Adrenal gland

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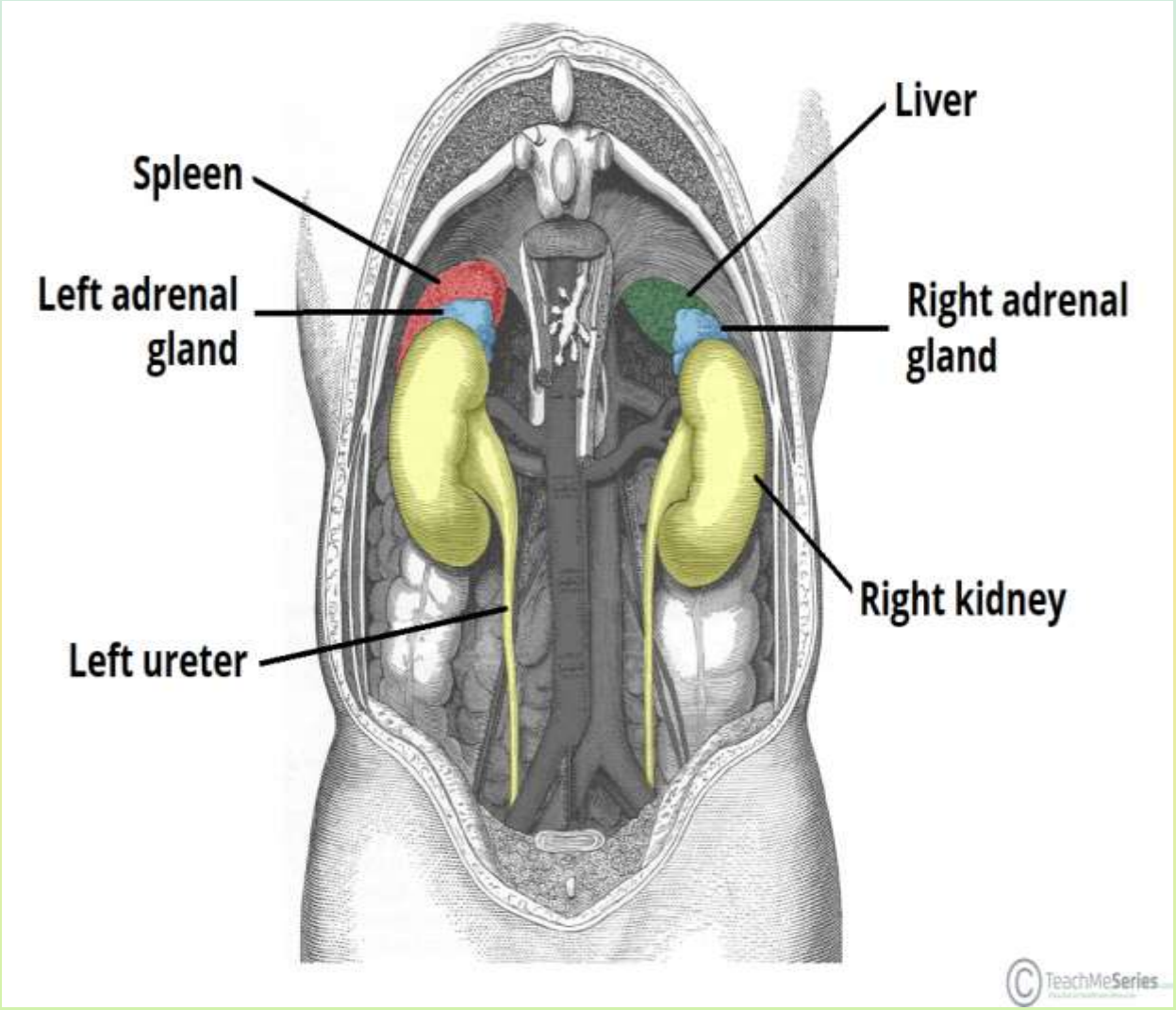
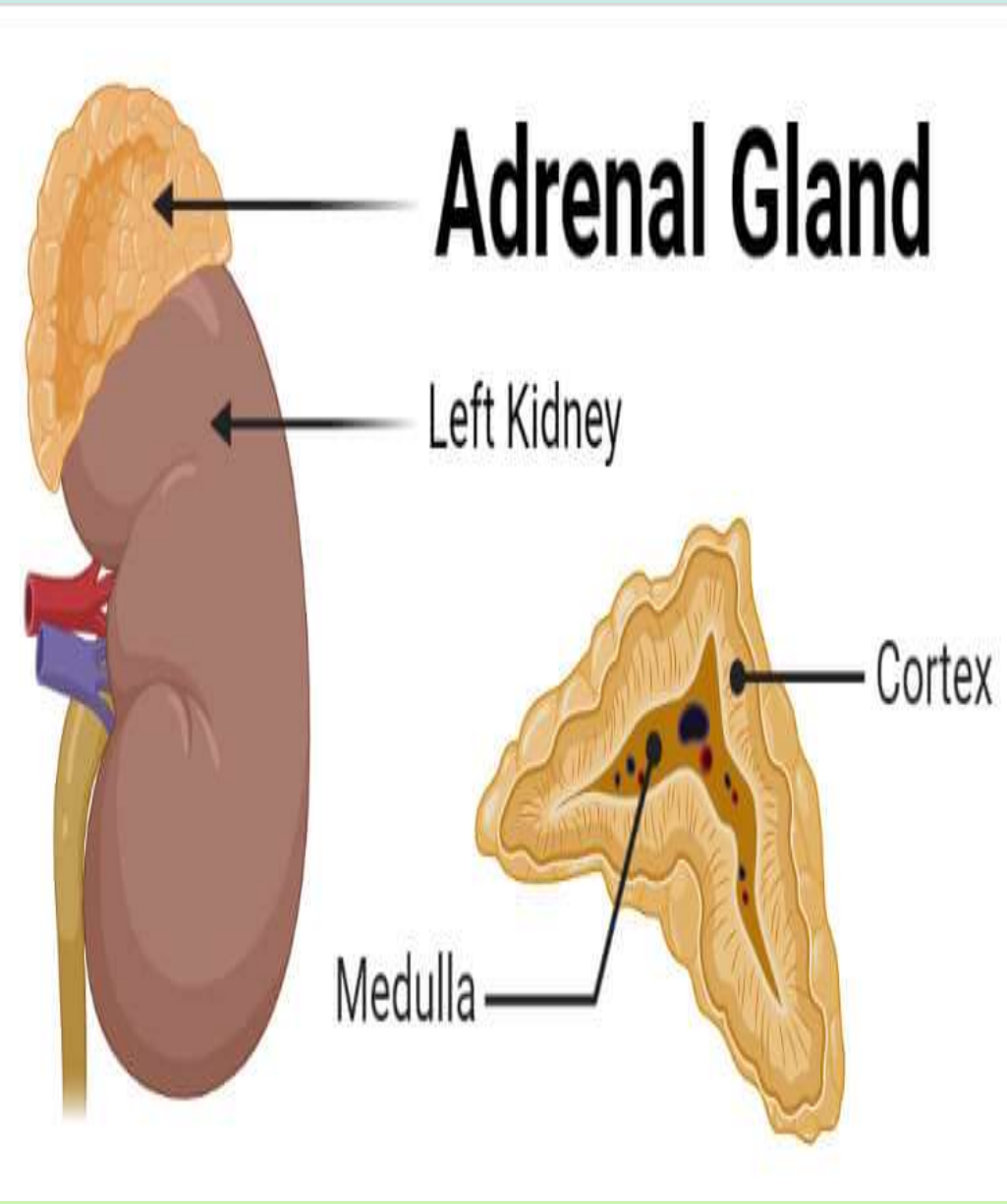
Adrenal gland-Structure, functions and hormonal disorders

- Location of adrenal glands:

- The **adrenal** (or suprarenal) glands are paired endocrine glands situated over the medial aspect of the upper poles of each kidney.
- They
  secrete steroid and catecholamine **hormones** directly into the blood.



Location of adrenal glands:



What are Adrenal Glands?

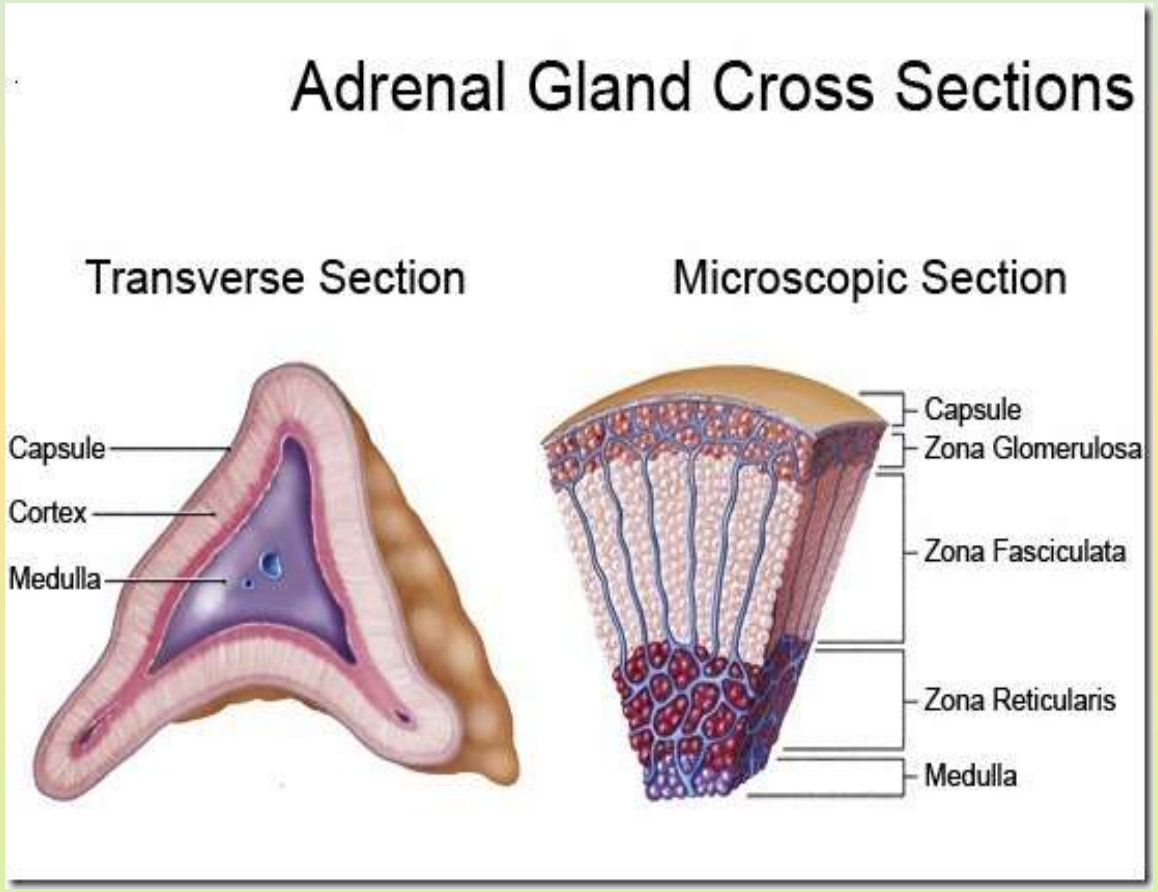
- Adrenal glands are orange-colored organs located on top of both kidneys.
- Adrenal glands are about the size and shape of a fortune cookie.
- They are triangular and not round. Adrenal glands secrete several types of hormones and thus are part of the endocrine system.
- We all have two adrenal glands, but we can live just fine with only one (In fact, most people can live normally with less than half a normal adrenal gland).
- Adrenal glands usually do not cause problems, but they can develop tumors which require surgery.

What Do Adrenal Glands Do?

- Adrenal glands secrete several types of hormones to help maintain blood pressure, salt balance and help in times of stress.
- Humans cannot live without adrenal glands, so if both adrenal glands are removed (very rarely, if necessary), then the patient needs to take medications and supplements to provide the necessary hormones.
- The adrenal gland secretes metabolically important hormones like mineralocorticoids and glucocorticoids, as well as steroid hormones like androgens.
- The hormones of the adrenal gland are important for metabolism as well as reproduction, and the normal functioning of the body.

Adrenal gland-Structure

- Adrenal glands consist of two distinct structures; the adrenal cortex and adrenal medulla, both of which are different in structure as well as functions.



Adrenal Cortex

- It consists of three distinct zones; zona glomerulosa, zona fasciculate and zona reticularis.
- The zona glomerulosa is the outermost zone that is composed of a thin layer of columnar cells arranged in an arched pattern. Zona glomerulosa of the adrenal cortex produces the hormone aldosterone (mineralocorticoids).
- Zona fasciculata is the middle and thickest zone of the cortex. It is composed of columns of secretory cells surrounded by multiple capillaries. This zone produces glucocorticoids.
- The zona reticularis is the innermost layer composed of polyhedral cells arranged in linear or round nests. The region mostly produces glucocorticoids, but some species might produce the sex steroids called androgens.

Medulla

- The medulla lies in the centre of the gland, and is dark brown in colour. It contains **chromaffin cells**, which secrete catecholamines (such as adrenaline) into the bloodstream in response to stress.

- These hormones produce a ‘**flight-or-fight**‘ response.

- Chromaffin cells also secrete enkephalins which function in pain control

Hormones of the adrenal cortex

Mineralocorticoids (Aldosterone)

- **Mineralocorticoids are a group of steroid hormones secreted by the cells of the zona glomerulosa of the adrenal cortex.**
- **Mineralocorticoids function to regulate the concentrations of mineral salts (like Na+ and K+) in the extracellular fluids.**

Glucocorticoids

- **Glucocorticoids are essential to life as these influence the energy metabolism in the body.**
- **The primary function of glucocorticoids is to maintain blood glucose and blood pressure by influencing the activity of vasoconstrictors.**

Gonadocorticoids/Androgens/Sex Hormones

- **The gonadocorticoids or androgens produced by the adrenal cortex are weak sex hormones and are converted into potent sex hormones.**
- **pubic hair development in both males and females.**

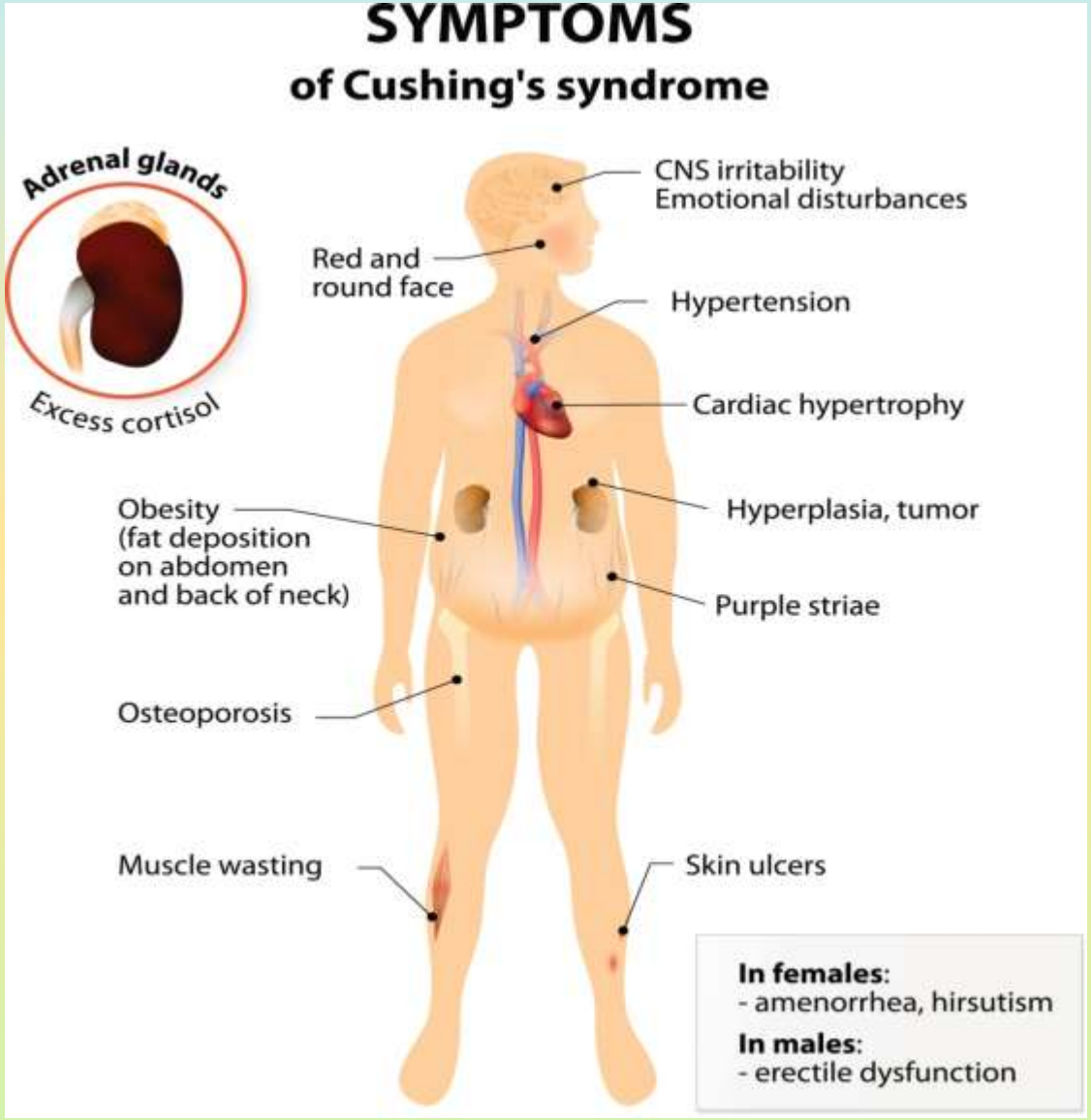
Hormones produced by the adrenal medulla
Epinephrine and Norepinephrine

- **The adrenal medulla produces two hormones in response to stress; epinephrine and norepinephrine.**
- **epinephrine, also called adrenaline, hormone that is secreted mainly by the medulla of the adrenal glands and that functions primarily to increase cardiac output and to raise glucose levels in the blood.**
- **The adrenal medulla produces norepinephrine in response to low blood pressure and stress. Norepinephrine promotes vasoconstriction, which is a narrowing of the blood vessels, and this increases blood pressure.**

Diseases and Disorders of Adrenal Gland

Cushing's syndrome:

- Cushing's syndrome is a condition caused due to the hypersecretion of cortical, which is the primary glucocorticoid hormone of the adrenal cortex.
- The hypersecretion can occur due to the formation of adrenal tumors or the hypersecretion of the ACTH by the pituitary.
- The condition is characterized by adiposity of the face, neck, and abdomen followed by extensive tissue protein breakdown



Adrenal Hypoplasia

- Adrenal hypoplasia is a condition resulting from the underdevelopment of the adrenal cortex due to various clinical conditions.
- Hypoplasia of the adrenal cortex can either be primary or secondary. Primary hypoplasia results in hyposecretion of adrenal hormones and underdevelopment of the adrenal gland.

Addison's Disease

- Addison's disease is a disorder caused due to the destruction of the adrenal gland due to the hyposecretion of glucocorticoids and mineralocorticoids.
- The disease can occur due to the formation of autoantibodies by the immune system against the cortical cells.
- Some common symptoms of this condition are muscle weakness, tiredness, and increased skin pigmentation.

References:

1. T.B. of Physiology-Guyton & Hall
2. T.B. of Physiology- G.N. Vankhede
3. References from Google

Thank You!