THE ENDOCRINE SYSTEM

MORPHOLOGICAL & MICROSCOPIC ANATOMY OF ENDOCRINE GLANDS

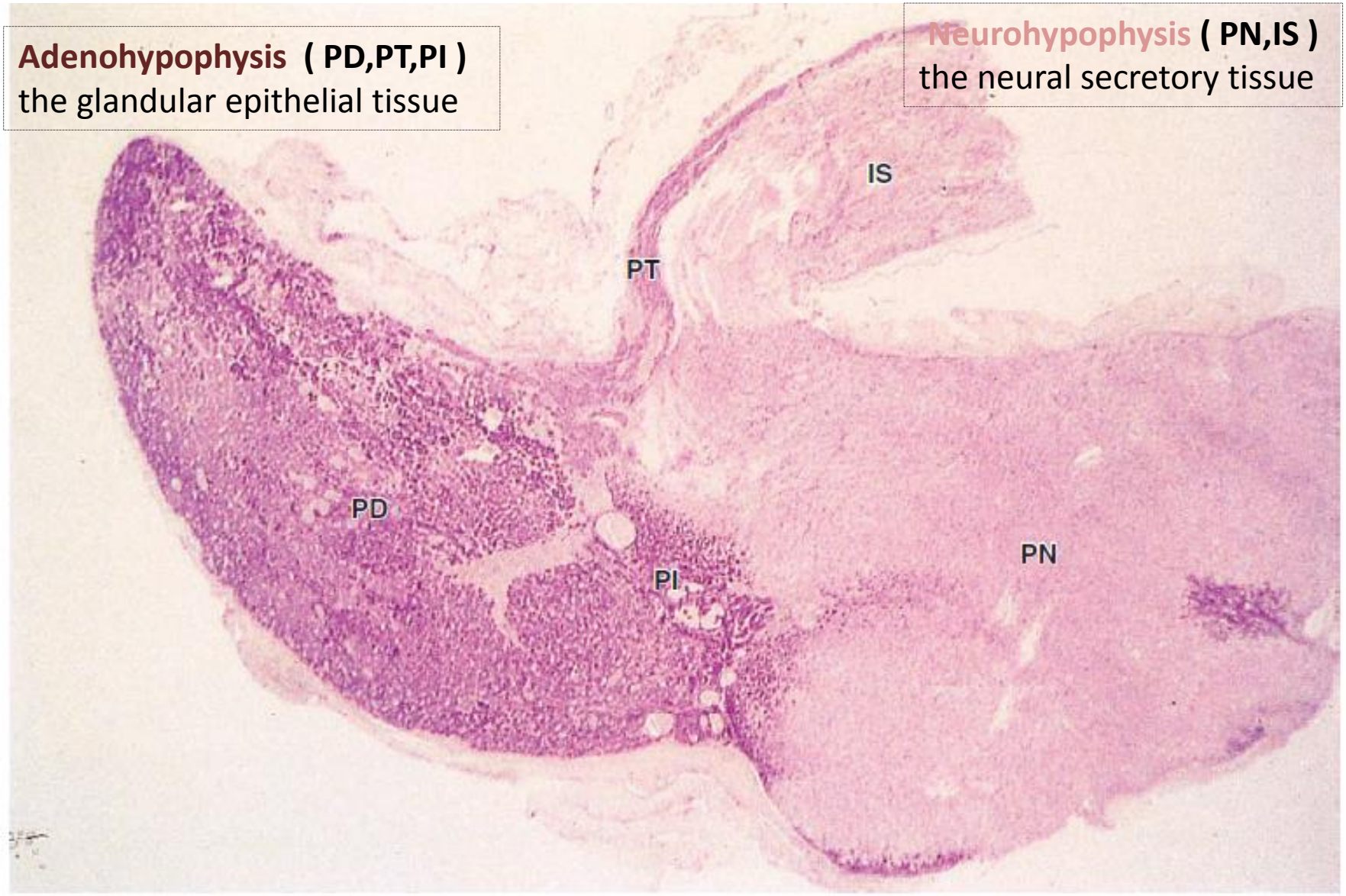
Objectives

1. Identify different parts of the thyroid gland and study its relations
2. Identify the adrenal gland and study its relations.
3. Identify the pituitary gland and study its relations.
4. Identify the ultra-structural components of the following glands and correlate between them:
   - **Pituitary gland**
   - **Adrenal glands**
   - **Pancreas**
   - **Thyroid gland**
   - **Parathyroid glands**

Pituitary gland

Adenohypophysis (PD,PT,PI)
the glandular epithelial tissue

Neurohypophysis (PN,IS)
the neural secretory tissue



Pars Distalis

The main components:

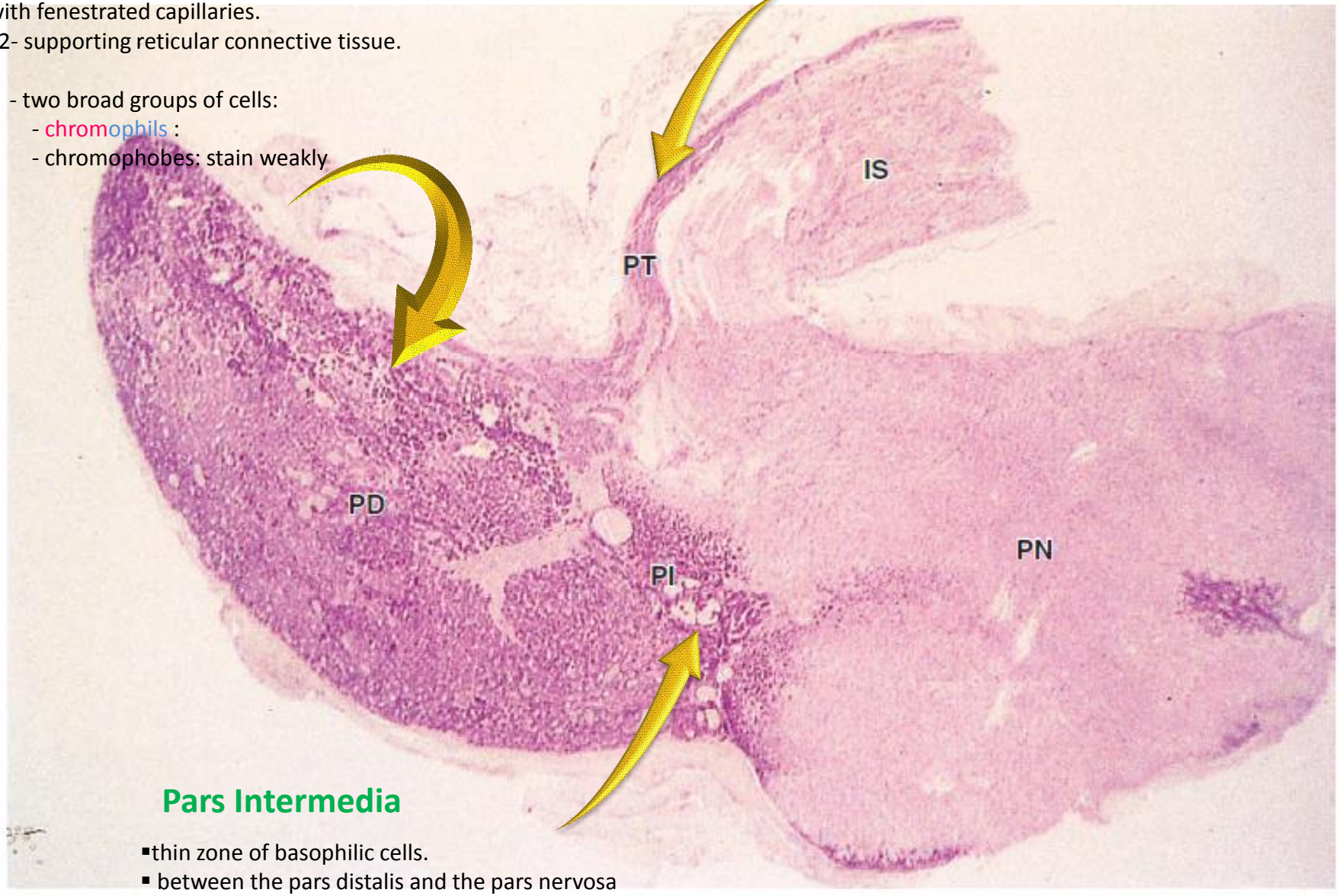
1 - cords of **well-stained** endocrine cells interspersed with fenestrated capillaries.

2- supporting reticular connective tissue.

- two broad groups of cells:
  - chromophils :
  - chromophobes: stain weakly

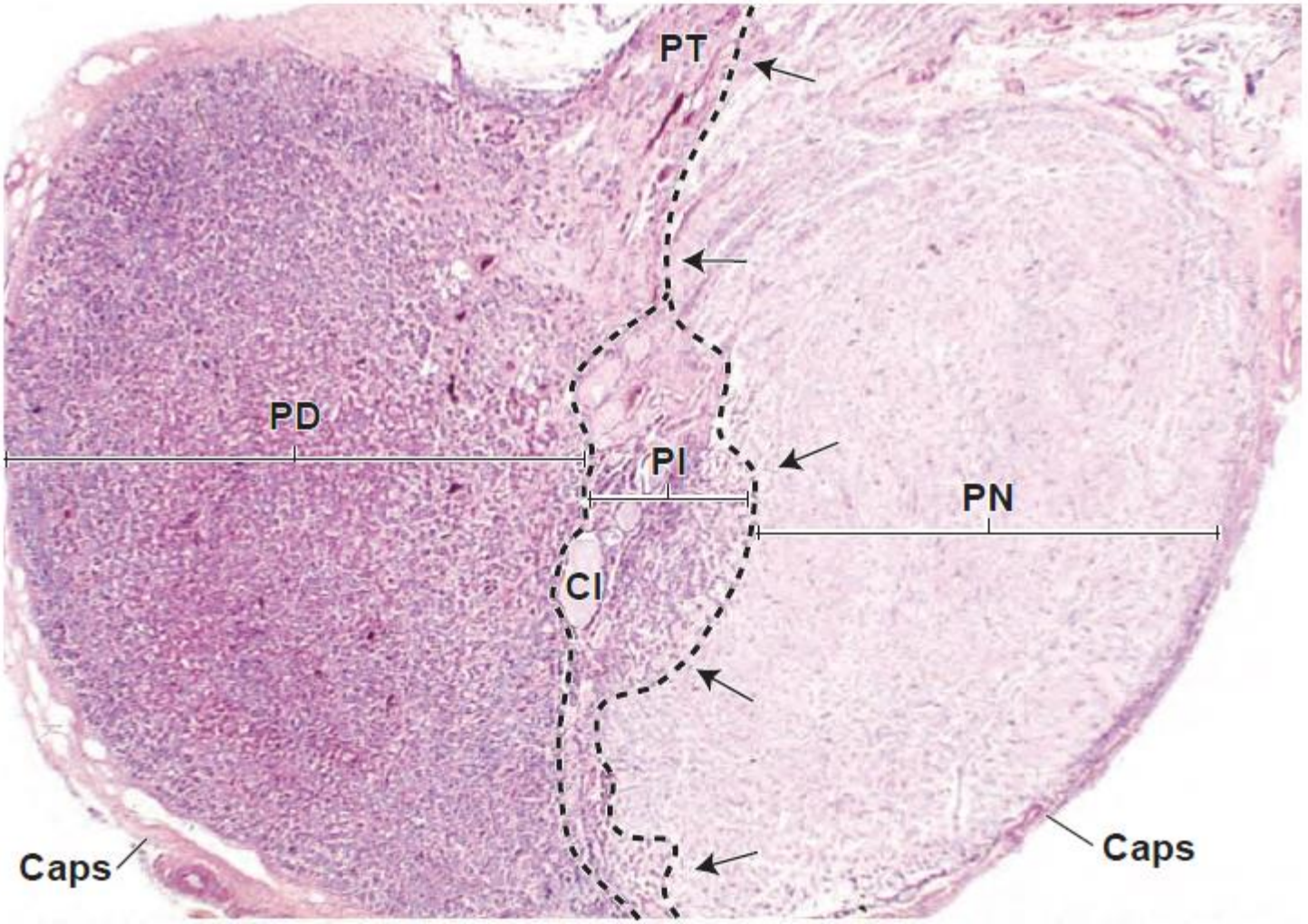
Pars Tuberalis

smaller funnel-shaped region surrounding the infundibulum of the neurohypophysis



Pars Intermedia

- thin zone of basophilic cells.
- between the pars distalis and the pars nervosa
- usually contains colloid-filled cysts of various sizes

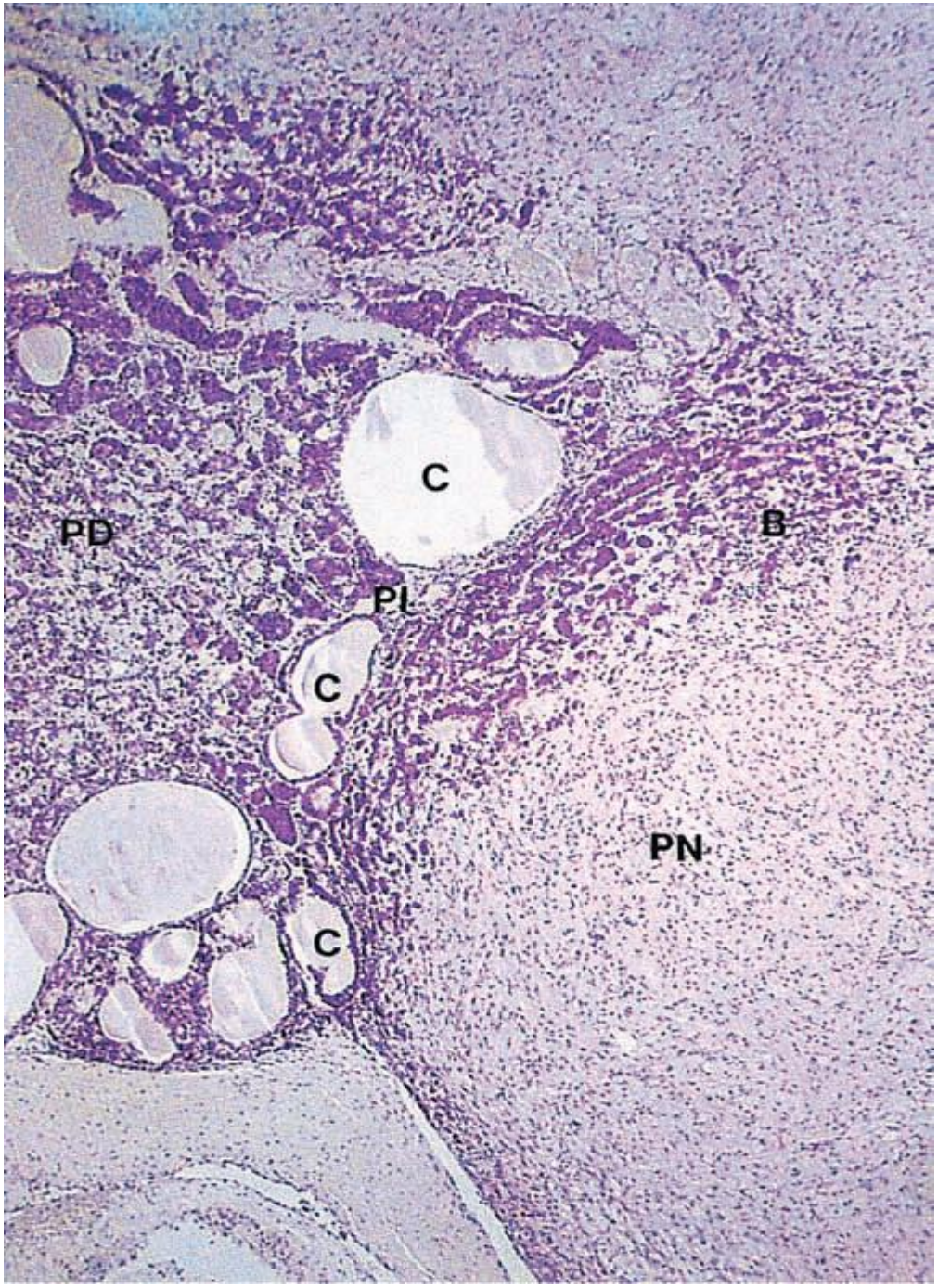


PD, pars distalis
PT, pars tuberalis
PI, pars intermedia
Cl, cleft
PN, pars nervosa
Caps, capsule

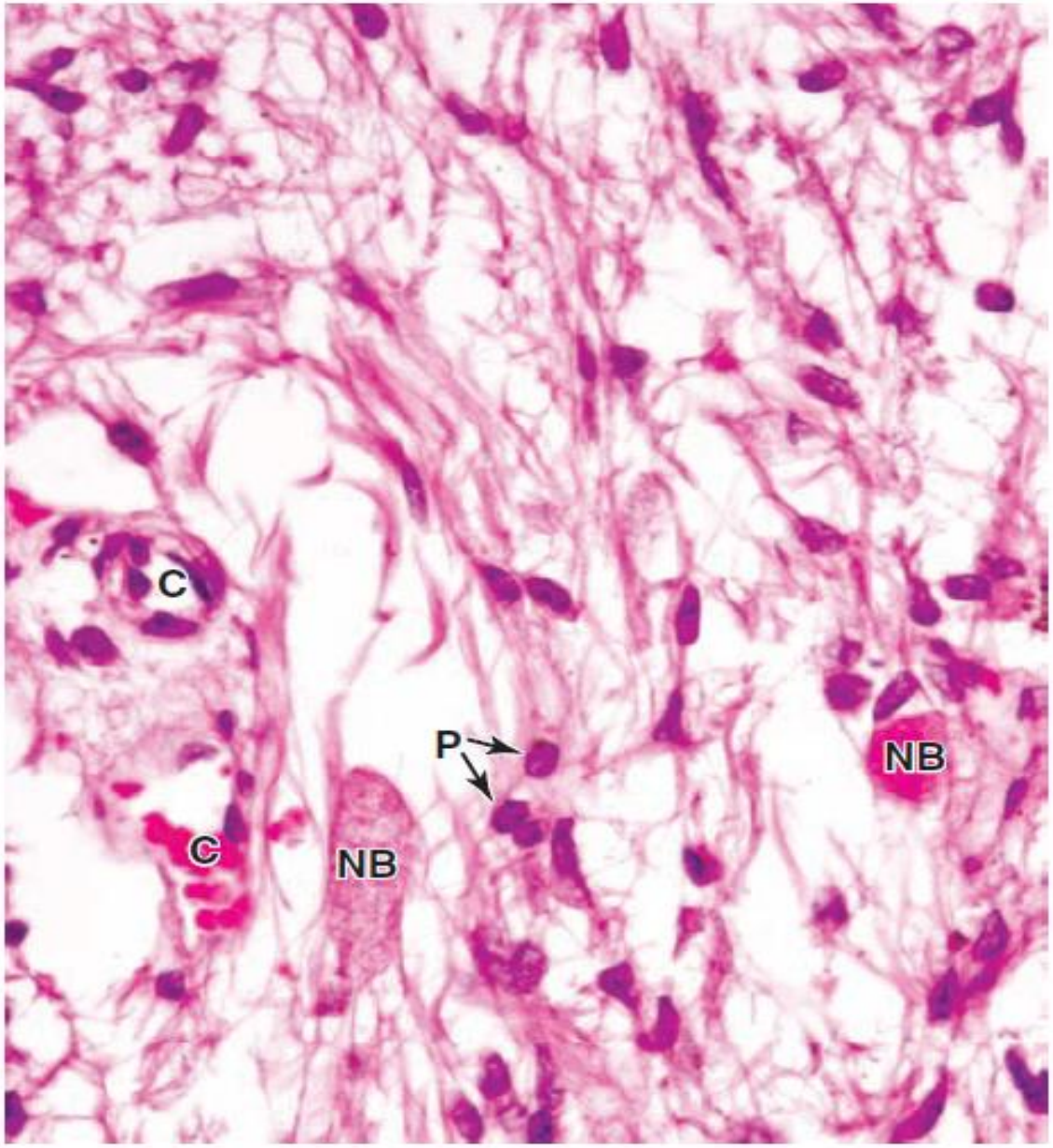
This specimen is a sagittal section of the pituitary gland. The neurohypophysis is delineated by the *dashed line* (indicated by *arrows*) that separates it from the adenohypophysis.

Pituitary gland

- this low-magnification section of an entire gland.
  - The infundibular stalk (**IS**) and pars nervosa (**PN**) of the neurohypophysis resemble CNS tissue .
  - the adenohypophysis' pars distalis (**PD**), pars intermediate (**PI**), and pars tuberalis (**PT**) are typically glandular in their level of staining .



- The **pars intermedia** (PI) lies between the pars distalis (PD) and the pars nervosa (PN), with many of its basophilic cells (B) usually invading the latter.
  - Remnants of the embryonic hypophyseal pouch's lumen are usually present in this region as colloid-filled cysts (C) of various sizes. X56. H&E



- 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.

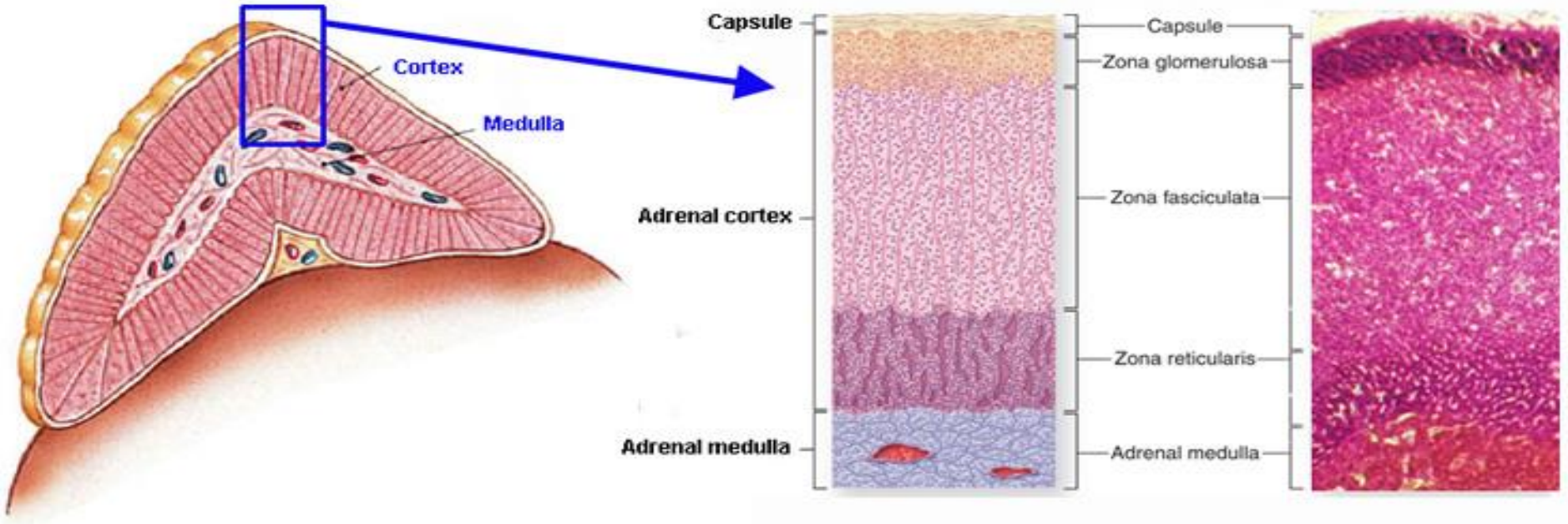
- **pituicytes** that resemble astrocytes and are the most abundant cell type in the posterior pituitary.
- Herring bodies: axonal dilations visible in the light microscope as faintly eosinophilic structures

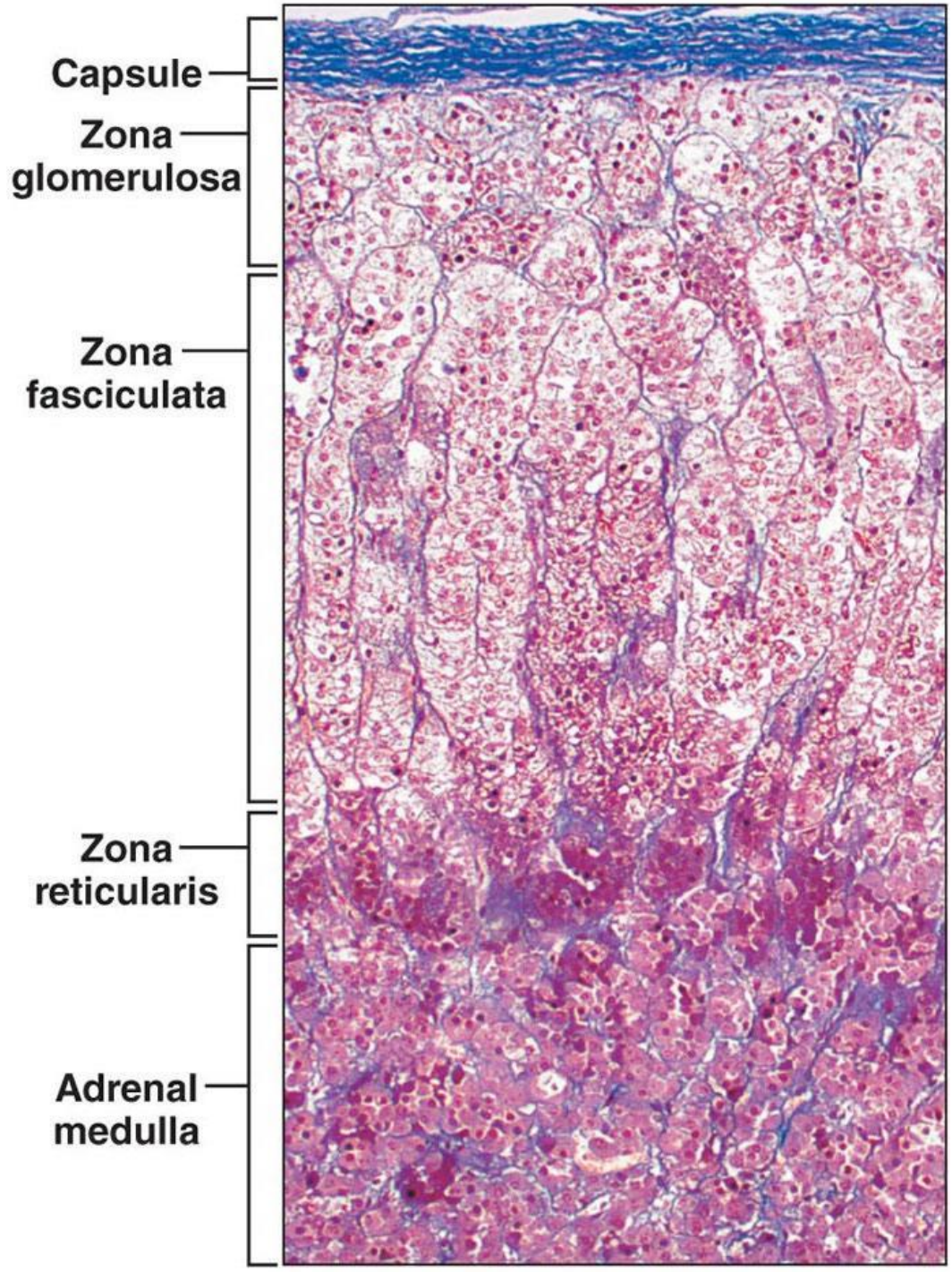
Adrenal Glands

- covered by a dense connective tissue capsule that sends thin trabeculae into the gland's parenchyma.
- The stroma consists mainly of reticular fibers supply secretory cells and microvasculature.
- Each gland has two concentric regions:
  - a **yellowish** adrenal cortex
  -**reddish** brown central adrenal medulla.

Adrenal Cortex

- Cells of the adrenal cortex have characteristic features of steroid-secreting cells:
  - acidophilic cytoplasm rich in lipid droplets, with central nuclei.
- The adrenal cortex has three concentric zones:
  1. The zona glomerulosa
  2. The middle zona fasciculata
  3. The innermost zona reticularis





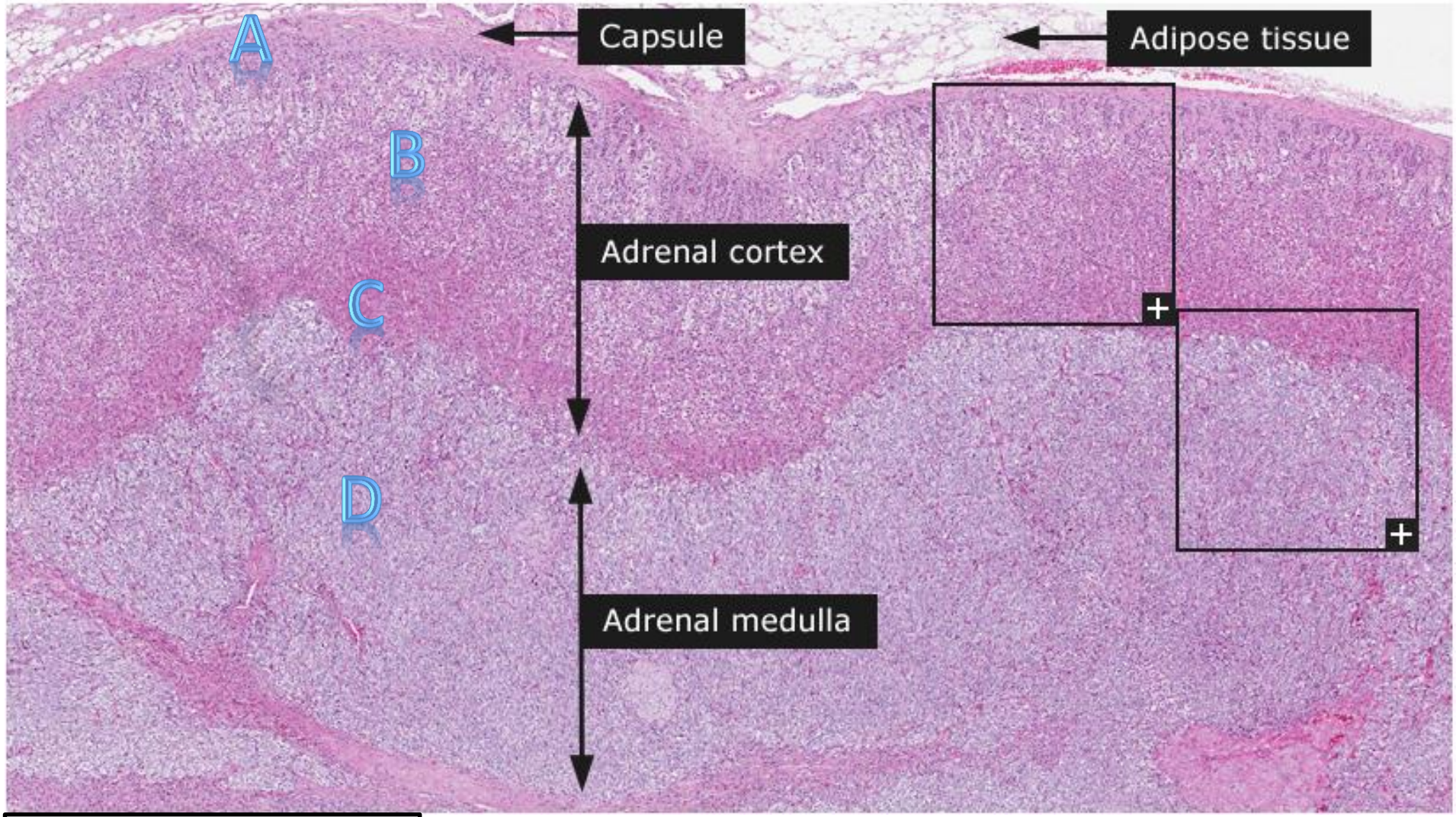
- **The zona glomerulosa:**
  - immediately **inside** the capsule.
  - consists of closely packed, rounded or arched cords of columnar or pyramidal cells with many capillaries.

The middle zona fasciculata:

- consists of long cords of large polyhedral cells,one or two cells thick, separated by fenestrated sinusoidal capillaries.
- The cells are filled with lipid droplets and **appear vacuolated** in routine histologic preparations.

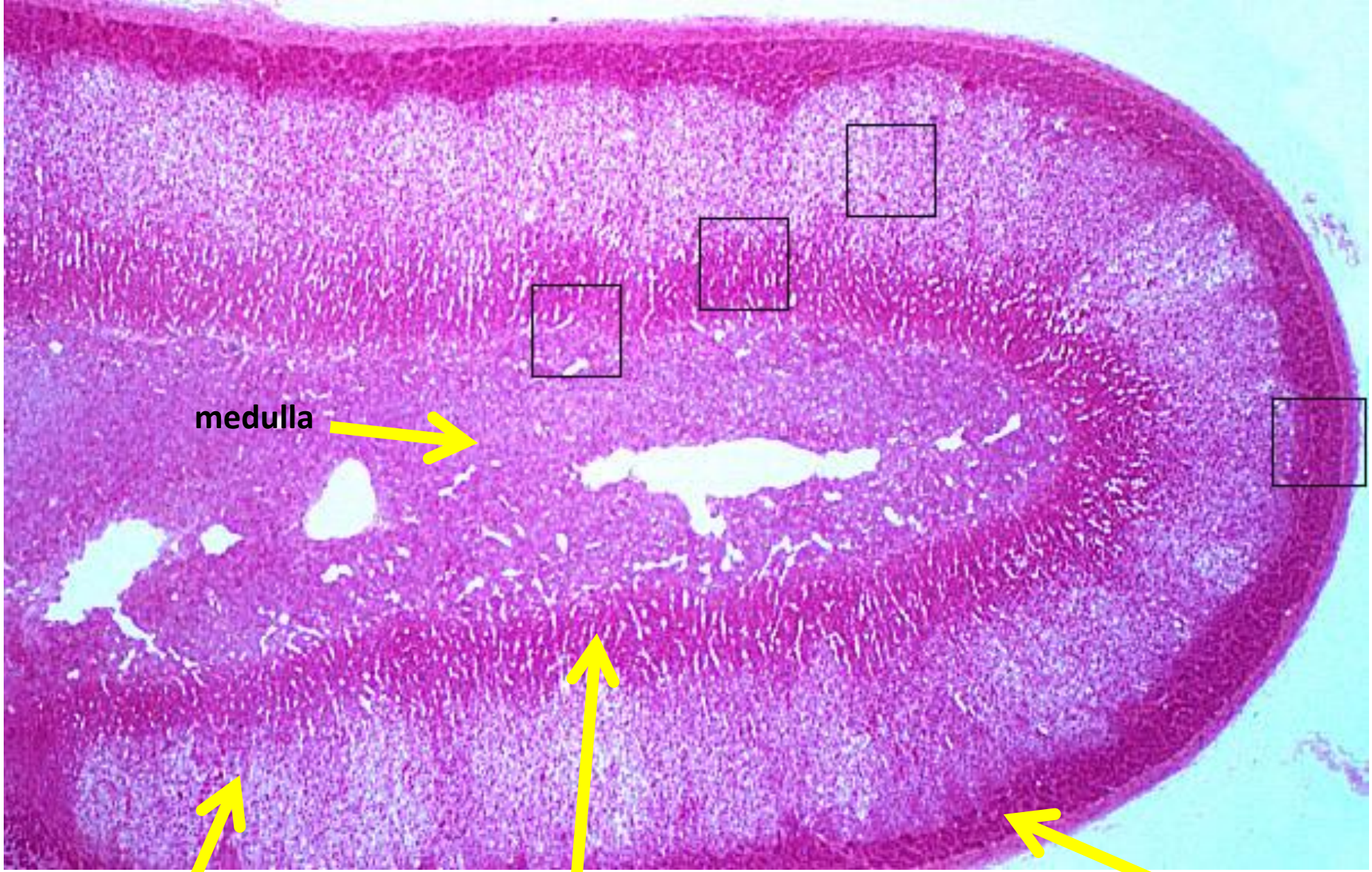
The innermost zona reticularis:

- consists of smaller cells in a network of irregular cords interspersed with **wide capillaries**.
- The cells are usually more heavily stain than those of the other zones.



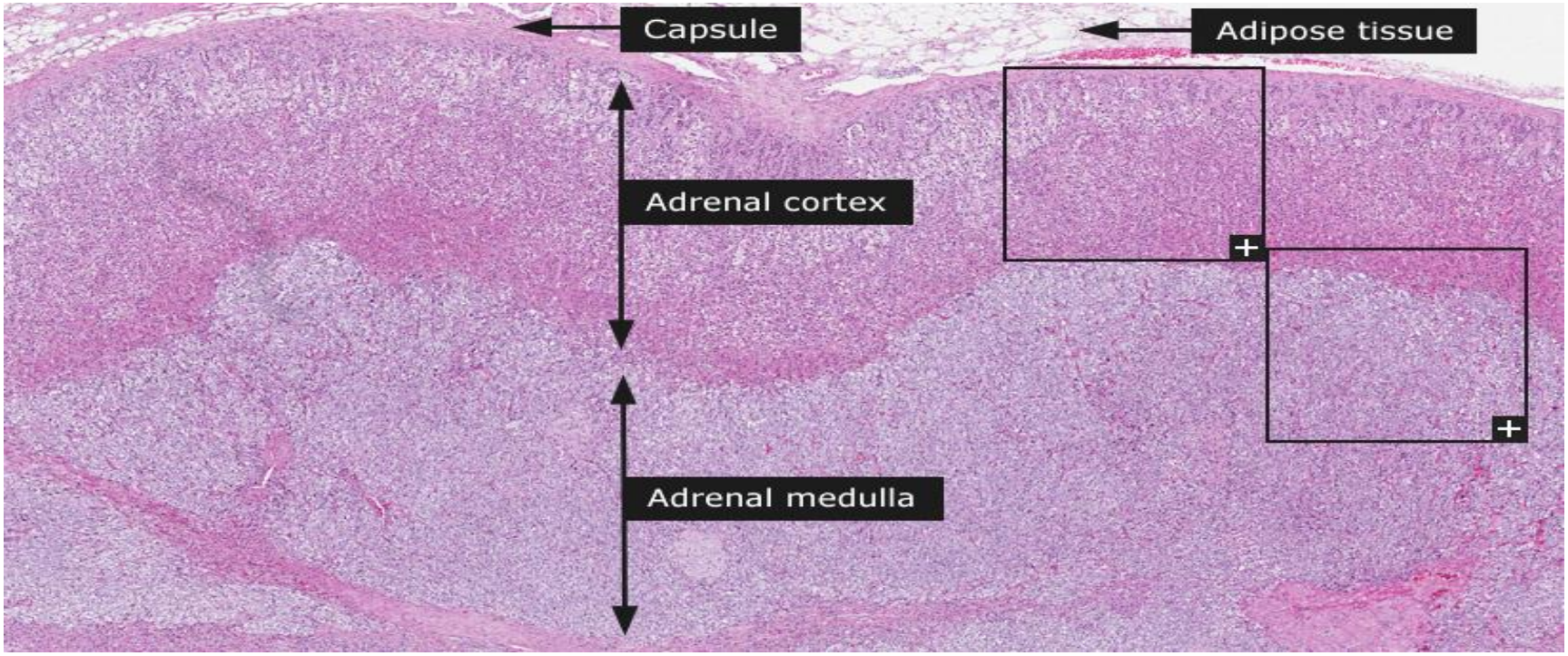
A. zona glomerulosa
B. zona fasciculata
C. zona reticularis
D. medulla

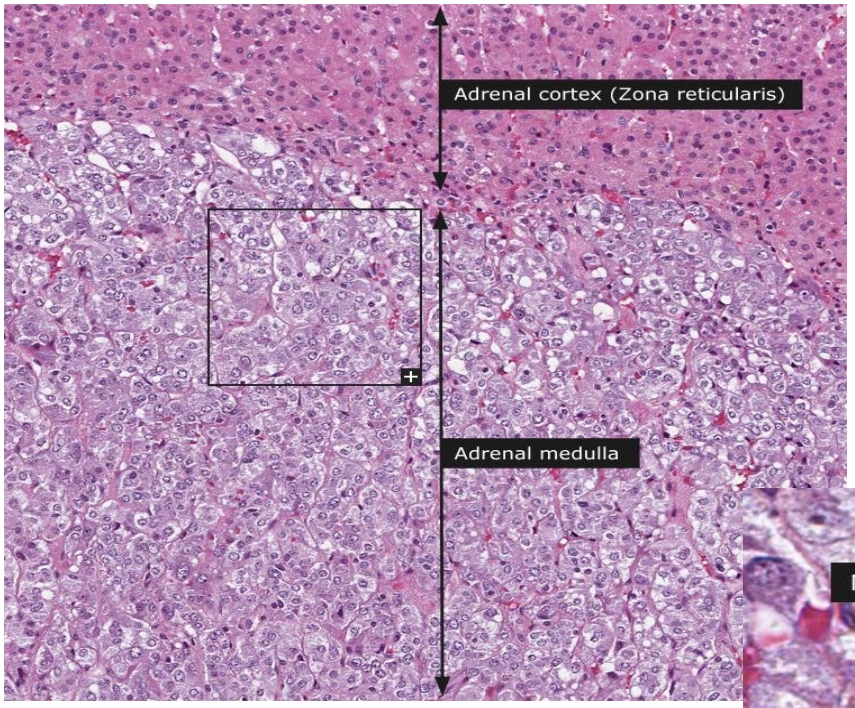
Photomicrograph of the cortex and medulla of the human adrenal gland

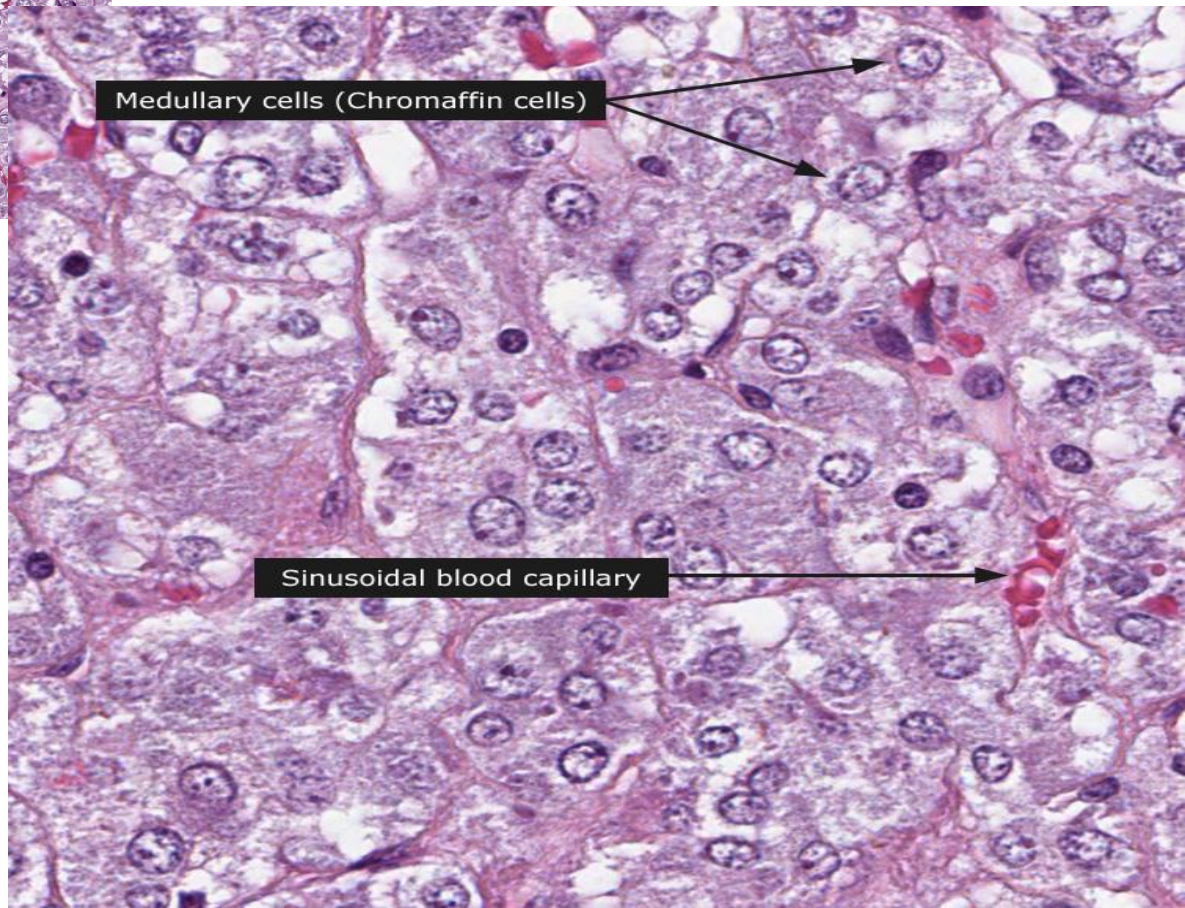

medulla
zona fasciculata
zona reticularis
Zona glomerulosa

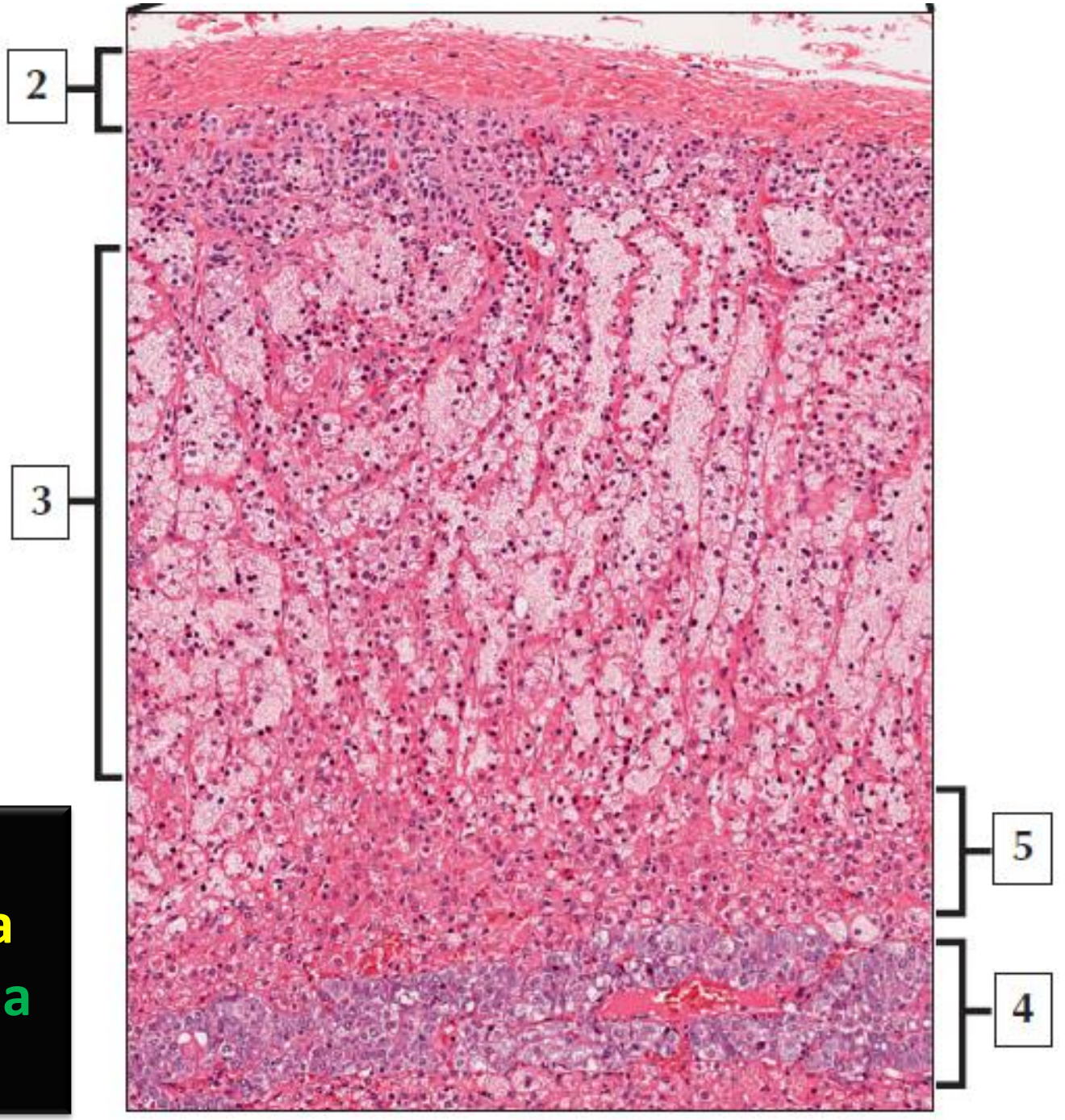
Adrenal Medulla

- composed of large, pale-staining polyhedral cells arranged in cords or clumps and supported by a reticular fiber network.
- ***chromaffin cells*** in the medulla are lightly stained basophilic cells that are arranged in ovoid clusters in close proximity to capillaries.




Adrenal cortex (Zona reticularis)
Adrenal medulla

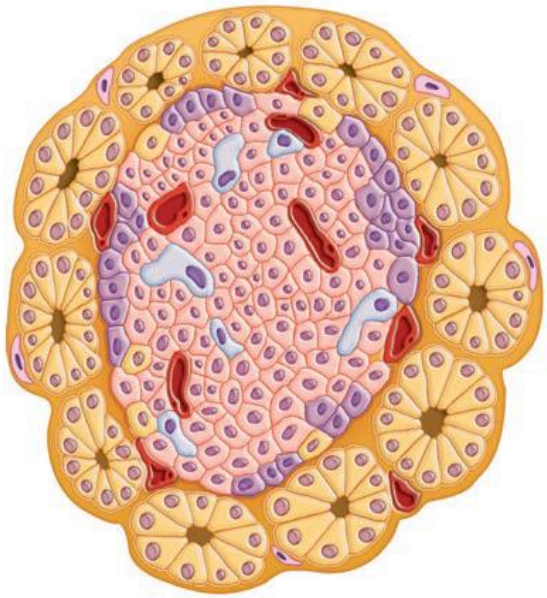

Medullary cells (Chromaffin cells)
Sinusoidal blood capillary

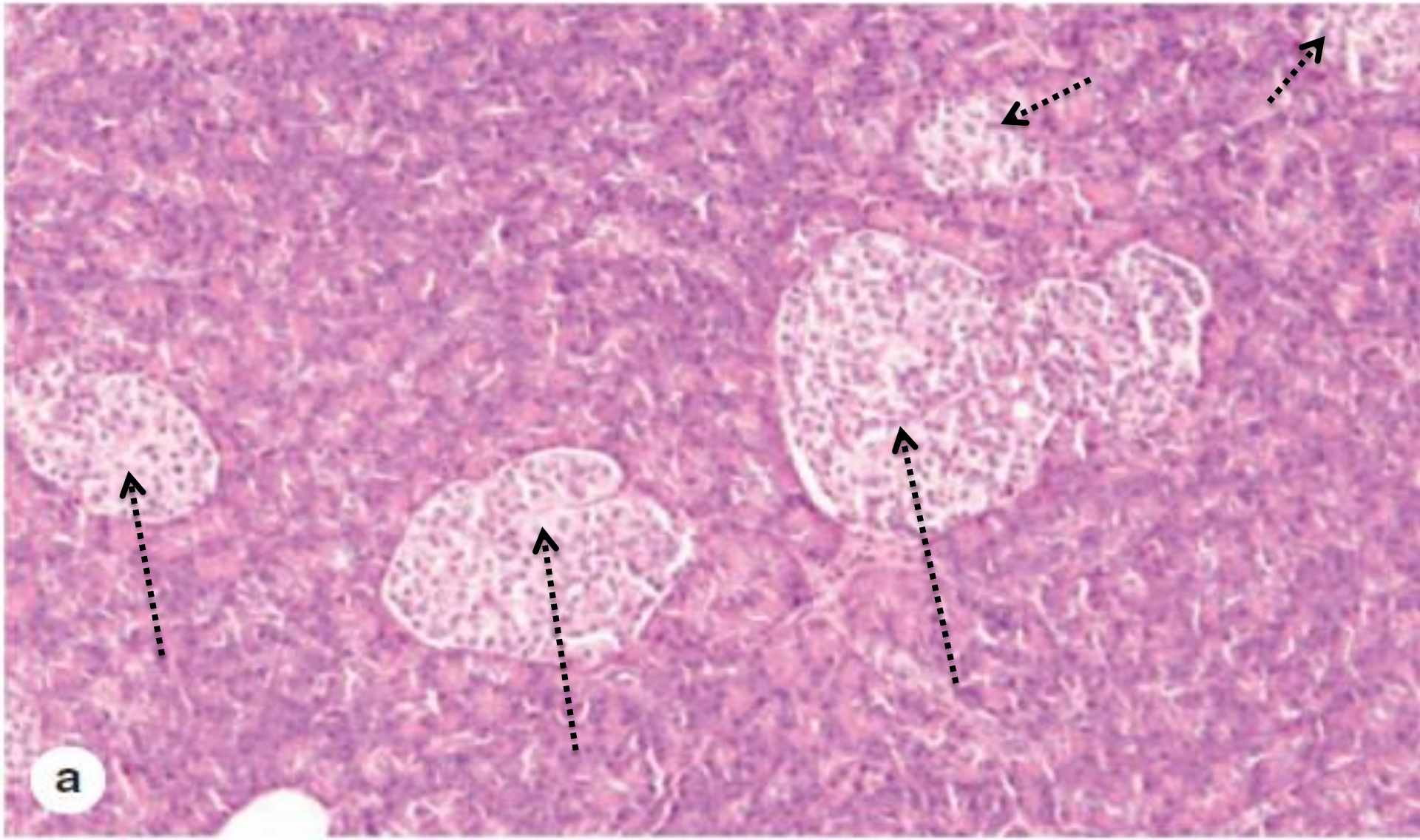


2. Capsule
3. Zona fasciculata
4. Adrenal Medulla
5. Zona reticularis

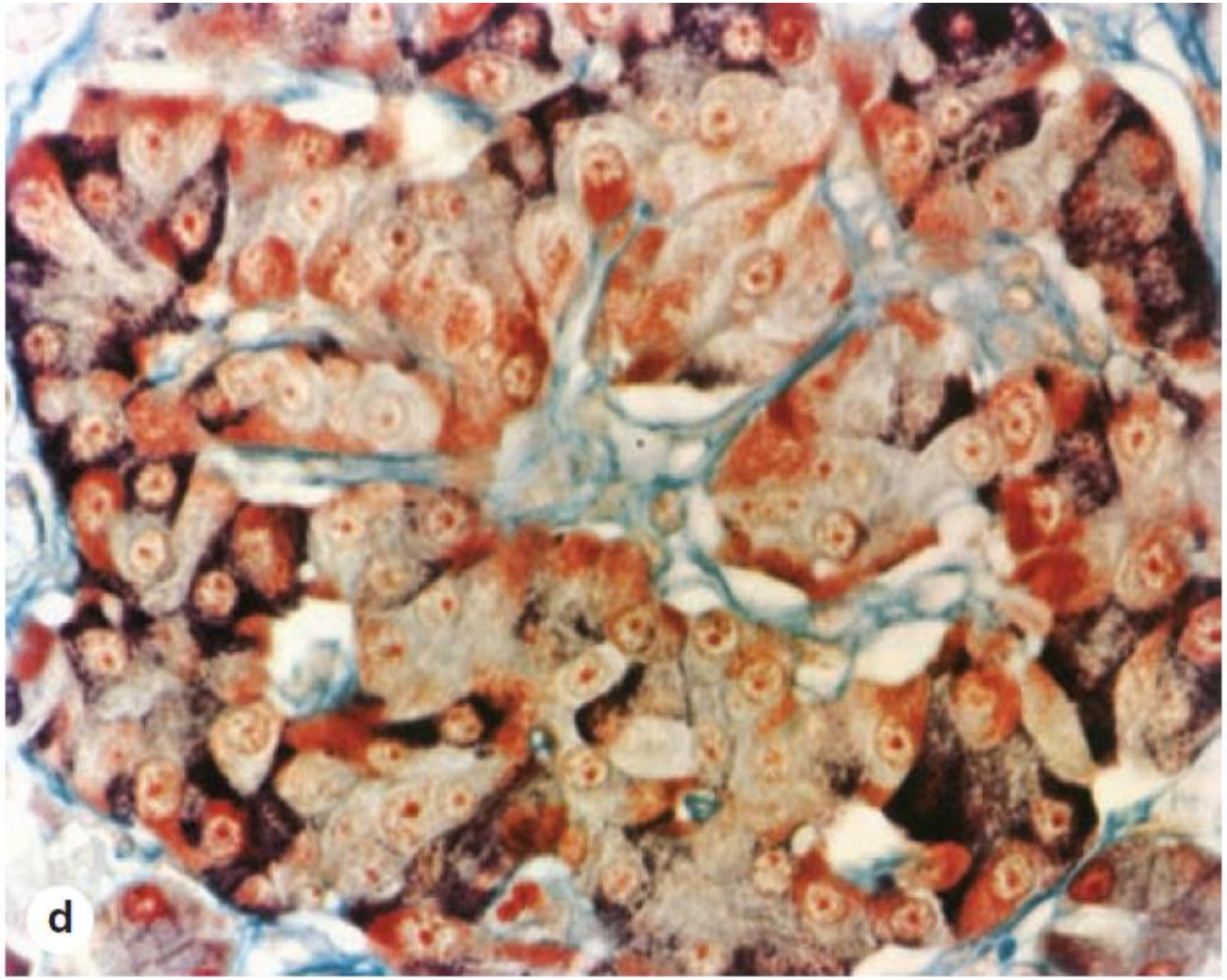
Pancreatic islets

- Compact spherical or ovoid masses of endocrine cells ***embedded*** within the acinar exocrine tissue of the pancreas.
- constitute 1% to 2% of the organ's total volume.
- **The cells of islets are**:
  - polygonal or rounded
  - smaller
  - more lightly stained than the surrounding acinar cells.
  -arranged in cords
  - separated by fenestrated capillaries





❖ The islets are clusters of cells smaller and lighter staining than cells of the surrounding tissue. (X12.5; H&E)

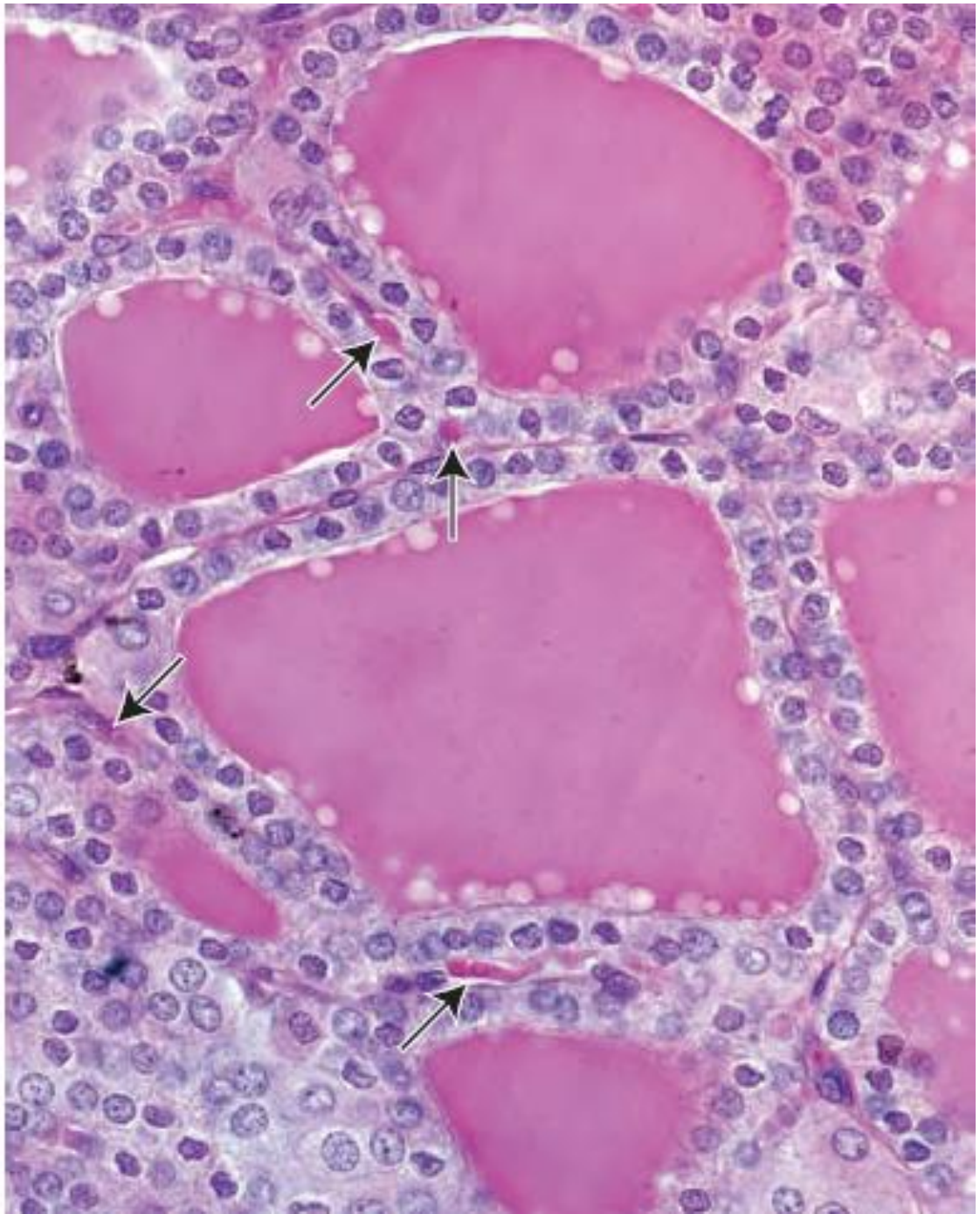


Modified aldehyde fuchsin and light green stain :

- α cells are a deep brownish purple
- β cells granules are brownish orange
- Reticulin connective tissue of the islet capsule and along the capillaries stains green

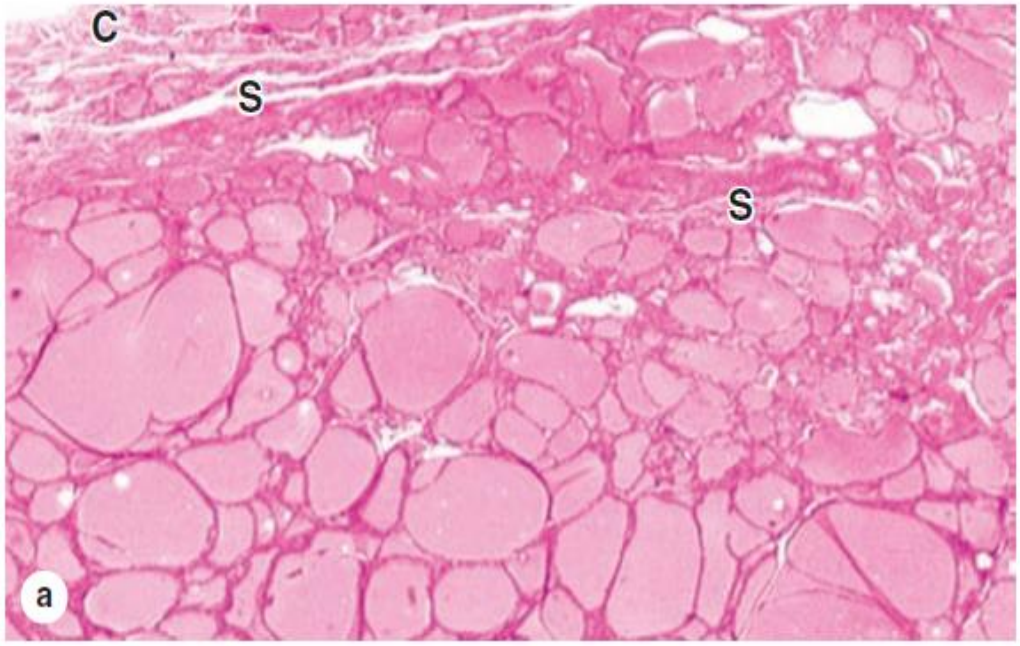
Thyroid gland

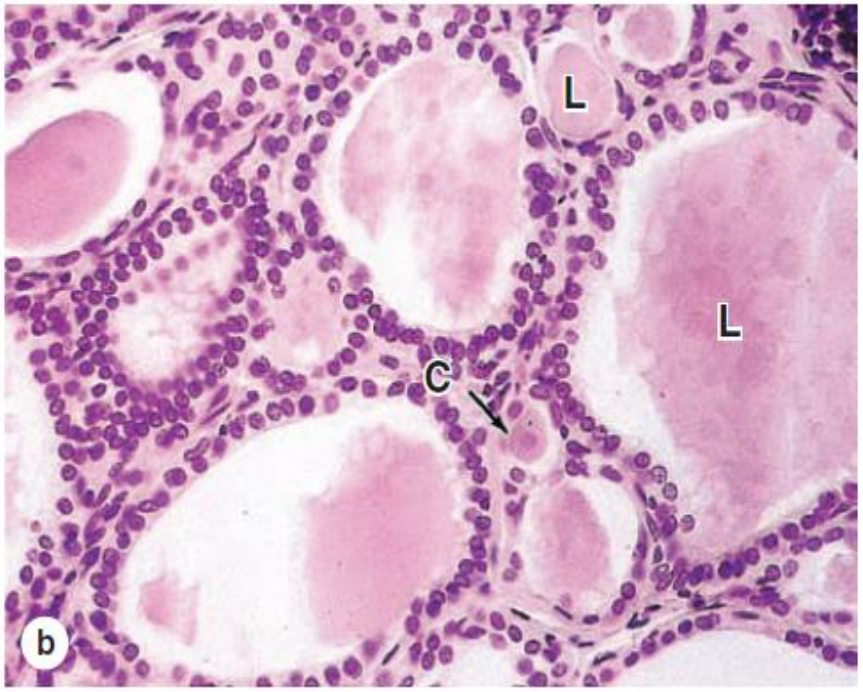
- **The thyroid follicle** is the structural and functional unit of the thyroid gland.
- The thyroid gland has lobular organization.
- A **thyroid follicle** is a roughly spherical cystlike compartment with a wall formed by a simple cuboidal or low columnar epithelium, the **follicular epithelium.**
- The follicles contain a gel-like mass called **colloid**
- The apical surfaces of the follicular cells are in contact with the colloid, and the basal surfaces rest on a typical basal lamina.



- This photomicrograph of a human thyroid is from a section stained with H&E.
  - It shows the colloid-containing follicles of the gland. Each follicle consists of a single layer of epithelial cells surrounding a central mass of colloid.
  - The *arrows* indicate some of the blood capillaries between the follicles. 500.

FIGURE **20–19** **Thyroid follicular cells and parafollicular cells.**





Follicular epithelium contains two types of cells:
- Follicular cells
- Parafollicular cells.

Parafollicular (C) cell

- found:
  - inside the basal lamina of the follicular epithelium or
  - as isolated clusters between follicles.
- These cells have no exposure to the follicle lumen.
- are usually somewhat:
  - larger than follicular cells
  - stain less intensely

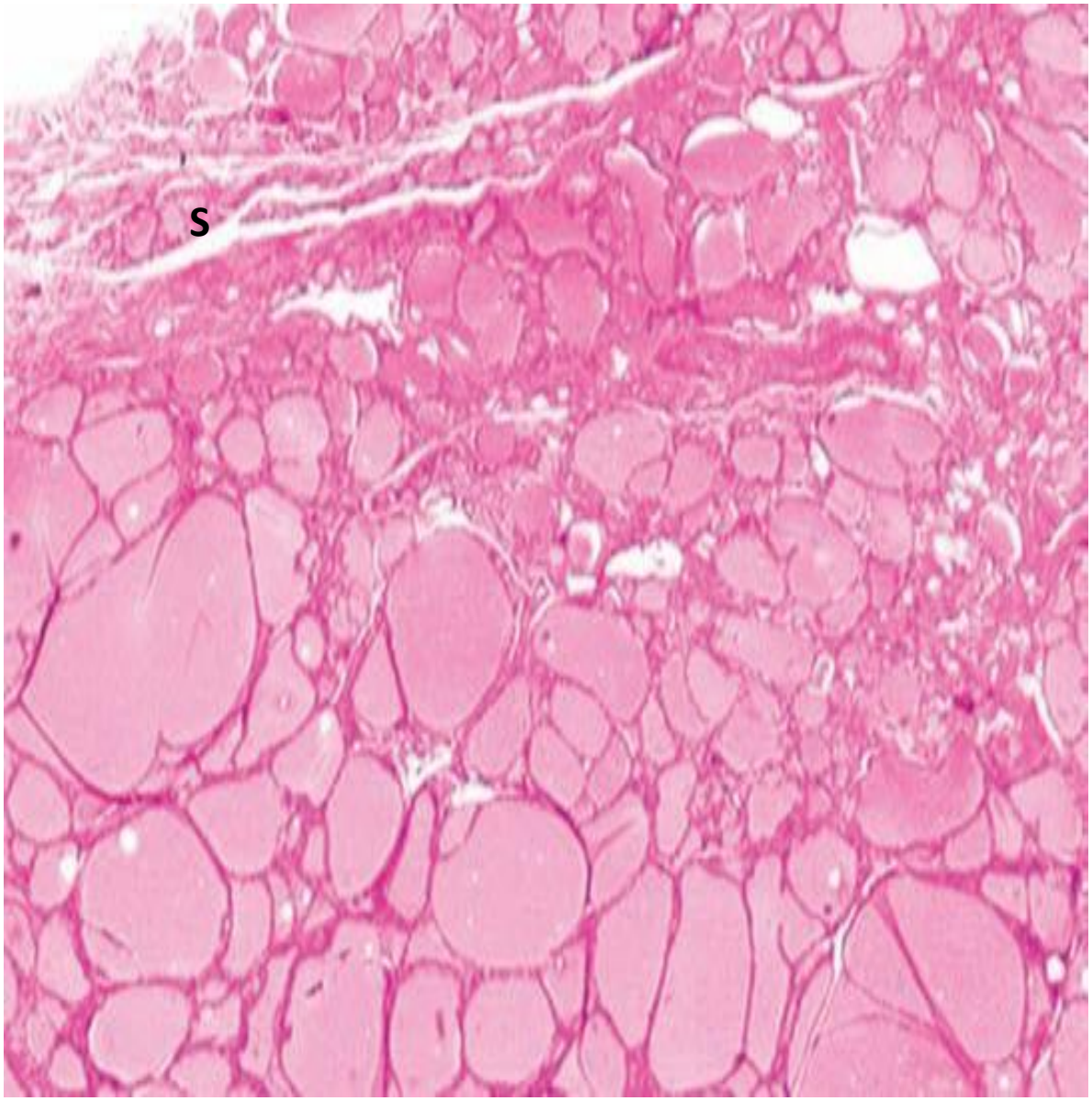
Follicular cell

- vary in shape and size according to the functional state of the gland.
- In routine hematoxylin and eosin (H&E) preparations, follicular cells exhibit a **slightly basophilic** basal cytoplasm with spherical nuclei containing one or more prominent nucleoli.

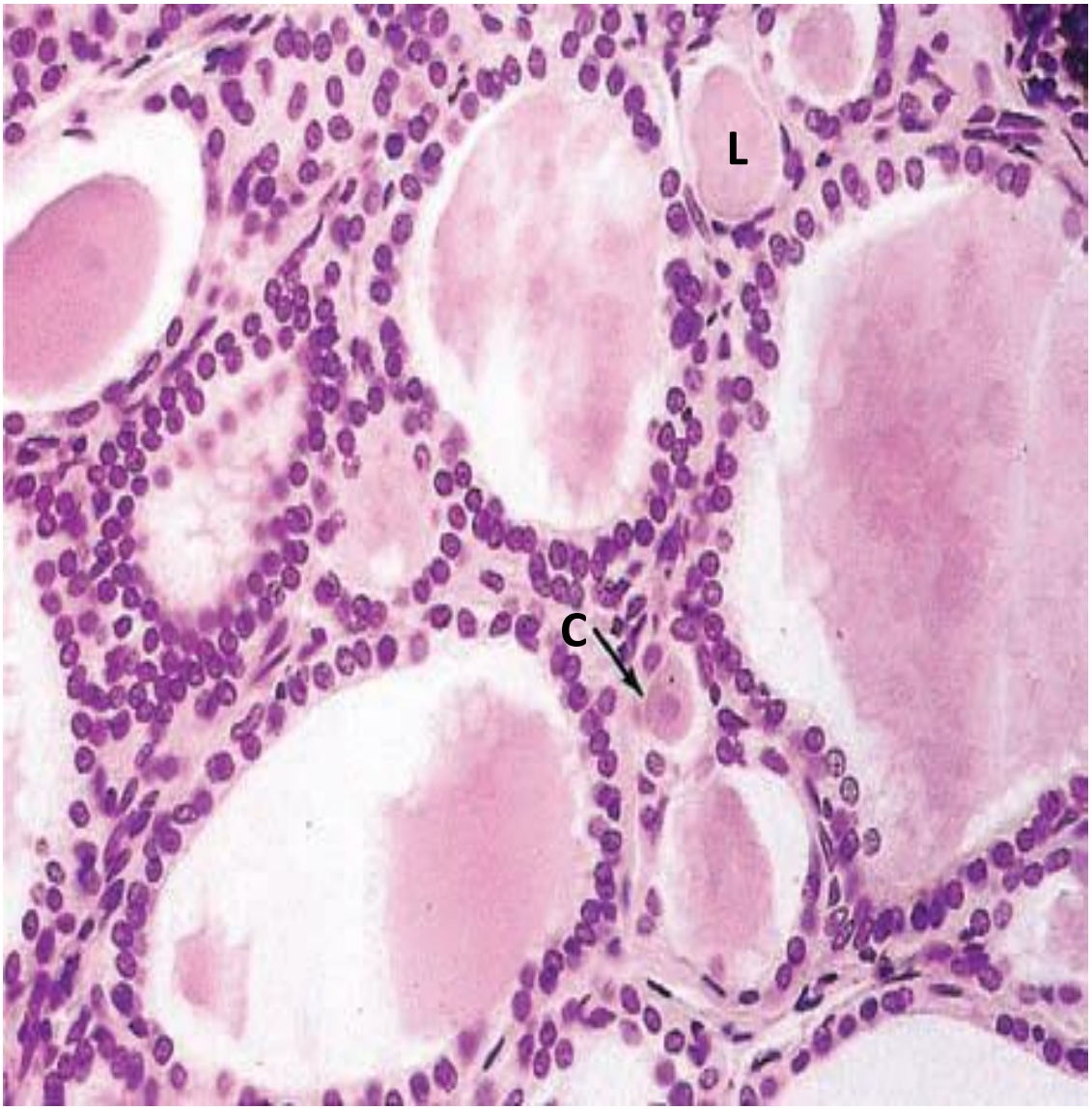
Thyroglobulin (TGB) (colloid)

Basement membrane

Thyroid gland



(a) A low-power micrograph of thyroid gland shows the thin capsule (C), from which **septa** (S) with the larger blood vessels, lymphatics, and nerves enter the gland. The parenchyma of the organ is distinctive, consisting of colloid-filled epithelial **follicles** of many sizes.
- The lumen of each follicle is filled with a lightly staining colloid of a large gelatinous protein called thyroglobulin. X12. H&E.



- The lumen (L) of each follicle is surrounded by a simple epithelium of thyrocytes in which the cell height ranges from squamous to low columnar.
- Also present are large pale staining parafollicular or C cells (C) that secrete calcitonin, a polypeptide involved with calcium metabolism. X200. H&E.

Parathyroid glands

- are four small ovoid masses
- Located on the back of the thyroid gland
- usually embedded in the larger gland's capsule
- Each parathyroid gland is contained within a thin capsule from which septa extend into the gland
- a sparse reticular stroma supports dense elongated clusters of secretory cells.
- **The parathyroid gland has two cell types:**
  - Principal (chief) cells
  - Oxyphil cells

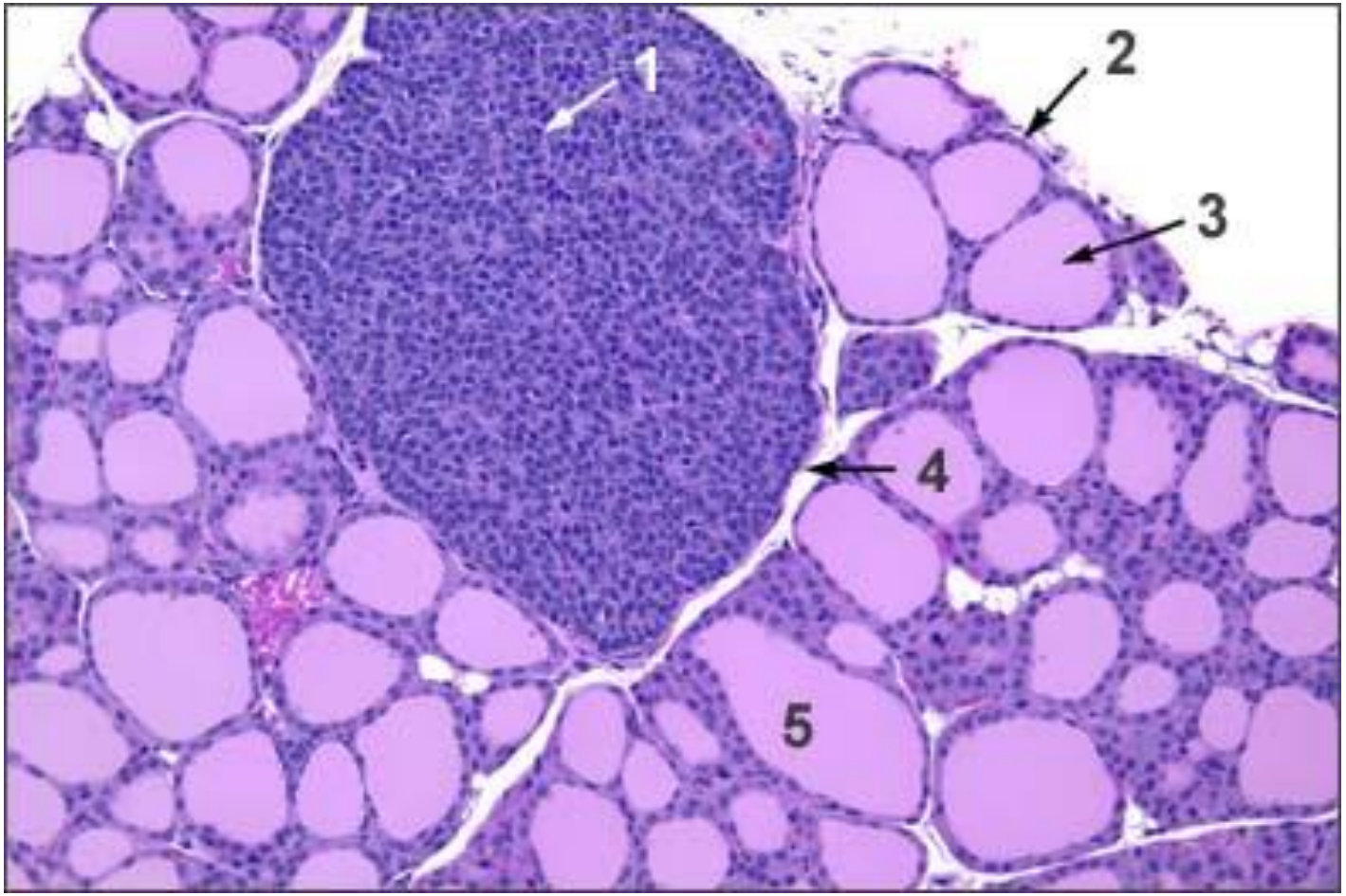
Parathyroid glands

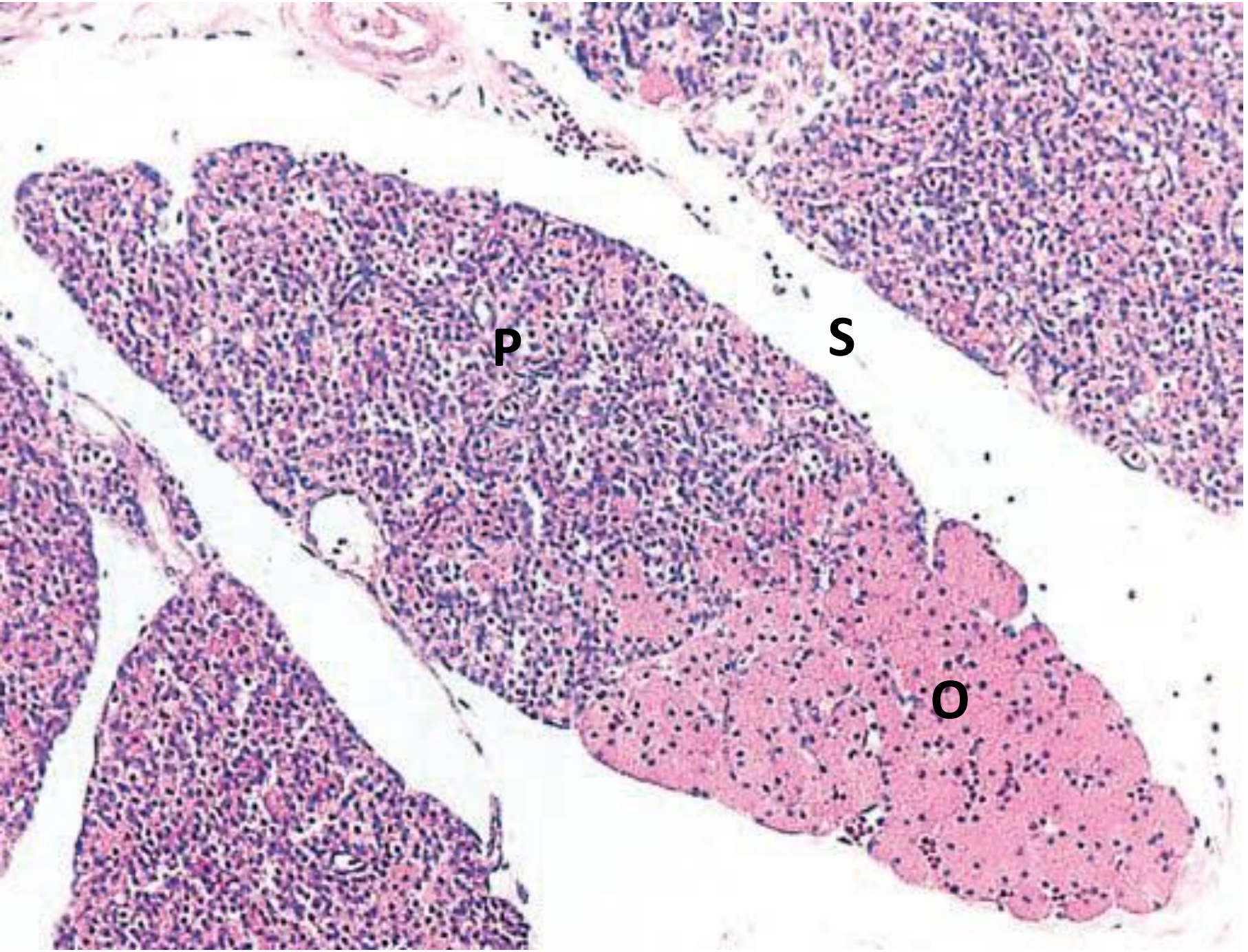
- **Principal (chief) cells are:**
  - more numerous
  - small polygonal cells
  - round nucleus surrounded by a small amount of cytoplasm
  - pale-staining, slightly acidophilic cytoplasm

- **Oxyphil cells are:**
  - seen in scattered groups among the chief cells
  - much larger than the principal cells
  - more commonly in older individuals
  - very acidophilic cytoplasm

- The parathyroid glands are easy to identify, as they are surrounded by thyroid follicles.

- The parathyroid glands are quite easily recognizable from the thyroid as they have densely packed cells, in contrast with the follicular structure the thyroid

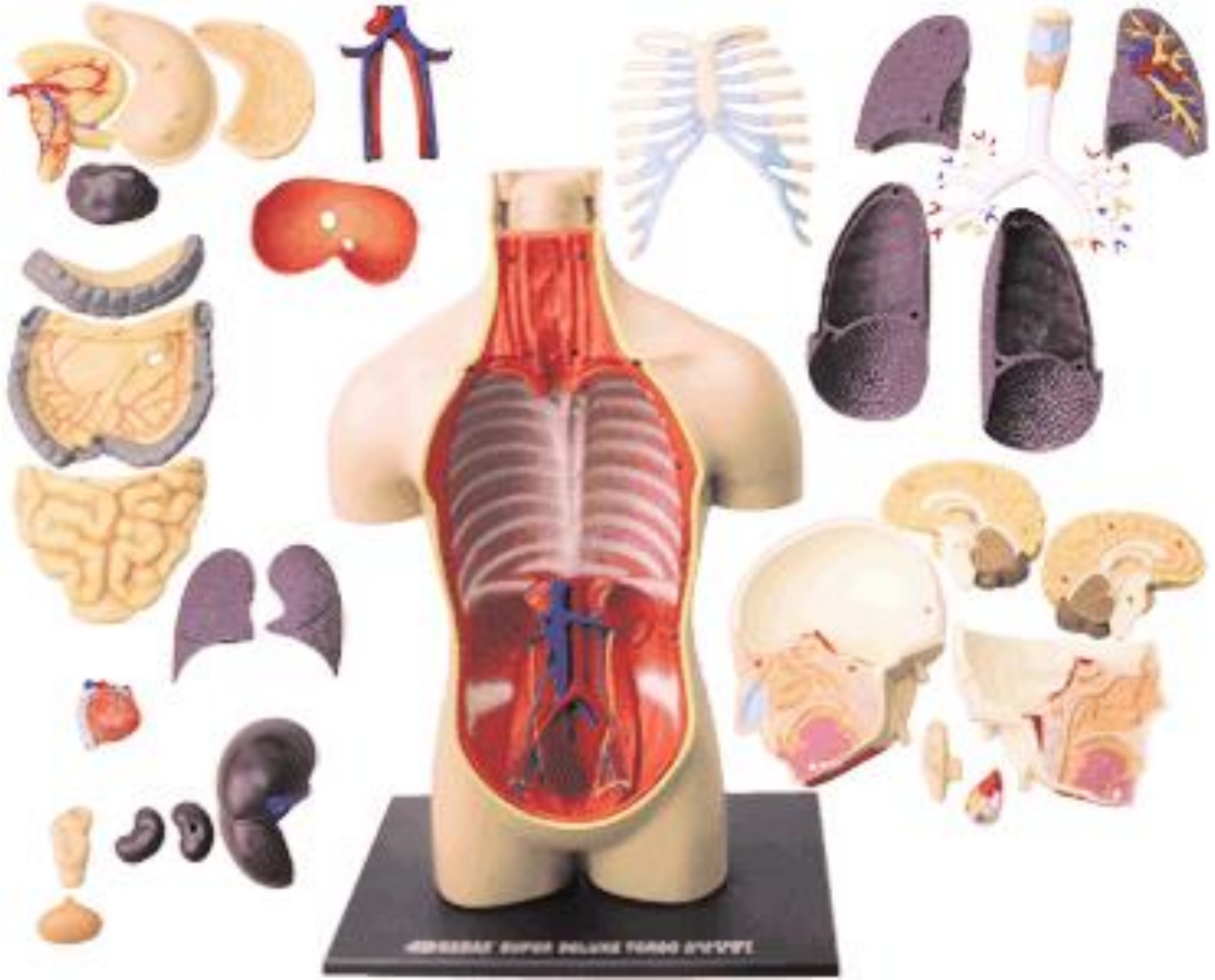


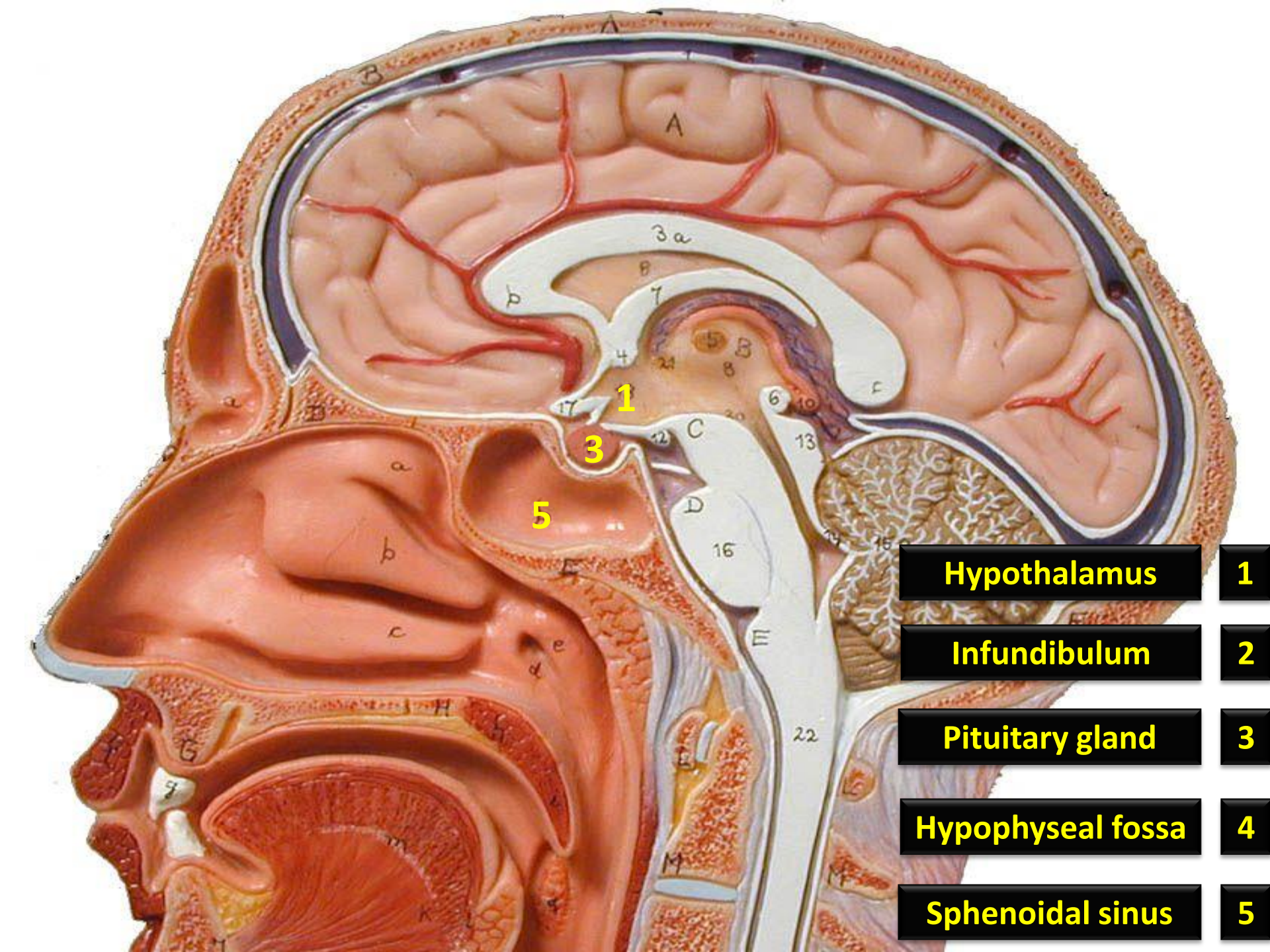

P
S
O

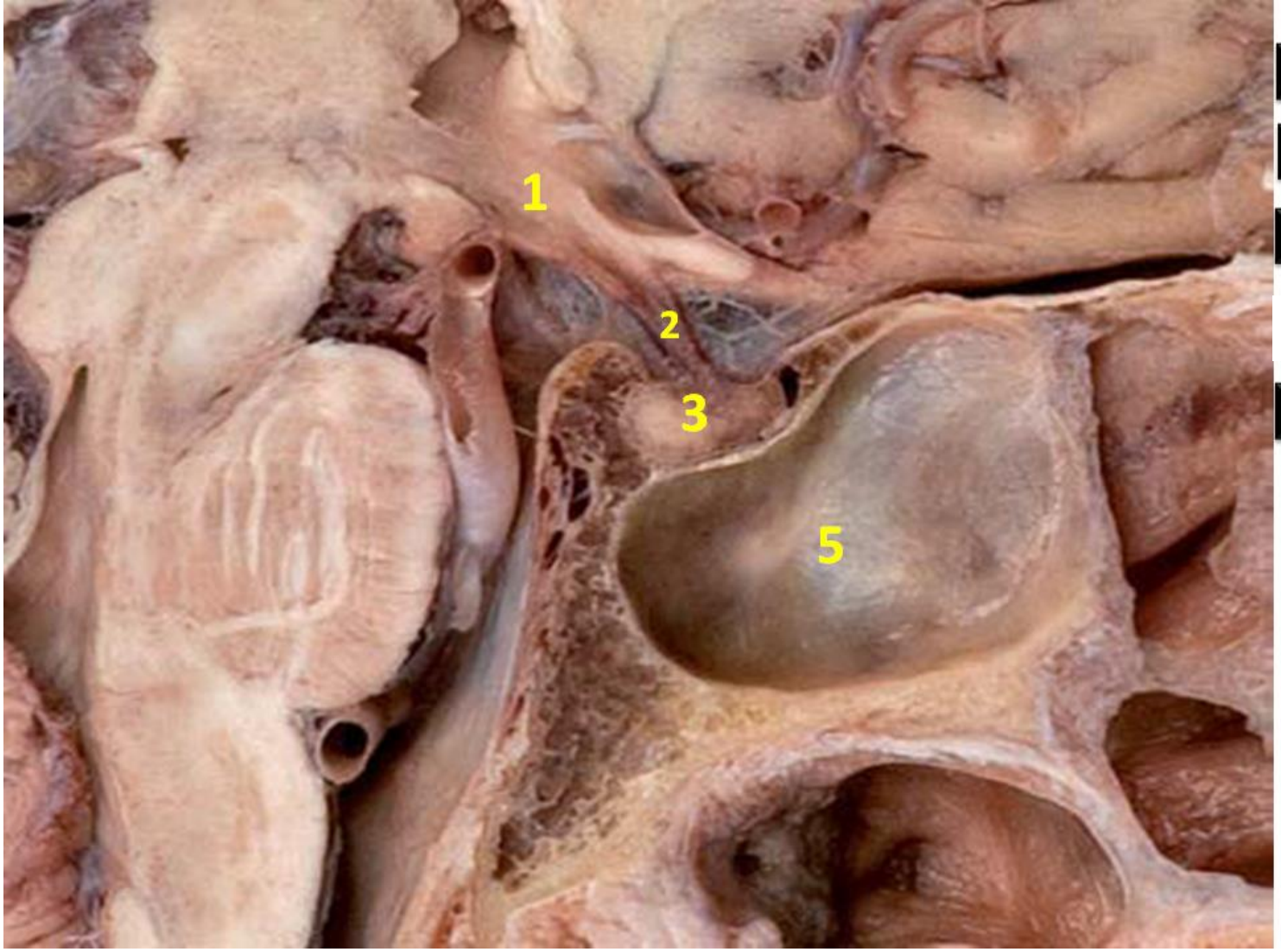
Parathyroid glands

- A small lobe of parathyroid gland, surrounded by connective tissue septa (S), shows mainly densely packed cords of small principal cells (P).
- Older parathyroid glands show increasing numbers of much larger and acidophilic nonfunctional oxyphil cells (O) that may occur singly or in clumps of varying sizes. X60. H&E.

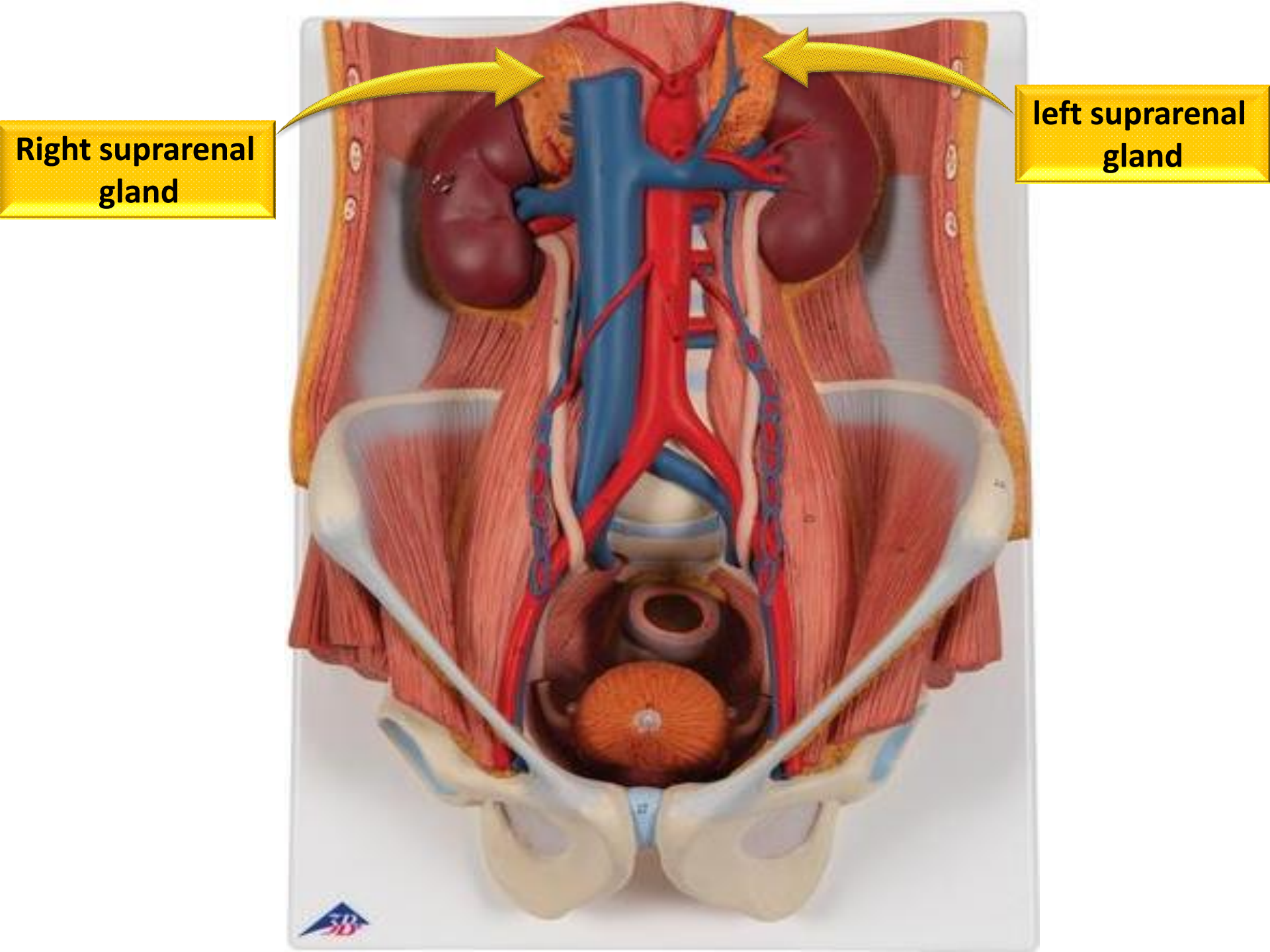
GROSS ANATOMY

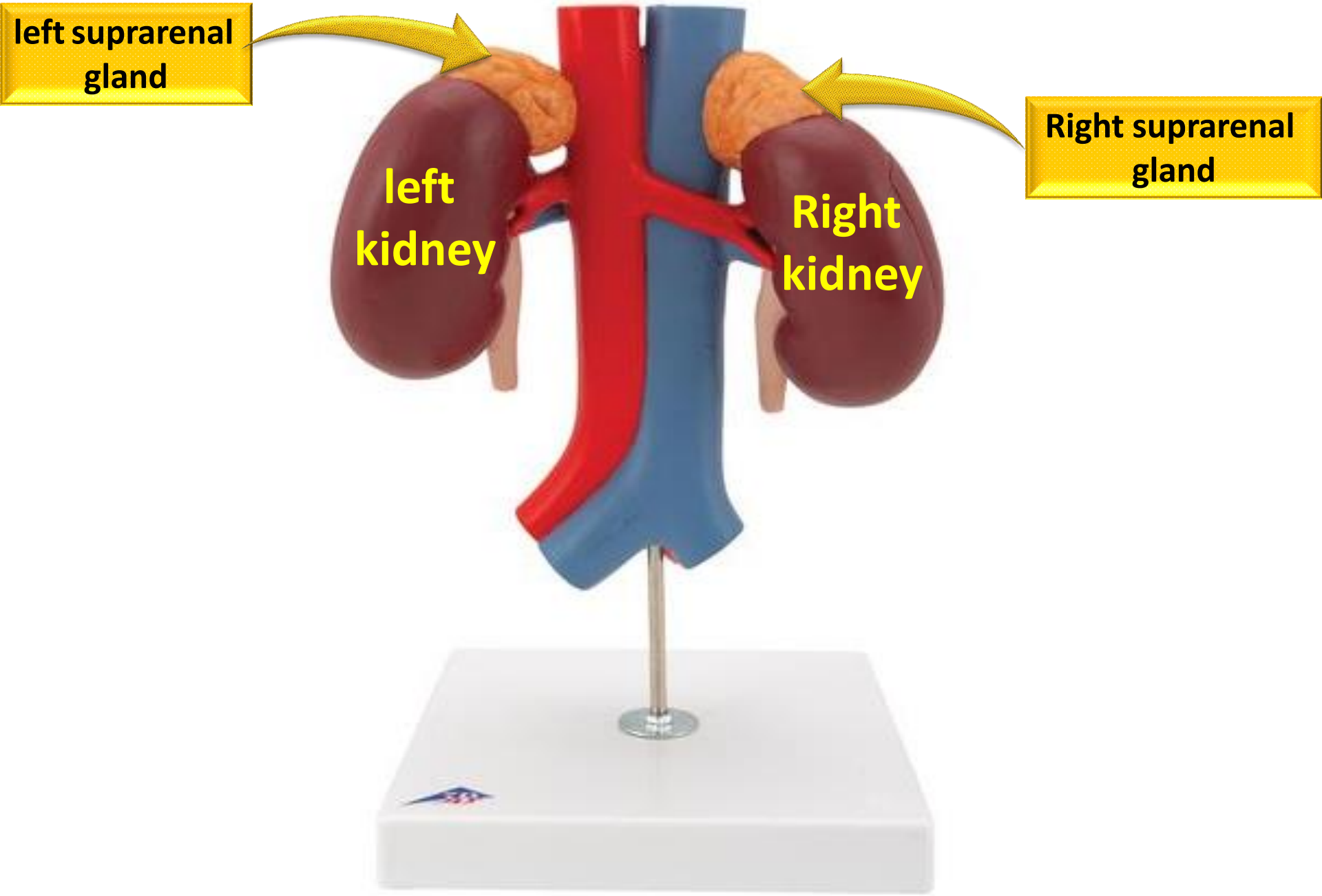


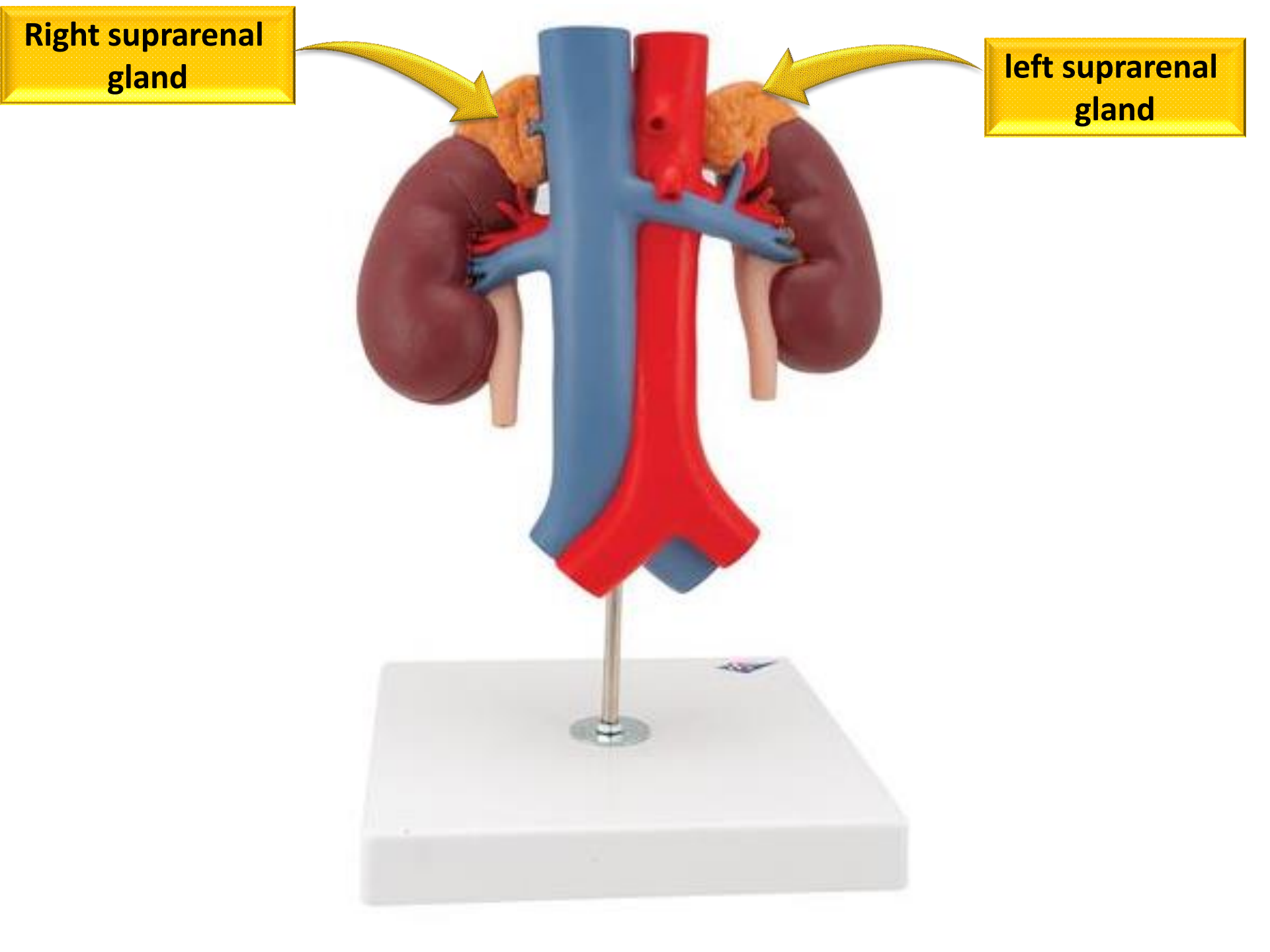

1
3
5
Hypothalamus
1
Infundibulum
2
Pituitary gland
3
Hypophyseal fossa
4
Sphenoidal sinus
5

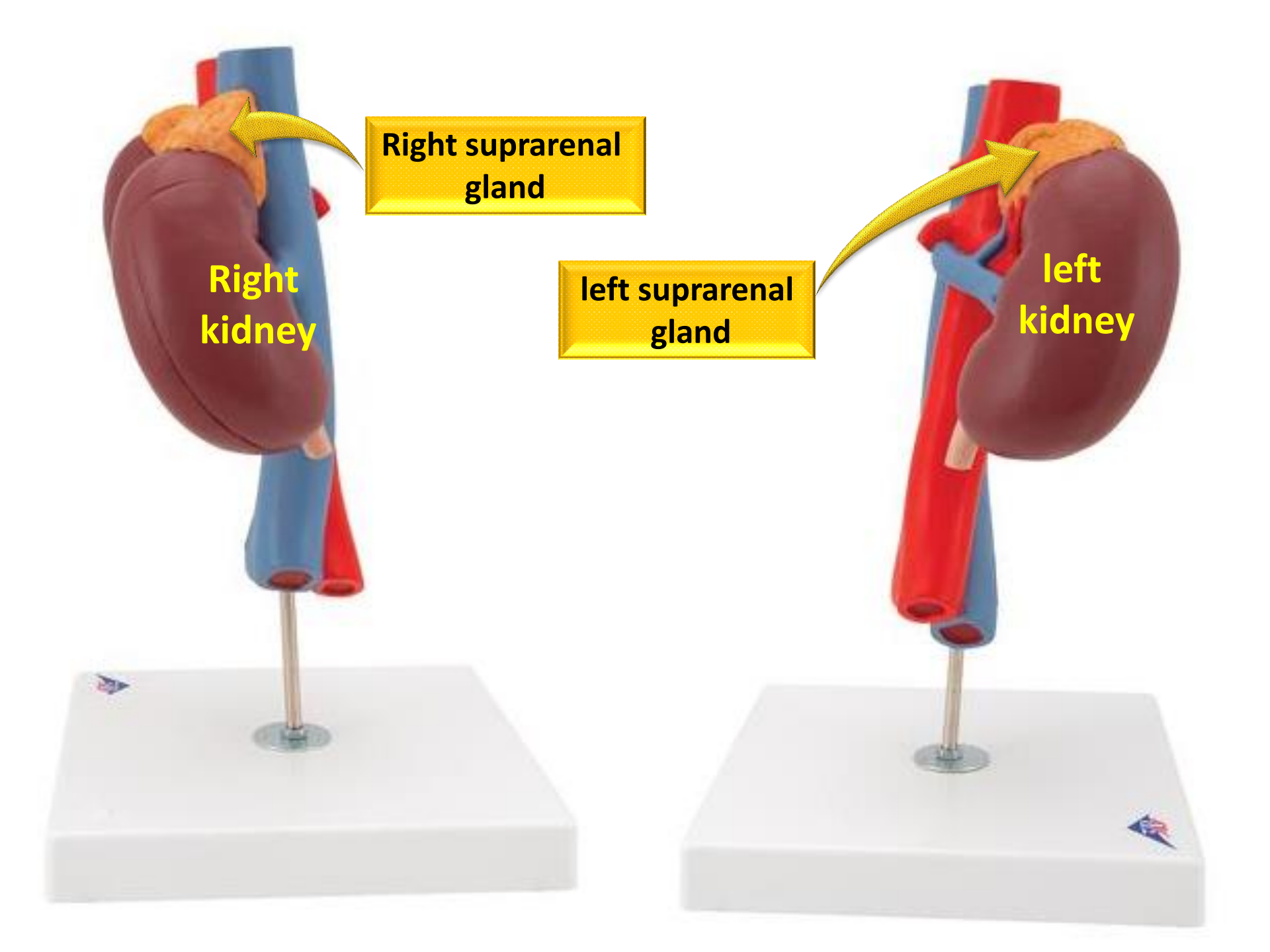


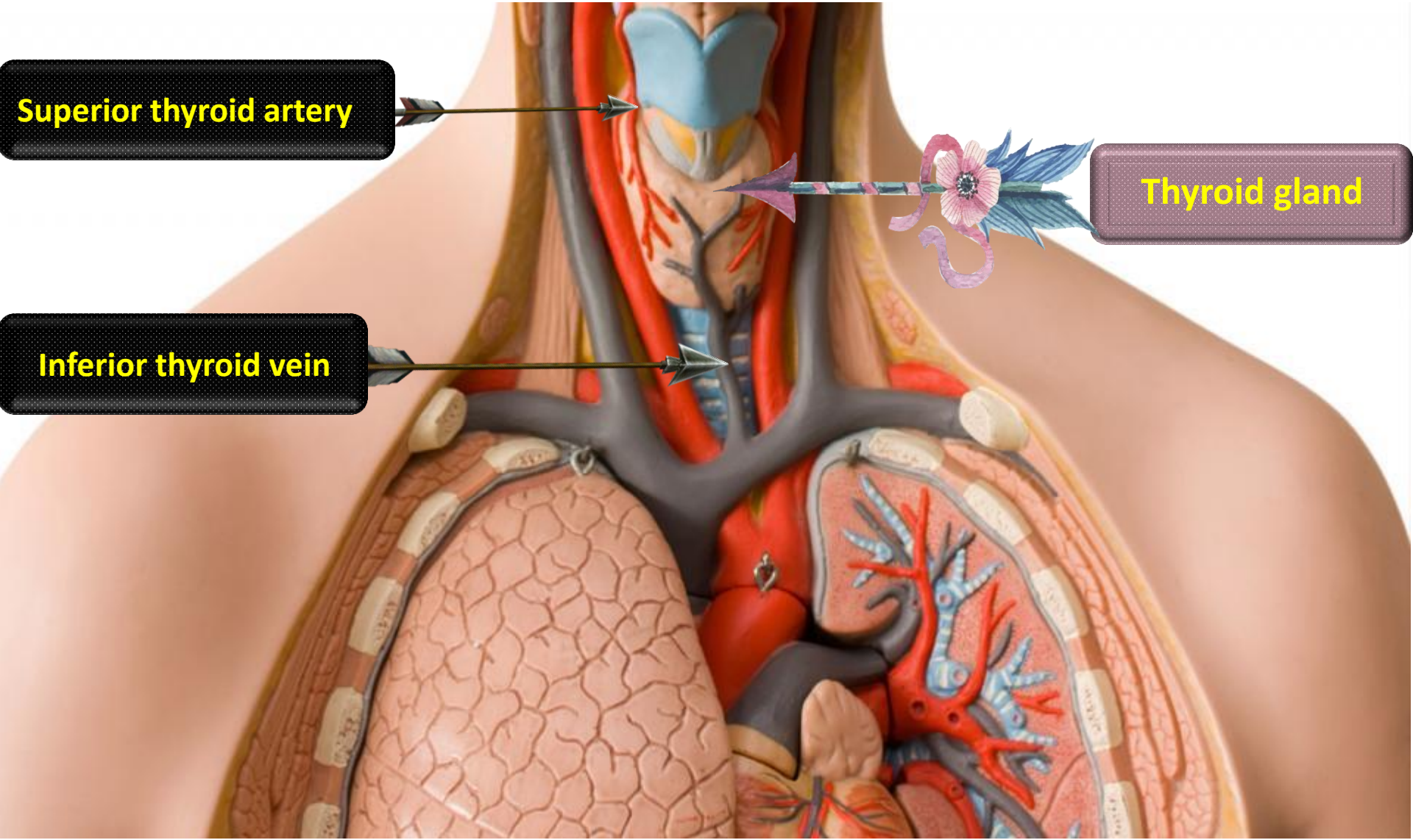
Hypothalamus	1
Infundibulum	2
Pituitary gland	3
Sphenoidal sinus	5

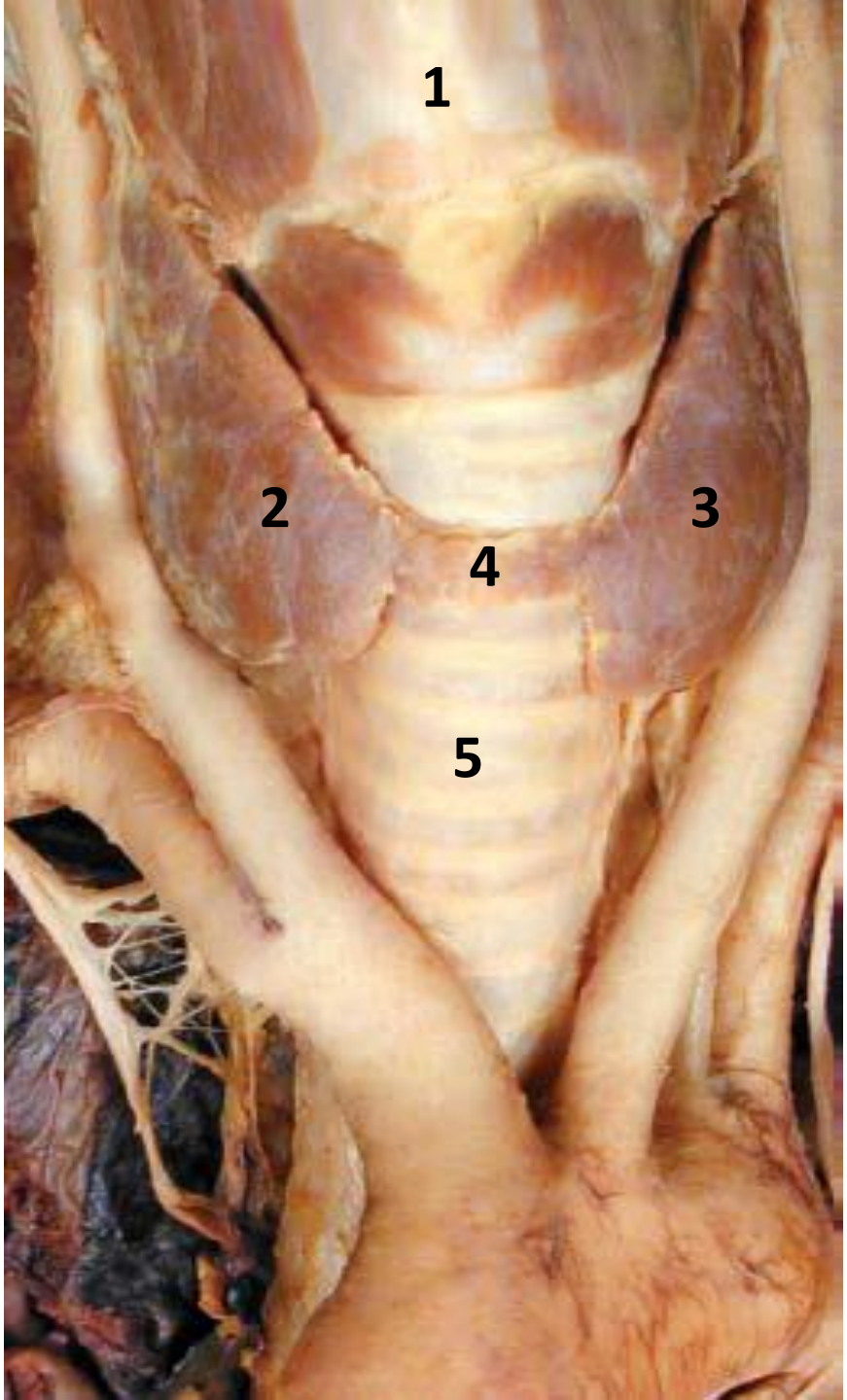

Right suprarenal gland
left suprarenal gland


left suprarenal gland
Right suprarenal gland
left kidney
Right kidney


Right suprarenal gland
left suprarenal gland


Right suprarenal gland
left suprarenal gland
Right kidney
left kidney


Superior thyroid artery
Thyroid gland
Inferior thyroid vein



Thyroid cartilage	1
Right lateral lobe of thyroid gland	2
Left lateral lobe of thyroid gland	3
Isthmus of thyroid gland	4
Trachea	5


Good luck