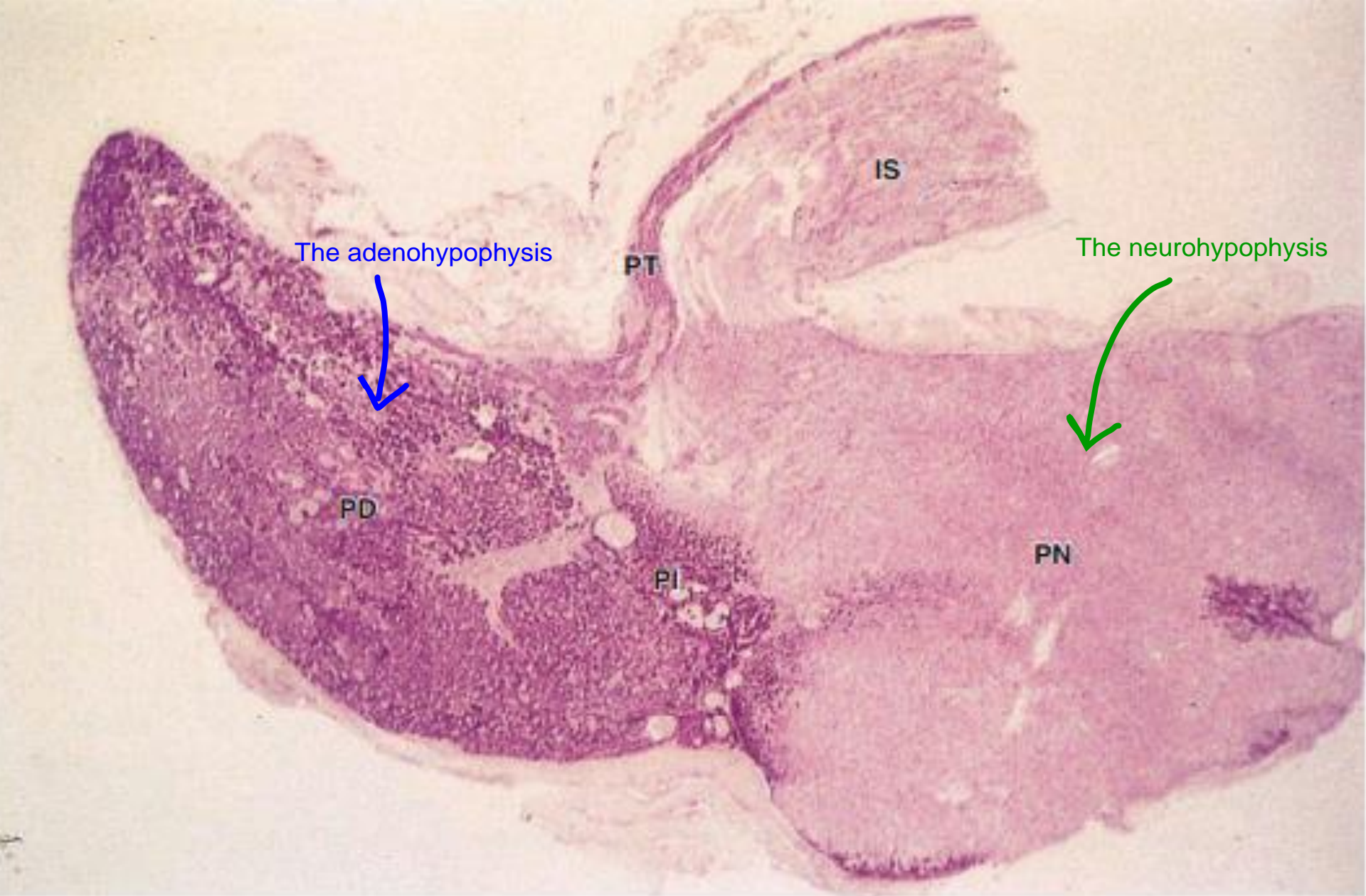


HISTOLOGY OF THE PITUITARY GLAND

Edited by: Majd Arabiyat



Histologically the two parts of the pituitary gland reflect their origins, as seen in this low-magnification section of an entire gland. The infundibular stalk (IS) and pars nervosa (PN) of the

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neurohypophysis resemble CNS tissue, while the adenohypophysis' pars distalis (PD), pars intermedia (PI), and pars tuberalis (PT) are typically glandular in their level of staining. (X30; H&E)

0.50 mm

neurohypophysis
(pars nervosa
posterior pituitary)

pars intermedia

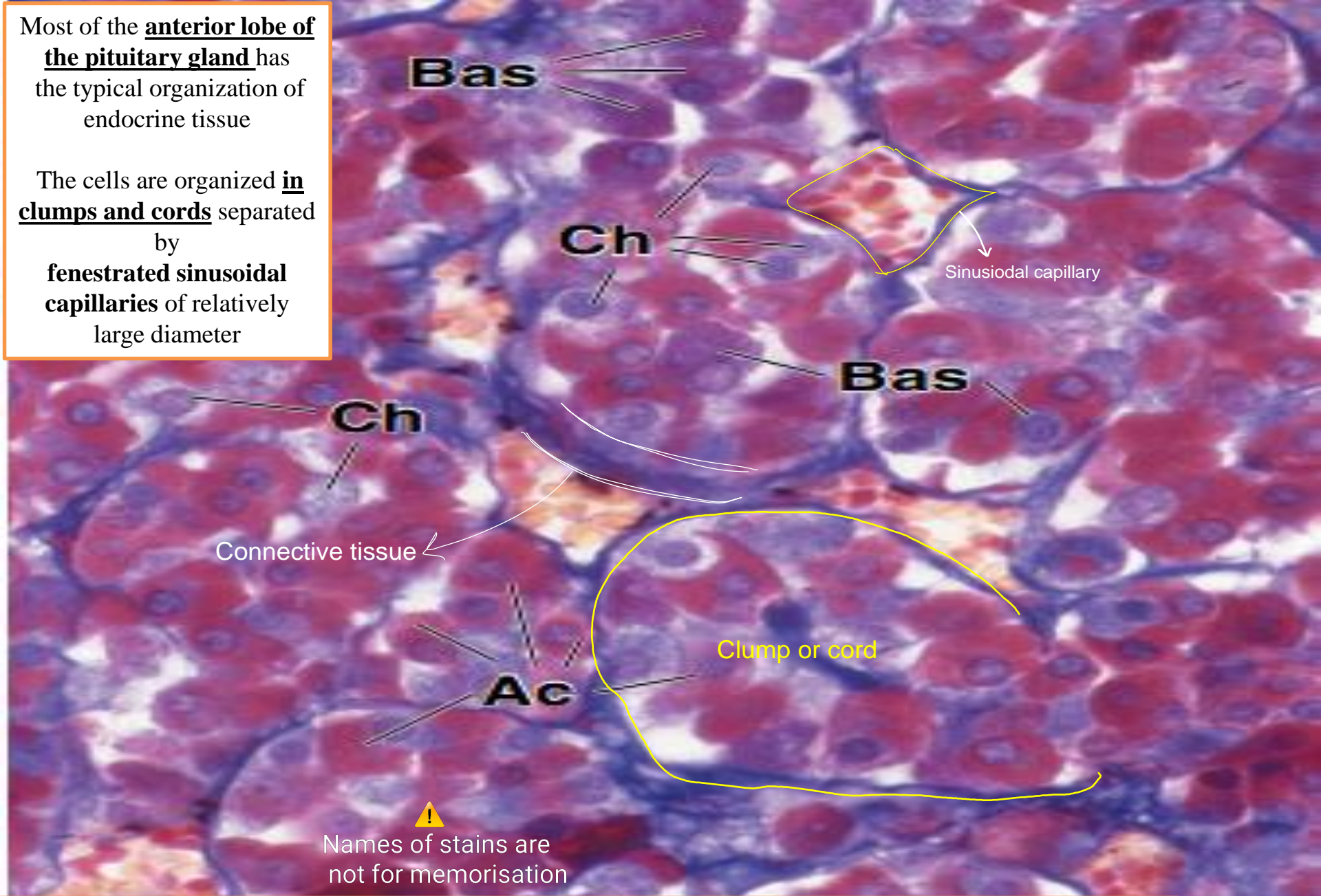
adenohypophysis
(pars distalis
anterior pituitary)



Cells of the adenohypophysis

Most of the **anterior lobe of the pituitary gland** has the typical organization of endocrine tissue

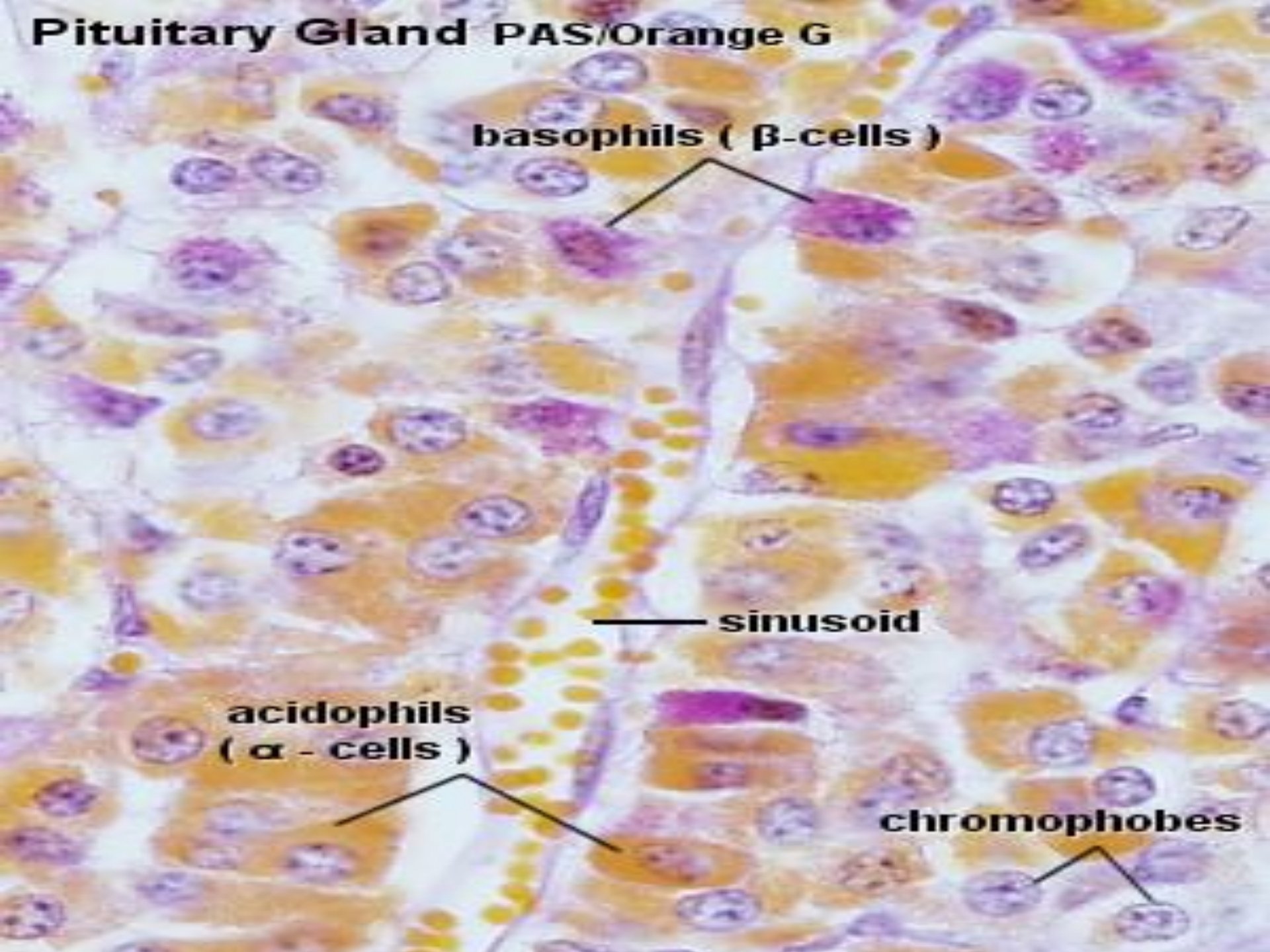
The cells are organized **in clumps and cords** separated by **fenestrated sinusoidal capillaries** of relatively large diameter



Names of stains are not for memorisation

This specimen of the pars distalis is stained with brilliant crystal scarlet, aniline blue, and Martius yellow to distinguish the various cell types and connective tissue stroma. *The cords of cells are surrounded by a delicate connective tissue stroma stained blue. The sinusoidal capillaries are seen in close association with the parenchyma and contain erythrocytes stained yellow.*

Pituitary Gland PAS/Orange G



basophils (β -cells)

sinusoid

**acidophils
(α - cells)**

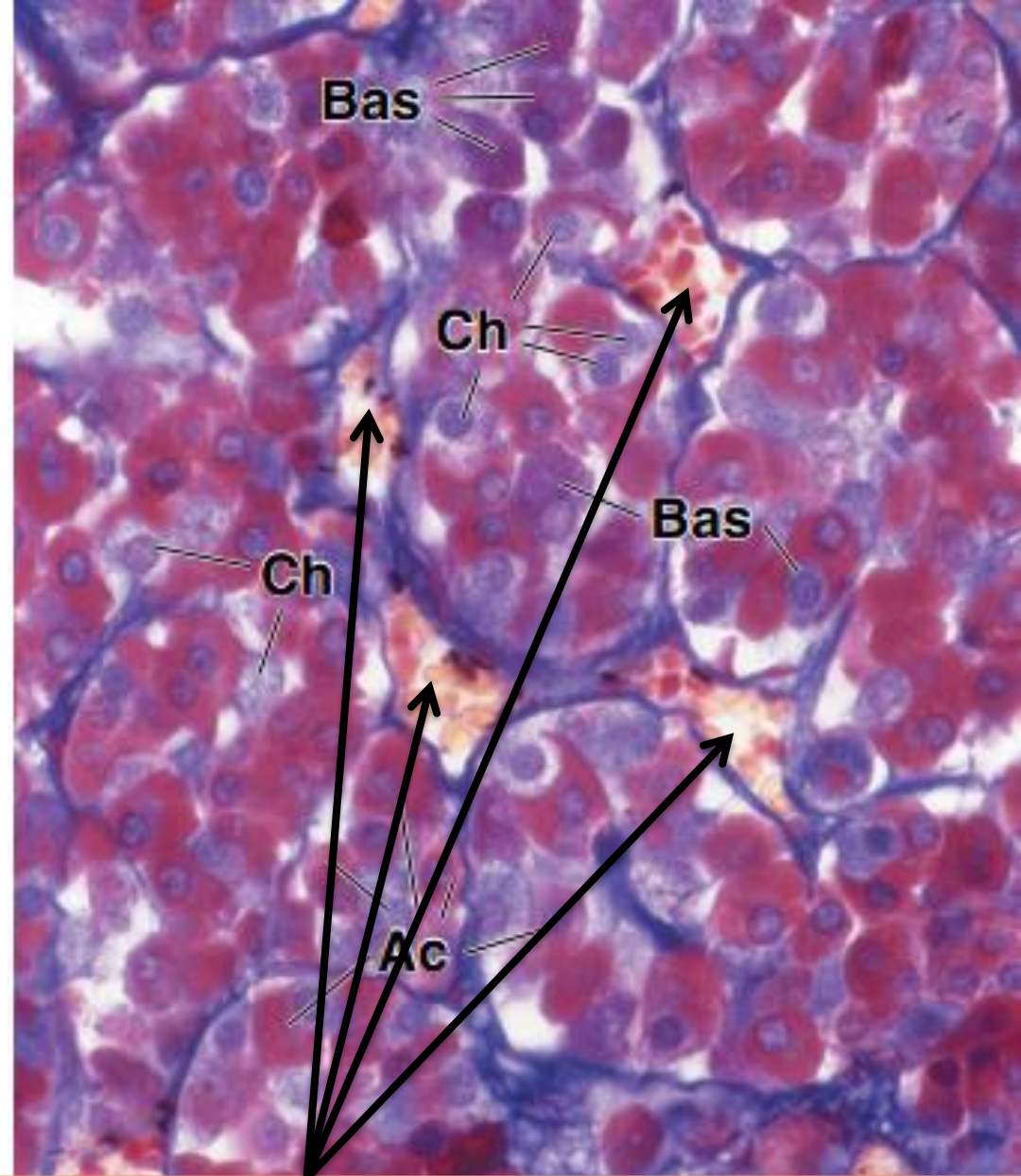
chromophobes

Pars distalis. This specimen of the pars distalis is stained with brilliant crystal scarlet, aniline blue, and Martius yellow to distinguish the various cell types and connective tissue stroma. The cords of cells are surrounded by a delicate connective tissue stroma stained blue. The sinusoidal capillaries are seen in close association with the parenchyma and contain erythrocytes stained yellow. In the region shown here, the acidophils (Ac) are the most numerous cell type present. Their cytoplasm stains cherry red. The basophils (Bas) stain blue. The chromophobes (Ch), although few in number in this particular region, are virtually unstained.

640

 Read only

Histology: A Text and Atlas: With Correlated Cell and Molecular Biology

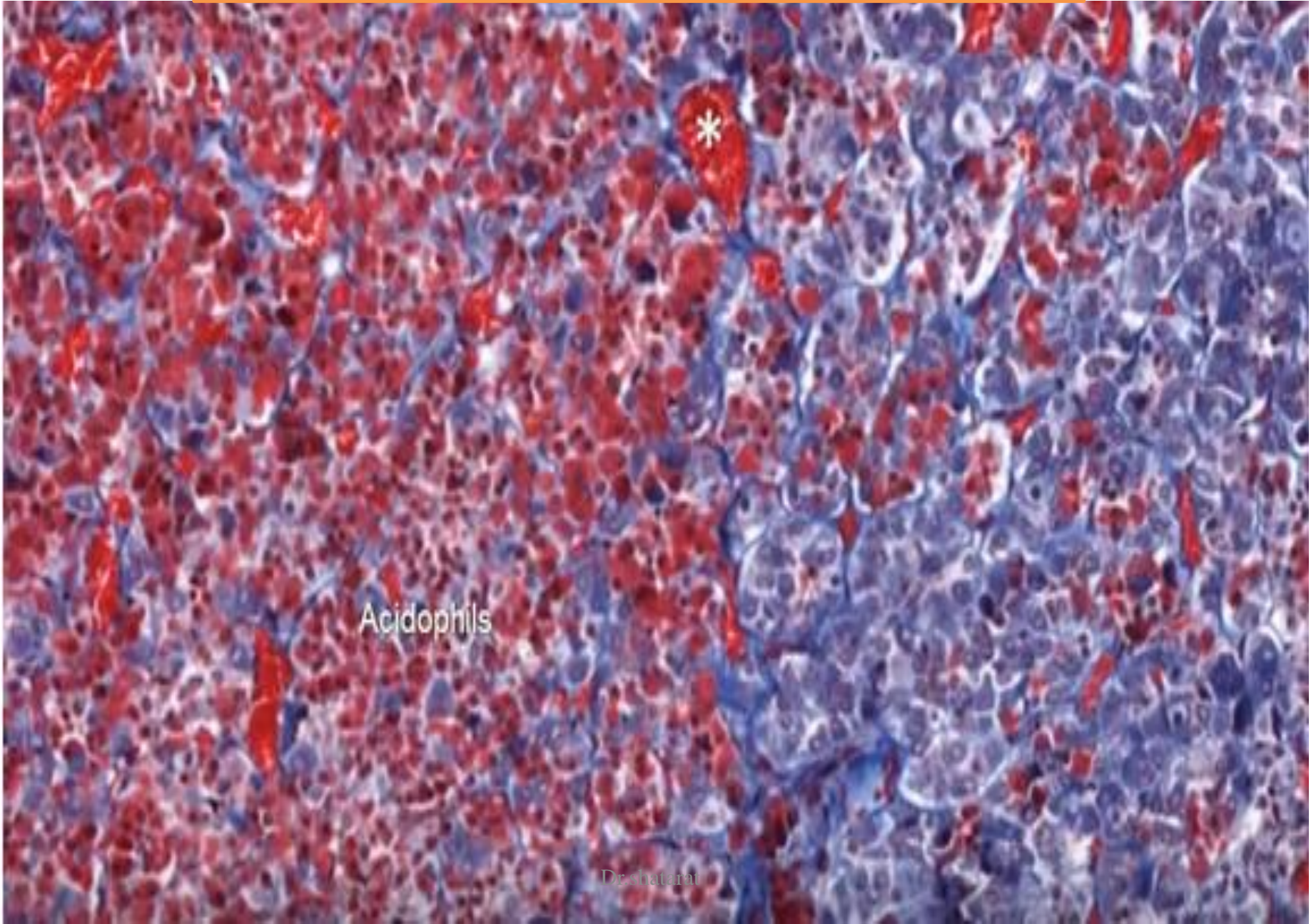


The adenohypophysis is made of **epithelia cells !!!!!!! and vascular Sinusiods supported by a mesh of connective tissue**

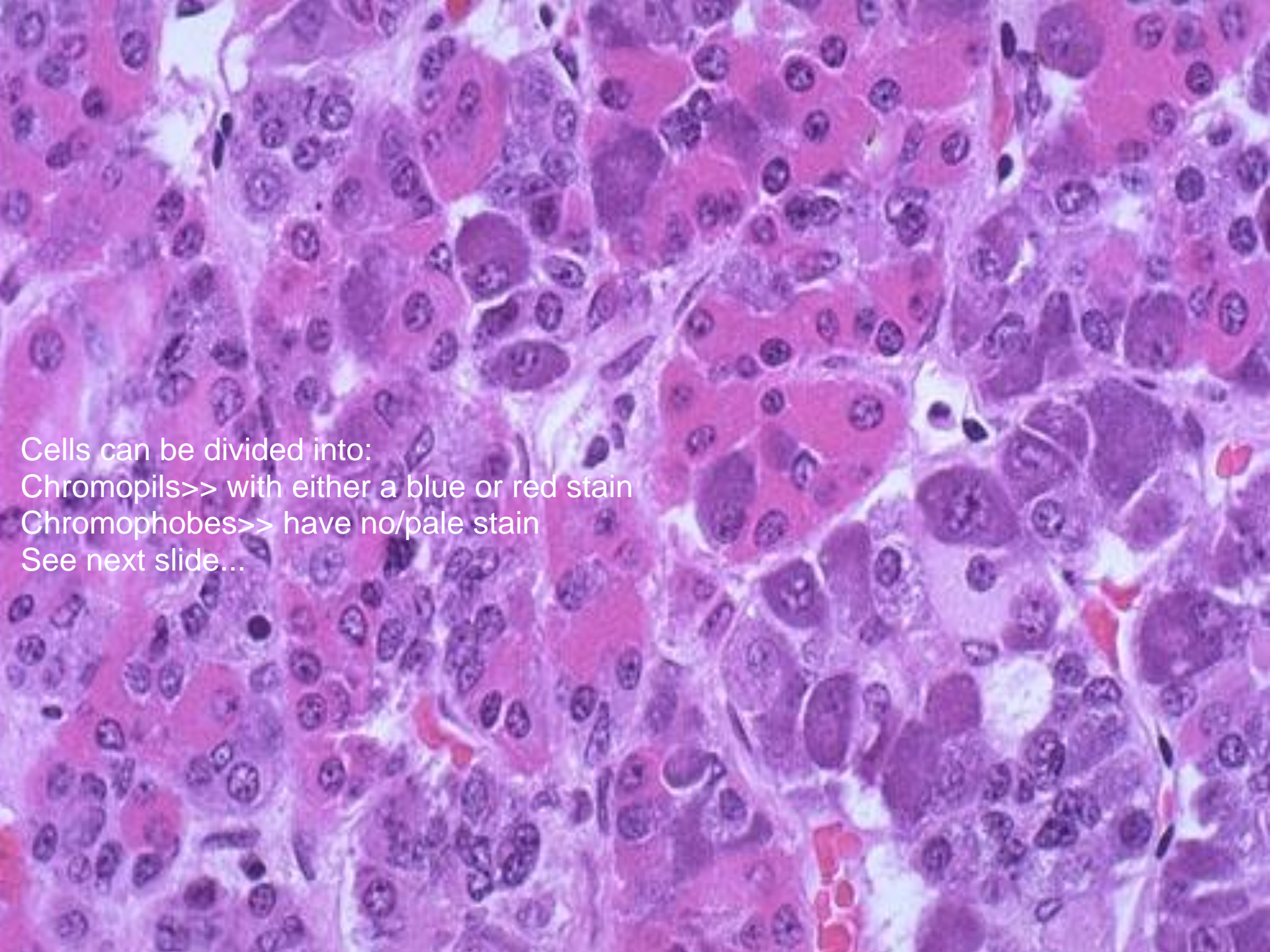
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How many colors can be identified in this H&E section?????

At least 2 colors are evident

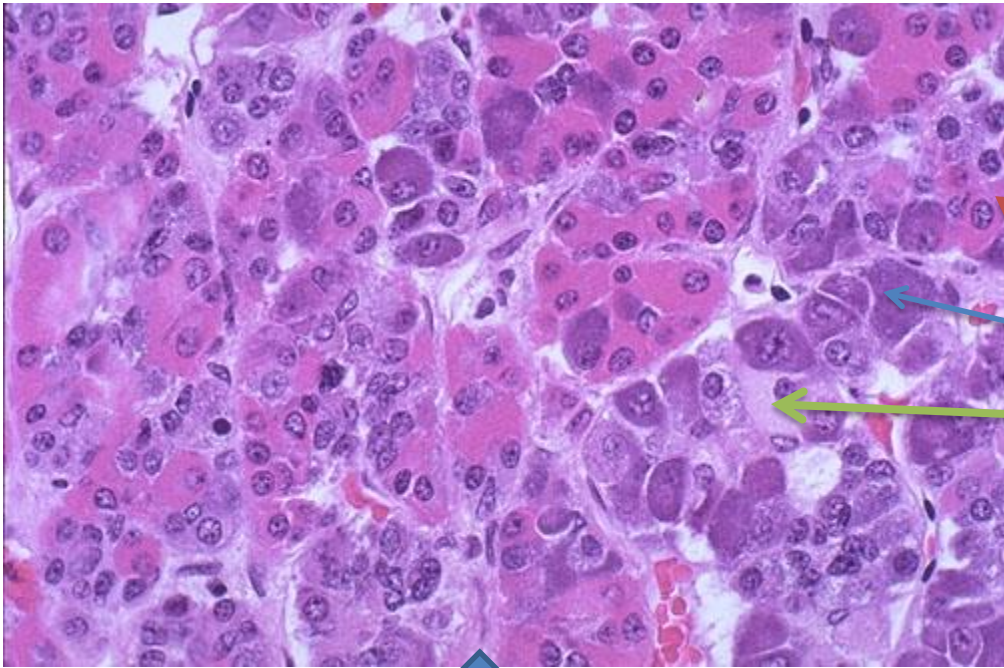


Acidophils



Cells can be divided into:
Chromophylls>> with either a blue or red stain
Chromophobes>> have no/pale stain
See next slide...

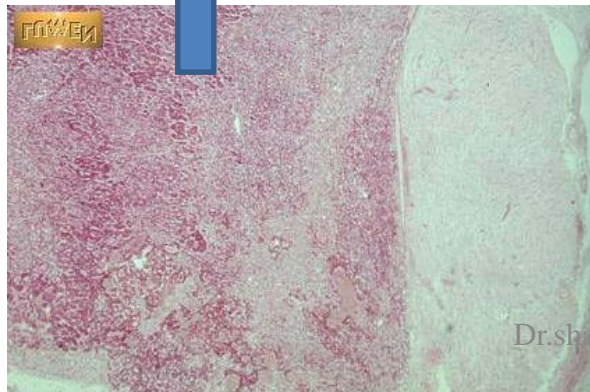
Adenohypophysis – high power



The adenohypophysis contains 3 cell types:

- acidophils (stain red)
- basophils (stain blue)
- chromophobes (pale stain)

Chromophils



The adenohypophysis stains red-blue on low power because of the acidophils and basophils

Histologists identified three types of cells according to their staining reaction, namely

1-Chromophils



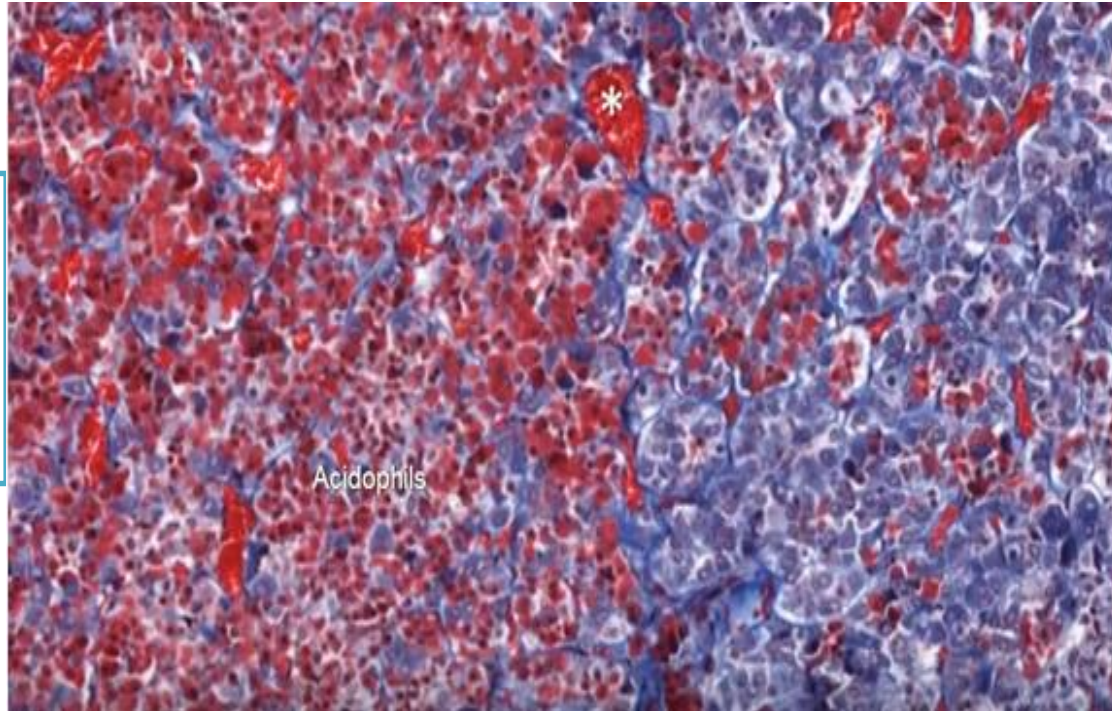
① Basophils (10%)

② Acidophils (40%)

2- Chromophobes (50%)

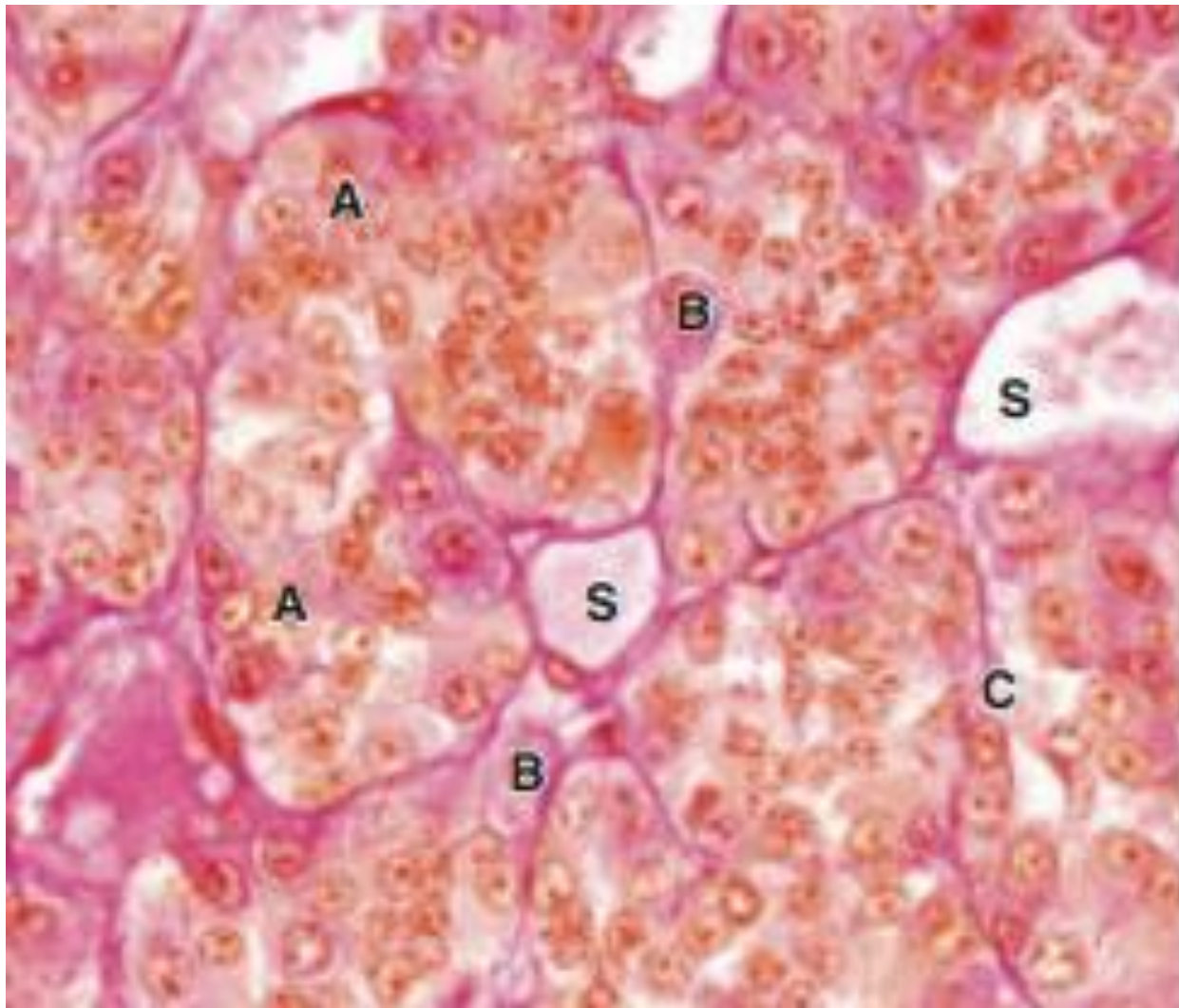
Those percentages are affected by the area where the section was taken from

chromophils
(cells which take up stain)
called **acidophils** and **basophils**.



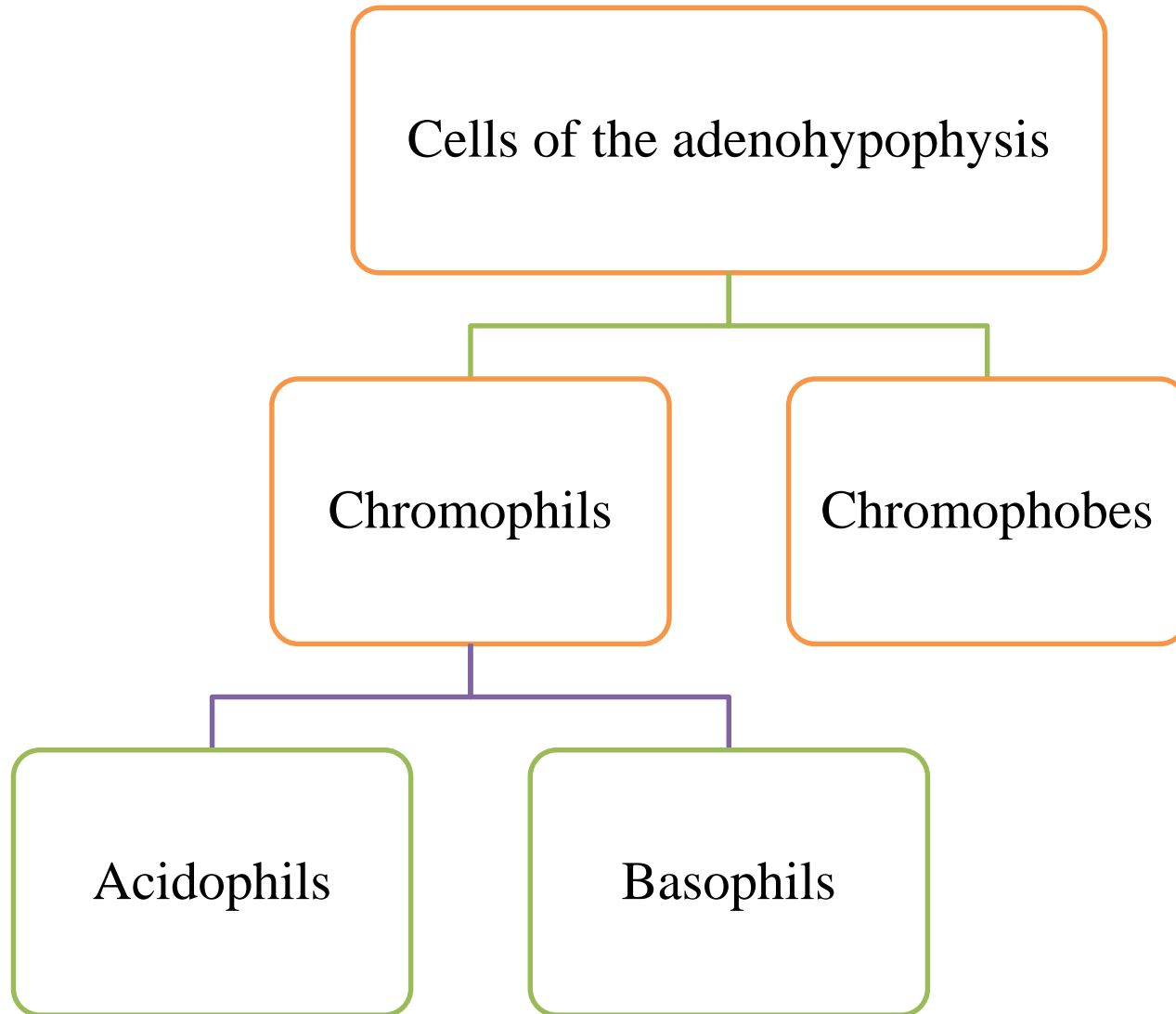
The anterior pituitary also contains one type of **chromophobe**

(cells which stain only weakly)



Parenchymal cells of the pars distalis to be subdivided into acidophil cells (A), basophils (B), and chromophobes (C) in which the cytoplasm is poorly stained. Also shown are capillaries and sinusoids (S)

stained with Gomori trichrome.
(X400)



Importance of different colors?

- Acidophils secrete growth hormone and prolactin
- Basophils secrete TSH, LH , FSH and ACTH
- Chromophobes are undifferentiated cells

1- Chromophobes

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

Chromophils



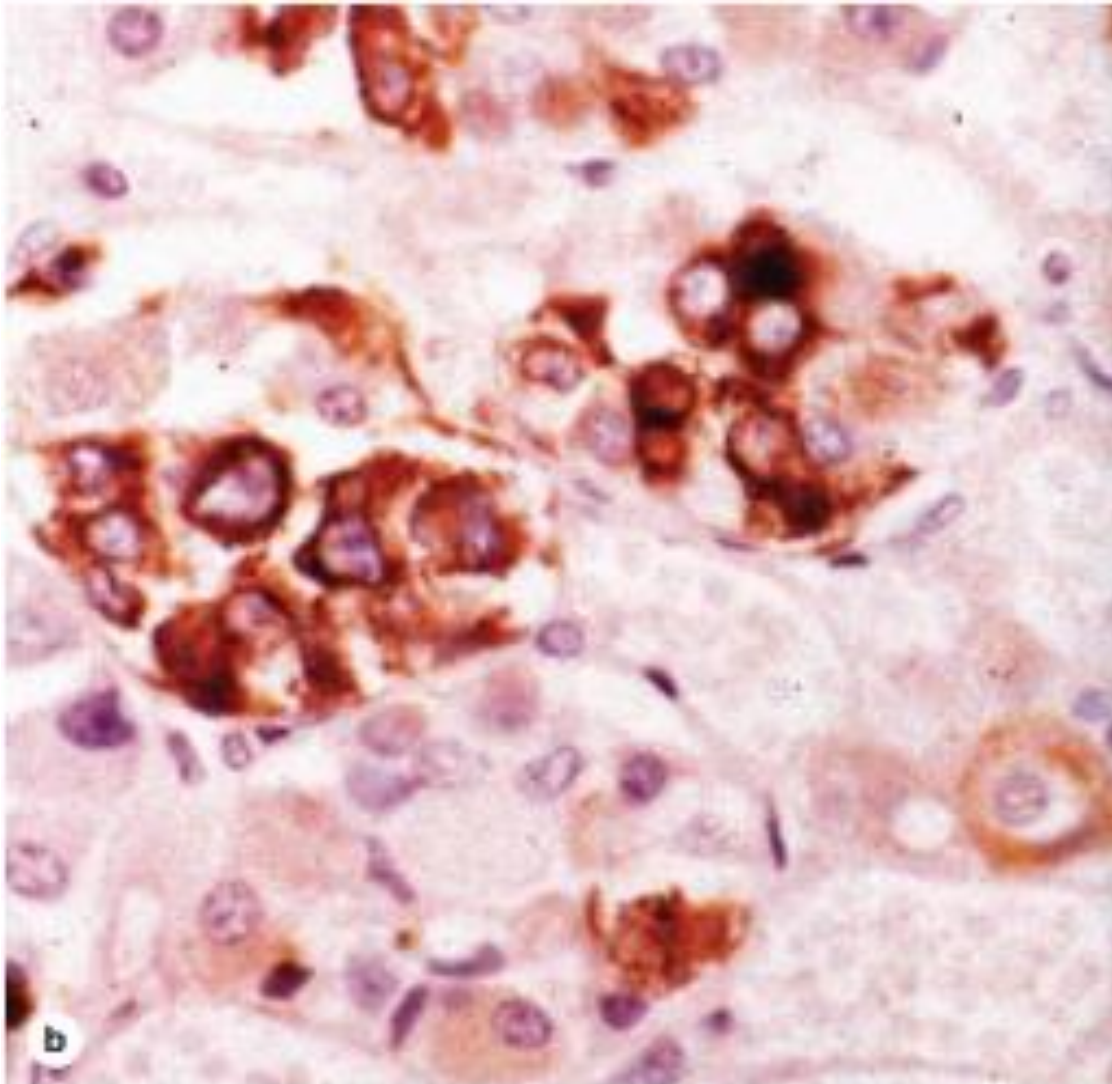
Subtypes of basophilic and acidophilic cells are identified by **immunohistochemistry**. Specific cells are usually named according to their hormone's target cells.

Acidophils secrete either growth hormone (somatotropin) or prolactin and are called **somatotrophs** and **lactotrophs**.

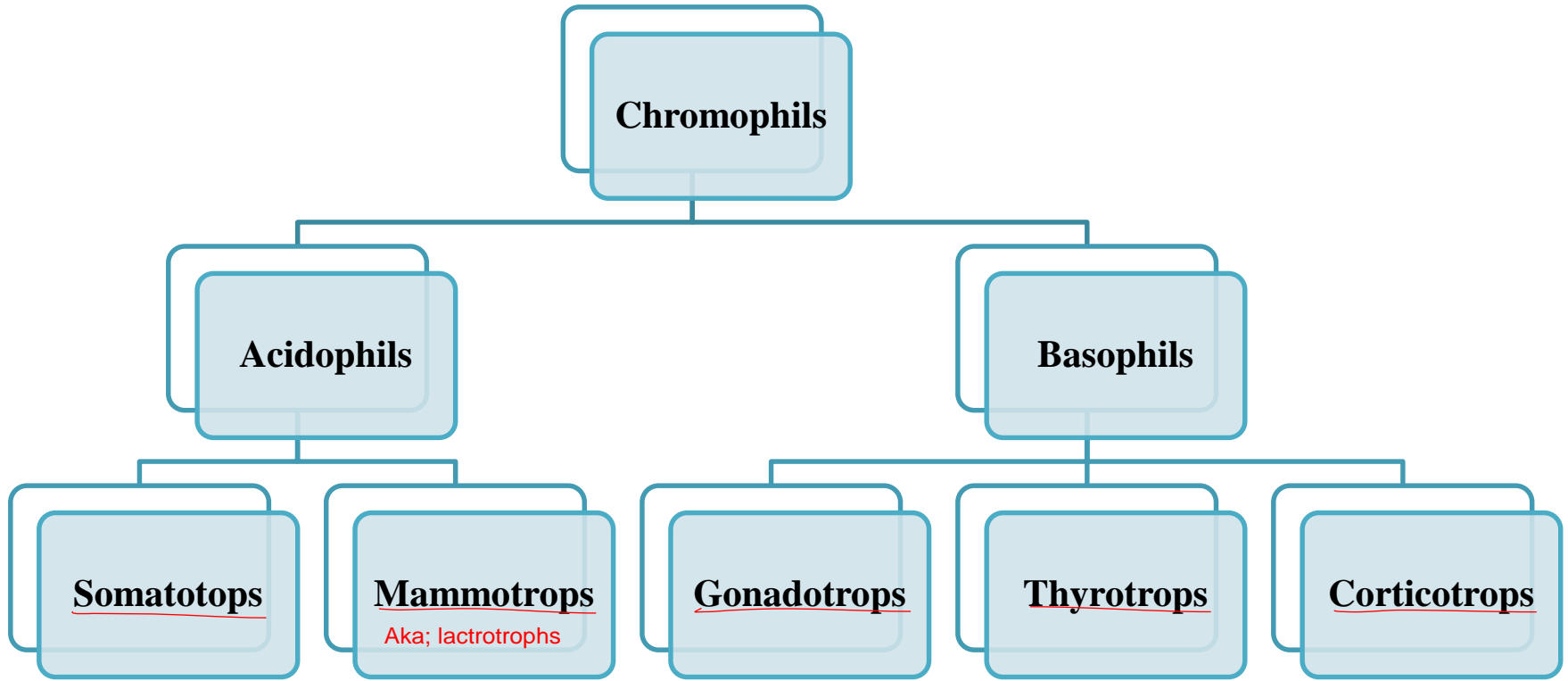
Very important
(or somatotrophic cells and lactotrophic cells), respectively.

The basophilic cells are the **corticotrophs**, **gonadotrophs**, and **thyrotrophs**.

Also important



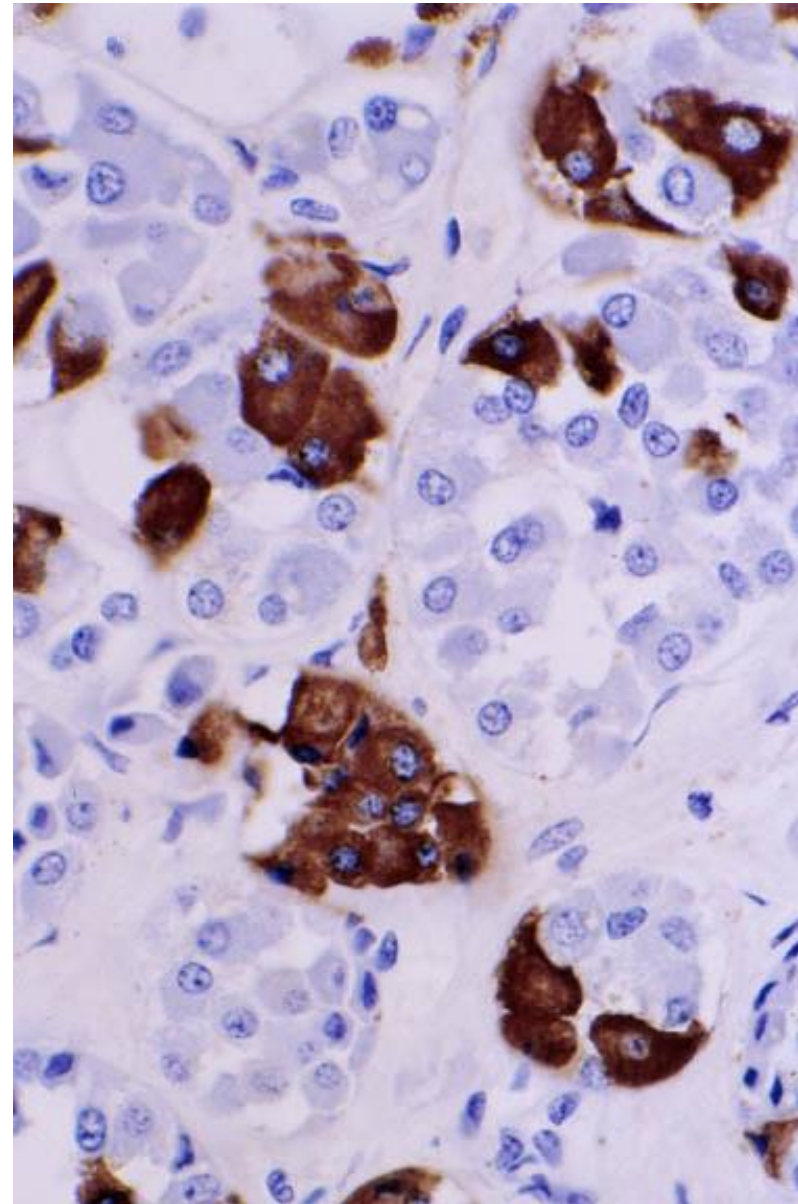
The micrograph shows somatotrophs stained using an antibody against somatotropin. (X400; Hematoxylin counterstain)



** memorize them

1- Somatotrops:

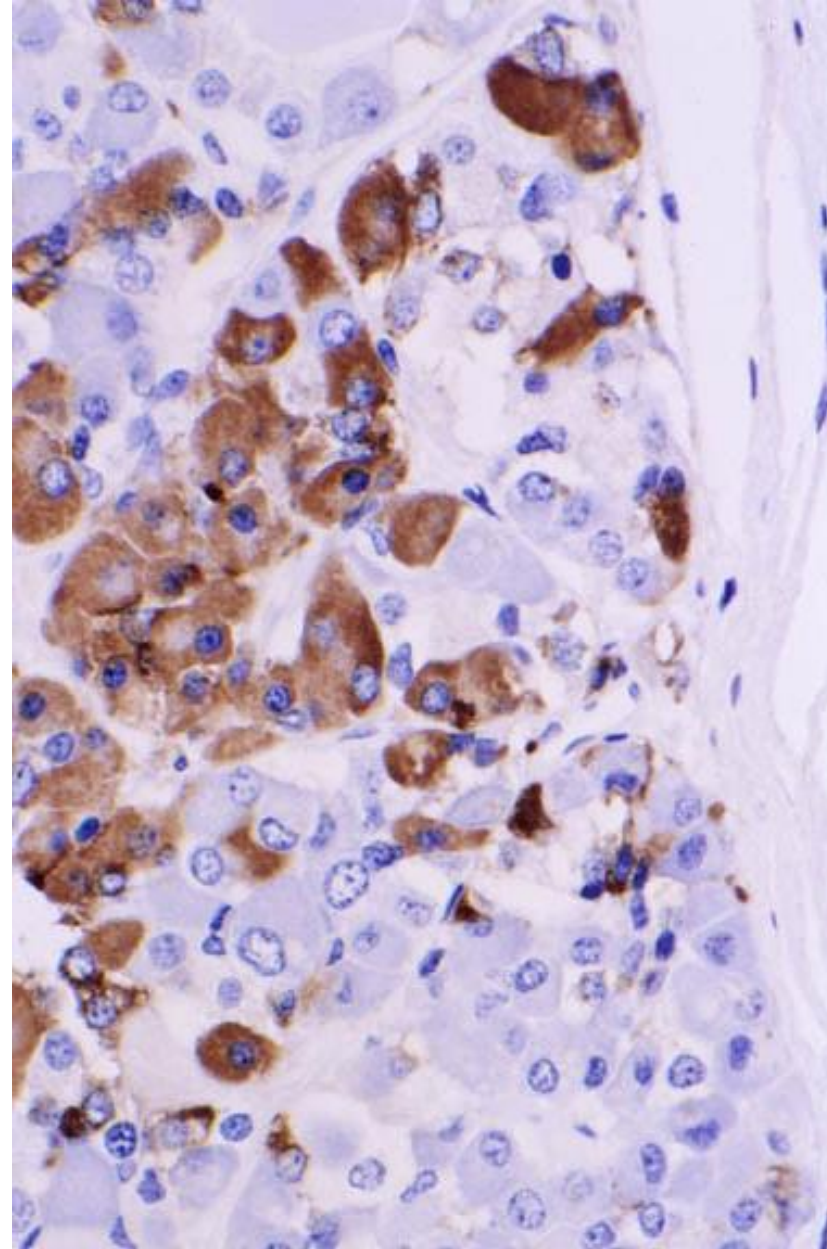
- LM
- Form ~ 50% of the total number of chromophils.
- Occur in clumps and clusters
- Central nucleus
- EM
- **Rod shaped mitochondria**
- **Many rER**
- **Many secretory granules (secrete GH)**
- **Moderate Golgi**
- Action of GH: acts on growth of long bones via insulin-like growth factors synthesized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



Read only

2- Mammatrops

- 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.

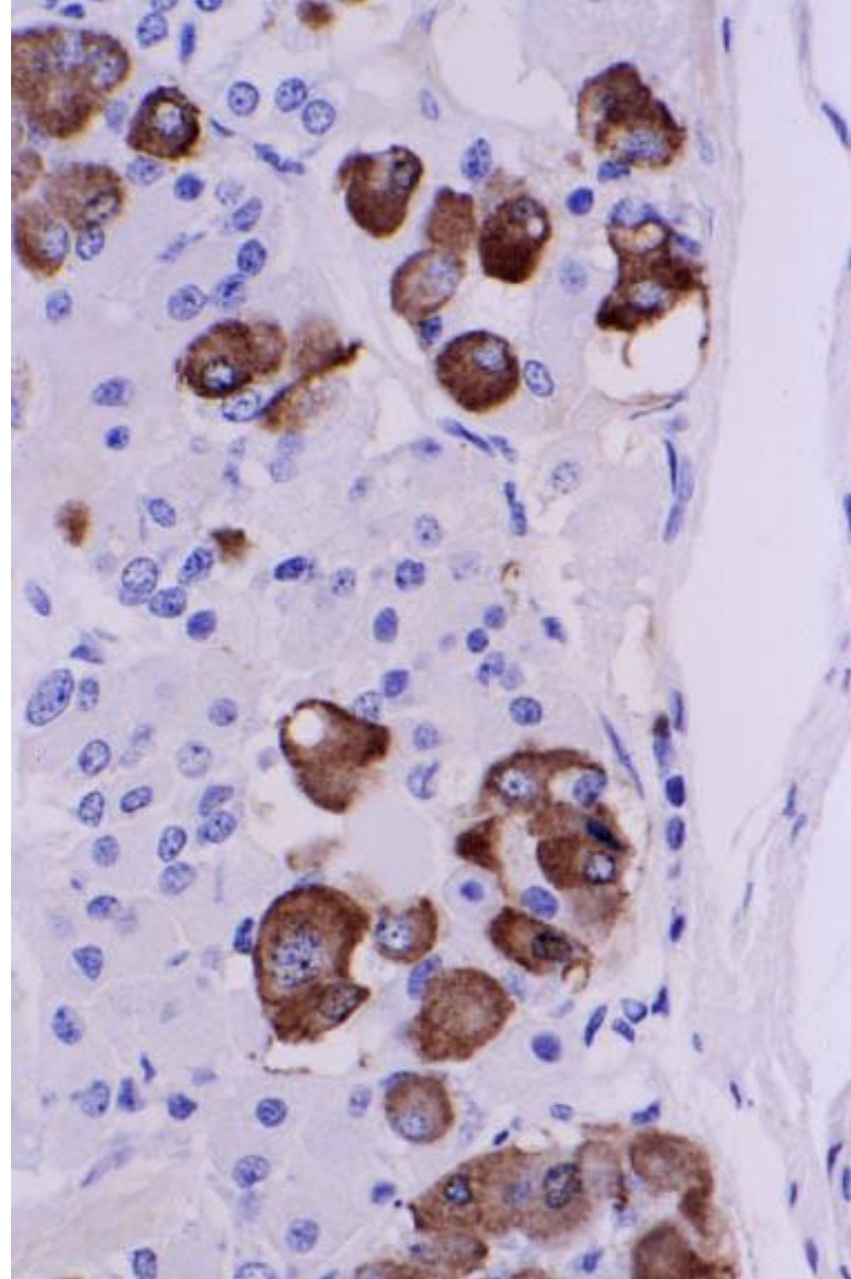
Read only

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

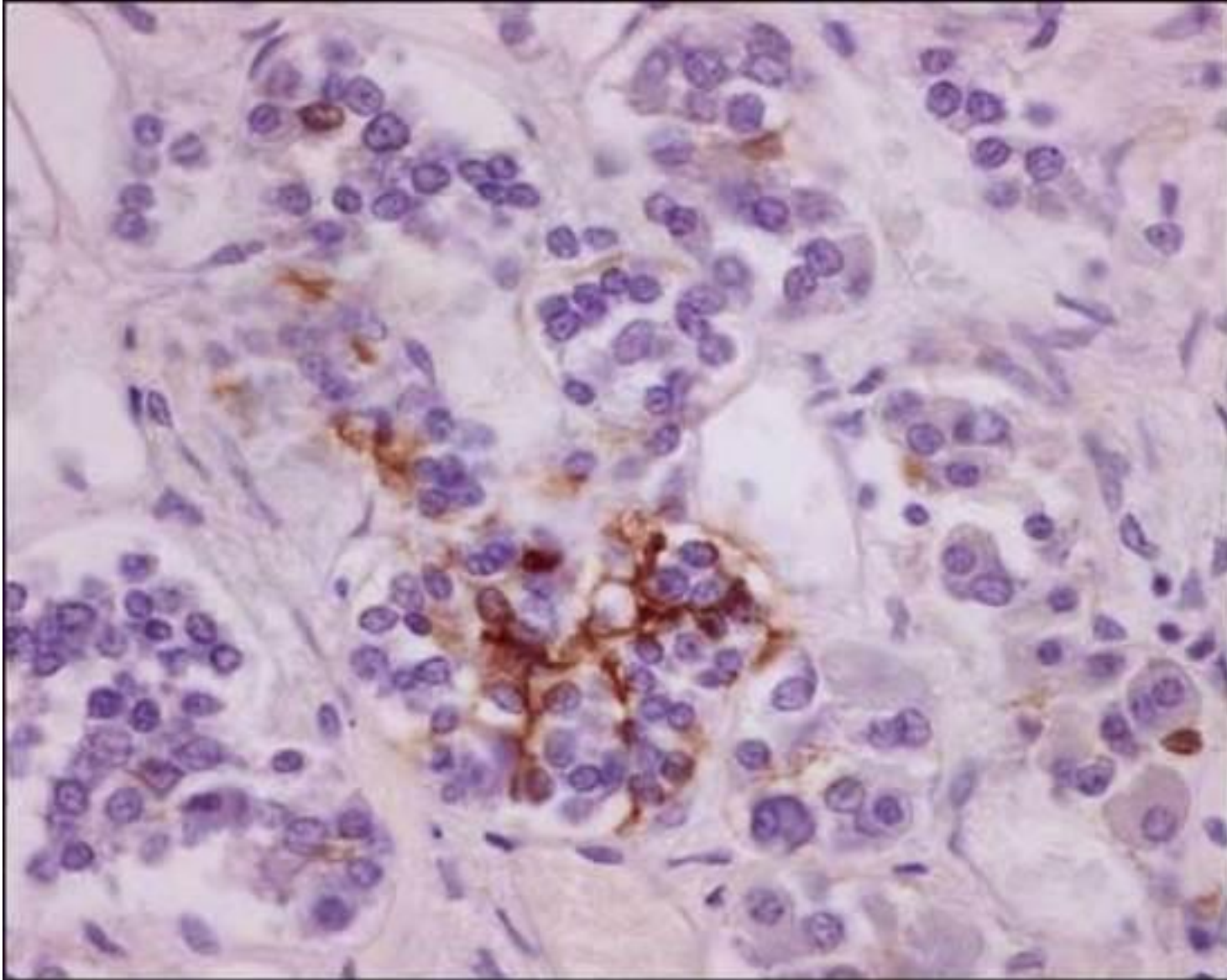
- Form 15-20% of chromophils.
- Round-ovoid cells scattered through pars distalis.
- Eccentric nucleus with few organelles.
- Secrete ACTH.
- **Action of ACTH**: stimulates secretion of adrenal cortex hormones and regulated lipid metabolism.



anterior lobe of the
pituitary gland also
contains
folliculostellate cell

* Folliculostellate cells

- are characterized by a star like appearance with their cytoplasmic processes encircling hormone-producing cells. → (The endocrine cells)
- They have the ability to make cell clusters or small follicles
 - **they do not produce hormones.** → **Gap junctions help them to act as a syncytium
 - Folliculostellate cells are interconnected by gap junctions.
- Based on immunocytochemical and electrophysiological studies, it is hypothesized that the network of folliculo-stellate cells interconnected by gap junctions transmits signals **from the pars tuberalis to pars distalis.**
- These signals may regulate hormone release throughout the anterior lobe of the pituitary gland. Thus, the folliculo-stellate network may appear to function in addition to the hypophyseal portal vein system



Folliculostellate cells are stromal cells that surround endocrine cells of the pituitary gland

Neurohypophysis (Posterior Pituitary)

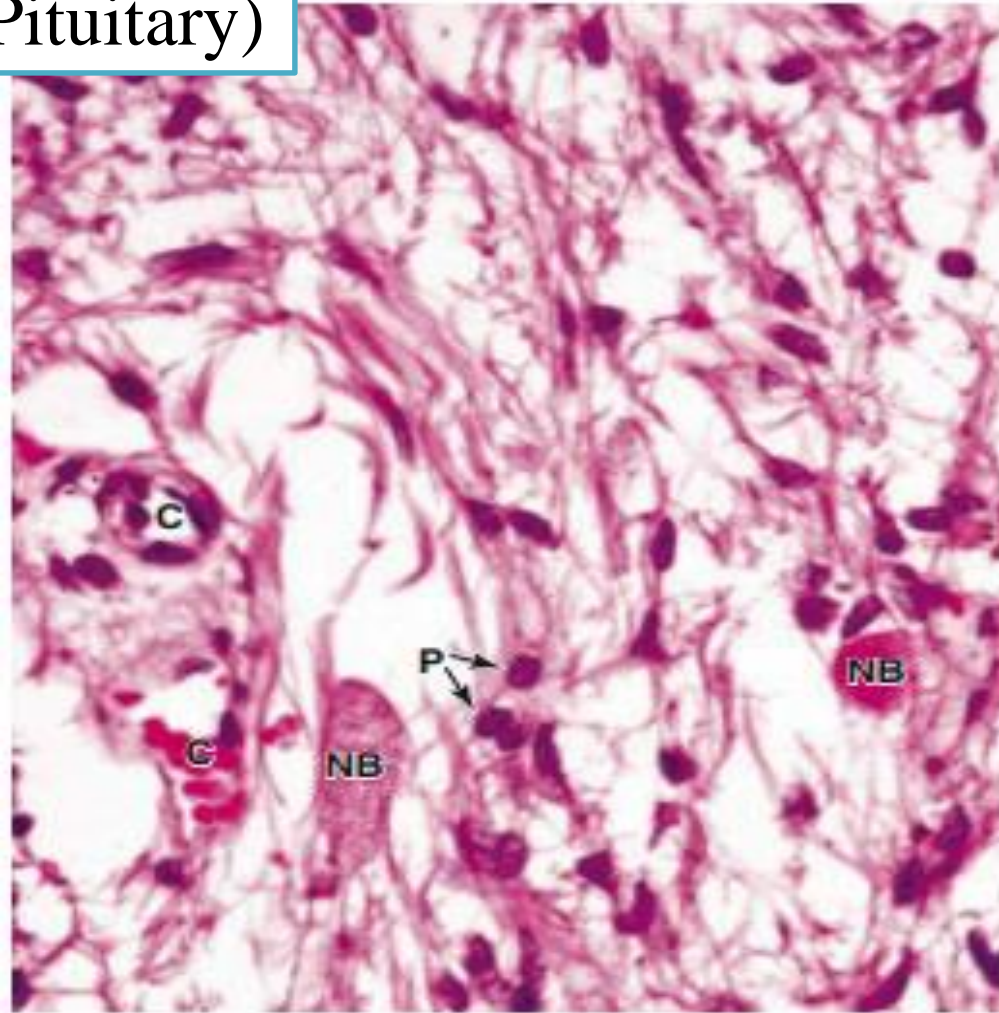
>>The origin of neurohypophysis is the **neuroectoderm**, that's why It's expected to see a part of the brain has invaginated down and settled into the hypophyseal fossa rather than an endocrine tissue.

It is composed of **neural tissue**, containing some 100,000 unmyelinated axons of large secretory neurons with cell bodies in the supraoptic and paraventricular nuclei of the hypothalamus

→ **The post. Pituitary gland has no cell bodies.
**cell bodies are found in the hypothalamus and their axons are transmitting through the infundibulum to occupy the post. Pituitary gland (neurohypophysis).

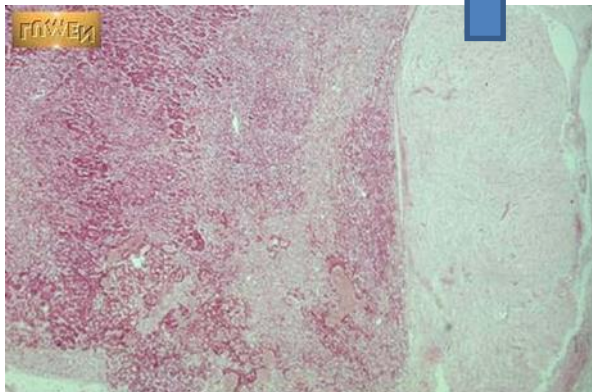
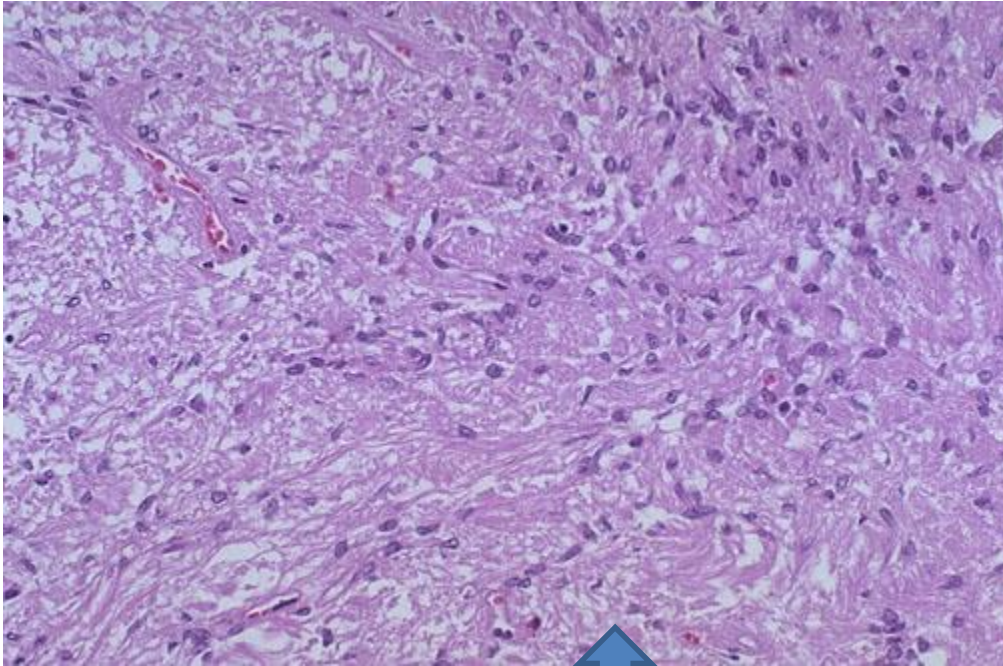
Also present are highly branched glial cells **called pituicytes** that resemble astrocytes and are the most abundant cell type in the posterior pituitary

To sum up...
The structure of the neurohypophysis is composed of:
Unmyelinated axons + pituicytes



The pars nervosa of the posterior pituitary consists of modified neural tissues containing unmyelinated axons supported and ensheathed by glia cells called **pituicytes (P)**, the most numerous cell present. The axons run from the supraoptic and paraventricular hypothalamic nuclei, and have swellings called **neurosecretory (Herring) bodies (NB)** from which either oxytocin or vasopressin is released upon neural stimulation. The released hormones are picked up by capillaries (**C**) for distribution. (X400; H&E)

Neurohypophysis – high power



The neurohypophysis resembles neural tissue, with glial cells, nerve fibers, nerve endings, and intra-axonal neurosecretory granules

those granules contain:

Precursors of ADH (vasopressin) and oxytocin are synthesized in the hypothalamus and transported to the pars nervosa where processing is completed

Neurohypophysis – high power



Herring bodies are large dilated axon terminal endings that are filled with accumulated neurosecretory granules

those herring bodies are found inside the post. part of the neurohypophysis.

Does not contain secretory cells.

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

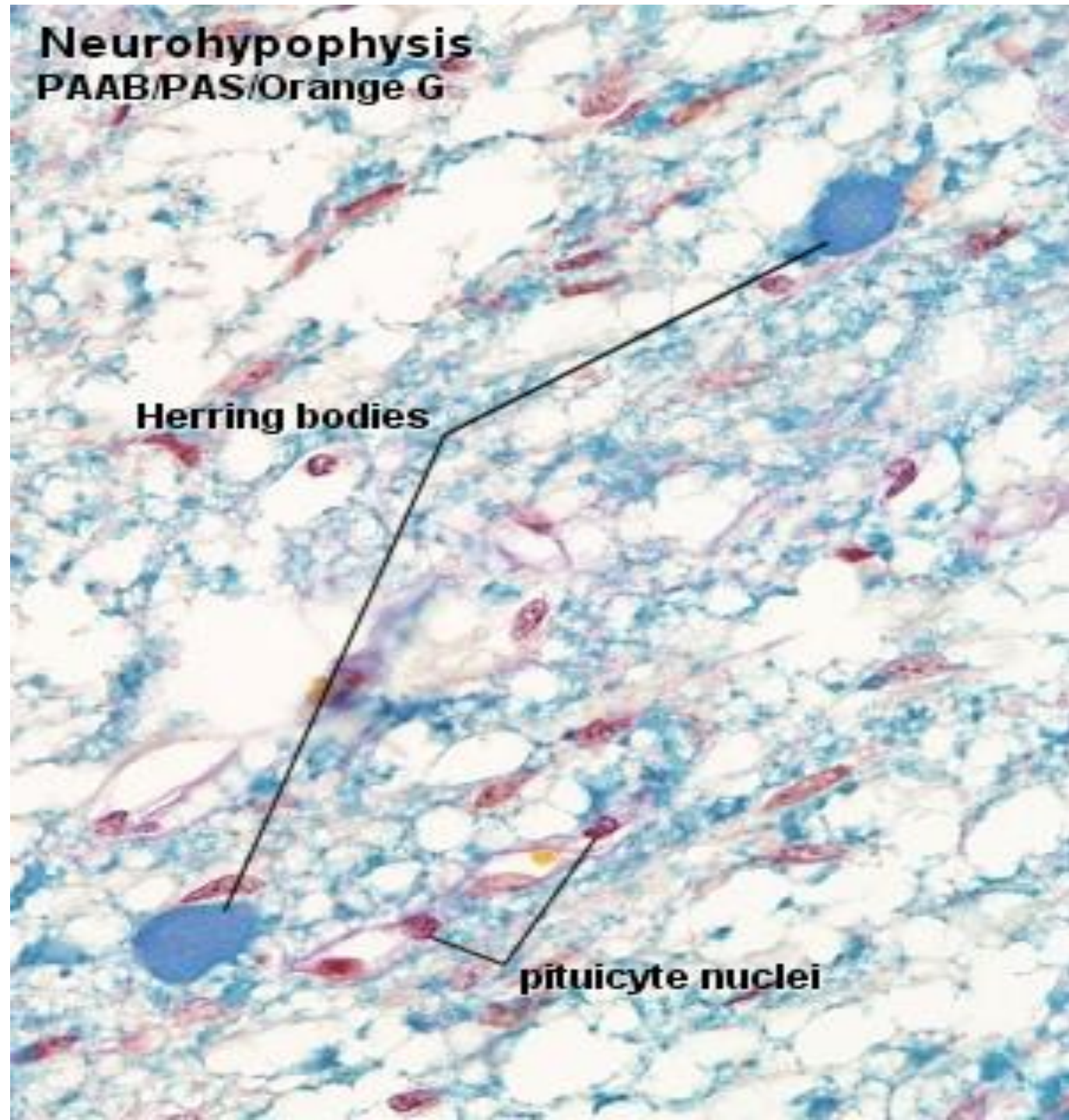
Pituicytes are the most numerous cells.

Pituicytes resemble astrocytes.

Neurohypophysis PAAB/PAS/Orange G

Pituitary, sheep -
PAAB/PAS/Orange G
Identify nuclei of
pituicytes and Herring
bodies

Regarding the neurohypophysis,
there are **no myelinating cells** as
the axons are unmyelinated, rather
there are astrocyte like cells
(pituicytes).

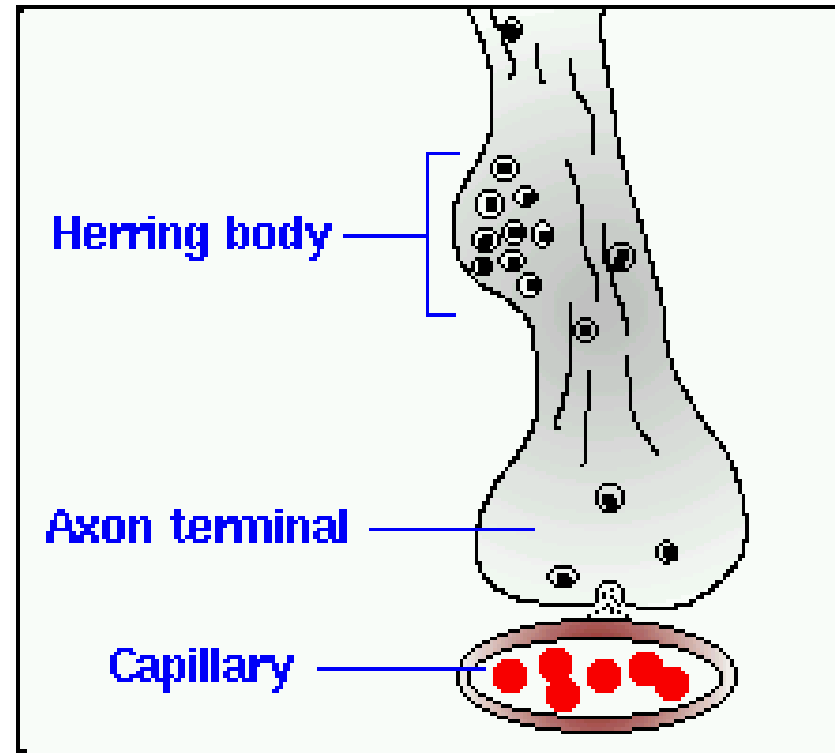


Hormones are produced by the hypothalamus, then they're transported through the axons until reaching out the terminal ends (stored there).

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.



The neurohypophysis is considered an endocrine gland, even though it is originating from a nervous tissue.

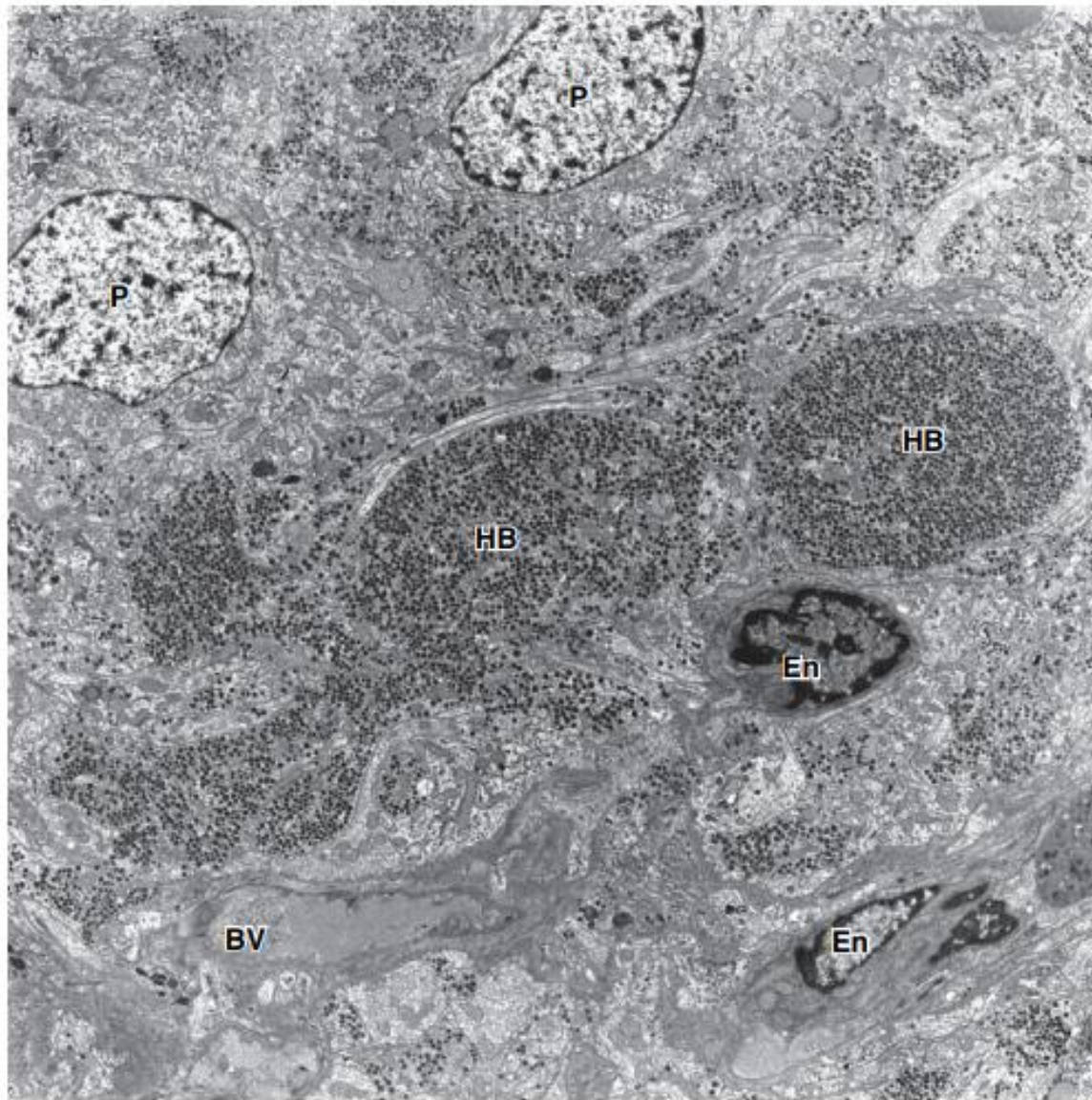


FIGURE 21.9 • Electron micrograph of Herring bodies of rat posterior lobe. Dilated portions of axons near their terminals called Herring bodies (HB) contain numerous neurosecretory vesicles filled with either oxytocin or ADH. They are surrounded by the specialized glial cells called pituicytes (P). Note that Herring bodies reside in a close proximity to blood vessels (BV), mainly fenestrated capillaries, lined by endothelial cells (En). $\times 6,000$. (Courtesy of Dr. Holger Jastrow).

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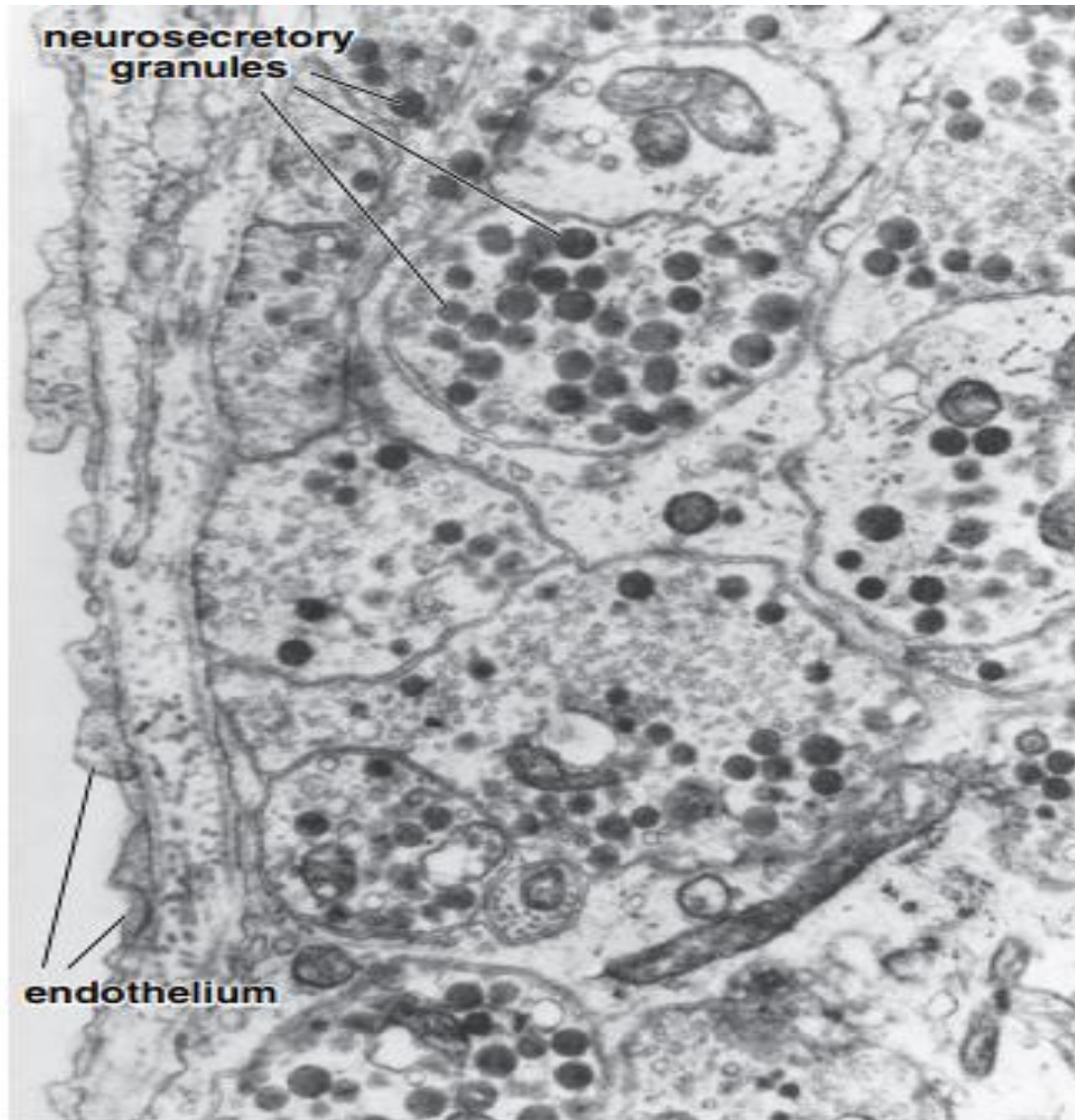


FIGURE 21.10 • Electron micrograph of rat posterior lobe. Neurosecretory granules and small vesicles are present in the terminal portions of the axonal processes of the hypothalamohypophyseal tract fibers. Capillaries with fenestrated endothelium are present in close proximity to the nerve endings. $\times 20,000$. (Courtesy of Drs. Sanford L. Palay and P. Orkland.)

**Memorize the origin of each hormone

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.

A tumour/ trauma in the fundibulum>> preventing the precursors of these hormones from reaching out the neurohypophysis >> central diabetes insipidus

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