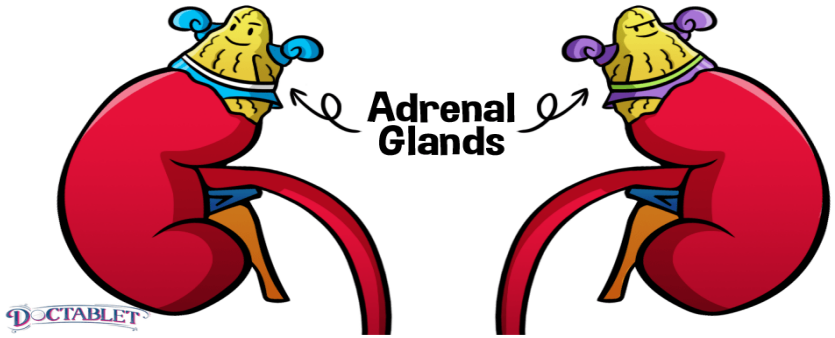
B.Sc. 3rd Semester Zoology (Hons.)

Topic: Histology of adrenal gland and its hormones



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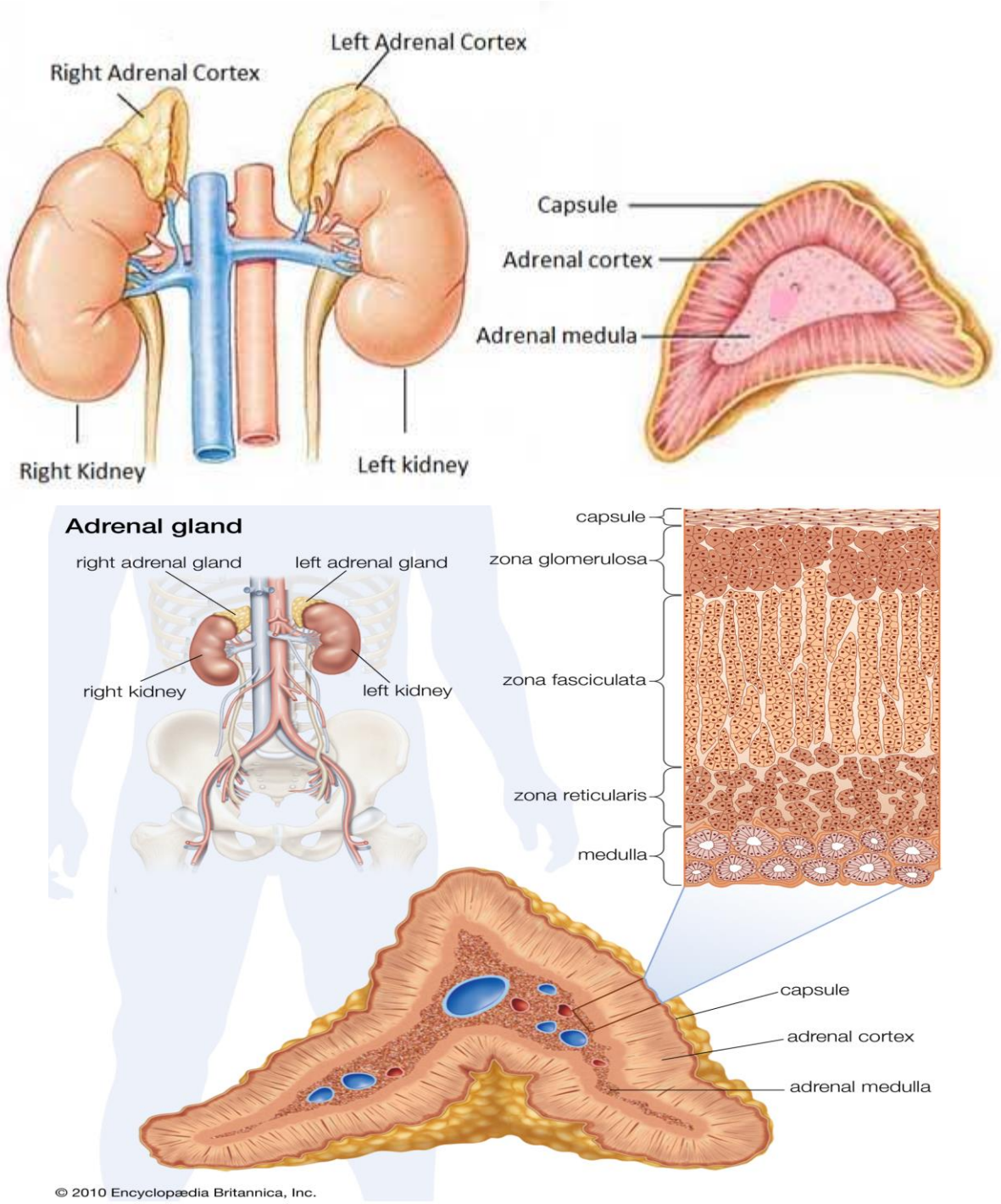
Structure of Adrenal gland-

- ***Adrenal glands*** **are located on superior to kidney.**
- **The two adrenal glands weighs about 4 g.**
- **Adrenal glands are divided into two regions-** ***adrenal cortex*** **and** ***adrenal medulla.***
- **The** ***adrenal medulla*****, the central 20 percent of the gland, is functionally related to the sympathetic nervous system. It secretes the hormone** ***epinephrine*** **and** ***nor-epinephrine*****.**
- **The** ***adrenal cortex*** **secretes an entirely different group of hormones called** ***corticosteroids*****.**



Histological structure of adrenal gland:-

- **The adrenal cortex has three distinct layers-**

- **The *Zona glomerulosa*, a thin layer of cells that lies just underneath the capsule, constitute about 15 % of the adrenal cortex.**

- **The *Zona fasciculata*, the middle and the widest layer, constitutes about 75 % of the adrenal cortex .**

- **The *Zona reticularis*, the deep layer of adrenal cortex is arranged in dense structure.**

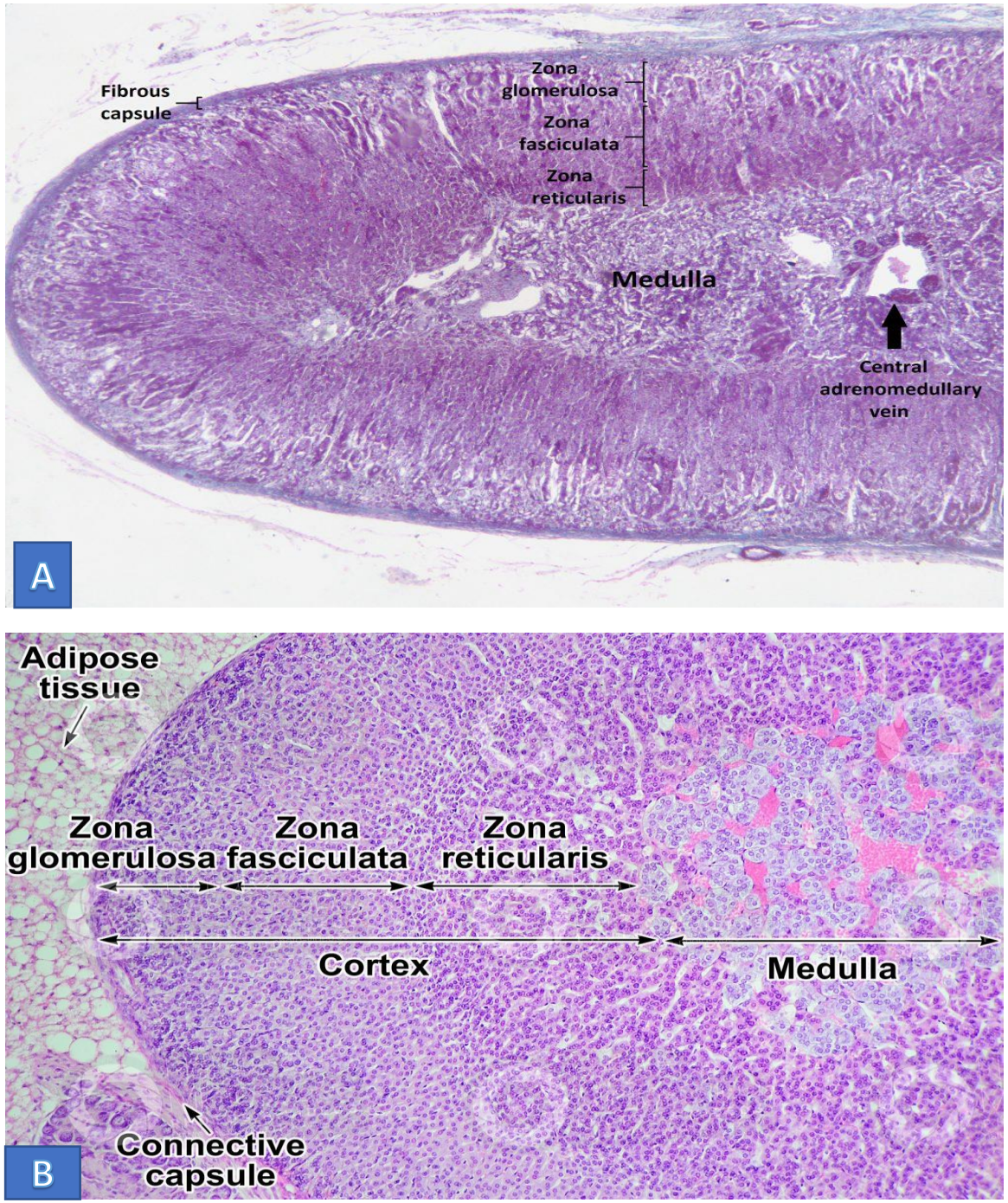


Fig. Histological structure of adrenal gland at 40X magnification (A) showing cortex (B) and medulla region

- **Adrenal medulla, derived from the ectoderm is the inner portion of the adrenal glands consists of glandular cells called *chromaffin cells* which on stimulation by sympathetic system, secretes hormones.**

- **Both *epinephrine* and *norepinephrine* are synthesized from the amino acid tyrosine.**

- **Secretion of adrenaline occurs more than the nor-adrenaline.**

- ***Epinephrine*, *dopamine* and *norepinephrine* are collectively known as catecholamines.**

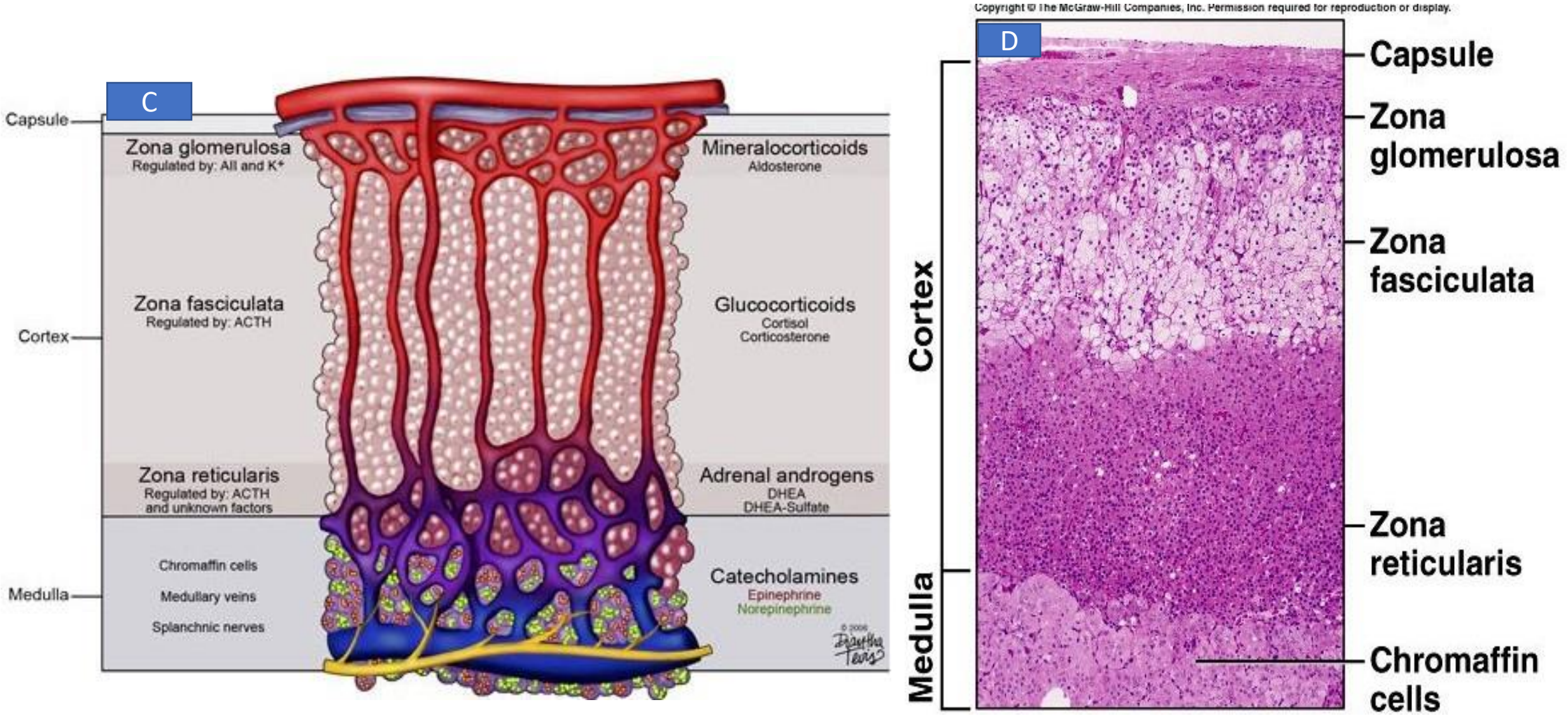
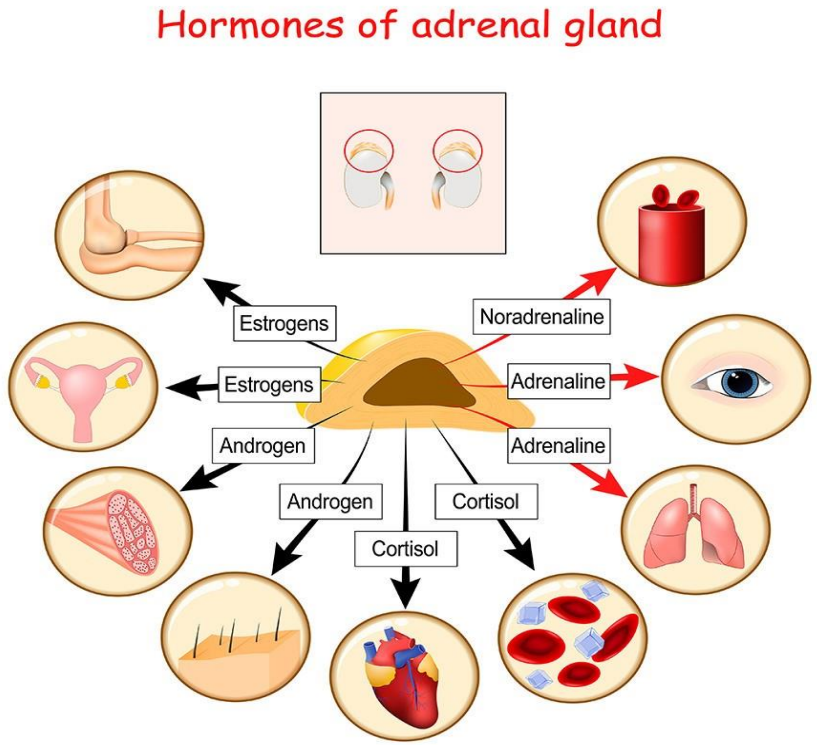


Fig. Diagrammatic representation of adrenal cortex regions (C) and histological view of adrenal cortex region (D)

Hormones secreted from adrenal cortex:-

- *Zona glomerulosa* secretes mineralocorticoids- *aldosterone*.
- *Zona fasciculata* secretes glucocorticoids- *Cortisol* and *corticosterone and small amount of adrenal androgens and estrogen.*
- *Zona reticularis* secretes sex corticoids- adrenal androgens- *dehydroepiandrosterone* (DHEA) and *androstenedione*.



Hormones secreted from adrenal medulla-

- **Adrenaline or Epinephrine**
- **Nor-adrenaline or Norepinephrine.**

Functions of adrenal hormones-

- ***Aldosterone*** **acts primarily on the kidney to promote absorption of sodium and excretion of potassium.**

- **In the absence of aldosterone, sodium is excreted and the lower sodium levels result in decreased blood volume and lower blood pressure.**

- ***Cortisol*** **raises the level of glucose in the blood by stimulating the liver to produce glucose from stored non-carbohydrate sources such as proteins and lipids and to release it into the blood.**

- ***Cortisol*** **reduces swelling by inhibiting the immune system.**
- **It is also used as immunosuppressive agent.**
- ***Adrenal androgens*** **has possible part in the early development of the male sex organs results from childhood secretion of adrenal androgens.**
- ***Adrenaline*** **increases blood pressure, BMR and acts as vasodilator.**
- **It increases sugar level in blood stimulating glycogenolysis in liver and skeletal muscles.**
- ***Nor-adrenaline*** **more or less resembles adrenaline in its biological effects except that it operates during normal state exercise.**

Disorders of Adrenal Hormones-

Hypoadrenalism:-

Addison's Disease is caused by hyposecretion of cortisol hormone

- **Addison's disease results from the failure of the adrenal cortices to produce adrenocortical hormones.**
- **Adrenal gland hypofunction is also caused by tuberculous destruction of the adrenal glands or invasion of the adrenal cortices by cancer.**
- **Lack of aldosterone secretion greatly decreases renal tubular sodium reabsorption and consequently allows sodium ions, chloride ions and water to be lost into urine with great profusion.**
- **Loss of cortisol secretion makes it impossible for a person with Addison's disease to maintain normal blood glucose concentration between meals because he or she cannot synthesize significant quantities of glucose by gluconeogenesis.**

Addison's disease caused due to insufficient release of cortisol hormone and symptoms associated with the disease.

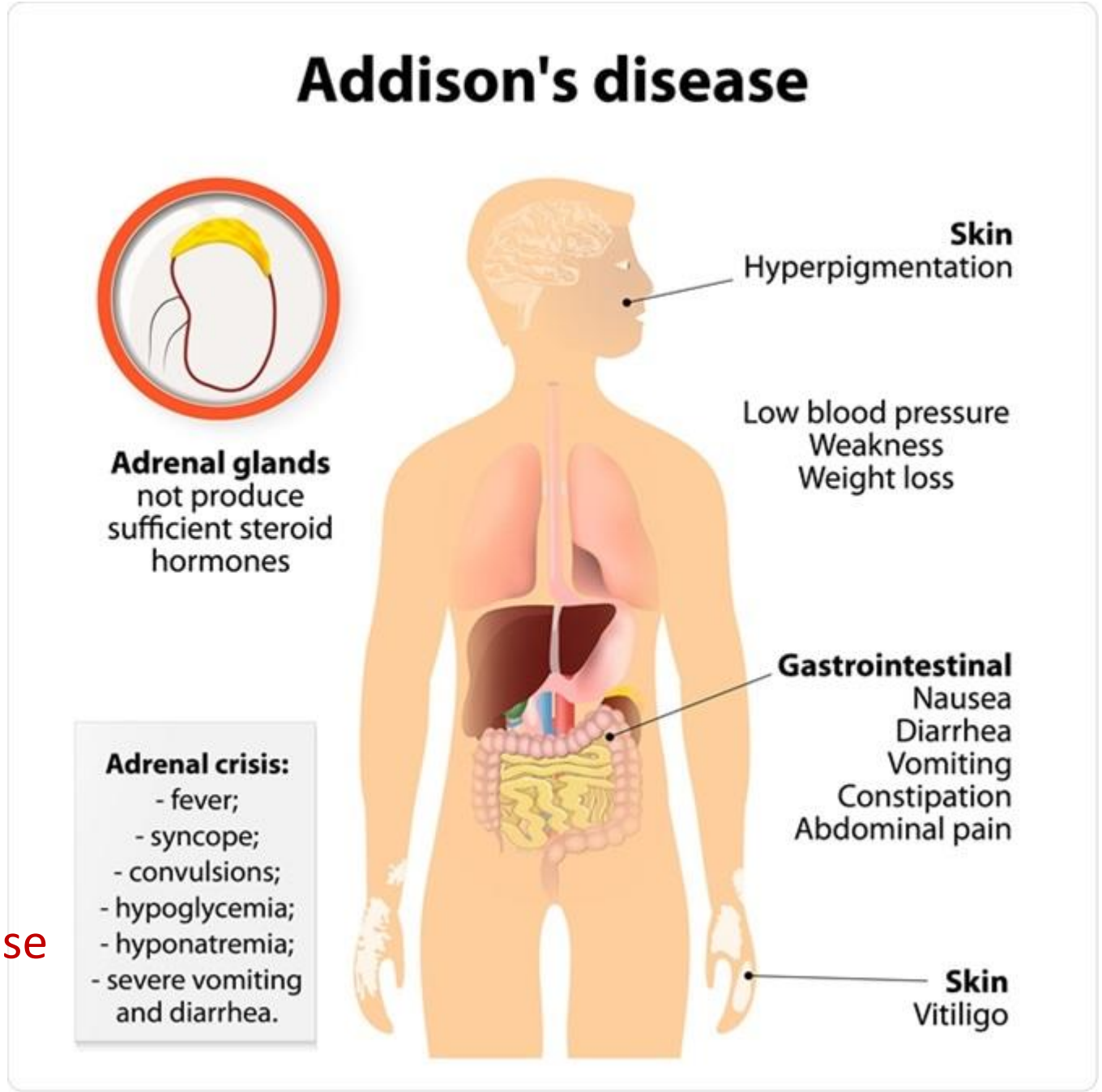


Fig: Addison's disease symptoms and causes.

Hyperadrenalism-

Cushing's syndrome- is caused by hypersecretion of Cortisol hormone

- **Hypersecretion by the adrenal cortex causes a complex cascade of hormone effects called Cushing's syndrome.**
- **Hypercorticolism can occur from adenomas of the anterior pituitary that secrete large amount of ACTH.**
- **Special characteristic of Cushing's syndrome is mobilization of fat from the lower part of the body, with concomitant extra deposition of fat in the thoracic and upper abdominal regions, giving rise to buffalo torso.**
- ***Primary Aldosteronism (Conn's Syndrome)*- is caused by hypersecretion of Aldosterone**
- **A small tumor of the Zona glomerulosa cells occurs and secretes large amounts of aldosterone resulting in Conn's disease.**
- **The most important effects are hypokalemia, slight increase in extracellular fluid volume and blood volume.**

Cushing's syndrome

Due to **excess cortisol-like medication** (prednisone) or **tumor** that produces or results in production of **excessive cortisol**

[Cases due to a pituitary adenoma = Cushing's disease]

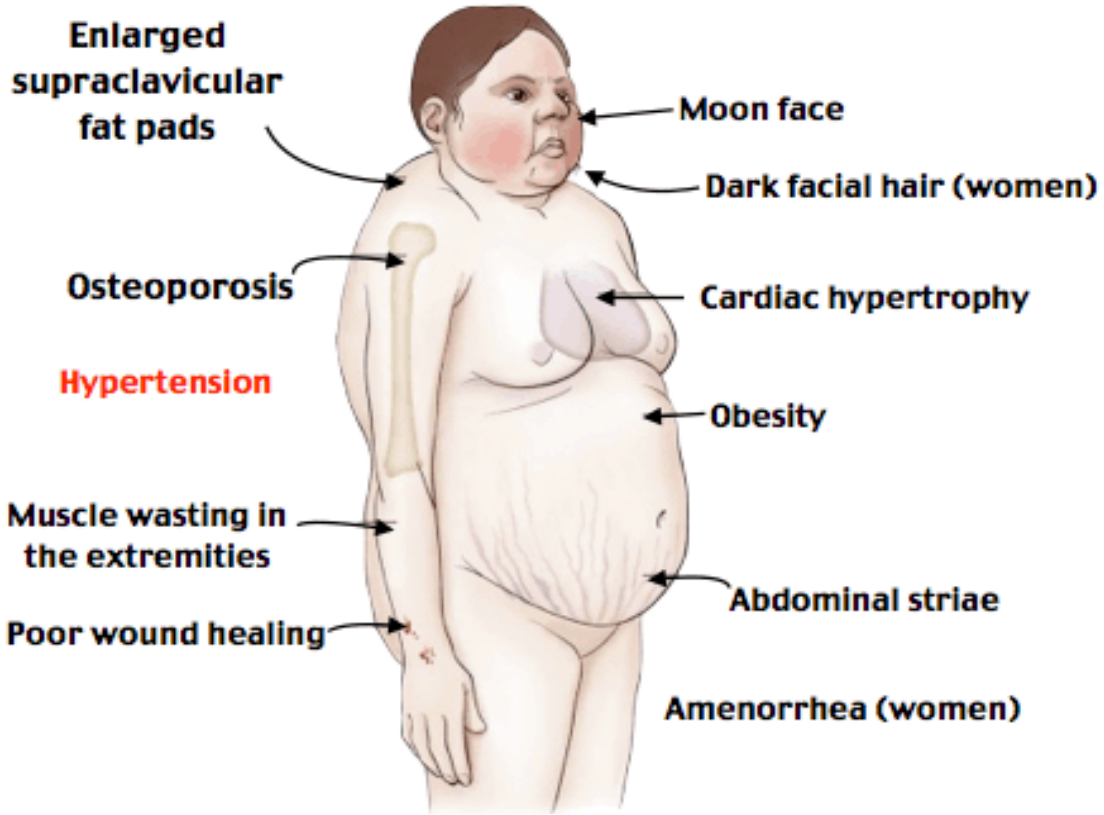


Fig: Cushing's syndrome symptoms and causes.

Hyperaldosteronism

- This occurs when the adrenal glands secrete excessive amounts of aldosterone – Conn syndrome

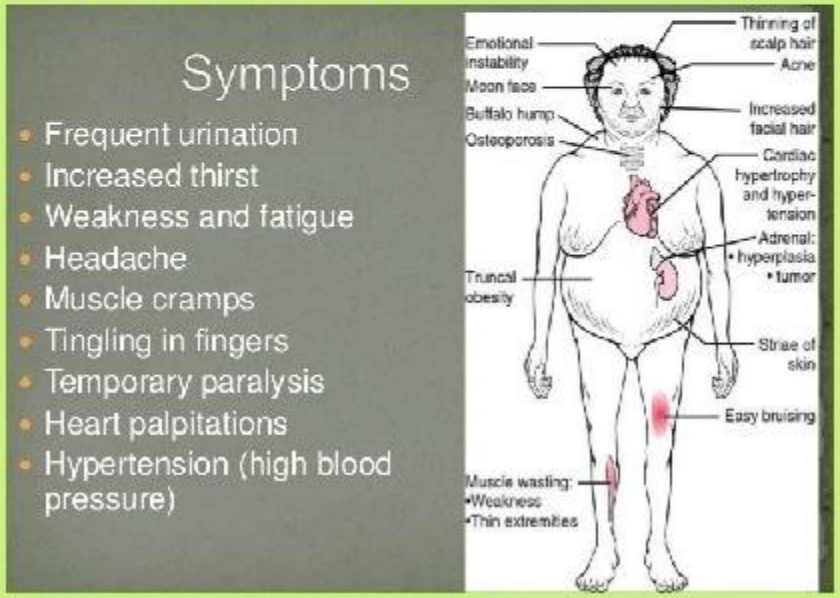


Fig: Conn's syndrome symptoms and causes.

THANK YOU