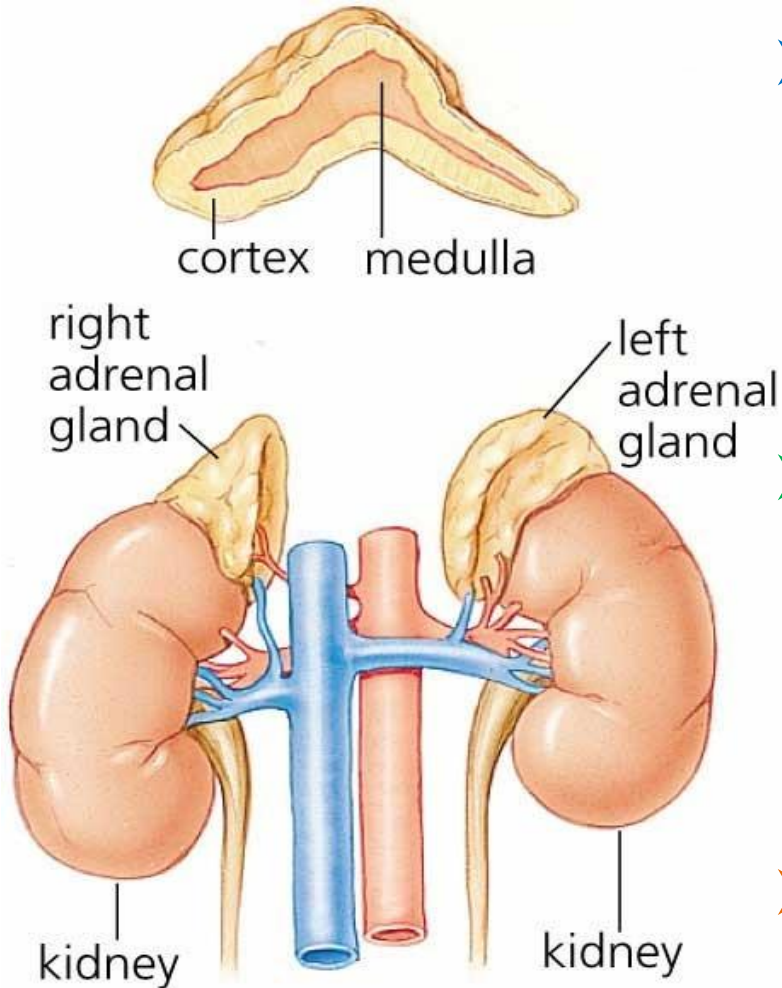


# **Histology of Adrenal Gland**

# Introduction

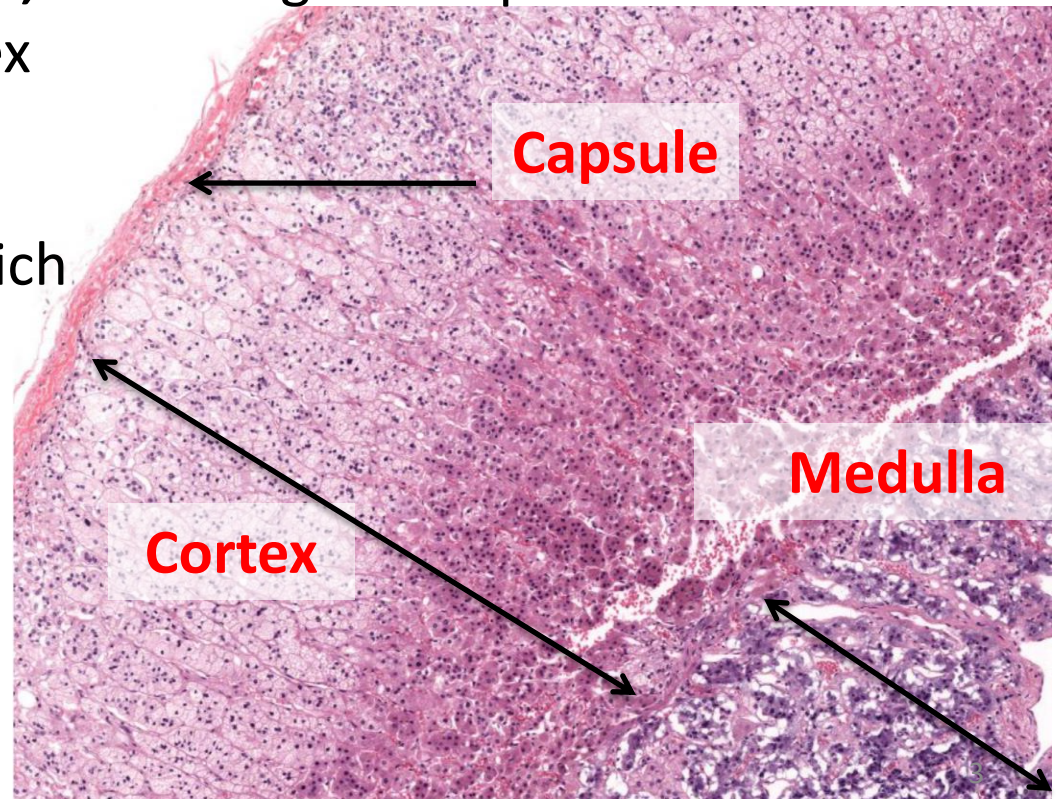
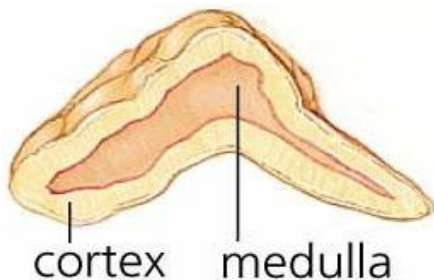


Carlyn Iverson

- The adrenal glands are paired organs that lie near the superior poles of the kidneys, embedded in adipose tissue .
- They are flattened structures with a half-moon shape; in the human, they are about 4–6 cm long, 1–2 cm wide, and 4–6 mm thick.
- Kidney are at the level of T12 to L3,
- Also called as suprarenal gland

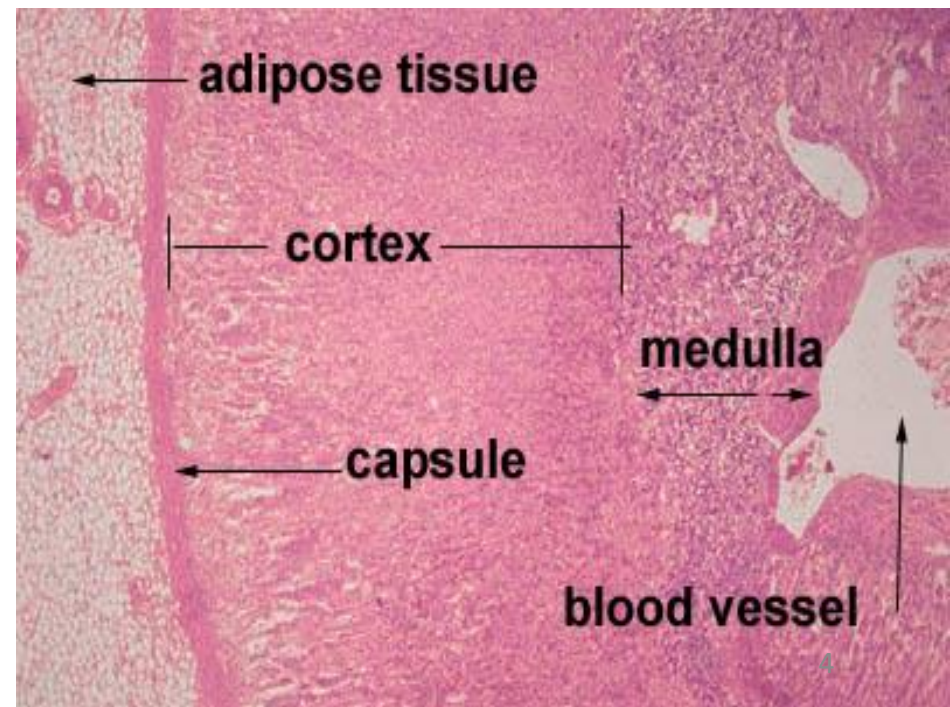
# Blood Supply

- The adrenal glands are supplied by several arteries that enter at various points around their periphery.
- The branches of these arteries can be divided into three groups: superior, middle and inferior arteries. The Superior artery irrigate the capsule; **Cortical arteries**, branching into capillaries that irrigate the cells of the cortex
- And **Medullary arteries**, which pass through the cortex and form an extensive capillary network in the medulla.



# Cross section and Regions of Adrenal

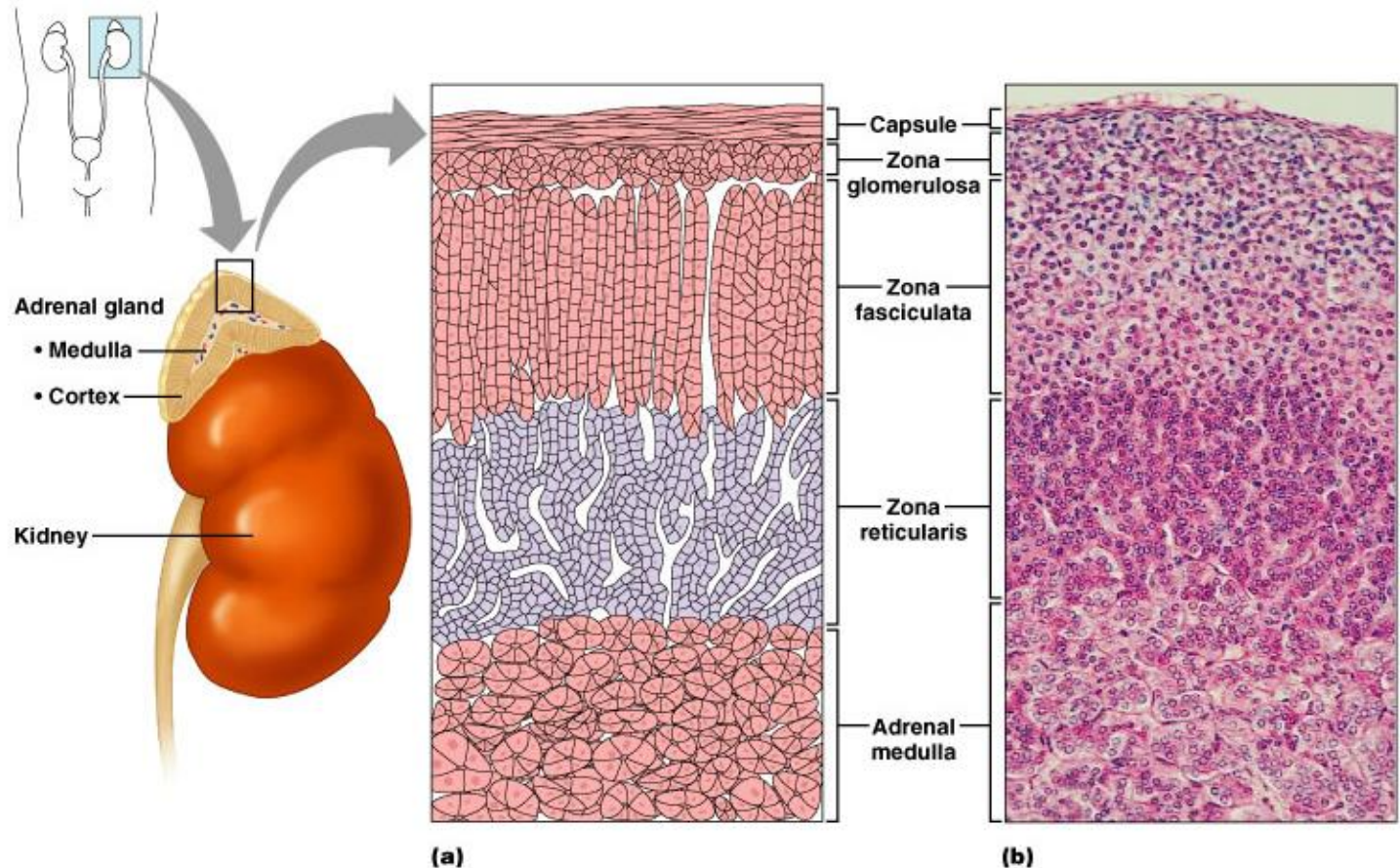
1. **Adrenal capsule** is a connective tissue, no secretions.  
Protective in function
2. **Adrenal cortex** is on the outside
  - Originates from mesoderm
  - Produces steroids (mineralocorticoids, glucocorticoids and sex steroids)
3. **Adrenal medulla** is on inside
  - Originates from neural crest
  - Produces epinephrine and norepinephrine



**Cortex :** It is region just after the adrenal capsule and divided into

3 regions. All secrete steroid hormones

- Zone Glomerulosa 15%
- Zona Fasciculata 75%
- Zona reticularis 10%



# Zona Glomerulosa

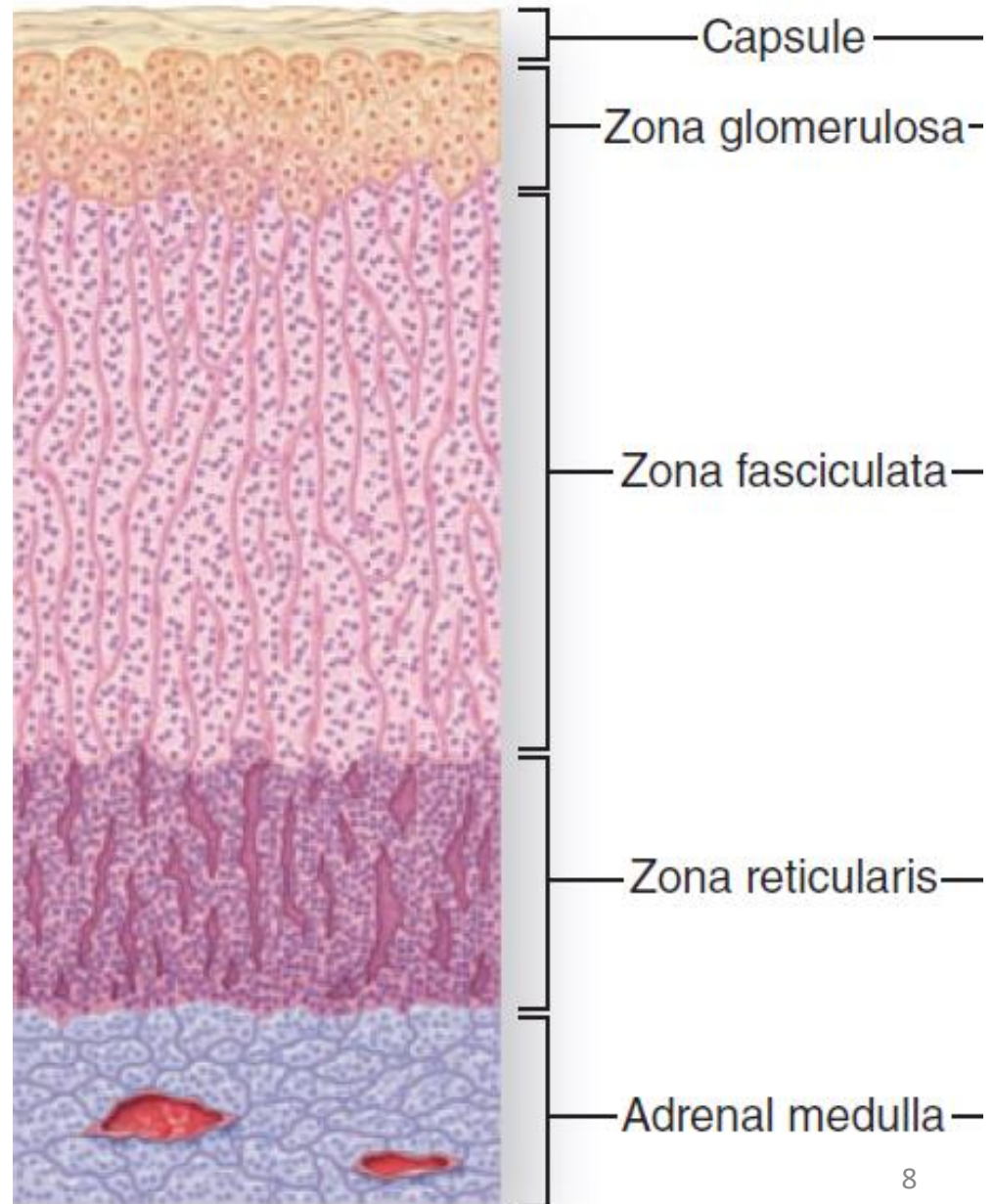
- The layer immediately beneath the connective tissue capsule is the zona glomerulosa, in which columnar or pyramidal cells are arranged in closely packed, rounded, or arched cords surrounded by capillaries
- Cells form spherical clusters (“glomerula” – but different than the kidney’s glomerula) and produce mineralocorticoids (mostly aldosterone).
- Aldosterone production is stimulated mostly by angiotensin II (only slightly by ACTH).
- Aldosterone helps regulate water and electrolytes by stimulating sodium reabsorption by the kidney.

# Zona Fasciculata

- Cells form straight columns (fascicles) separated by sinusoids.
- The cells of the zona fasciculata have a great number of lipid droplets in their cytoplasm.
- Because of their vacuolization, the cells of the fasciculata are also called **spongyocytes**
- Cells make glucocorticoids (mainly cortisol), and small amount of androgens.
- Cortisol synthesis is stimulated by ACTH.
- Glucocorticoids affect carbohydrate, fat and protein metabolism and increase blood glucose levels.

# Zona Reticularis

- Cells form an irregular network (reticulum).
- Cells make sex steroids (mostly androgens) and a small amount of glucocorticoids.
- These cells are smaller than those of the other two layers.





# Main Effects of Adrenocortical Hormones

**Mineralocorticoids (Aldosterone):** produced by zona glomerulosa

- Increases reabsorption of sodium (Na)<sup>+</sup> and excretion of potassium(K<sup>+</sup>) and hydrogen (H<sup>+</sup>) ions.
- **Overall Effects of Aldosterone:**
  - **Increases sodium reabsorption**
  - **Increases excretion of: K<sup>+</sup>, H<sup>+</sup>**

If aldosterone is secreted in excessive amounts, this results in:

- **Hypokalemia** (High number of potassium ions in blood)
- **Increased water retention** → **Increased blood pressure**
- **Alkalosis** (high blood alkalinity due to high number of hydrogen ions)

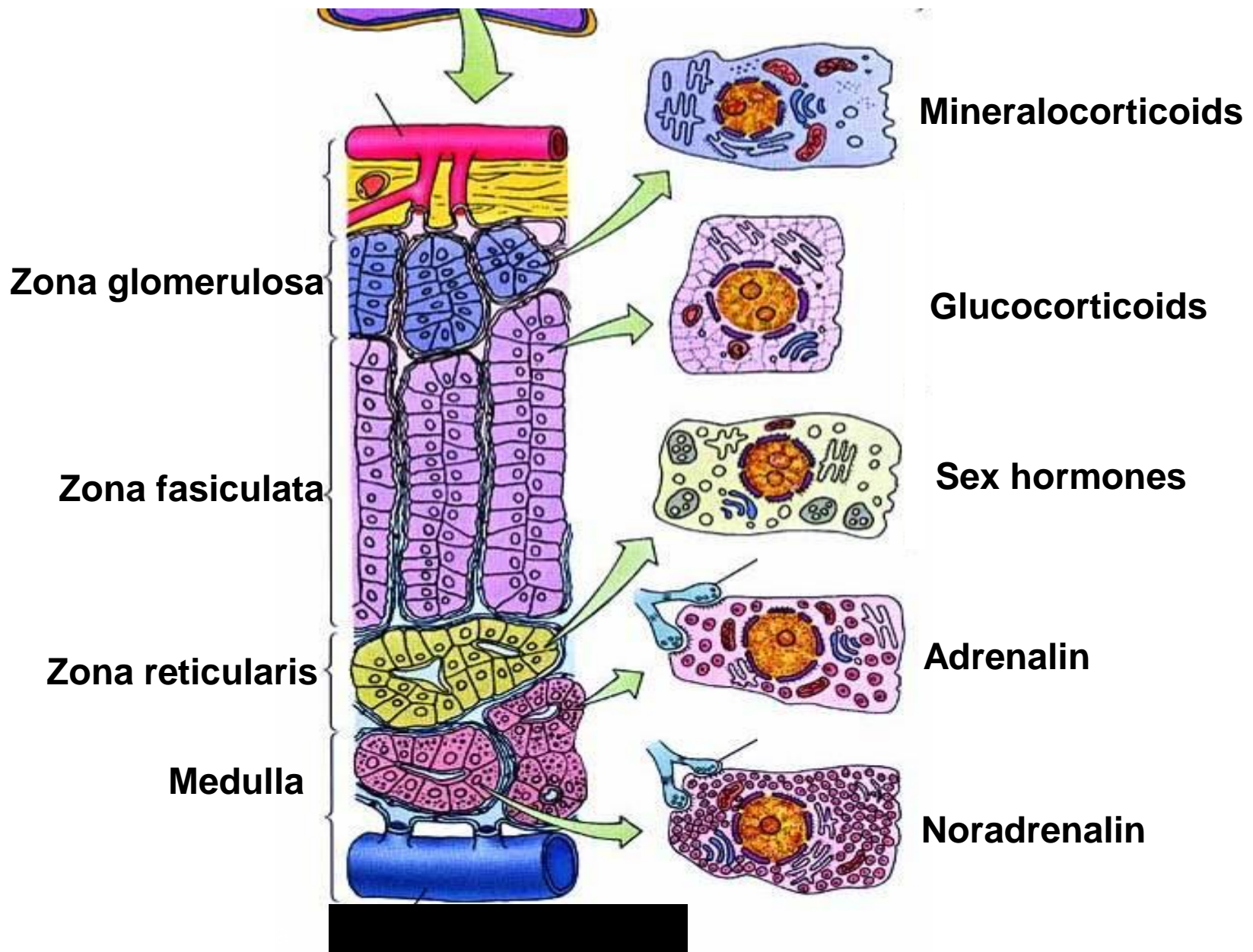
**Glucocorticoids:** produced by zona fasciculata

- Regulation of Metabolism
- Anti-inflammatory effects and immunosuppression
- Stress hormone and a counter-regulatory hormone

# Gonadocorticoids/Androgens (Sex Hormones)

produced by zona reticularis

- Most weak androgens (male sex hormones) converted to testosterone in tissue cells, some to estrogens
- May contribute to
  - Onset of puberty
  - Appearance of secondary sex characteristics
  - Sex drive in women
  - Estrogens in postmenopausal women



## Adrenal gland hormones

# Adrenal Medulla

- Chromaffin cells secrete epinephrine (80%) and norepinephrine (20%)
- These hormones cause
  - Blood vessels to constrict
  - Increased Heart Rate
  - Blood glucose levels to rise
  - Blood to be diverted to the brain, heart, and skeletal muscle
- Epinephrine stimulates metabolic activities, bronchial dilation, and blood flow to skeletal muscles and the heart
- Norepinephrine influences peripheral vasoconstriction and blood pressure

# Adrenal Medulla

- **Hypersecretion**

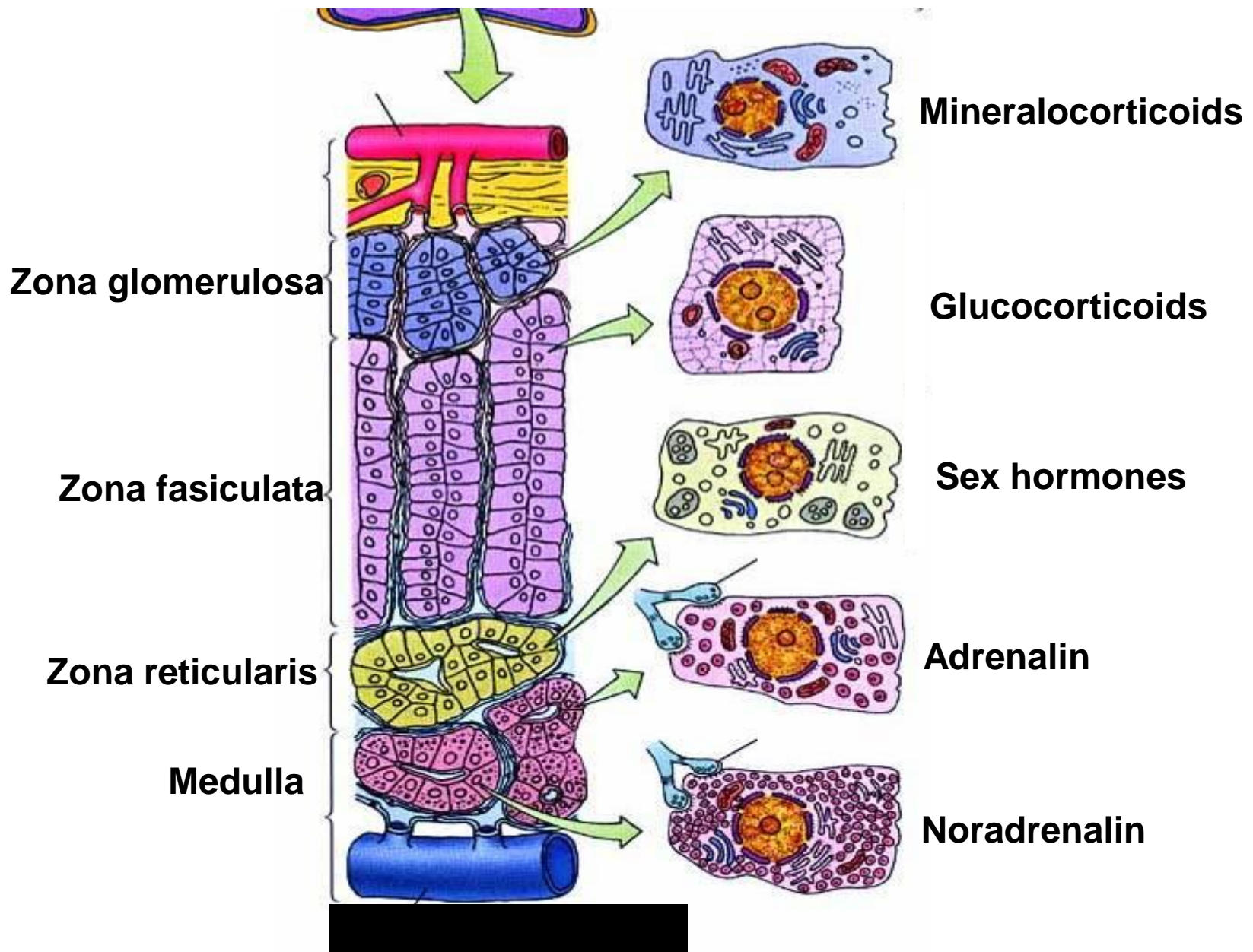
- Hyperglycemia, increased metabolic rate, rapid heartbeat and palpitations, hypertension, intense nervousness, sweating

- **Hyposecretion**

- Not problematic
- Adrenal catecholamines not essential to life

# Adrenal medulla

- Contains chromaffin cells (modified sympathetic neurons lacking axons and dendrites) and a few sympathetic ganglion cells.
- Chromaffin cells produce catecholamines (mostly epinephrine and a little norepinephrine) when stimulated by preganglionic sympathetic neurons.
- Catecholamines are the “fight or flight” hormones. They increase blood glucose, increase heart rate, increase blood flow to heart and skeletal muscle, and decrease blood to non-essential organs.



## Adrenal gland hormones

# Summary

## The adrenal cortex

- **Mineralocorticoids** are secreted by the outermost region of the cortex. They help regulate blood volume and the concentration of minerals in the blood. The main mineralocorticoid is aldosterone, which maintains sodium and potassium levels in the body.
- **Glucocorticoids** are produced by the middle and inner layers of the cortex. These promote normal cell function and promote the conversion of fats (and sometimes proteins) into glucose; for this reason they are sometimes called hyperglycemic hormones.
- **Androgens** and estrogens are sex hormones produced by the middle and innermost layers of the cortex. Androgens are male sex hormones and estrogens are female. The effect of these hormones is usually masked by hormones released from the ovaries and testes.

## The adrenal medulla

- **Epinephrine (adrenaline) and Norepinephrine (noradrenaline)**, both secreted in response to stress. Epinephrine stimulates the heart; norepinephrine constricts blood vessels. Together they increase blood pressure, and the rate and force of heart contractions.