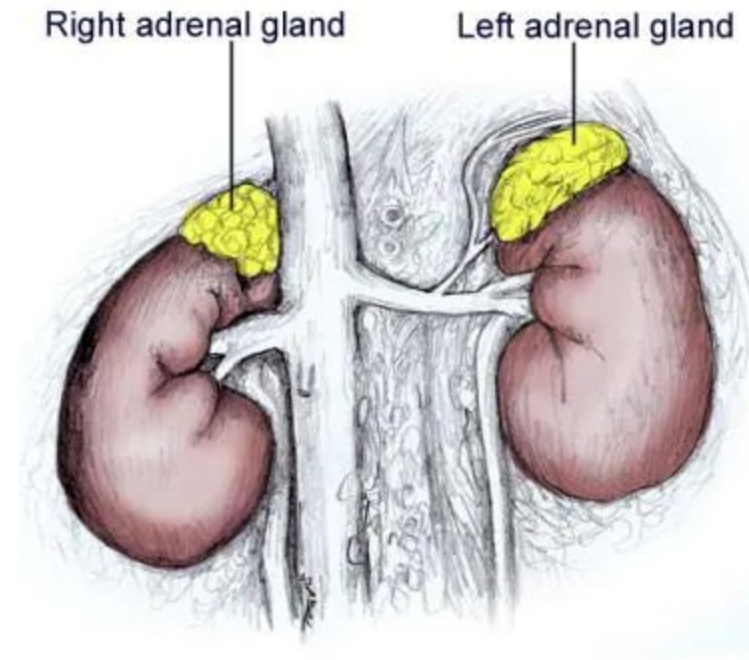
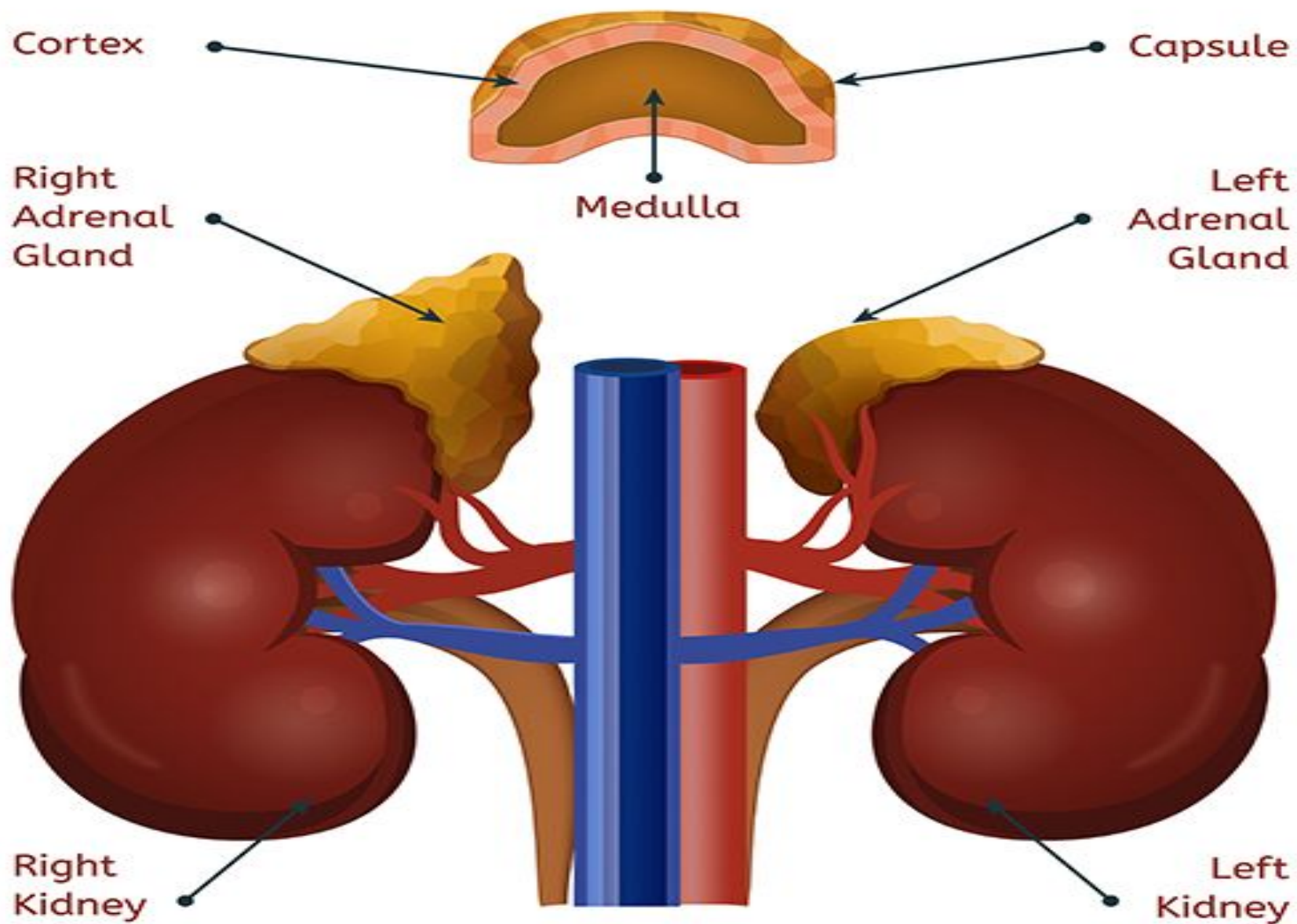




ANATOMY & HISTOLOGY LAB – SUPRARENAL GLANDS (ADRENAL GLANDS)

ROLA ALWAHEIDI, MD

KIDNEYS & ADRENAL GLANDS



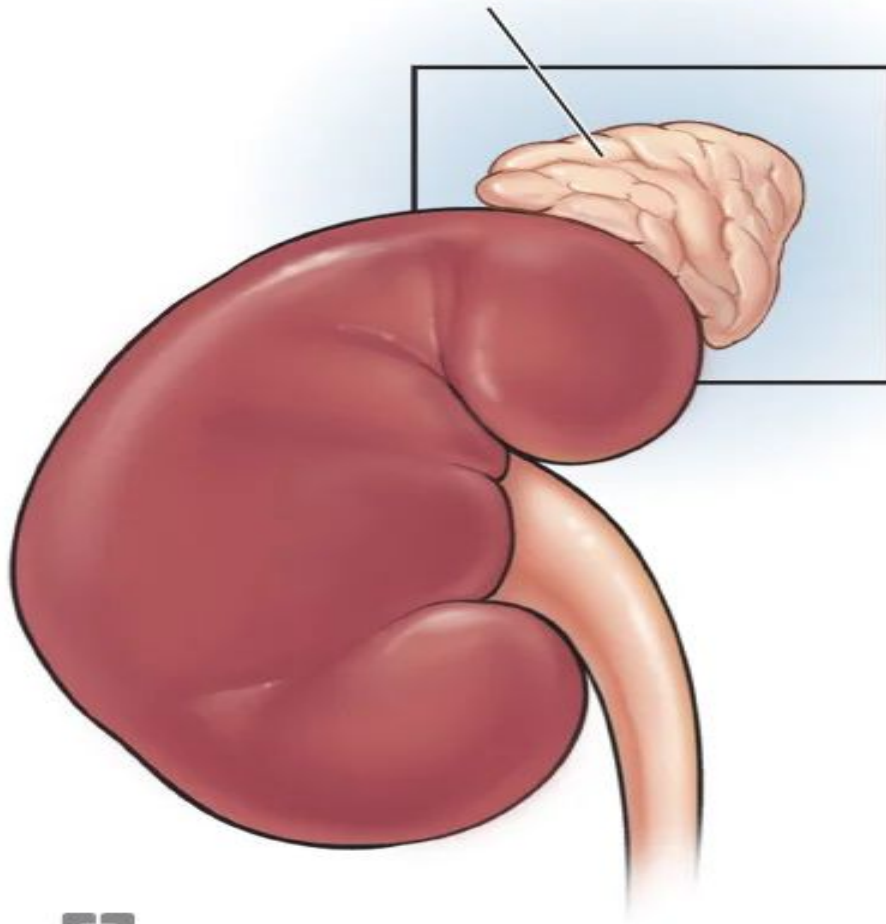
ADRENAL GLANDS ANATOMY

- ❑ **Description:** a bilateral endocrine gland composed of an **outer cortex** that produces steroid hormones and **inner medulla** that produces catecholamines (e.g., epinephrine).



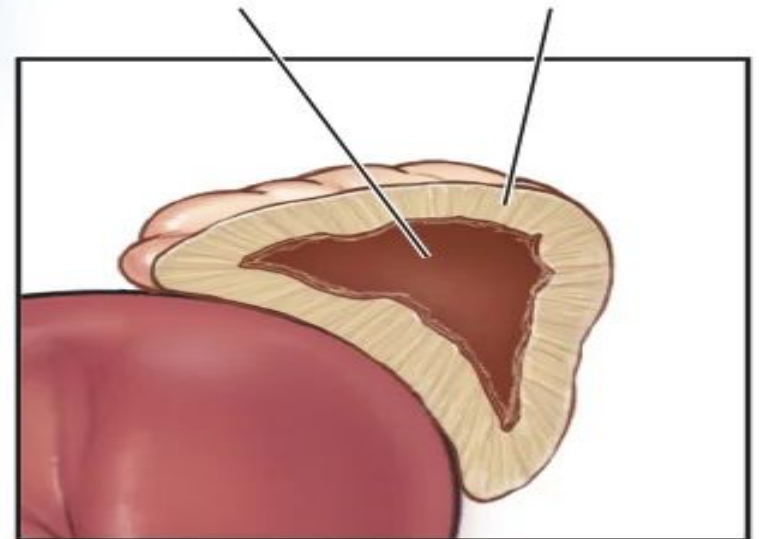
Adrenal Gland

Adrenal gland



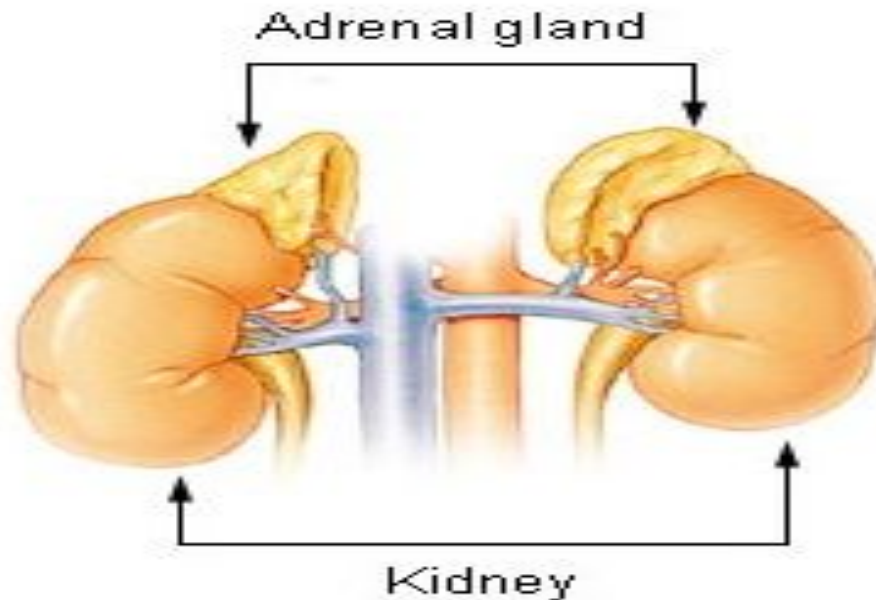
Adrenal medulla

Adrenal cortex



Morphology

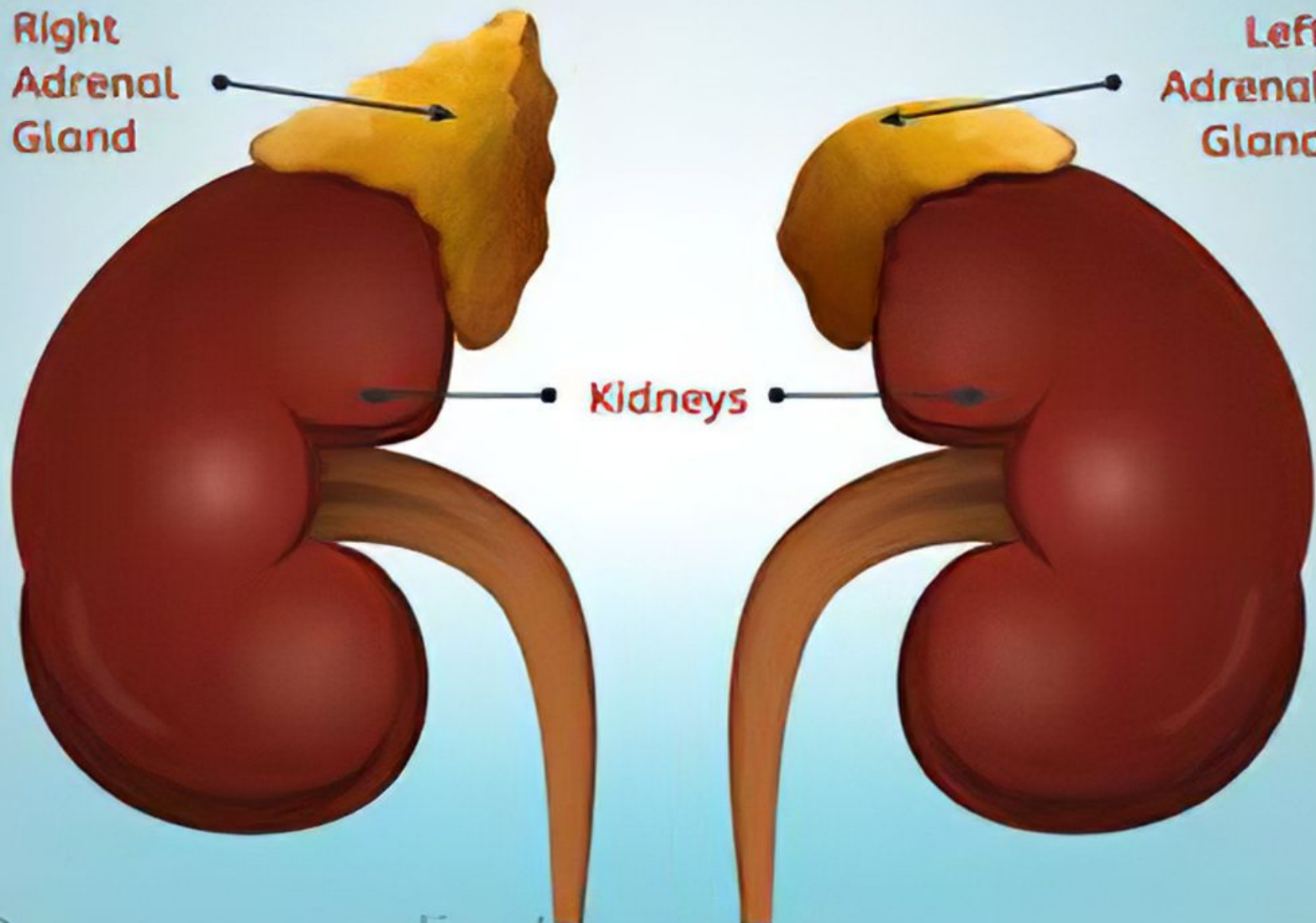
- Height 4-6 cm
- Thickness 4-6 mm
- Width: 1-2 cm
- Weight together 8 gm
- The left adrenal gland is shaped like a crescent, while the right resembles a pyramid.



Right
Adrenal
Gland

Left
Adrenal
Gland

Kidneys

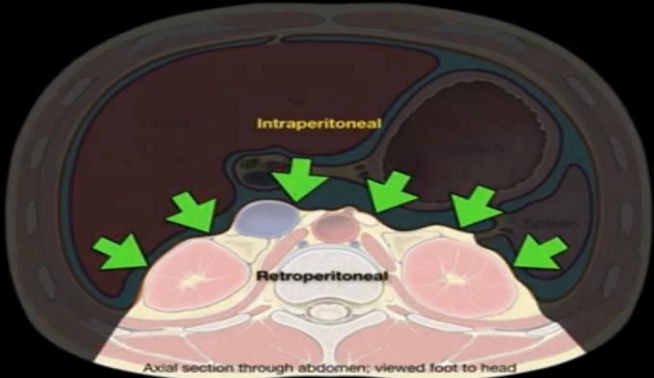


Location

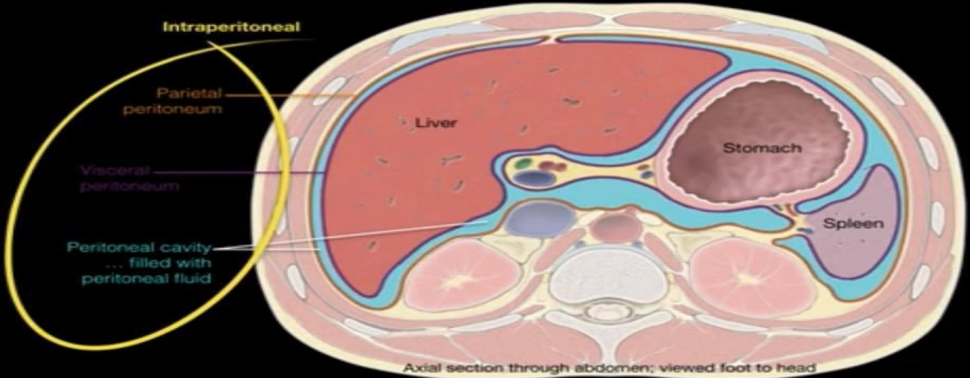
- Primary retroperitoneal organs
 - Each gland is located superior to the upper pole of the kidney.
 - Enclosed by the renal fascia and adipose capsule of the kidney
- The **right suprarenal gland** lies behind the right lobe of the liver and extends medially behind the inferior vena cava. It rests posteriorly on the diaphragm.
- The **left suprarenal gland** lies behind the pancreas, the lesser sac, and the stomach and rests posteriorly on the diaphragm.

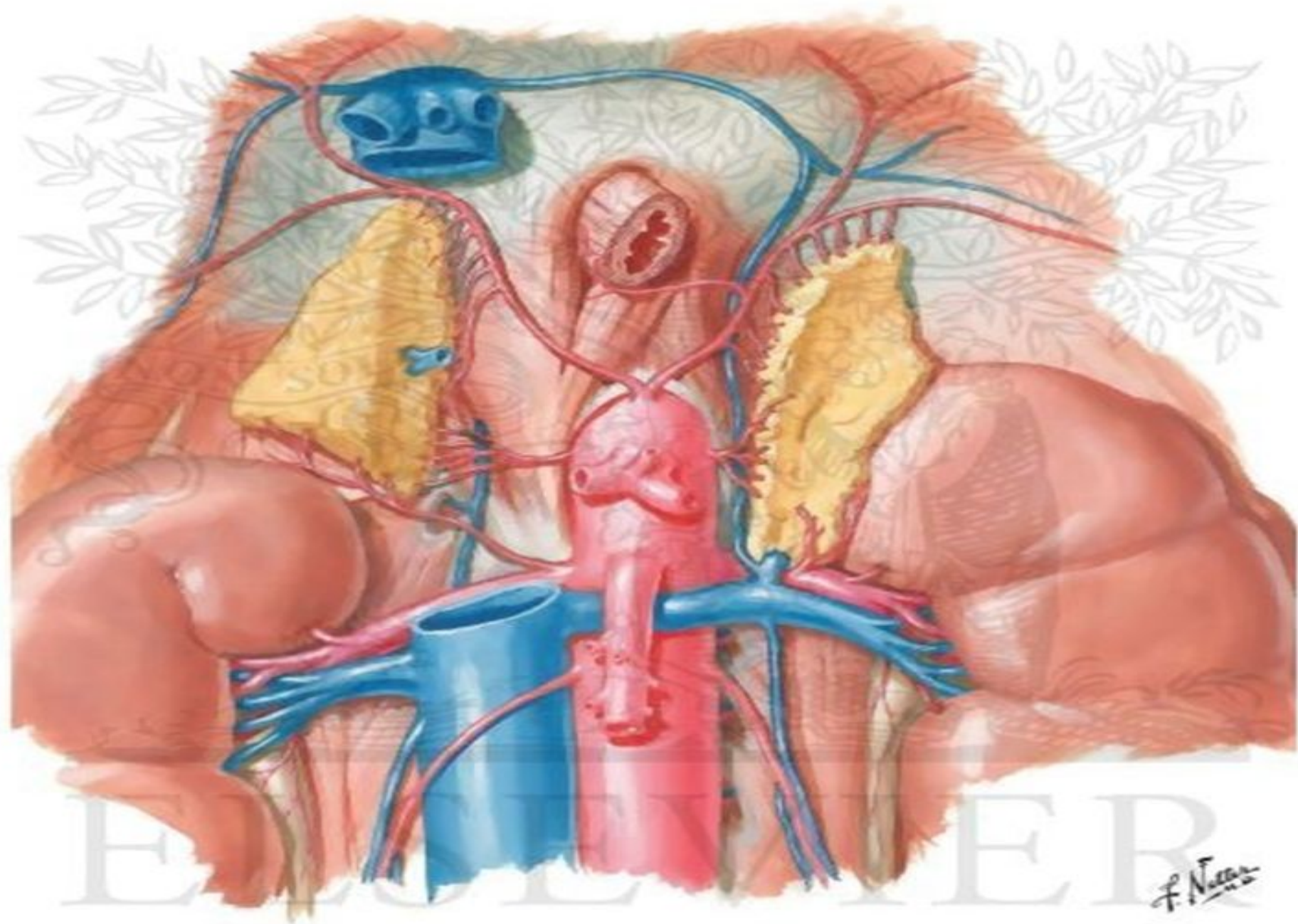


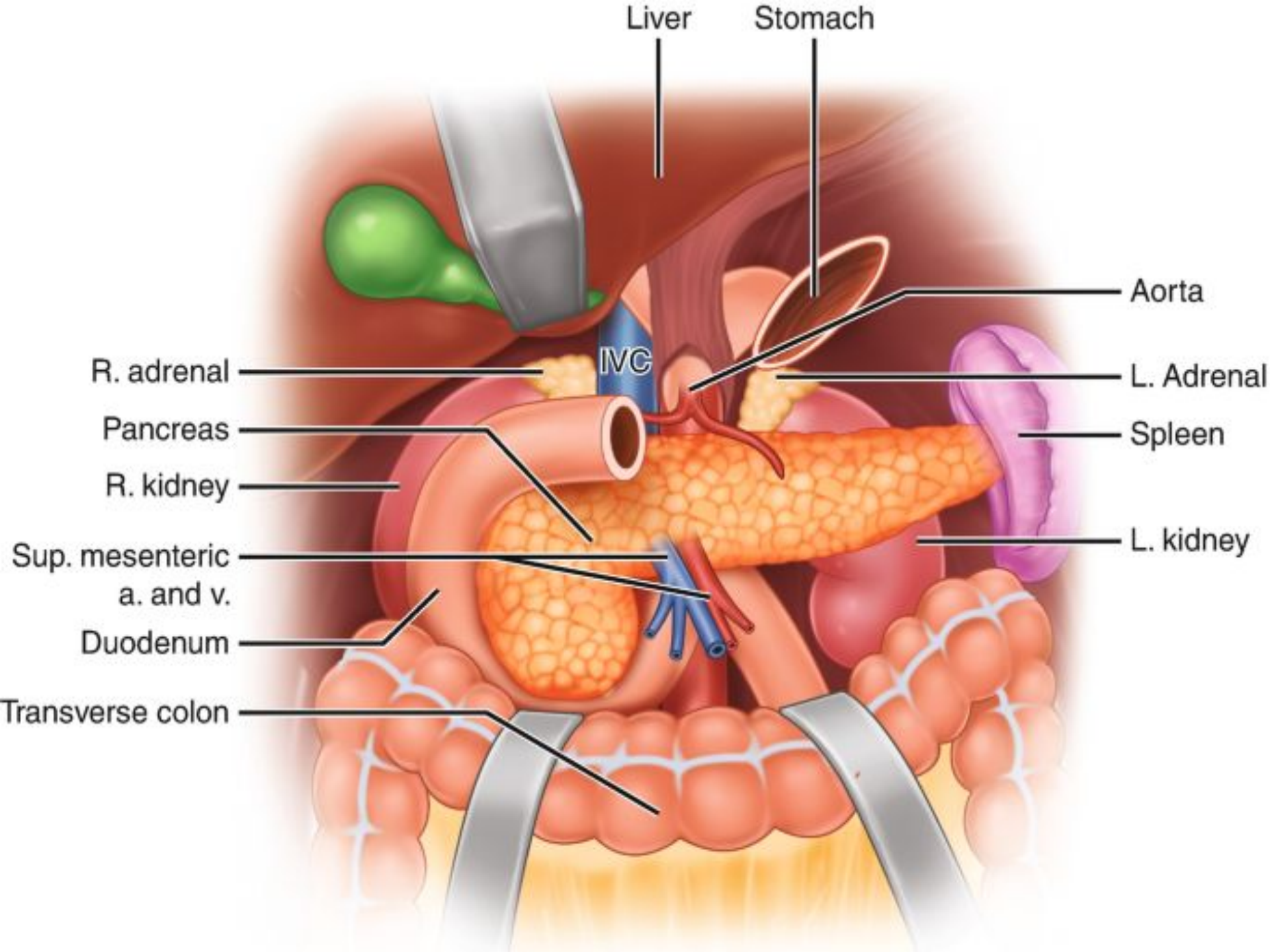
- Adrenal gland
- Retroperitoneal

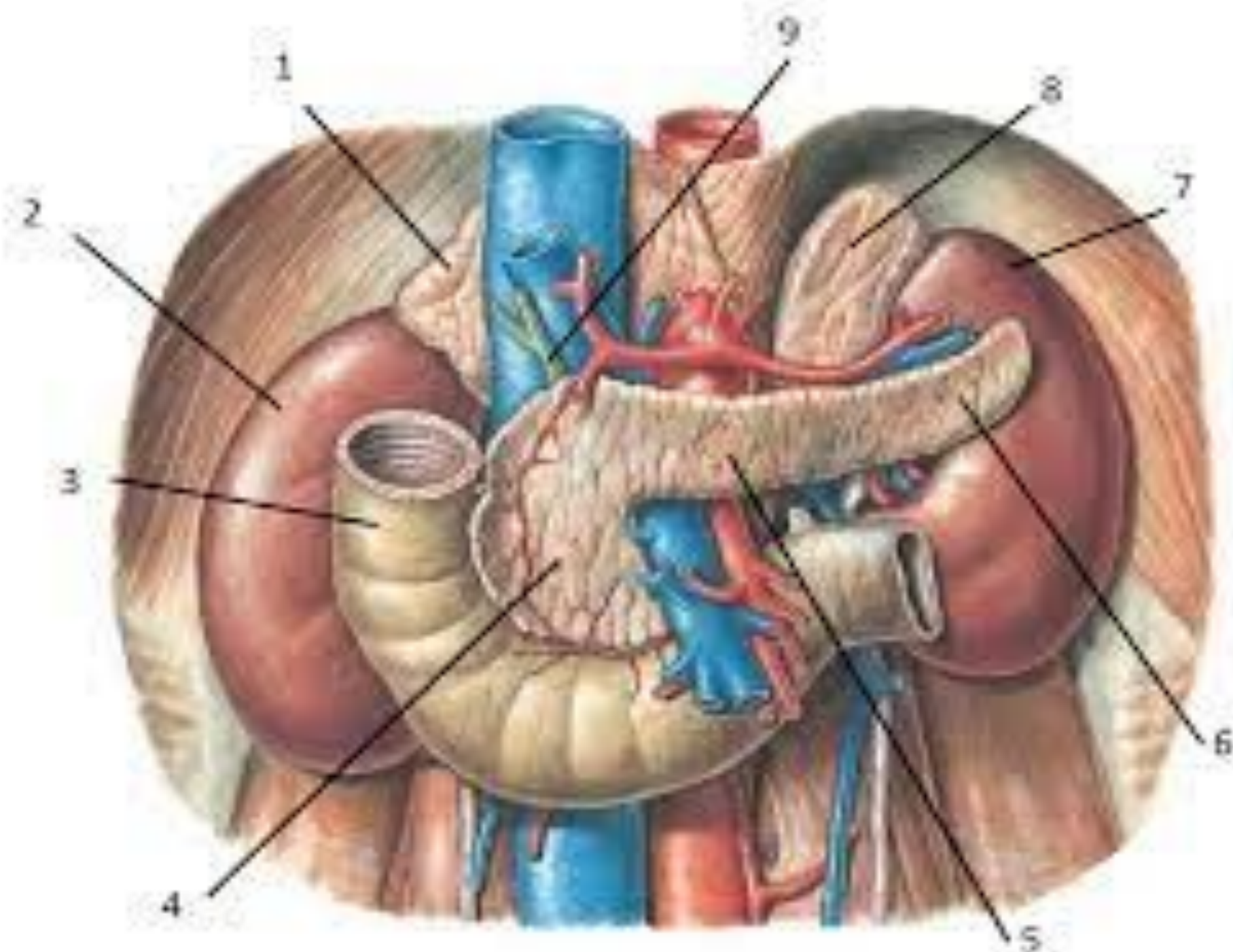


- Adrenal gland
- Retroperitoneal





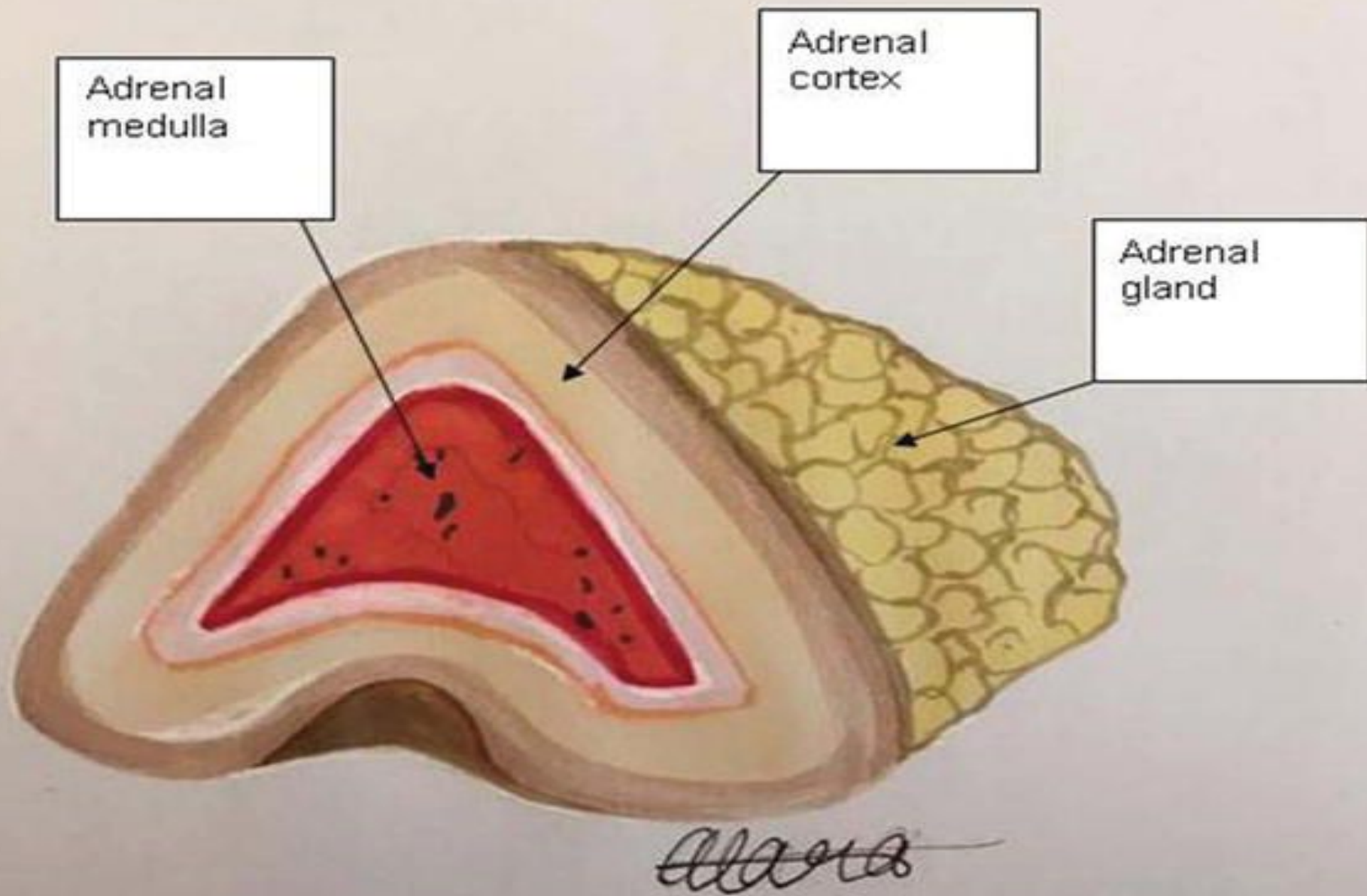




□ **Function**

- **Adrenal cortex**: production of steroid hormones (mineralocorticoids, glucocorticoids, and androgens)
- **Adrenal medulla**: production of catecholamines (epinephrine, norepinephrine)





Blood supply and lymphatics

- ❖ Because the adrenal glands produce and subsequently release a number of essential hormones, they are very well vascularized and perfused.



▣ **Arterial blood supply** (Usually, the two glands receive blood from three arteries in the same fashion. They supply a network of small arteries that enter the adrenal glands.)

- Superior suprarenal artery - Arises from the ipsilateral inferior phrenic artery
- Middle suprarenal artery - Branches off the lateral side of the abdominal aorta
- Inferior suprarenal artery - Arises from the ipsilateral renal artery



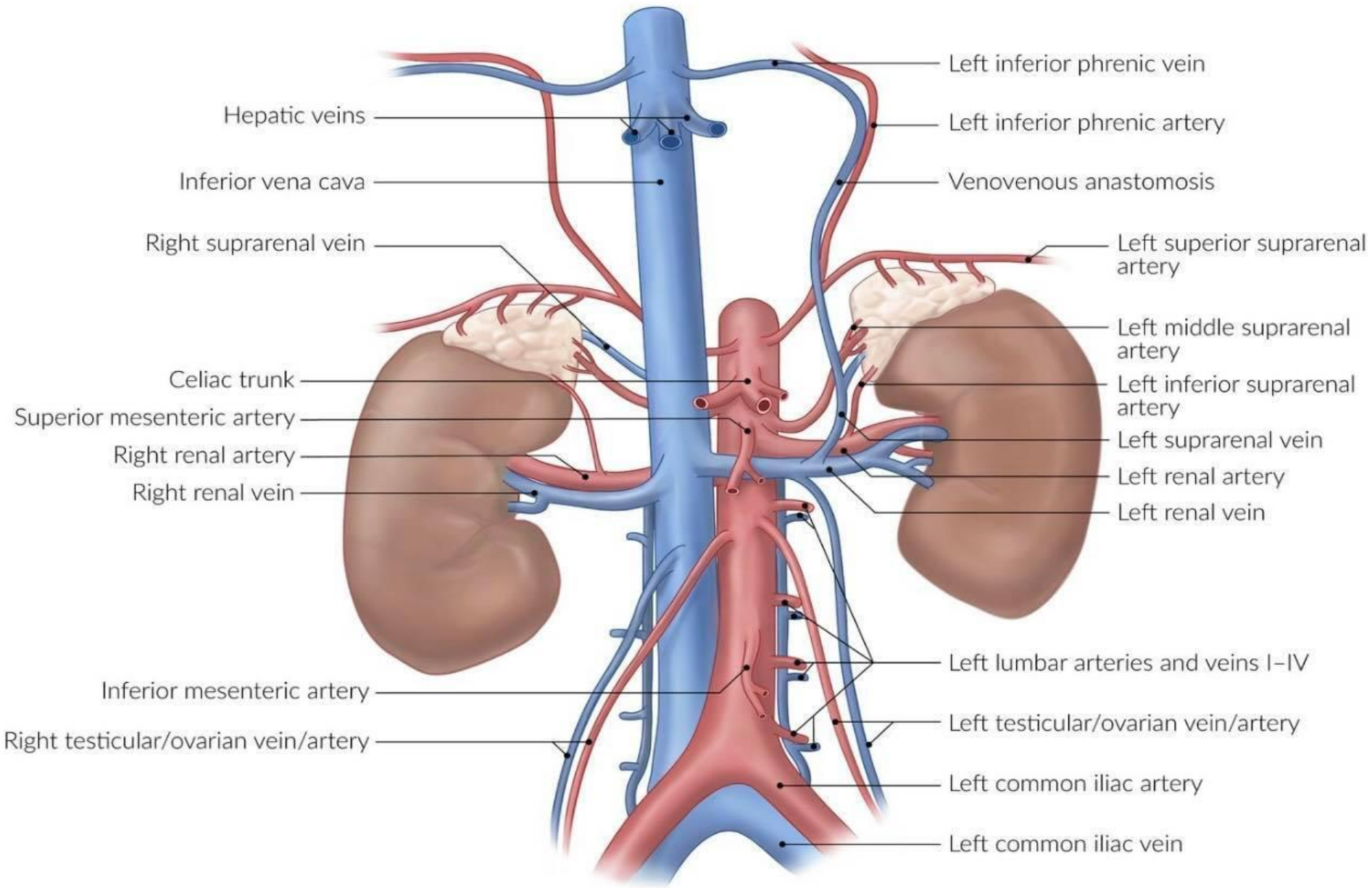
▣ Venous drainage

- The right suprarenal vein drains into the inferior vena cava.
- The left suprarenal vein drains into the left renal vein and then into the inferior vena cava.

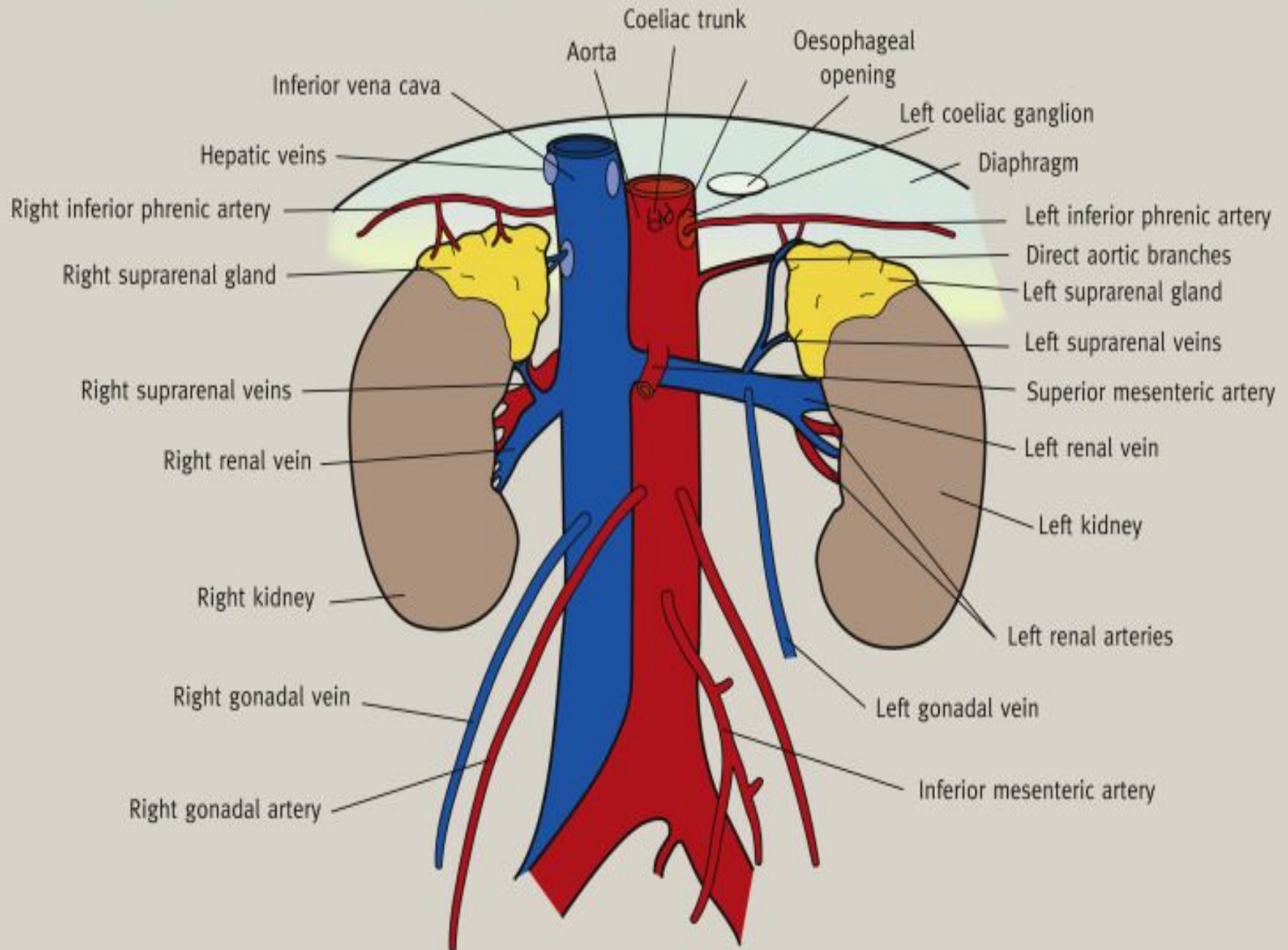
▣ Lymphatic drainage (Para-aortic LNs)

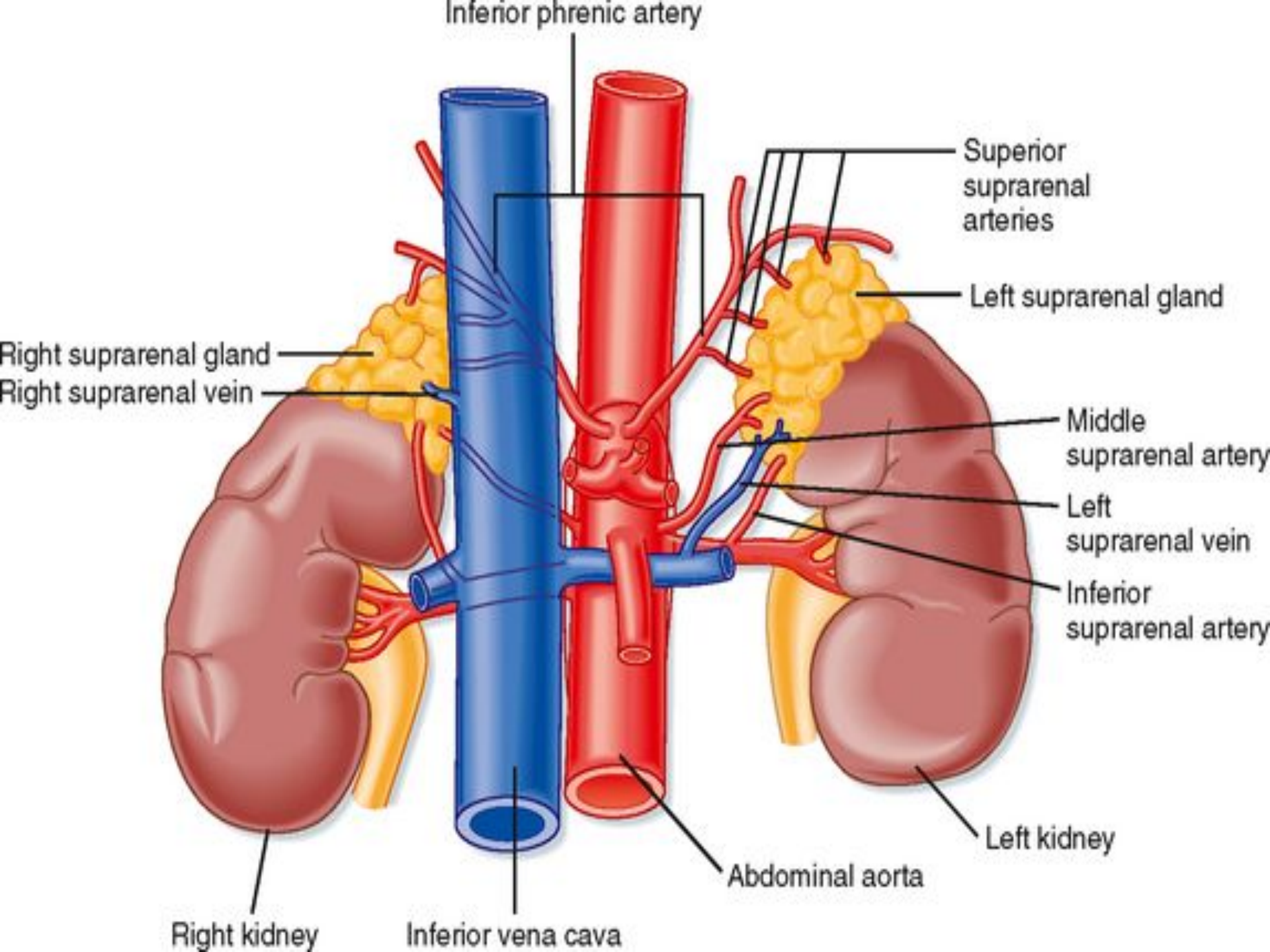
- Left aortic lymph nodes
- Right caval lymph nodes





The adrenal glands with their blood supply and anatomical relations



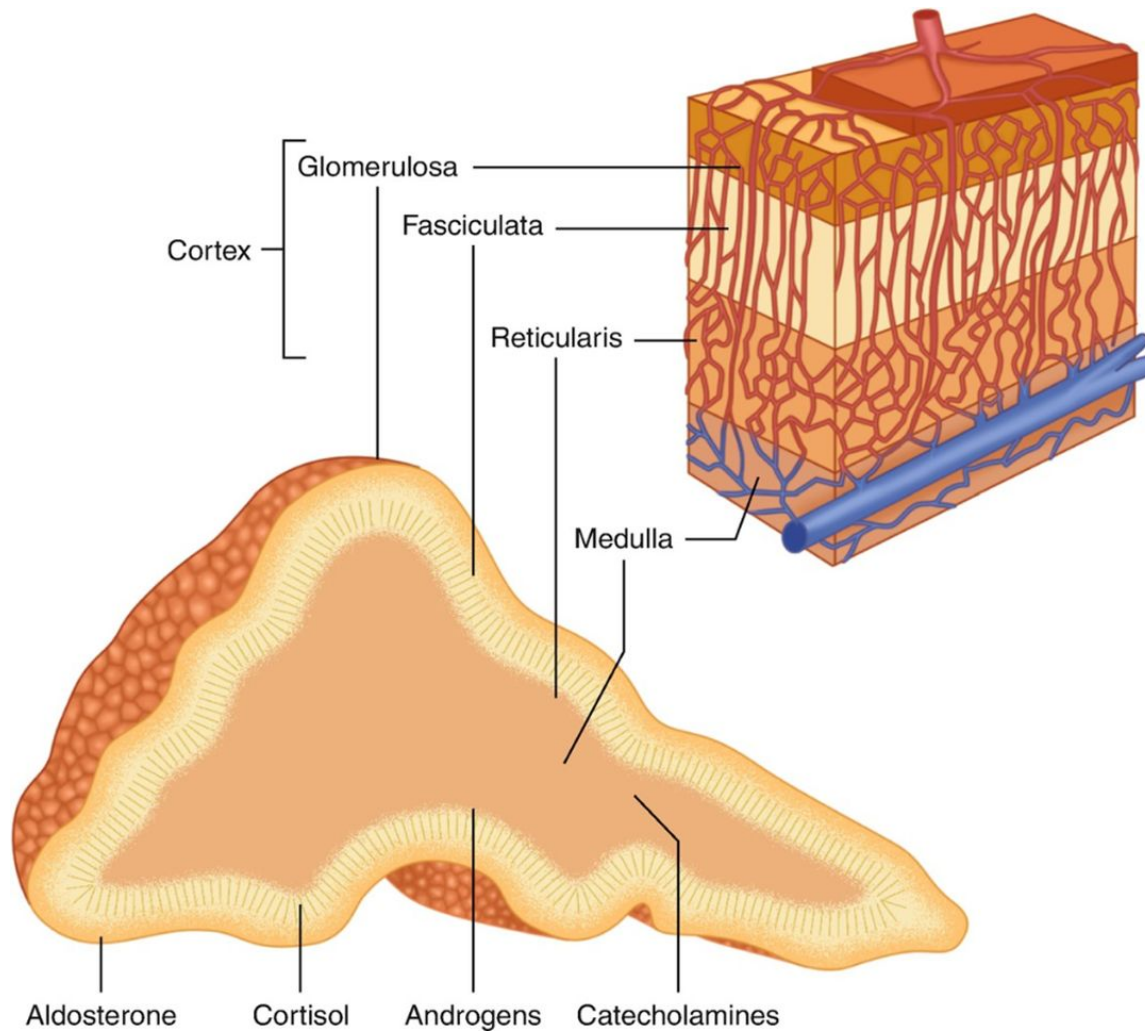


Innervation

- ▣ **Sympathetic**: preganglionic sympathetic fibers from the major and minor splanchnic nerves
- ▣ **Parasympathetic**: fibers from phrenic and vagal nerve



ADRENAL GLANDS HISTOLOGY



ADRENAL GLANDS ARE EACH FORMED OF:

1. **Stroma**: dense connective tissue capsule covering the glands and sends thin trabeculae into the gland's parenchyma.

2. **Parenchyma**: Each gland has two concentric regions: a yellowish adrenal cortex and a reddish-brown central adrenal medulla.

- Adrenal cortex
- Adrenal medulla



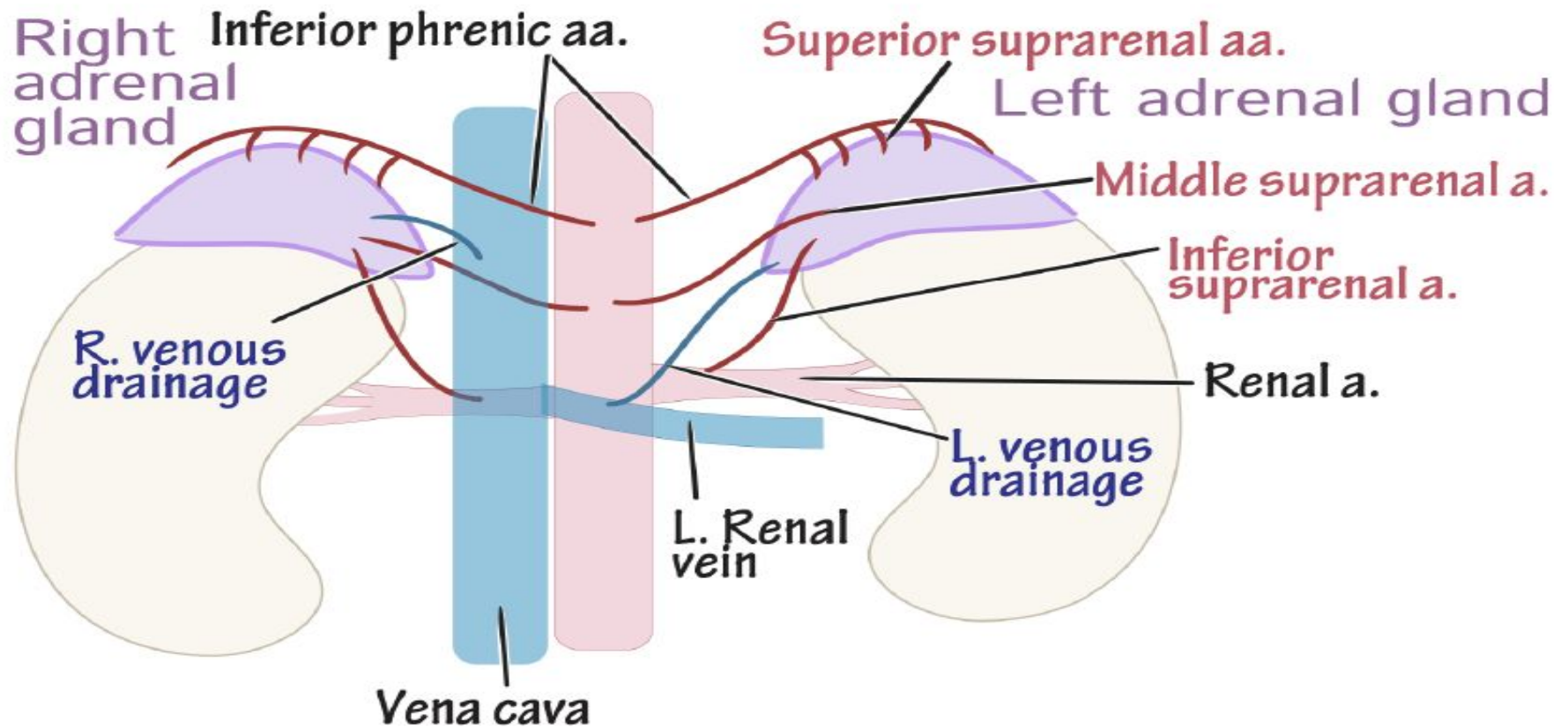
- The adrenal cortex and medulla can be considered two different organs with distinct embryonic origins, functions, and morphologic characteristics that become united during embryonic development.
- The cortex arises from mesoderm and the medulla from the neural crest.
- The general histologic appearance of the adrenal gland is typical of an endocrine gland in which cells of both cortex and medulla are grouped in cords along wide capillaries.

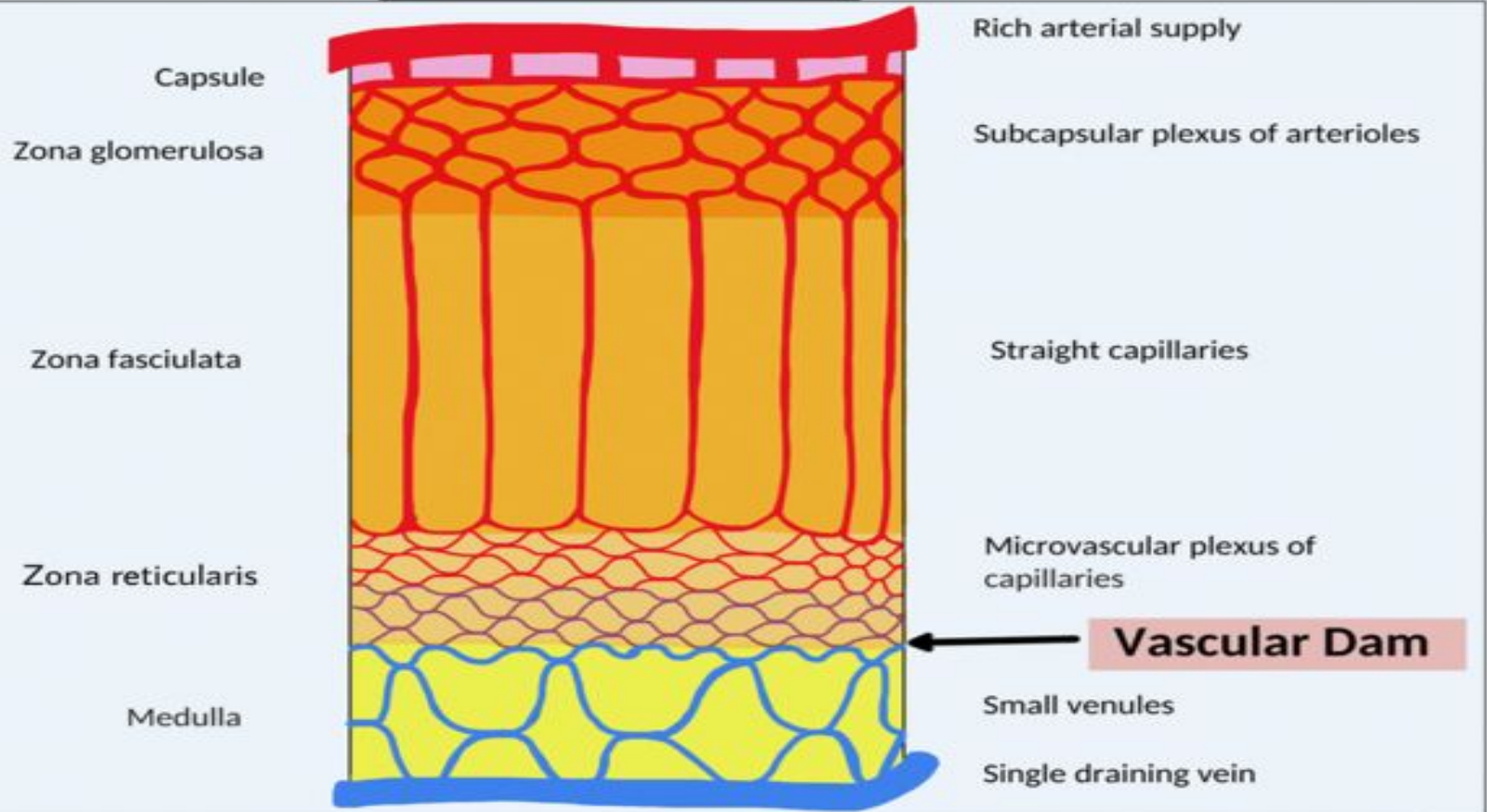
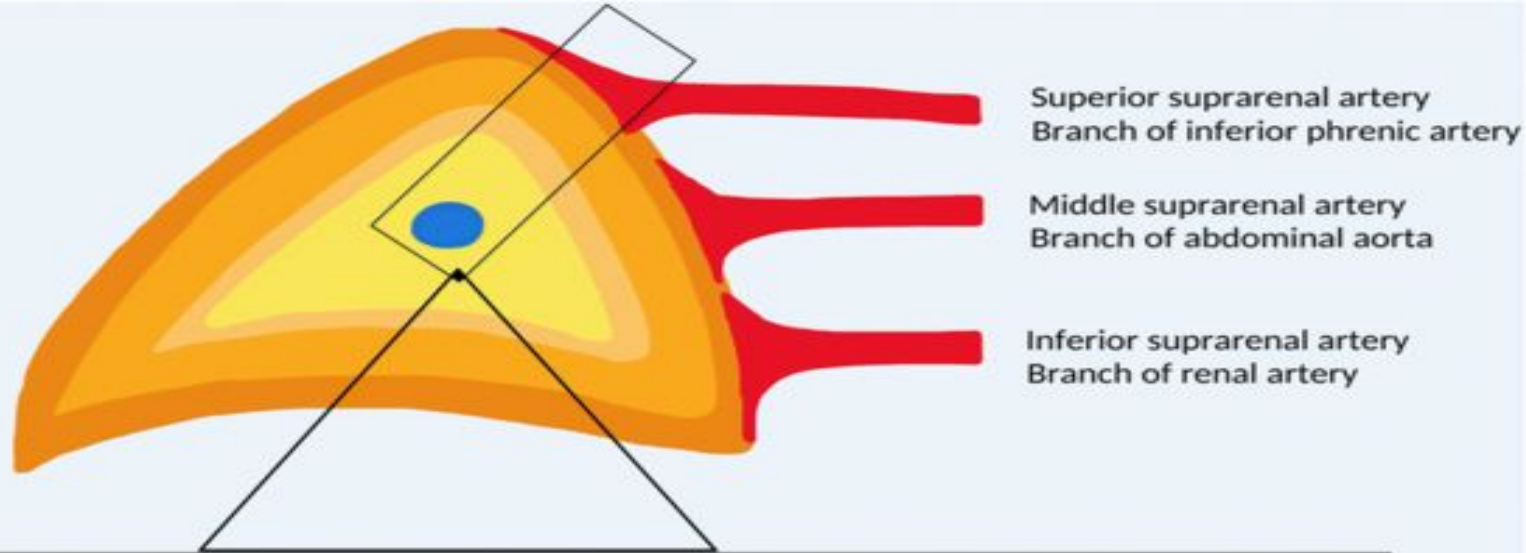


- Superior, middle, and inferior suprarenal arteries arising from larger abdominal arteries penetrate the capsule independently , and branch immediately to form a subcapsular arterial plexus.
- From this plexus arterioles for the adrenal cortex and medulla emerge separately to form rich networks of fenestrated capillaries and sinusoids. Cortical capillaries irrigate endocrine cells of the cortex and then drain into the microvasculature of the medulla.
- Venous drainage from the glands occurs via the suprarenal veins



Anatomy: Blood Supply

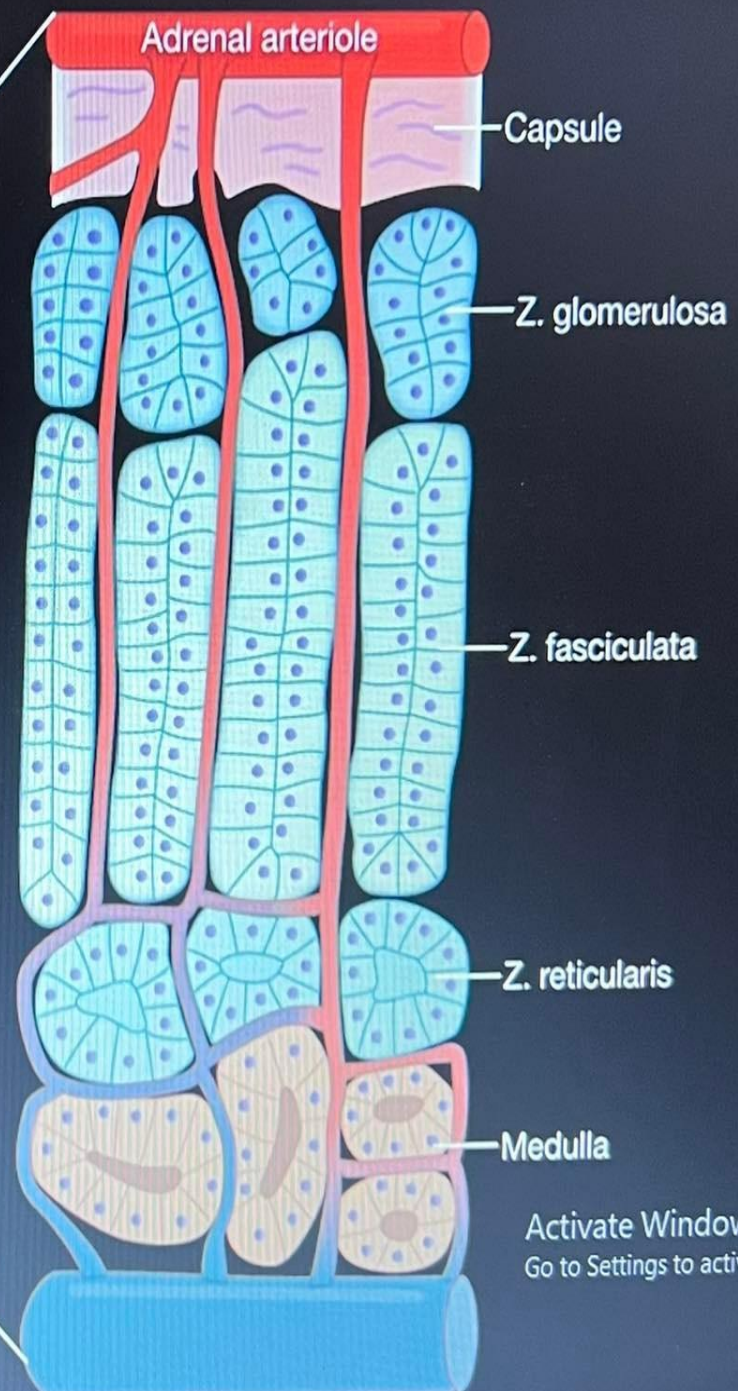




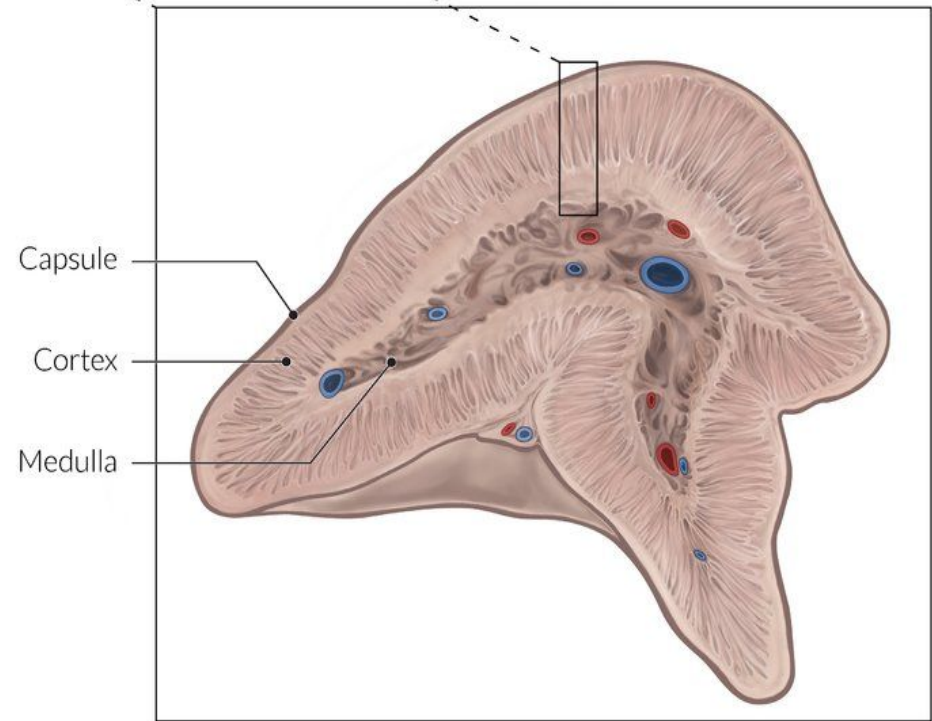
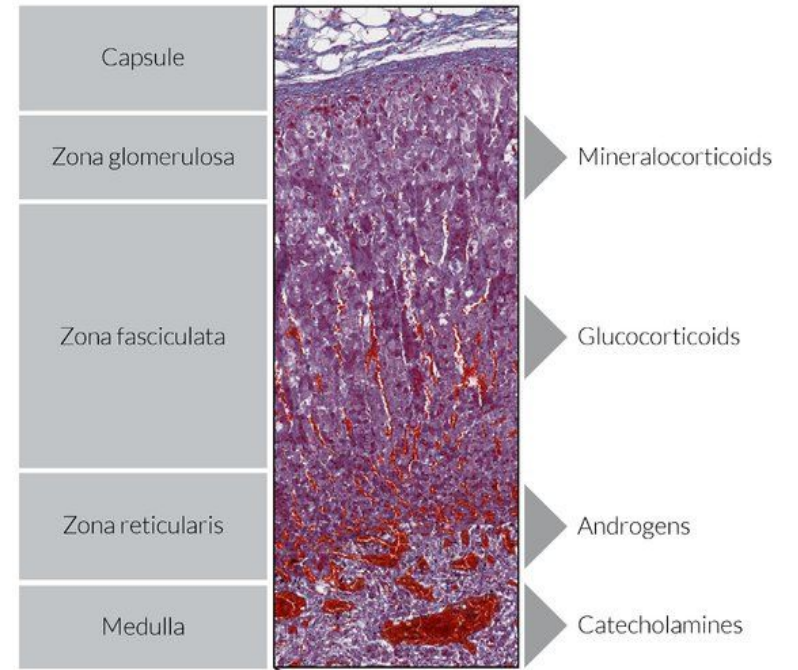
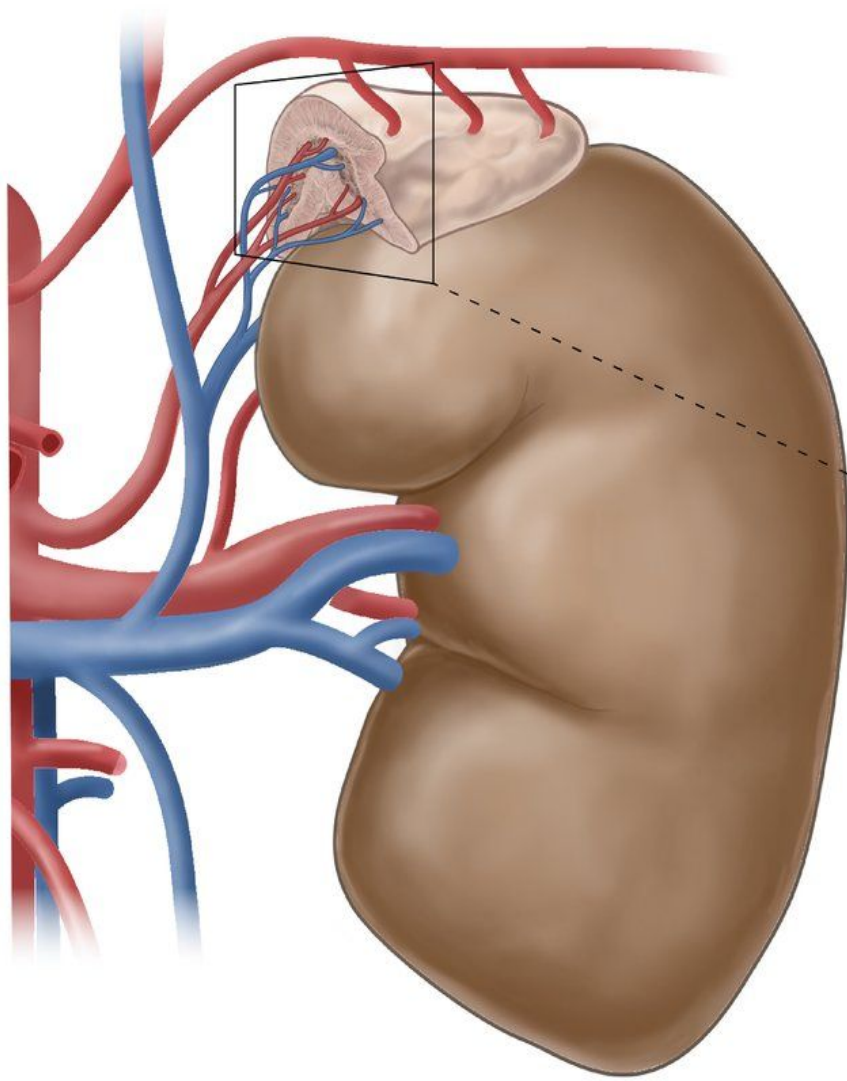
Adrenal gland

Vascular supply

- Adrenal gland capillaries



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Go to Settings to activate Windows.



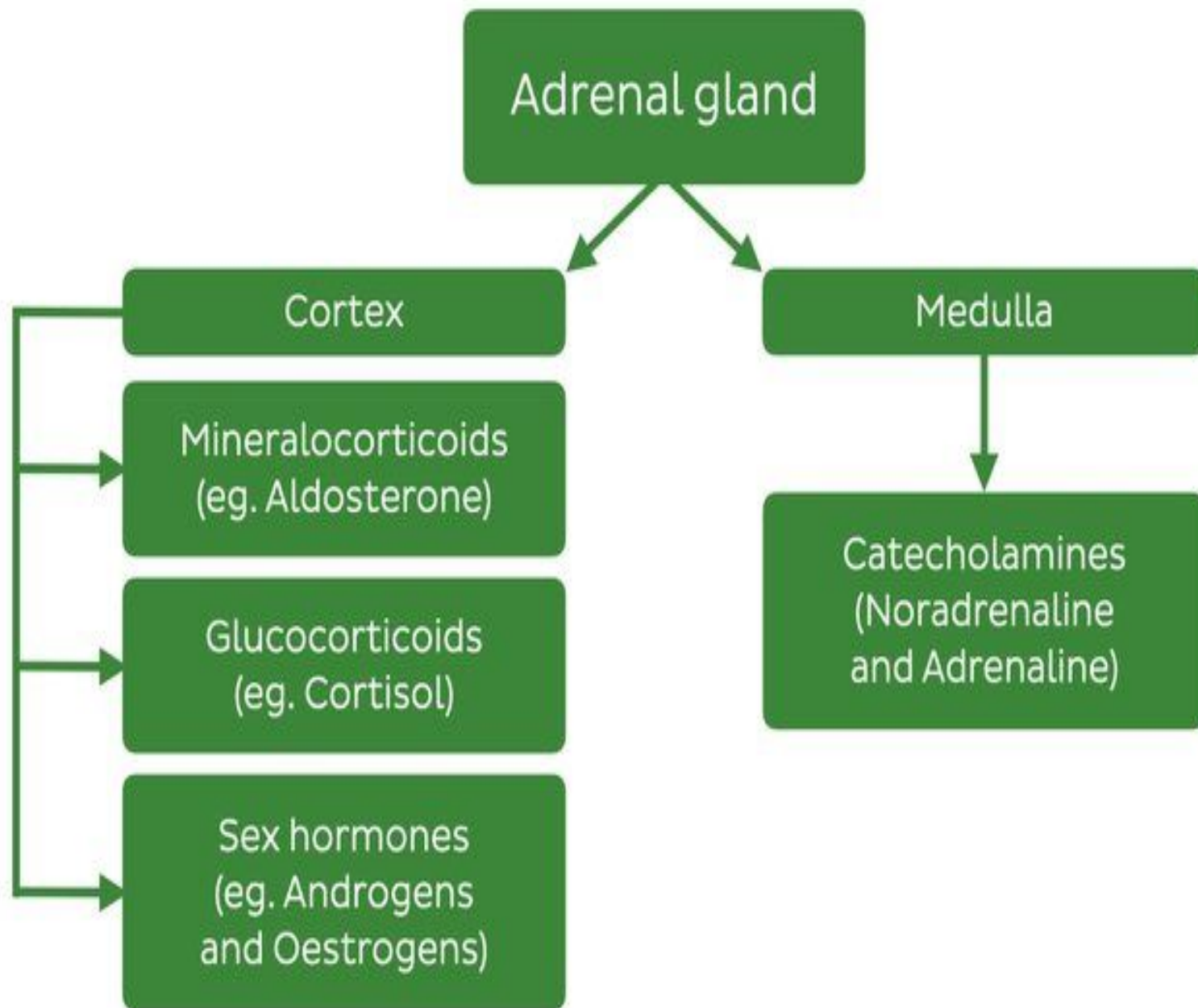
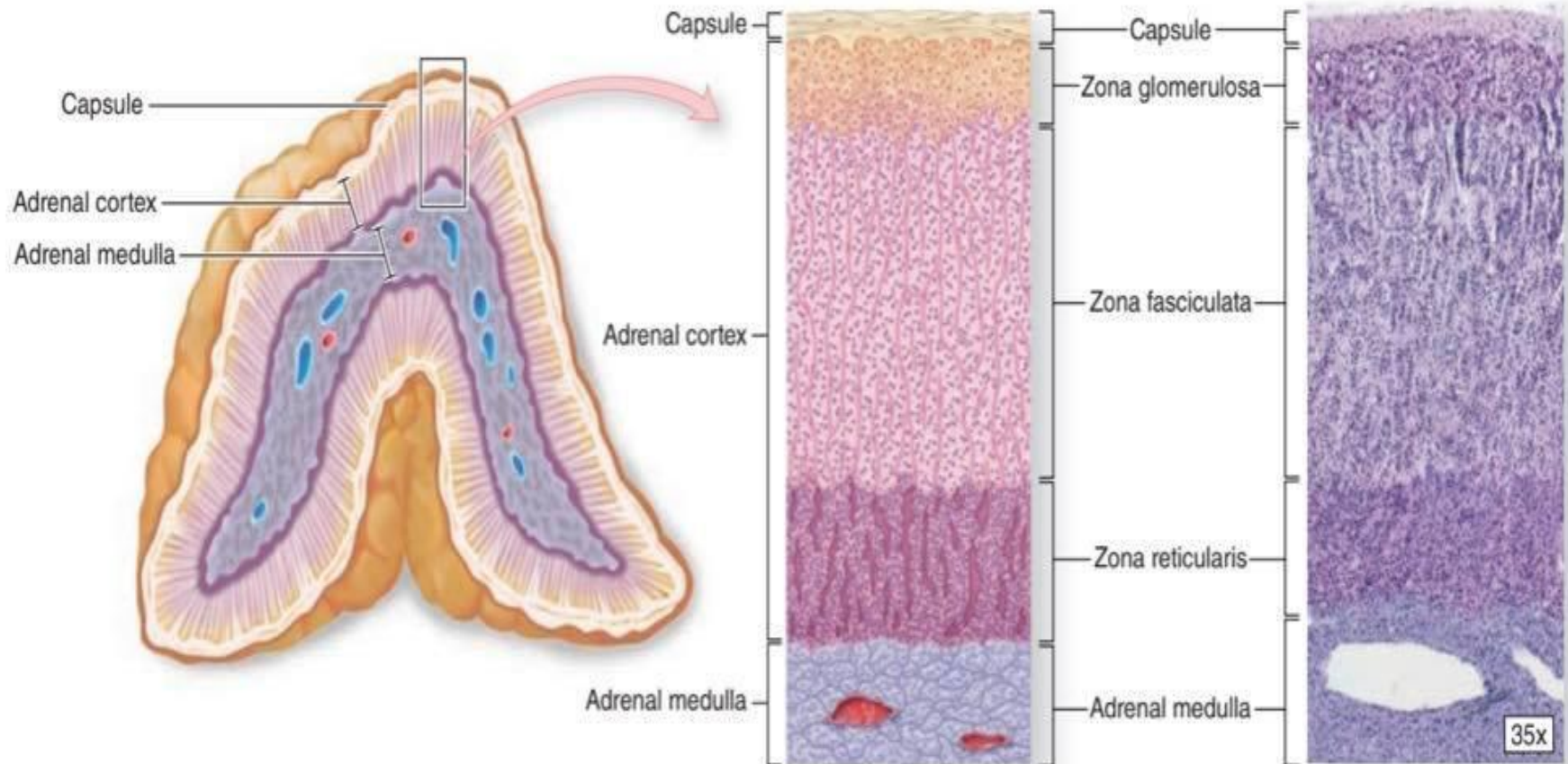


FIGURE 20-14 Adrenal gland.



Inside the capsule of each adrenal gland is an adrenal cortex, formed from embryonic mesodermal cells, which completely surrounds an innermost adrenal medulla derived embryologically from neural crest cells. Both regions are very well vascularized with

fenestrated sinusoidal capillaries. Cortical cells are arranged as three layers: the zona glomerulosa near the capsule, the zona fasciculata (the thickest layer), and the zona reticularis.

THE ADRENAL CORTEX HAS 3 CONCENTRIC ZONES

□ Zona glomerulosa

- Outermost layer
- Comprising about 15% of the cortex
- Cells are arranged in oval clusters surrounded by connective tissue from the fibrous capsule.
- Consists of closely packed, rounded or arched cords of columnar or pyramidal cells with many capillaries
- The steroids made by these cells are called mineralocorticoids because they affect uptake of Na^+ , K^+ , and water by cells of renal tubules. The principal product is aldosterone



□ Zona fasciculata

- Located between the zona glomerulosa and zona reticularis
- Occupies 65% to 80% of the cortex.
- Cells are arranged in straight columns that are separated by small fibrous septa. (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.
- Main site of glucocorticoid **production** especially cortisol.
- Small amounts of weak androgens are also produced here.



□ Zona reticularis

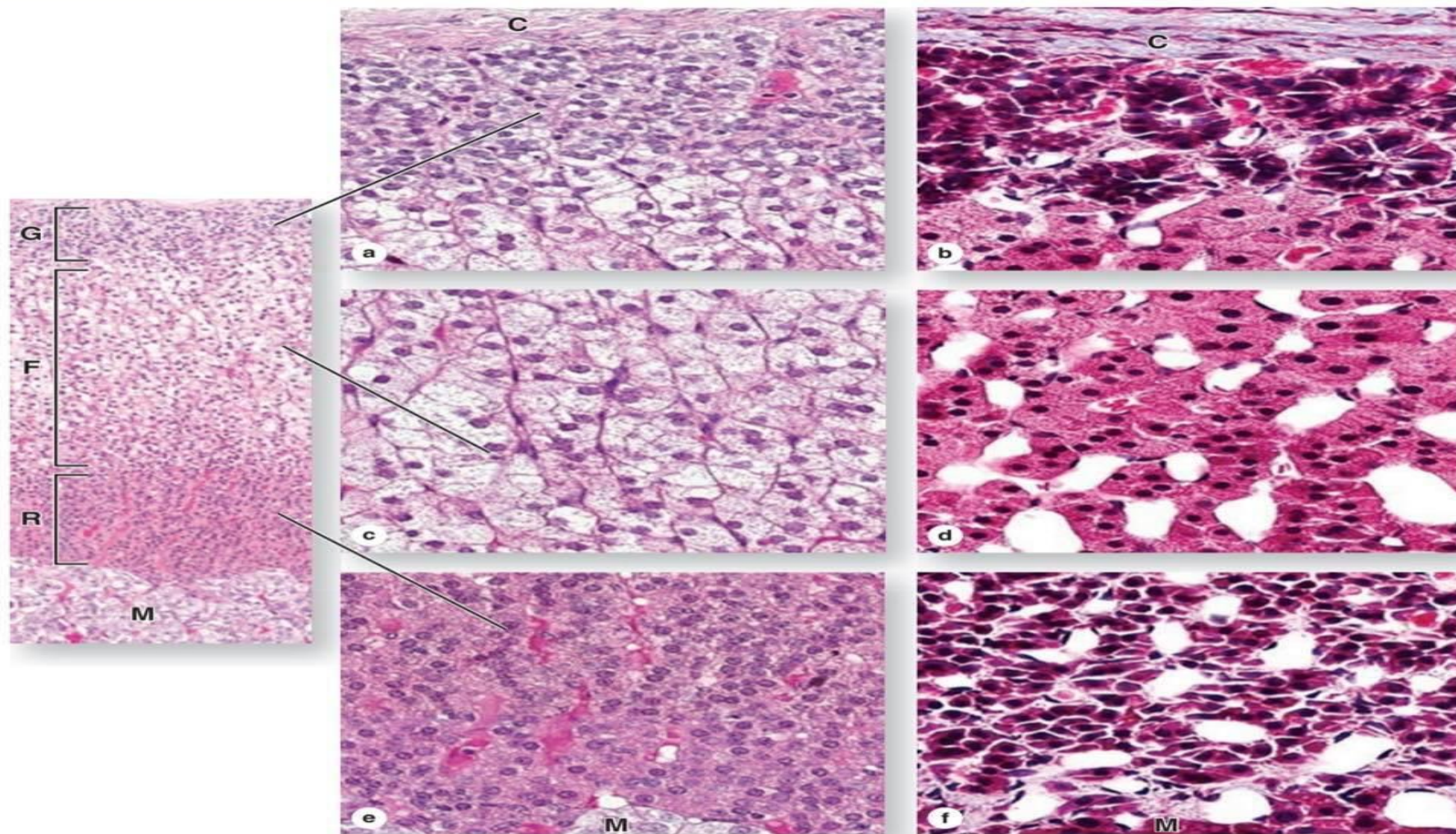
- Inner cortical layer
- Comprises about 10% of the cortex
- Small cells are arranged in an irregular netlike formation surrounded by connective tissue and capillaries.
- The cells are usually more heavily stained than those of the other zones because they contain fewer lipid droplets and more lipofuscin pigment.
- Main site of **androgen production** including dehydroepiandrosterone (DHEA) that is converted to testosterone in both men and women.



	Zona glomerulosa	Zona fasciculata	Zona reticularis
1- Percentage	15%	65-80%	7%
2- Arrangement	Closely packed arches	Long straight cords	Irregular cords
3- Shape of the cells	Columnar	Large polyhedral	Small polyhedral
4- Nucleus	Dense	Large & pale	
5- Cytoplasm	Acidophilic & slightly vacuolated	Acidophilic & highly vacuolated	Acidophilic & slightly vacuolated
6- Lipid droplets	Few	Numerous	Few
7- Function	Secretes mineralocorticoids	Secretes glucocorticoids	Secretes androgen

Dr. Imran Nabil

FIGURE 20–15 Adrenal cortex.



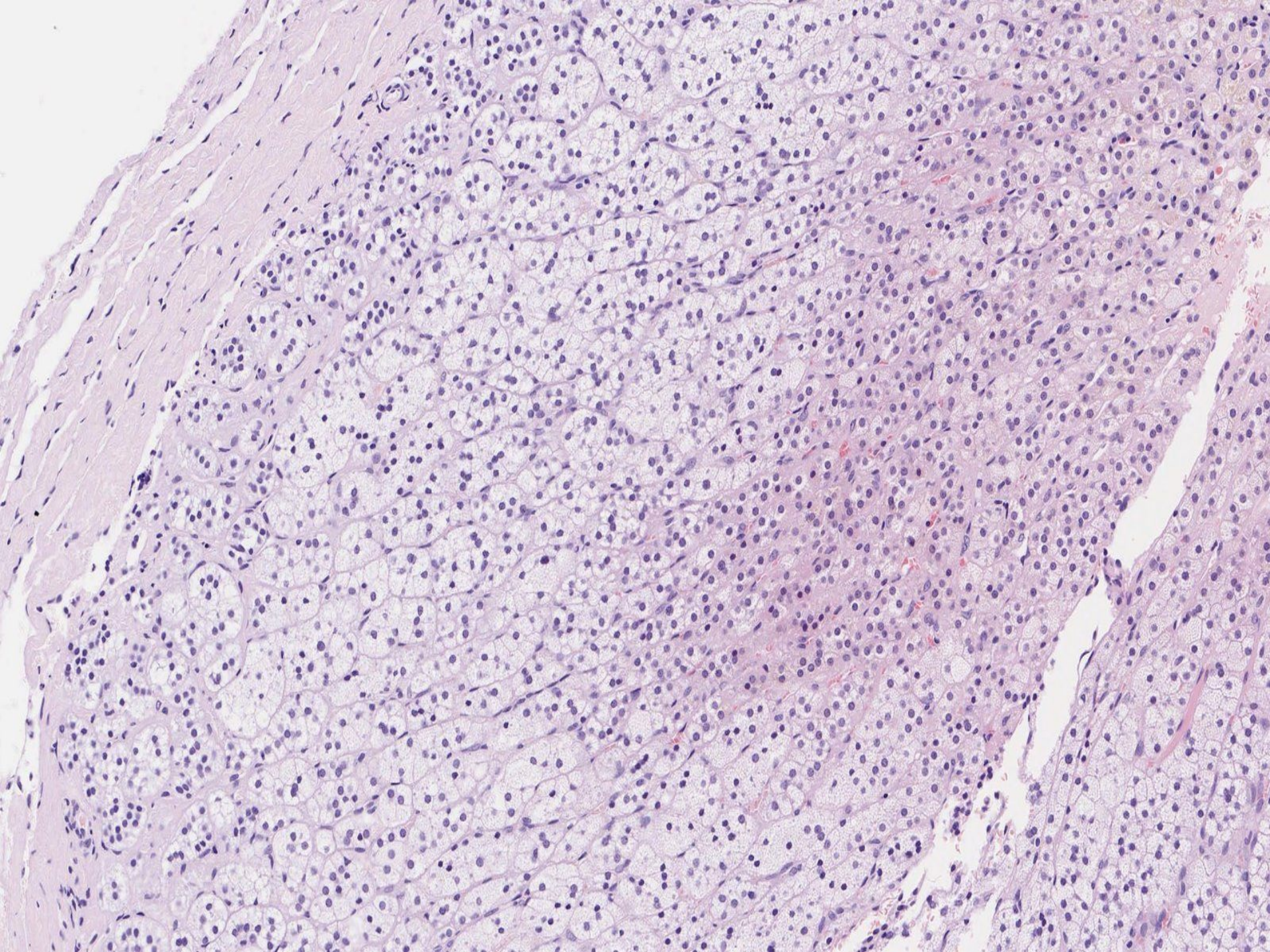
The steroid-secreting cells of the adrenal cortex are arranged differently to form three fairly distinct concentric layers, the **zona glomerulosa (G)**, **fasciculata (F)**, and **reticularis (R)**, surrounding the medulla (**M**). As with all endocrine glands, the layers of the adrenal cortex all contain a rich microvasculature. Shown here are sections from two adrenal glands, stained with H&E (left) and Mallory trichrome, in which the sparse collagen appears blue (right).

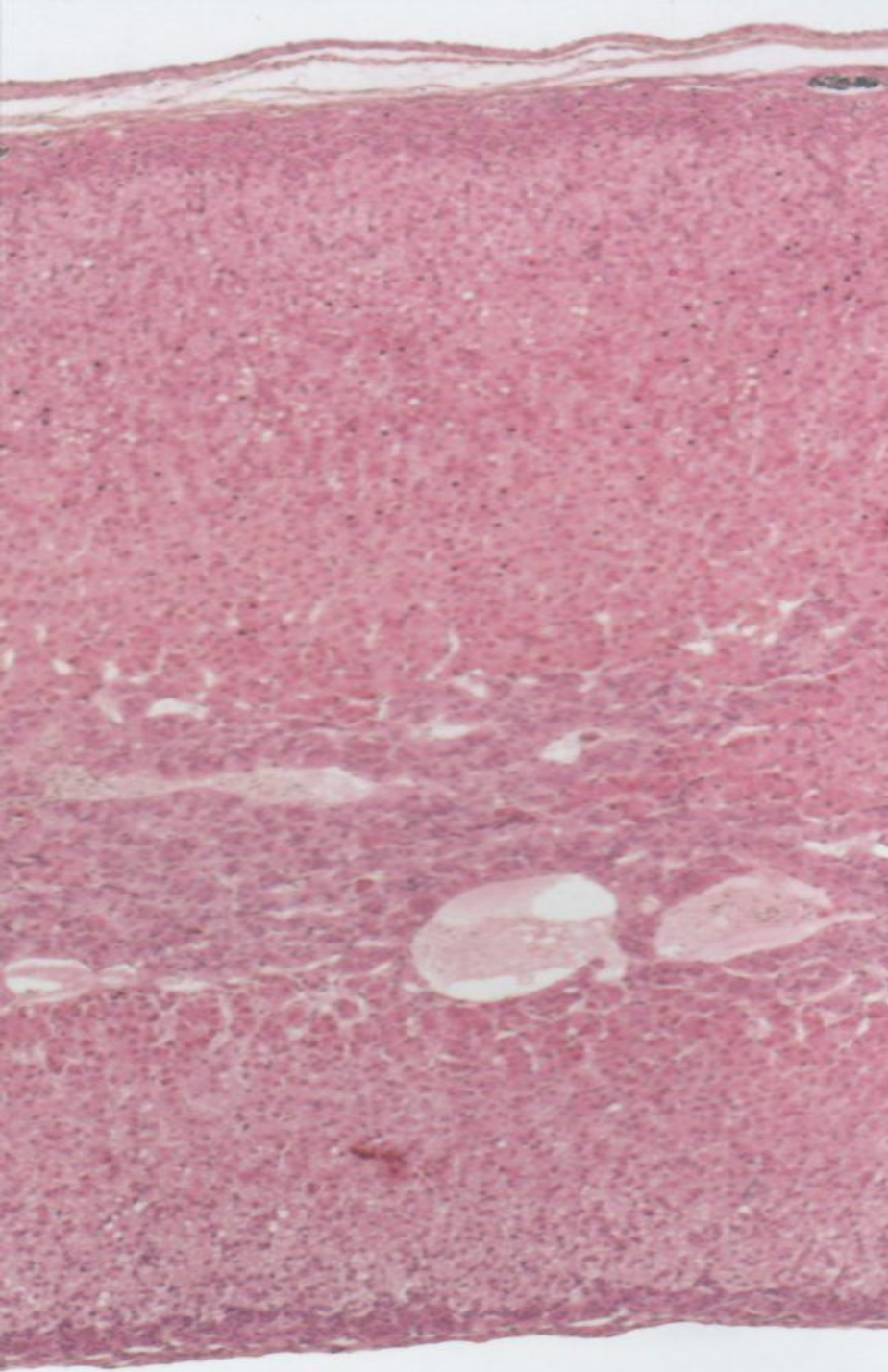
(a, b) Immediately beneath the capsule (**C**), the **zona glomerulosa** consists of rounded clusters of columnar or pyramidal cells principally secreting the mineral corticoid aldosterone. Blood-filled regions are parts of the subcapsular arterial plexus.

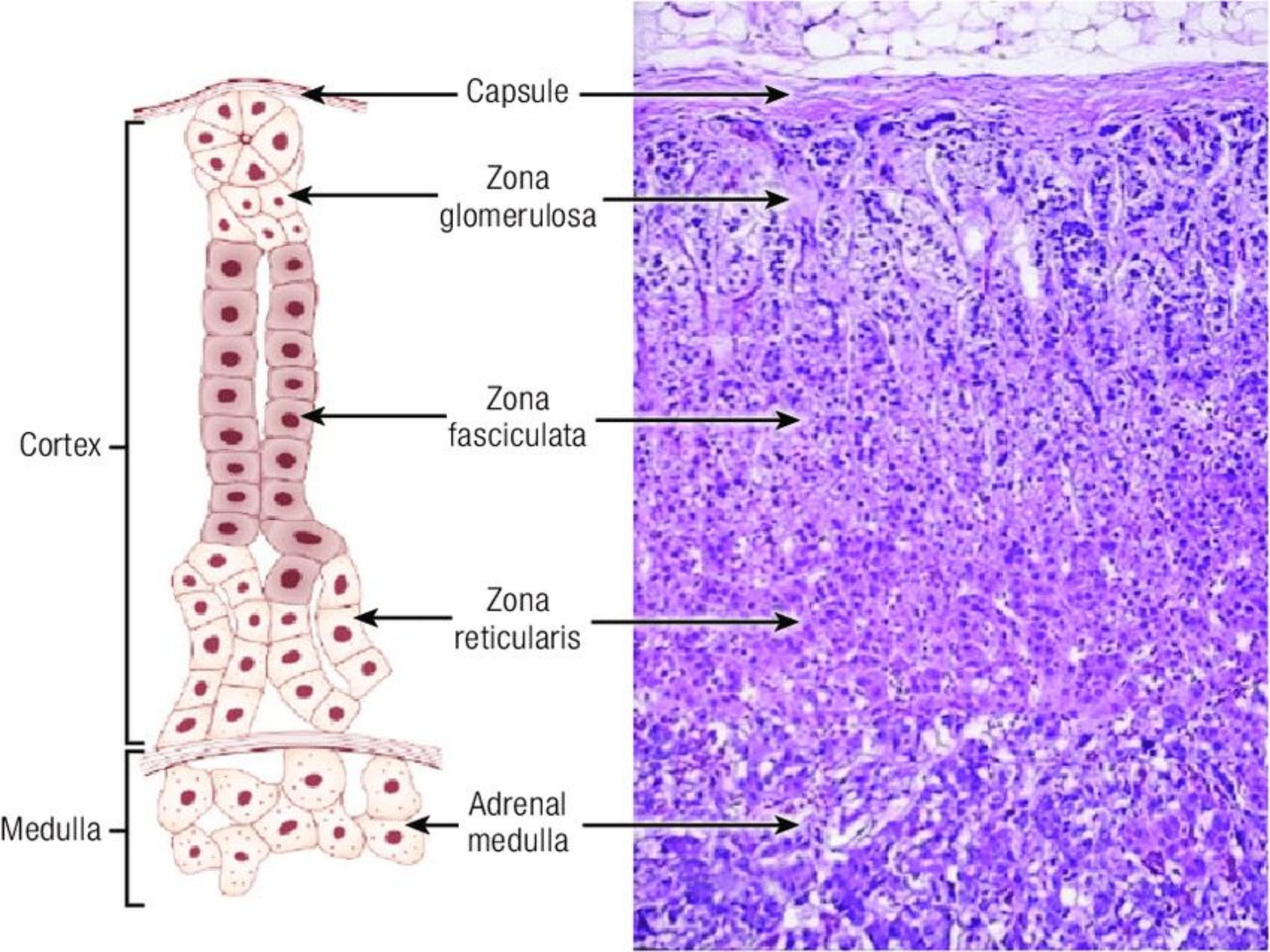
(c, d) The thick middle layer, the **zona fasciculata**, consists of long cords of large, spongy-looking cells mainly secreting glucocorticoids such as cortisol.

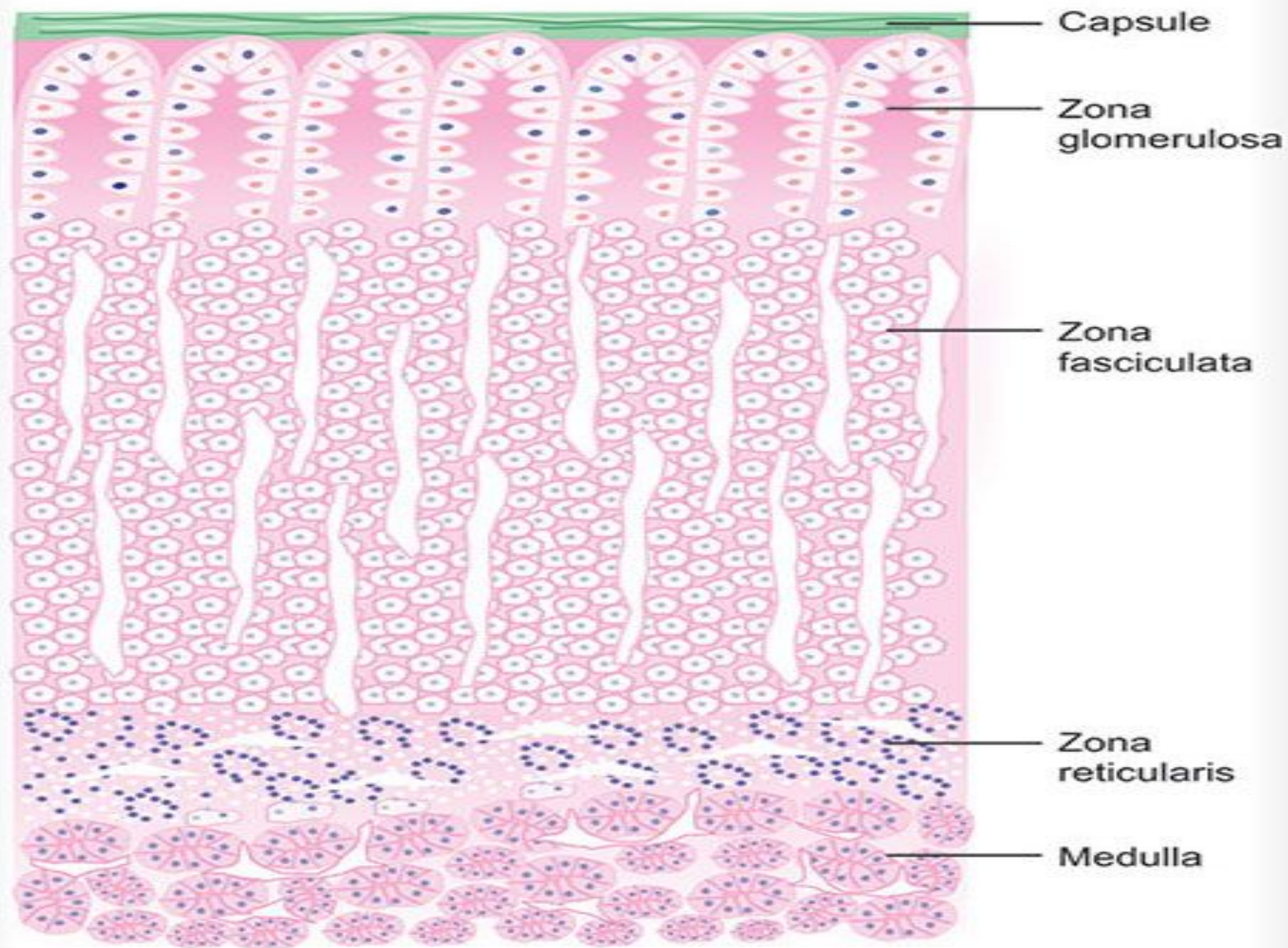
(e, f) Cells of the innermost **zona reticularis**, next to the medulla (**M**), are small, have fewer lipid droplets and are therefore better stained, arranged in a close network and secrete mainly sex steroids, including the androgen precursor DHEA. Cells of all the layers are closely associated with capillaries and sinusoids.

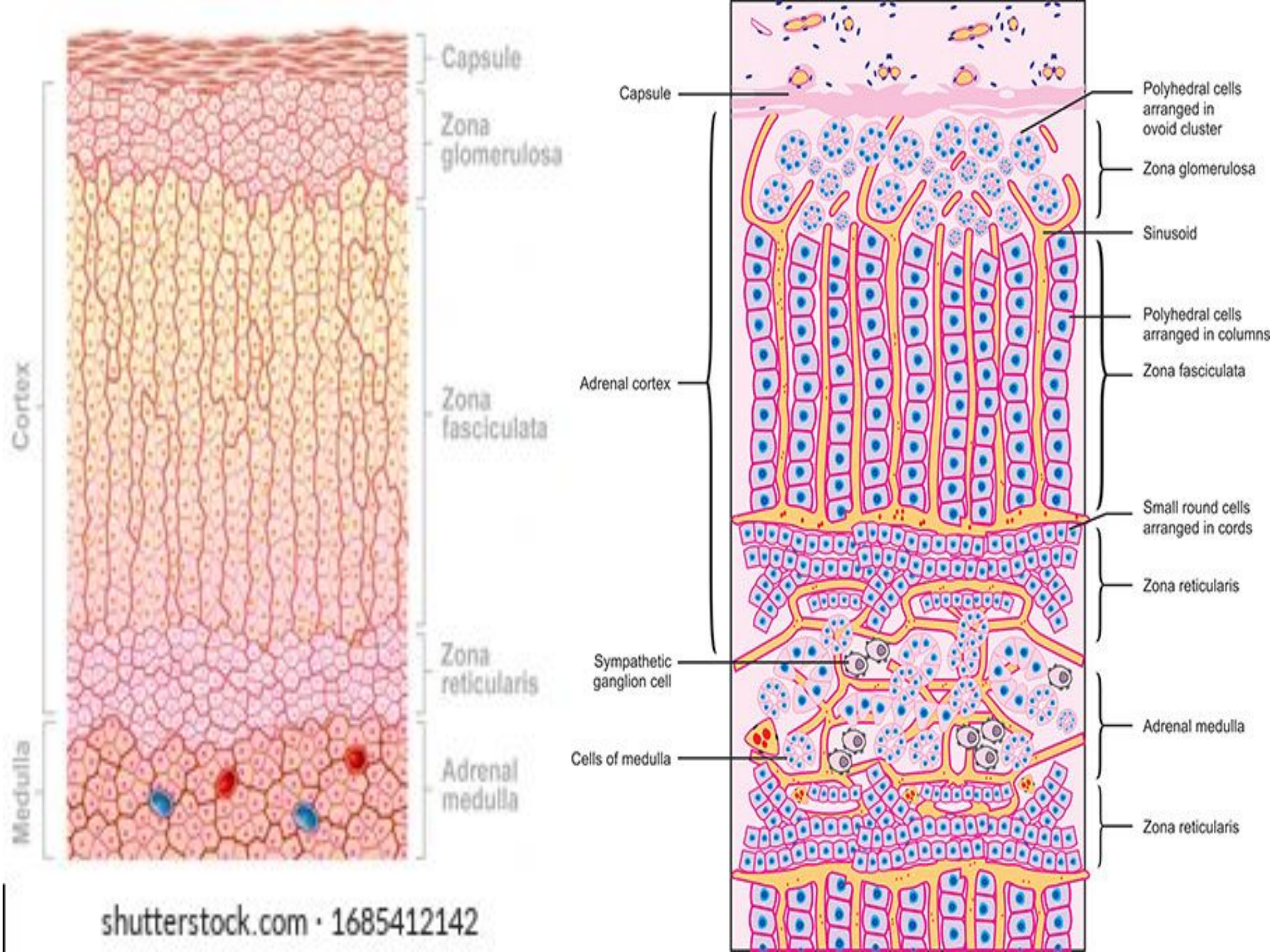
Left: (X20); a–f: (X200)











ADRENAL MEDULLA

- ❑ **Overview:** The adrenal medulla is surrounded by the adrenal cortex and made up of modified sympathetic postganglionic neurons (lacking axons and dendrites and specialized as secretory cells)
- ❑ **Organization**
 - Contains large, irregularly shaped, chromaffin cells with many secretory granules for catecholamine storage
 - Arranged in clusters and grouped around fenestrated capillaries (This allows them to quickly secrete their synthesized hormones directly into the bloodstream.)



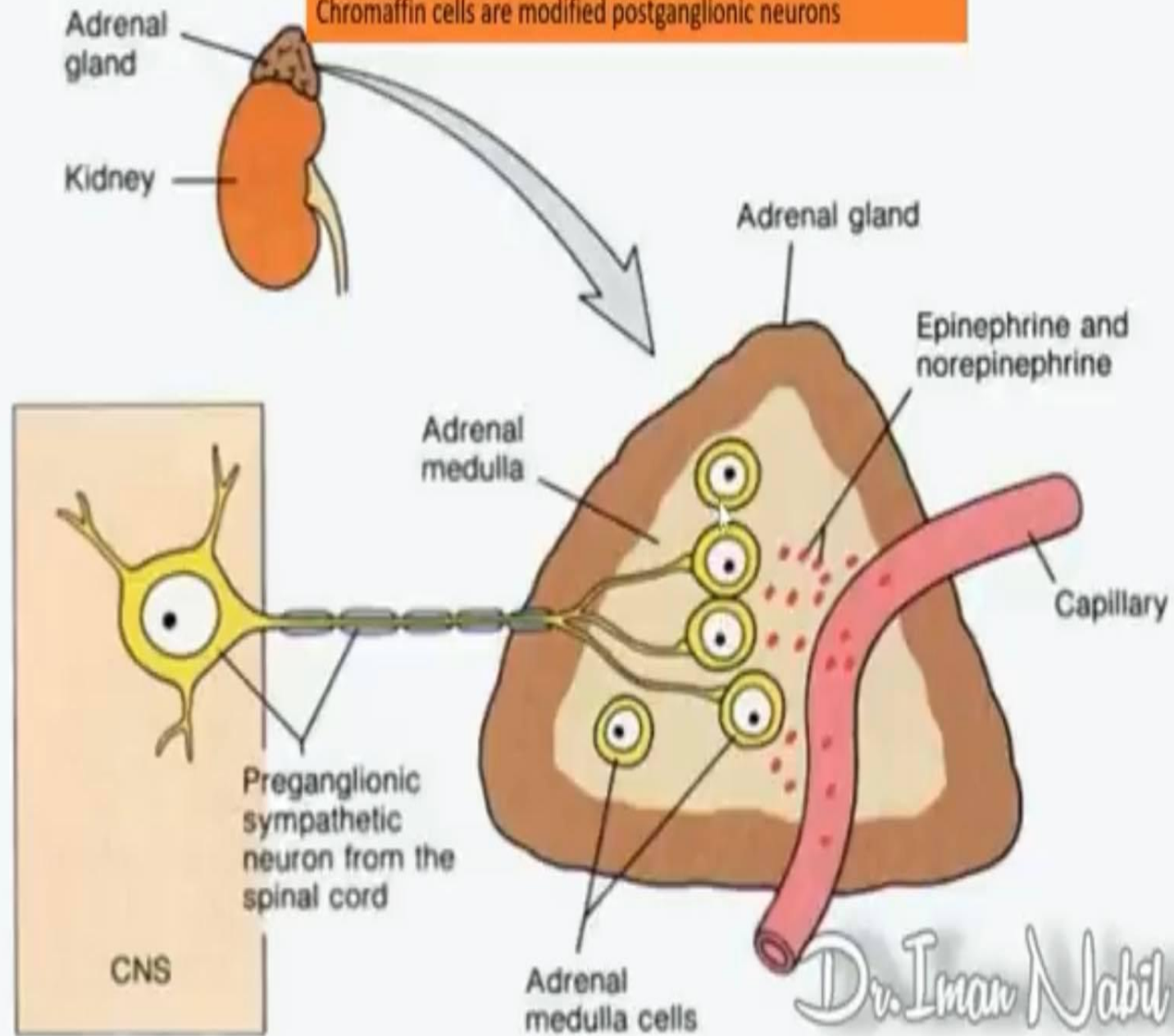
- The adrenal medulla is composed of large, pale-staining polyhedral cells arranged in cords or clumps and supported by a reticular fiber network
- A profuse supply of sinusoidal capillaries intervenes between adjacent cords and a few parasympathetic ganglion cells are present.
- Medullary parenchymal cells, known as chromaffin cells, arise from neural crest cells.
- chromaffin cells contain many electron-dense granules, for storage and secretion of catecholamines, either epinephrine or norepinephrine.
- The granules of epinephrine-secreting cells are less electron-dense and generally smaller than those of norepinephrine-secreting cells.



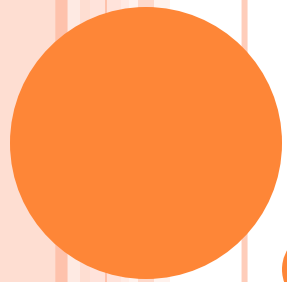
- The conversion of norepinephrine to epinephrine (adrenalin) occurs only in chromaffin cells of the adrenal medulla. About 80% of the catecholamine secreted from the adrenal is epinephrine.



Adrenal medulla is considered as a modified sympathetic ganglia
Chromaffin cells are modified postganglionic neurons



Dr. Iman Nabil



THANK YOU