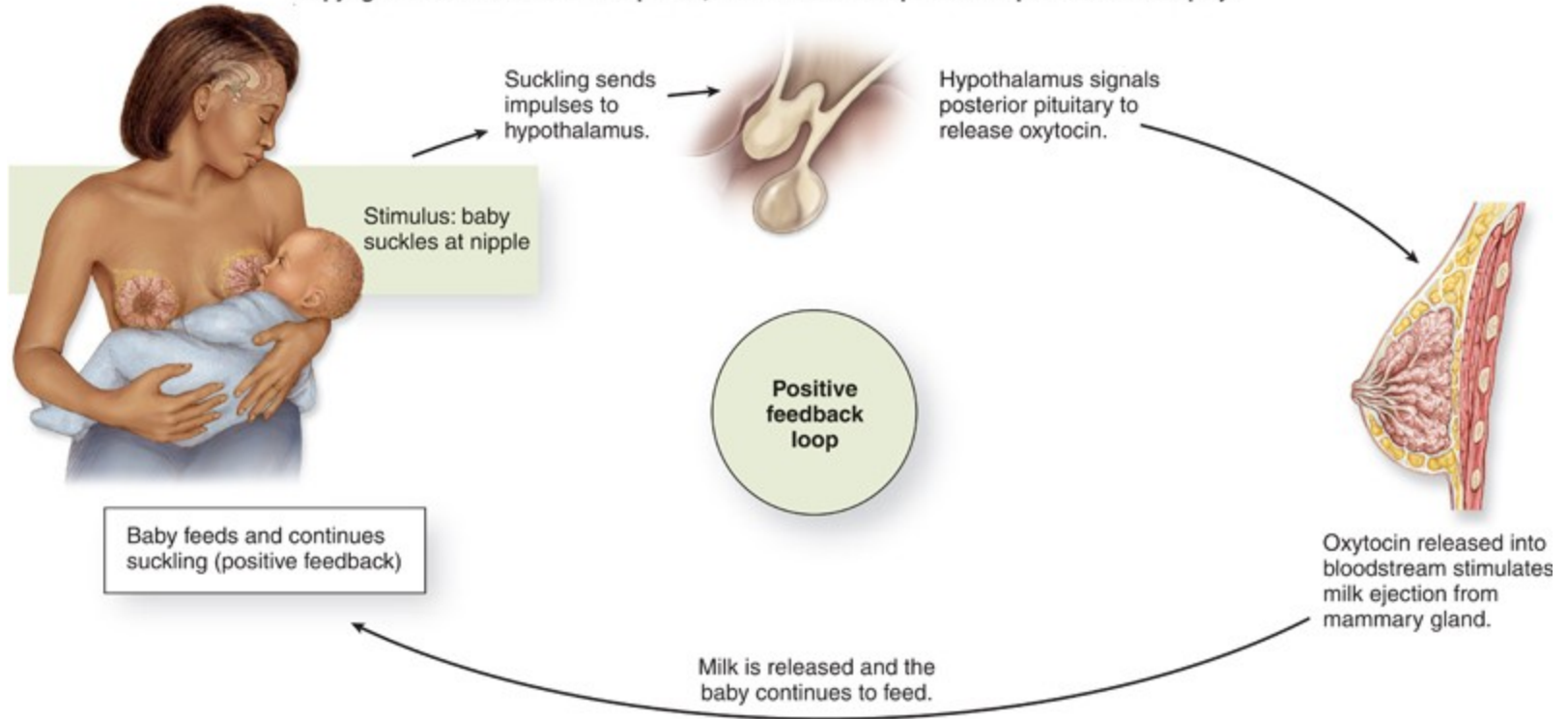


# **Endocrine system**

# Hormonal regulation

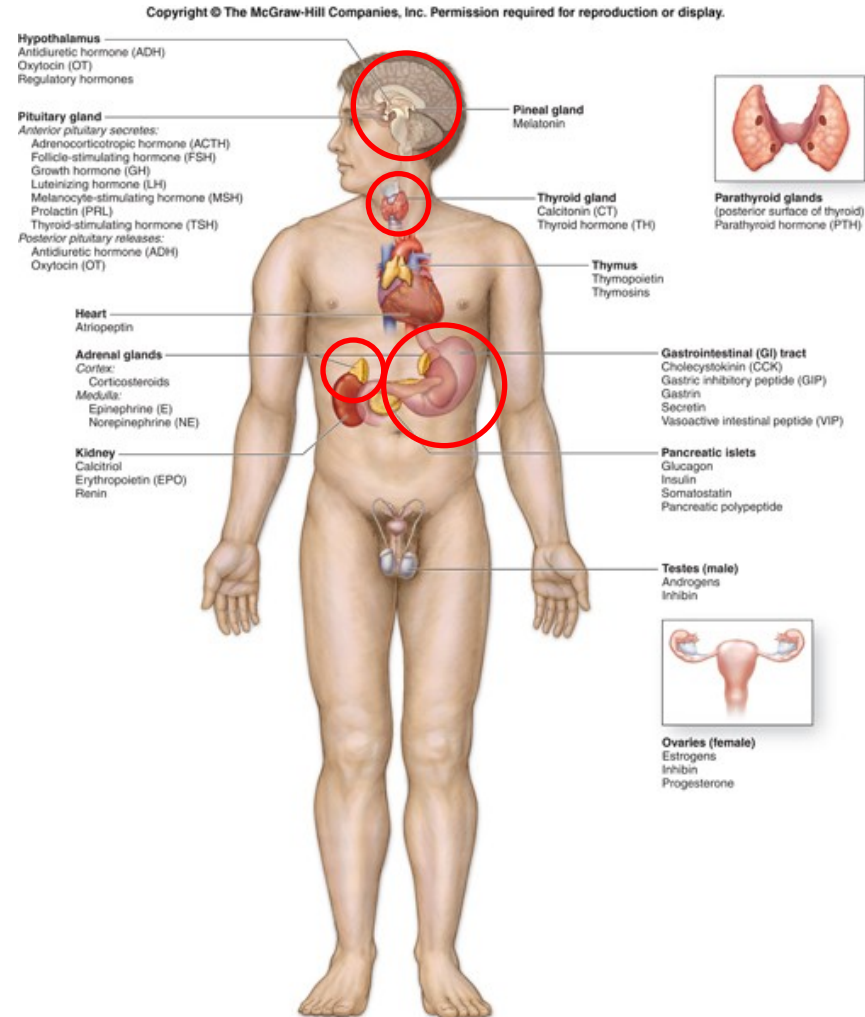
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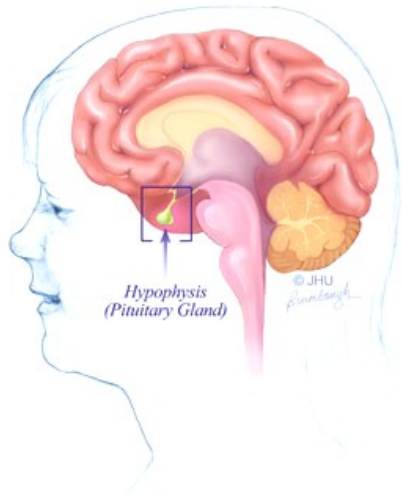
(b) Positive feedback

# Endocrine glands

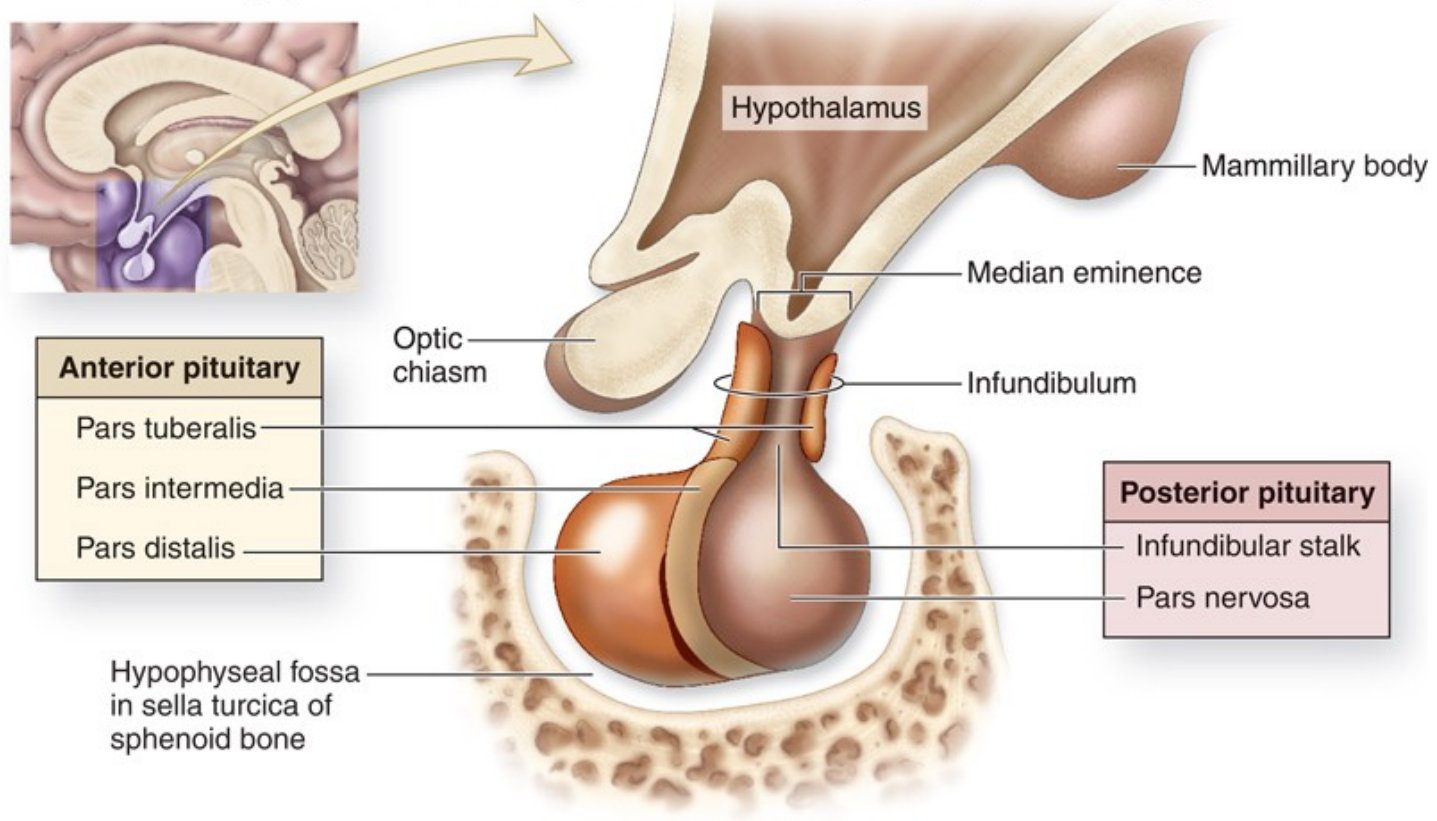
- Glands w/o ducts
- Secretory cells release their products, *hormones*, into the extracellular space and blood stream
- Alternatively, the hormones may affect neighbor cells (*paracrine*)
- Structure:
  - c.t. – capsule + septa
  - irregular clumps or cords of the cells
  - network of capillaries
    - fenestrated capillaries
    - sinusoids



# Hypophysis – pituitary gland



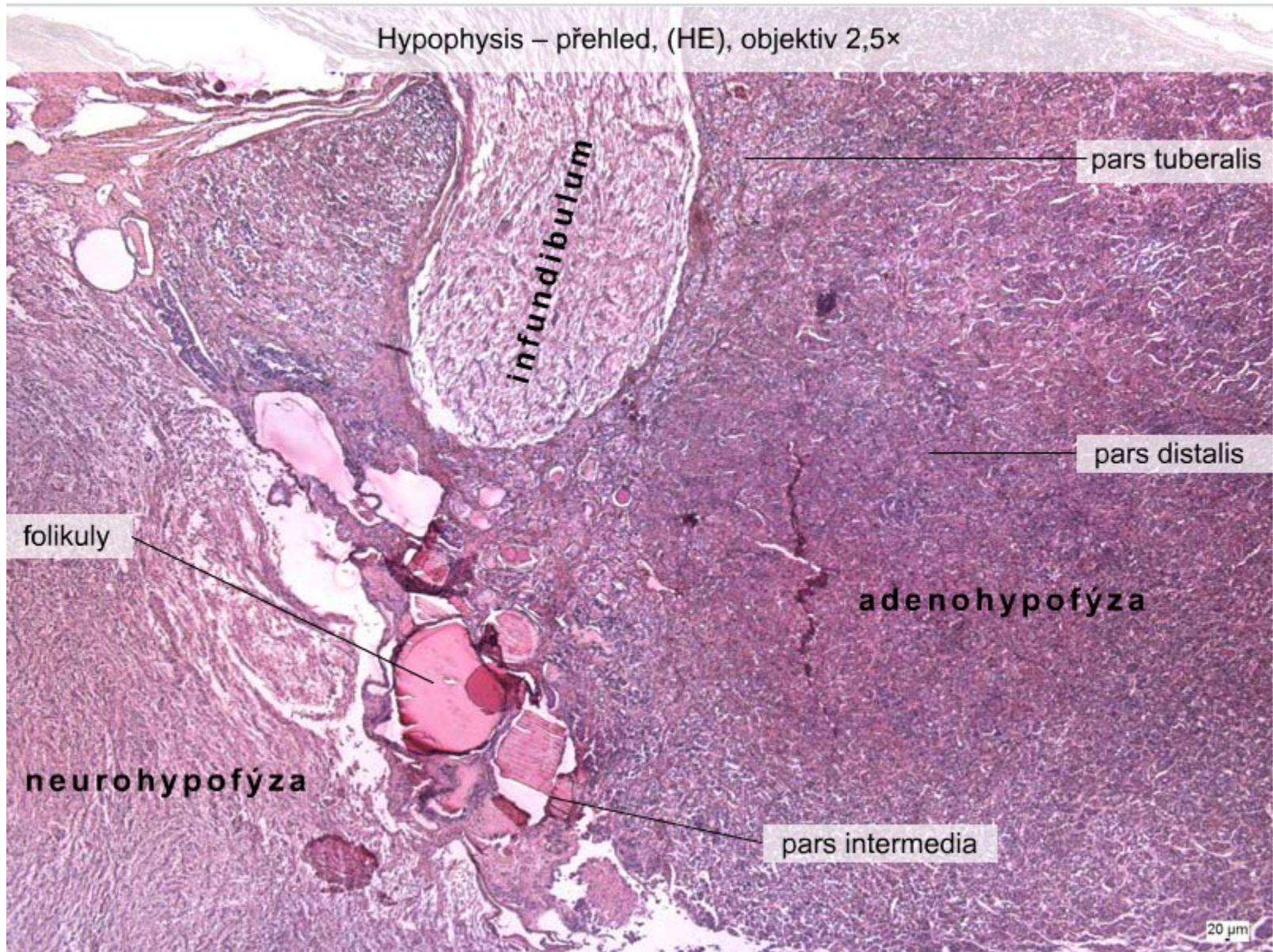
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Development of the Hypophysis



# Pituitary gland – anterior pituitary

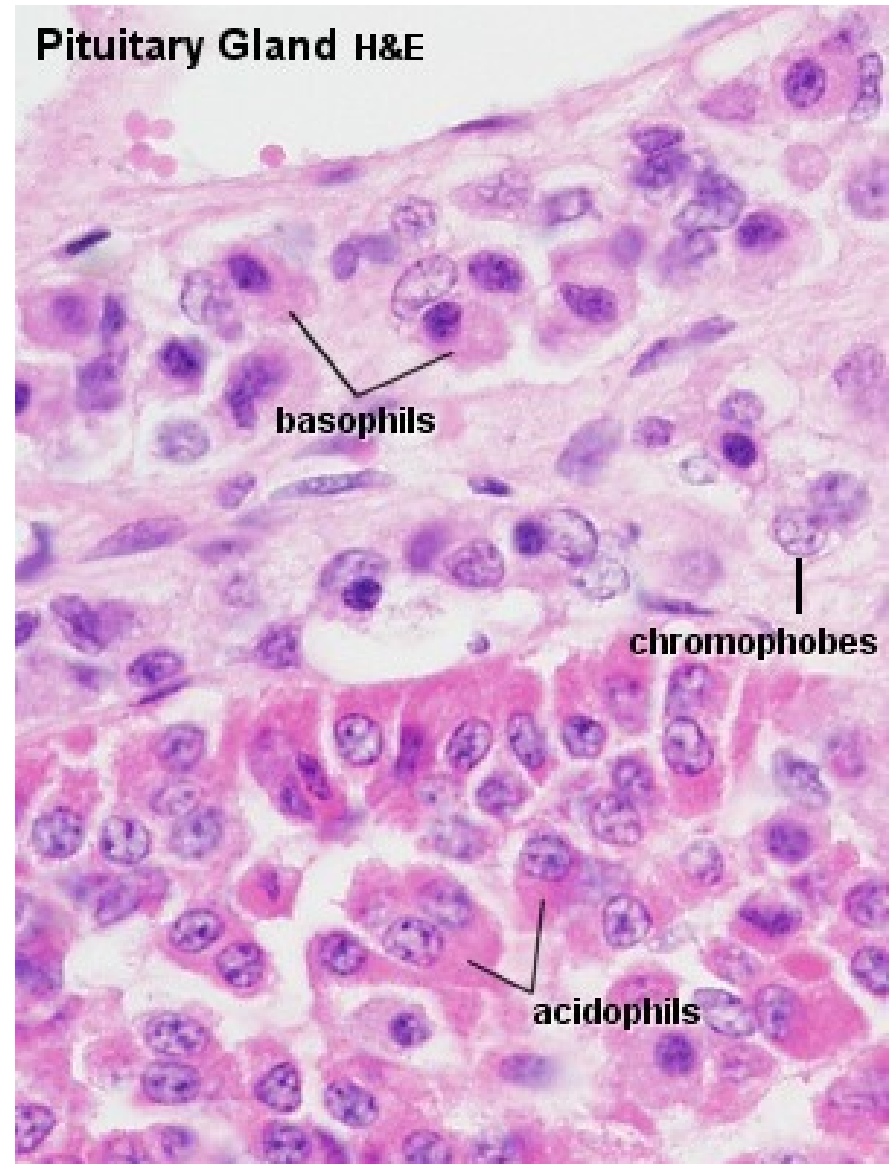


# Pituitary gland – anterior pituitary

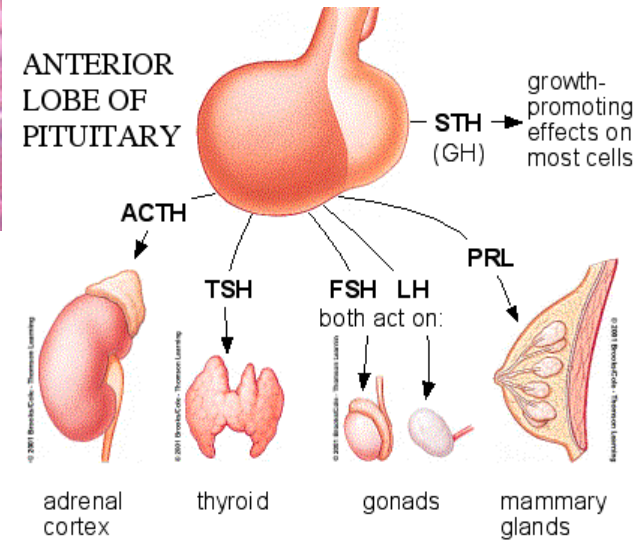
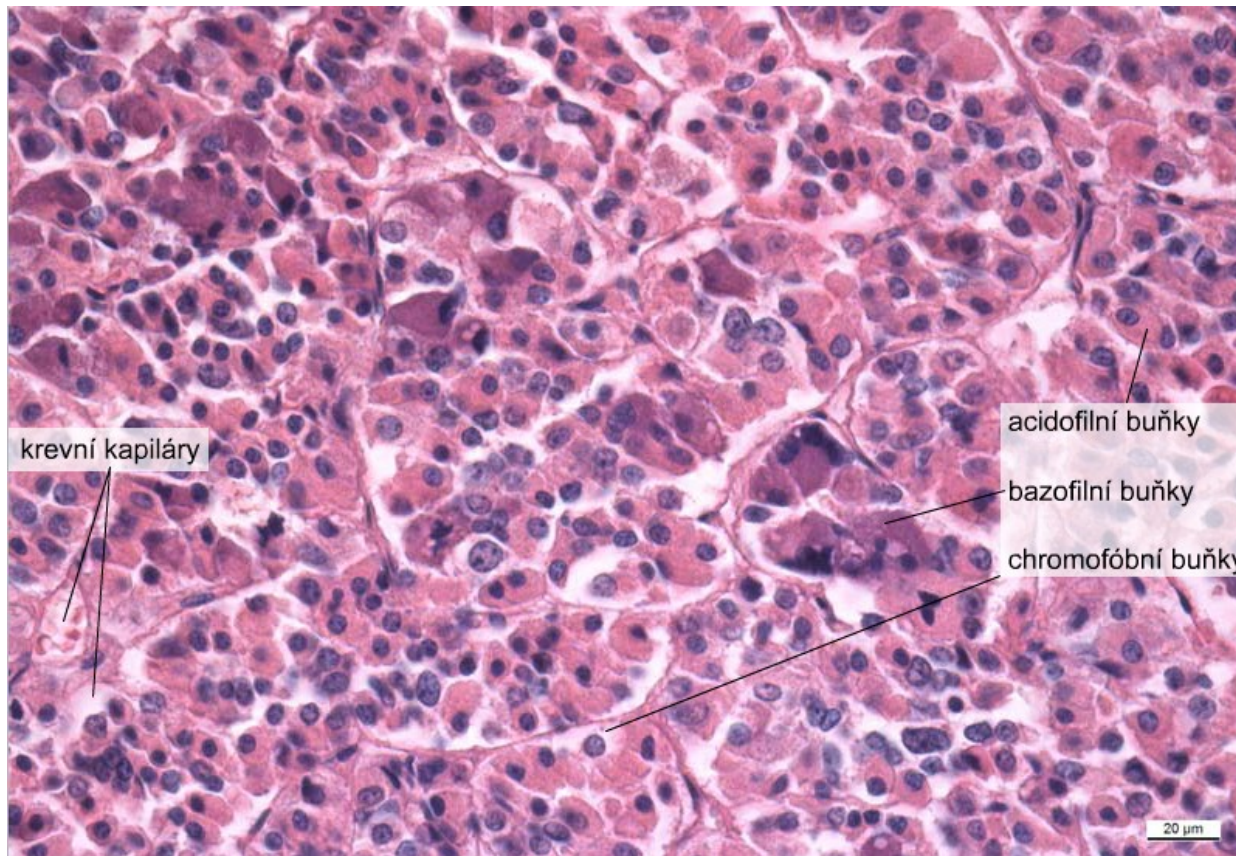
- **Chromophil cells**

- Acidophilic cells (produce proteins)  
*somatotrophs*  
*mammotrophs* (or lactotrophs)
- Basophilic cells (produce glycoproteins)
  - thyrotrophs produce *thyroid stimulating hormone* (TSH or thyrotropin).
  - gonadotrophs produce *follicle stimulating hormone* (FSH) and *luteinizing hormone* (LH)
  - corticotrophs (or adrenocorticolipotrophs)

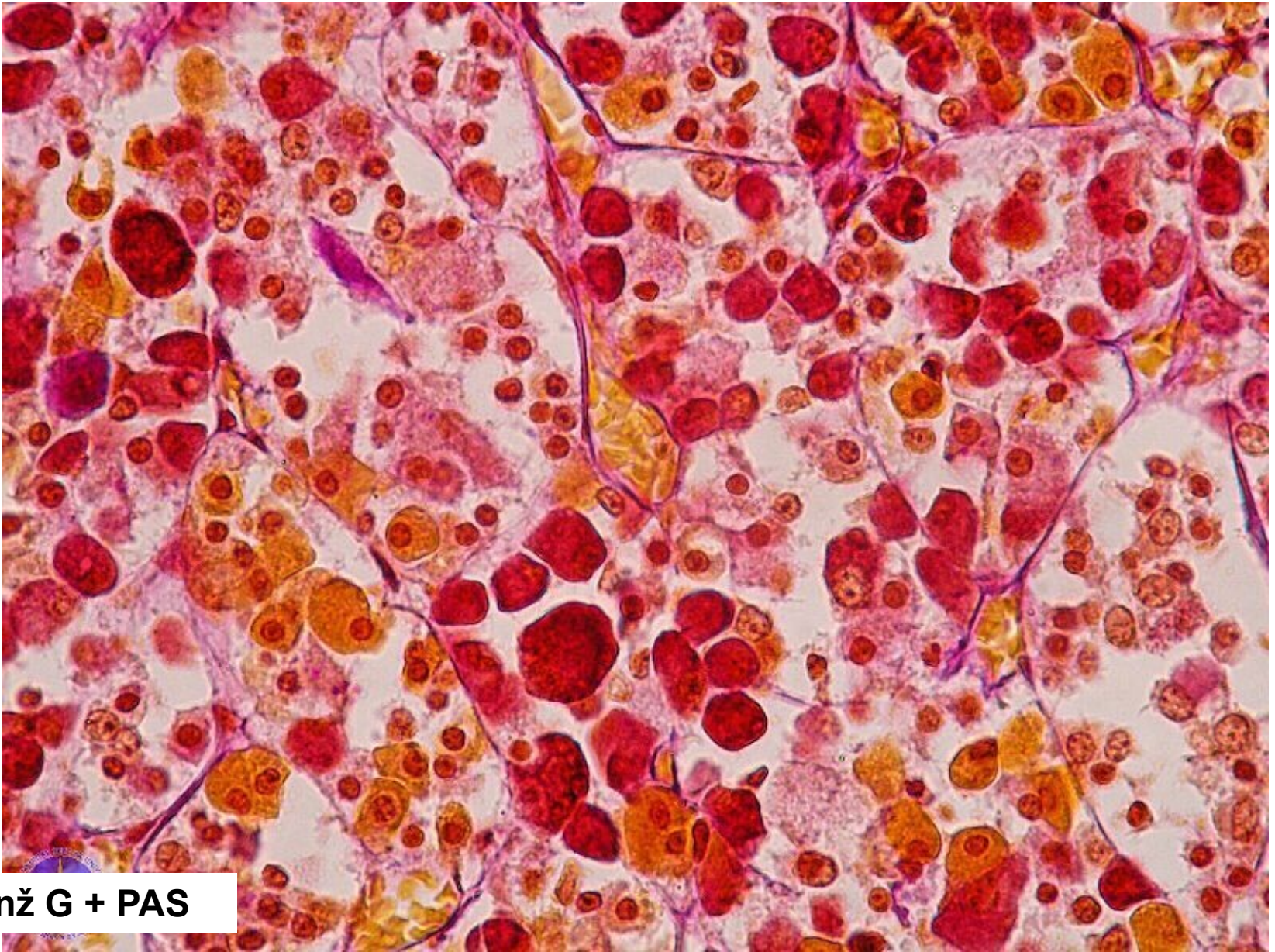
- **Chromophobe cells**



# Adenohypophysis



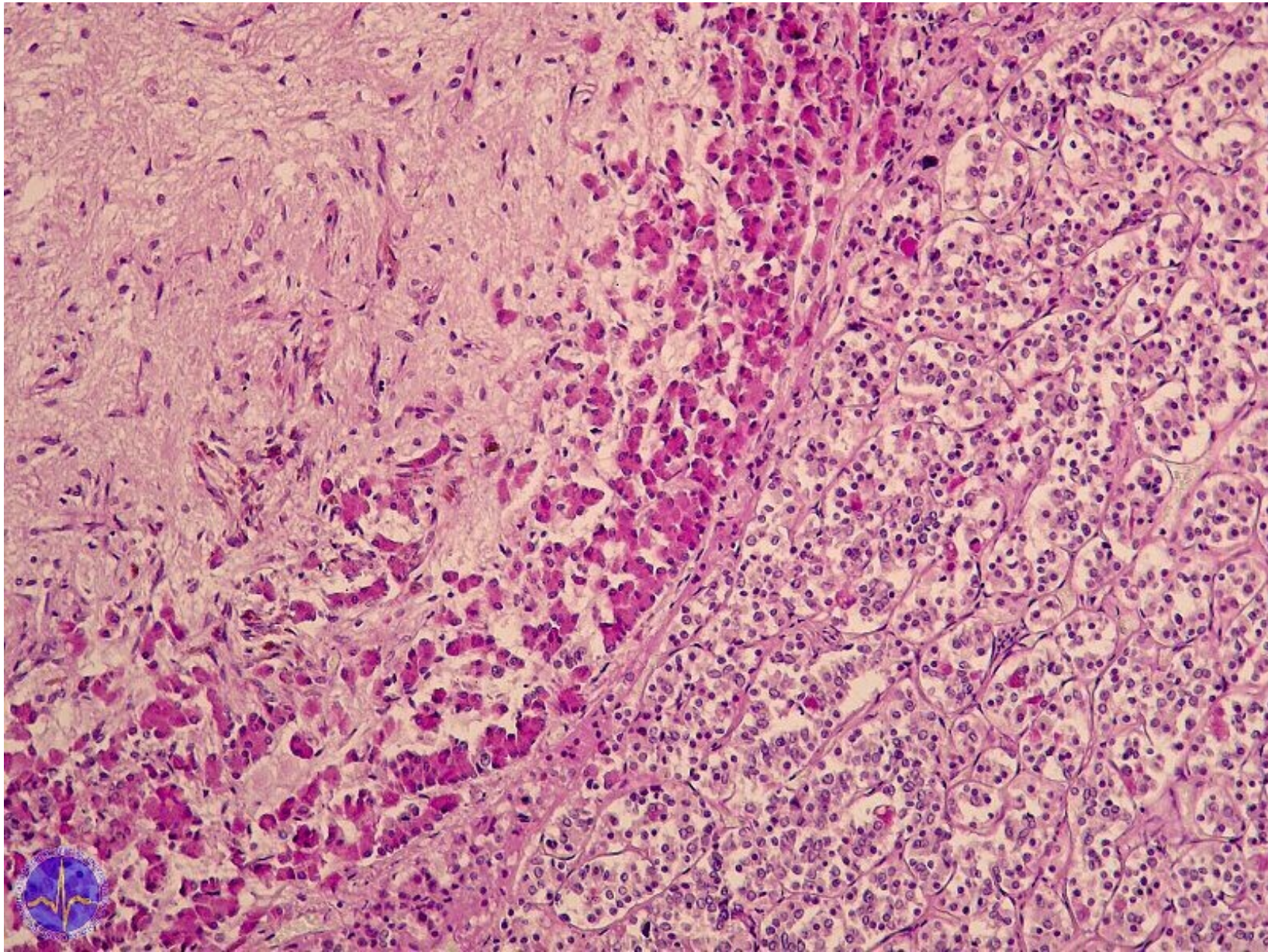
# Adenohypophysis



oranž G + PAS



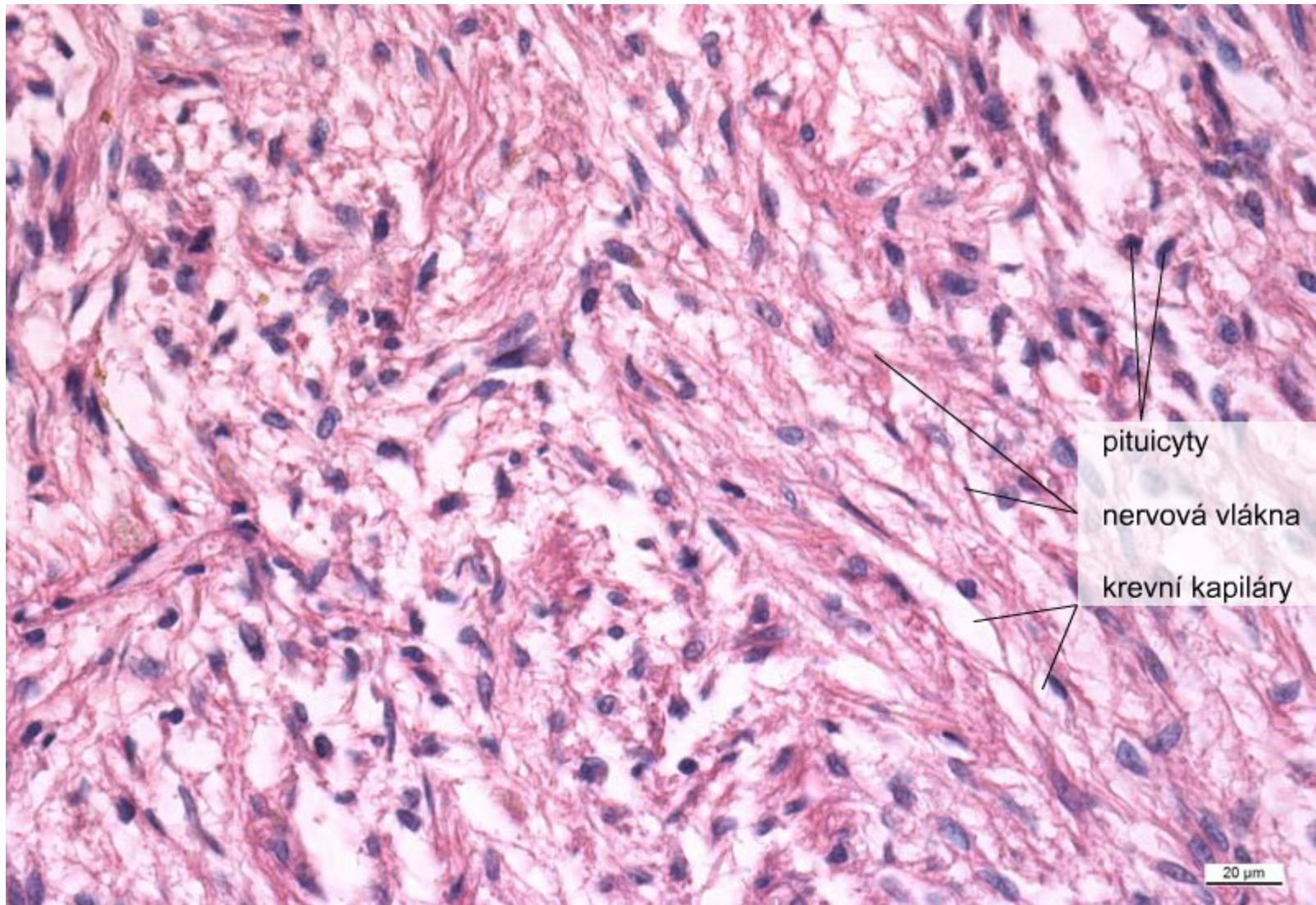
# Neurohypophysis x Adenohypophysis



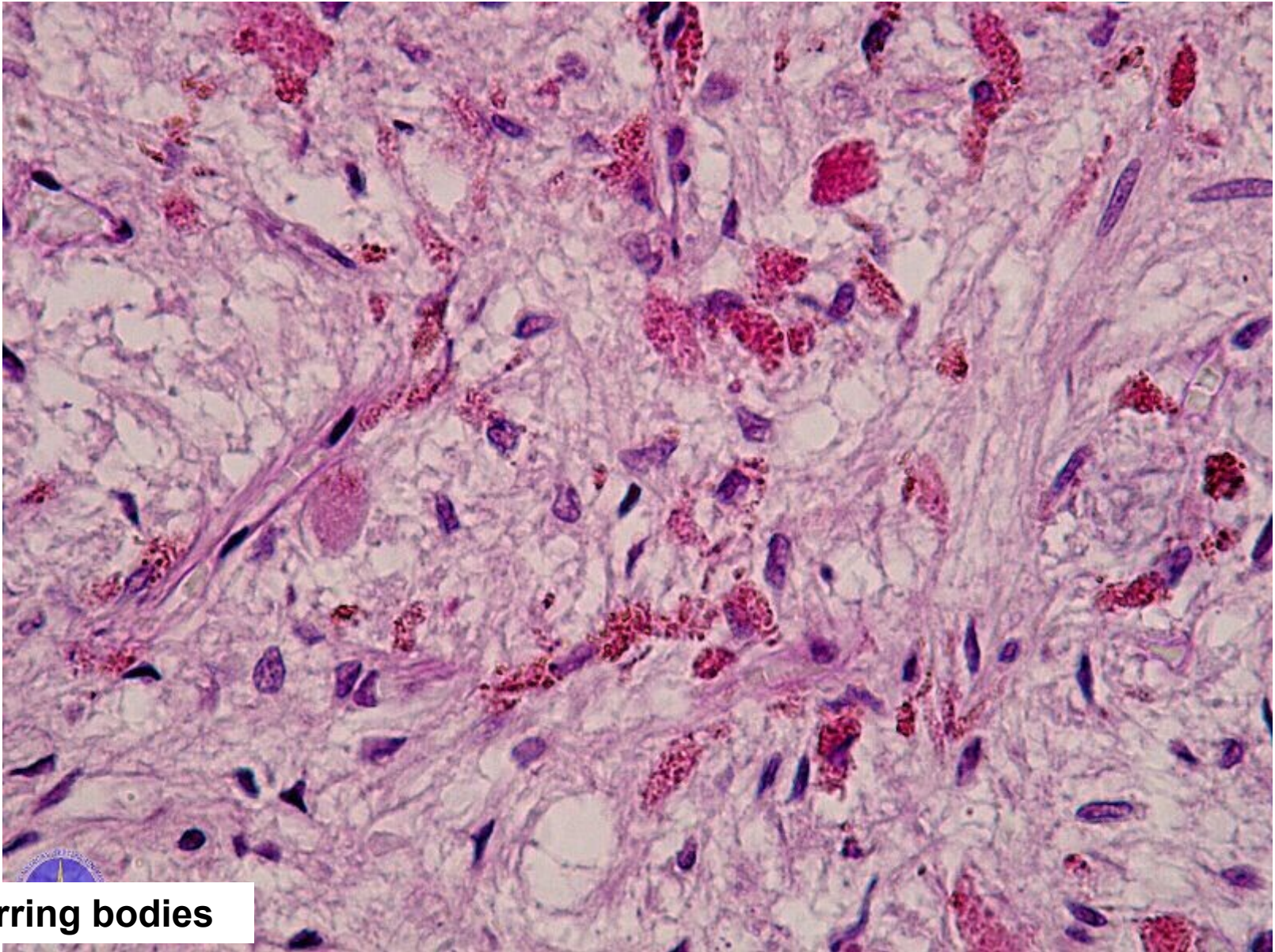
# Neurohypophysis - structure

- Structure
  - **unmyelinated nerve fibres** derived from neurosecretory cells of the supraoptic and paraventricular hypothalamic nuclei
  - **pituicytes /neuroglia/**
- Function
  - Two hormones are *oxytocin*, which stimulates the contraction of smooth muscle cell in the uterus and participates in the milk ejection reflex, and *antidiuretic hormone* (ADH or vasopressin), which facilitates the concentration of urine in the kidneys and, thereby, the retention of water.
- Usually only the oval or round nuclei of the pituicytes are visible. Hypothalamic nerve fibres typically terminate close to capillaries. Scattered, large masses represent dilations of these nerve fibres - *Herring bodies* - are filled by small vesicles which contain the neurosecretory products of the hypothalamic cells.

# Neurohypophysis

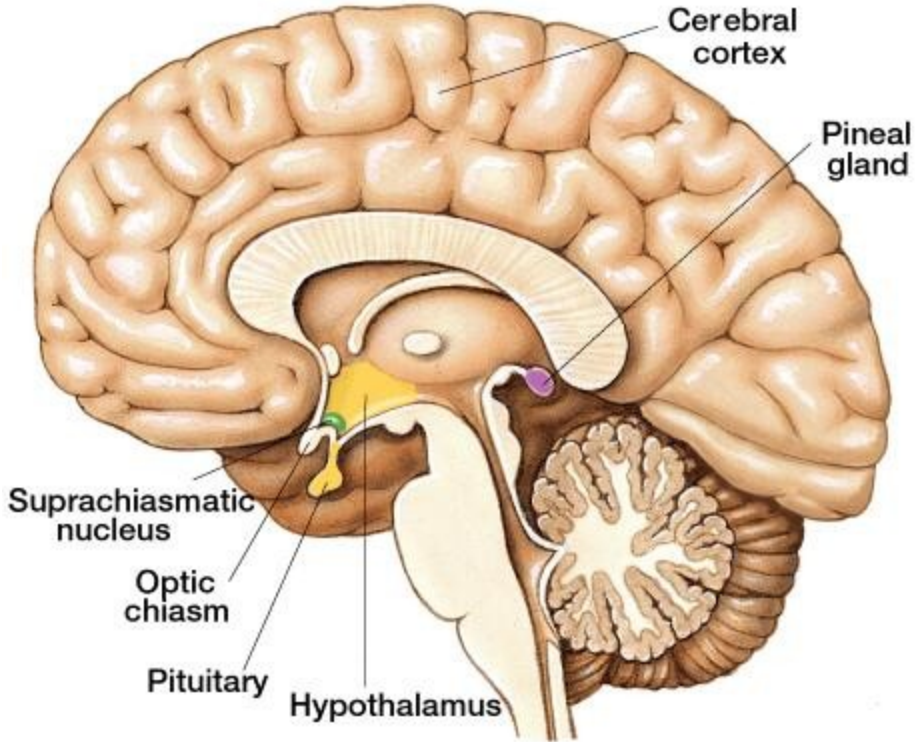


# Neurohypophysis



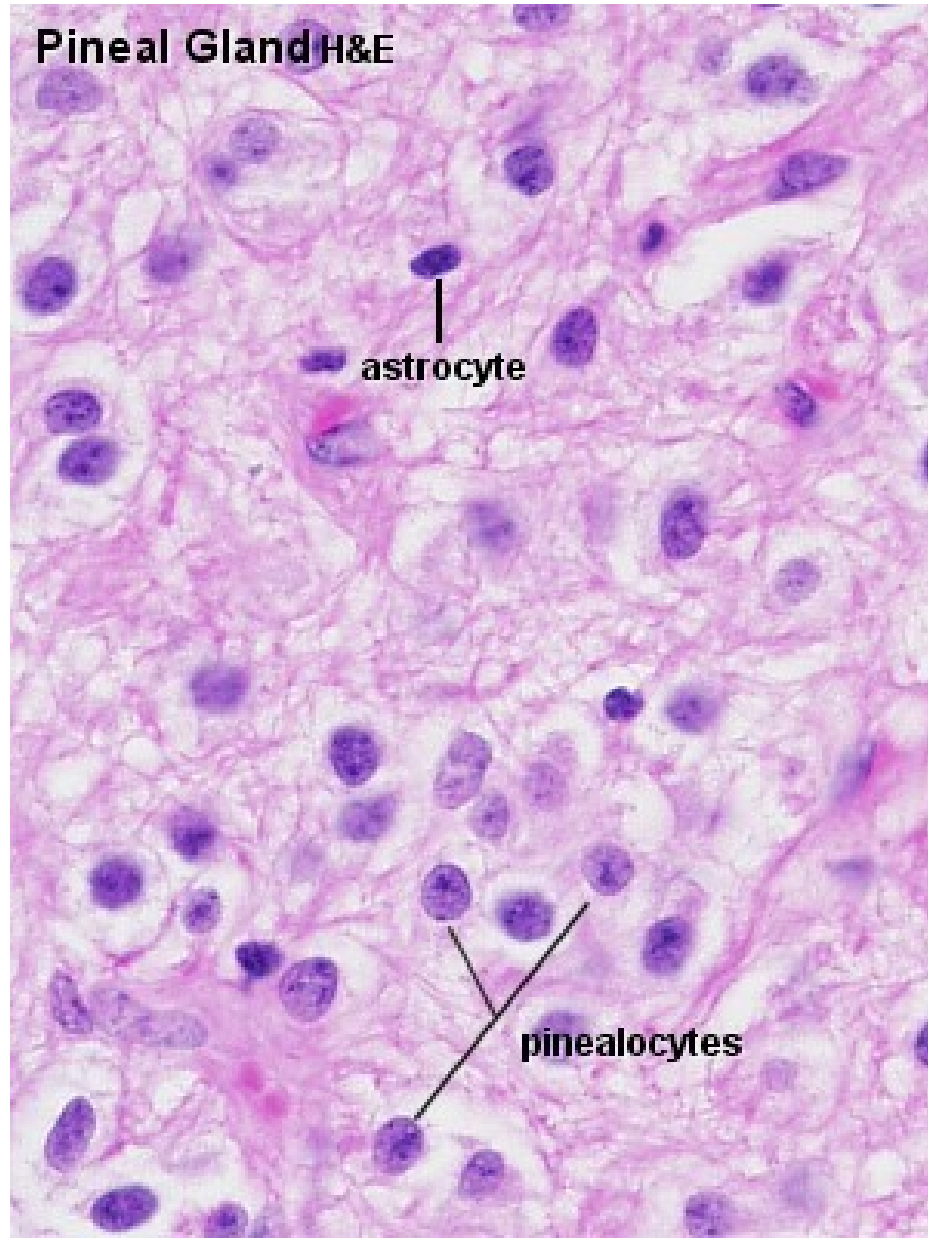
Herring bodies

# Pineal body (epiphysis cerebri)

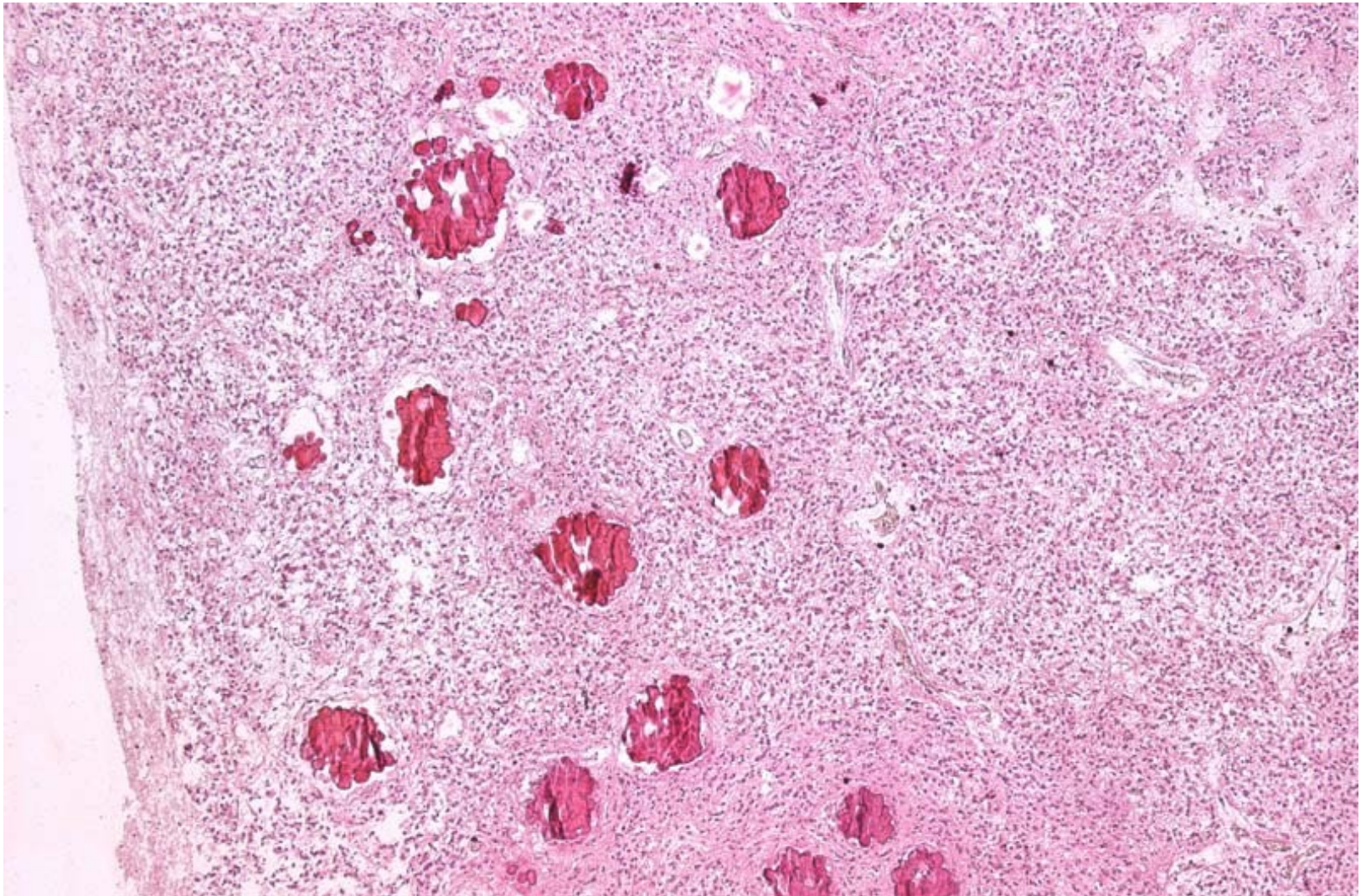


# Pineal body

- is surrounded by pia mater, which functions as its capsule and which sends c.t. septa into the pineal body, subdividing it into lobules
- two cell types and unmyelinated nerve fibers
  - *pinealocytes* (about 95% of the cells; large, light and round nuclei)
  - *astrocytes* (glial cells; dark, elongated nuclei)
  - both pinealocytes and astrocytes have long processes which give the tissue between the nuclei its "stringy" appearance
- the most prominent secretory product of the pineal body is *melatonin* - decrease secretory activity in most other endocrine glands and may "delay" puberty through antigonadotrophic effects.
- secretory activity in the pineal gland is stimulated by darkness and inhibited by light



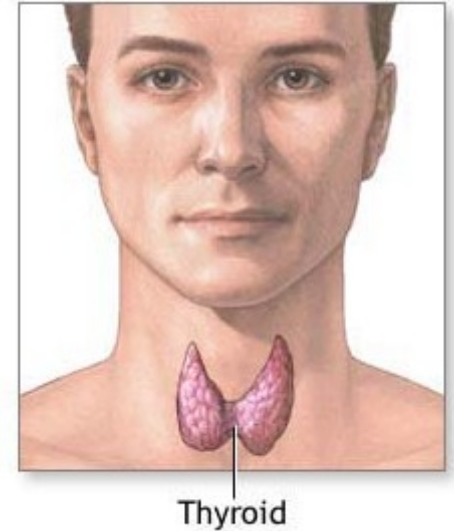
# Pineal body



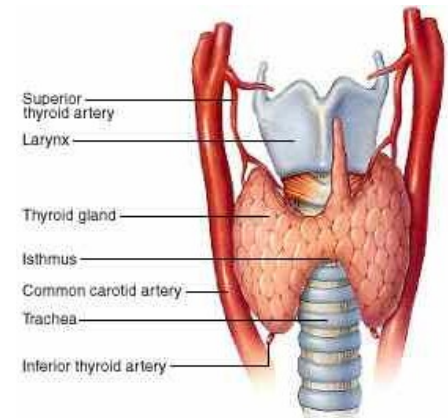
**brain sand** (or acervulus cerebri or corpora arenacea) - calcium-containing concretions which increase in size and number with age /are radioopaque/

# Thyroid gland

- **Thyroid hormones (T<sub>3</sub>, T<sub>4</sub>)** *increase metabolic activity in almost all tissues and organs.* Many of the other effects of the hormones are secondary to an increased oxygen consumption of the affected cells.
- **C cells** produce the hormone *calcitonin*, which decreases blood calcium concentration



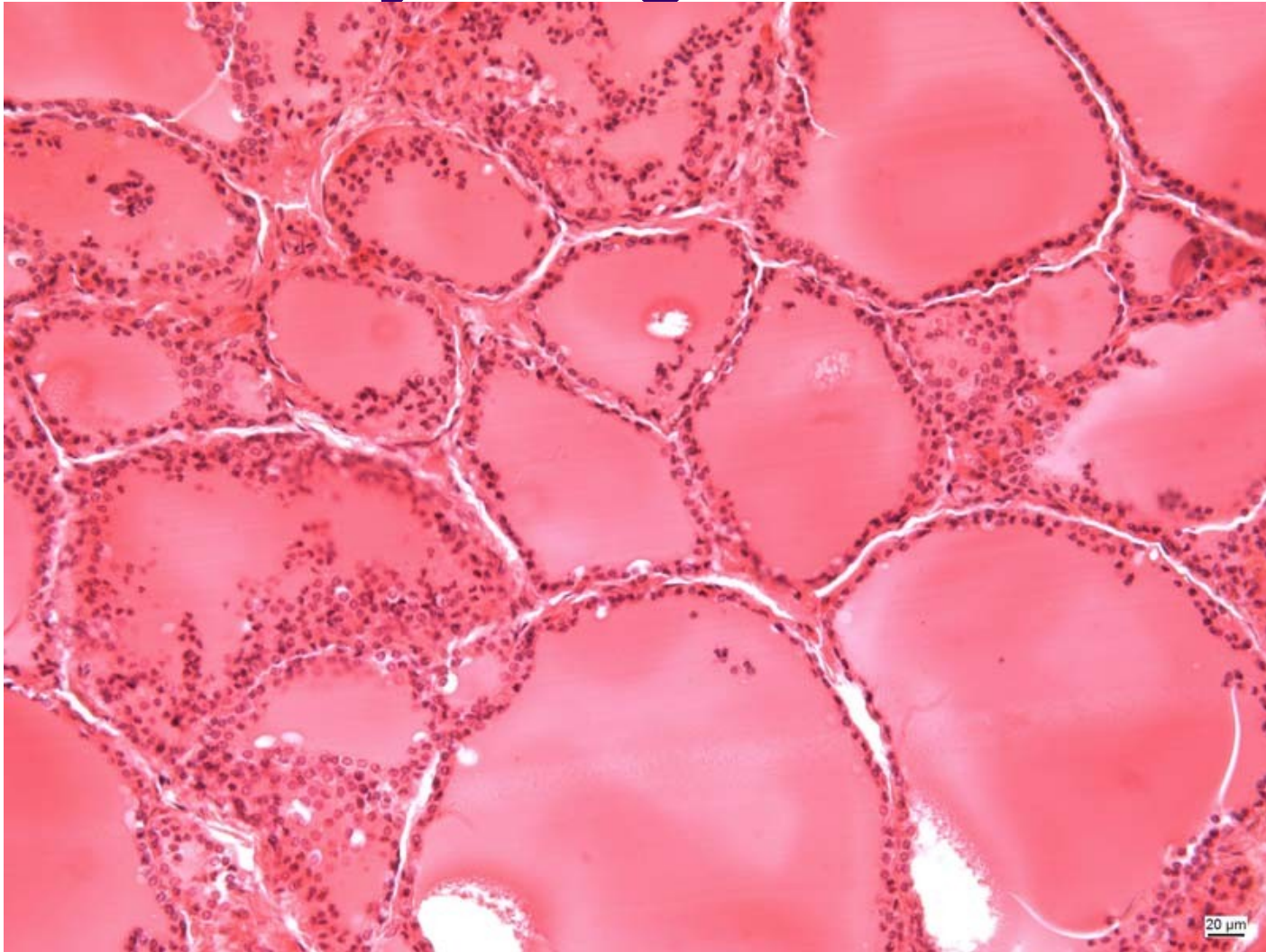
20 g



lobes → lobules - **follicles**



# Thyroid gland



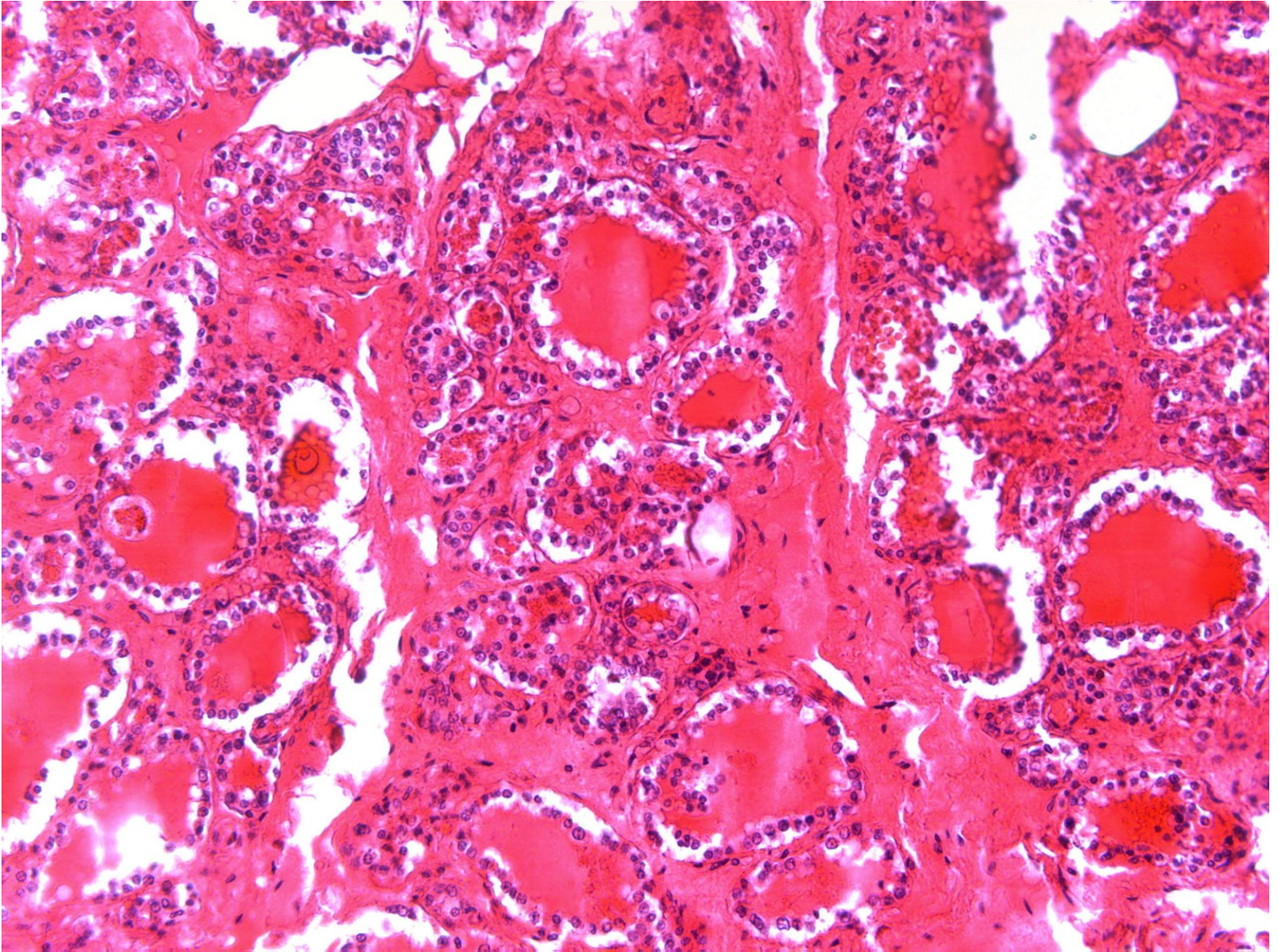
**Follicles** /50  $\mu\text{m}$  to about 1 mm/, which are separated by scant interfollicular c.t. It consists of a simple cuboidal epithelium which surrounds a lumen filled with a viscous substance, colloid.

# Thyroid gland - follicles



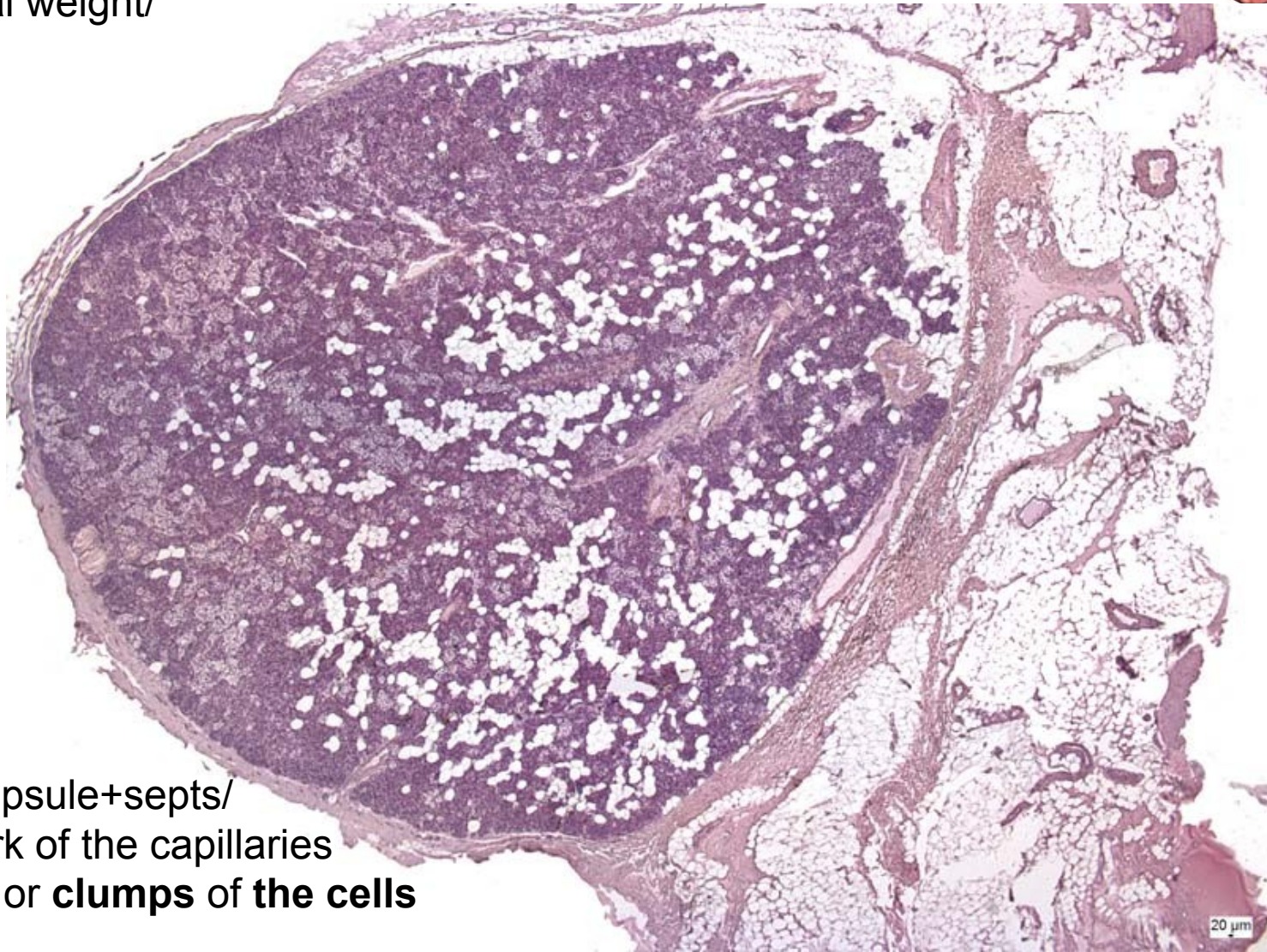
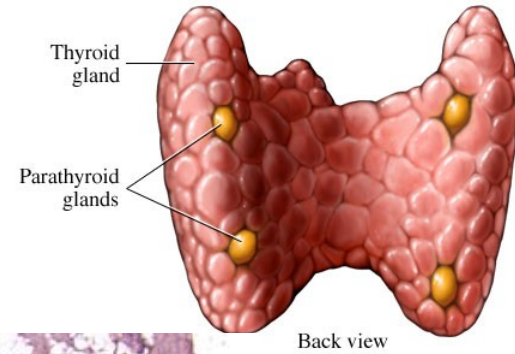
**C cells** (or **parafollicular cells**) are only few of them, typically situated basally in the epithelium, without direct contact with the follicular lumen. They are always situated within the basement membrane, which surrounds the entire follicle.

# Glandula thyreoidea



# Parathyroid gland

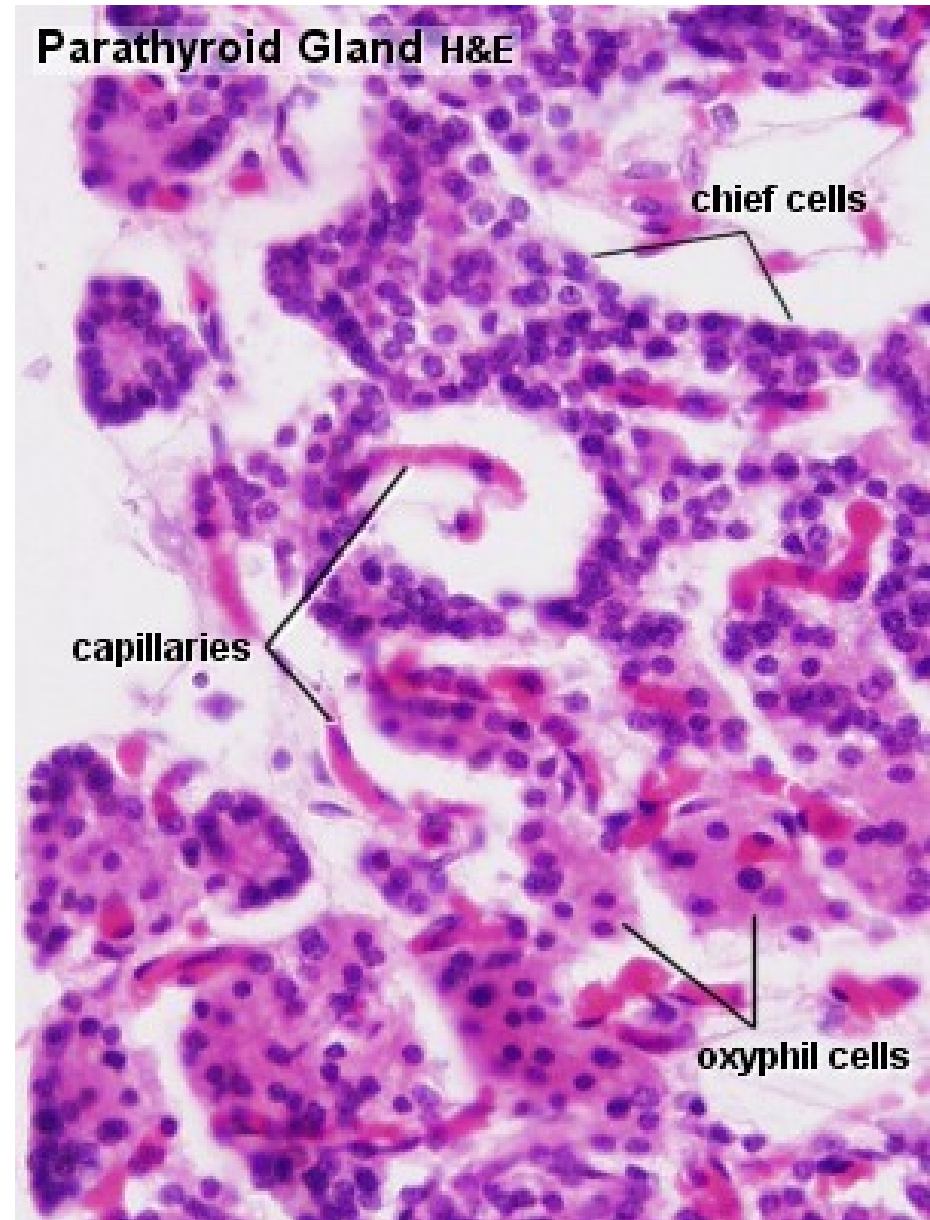
6 mm, 130 mg  
/total weight/



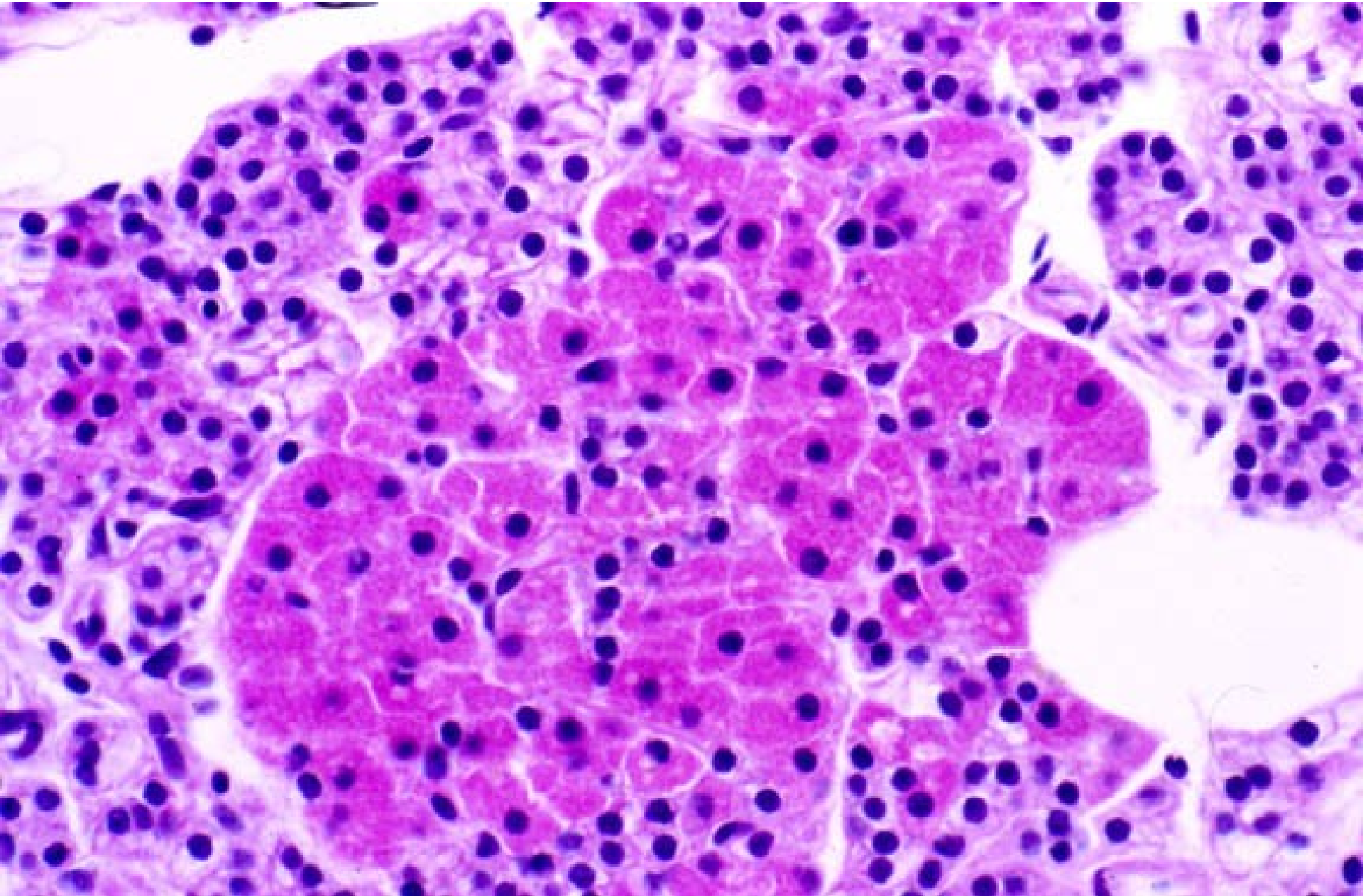
c.t. /capsule+septs/  
network of the capillaries  
**ords or clumps of the cells**

# Parathyroid gland

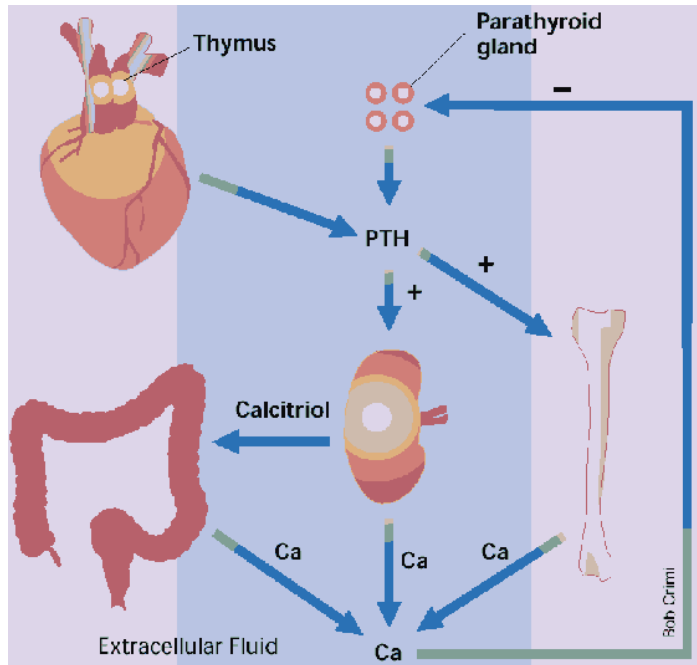
- **Chief cells** are the most numerous type. They are small cells /7-10  $\mu\text{m}$ / with round, big and centrally placed nucleus and a small amounts of cytoplasm /very weakly acidophilic/.
- **Oxyphilic cells** less frequent (occurring first in children 6-7 years old and increasing with age), larger - their cytoplasm is strongly acidophilic, the nucleus is round. They contain large amounts of mitochondria and glycogen.
- **Fat cells** (adipocytes)



# Glandula parathyreoidea



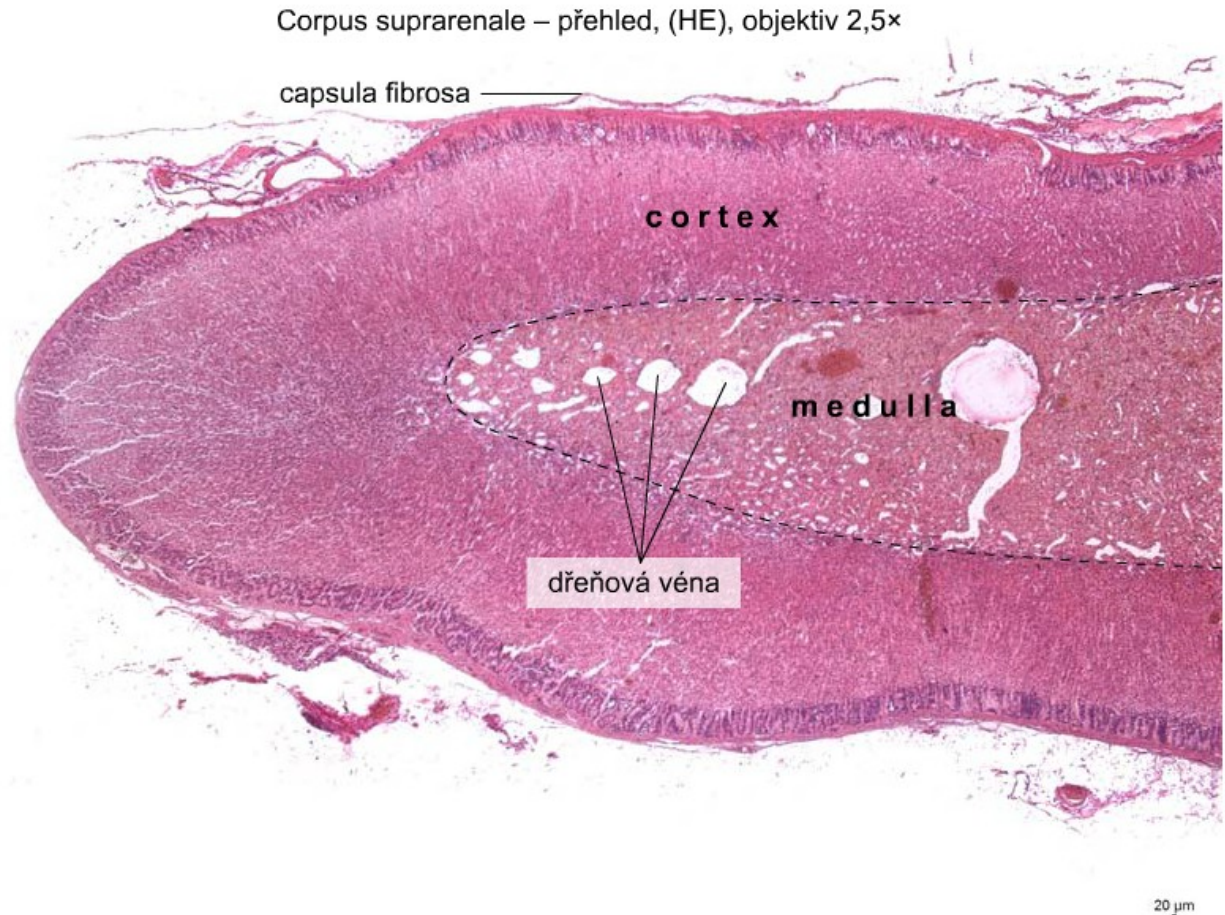
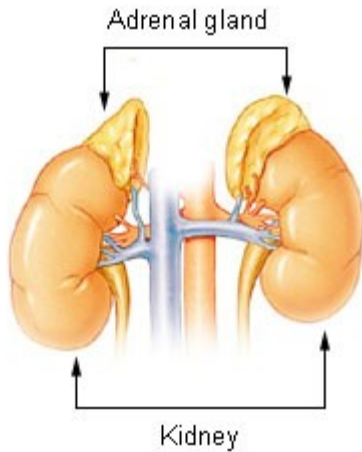
# Parathyroid gland



Synthesise *parathyroid hormone* (PTH or parathormone) which is of pivotal importance for **normal calcium concentrations** in the fluids and tissues of the body. The effect is mediated by a stimulation of osteoclastic bone resorption, intestinal calcium uptake and calcium resorption in the kidneys

# Suprarenal gland

## Adrenal Gland



c.t. : capsule+septs network of capillaries  
**CORDS** of the cells

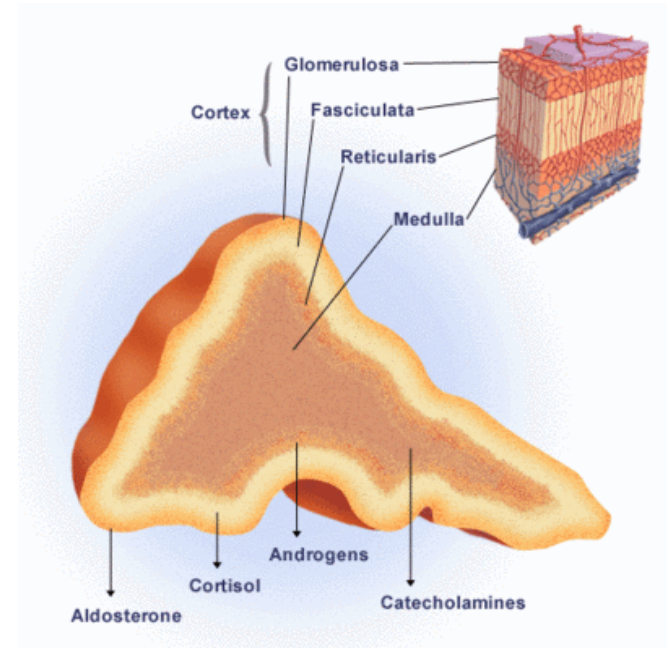


# Suprarenal gland - cortex

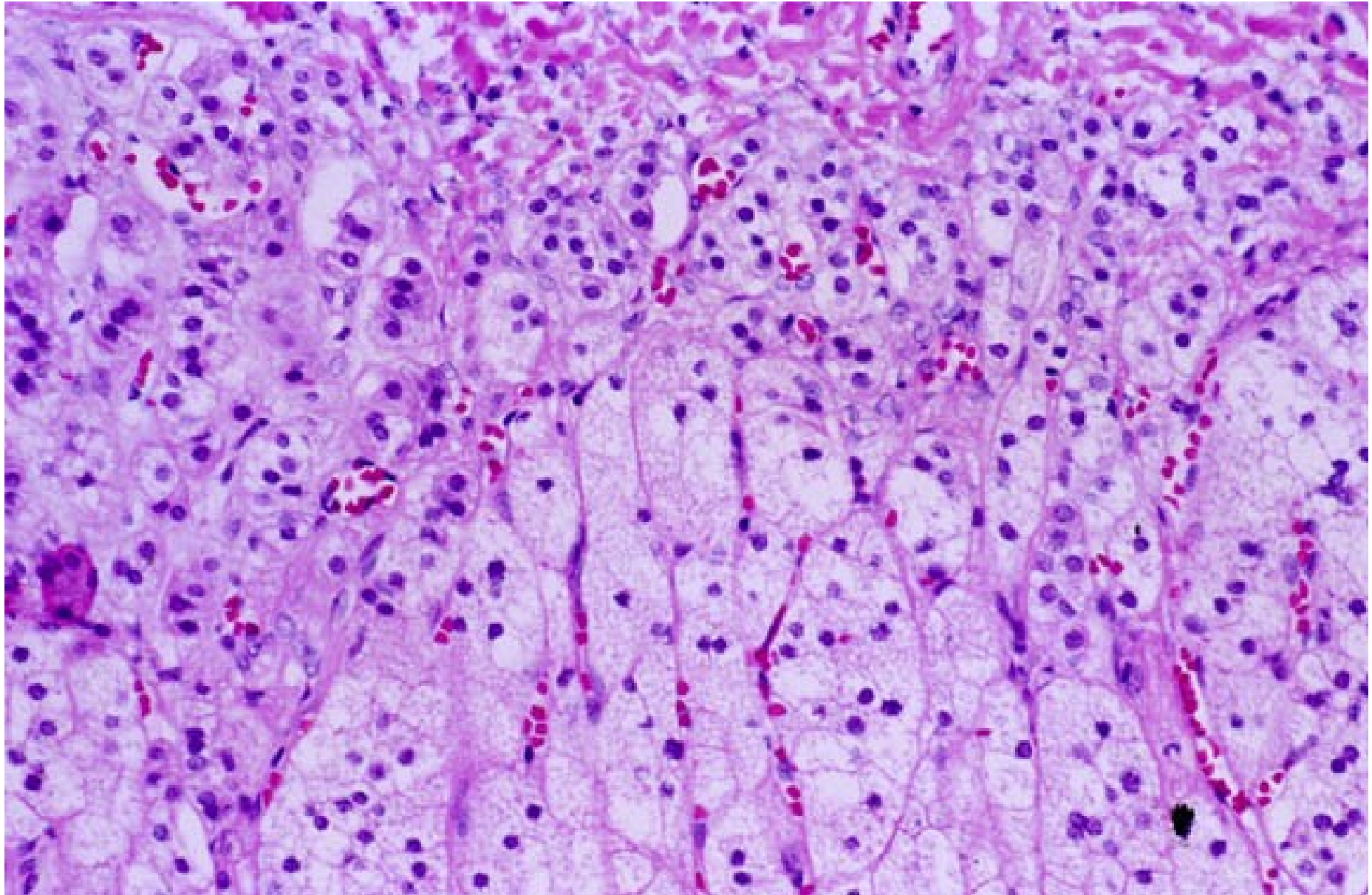
Corpus suprarenale – přehled, (HE), objektiv 2,5×



**Zona glomerulosa (1/10)**  
**Zona fasciculata (6/10)**  
**Zona reticularis (3/10)**



# Glandula suprarenalis

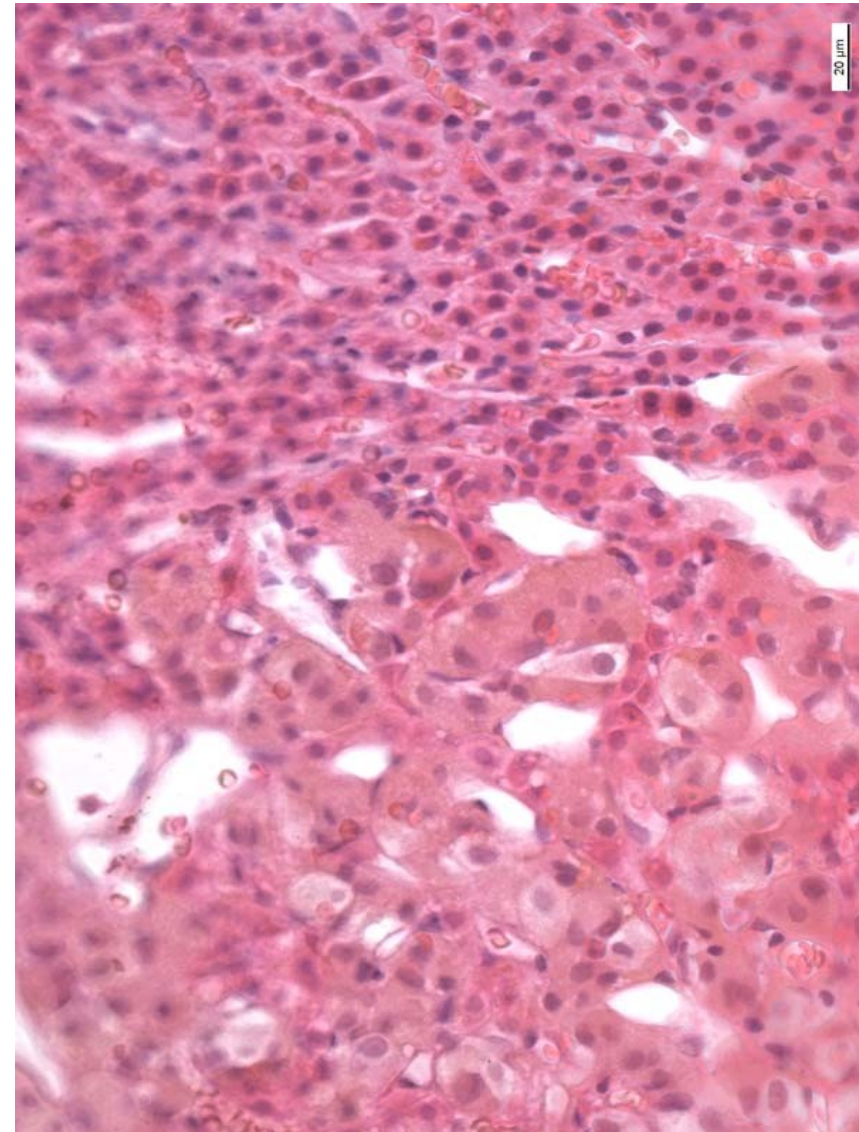


# Suprarenal gland - function

- Hormones produced in the cortex are all *steroids* - cortical cells contain large amounts of AER, lipid droplets and mitochondria with tubules. Since the hormones are synthesised in the cortex they are more termed **corticosteroids**.
  - mineralocorticoids*
  - glucocorticoids*
- The most important mineralocorticoid is **aldosterone**, which regulates the resorption of sodium and excretion of potassium in the tubules of the kidney – **zona glomerulosa**.
- The most important glucocorticoid is **cortisol**, which has a wide range of effects on most cells of the body. Cortisol effects protein catabolism in almost all cells aside from liver cells, gluconeogenesis, glycogen storage, mobilisation of fat from adipocytes, anti-inflammatory effects, inhibition of allergic reactions – **zona fasciculata**.
- Small amounts of **androgens**, oestrogens and progesterone are also produced – **zona reticularis**.
- Both the zona fasciculata and zona reticularis depend on ACTH.

# Suprarenal gland - medulla

- Cells are arranged in strands or small clusters in reticular c.t.
  - **chromaffin cells** because the granules of these cells can be stained with potassium bichromate and also some ganglion cells.
- Chromaffin cells correspond to the **adrenaline** - (80%) and **noradrenaline** - producing cells of the medulla. The two groups cannot be distinguished using routine histology.
- Chromaffin cells are innervated by preganglionic sympathetic fibres and correspond functionally to postganglionic neurones. The correspondence is not only functional - chromaffin cells are, like ganglion cells of the PNS, derived from neural crest cells.



# Islets of Langerhans

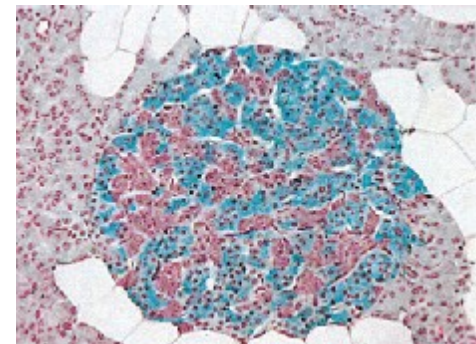
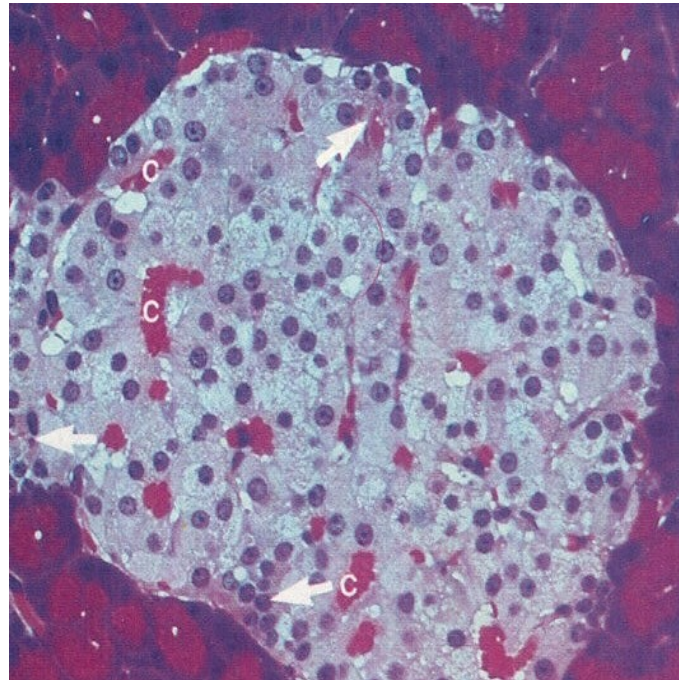
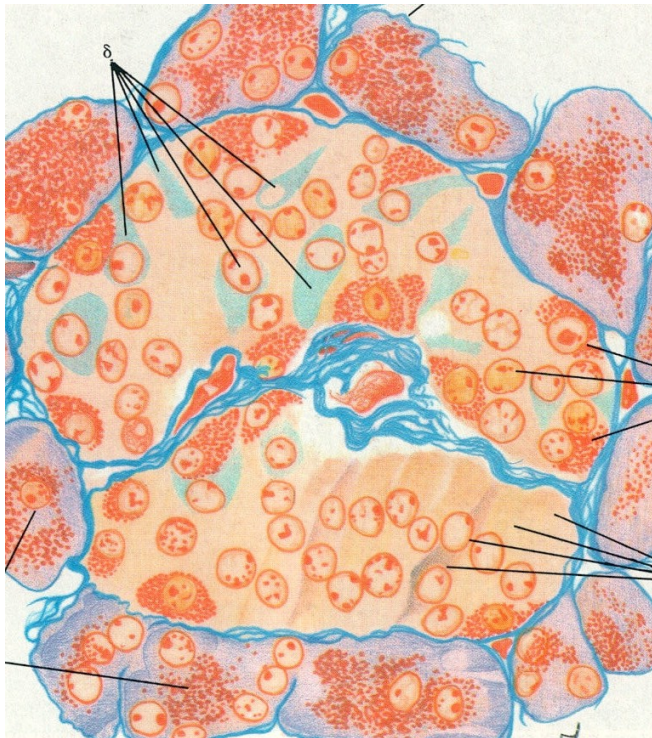
- Groups of pale cells
- cca  $1,5 \times 10^6$
- Thin c.t. capsula
- Epithelial-like cords of cells
- Sinusoids
- Cell types: A, B, D, PP

A cells: 20%, glukagon

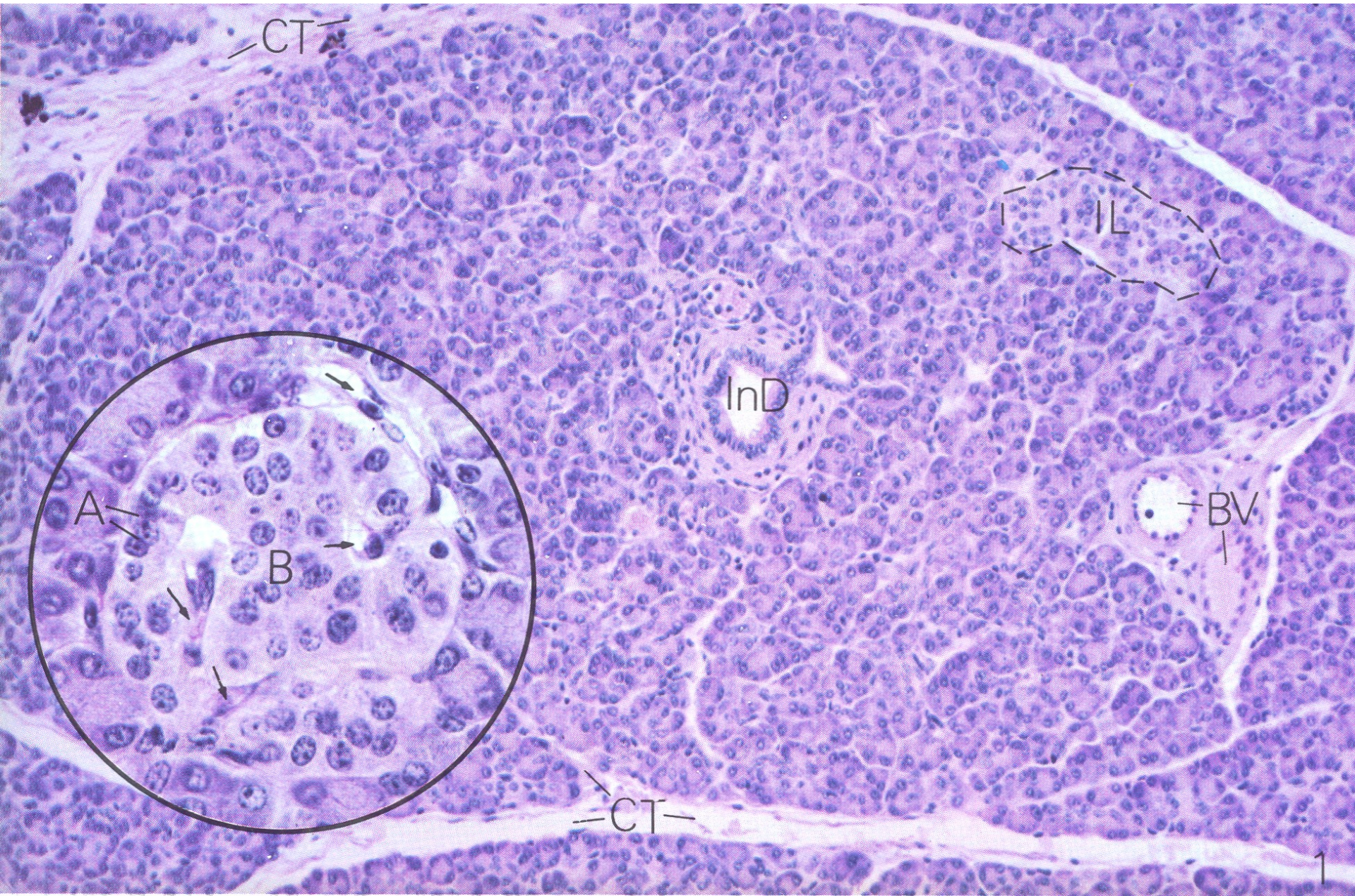
B cells: 60-70%, insulin

D cells: minor, somatostatin

PP cells: minor, pancreatic polypeptide



# Islets of Langerhans



# List of slides

- 52. Hypophysis cerebri
- 53. Epiphysis
- 54. Glandula thyreoidea
- 55. Glandula  
parathyroidea
- 56. Corpus suprarenale
- 23. Pancreas – islets of  
Langerhans