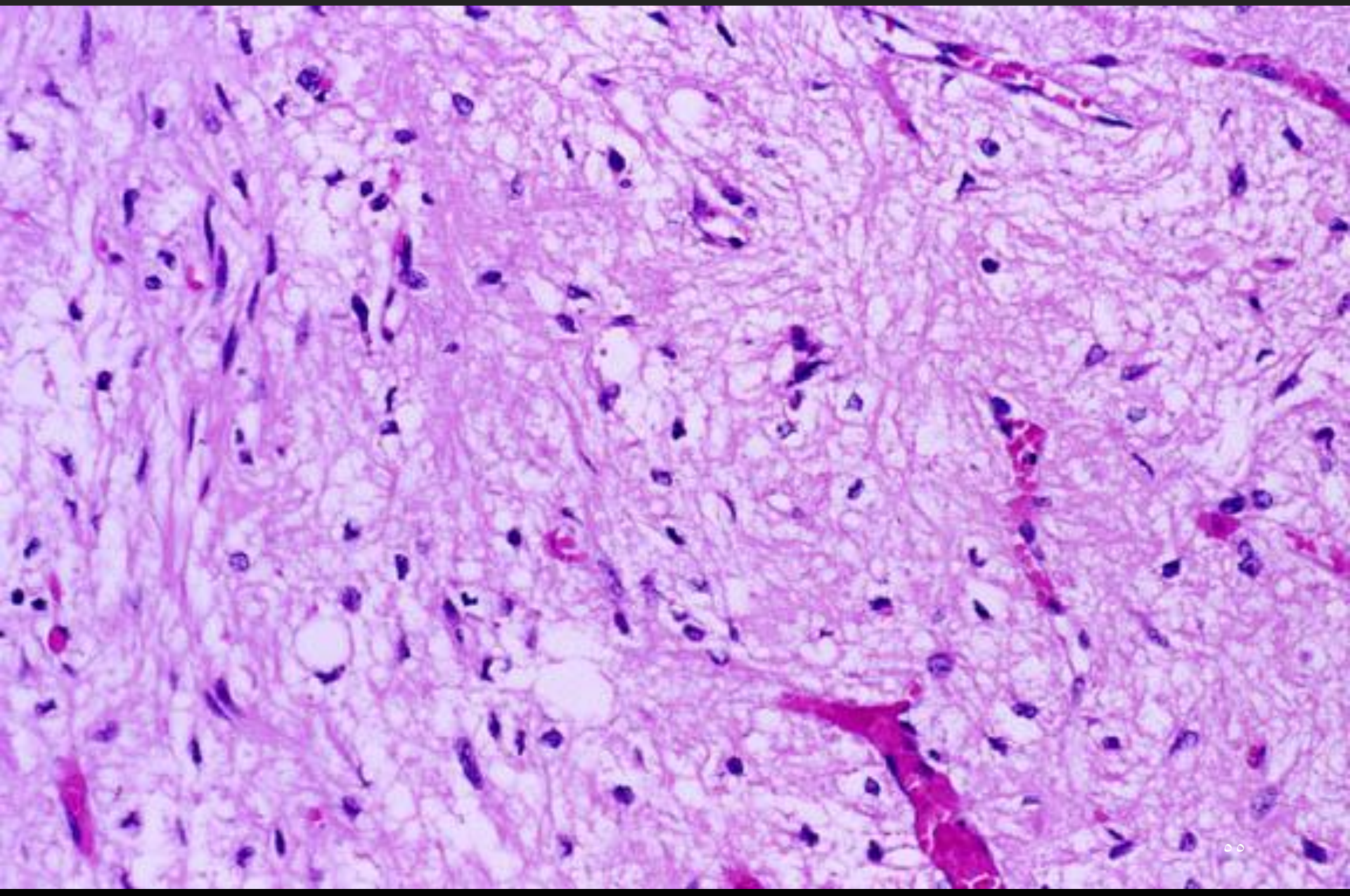
ADH facilitates resorption of water from the distal tubules and collecting ducts of the kidney by altering the permeability of the cells to water.

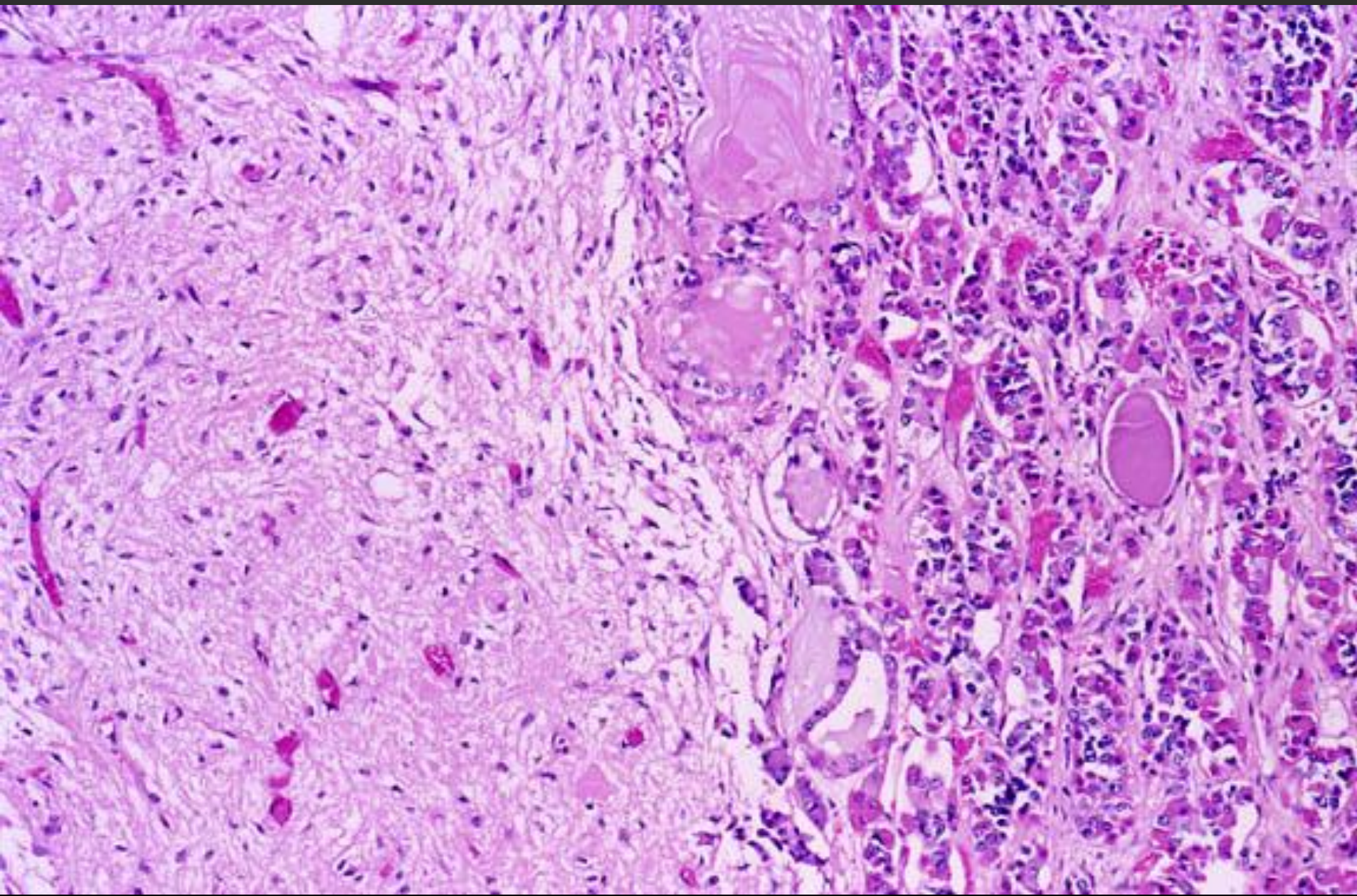
Oxytocin promotes contraction of smooth muscles of the uterus and myoepithelial cells of the breast.





NEUROHYPOPHYSIS





SYNAPTOPHYSIN

