Histology of the thyroid gland

Thyroid follicle:

- The structural and functional unit of the thyroid gland.
- Consists of a group of cells resting on the same basal lamina surrounding a lumen filled with colloid.
- The follicles are variable in size.
- Hormones are stored in the follicles.
- Each follicle is surrounded by variable amount of connective tissue.

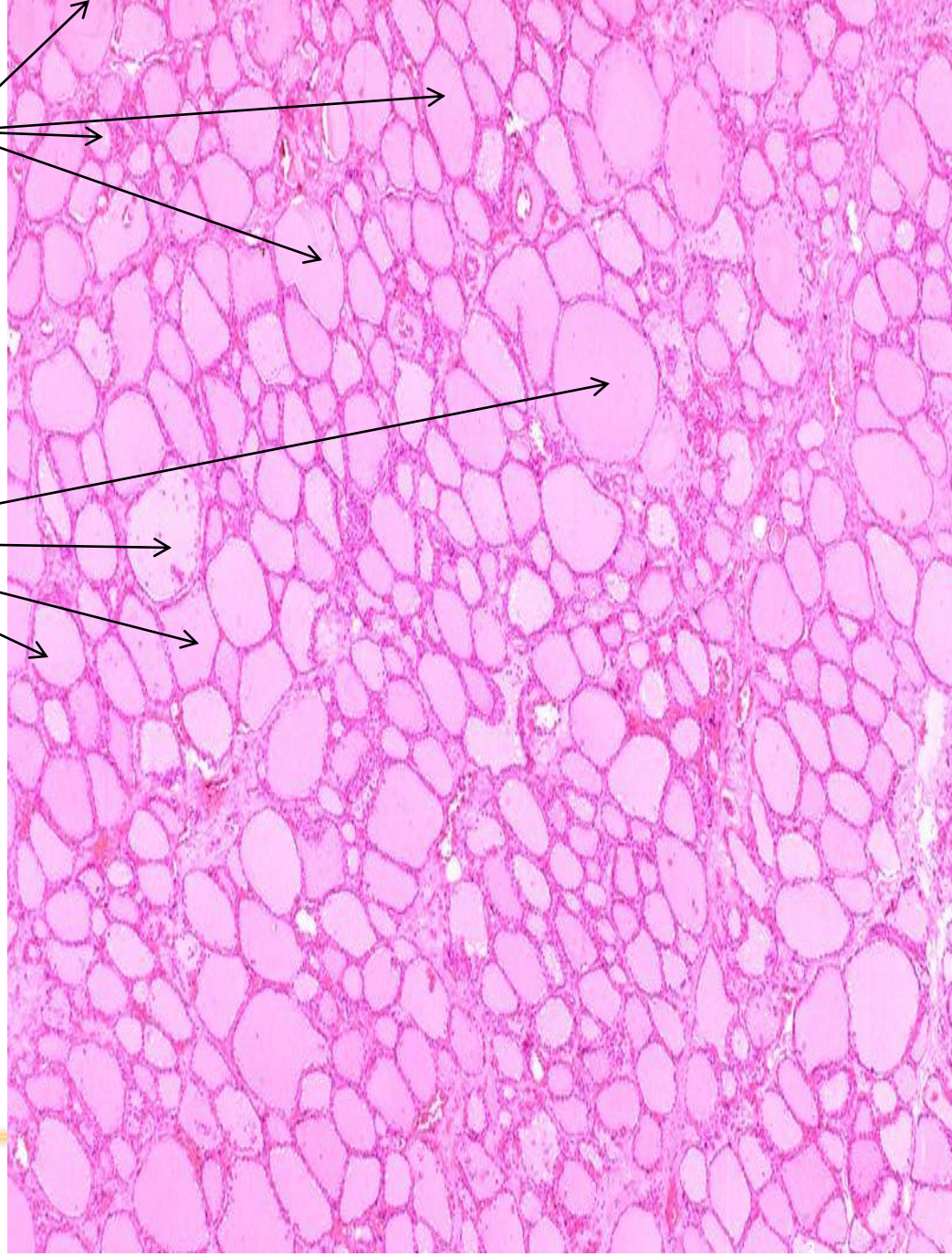
The follicles are variable in size

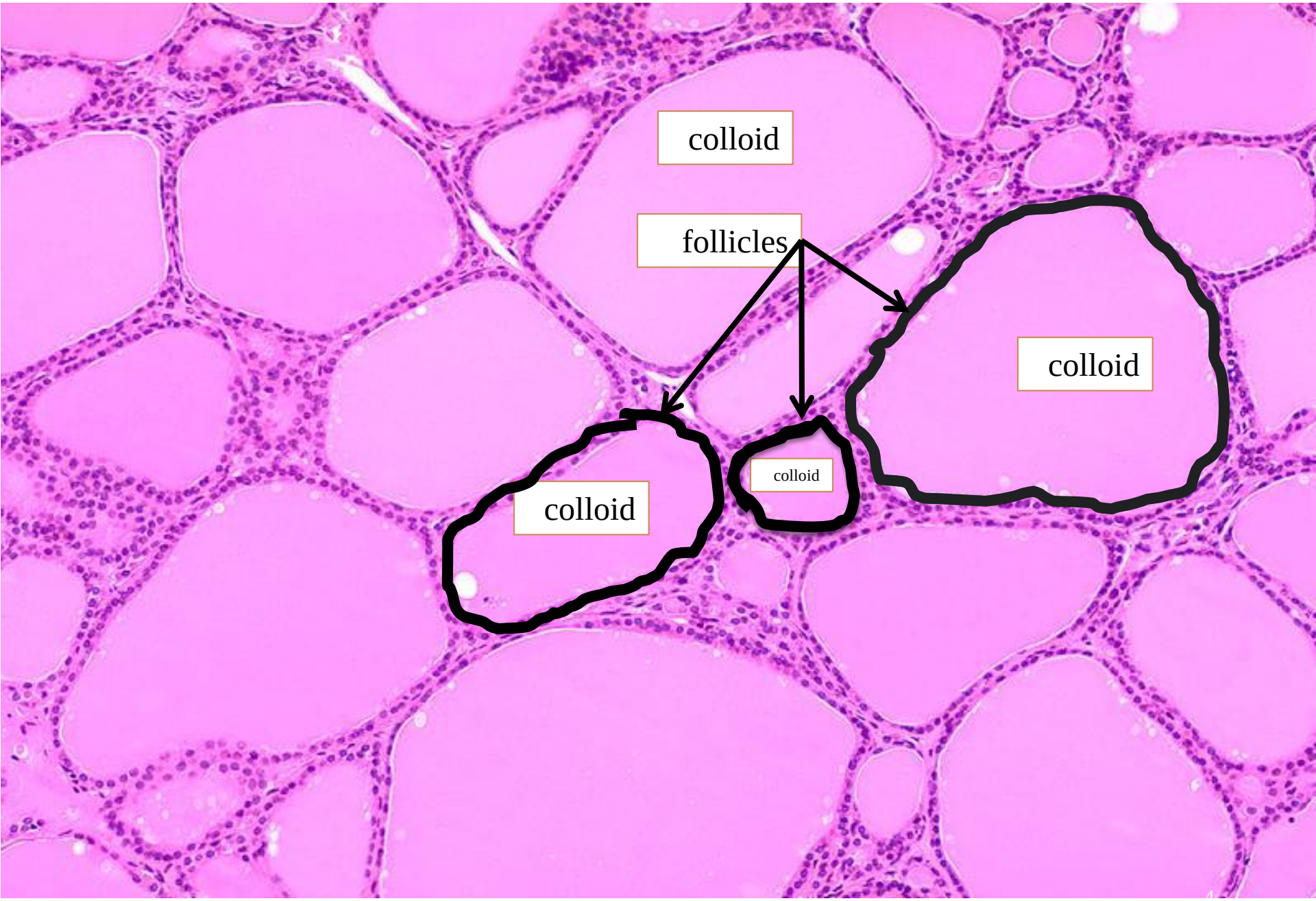
Hormones are stored in the follicles

The follicles contain a gel-like mass called colloid

colloid

Hundreds of thousands of follicles that vary in diameter from about 0.2 to 1.0 mm constitute nearly the entire mass of the human thyroid gland.

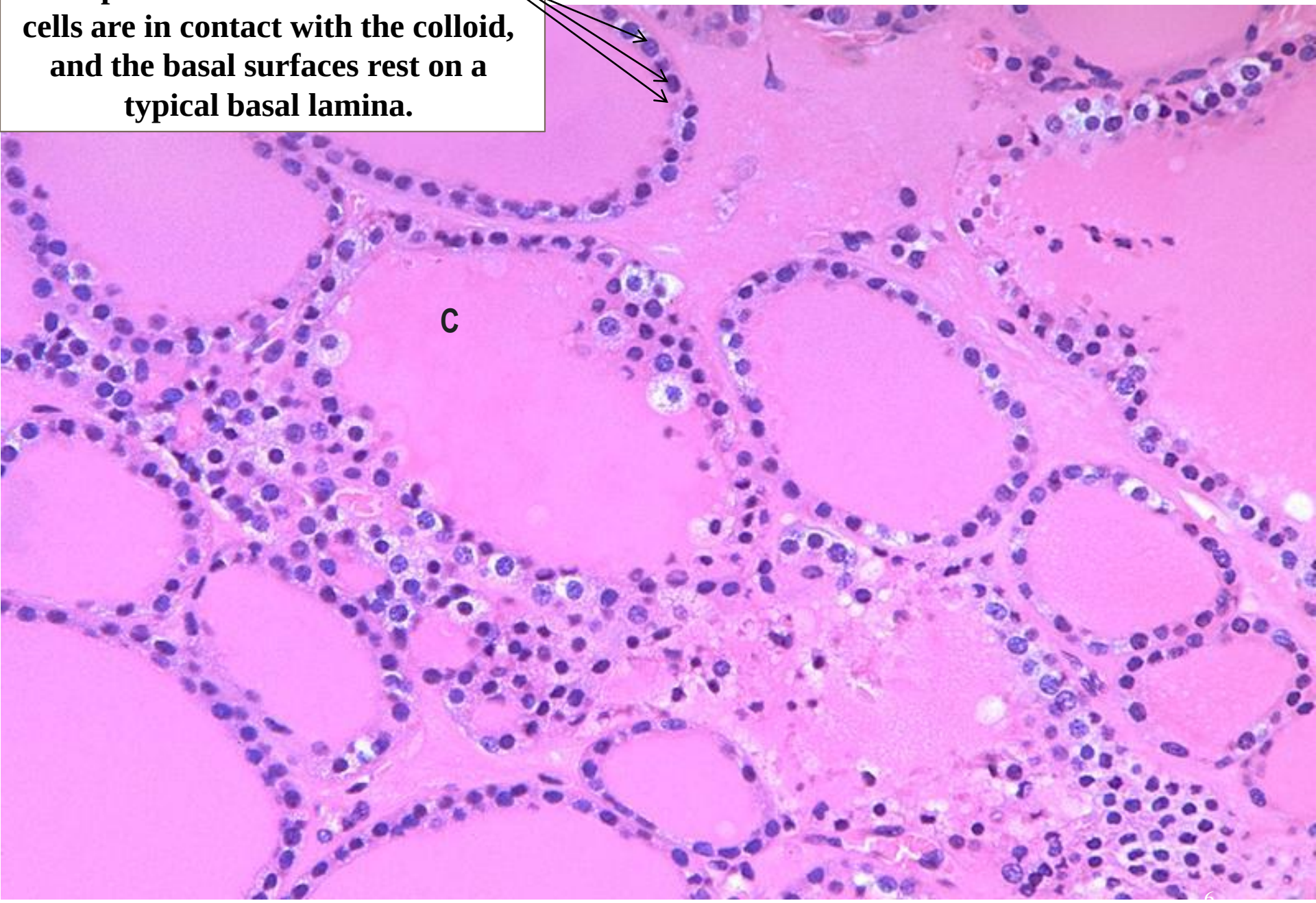



colloid
follicles
colloid
colloid
colloid

Follicular cells (principal cells):

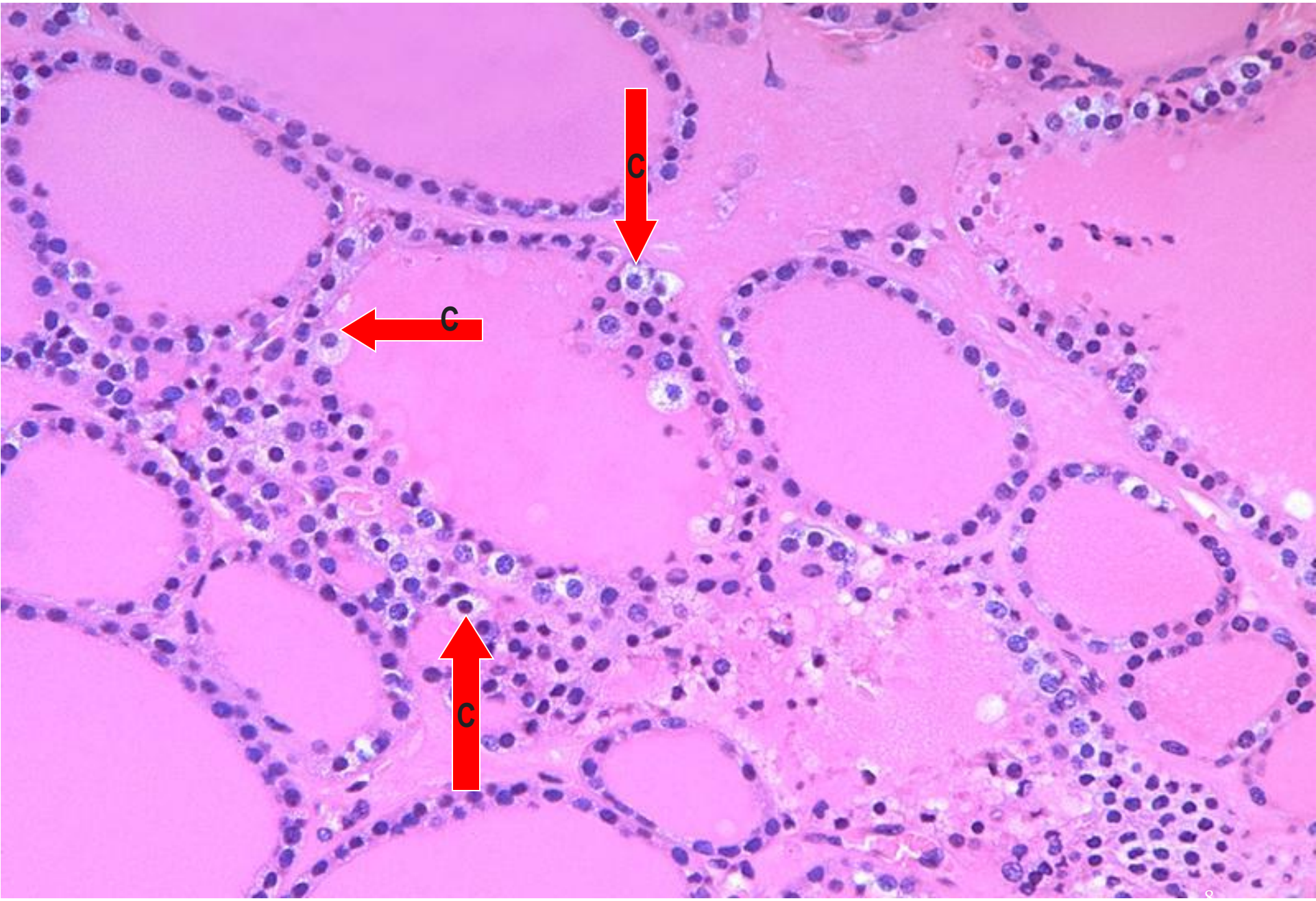
- Squamous-columnar cells according to activity.
- Basophilic cytoplasm.
- Nucleus: round-ovoid with 2 nucleoli.
- Many rER.
- Numerous apical lysosomes and mitochondria.
- Supranuclear Golgi complex.
- Apical microvilli.
- Numerous vesicles in the cytoplasm.

The apical surfaces of the follicular cells are in contact with the colloid, and the basal surfaces rest on a typical basal lamina.

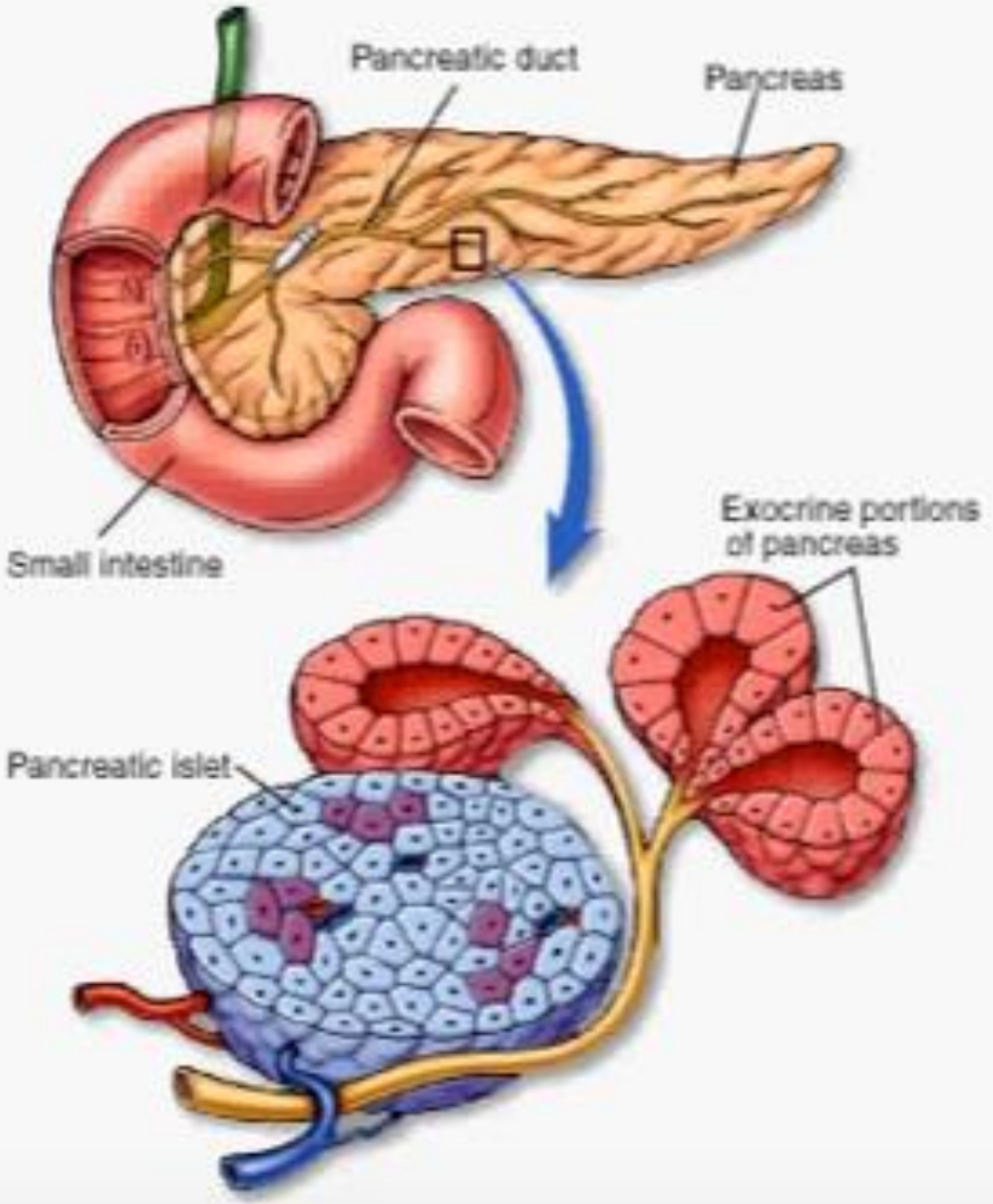


Parafollicular cells (Clear cells, C cells):

- Pale staining, larger than follicular cells.
- Occur singly or in clusters among follicular cells.
- Overlapped by follicular cells.
- E.M:
  - Moderate rER.
  - Well-developed Golgi.
  - small, dense, basal secretory granules.
- Secrete calcitonin:
  - Inhibits bone resorption by osteoclasts.
  - Stimulated when Ca^{2} is high.


C
C
C

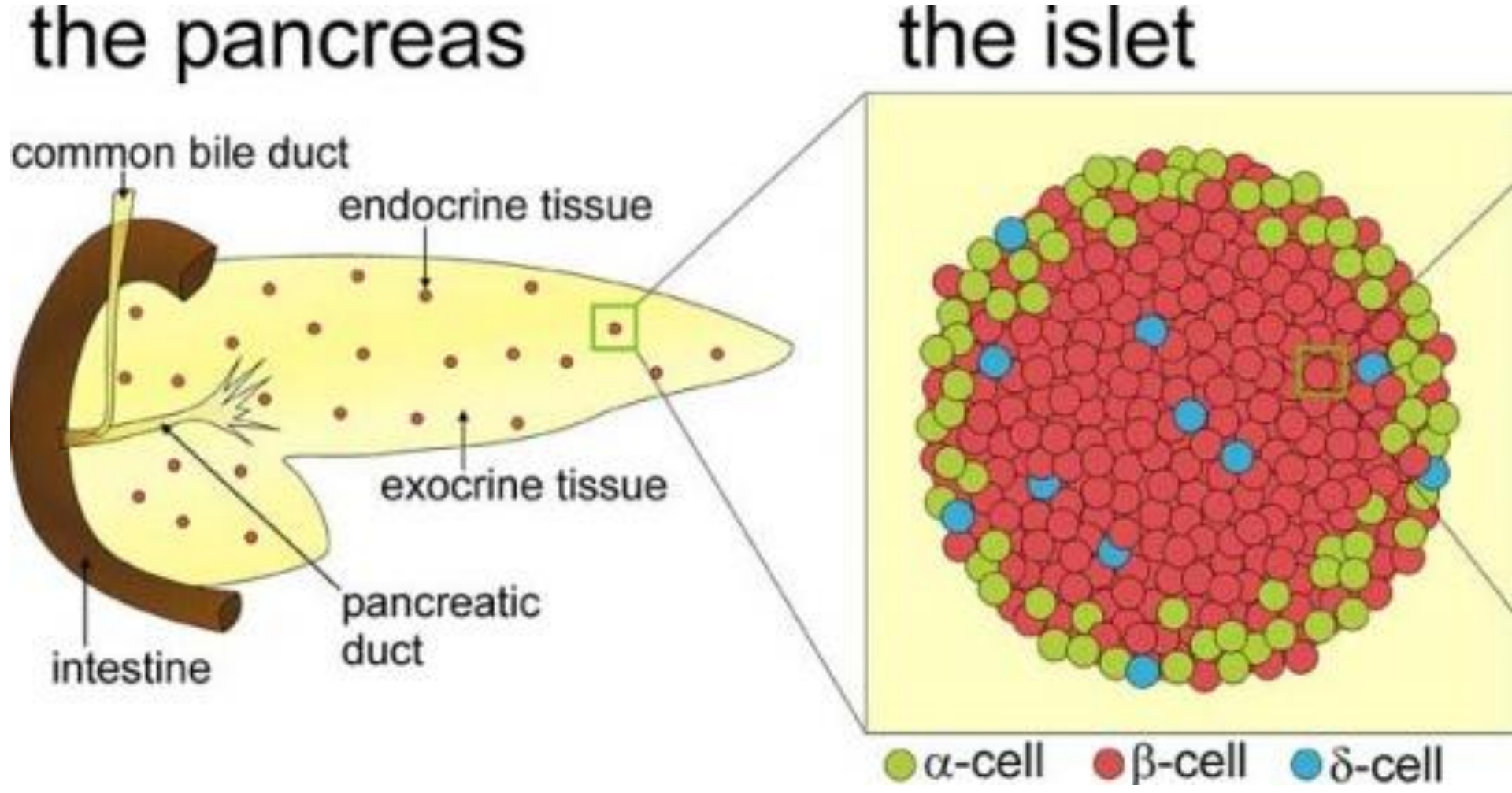
Endocrine Pancreas
(Islets of Langerhans)


Pancreatic duct
Pancreas
Small intestine
Exocrine portions of pancreas
Pancreatic islet

Islets of Langerhans

First described by Langerhans in 1869 (as an observation on the urine of pancreactictomized dogs).

In 1893 Gustave-Edouard Laguesse (1861-1927) attached the name Langerhans to the structures. Langerhans did not suggest any function for them. The book has been reprinted with an English translation by H. Morrison.


the pancreas
the islet
common bile duct
endocrine tissue
exocrine tissue
pancreatic duct
intestine
α-cell
β-cell
δ-cell

Spherical-oval cellular masses between the acini of the pancreas.

Variable in size and number of cells in them.

They form ~ 1 million secretroy units.

Not homogeneously distributed and increase in number towards the tail.

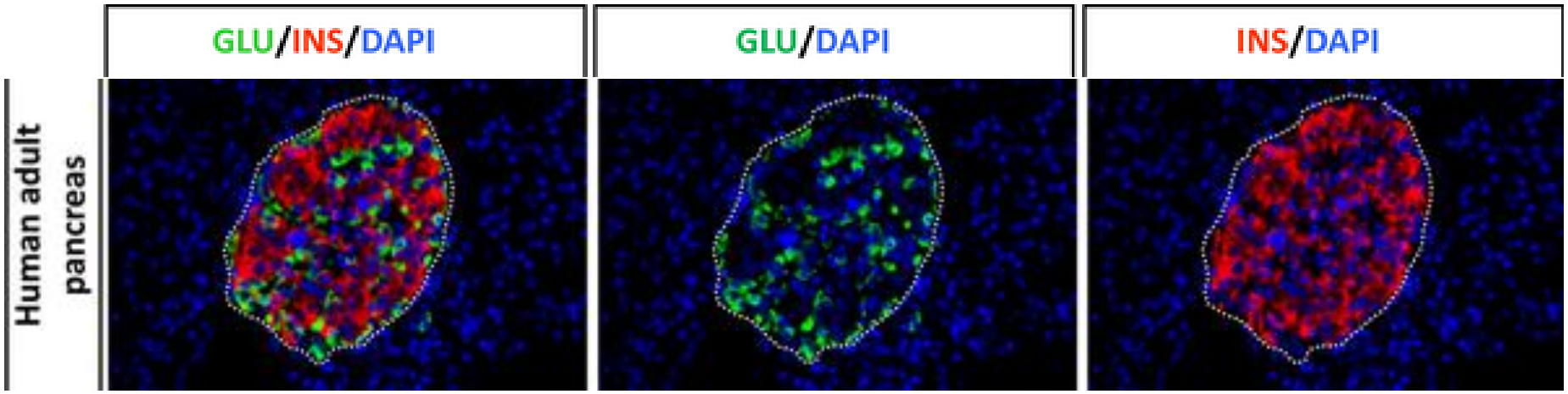
Surrounded by a very thin capsule.

They have the same embryological origin as the rest of the pancreas (endoderm).

In H & E cells show variation in staining reaction between acidophilia and basophilia.

E.M. shows typical poly peptide secreting cells with variable amount of granules.

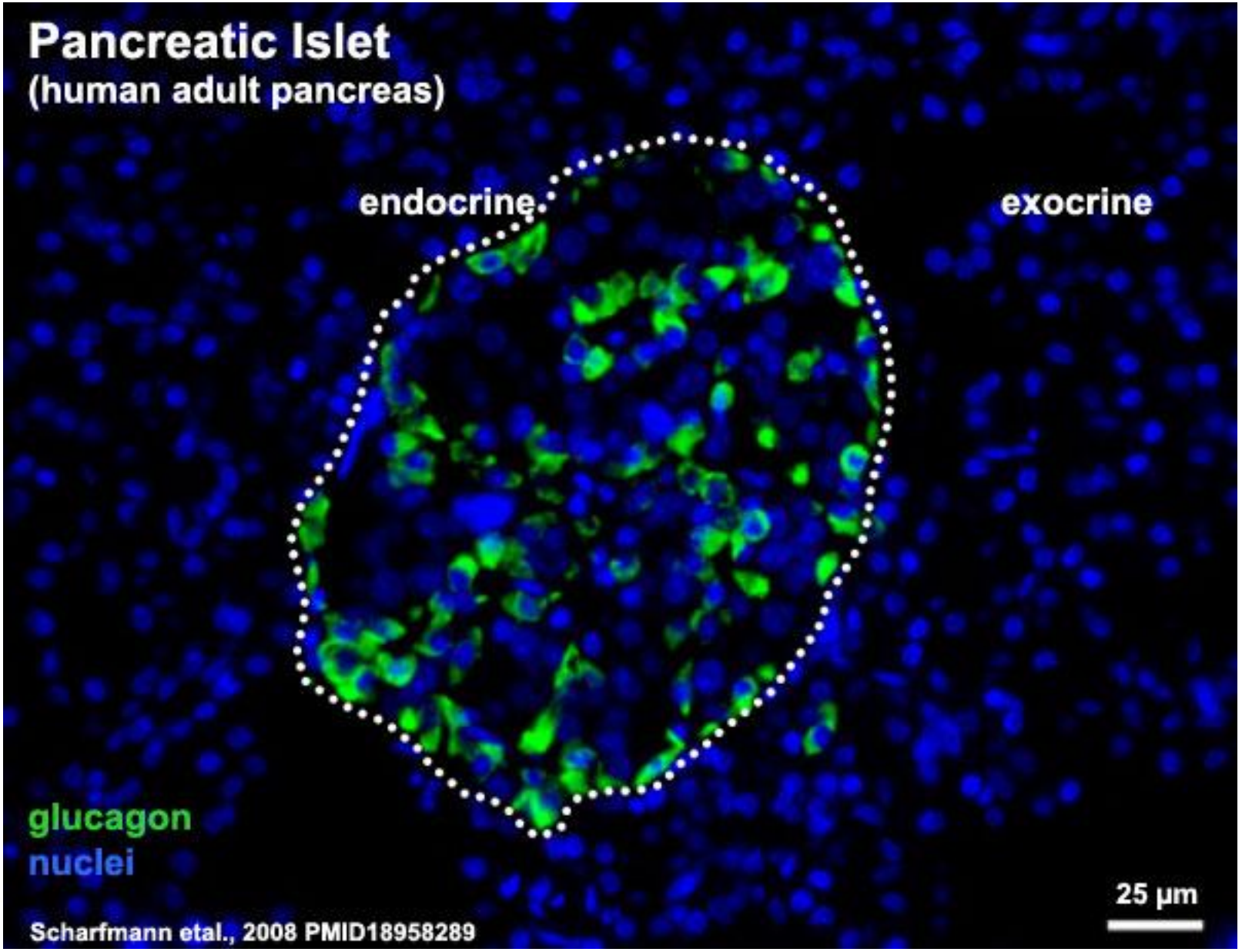
Immunohistochemistry is the only accurate method to differentiate between cells.

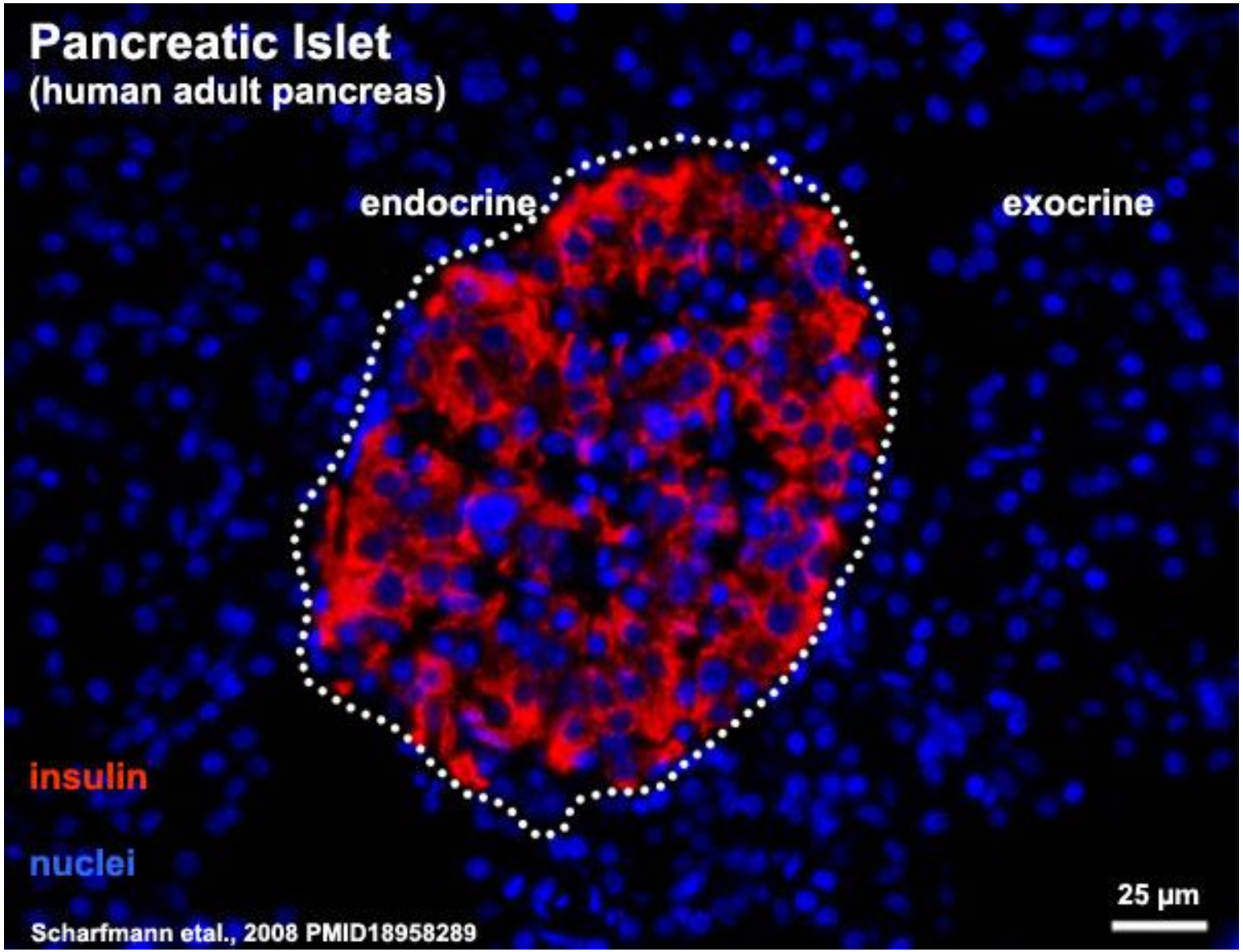


Section of an adult human pancreas stained for glucagon (green) and insulin (red)

Major pancreatic cells cell

Cell	Location	%	Secretion	Function
α	Peripheral	~ 20	Glucagon	↑ Blood glucose level; ↑ glycogenolysis and lipolysis
β	Central	~ 70	Insulin	↓ Blood glucose level
δ	Scattered	5-10	Somatostatin	Inhibits release of other cells
F (PP)	Scattered	<1	Pancreatic polypeptide	↑ activity of chief cells, ↓ bile secretion. ↓ pancreatic enzyme and HCO3 secretion. ↓ intestinal motility


Pancreatic Islet
(human adult pancreas)
endocrine
exocrine
glucagon
nuclei
Scharfmann etal., 2008 PMID18958289
25 µm


Pancreatic Islet
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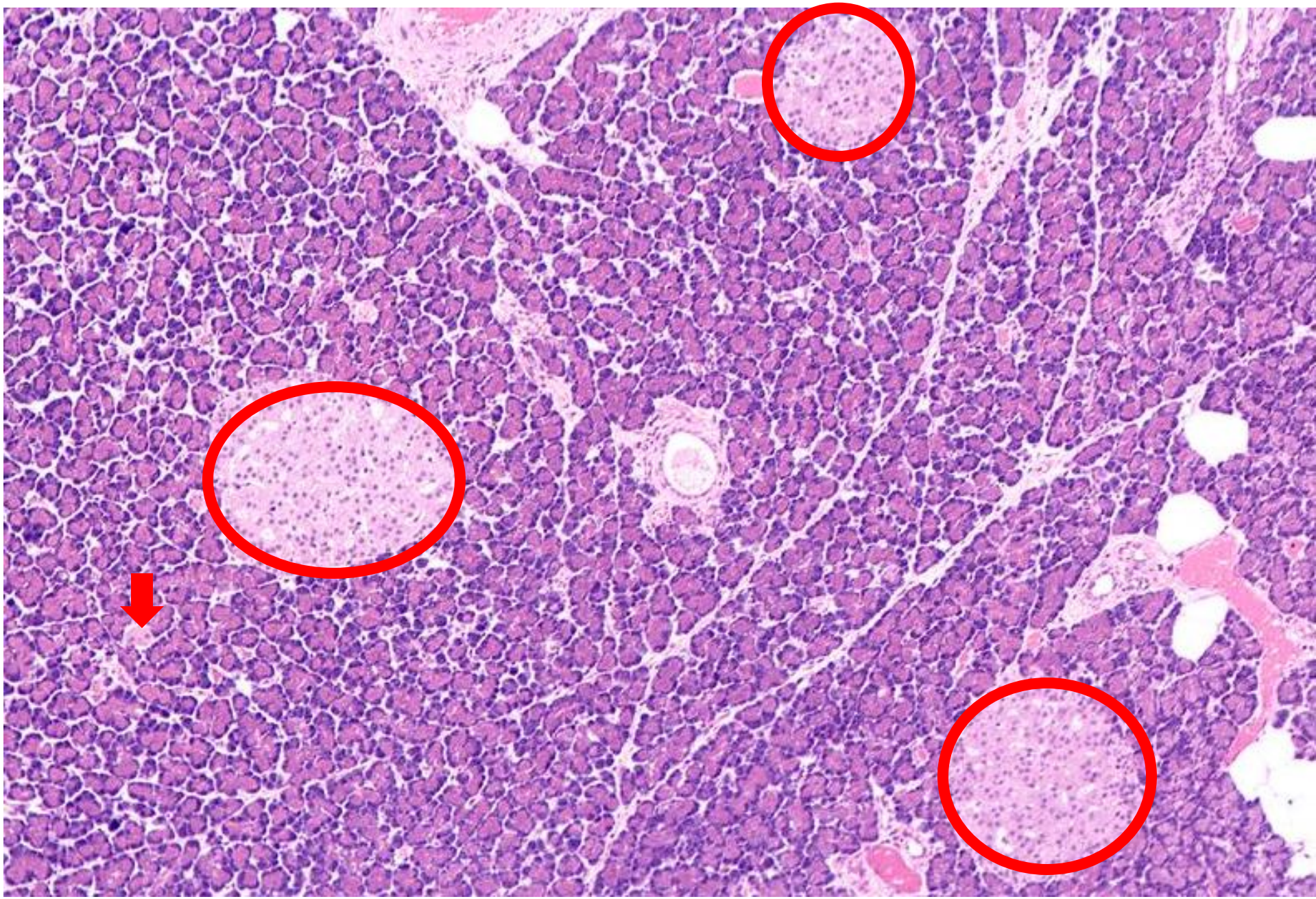
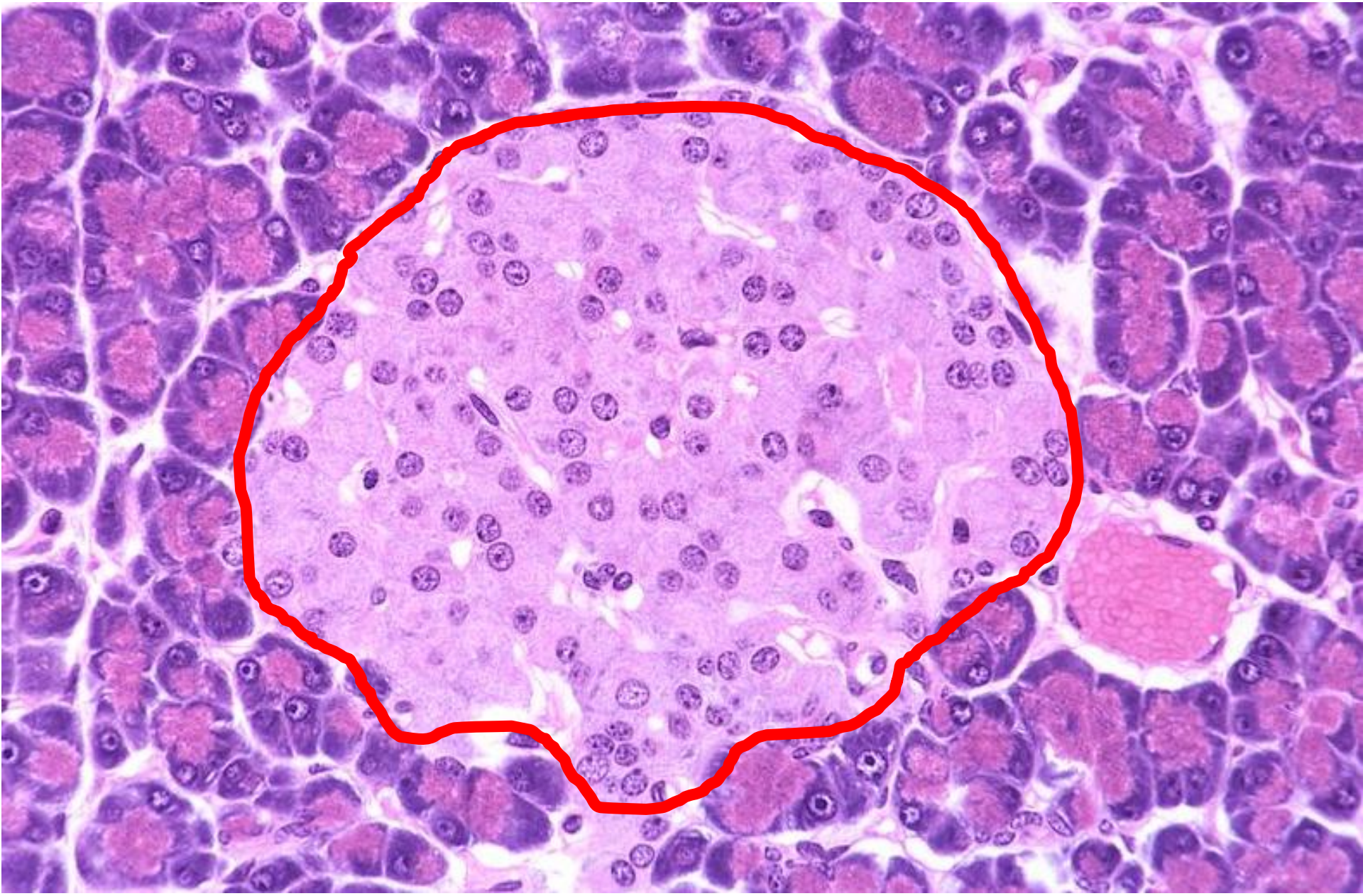




Parathyroid glands

Histology

Composed mostly of chief cells and oxyphil cells within an adipose stroma.

Oxyphil cells derived from chief cells and increase as one ages

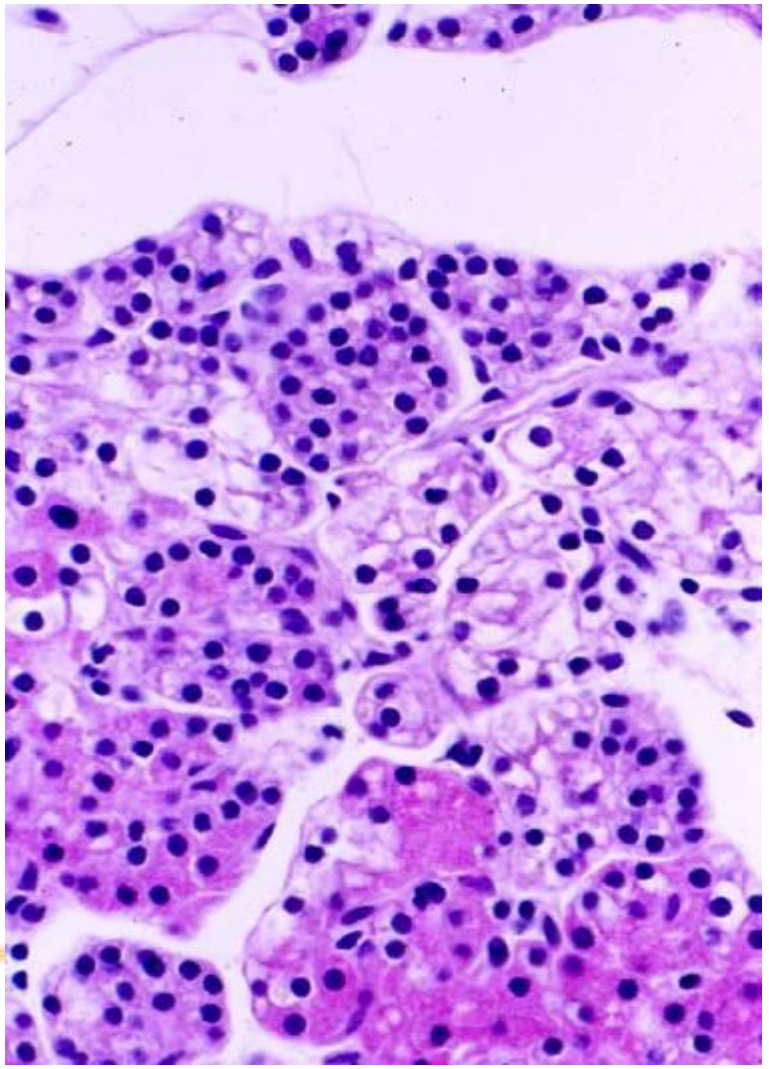
Chief (principal) Parathyroid cells

The most numerous type.

They are small, polygonal cells with round, lightly stained and centrally placed nucleus and weakly acidophilic cytoplasm, that contains irregular granules (E.M).

They synthesize and secrete large amounts of parathormone (PTH) which regulates calcium and phosphate levels in the blood.

They can replicate when chronically stimulated by changes in blood calcium levels.



Effects of Parathormone

Decreases kidney excretion of calcium.

Increases urinary phosphate excretion.

Regulates conversion of 25-OH vitamin D3 to hormonally 1,25 –(OH)2 Vitamin D3.

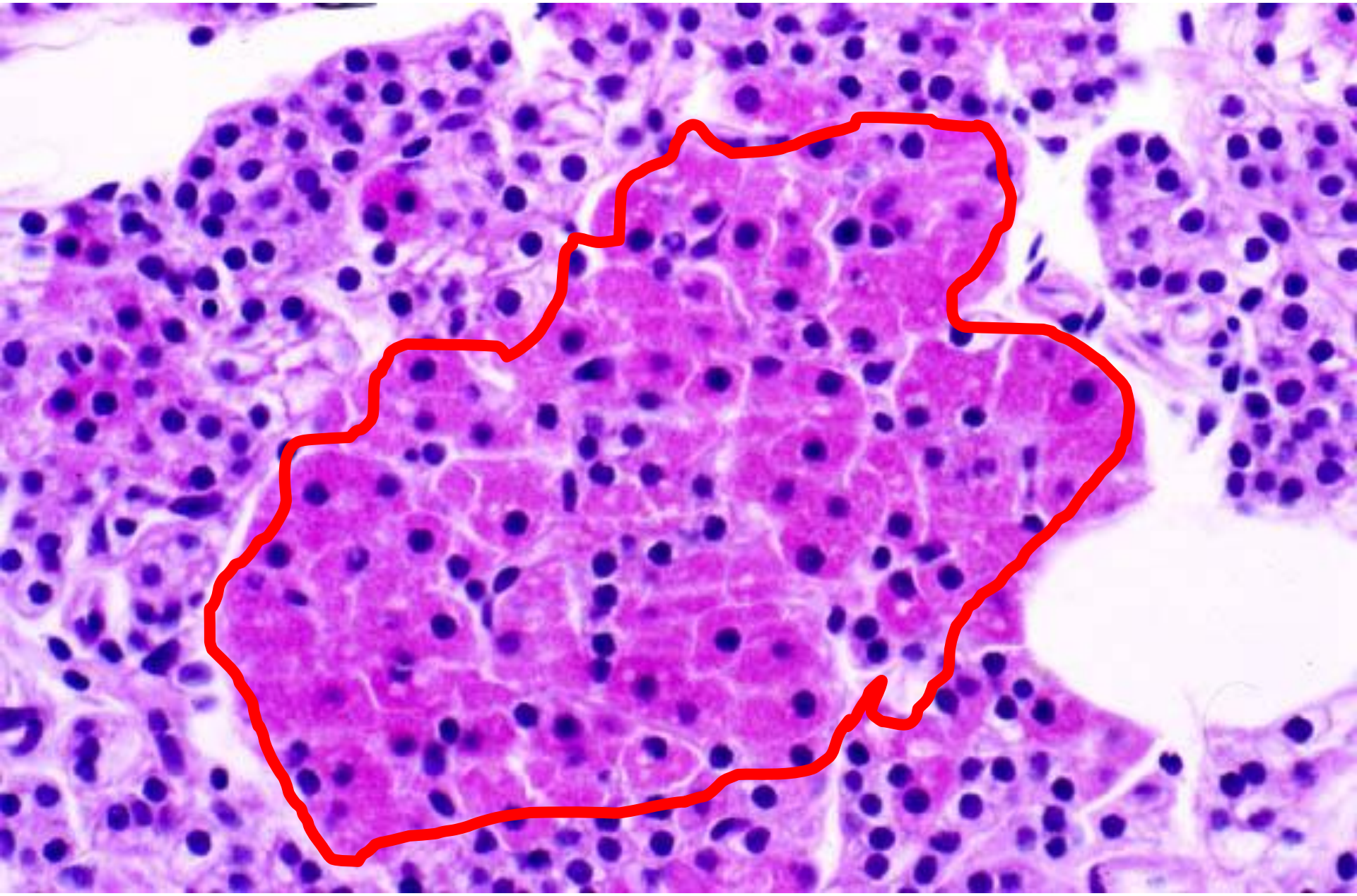
Increases intestinal absorption of Calcium.

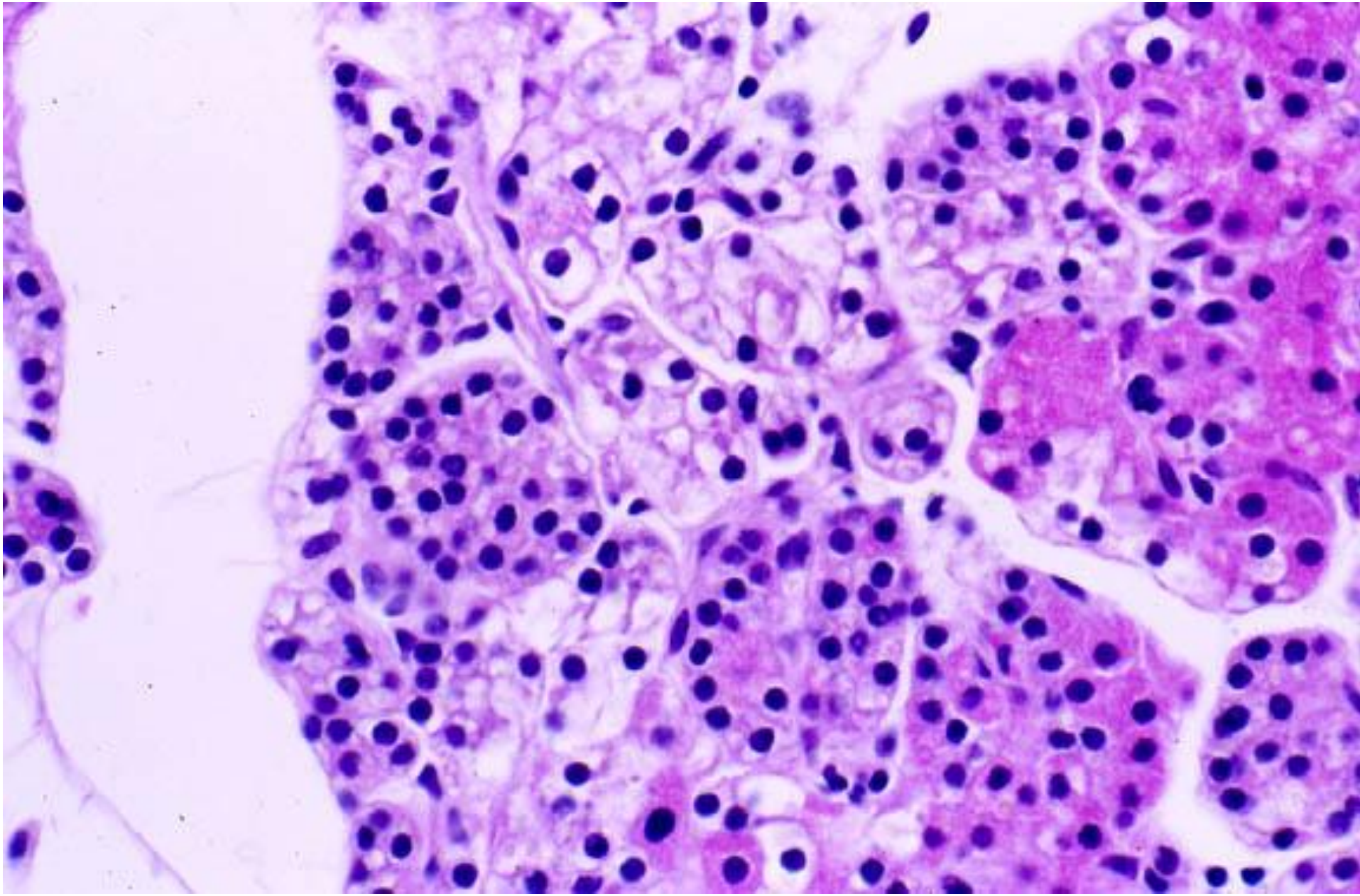
Oxyphil Cells

They start to appear in the gland about 4-7 years of age and increase in number after puberty.

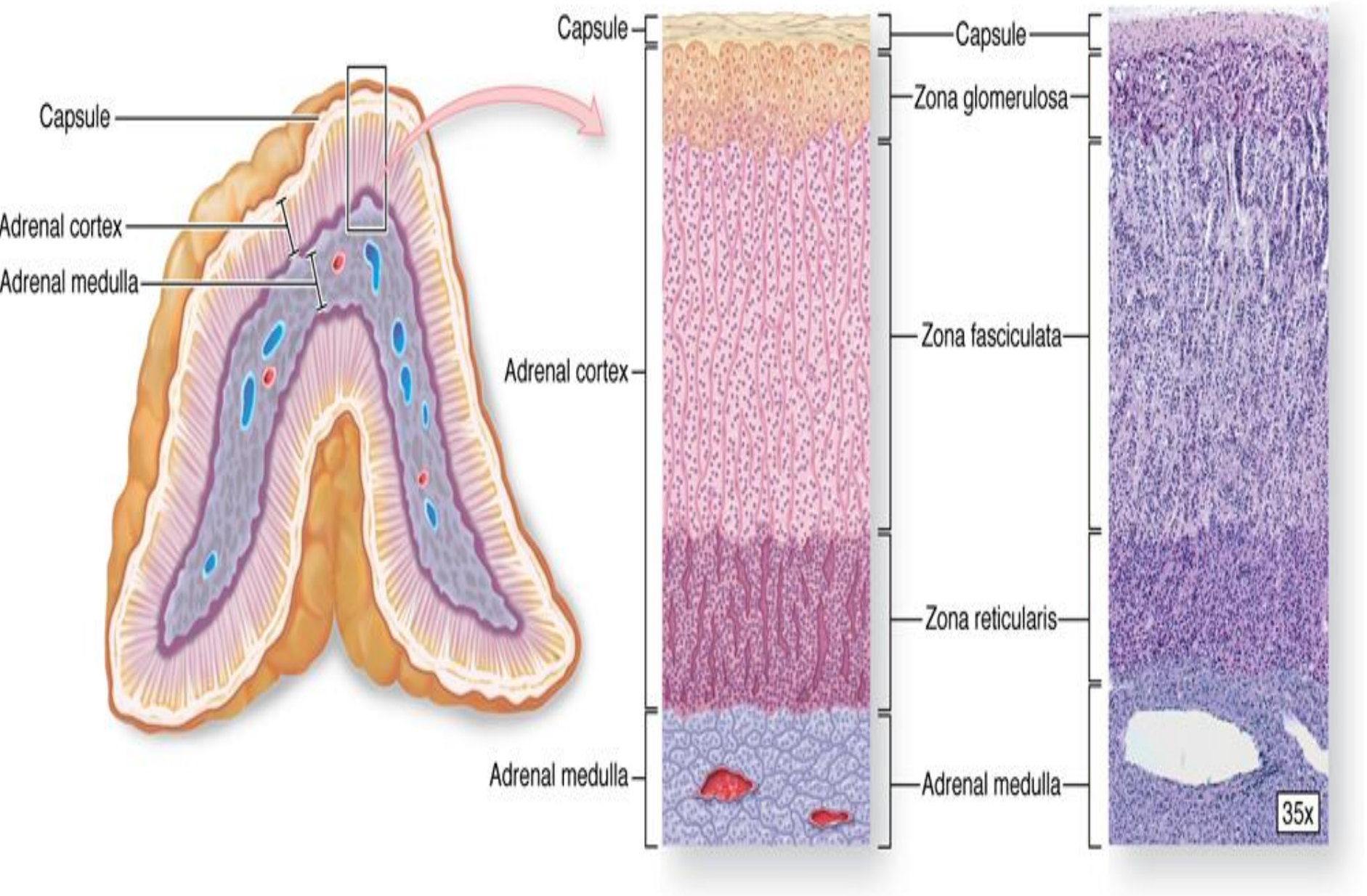
Their cytoplasm is strongly acidophilic, the nucleus is small and uniformly intense basophilic. They contain large amounts of abnormally shaped mitochondria.

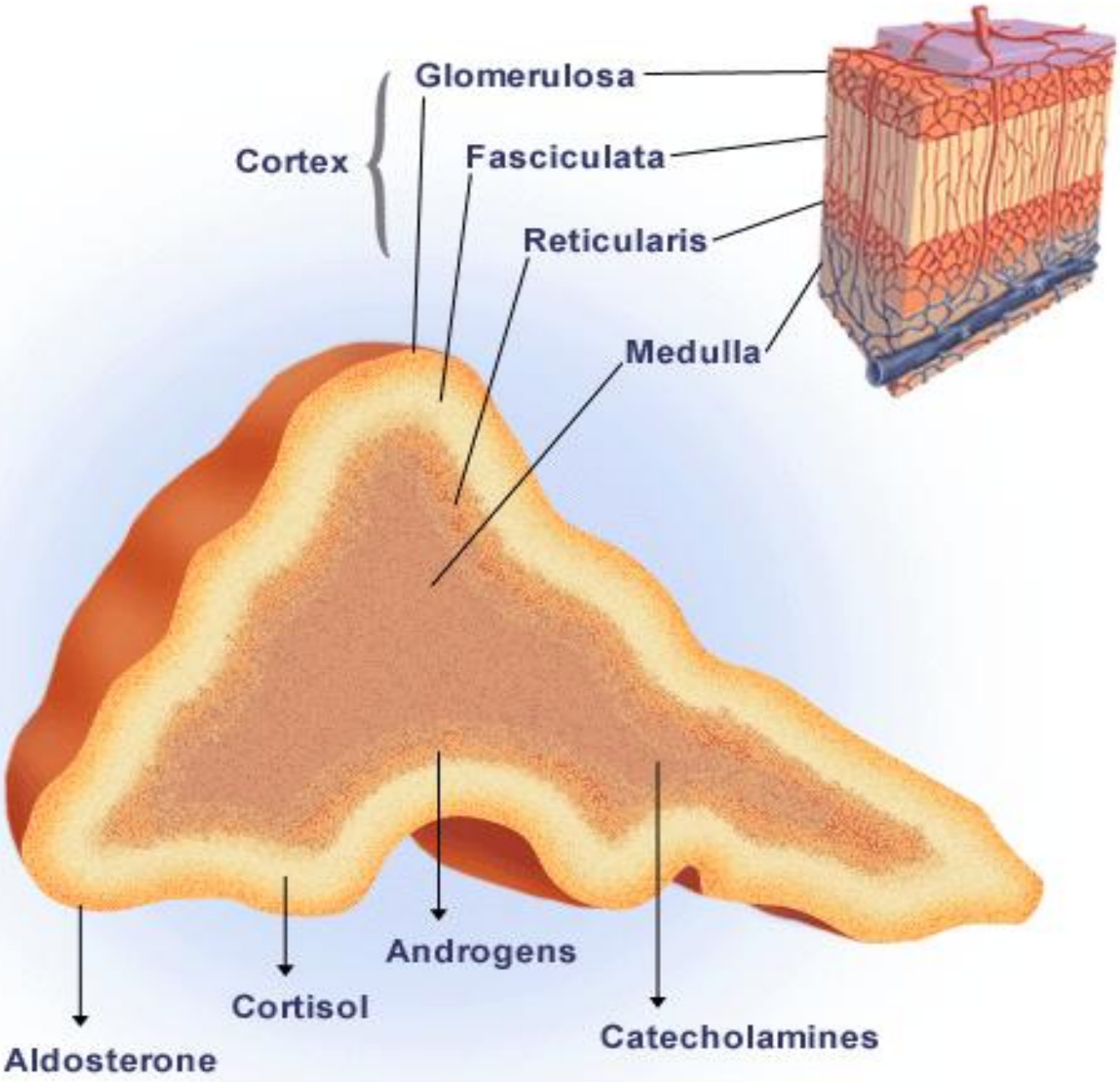
As they some cells show low level of PTH activity, they are believed to be derivatives from chief cells.

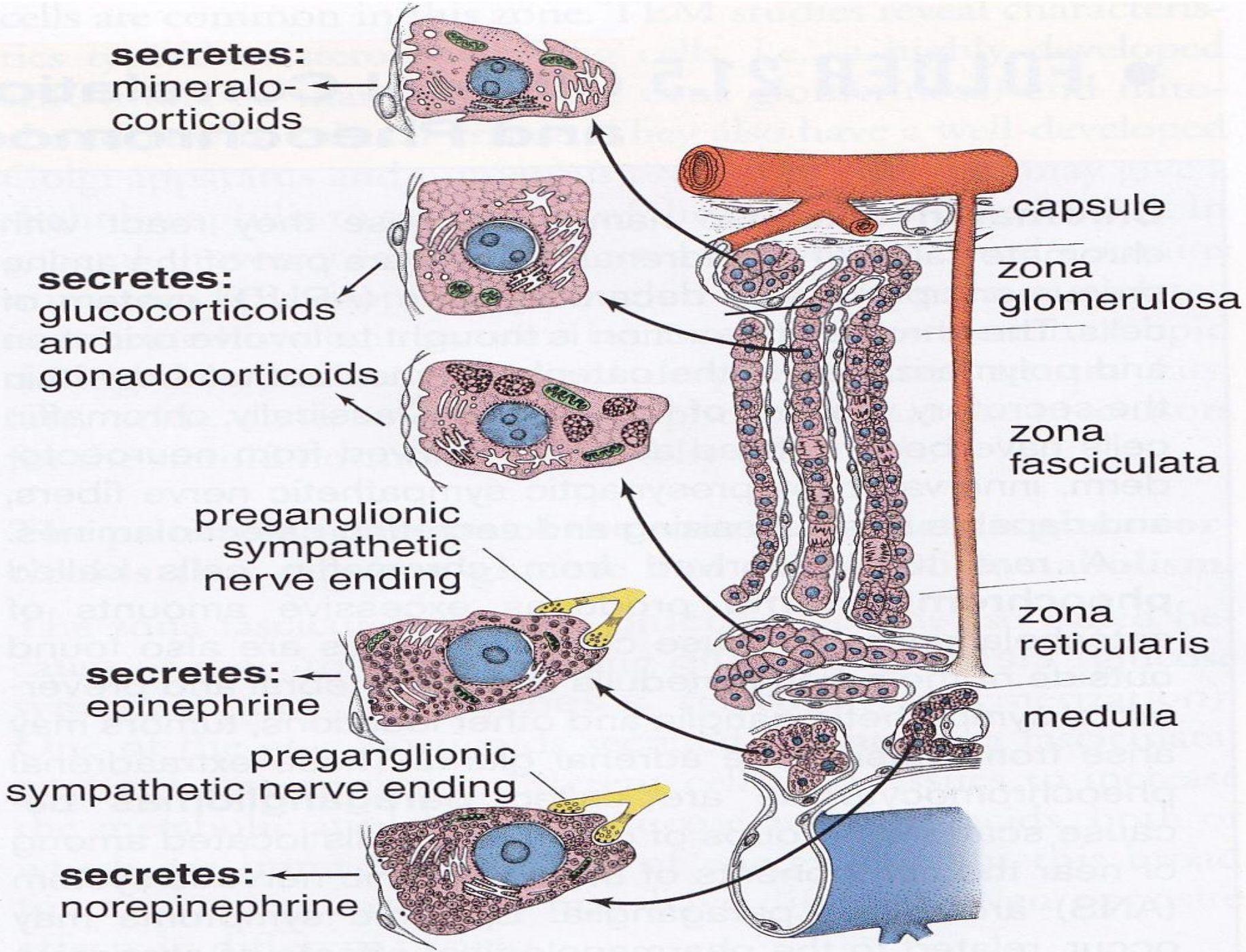




Adrenal Histology


Capsule
Adrenal cortex
Adrenal medulla
Capsule
Adrenal cortex
Adrenal medulla
Capsule
Zona glomerulosa
Zona fasciculata
Zona reticularis
Adrenal medulla
35x


Glomerulosa
Cortex
Fasciculata
Reticularis
Medulla
Androgens
Cortisol
Aldosterone
Catecholamines


secretes:
mineralo-
corticoids
secretes:
glucocorticoids
and
gonadocorticoids
preganglionic
sympathetic
nerve ending
secretes:
epinephrine
preganglionic
sympathetic nerve ending
secretes:
norepinephrine
capsule
zona
glomerulosa
zona
fasciculata
zona
reticularis
medulla

The gland is divided into an outer cortex and an inner medulla.

The adrenal cortex is composed of three zones histologically:

- Outer zona **glomerulosa**, site for aldosterone synthesis.
- Central zona **fasciculata** produce cortisol, and
- Inner zona **reticularis** produce androgens

Zona glomerulosa

Is the exclusive site of production of aldosterone.

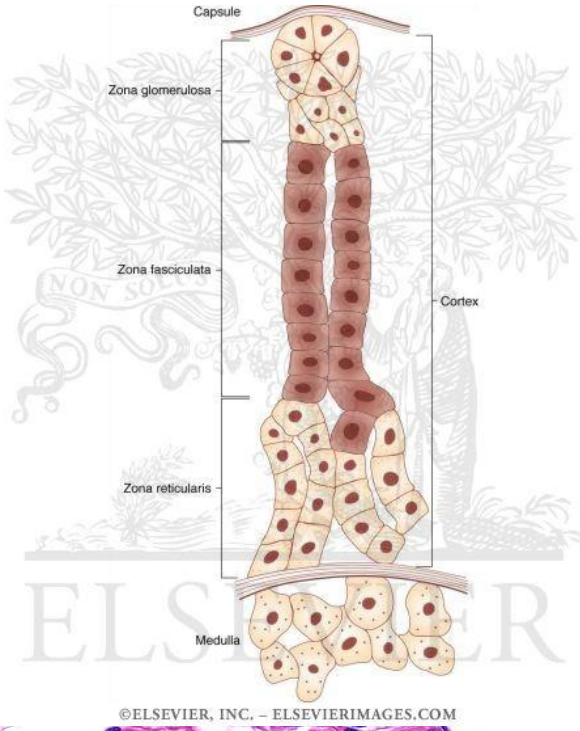
Consists ~ 15% of the cortex.

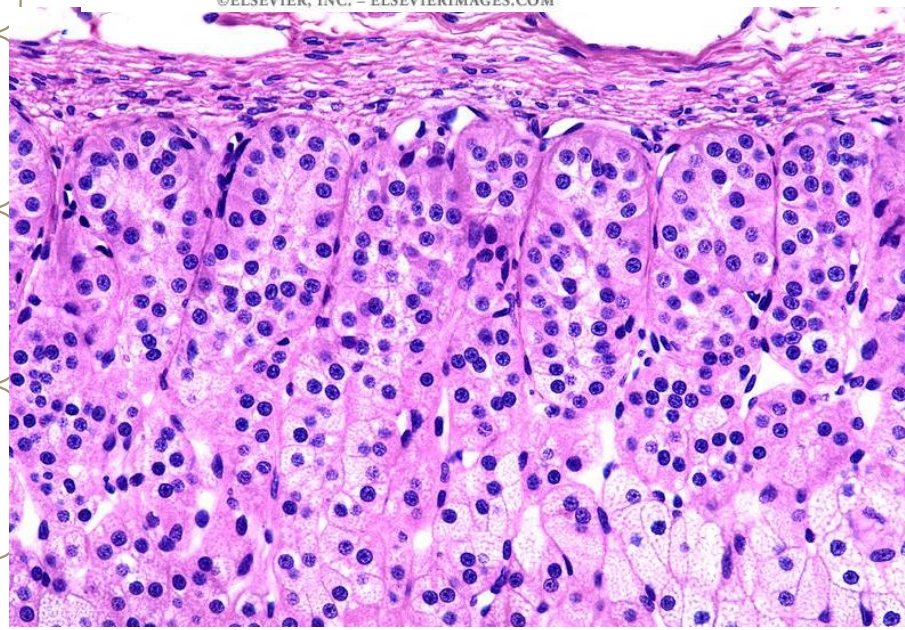
Cells are arranged in closely packed clusters continuous with the next layer.

Cells are small pyramidal-columnar with spherical nuclei.

Clusters of cells are surrounded by fenestrated sinusoidal capillaries.

Cells have abundant sER, large mitochondria with shelf-like cristae, Golgi complex, few rER, and few lipid droplets.





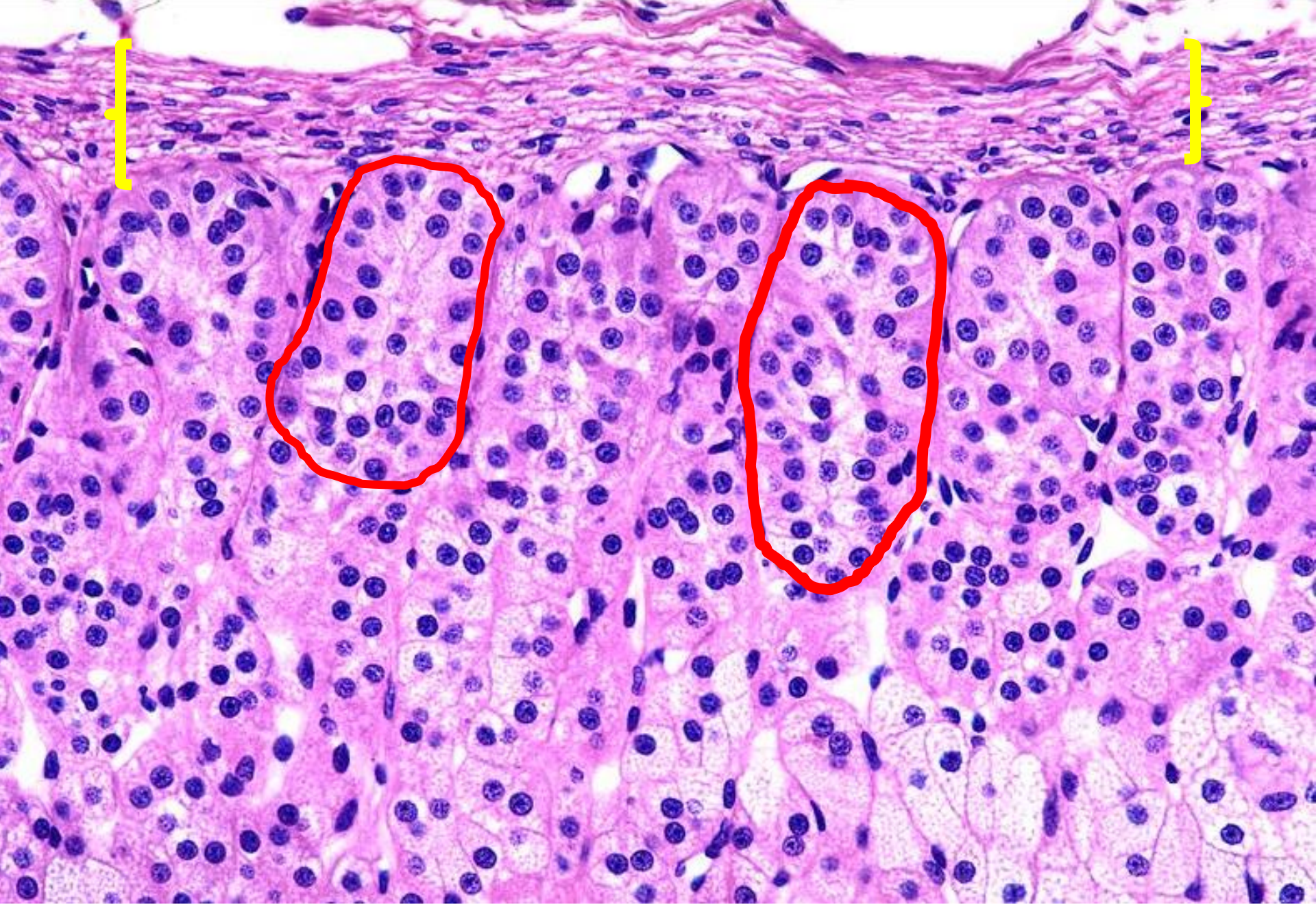
Zona glomerulosa secretes mineralocorticoids, that function in the regulation of sodium and potassium homeostasis and water balance.

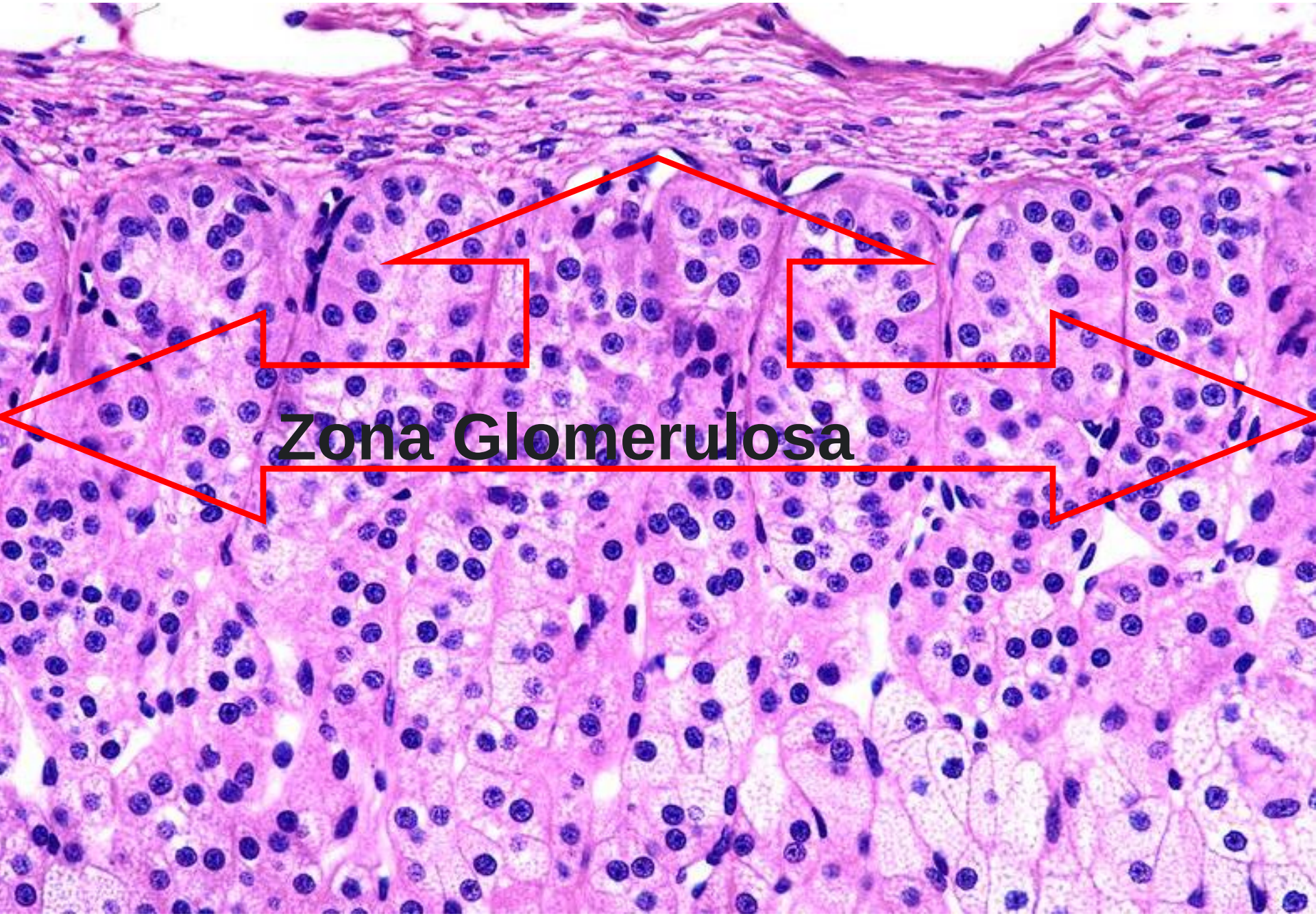
The main mineralocorticoid is aldosterone.

Aldosterone stimulates resorption of sodium from:

- Distal renal tubules.
- Gastric mucosa.
- Salivary glands.
- Sweat glands.

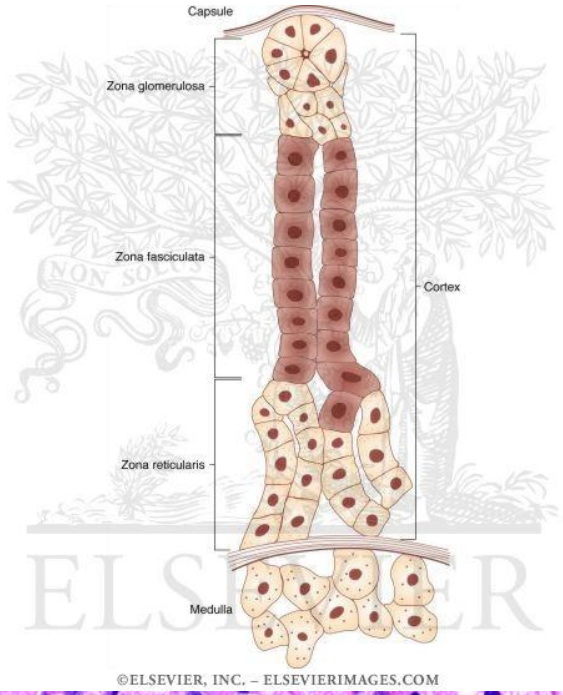
The zona glomerulosa is under the feed back control of the ***renin-angiotensin-aldosterone*** system.

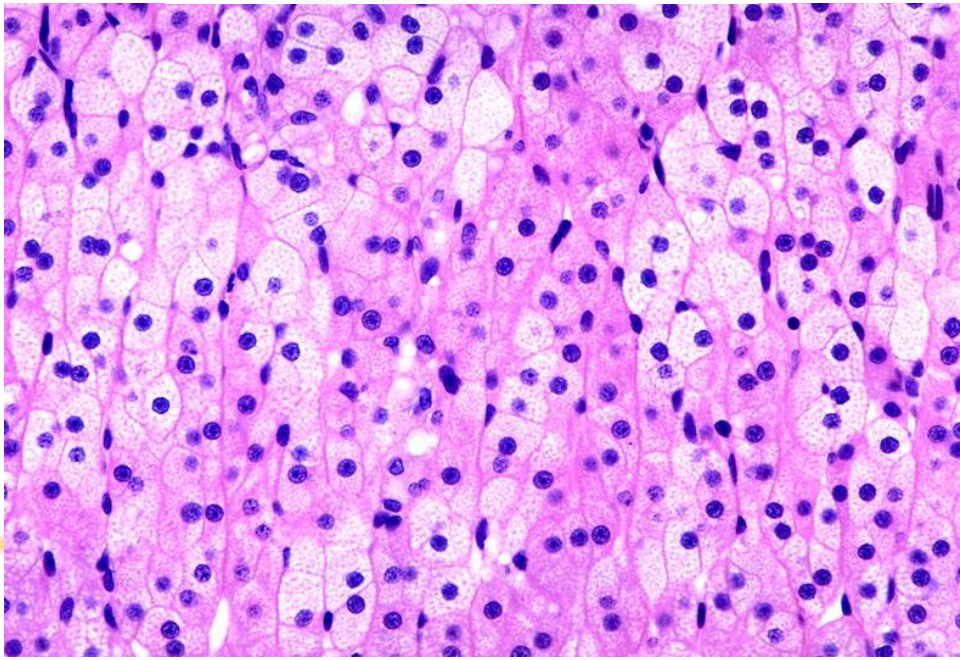


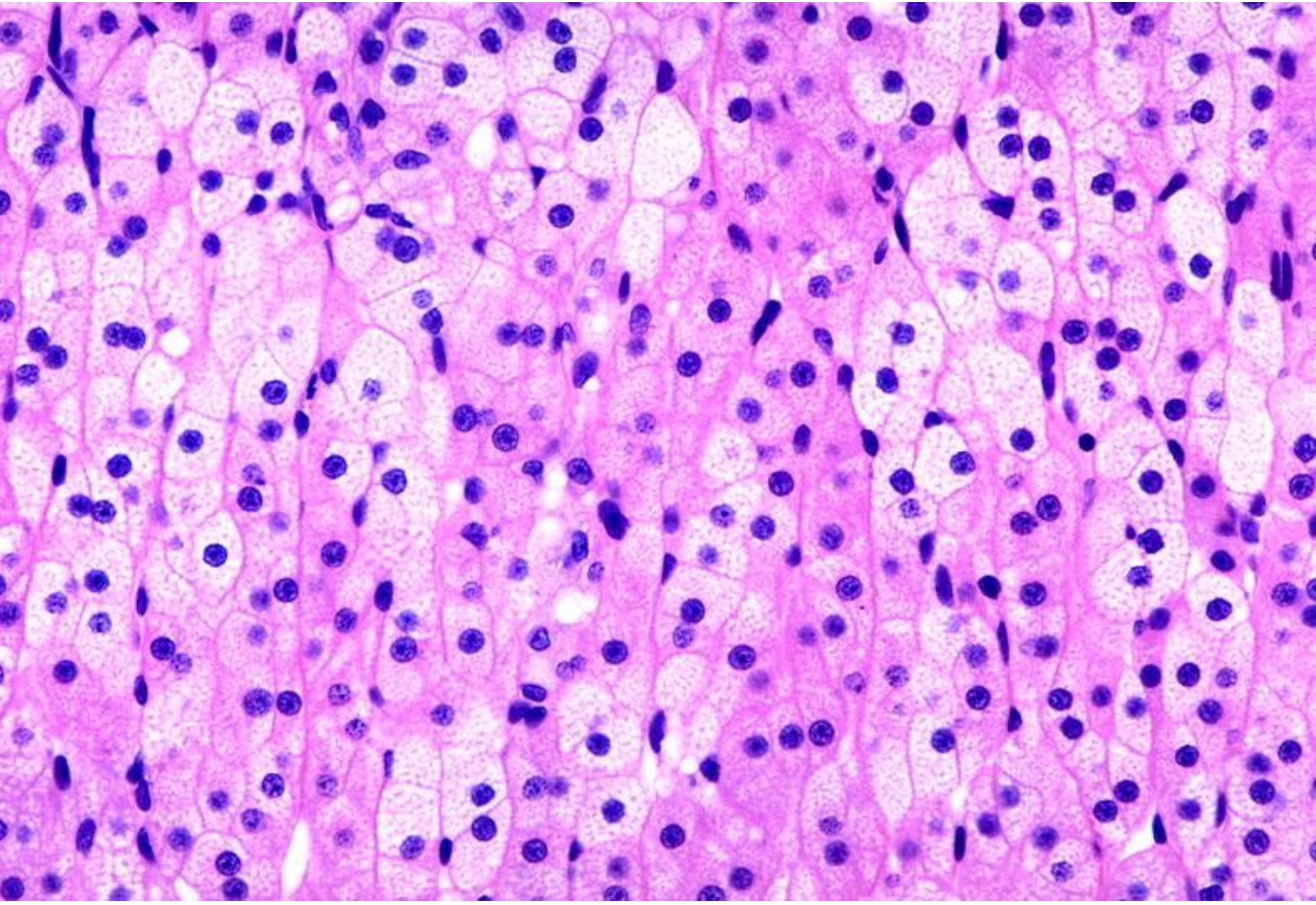

Zona Glomerulosa

Zona Fasciculata

- The thickest middle zone that form ~80% of the cortex.
- Cells are large polyhedral, arranged in long straight cords 1-2 cells thick.
- Cords are separated by sinusoidal capillaries.
- Cells are lightly stained, commonly binucleated.
- Cells are typical steroid synthesizing cells.
- Cytoplasm contains lipid droplets.
- Cells secrete glucocorticoids, mainly cortisol.







Zona reticularis

The inner zone, forms 5-7% of the cortex. Contains light and dark cells.

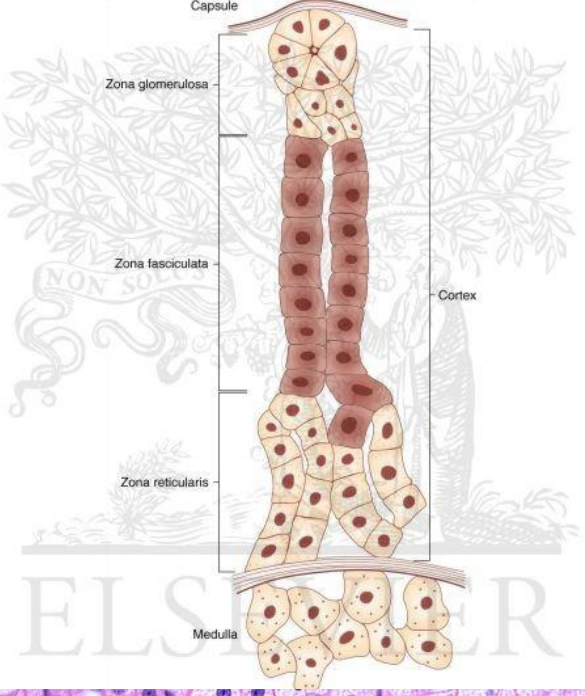
Cells are smaller than the reticularis, their nuclei are more deeply stained.

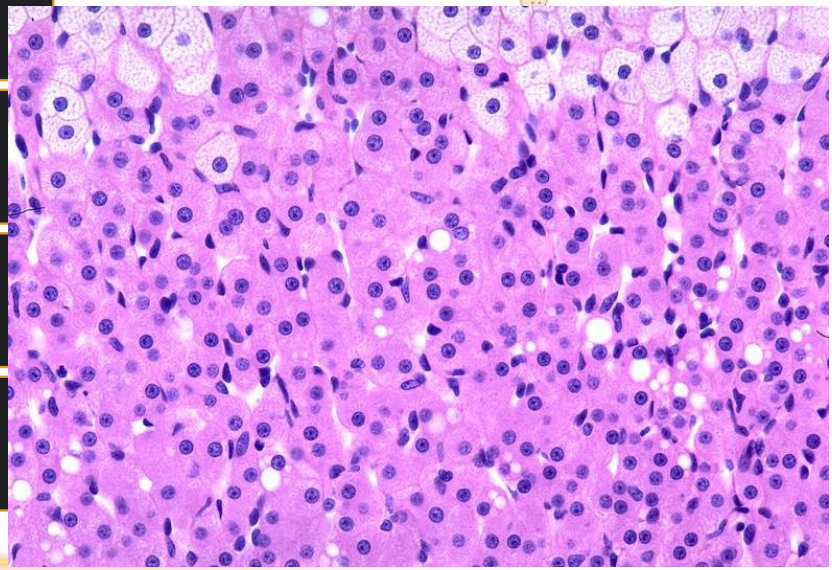
Cells are arranged in anastomosing cords separated by fenestrated capillaries.

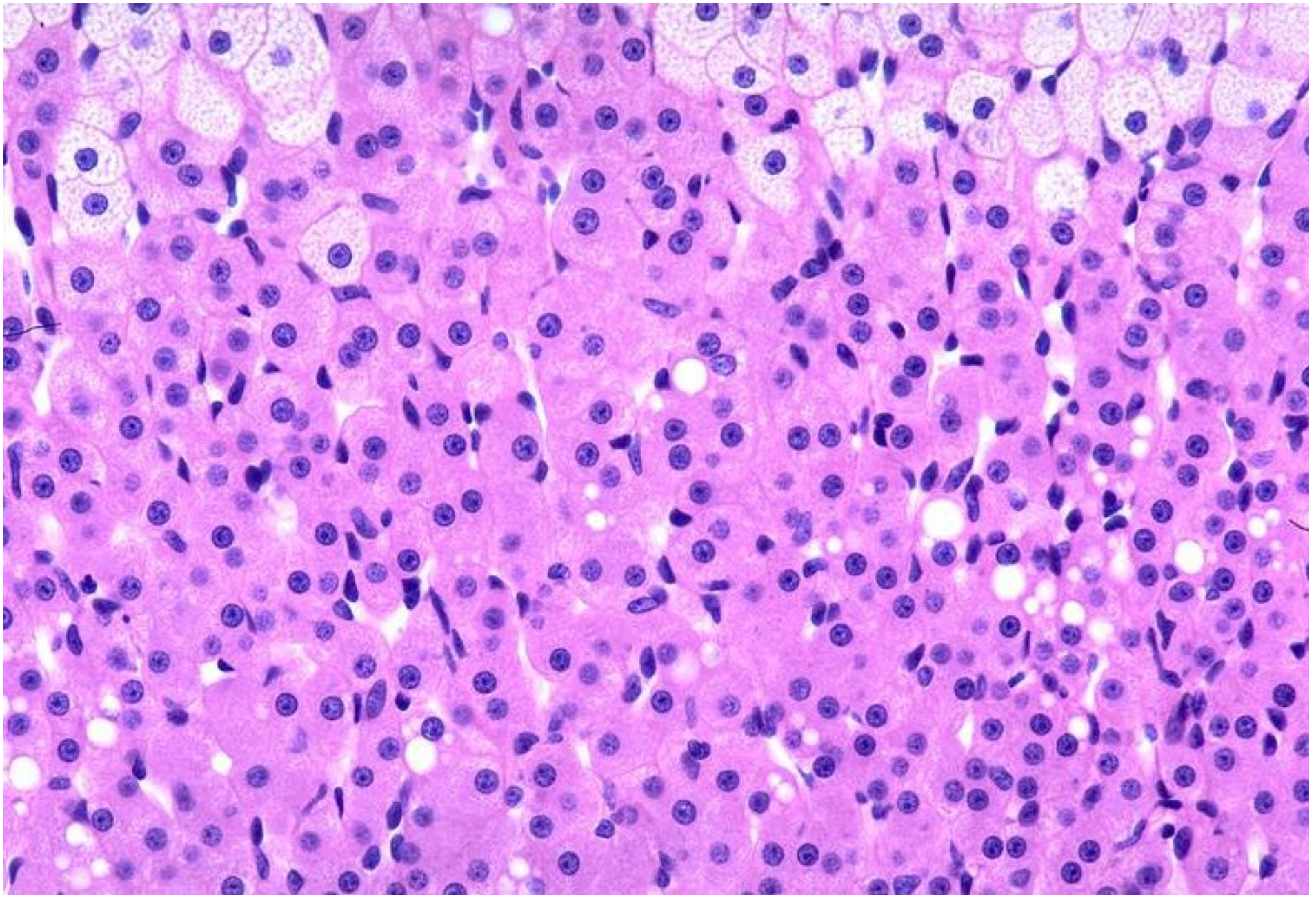
Cells have few lipid droplets.

Cells are typical steroid-secreting cells.

Their principal secretion is weak androgen (minimal glucocorticoids).





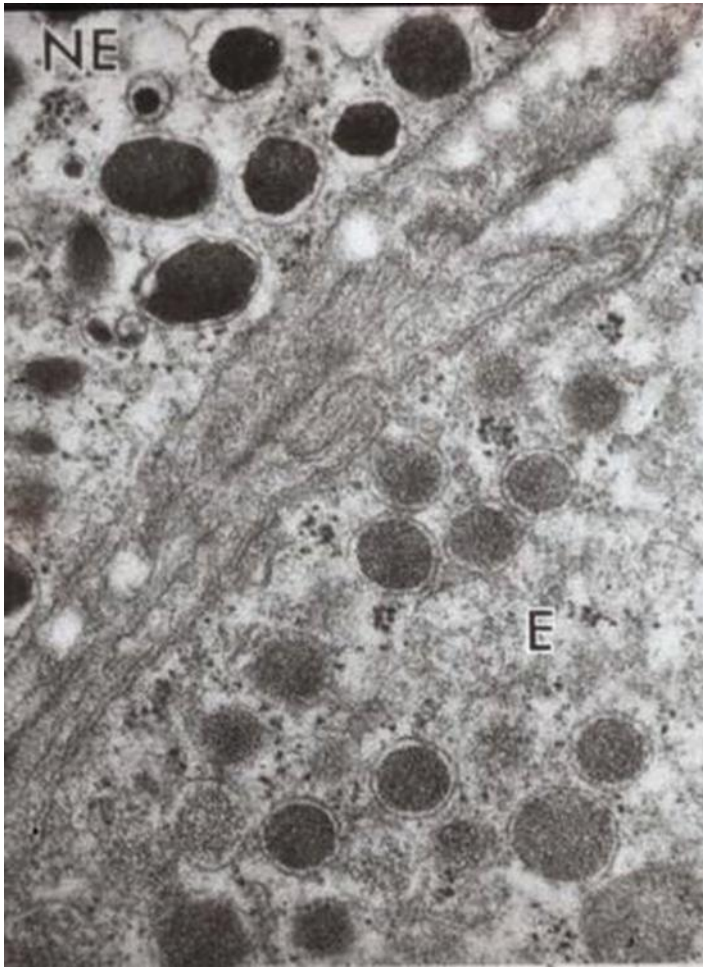


Adrenal medulla

Composed of large, pale staining epithelioid cells; chromaffin cells, connective tissue, sinusoidal capillaries and nerves.

The chromaffin cells are modified neurons.

Myelinated, presynaptic nerves pass directly to chromaffin cells.



Chromaffin cells

E.M shows that there are two types of chromaffin cells:

- Cells containing large dense core vesicles → secrete norepinephrine.
- Cells containing small homogeneous less dense vesicles → secrete epinephrine.