

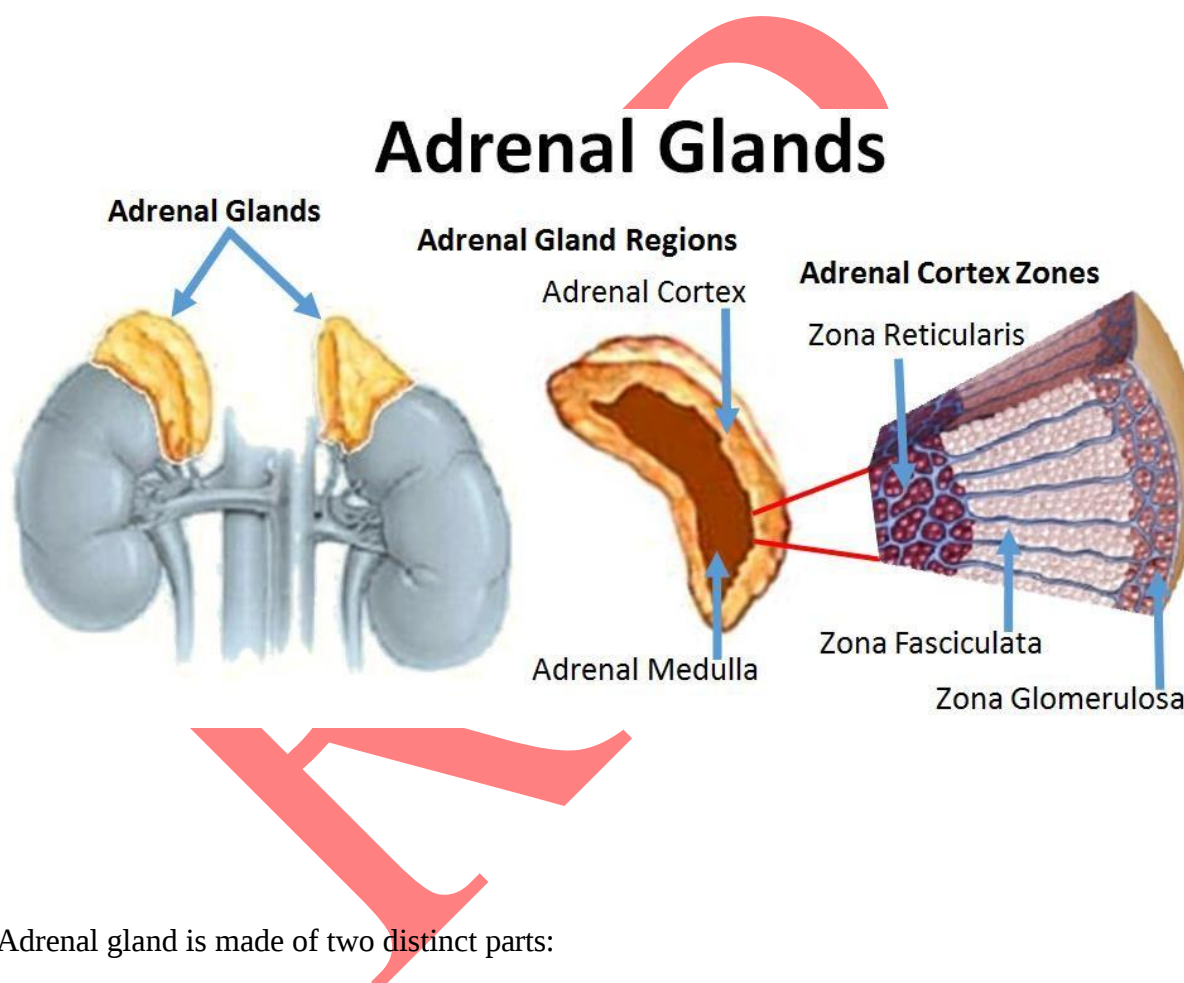
HUMAN ANATOMY & PHYSIOLOGY-II- BP201T

UNIT: 4 (ENDOCRINE SYSTEM)

CLASS: 7

TOPIC: ADRENAL GLAND

Adrenal glands are called the 'life-saving glands' or 'essential endocrine glands'. It is because the absence of adrenocortical hormones causes death within 3 to 15 days and absence of adrenomedullary hormones, drastically decreases the resistance to mental and physical stress. There are two adrenal glands. Each gland is situated on the upper pole of each kidney. Because of the situation, adrenal glands are otherwise called suprarenal glands.



Adrenal gland is made of two distinct parts:

1. Adrenal cortex: Outer portion, constituting 80% of the gland
2. Adrenal medulla: Central portion, constituting 20% of the gland.

These two parts are different from each other in development, structure and functions.

Adrenal medulla develops from the neural crest, which gives origin to sympathetic nervous system. So, its secretions and functions resemble that of sympathetic nervous system.

Adrenal cortex develops from the mesonephros, which give rise to the renal tissues. It secretes entirely a different group of hormones known as corticosteroids.

ADRENAL CORTEX

Adrenal cortex is formed by three layers of structure. Each layer is distinct from one another.

1. Outer zona glomerulosa 2. Middle zona fasciculata 3. Inner zona reticularis.

Adrenocortical hormones are steroids in nature, hence the name 'corticosteroids'. Based on their functions, corticosteroids are classified into three groups:

1. Mineralocorticoids 2. Glucocorticoids 3. Sex hormones.

All adrenocortical hormones are steroid in nature and are synthesized mainly from cholesterol that is absorbed directly from the circulating blood. Small quantity of cholesterol is also synthesized within the cortical cells from acetyl coenzyme A (acetyl-CoA).

Mineralocorticoids are transported in blood by binding with plasma proteins, especially globulins. The binding is loose and 50% of these hormones are present in free form.

Glucocorticoids are transported by a special plasma protein known as glucocorticoids-binding globulin or transcortin. Ninety four percent of glucocorticoids are transported by this protein, whereas about 6% of them are found free in plasma. Albumin plays a very little role in glucocorticoid transport.

Adrenal sex hormones are transported by another special plasma protein known as sex hormone-binding globulin.

Mineralocorticoids are the corticosteroids that act on the minerals (electrolytes), particularly sodium and potassium.

Mineralocorticoids are:

1. Aldosterone
2. 11-deoxycorticosterone.

Mineralocorticoids are secreted by zona glomerulosa of adrenal cortex. Mineralocorticoids are C₂₁ steroids having 21 carbon atoms. Half-life of mineralocorticoids is 20 minutes. Ninety percent of mineralocorticoid activity is provided by aldosterone.

Aldosterone is very essential for life and it maintains the osmolarity and volume of ECF. It is usually called life-saving hormone because, its absence causes death within 3 days to 2 weeks.

Aldosterone has three important functions. It increases:

1. Reabsorption of sodium from renal tubules
2. Excretion of potassium through renal tubules

3. Secretion of hydrogen into renal tubules.

Actions of aldosterone are:

1. On Sodium Ions: Aldosterone acts on the distal convoluted tubule and the collecting duct and increases the reabsorption of sodium.
2. On Extracellular Fluid Volume: When sodium ions are reabsorbed from the renal tubules, simultaneously water is also reabsorbed. Water reabsorption is almost equal to sodium reabsorption; so the net result is the increase in ECF volume. Even though aldosterone increases the sodium reabsorption from renal tubules, the concentration of sodium in the body does not increase very much because water is also reabsorbed simultaneously.
3. On Blood Pressure: Increase in ECF volume and the blood volume finally leads to increase in blood pressure.

Aldosterone escape or escape phenomenon

Aldosterone escape refers to escape of the kidney from salt-retaining effects of excess administration or secretion of aldosterone, as in the case of primary hyperaldosteronism.

Mechanism of aldosterone escape: When aldosterone level increases, there is excess retention of sodium and water. This increases the volume of ECF and blood pressure.

Aldosterone-induced high blood pressure decreases the ECF volume through two types of reactions:

- i. It stimulates secretion of atrial natriuretic peptide (ANP) from atrial muscles of the heart
- ii. It causes pressure diuresis (excretion of excess salt and water by high blood pressure) through urine.

**Because of aldosterone escape, edema does not occur.*

4. On Potassium Ions Aldosterone increases the potassium excretion through the renal tubules.