

# **ENDOCRINE**

# Objectives

- 1. To describe the gross structure of the pituitary gland and be able to identify the pars nervosa, pars intermedia and pars distalis.**
- 2. Identify and describe the histological features of the pars nervosa and pars distalis and be able to relate these features to the different modes of hormone secretion.**
- 3. Identify and describe the histological features of the thyroid and parathyroid glands.**
- 4. Identify and describe the histological features of the pancreatic Islets of Langerhans.**
- 5. Identify and describe the histological features of the adrenal gland; in particular the different regions of the adrenal cortex.**

# Pituitary gland (hypophysis)

At low magnification identify the main areas of the gland :

- A. **Pars tuberalis.**
- B. **Pars distalis.**
- C. **Pars intermedia.**
- D. **Pars nervosa.**

A,B,C form the anterior hypophysis  
(adenohypophysis).

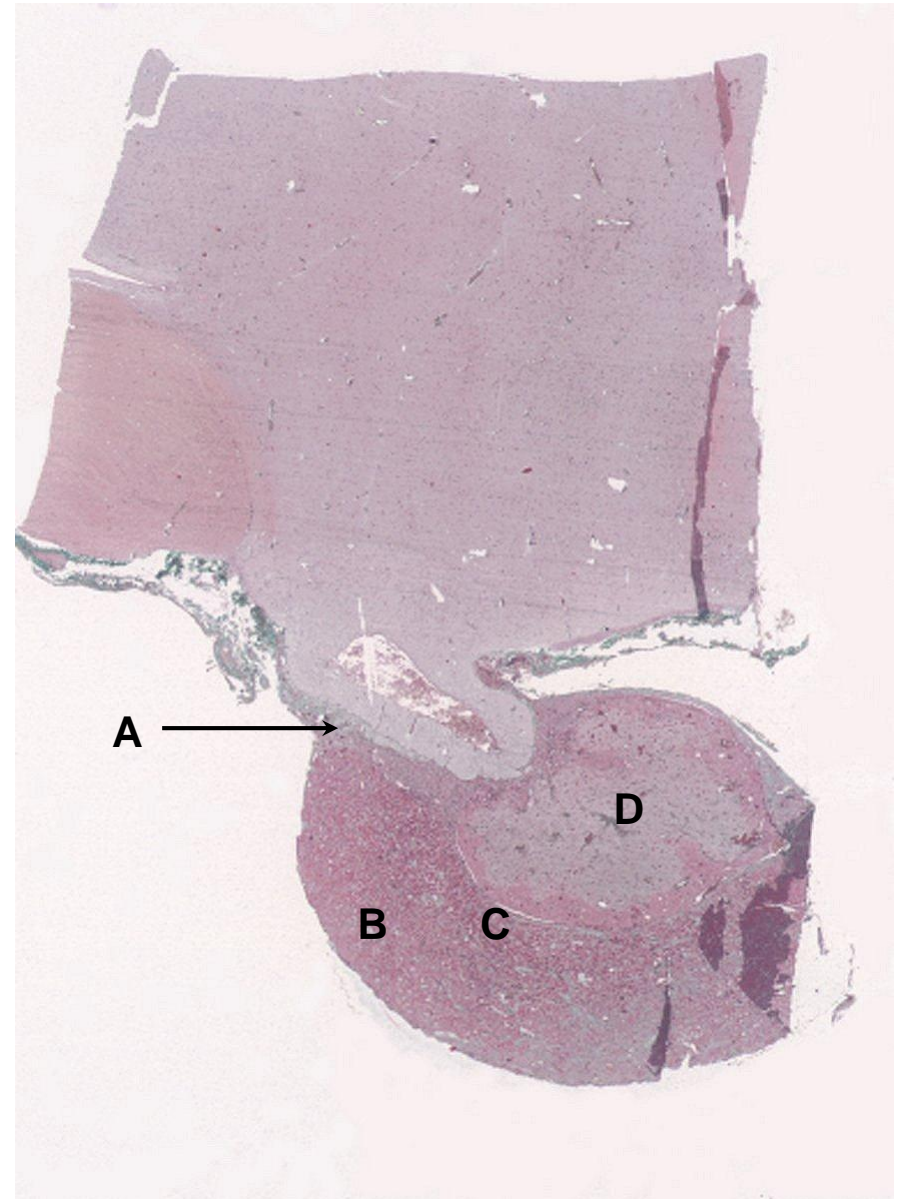
D forms the posterior hypophysis  
(neurohypophysis).

From what germ cell layers does :  
B develop?

**ectoderm.**

D develop?

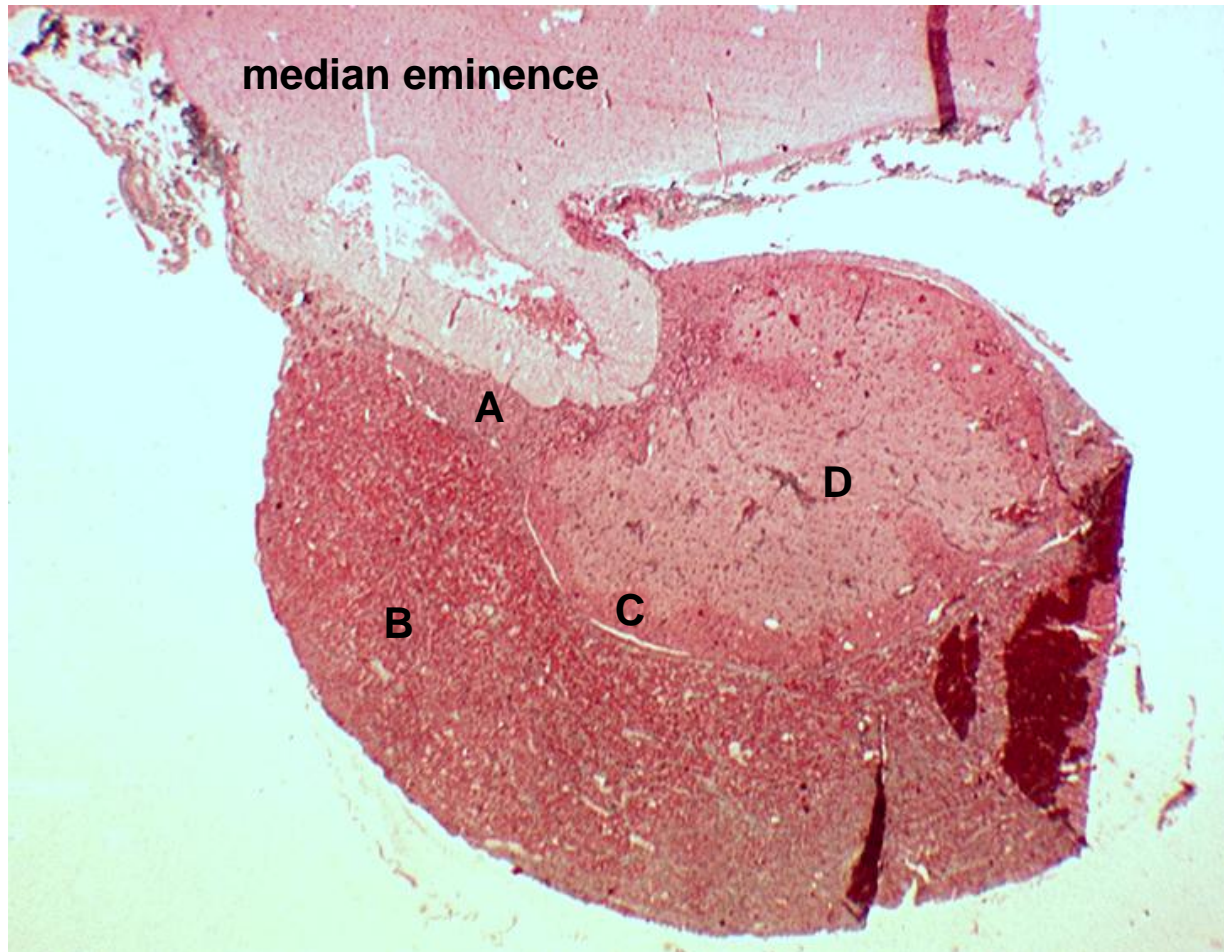
**neuro-ectoderm.**



# Pituitary gland (hypophysis)

What are the principal secretory products of B, C and D?

(The pars tuberalis contains secretory cells whose function is unknown).



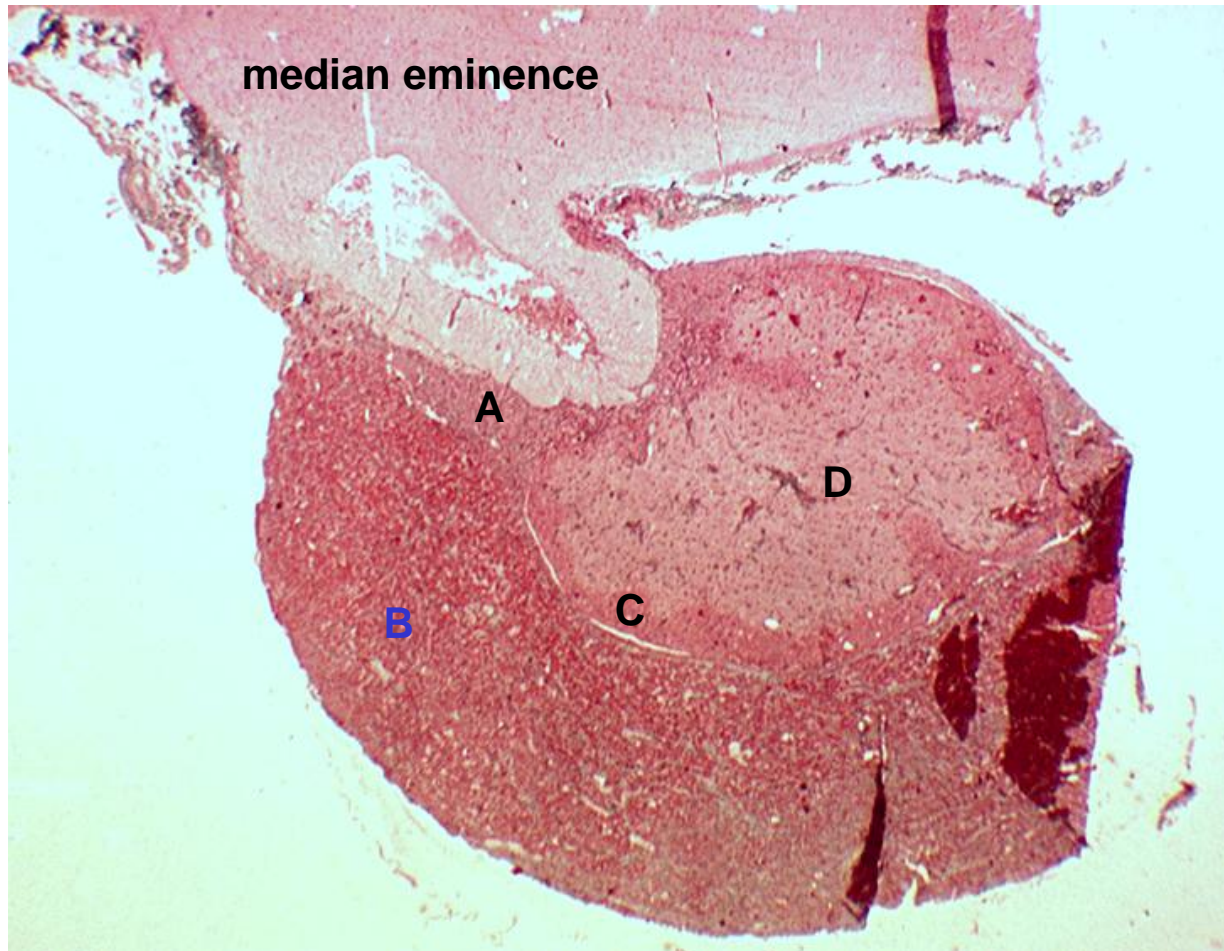
- A : pars tuberalis**
- B : pars distalis**
- C : pars intermedia**
- D : pars nervosa**

1.0 mm

# Pituitary gland (hypophysis)

What are the principal secretory products of B,C and D?

**B** : somatotropin, prolactin,  
FSH (follicle-stimulating hormone), LH (luteinizing hormone),  
TSH (thyroid-stimulating hormone), ACTH (adrenocorticotrophic hormone).



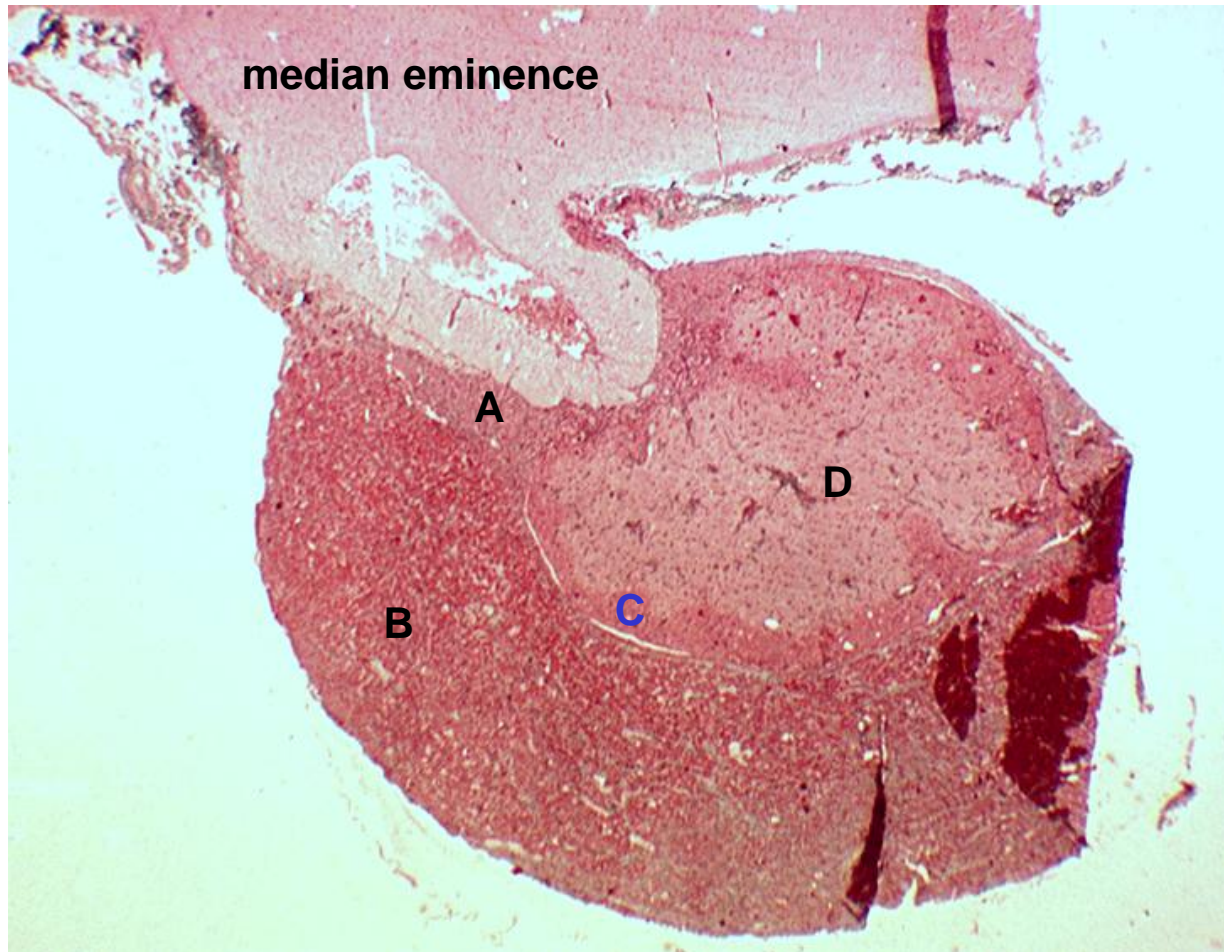
**A** : pars tuberalis  
**B** : pars distalis  
**C** : pars intermedia  
**D** : pars nervosa

1.0 mm

# Pituitary gland (hypophysis)

What are the principal secretory products of B,C and D?

**C : MSH (melanocyte-stimulating hormone).**



- A : pars tuberalis
- B : pars distalis
- C : pars intermedia
- D : pars nervosa

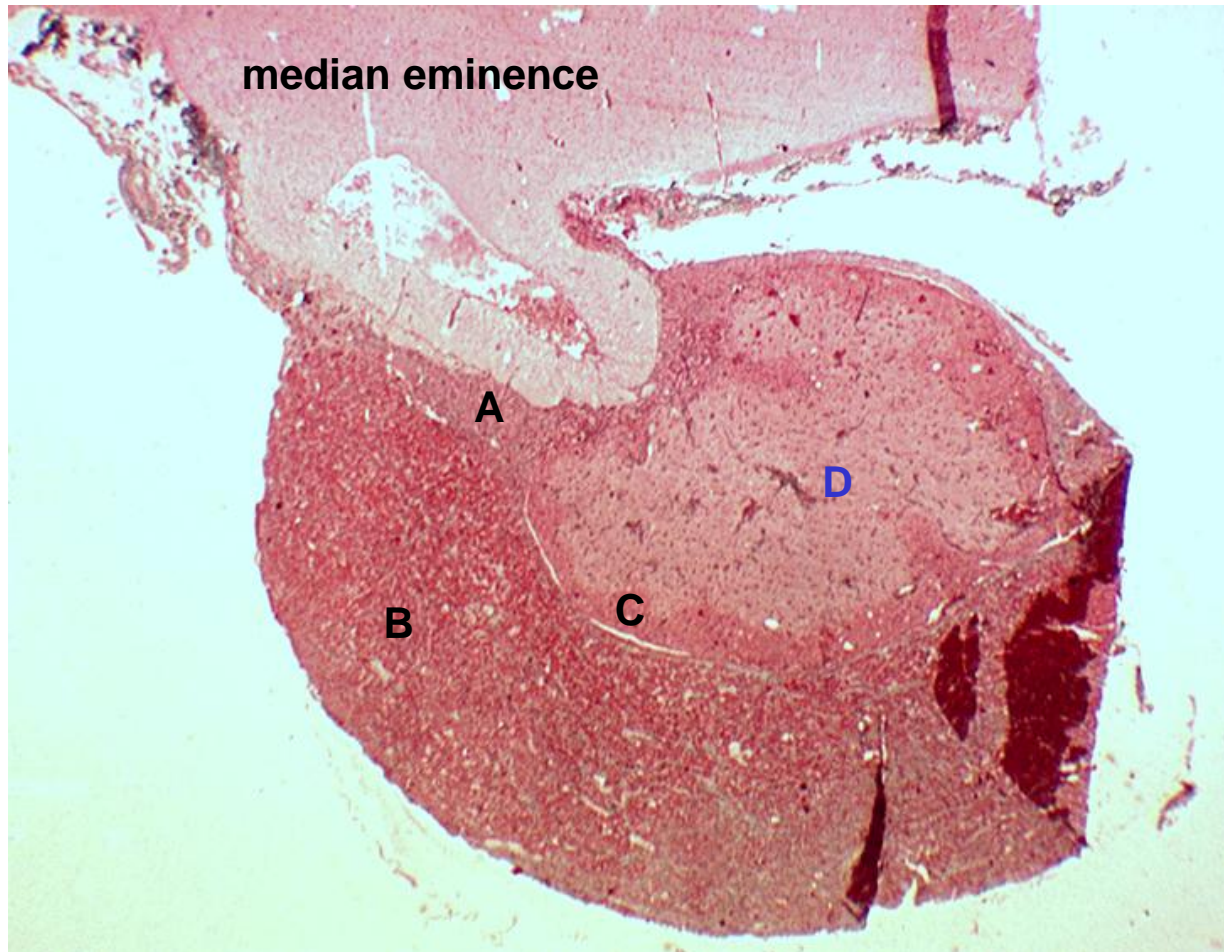
1.0 mm

# Pituitary gland (hypophysis)

What are the principal secretory products of B,C and D?

**D** : oxytocin,

**ADH** (antidiuretic hormone or vasopressin).



- A** : pars tuberalis
- B** : pars distalis
- C** : pars intermedia
- D** : pars nervosa

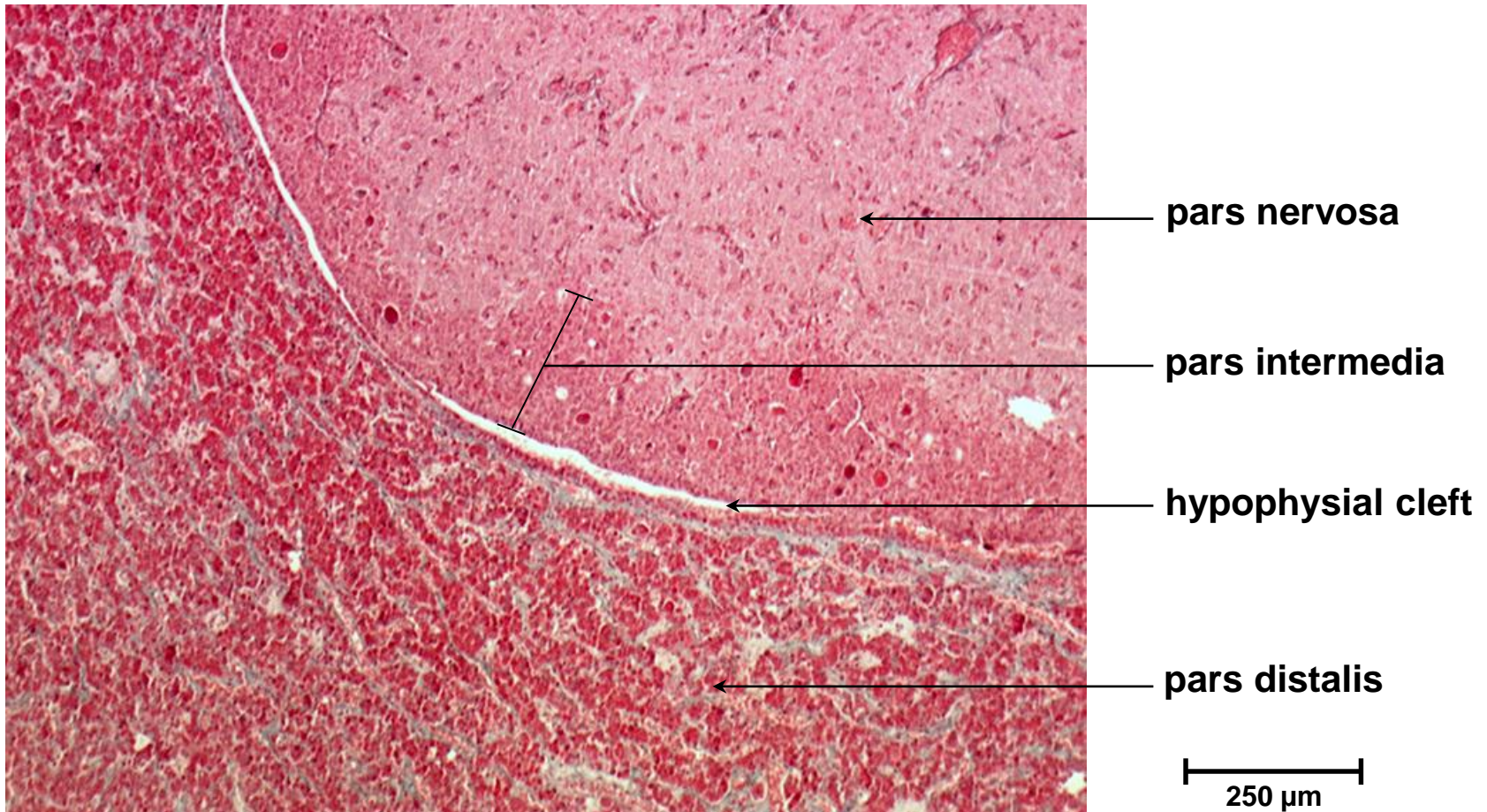
1.0 mm

# Pituitary gland (hypophysis)

The pars distalis is separated from the pars intermedia.

This space is the residual lumen of Rathke's pouch (from which the anterior hypophysis develops) and is called the hypophysial cleft.

The pars nervosa lies next to the pars intermedia.





# Pituitary gland (hypophysis)

Area of the pars distalis, identify :

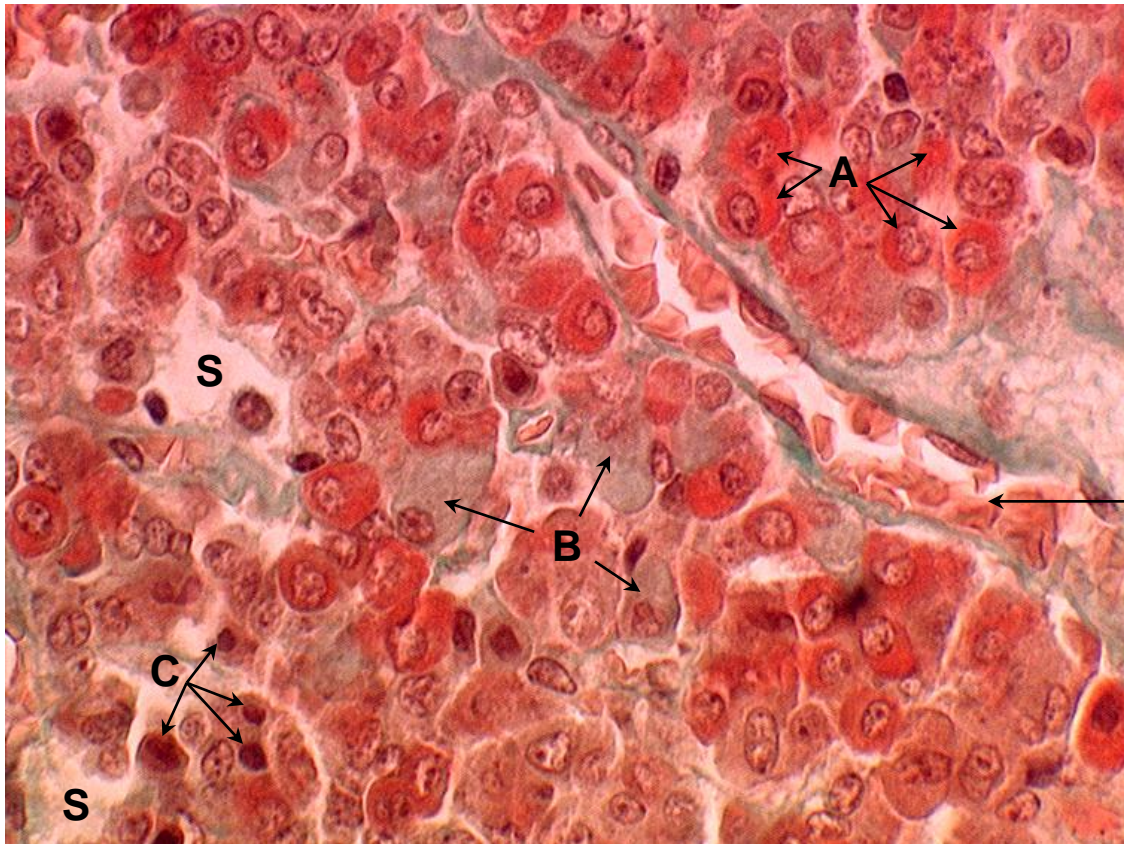
chromophilic cells

a). acidophils (staining red).

b). Basophils (pale-blue staining).

chromophobes

seen as clusters of nuclei.



A : acidophils

B : basophils

C : chromophobes

S : sinusoid

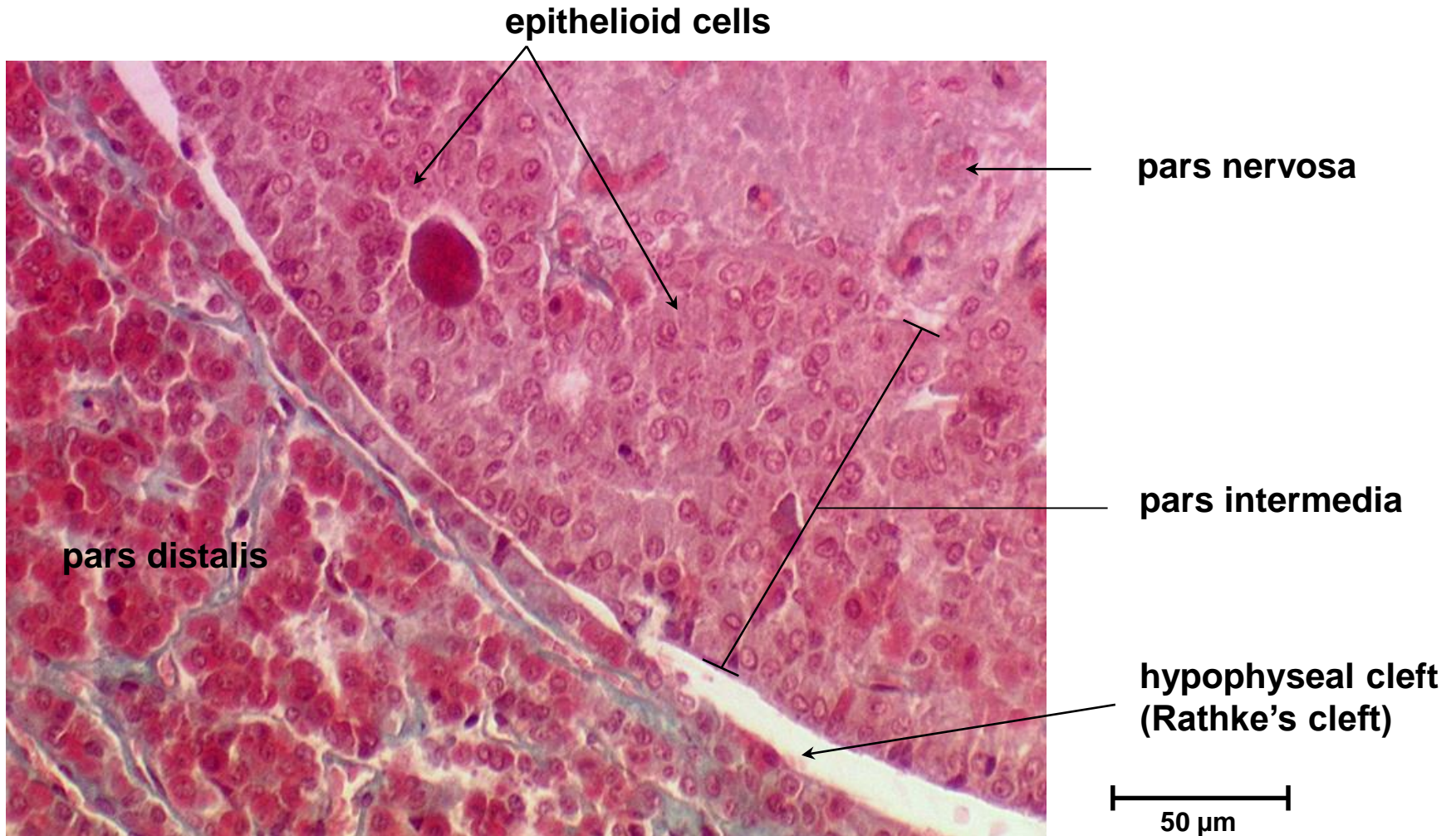
blood vessel

25  $\mu$ m

# Pituitary gland (hypophysis)

Area of the pars intermedia, identify :

epithelioid cells

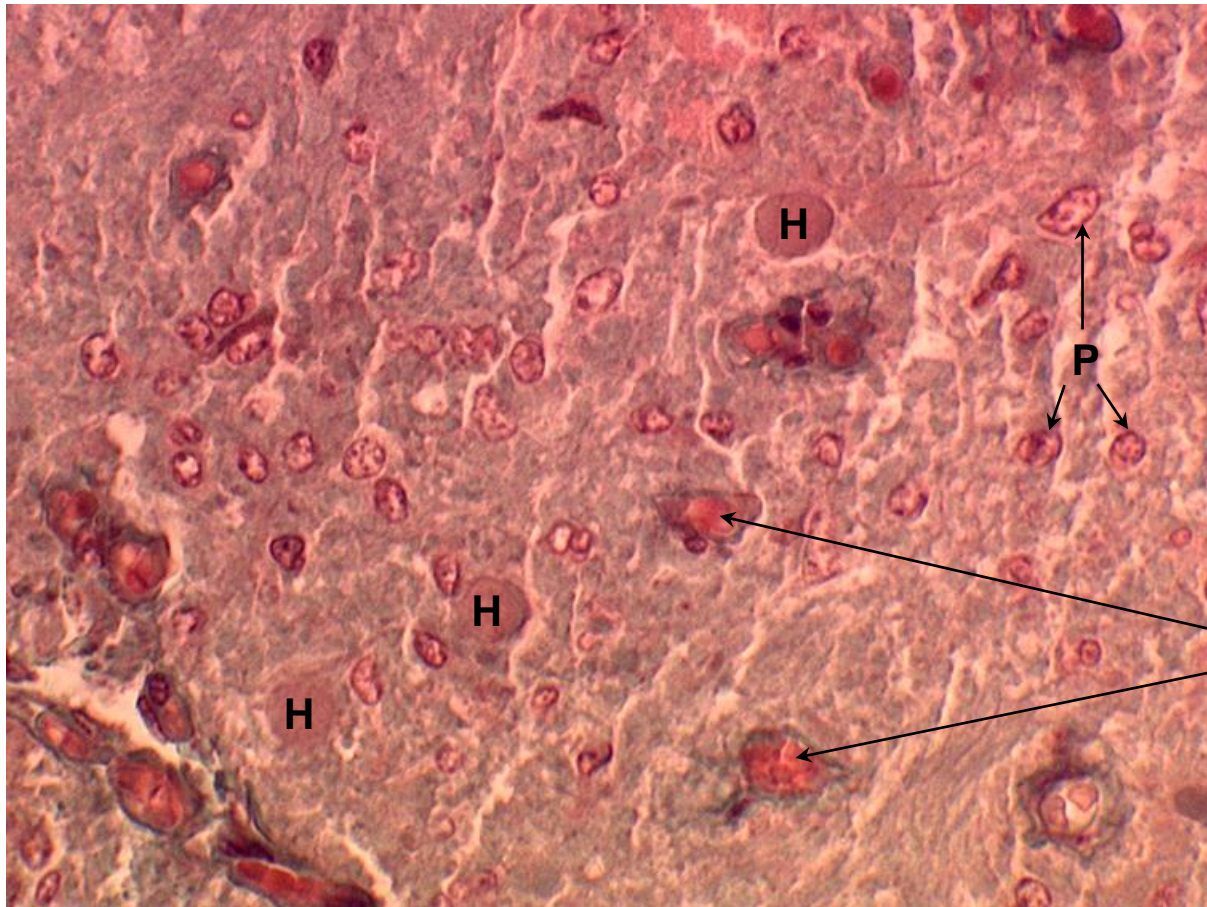


# Pituitary gland (hypophysis)

Area of the neurohypophysis, the pars nervosa.

Identify : pituicytes (neuroglia-like cells).

Herring bodies.



H : Herring bodies

P : pituicytes

blood vessels

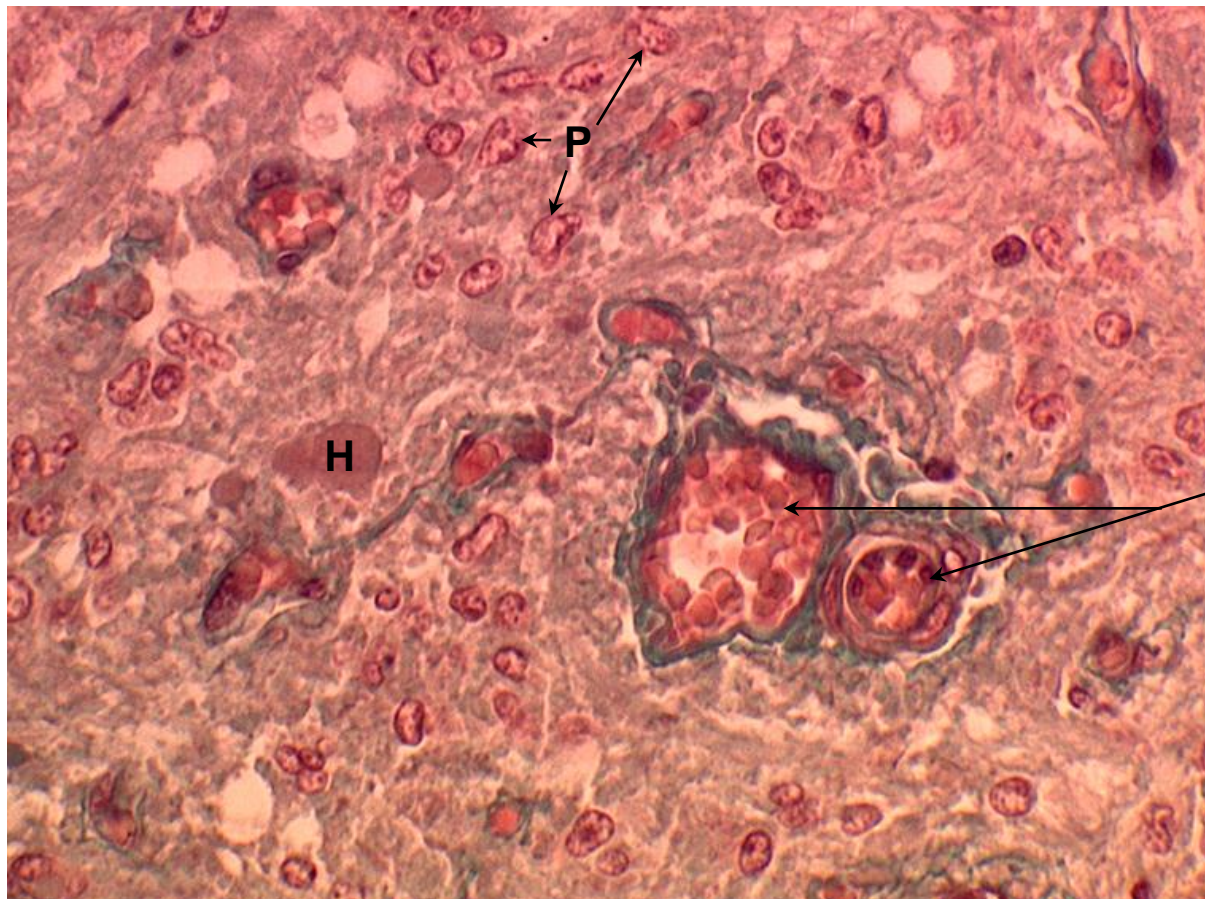
25  $\mu$ m

# Pituitary gland (hypophysis)

What are Herring bodies?

**Accumulations of neurosecretions at the terminal regions of nerve fibres.**

Note the rich vasculature of this region.



**H : Herring bodies**

**P : pituicytes**

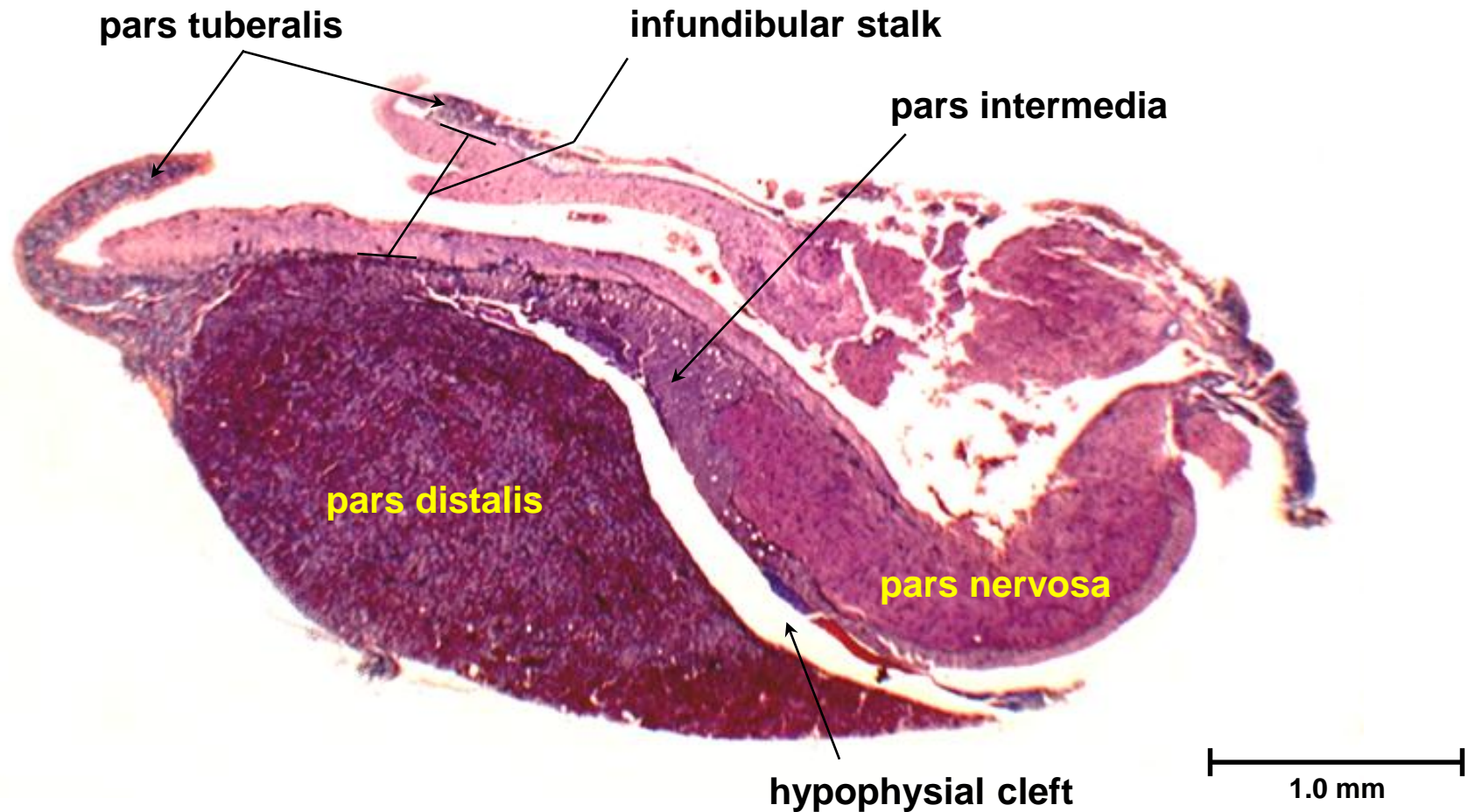
**blood vessels**

25  $\mu$ m

# Pituitary gland (hypophysis)

This section has been stained to show the chromophils and chromophobes of the pars distalis.

Identify the main areas at this low magnification.

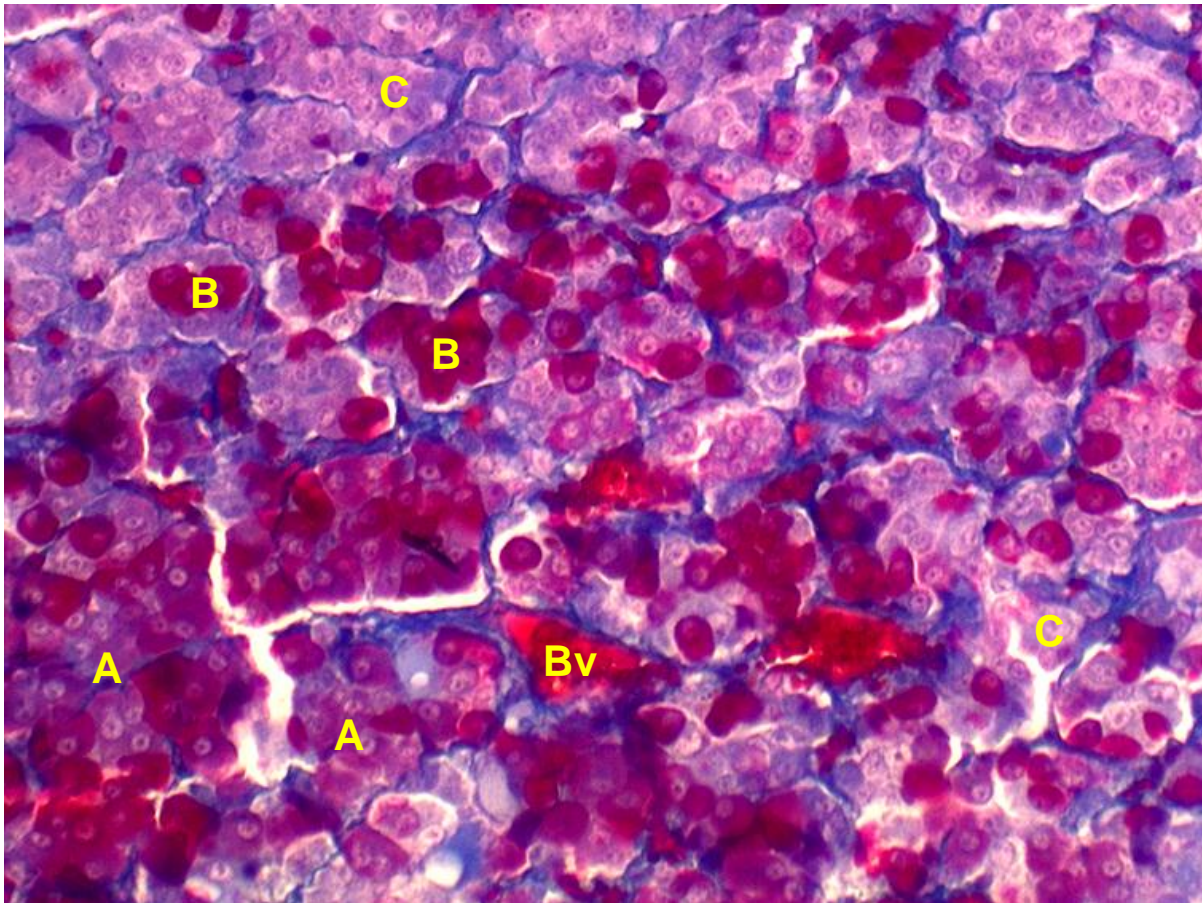


# Pituitary gland (hypophysis)

Pars distalis :

The chromophils have stained well, the acidophils staining pink and the basophils staining deep pink to purple.

The chromophobes remain poorly stained .

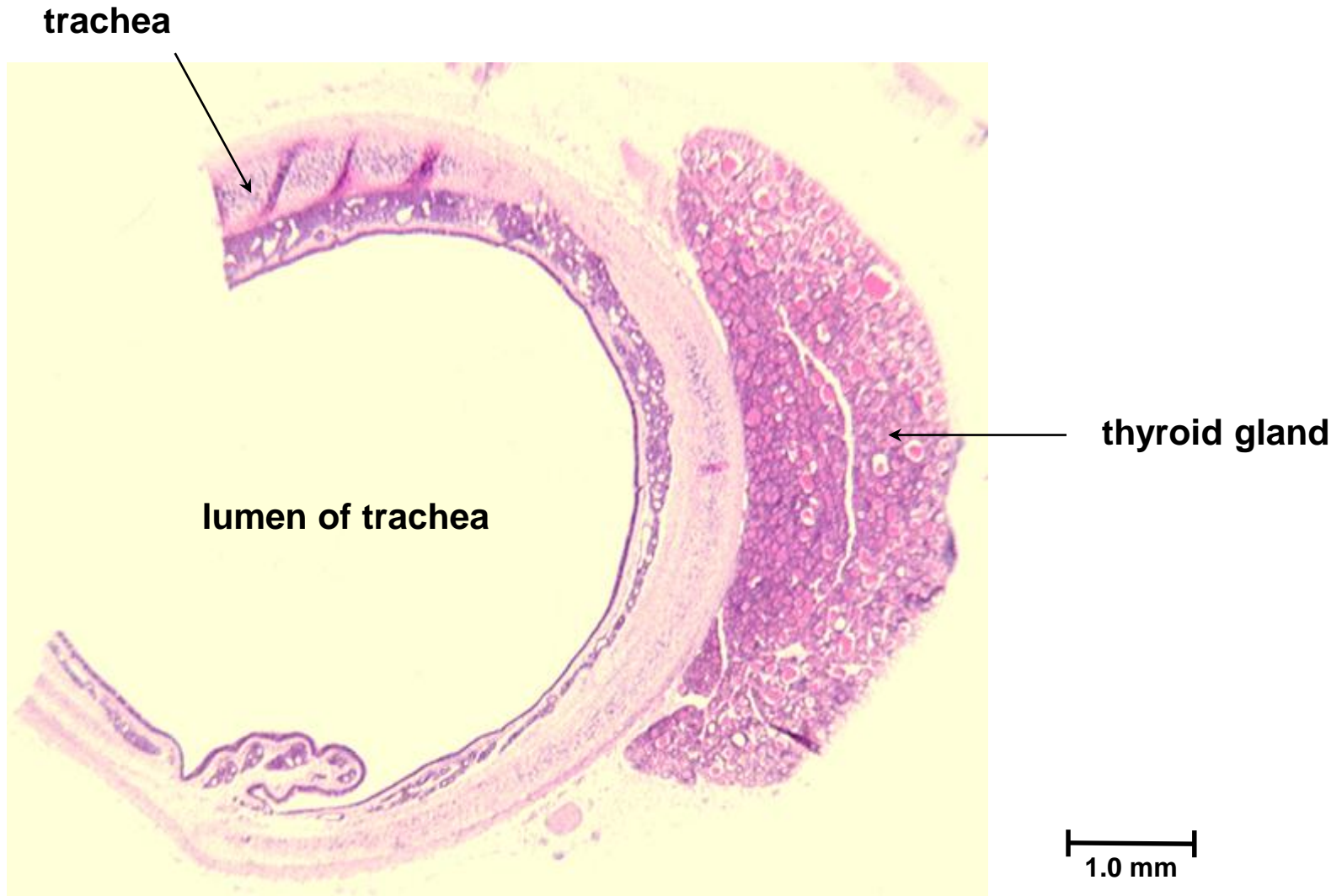


A : acidophils  
B : basophils  
C : chromophobes  
Bv : blood vessels

25  $\mu$ m

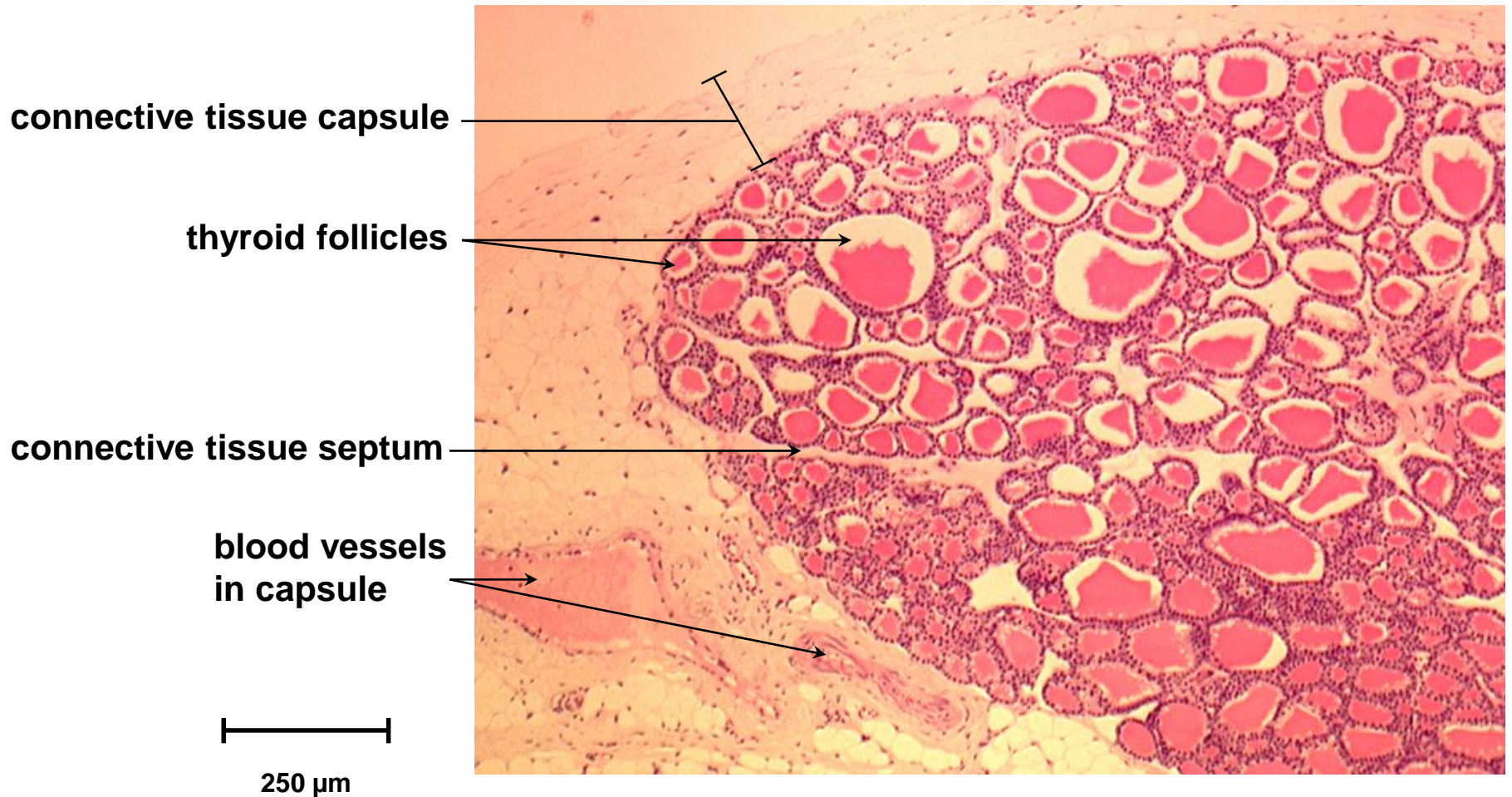
# Thyroid gland

Whole section viewed under low power.



# Thyroid gland

Note the different sized follicles and the connective tissue capsule surrounding the gland. Connective tissue septa or trabeculae divide the gland into lobes.





# Thyroid gland

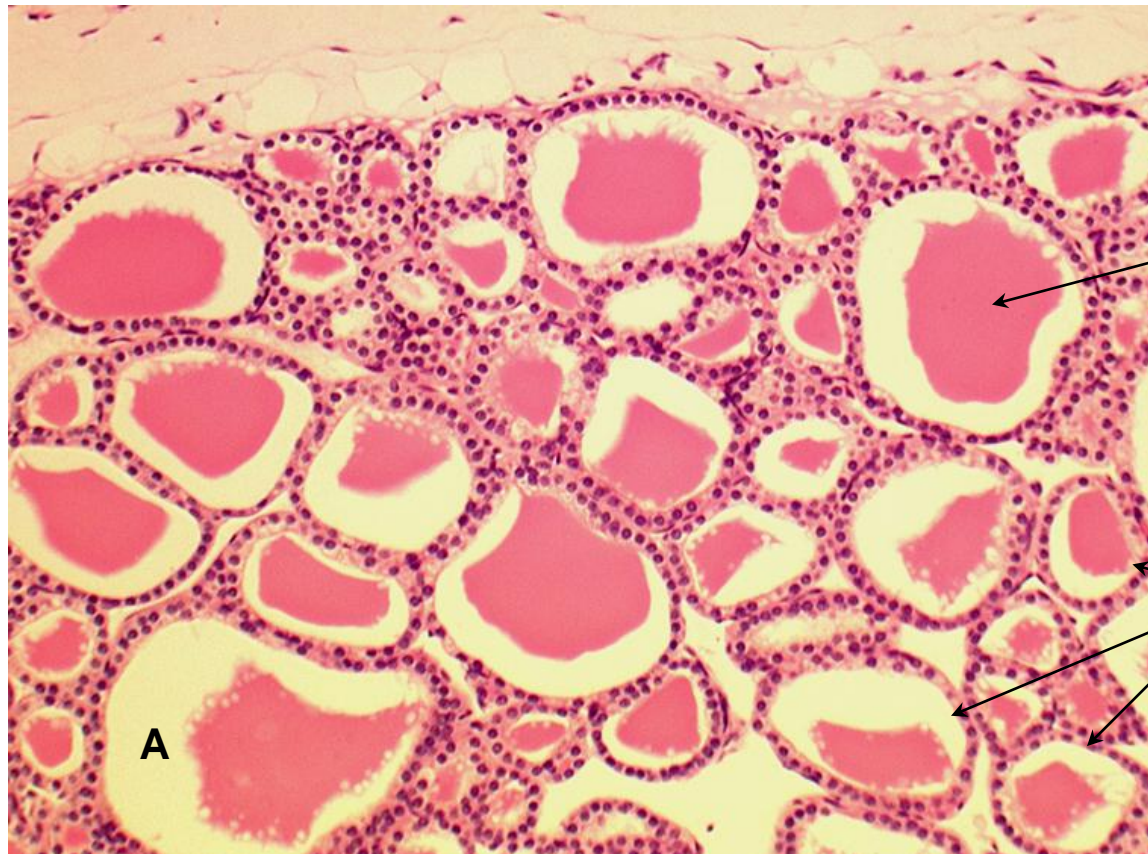
Thyroid viewed at higher power.

What substance fills each follicle?

**Colloid; a suspension of iodinated thyroglobulin.**

What is its function?

**Thyroglobulin is the storage form of thyroid hormones T3 and T4.**



thyroid colloid  
the colloid fills the follicles  
space artefacts occur  
during histological fixation  
A : artefact

thyroid follicles

100  $\mu$ m

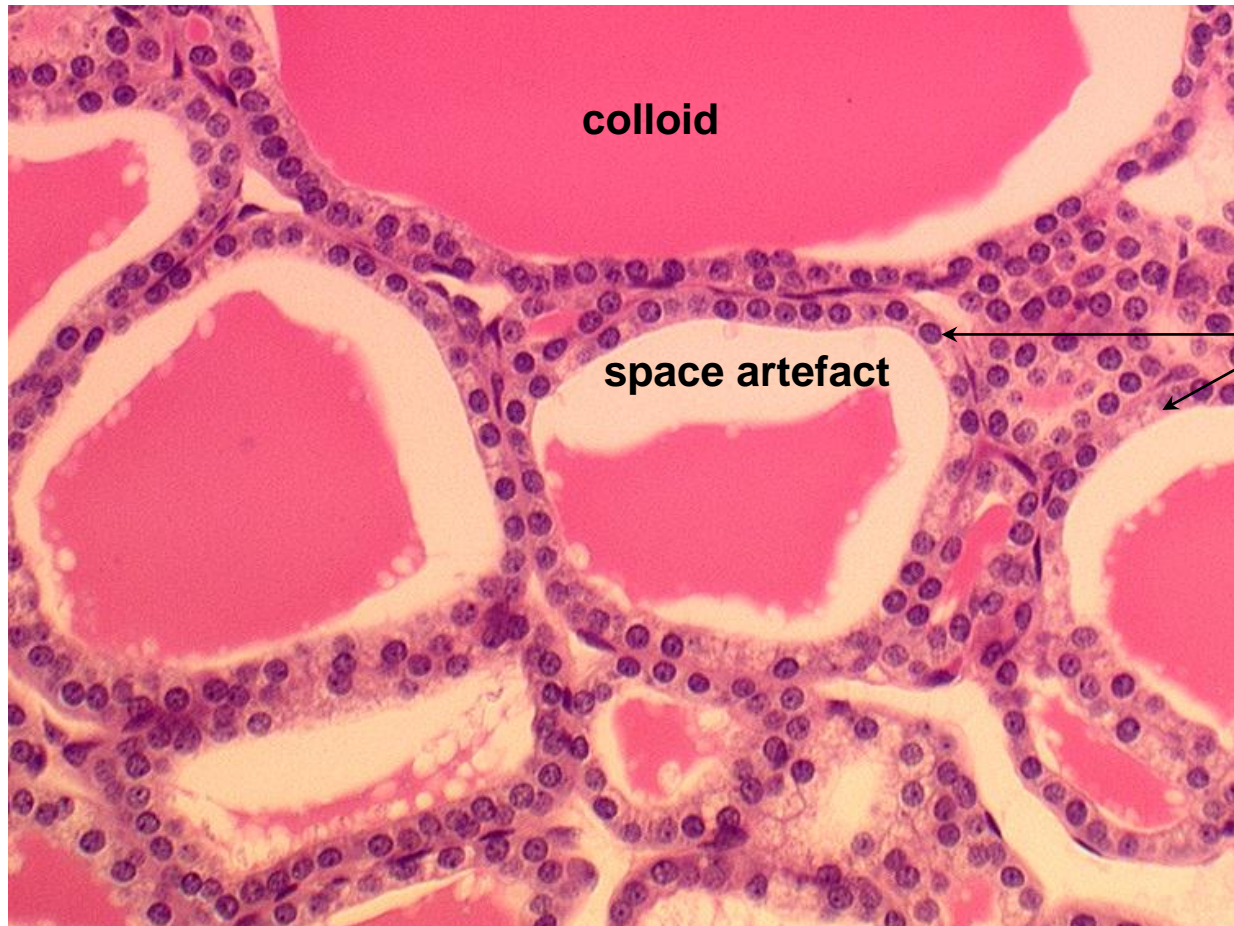
# Thyroid gland

Thyroid viewed at high power.

What changes would be evident in a thyroid follicle under TSH stimulation?

**The follicles would be smaller with less colloid.**

**The cuboidal lining cells are taller, indicating active hormone synthesis and secretion.**



cuboidal epithelium  
lining follicles

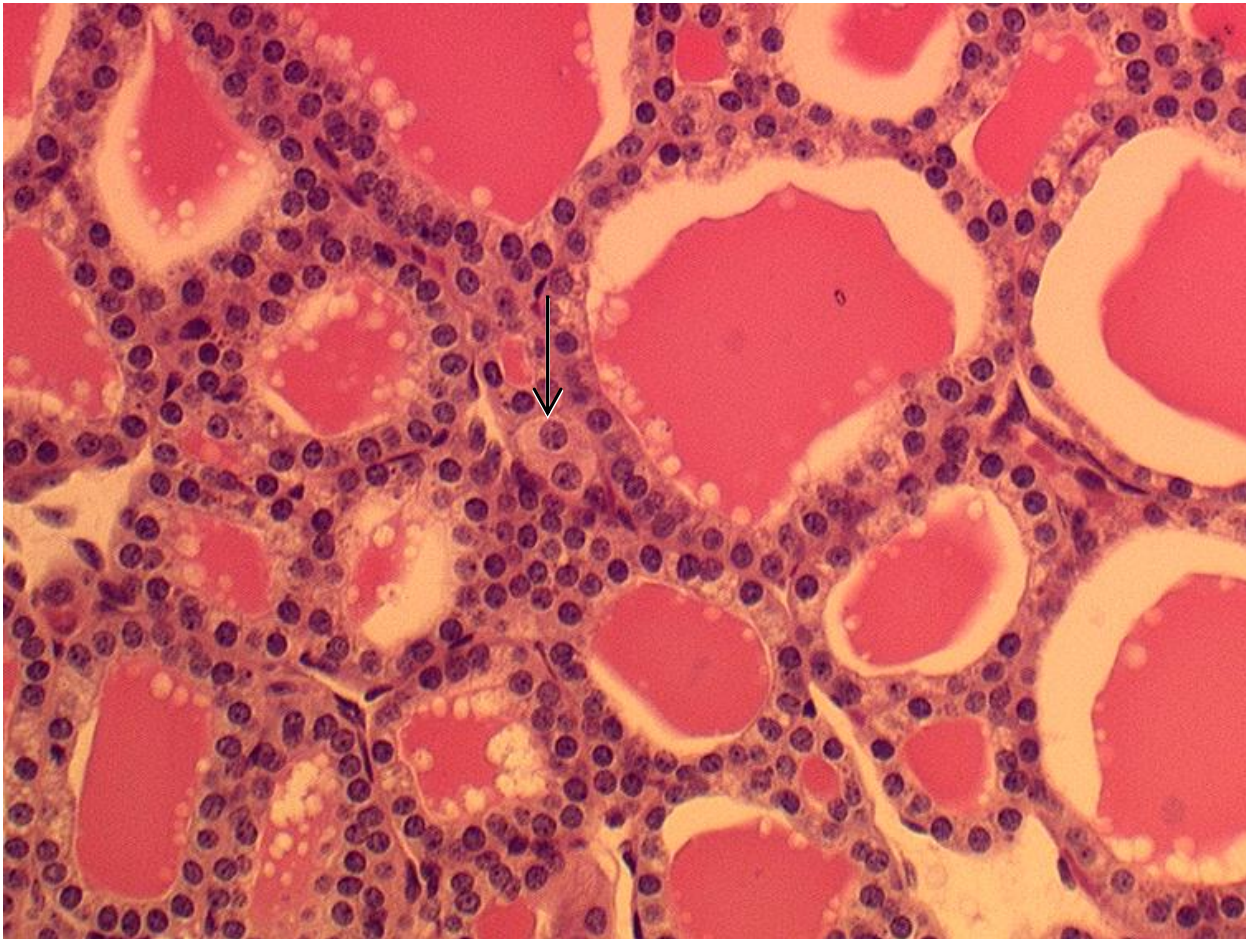
Follicles in an inactive thyroid are larger, filled with stored thyroid colloid and have a more flattened less active epithelium.

50 μm

# Thyroid gland

Where are 'C' cells located?

**C cells also called parafollicular cells are derived from the neural crest; they occur singly amongst the follicle cells or more usually are found in small groups between the follicles.**



**C cells arrowed**

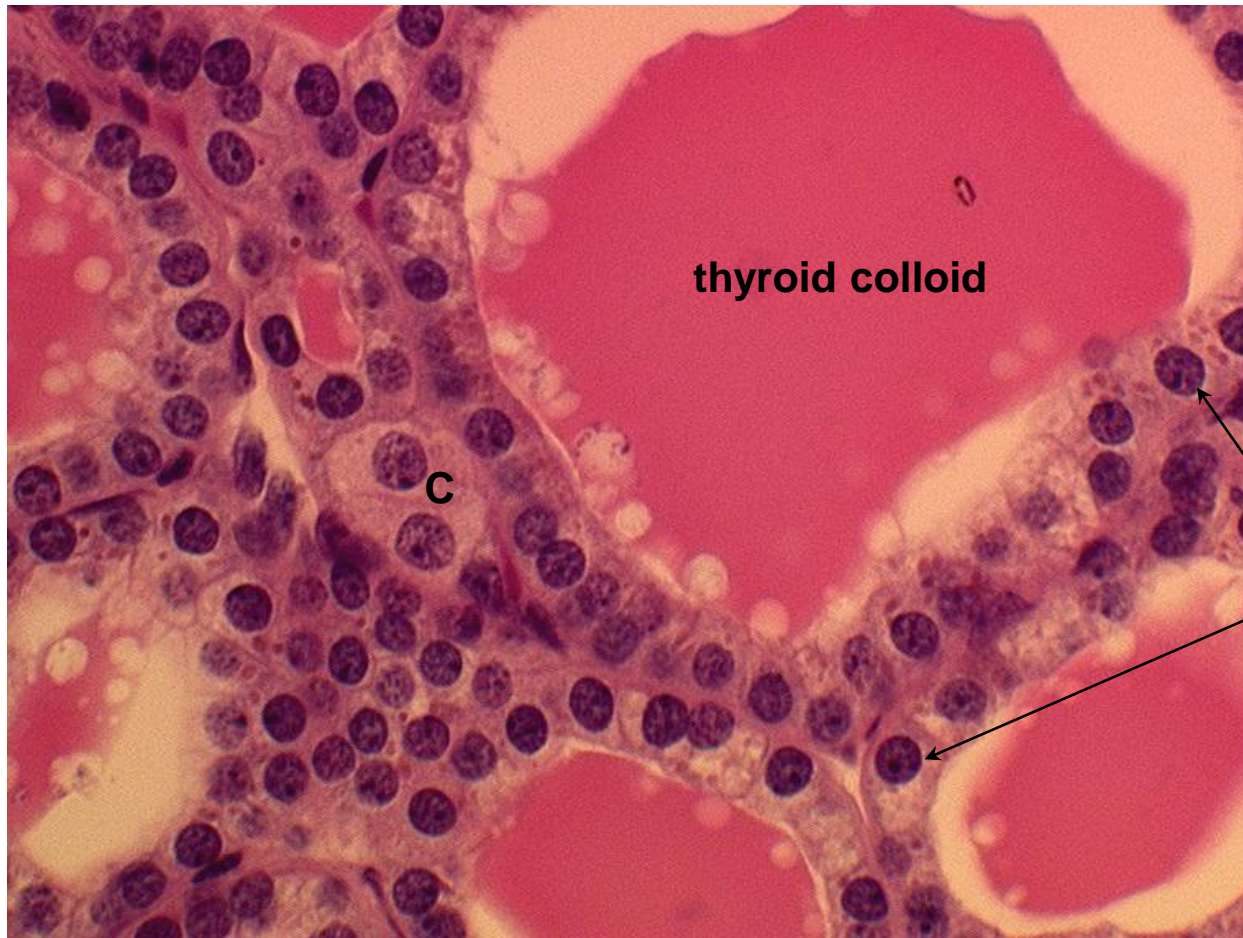
50  $\mu$ m

# Thyroid gland

What is the secretory product of C cells?

**Calcitonin : Secreted in response to high levels of blood calcium.**

**It lowers these levels by reducing the resorption of bone.**



thyroid colloid

C : C cells

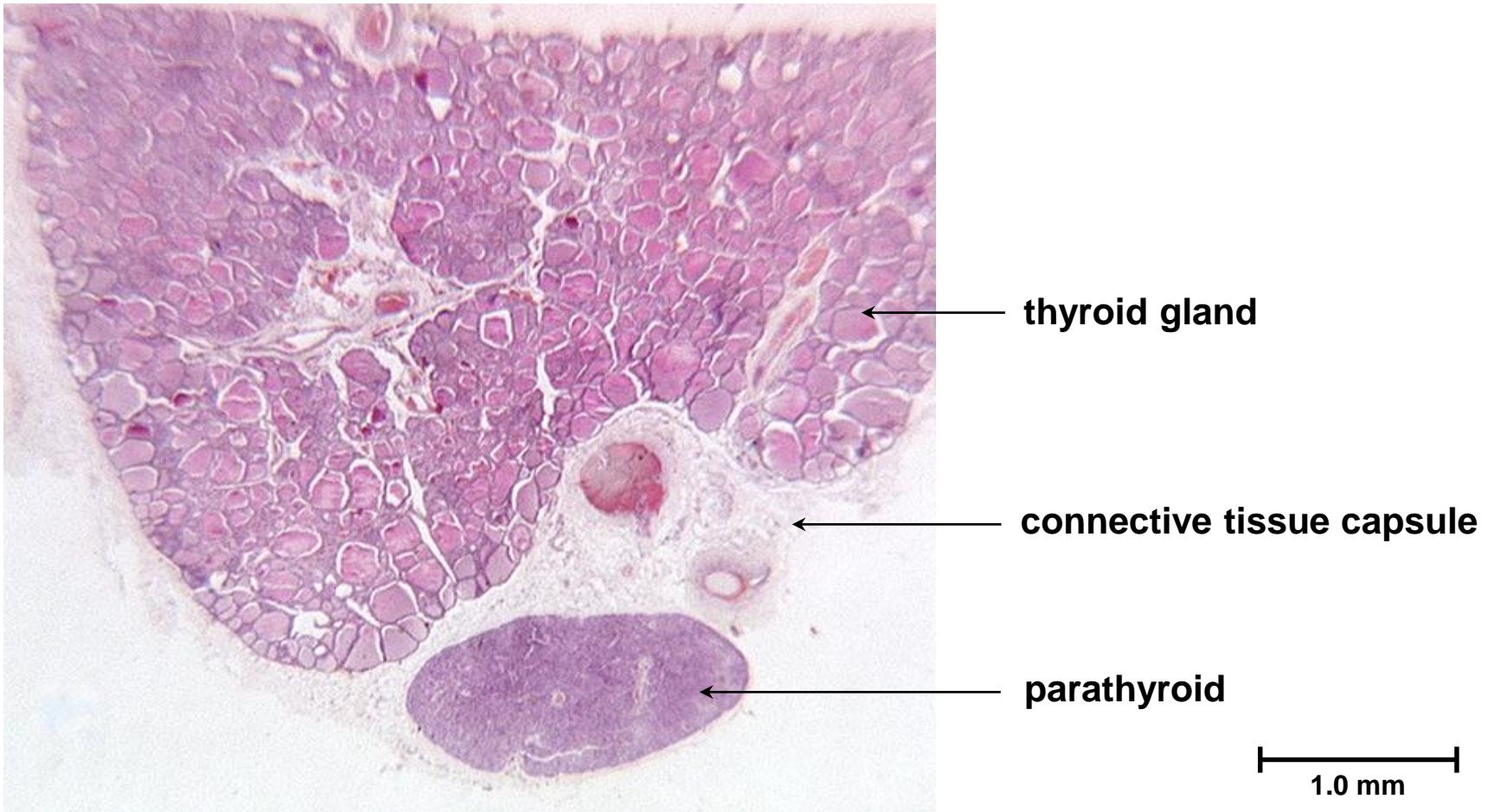
C

cuboidal follicular cells

25  $\mu$ m

# Parathyroid glands

At low magnification note that these glands lie within the capsule of the thyroid.

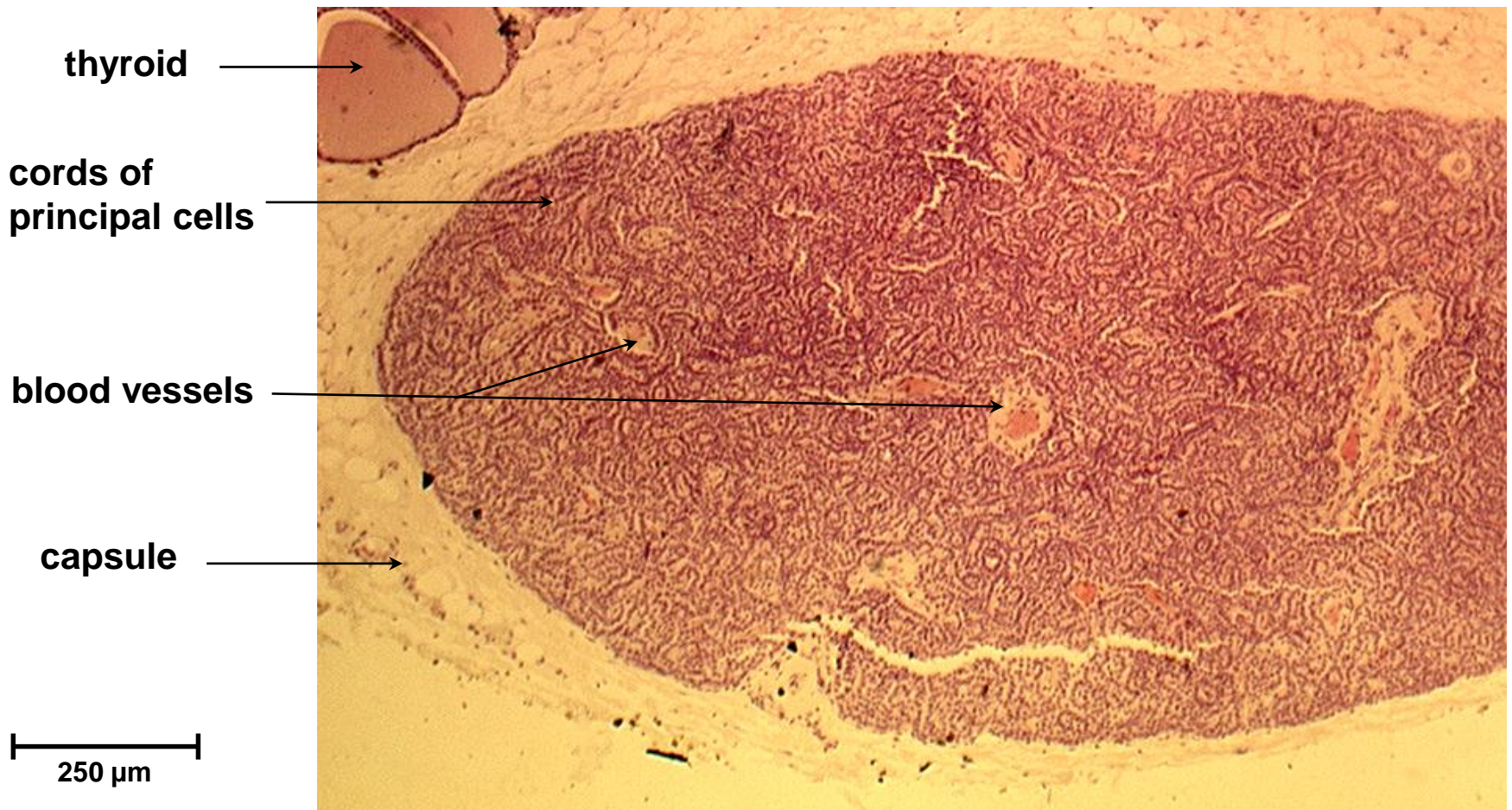


# Parathyroid glands

The parenchymal cells form cords and are highly vascularised.

What is the main cell type present in this gland?

**Principal cells (chief cells).**



# Parathyroid glands

What do the principal cells produce?

**Parathyroid hormone (PTH).**

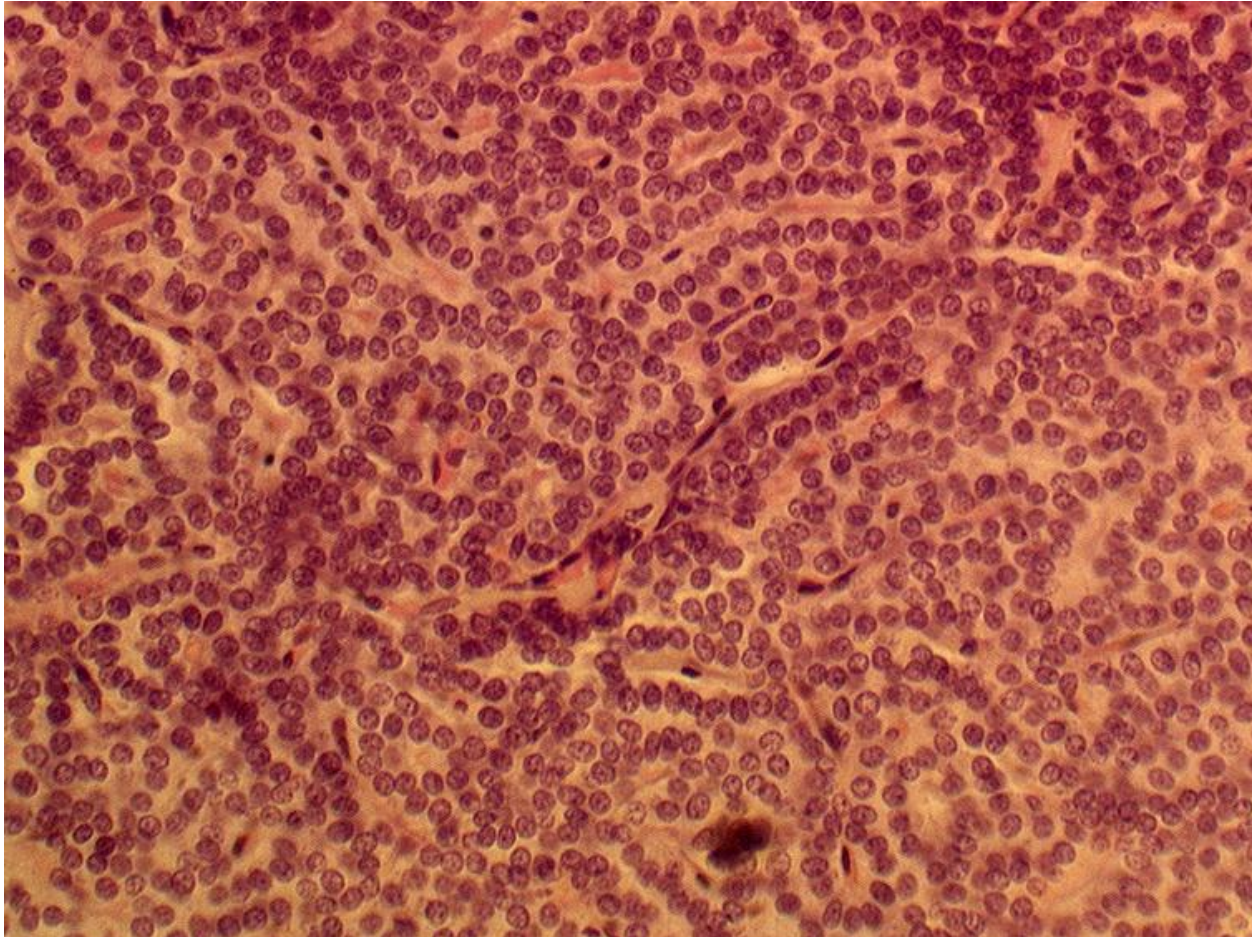


# Parathyroid glands

What conditions would result in the release of this hormone?

**Low blood calcium levels.**

Parathyroid hormone (PTH) raises blood calcium levels by increasing calcium absorption from the gut (diet) and from bone. It also decreases renal calcium excretion.



active principal cells  
stain darkly,

inactive cells are  
lighter staining.

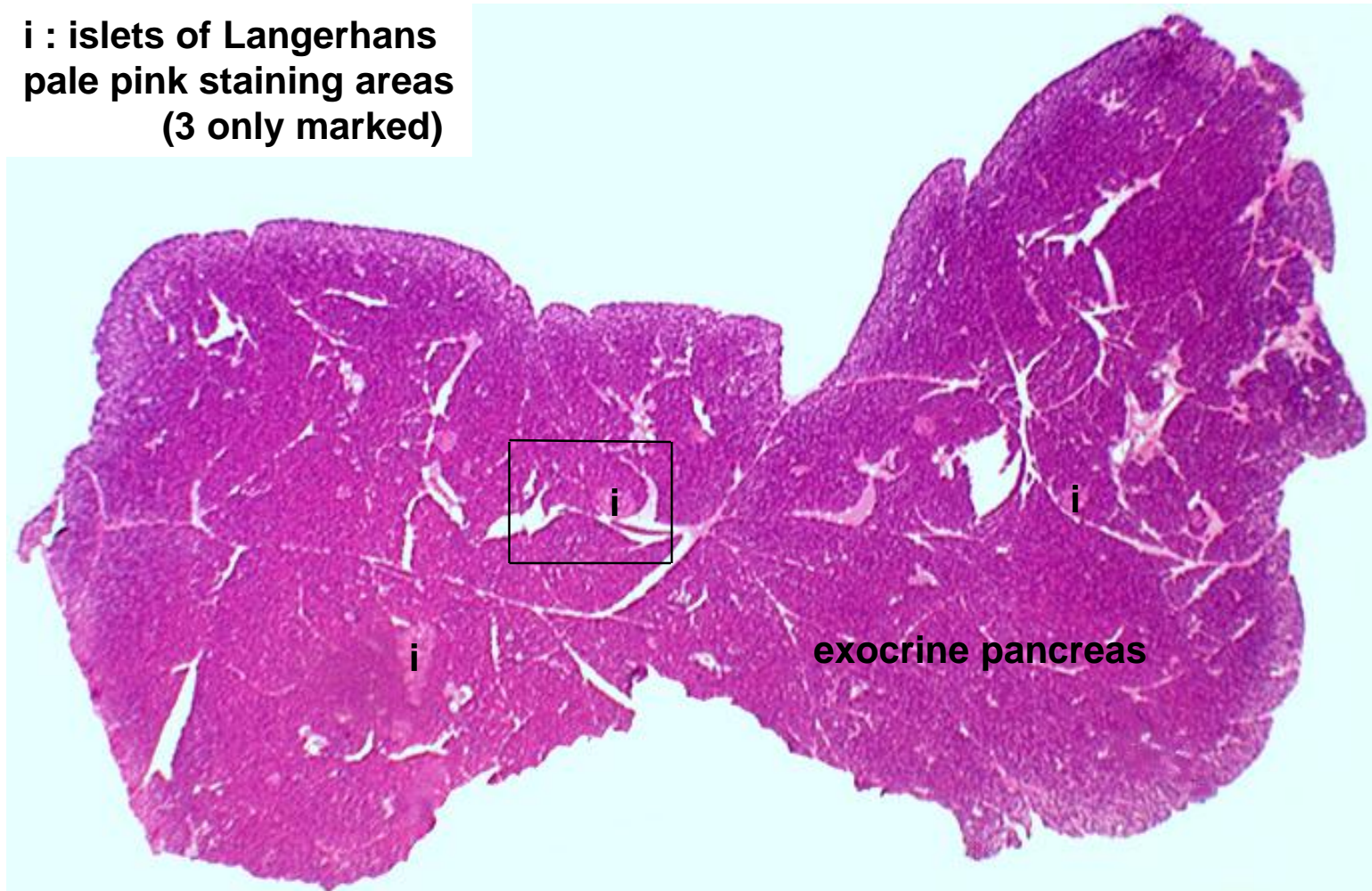
50  $\mu$ m



# Pancreas (H and E stain)

At low magnification identify and locate the Islets of Langerhans in the pancreas.

**i** : islets of Langerhans  
pale pink staining areas  
(3 only marked)

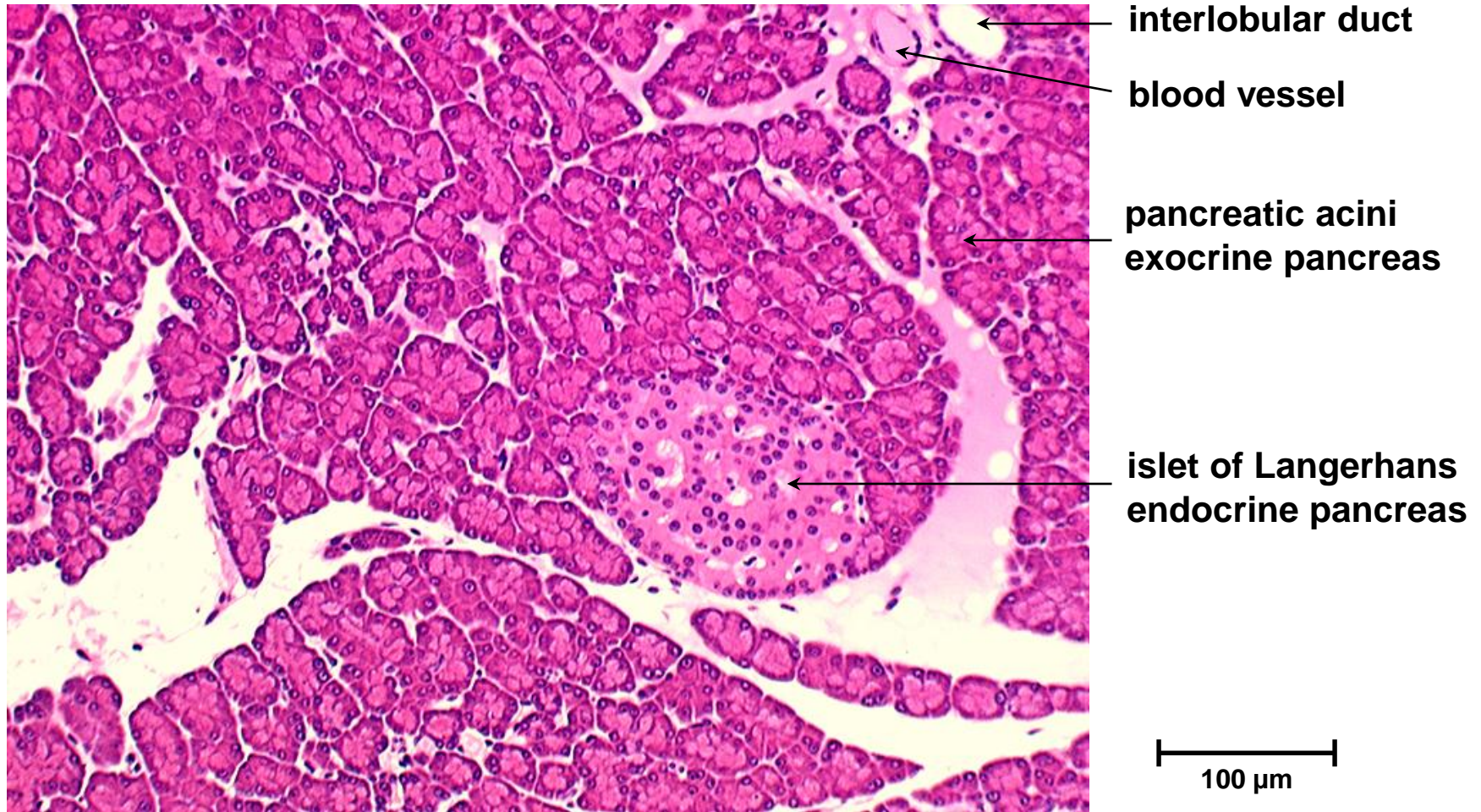


0.5 mm

# Pancreas (H and E stain)

With Haematoxylin and eosin the acini of the exocrine pancreas stain darker, with the basal portions of the cells staining stronger with the haematoxylin.

The islets of langerhans stain pale pink by comparison.

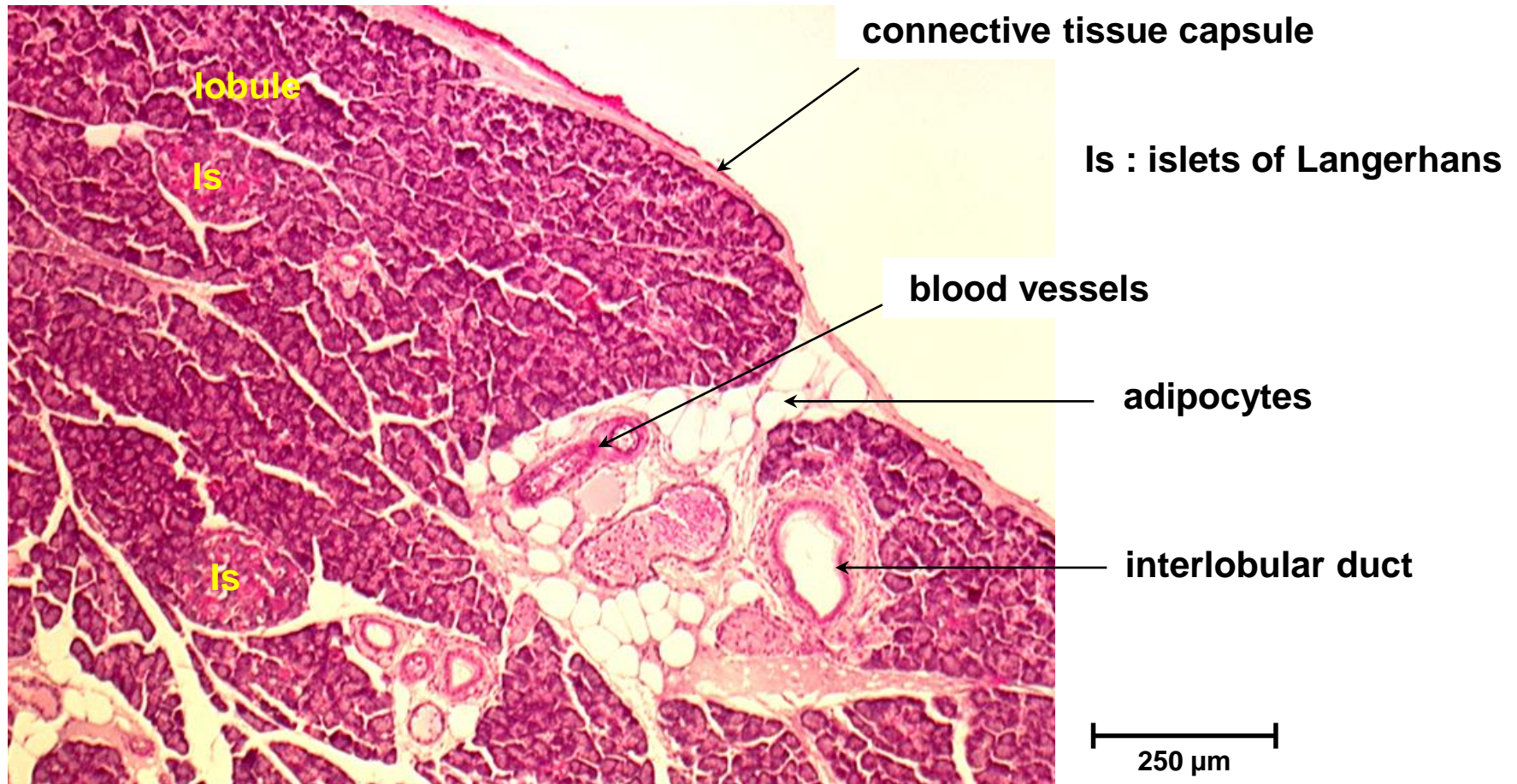


# Pancreas (Gomori stain)

The H & E stain showed the pale pink areas of islets clearly against the surrounding exocrine pancreas, but all cells in the islets were stained the same.

The Gomori stain helps to differentiate between cell types in the islet.

Cells are stained shades of pink, purple and blue.

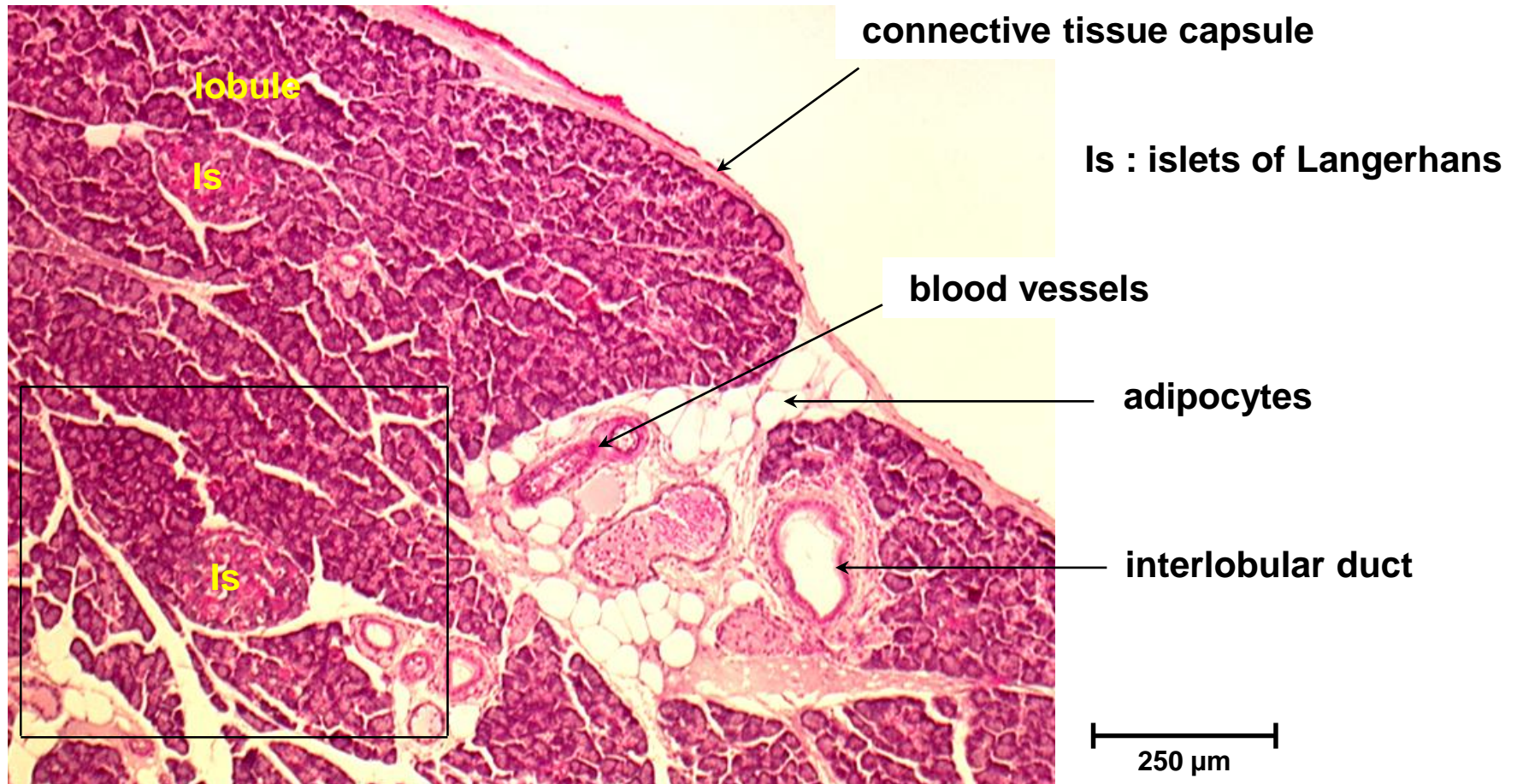


# Pancreas (Gomori stain)

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Cells are stained shades of pink, purple and blue.



# Pancreas (Gomori stain)

What cell types are present in an islet and what do they secrete?

$\alpha$  cells : secrete glucagon.

$\delta$  cells : secrete somatostatin.

$\beta$  cells : secrete insulin.

F cells : pancreatic polypeptide.

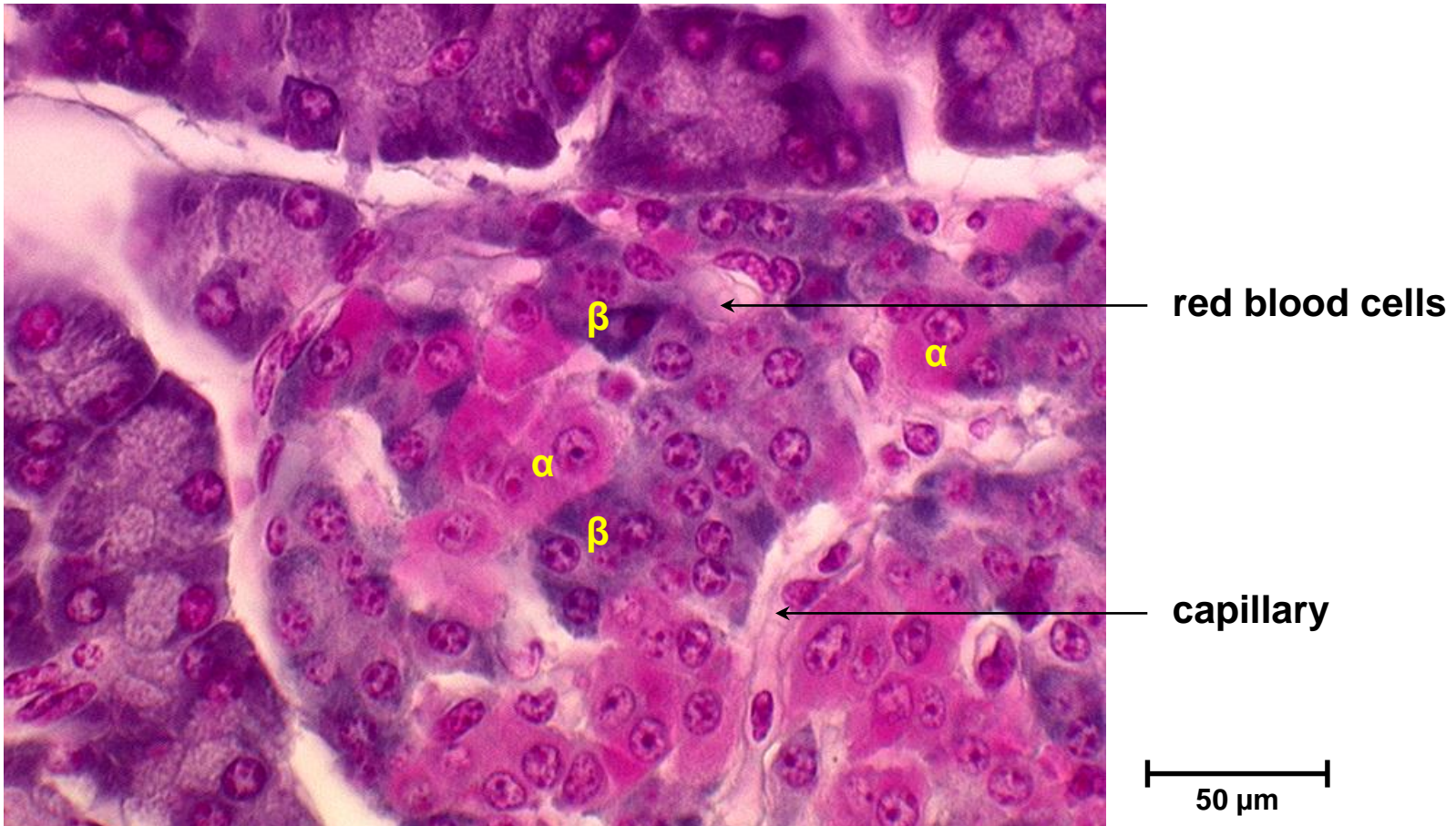


# Pancreas (Gomori stain)

How many cell types can be identified based on their histological staining?

Purple staining  $\beta$  cells and pink staining  $\alpha$  cells.

Endothelial cells of capillaries.



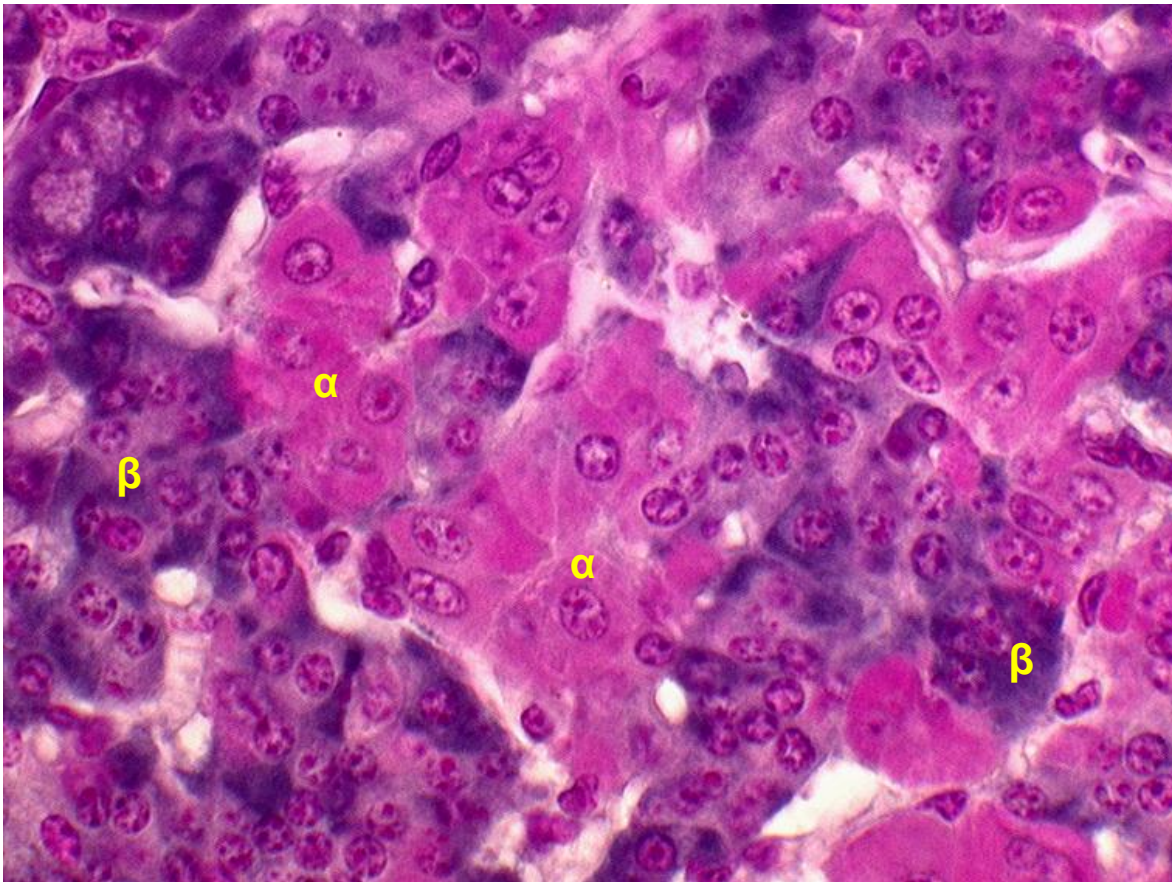
# Pancreas (Gomori stain)

Which islet hormone will increase glycogenolysis?

**Glucagon.**

In which major blood vessel are islet hormones carried from the pancreas?

**Hepatic portal vein.**



# Adrenal gland

Seen at low magnification, identify the zones of the adrenal gland :

A : capsule.

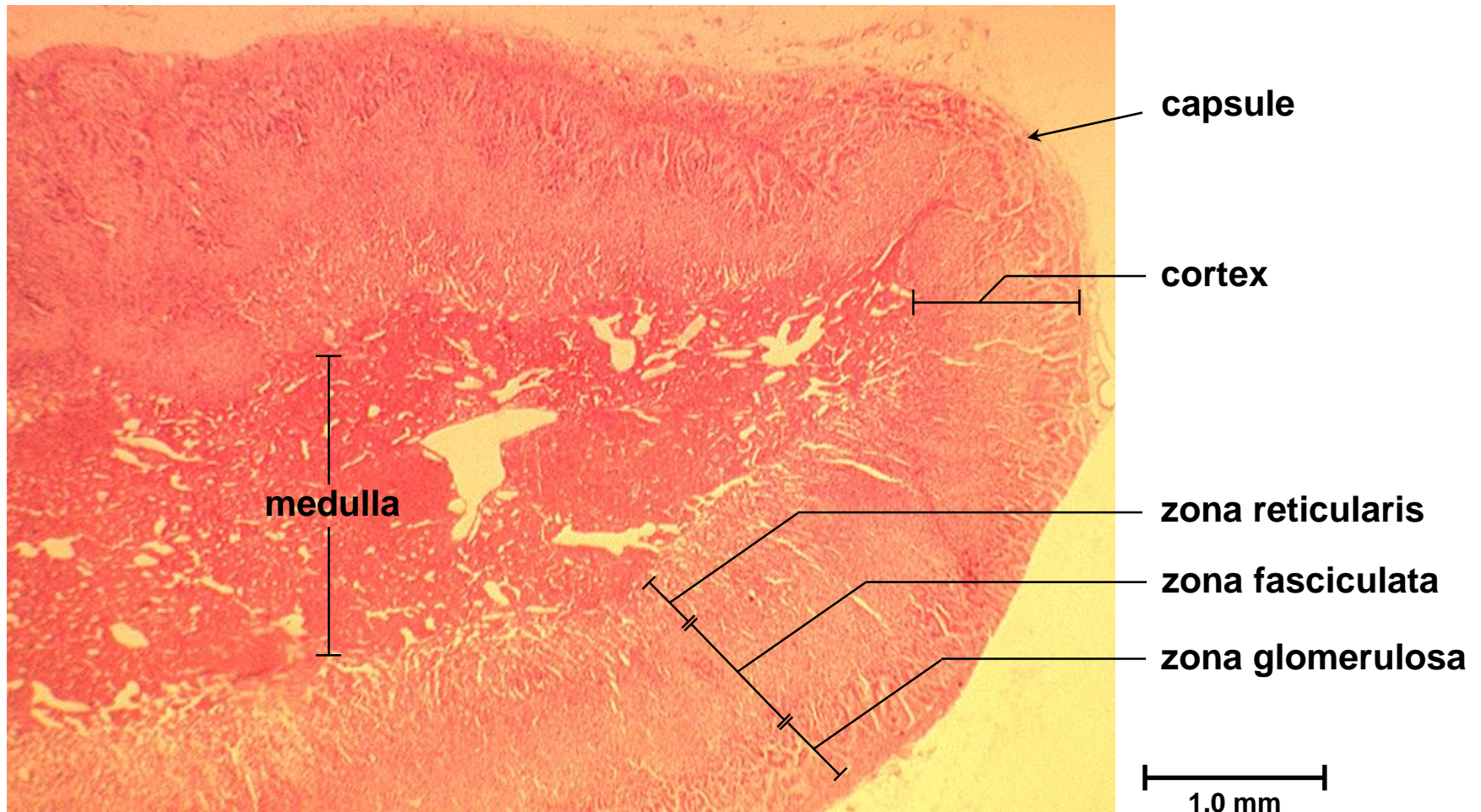
B : cortex.

i). Zona glomerulosa.

ii). Zona fasciculata.

iii). Zona reticularis.

C : medulla

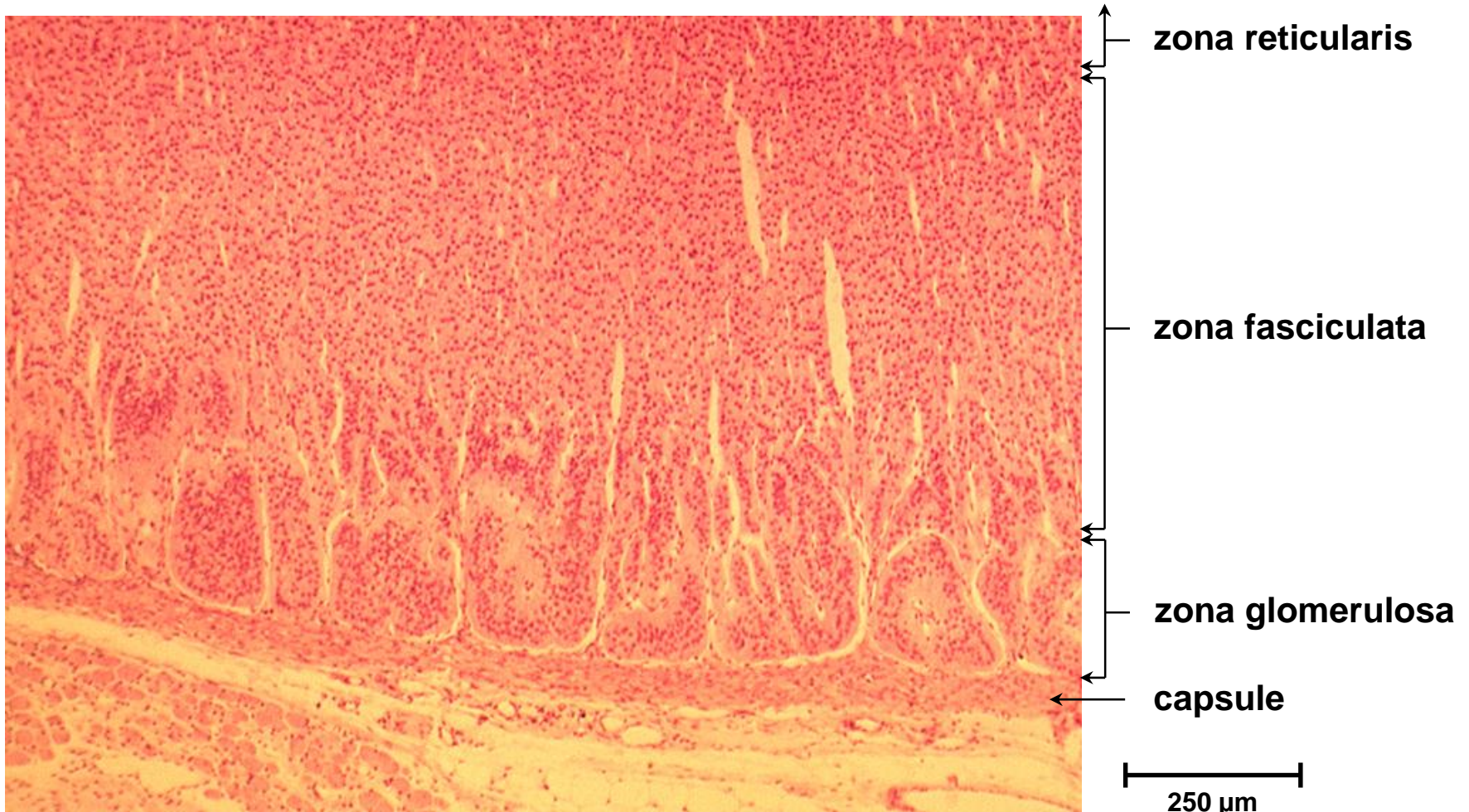




# Adrenal gland

At a slightly higher magnification the zona glomerulosa and zona fasciculata of the adrenal cortex.

(In horses, cats and dogs an area called the zona intermedia can be identified between the glomerulosa and fasciculata).

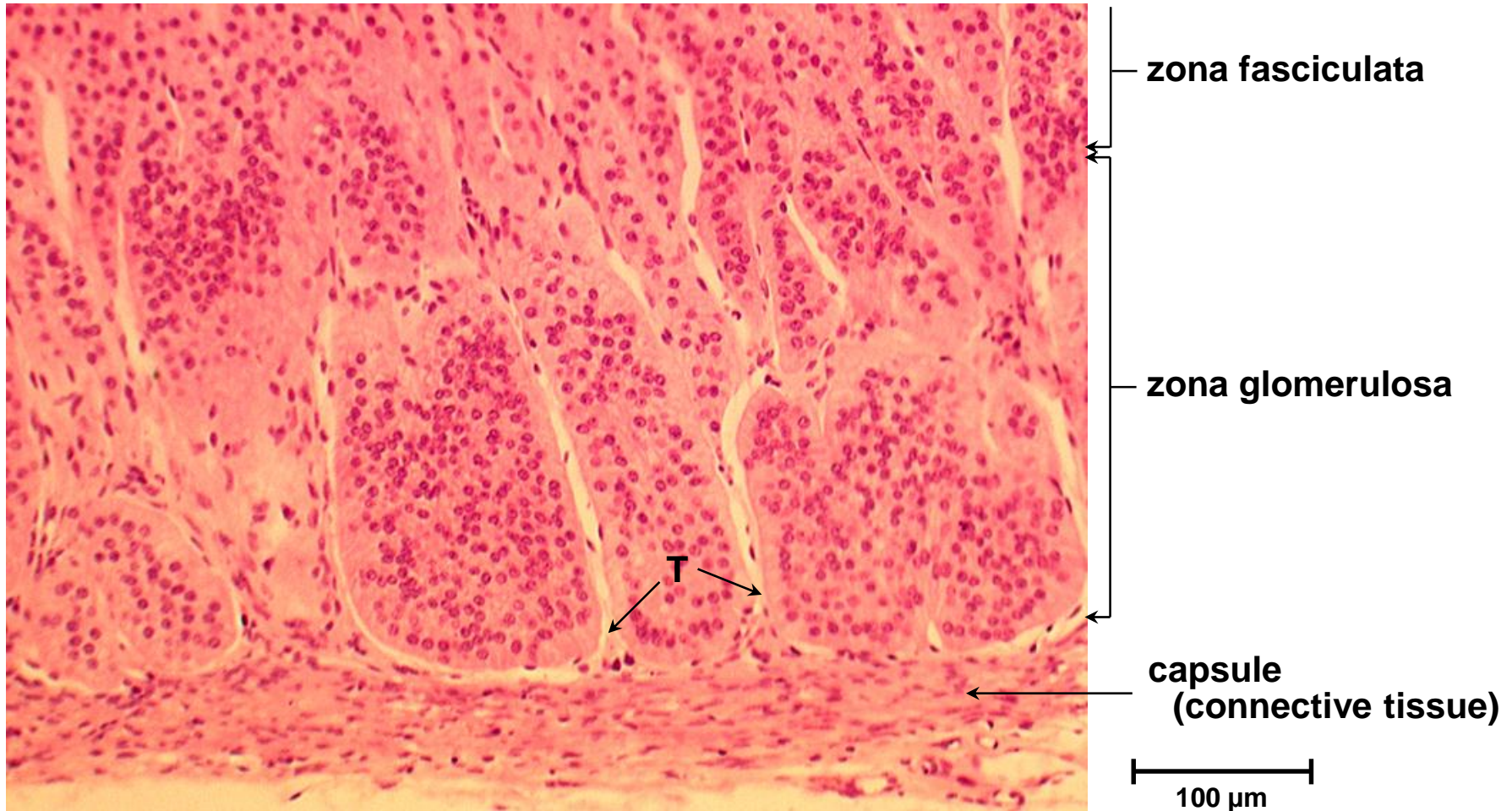


# Adrenal gland

Cortex. Zona Glomerulosa :

The cells in the zona glomerulosa are arranged in clusters or arcs.

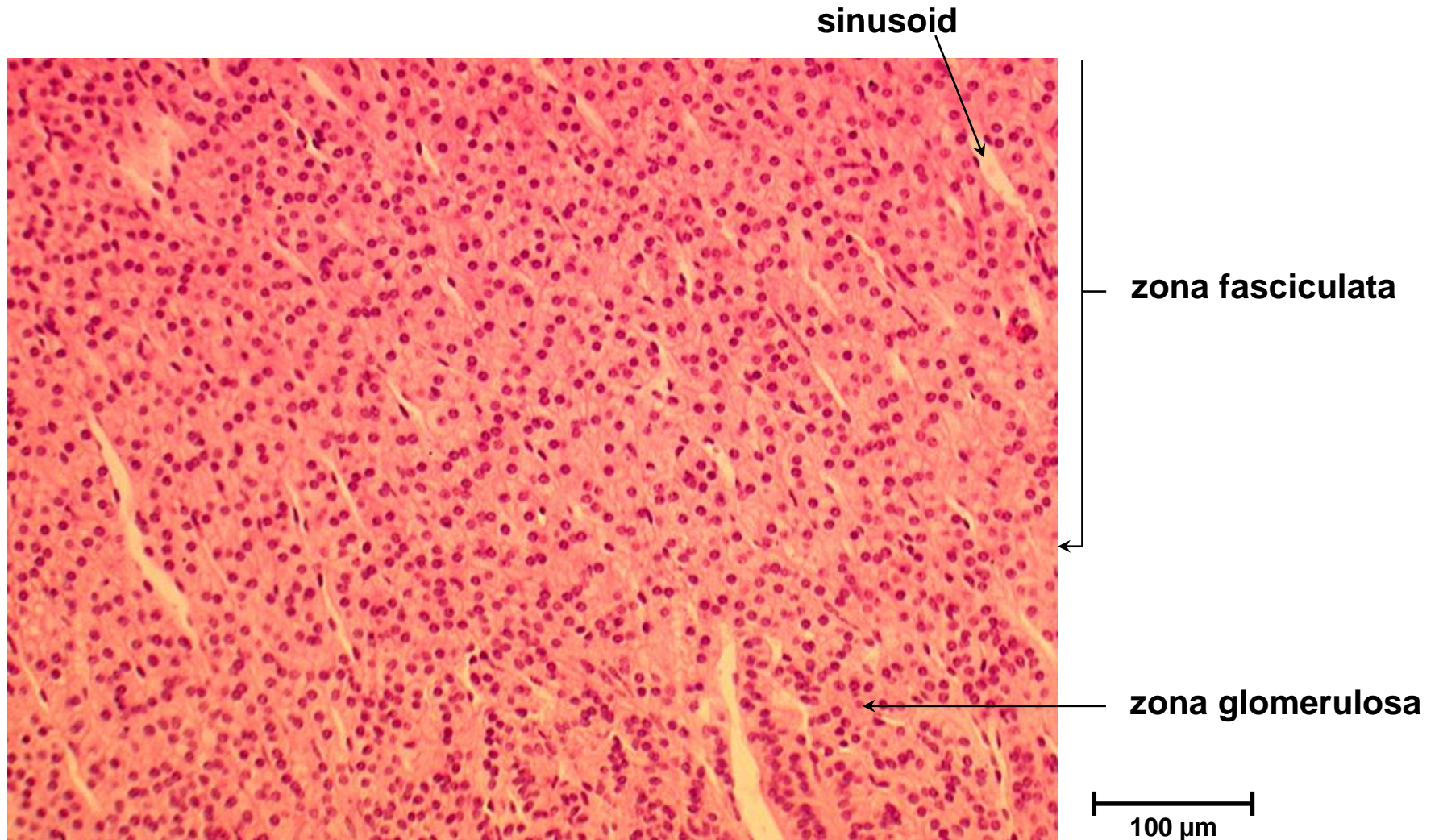
T : cortical trabeculae



# Adrenal gland

Cortex. Zona Fasciculata :

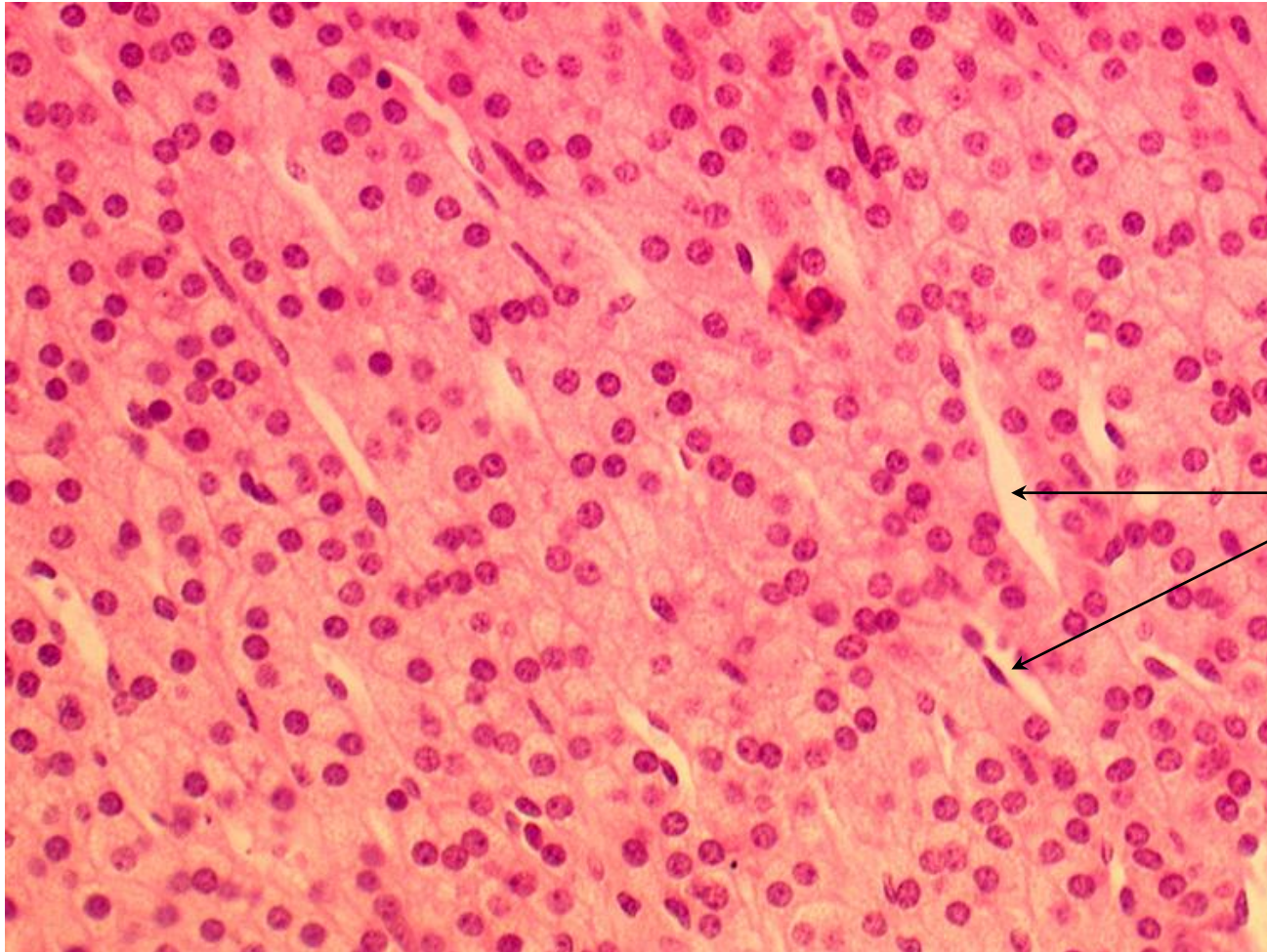
The zona fasciculata forms the widest layer in the adrenal cortex.



# Adrenal gland

Cortex. Zona Fasciculata :

The cells in the zona fasciculata are arranged in radial cords, usually only one cell thick. Cells are cuboidal to columnar.



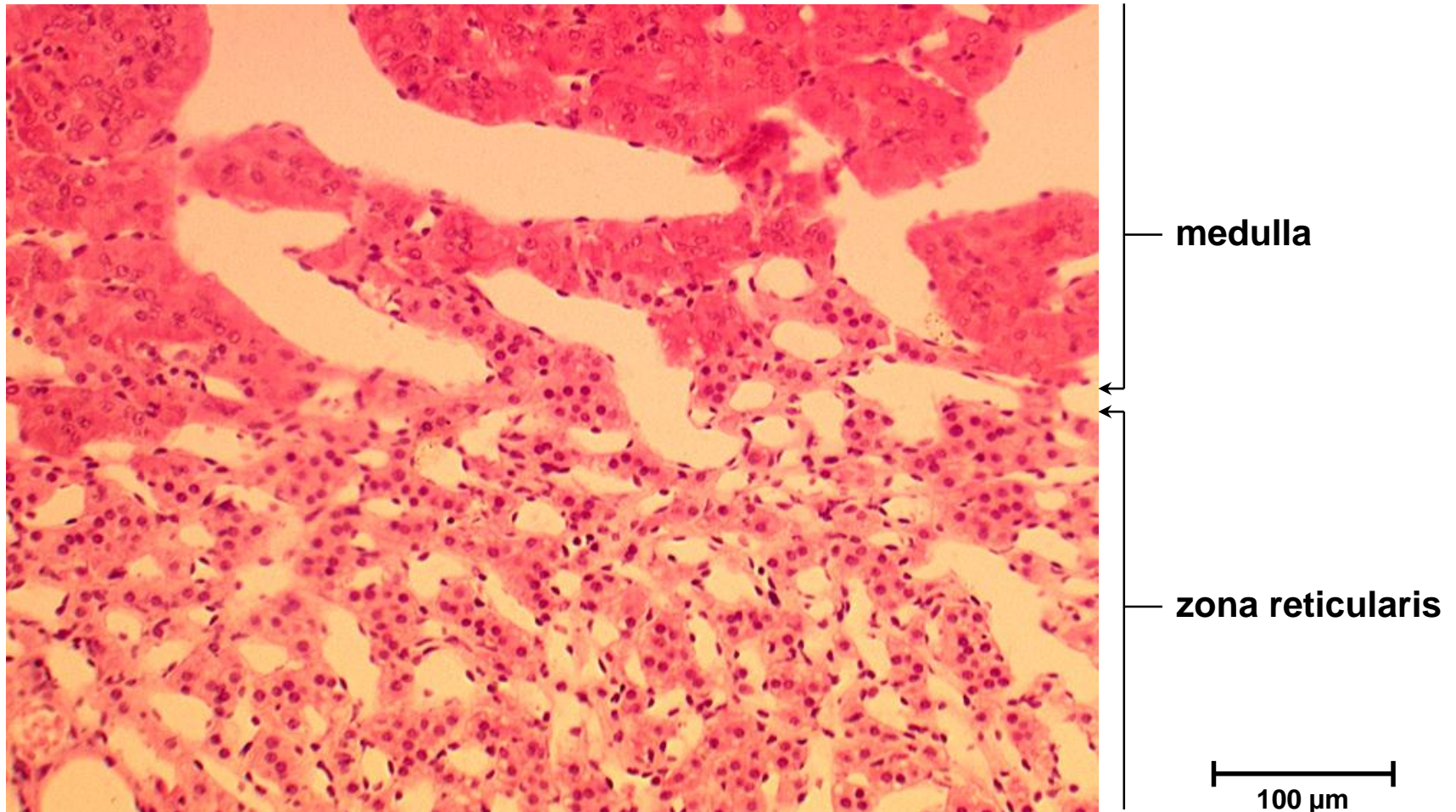
sinusoids

50  $\mu$ m

# Adrenal gland

Cortex. Zona Reticularis :

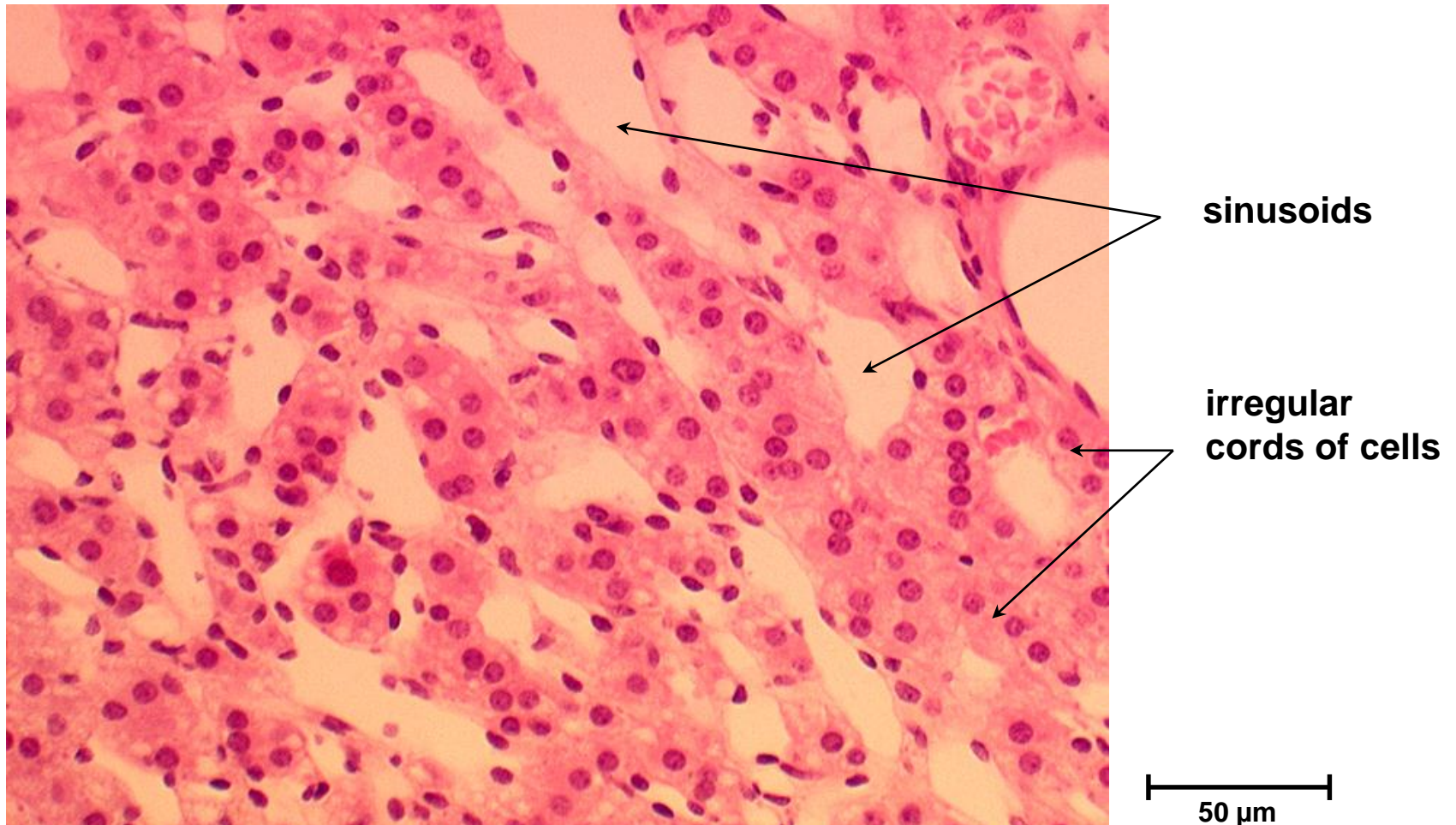
This is the inner zone of the cortex lying next to the adrenal medulla.



# Adrenal gland

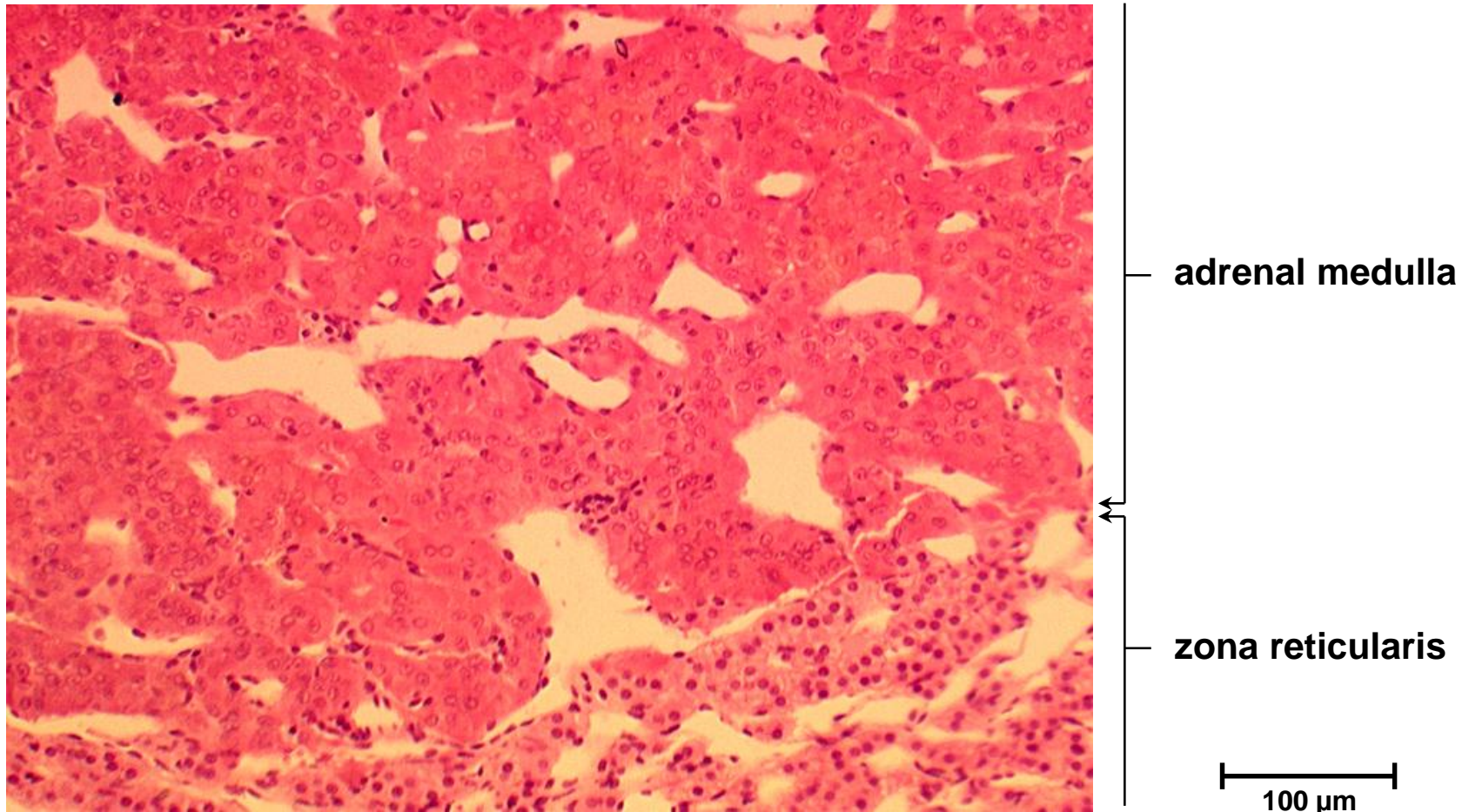
Cortex. Zona Reticularis :

The cells in the zona reticularis form irregular anastomosing cords surrounded by sinusoids.



# Adrenal gland

**Medulla :** The adrenal medulla consists of columnar or polyhedral cells in cords and clusters. These are called Chromaffin cells and have a neuroectodermal origin.



# Adrenal glands

What are the hormonal products of each of these zones?

Zona glomerulosa : **aldosterone (acts mainly on kidney to regulate electrolyte and fluid balance).**

Zona fasciculata : **cortisol (many metabolic effects).**

Zona reticularis : **adrenal androgens : e.g. DHEA (dehydroepiandrosterone).**

Adrenal medulla : **epinephrine and norepinephrine.**

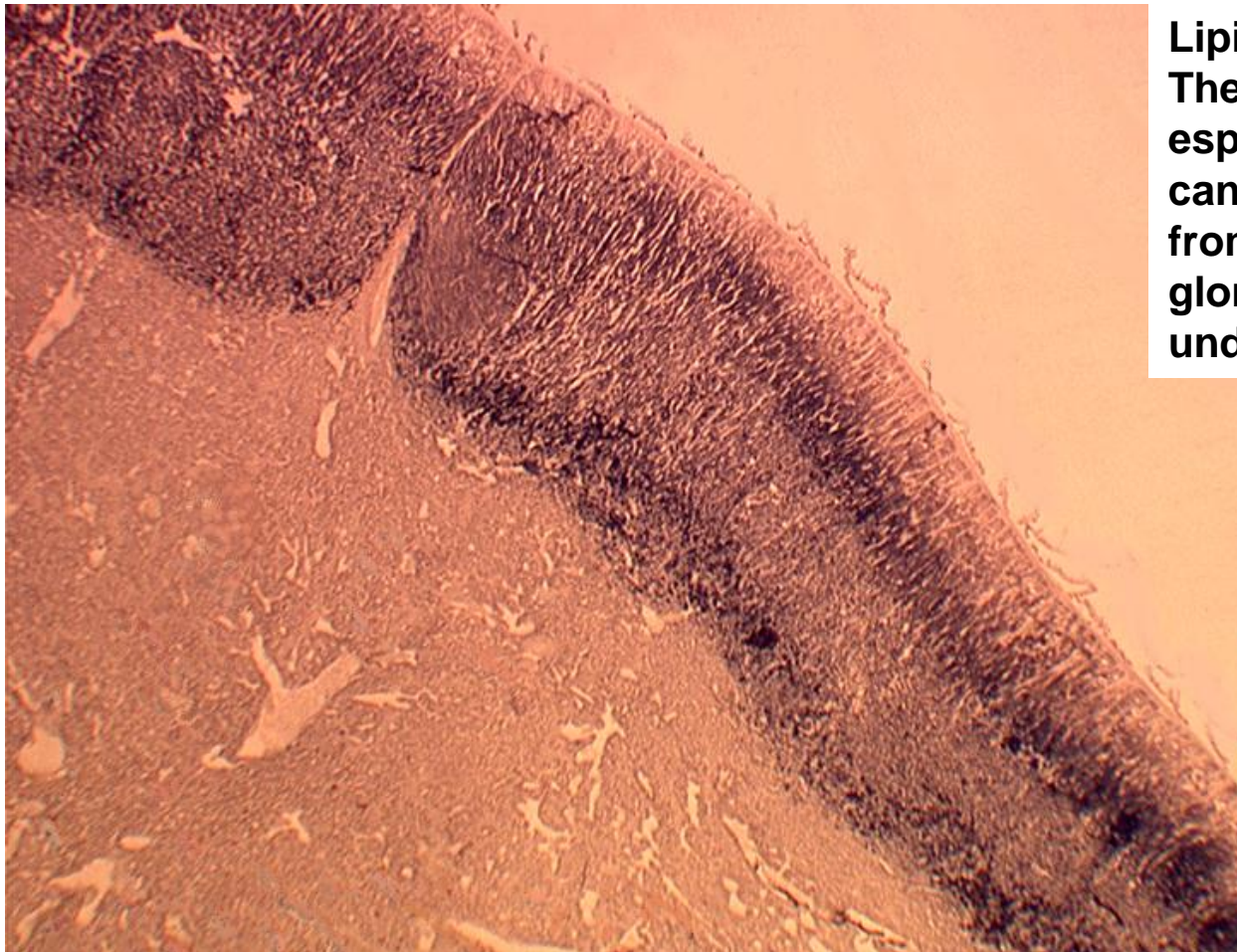


# Adrenal gland (Sudan black stain)

Stained with Sudan black for lipid.

What are the lipid droplets?

**Cholesterol esters.**



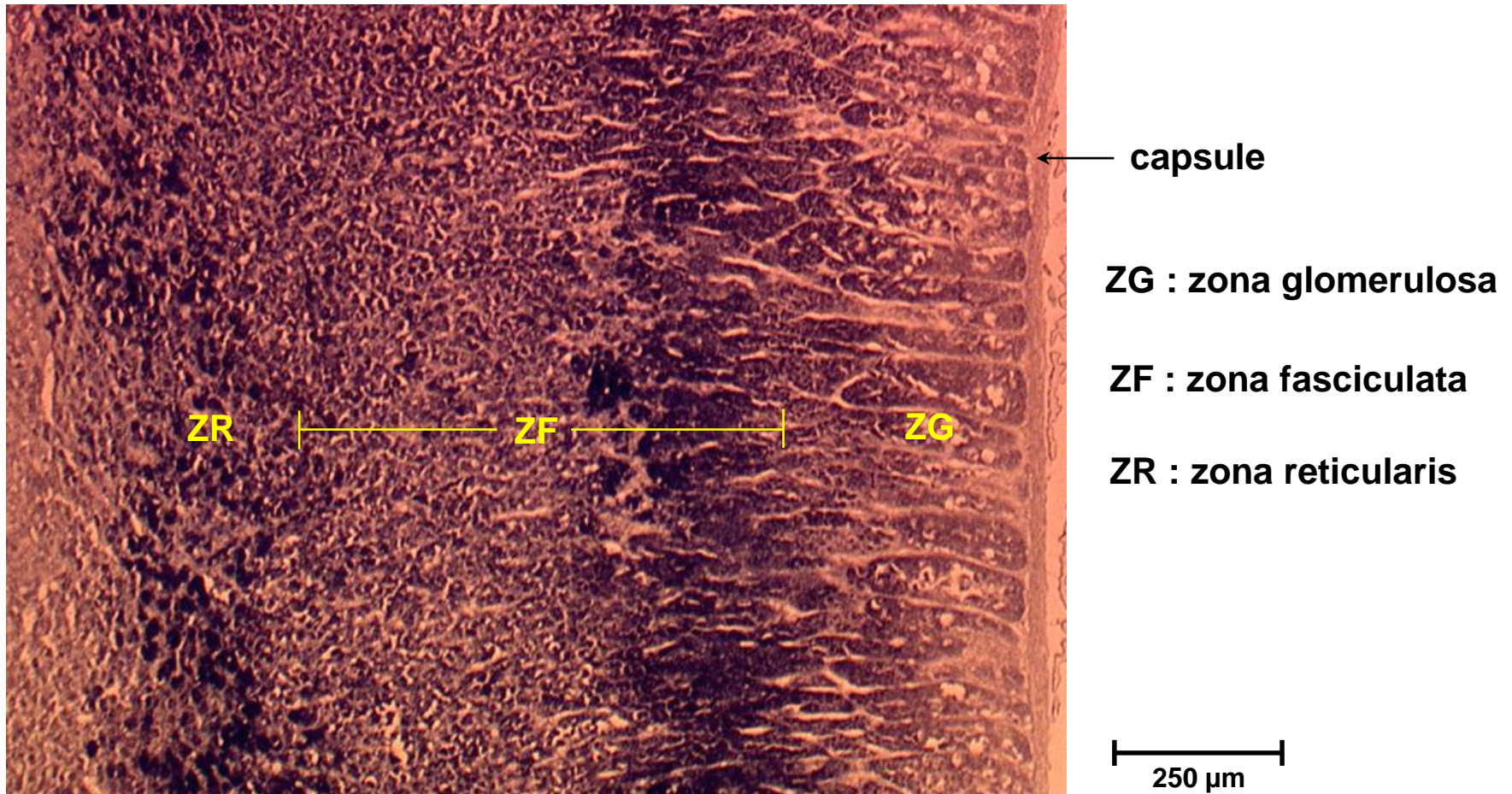
**Lipid staining:**  
The zona fasciculata is especially distinct and can readily be distinguished from the overlying zona glomerulosa and the underlying zona reticulosa.

1.0 mm

# Adrenal gland (Sudan black stain)

Would the number of lipid droplets increase or decrease following stimulation with ACTH and why?

**Decrease, because they are made into steroids.**



# Adrenal gland (Sudan black stain)

How is the release of catecholamines from the adrenal medulla regulated?

**By sympathetic innervation.**

