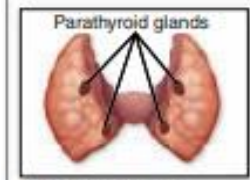
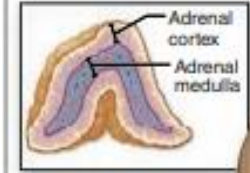


# Histology

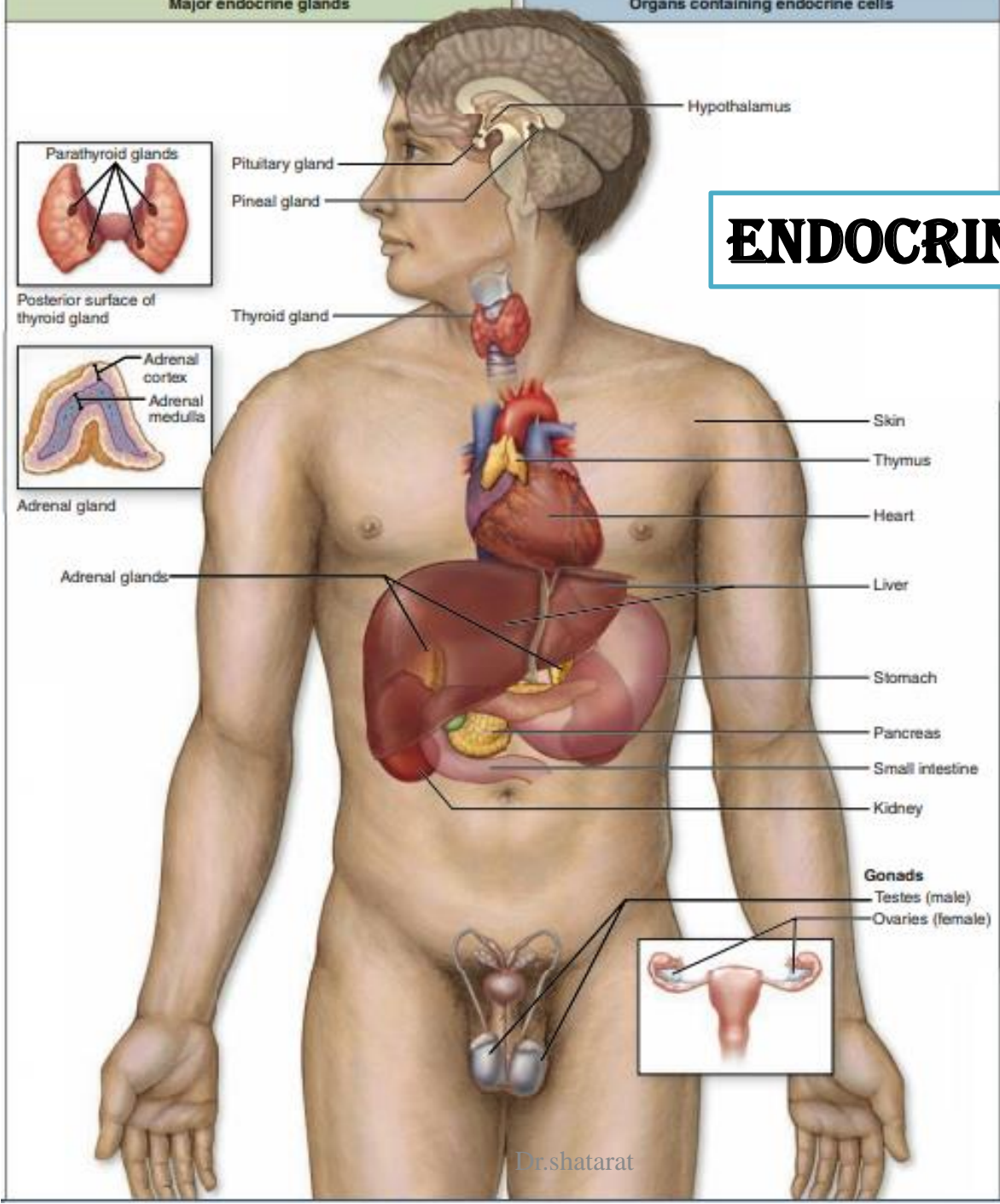
# ENDOCRINE GLANDS



Posterior surface of thyroid gland



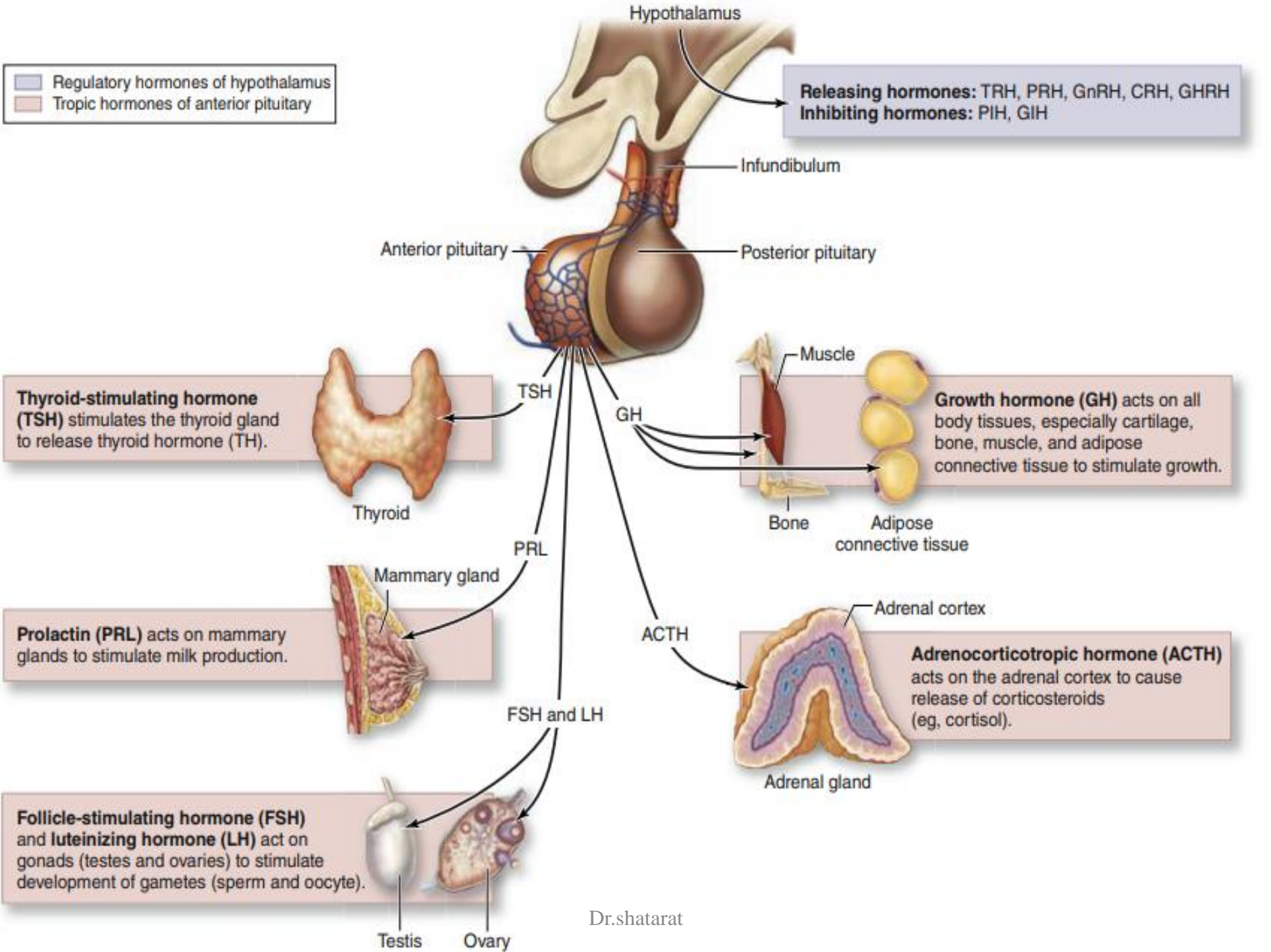
Adrenal gland



- Hypothalamus
- Pituitary gland
- Pineal gland
- Thyroid gland
- Adrenal glands
- Skin
- Thymus
- Heart
- Liver
- Stomach
- Pancreas
- Small intestine
- Kidney
- Gonads
  - Testes (male)
  - Ovaries (female)

Regulatory hormones of hypothalamus  
 Tropic hormones of anterior pituitary

Releasing hormones: TRH, PRH, GnRH, CRH, GHRH  
 Inhibiting hormones: PIH, GIH



# ENDOCRINE GLANDS

Secretory cells of endocrine glands release their products, signaling molecules called hormones, into the neighboring vascularized compartment for uptake by capillaries and distribution throughout the body.

- There is no secretory duct as in exocrine glands

Junqueira's  
Basic Histology  
Text and Atlas,  
2014<sup>th</sup> Edition

Ask

Distribution by the circulation allows hormones to act on target cells with receptors for those hormones at **a distance from the site** of their secretion.

Why?

Paracrine secretion

endocrine cells produce hormones  
that act

on target cells only **a short  
distance away**

Through

- 1- local in interstitial fluid
- 2-short loops of blood vessels

For example :gastrin  
made by pyloric G cells reaches  
target cells in the fundic  
glands

Juxtacrine

contact-dependent signalling

in which a signaling molecule  
remains on the secreting cell's surface  
or adjacent extracellular  
matrix and affects target cells when  
the cells make contact.

Juxtacrine signaling is particularly  
important **in embryonic  
and regenerative tissue interactions**

A.Sh

No ducts anyway!!!!!!!

Why the CNS is not enough?  
Why do we need Endocrine system?

**Neuroendocrine axis**

At puberty the female begins to undergo regular monthly cycles called

**sexual cycles**

Sexual cycles are under the control of the

**Brain**

**Hypothalamus**

The hypothalamus acts as a pulse generator which generates the pulsatile release of

**Gonadotropin releasing hormone (GnRH)**

(GnRH)

Controls the release of the Gonadotropin

*A.Sh*

**The follicle-stimulating hormone (FSH)**

**luteinizing hormone (LH)**

from the anterior part of the pituitary gland

FSH and LH

Control

**THE OVARIAN CYCLE**

Controls

The endometrial cycle (menstrual cycle)

*Dr. Shatara*

The **HEMATOXYLIN** stains *nucleic acids*  
(plus calcium deposits and bacteria) blue.

The **EOSIN** stains *most proteins*  
(actually, arginine and lysine) pink.

A.S.K

Clear areas represent

*water,*

*carbohydrate*

*lipid,*

*gas*



Nuclei

will always stain

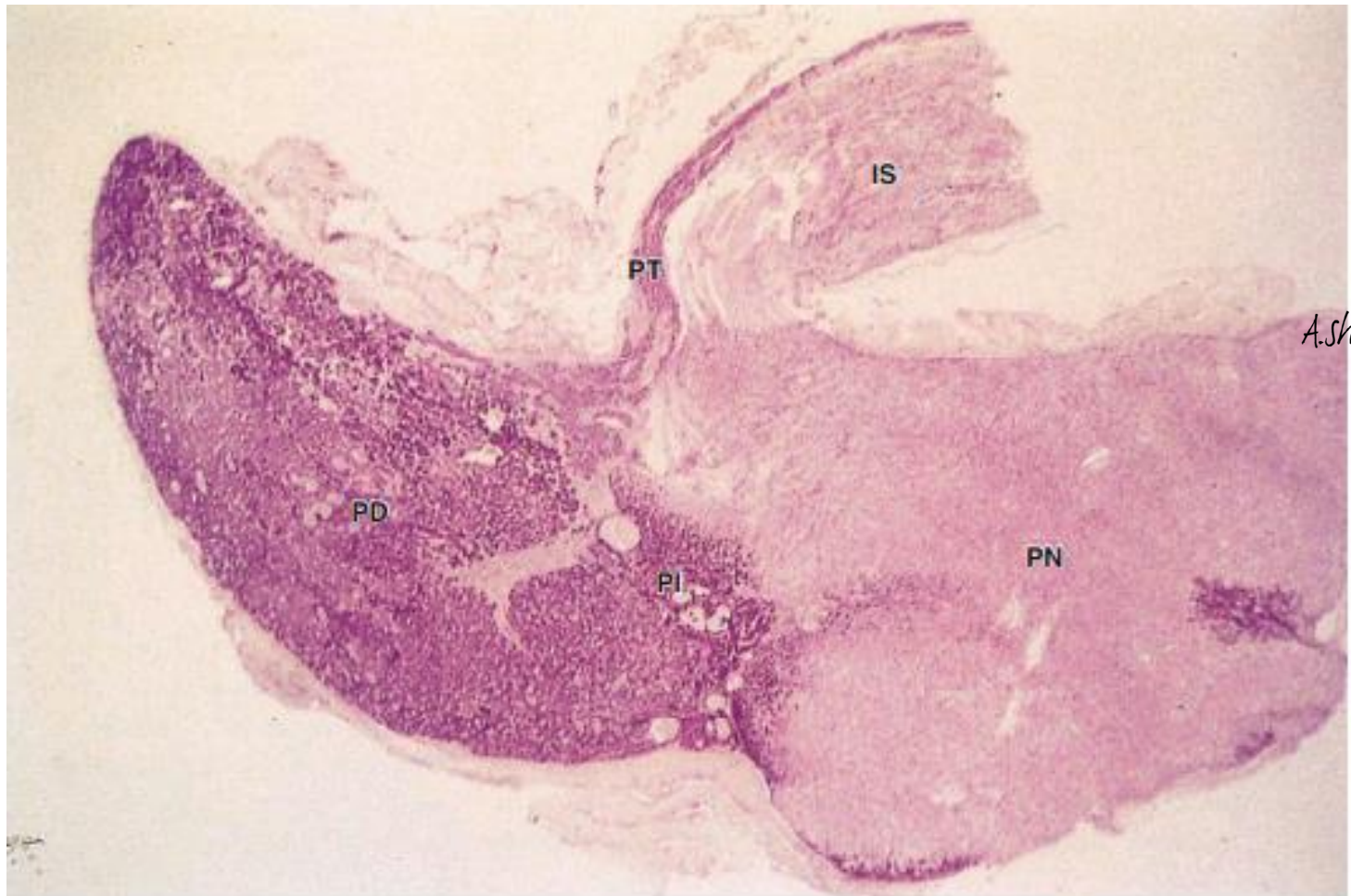
Blue with the

*Ask*  
Hematoxylin.

The cytoplasm of cells

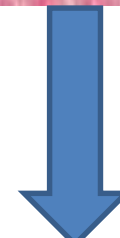
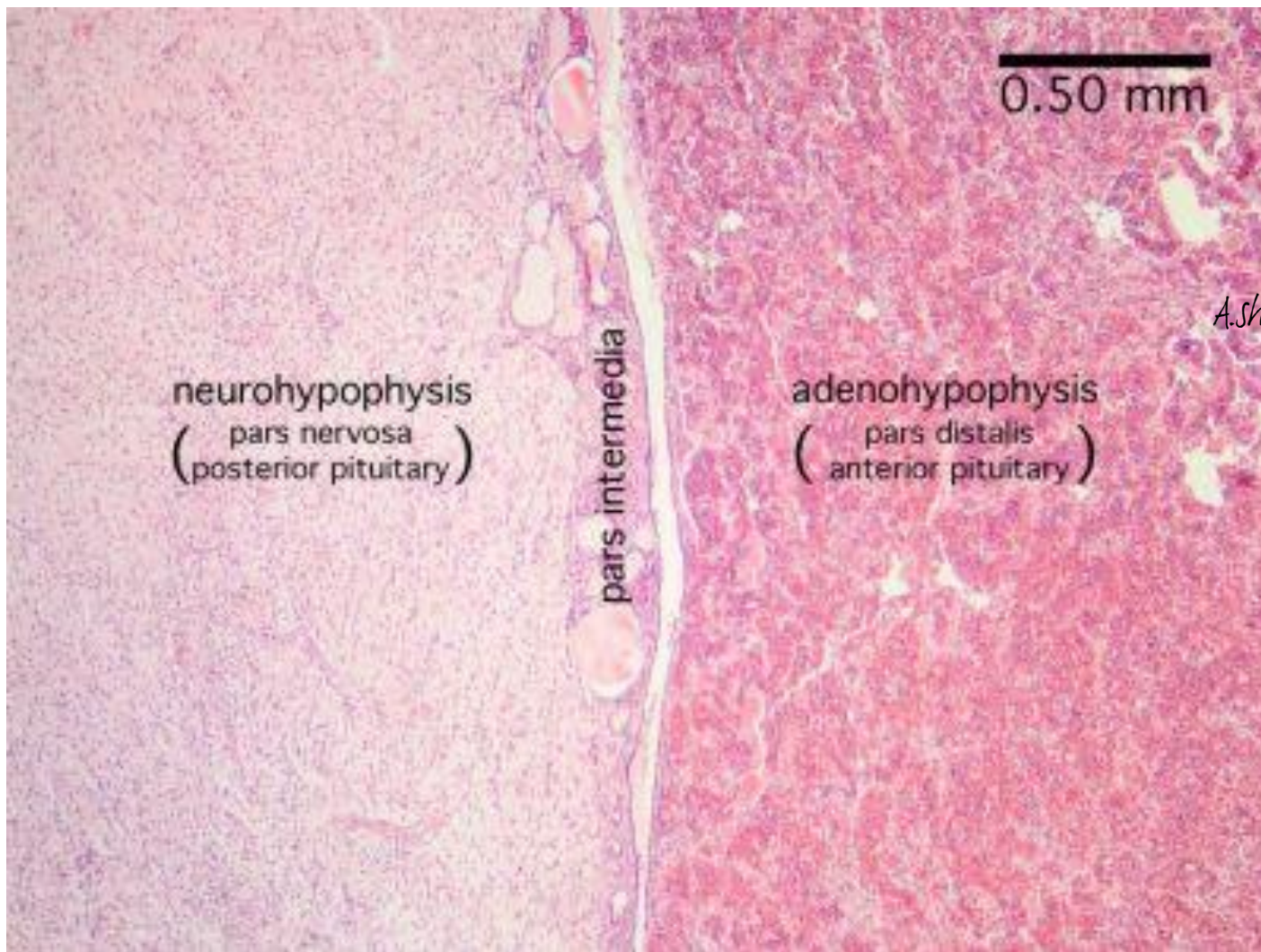
will stain according to its composition.

# PITUITARY GLAND



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

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)



**Cells of the adenohypophysis**



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

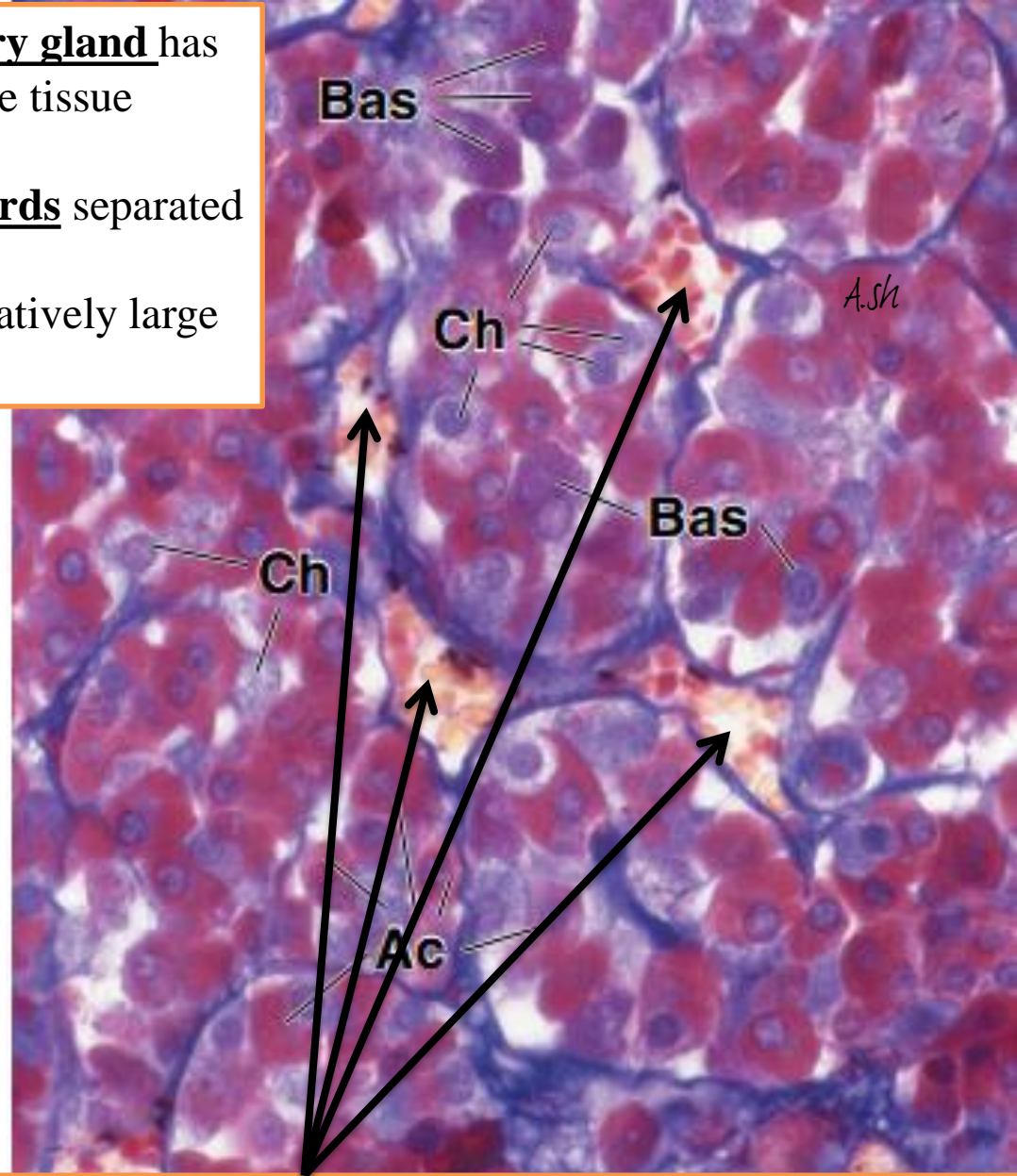
The cells are organized in clumps and cords separated by fenestrated sinusoidal capillaries of relatively large diameter

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

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

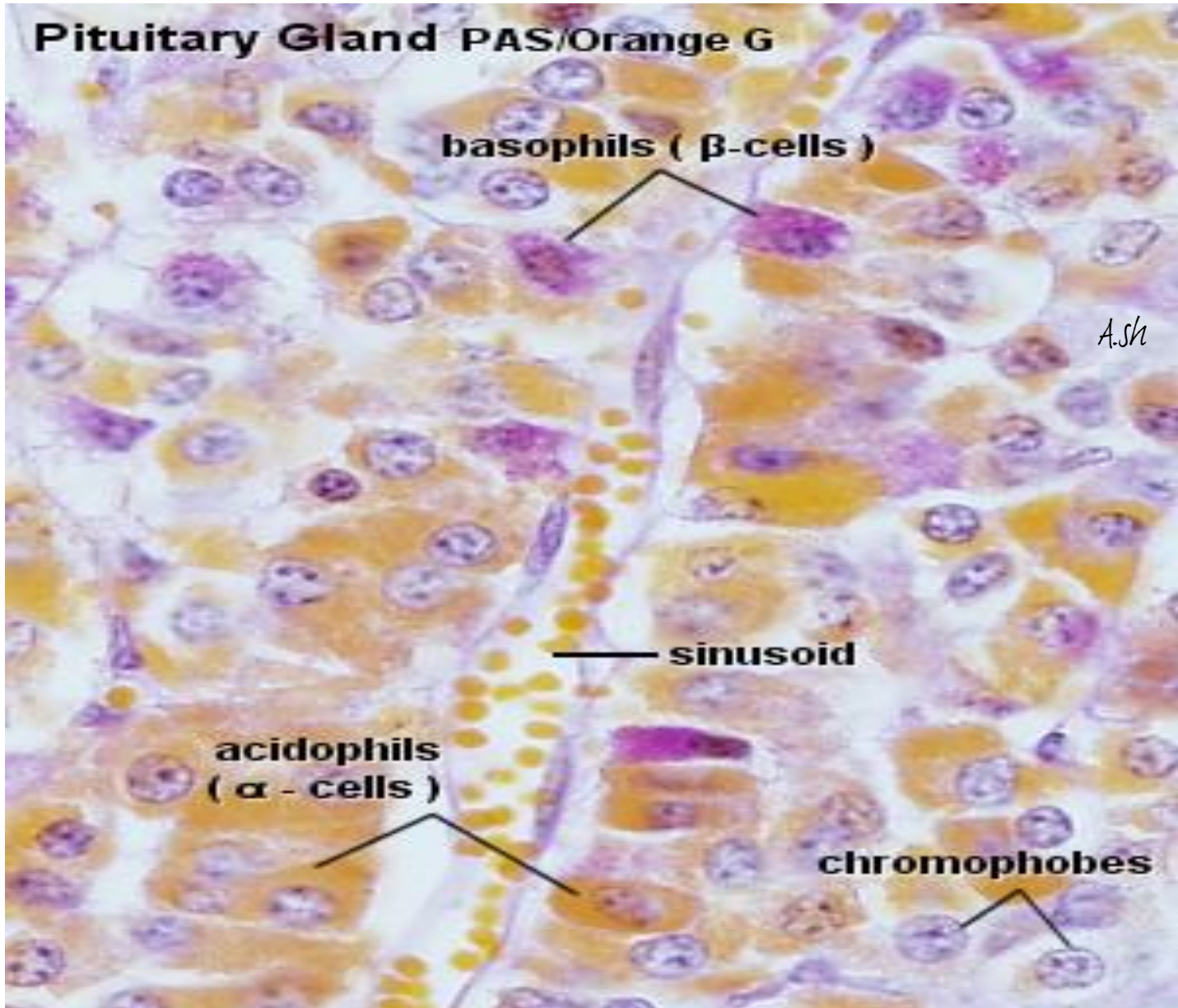
Read only



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

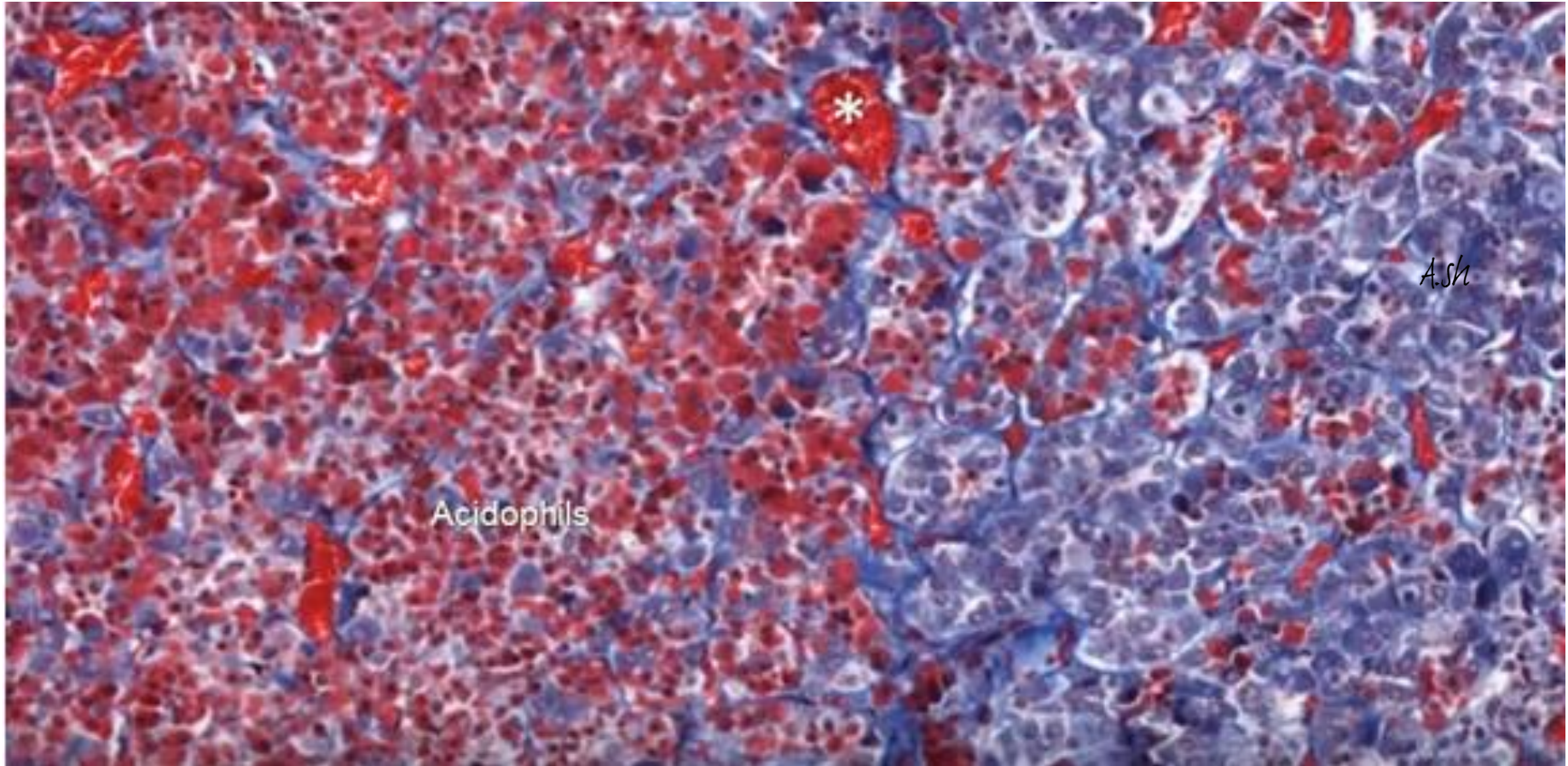
Dr.shatarat

# Pituitary Gland PAS/Orange G



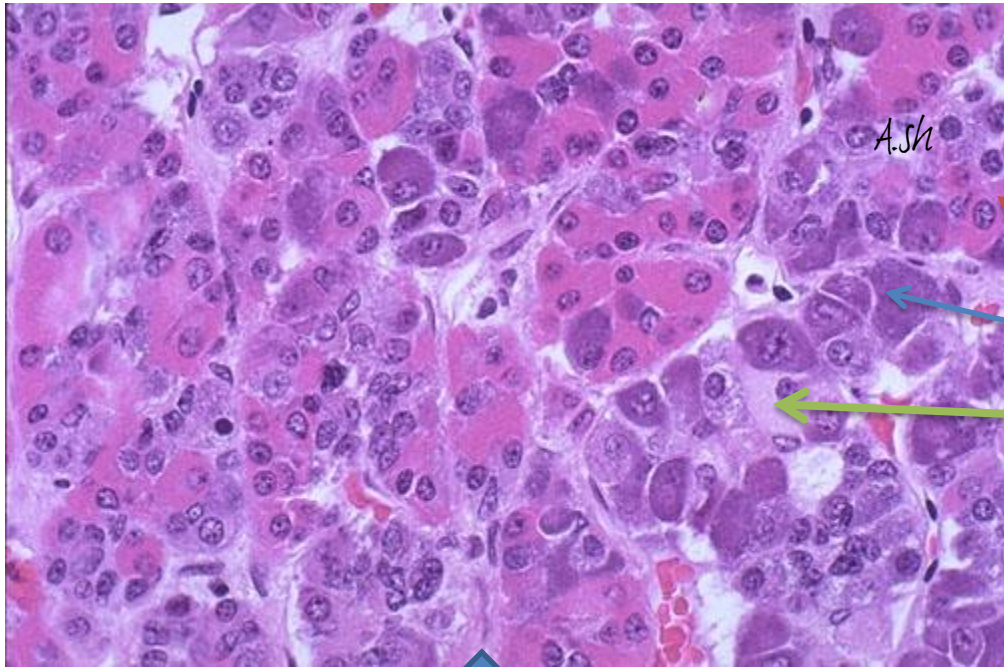


How many colors can be identified in this H&E section?????



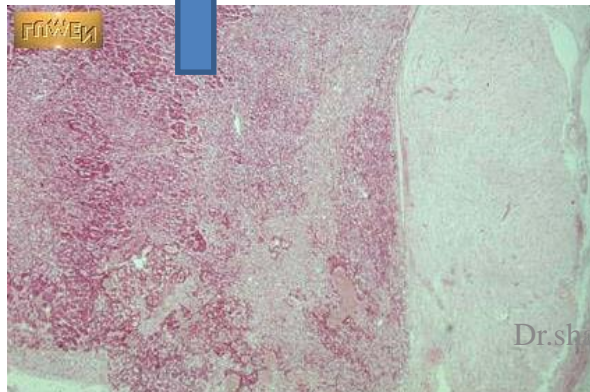
Dr.shatarat

# Adenohypophysis – high power



The adenohypophysis contains 3 cell types:

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



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

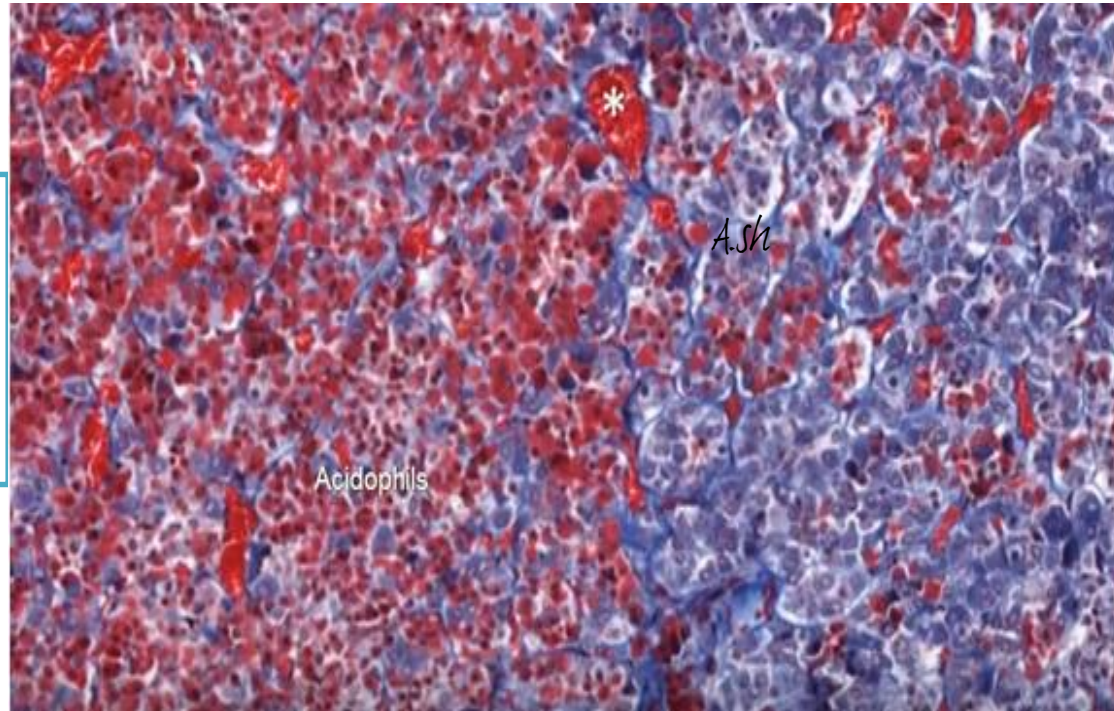
**1-Chromophils**

Basophils (10%)

Acidophils (40%)

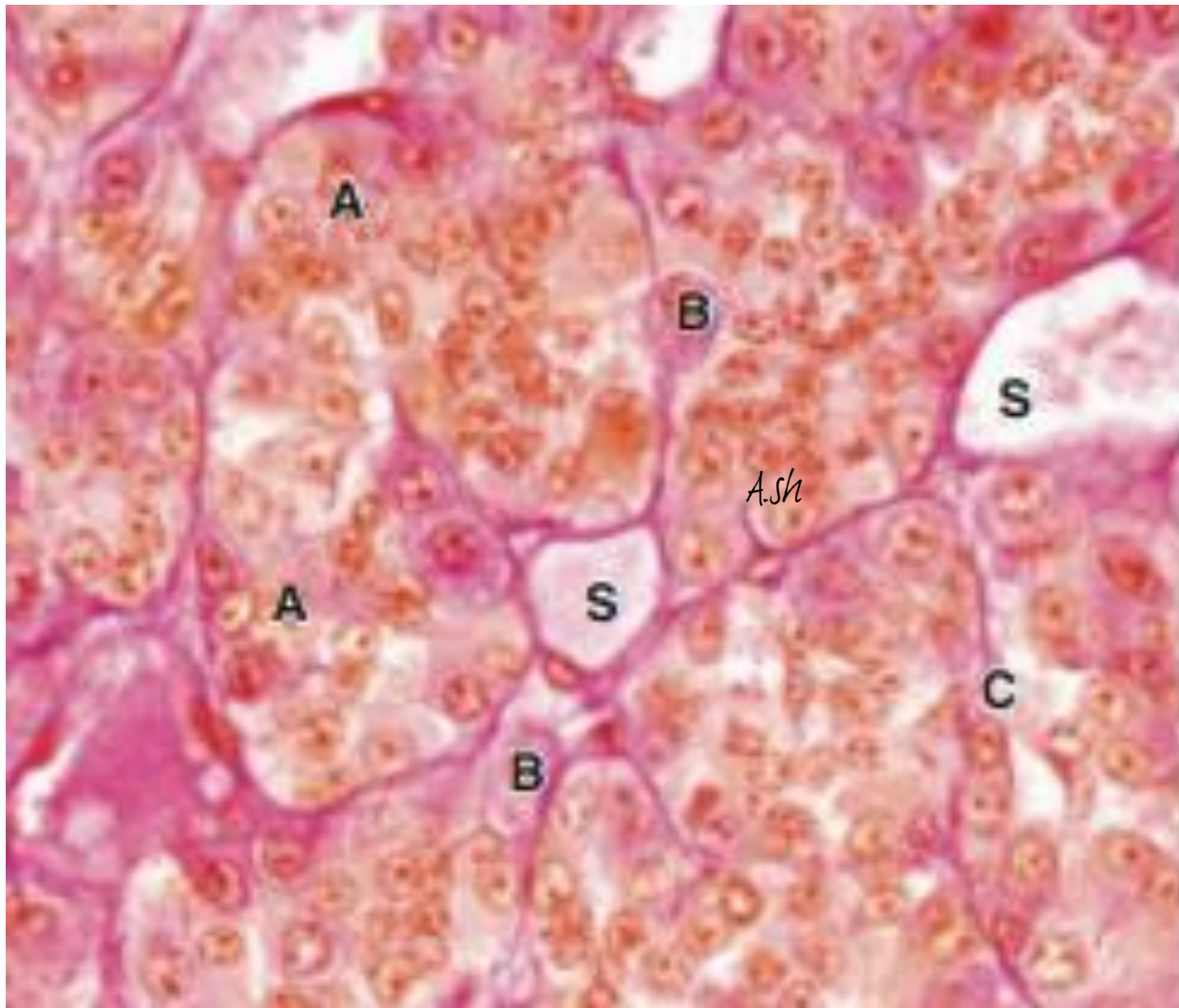
2- Chromophobes (50%)

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



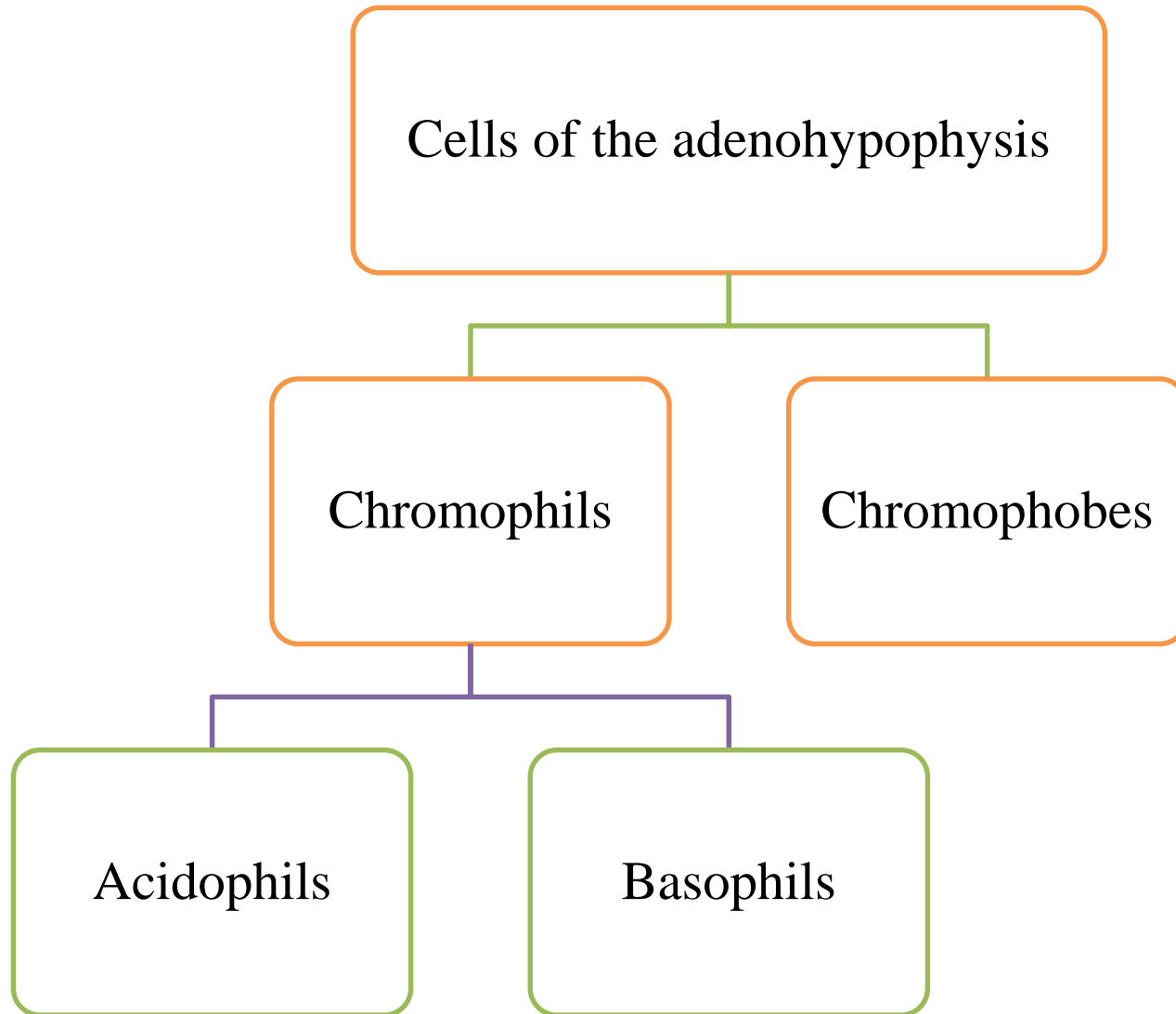
The anterior pituitary also contains one type of **chromophobe**

(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



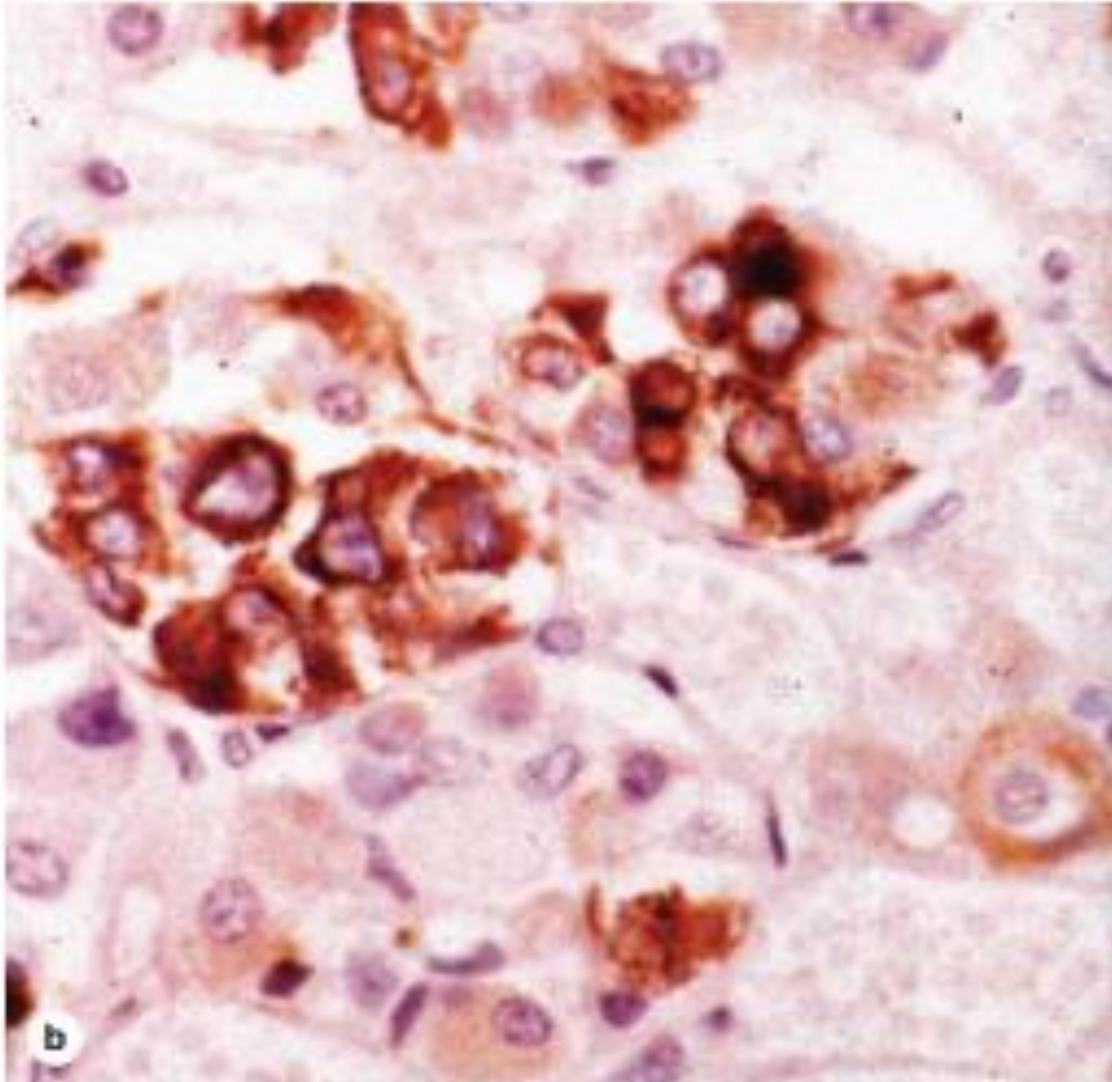
## Chromophils



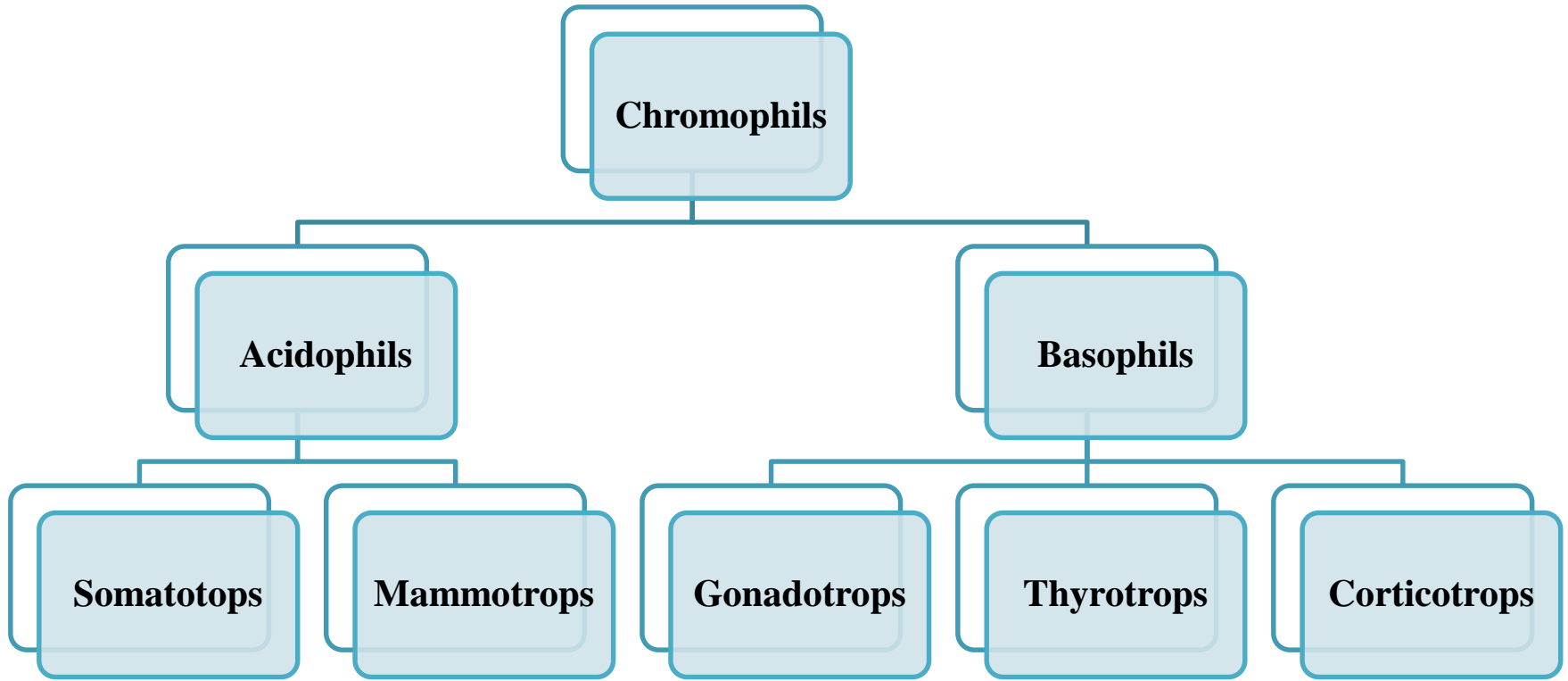
Subtypes of basophilic and acidophilic cells are identified by **immunohistochemistry**. Specific cells are usually named according to their hormone's target cells.

Acidophils secrete either growth hormone (somatotropin) or prolactin and are called **somatotrophs** and **lactotrophs** (or somatotrophic cells and lactotropic cells), respectively.

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

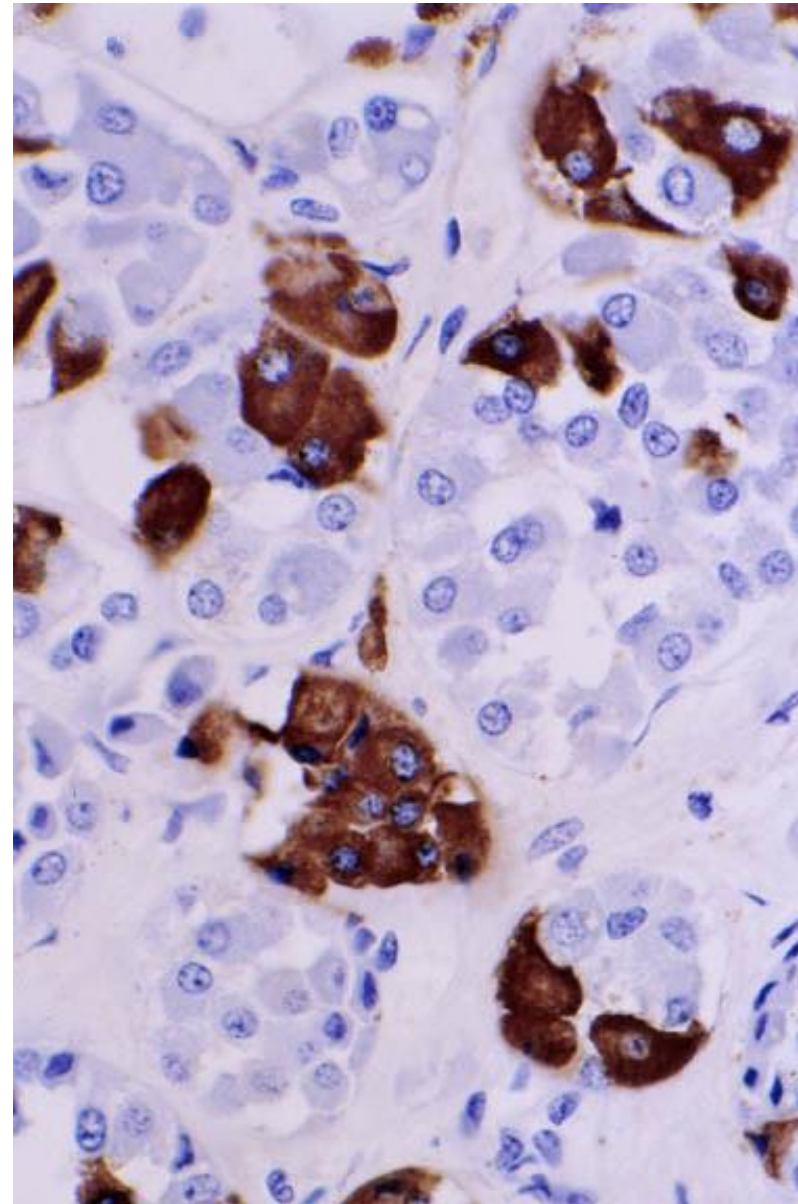


The micrograph shows somatotrophs stained using an antibody against somatotropin. (X400; Hematoxylin counterstain)



## 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.

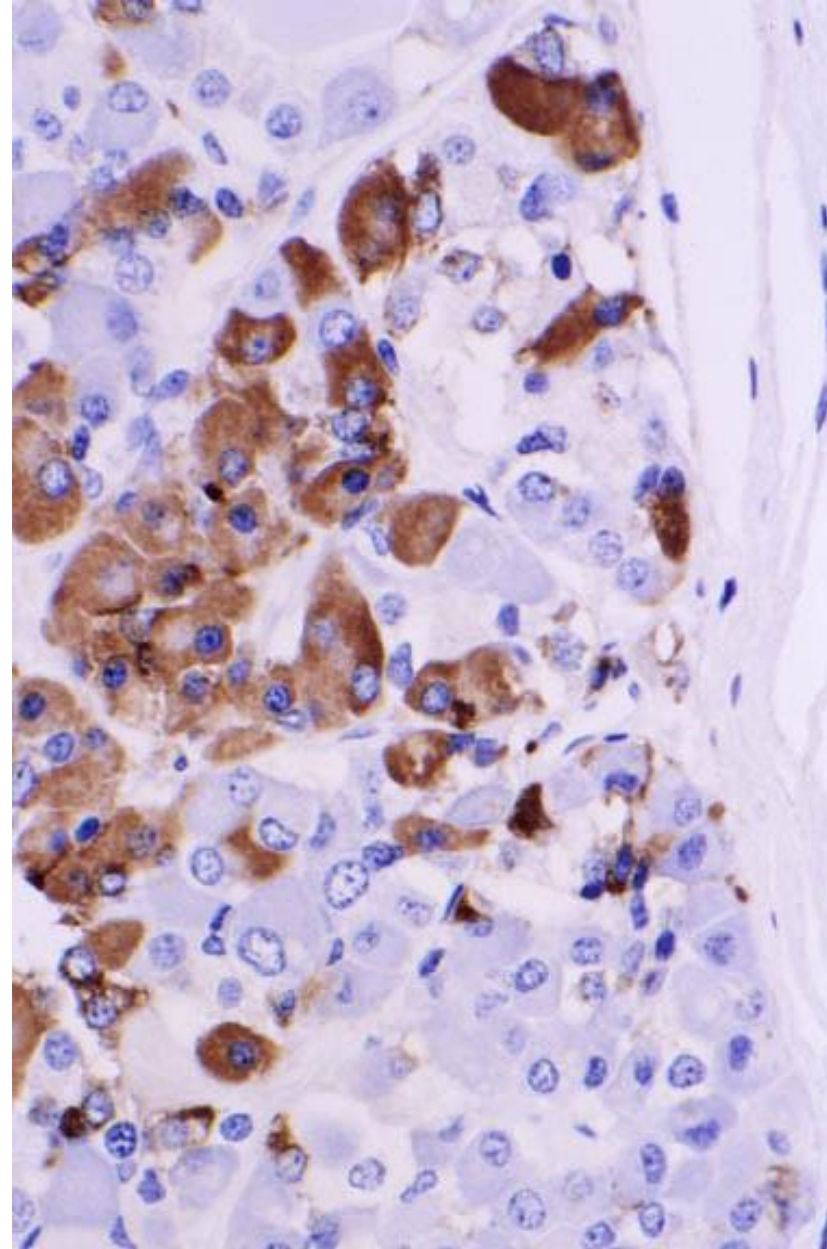




Read only

## 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.

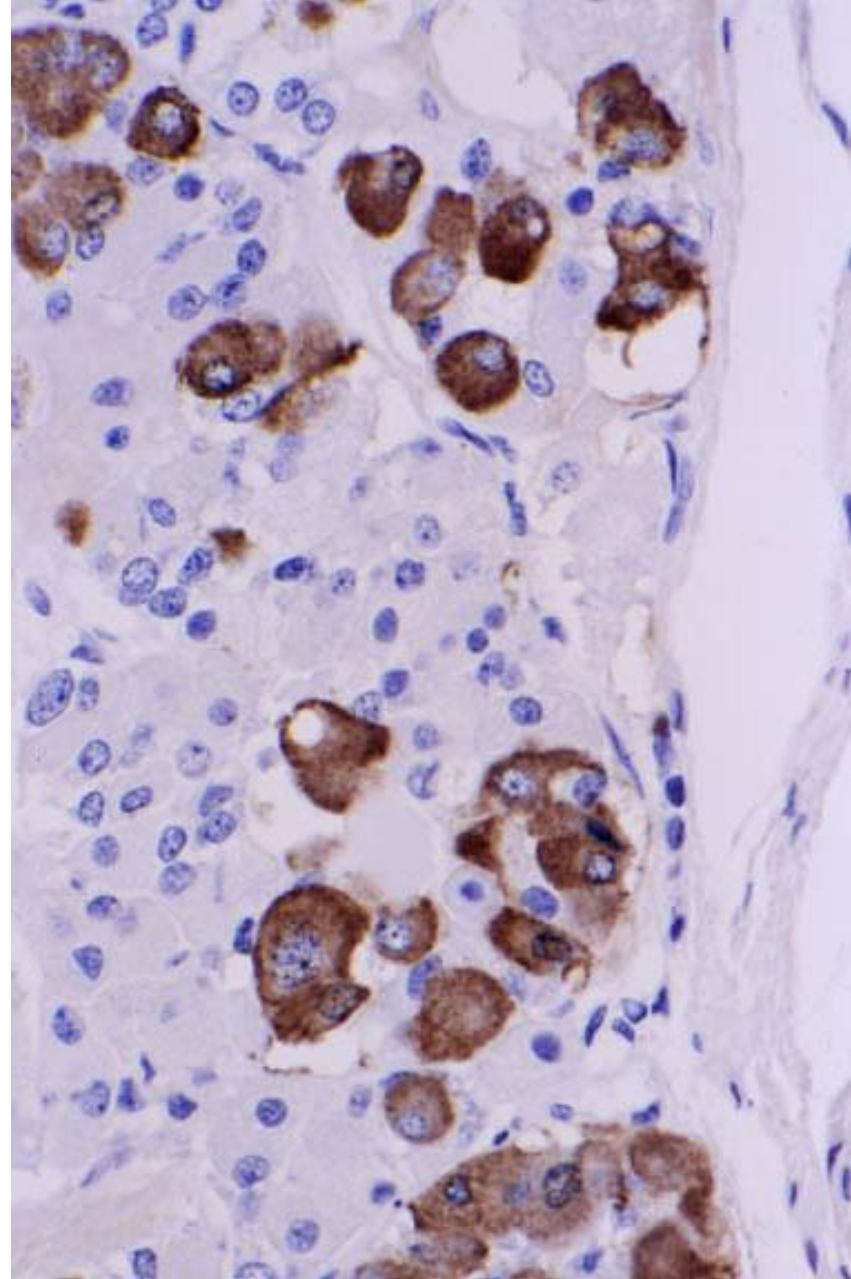
Read only

## 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.



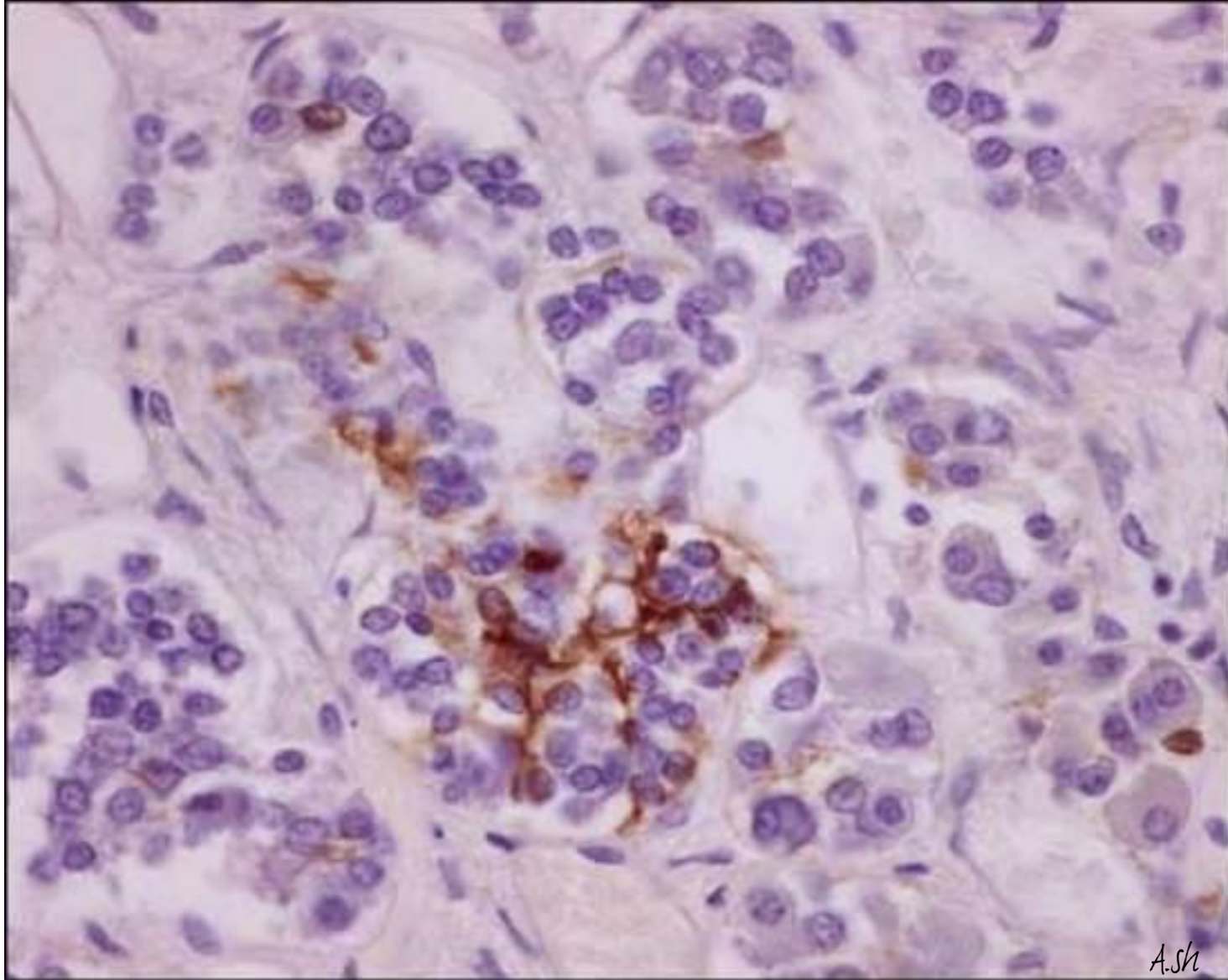
anterior lobe of the  
pituitary gland also  
contains  
folliculostellate cell

## \* Folliculostellate cells

Ash

- are characterized by a star like appearance with their cytoplasmic processes encircling hormone-producing cells.
- They have the ability to make cell clusters or small follicles
  - they do not produce hormones.
  - 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



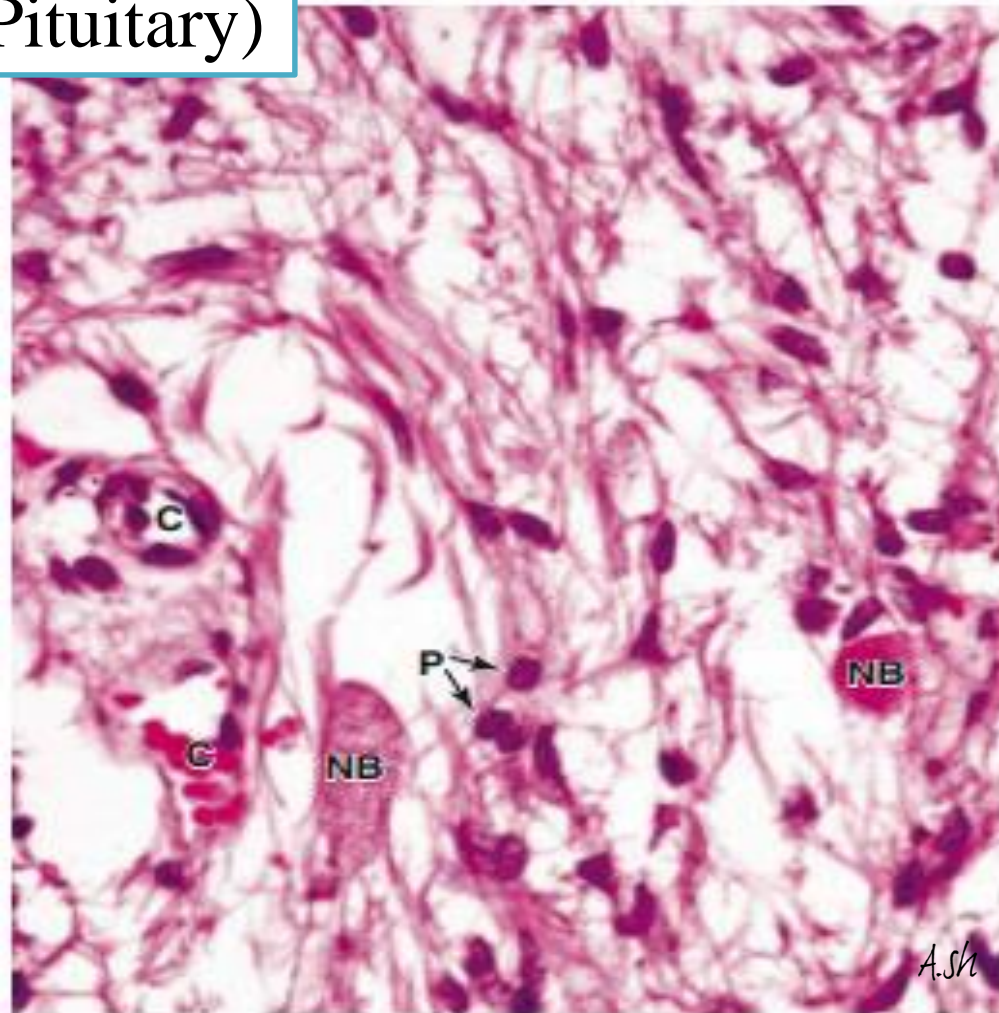


**Folliculostellate cells are stromal cells that surround endocrine cells of the pituitary gland**

# Neurohypophysis (Posterior Pituitary)

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

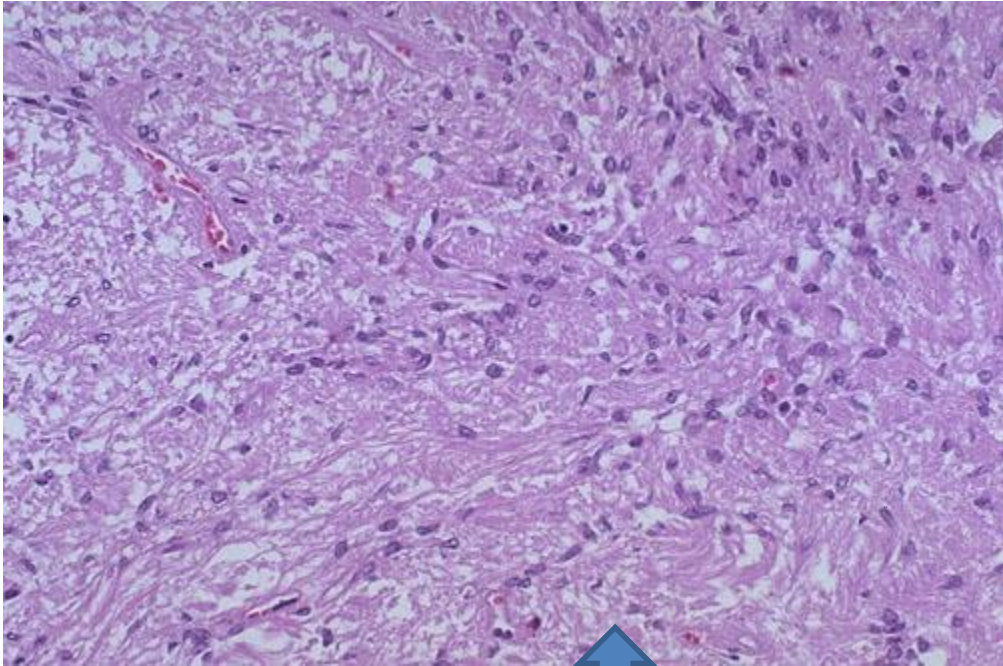
Also present are highly branched glial cells **called pituicytes** that resemble astrocytes and are the most abundant cell type in the posterior pituitary



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)

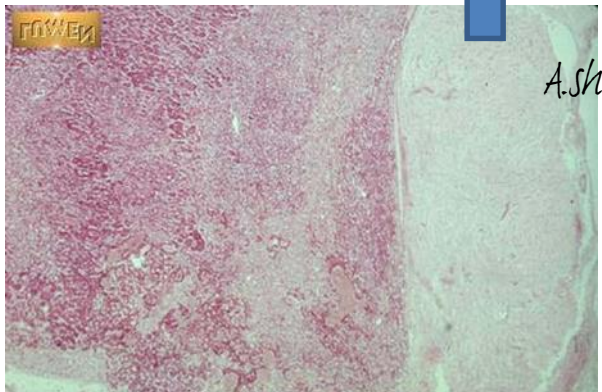


# Neurohypophysis – high power



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

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





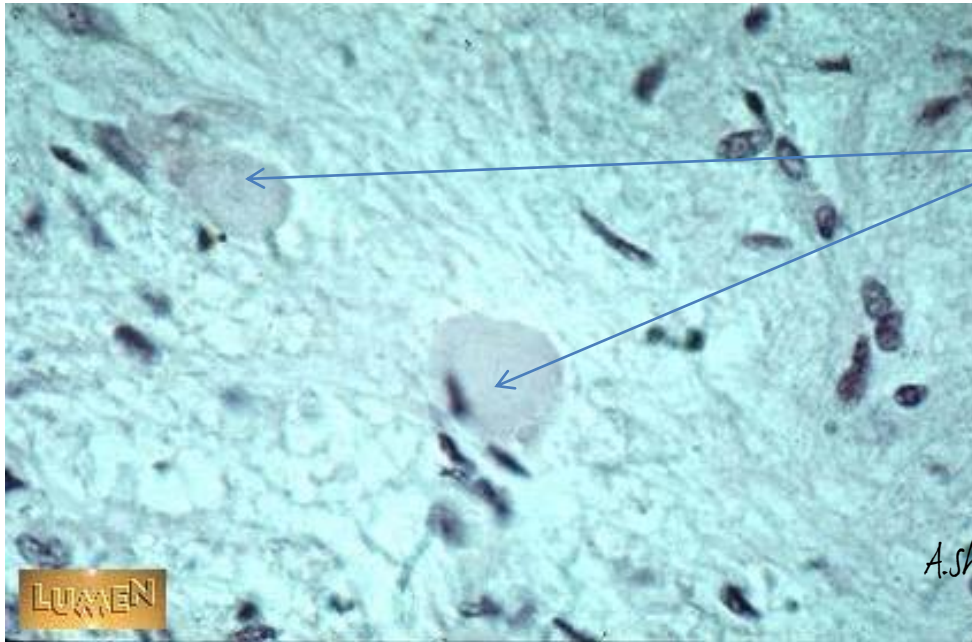
Does not contain secretory cells.

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.

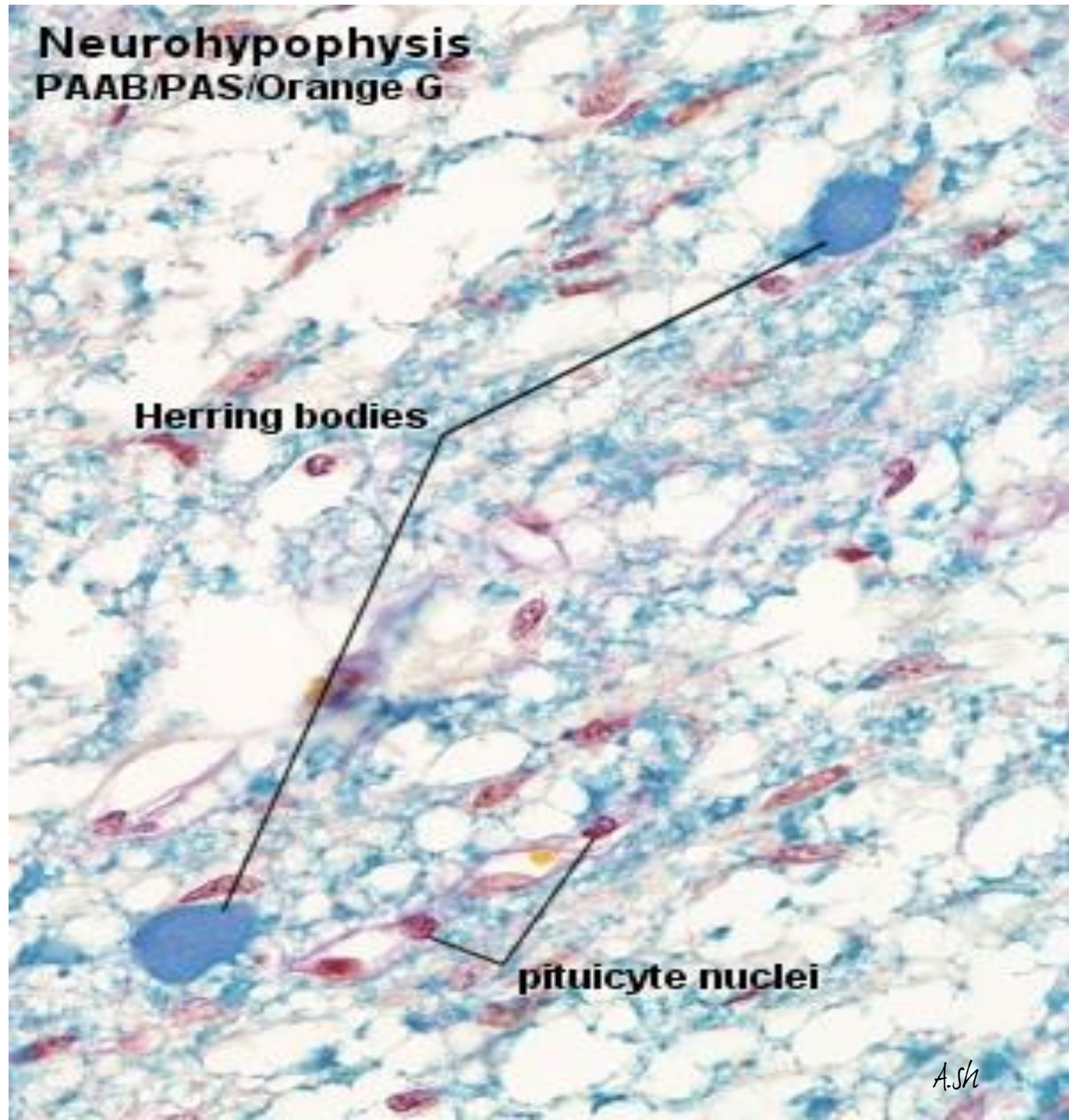
# Neurohypophysis – high power



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

**Neurohypophysis**  
**PAAB/PAS/Orange G**

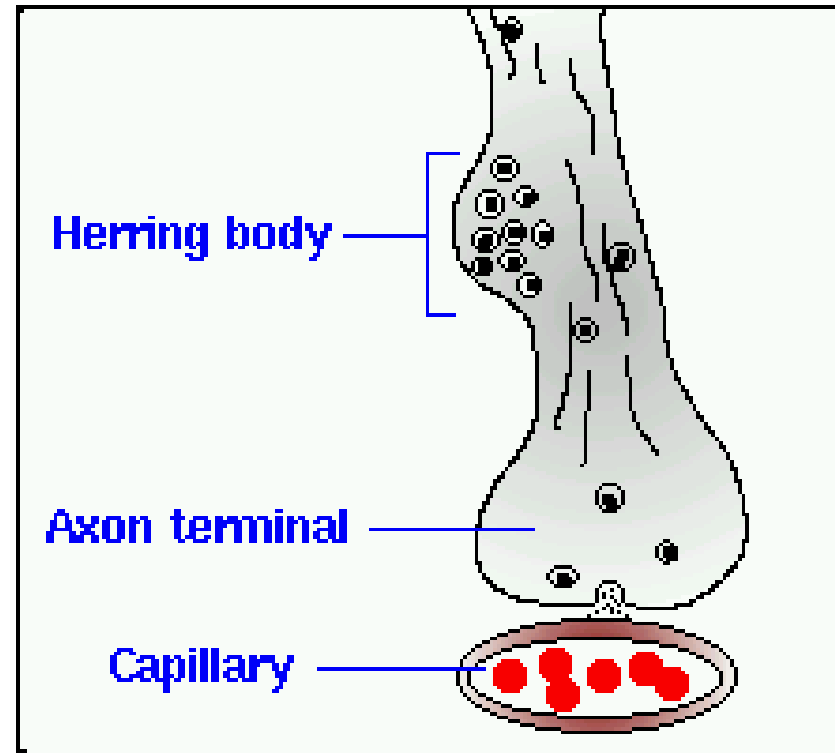
Pituitary, sheep -  
PAAB/PAS/Orange G  
Identify nuclei of  
pituicytes and Herring  
bodies



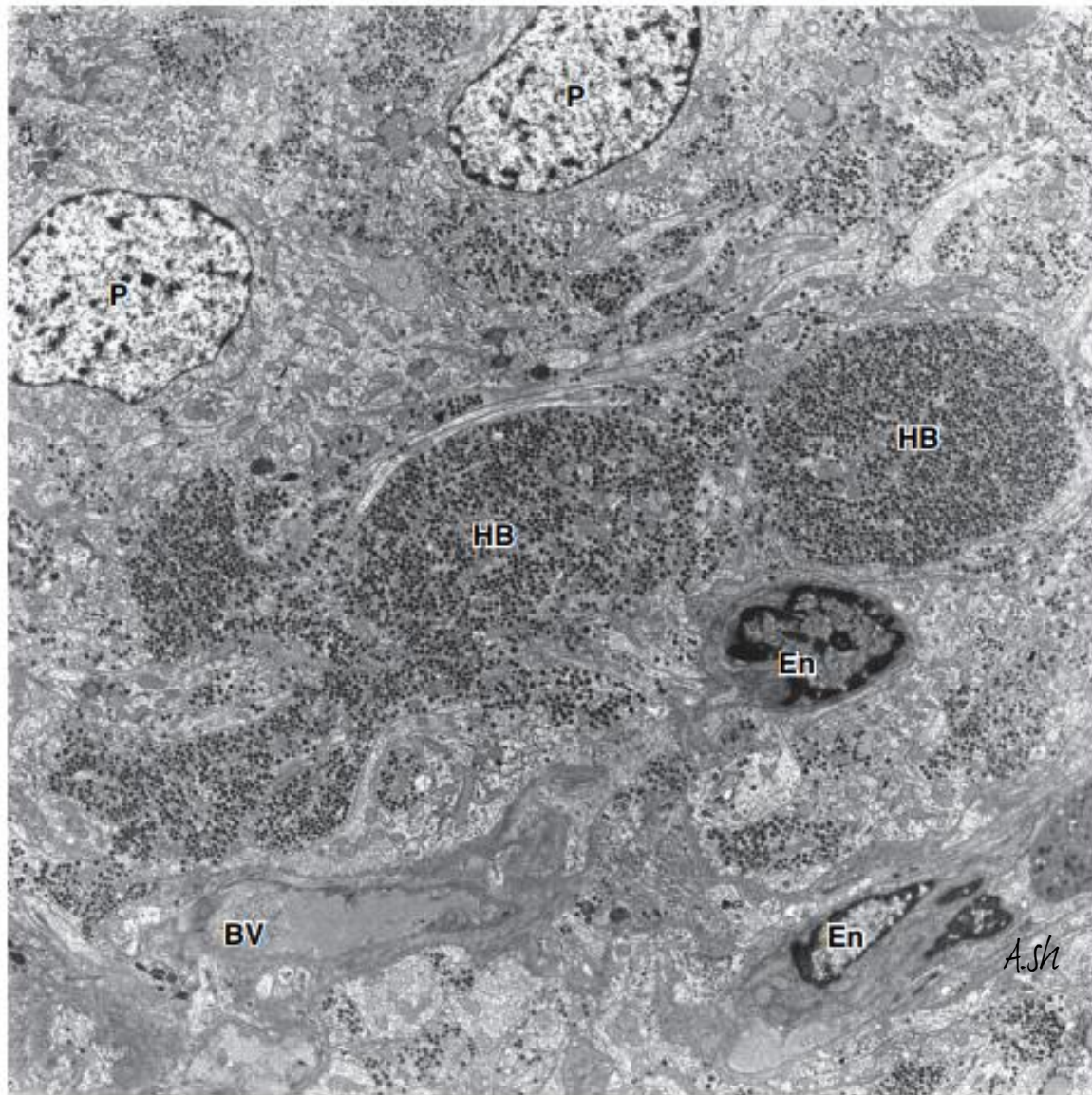
Secretory neurons have larger diameter but are histologically and functionally similar to other neurons.

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

- Secretory products accumulate in the distal part of the axon in Herring bodies.
- Herring 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.







**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).

Dr.shatarat



**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.)

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.

Tumours of the pituitary  
may have two special features;  
**their endocrine disturbances**  
and their relationship to the optic  
**chiasma.**