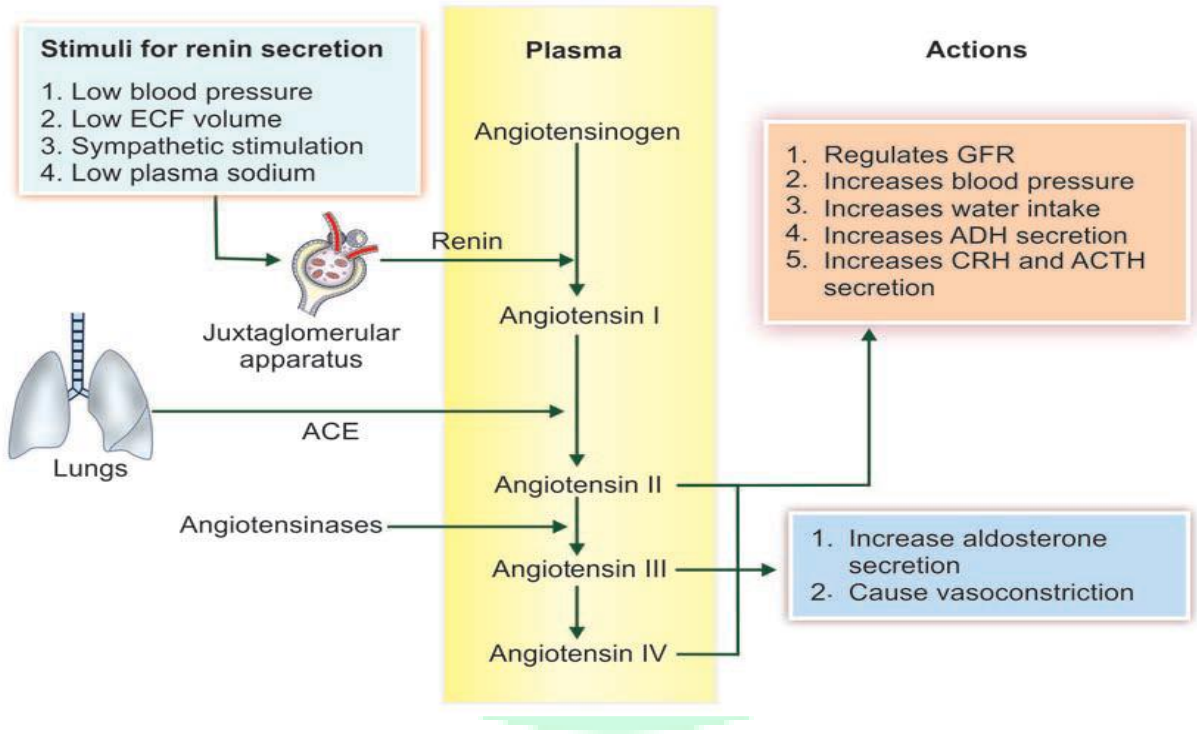
UNIT-3 RENIN-ANGIOTENSIN SYSTEM

Juxtaglomerular cells secrete renin. **Renin is a peptide** with 340 amino acids. Along with angiotensins, renin forms the **renin-angiotensin system**, which is a hormone system that plays an important role in the maintenance of blood pressure.

Secretion of renin is stimulated by four factors:

- ✓ i. Fall in arterial blood pressure
- ✓ ii. Reduction in the ECF volume
- ✓ iii. Increased sympathetic activity
- ✓ iv. Decreased load of sodium and chloride in macula densa.



Renin-angiotensin system

- ➢ Renin when released into the blood, acts on a specific plasma protein called **angiotensinogen** or **renin substrate.**
- ➢ It is the α2-globulin.

- By the activity of renin, the angiotensinogen is converted into angiotensin I.
- Angiotensin I is converted into angiotensin II, by the activity of **angiotensin-converting enzyme** (ACE) secreted from lungs.
- Most of the conversion of angiotensin I into angiotensin II takes place in lungs. Angiotensin II has a short half-life of about 1 to 2 minutes.
- Then it is rapidly degraded into angiotensin III by **angiotensinases,** which are present in RBCs and vascular beds in many tissues. Angiotensin III is converted into angiotensin IV**.**

Actions of Angiotensins

Angiotensin I- Physiologically inactive and serves only as the precursor of angiotensin II.

Angiotensin II-Most active form.

On blood vessels:

- Angiotensin II increases arterial blood pressure by directly acting on the blood vessels and causing vasoconstriction. It is a potent constrictor of arterioles. Earlier, when its other actions were not found it was called **hypertensin.**
- It increases blood pressure indirectly by increasing the release of noradrenaline from postganglionic sympathetic fibers.

On adrenal cortex:

It stimulates zona glomerulosa of adrenal cortex to secrete aldosterone. Aldosterone acts on renal tubules and increases retention of sodium, which is also responsible for elevation of blood pressure.

On kidney:

- Angiotensin II regulates GFR by two ways:

a. It constricts the efferent arteriole, which causes decrease in filtration after an initial increase

b. It contracts the glomerular mesangial cells leading to decrease in surface area of glomerular capillaries and filtration.

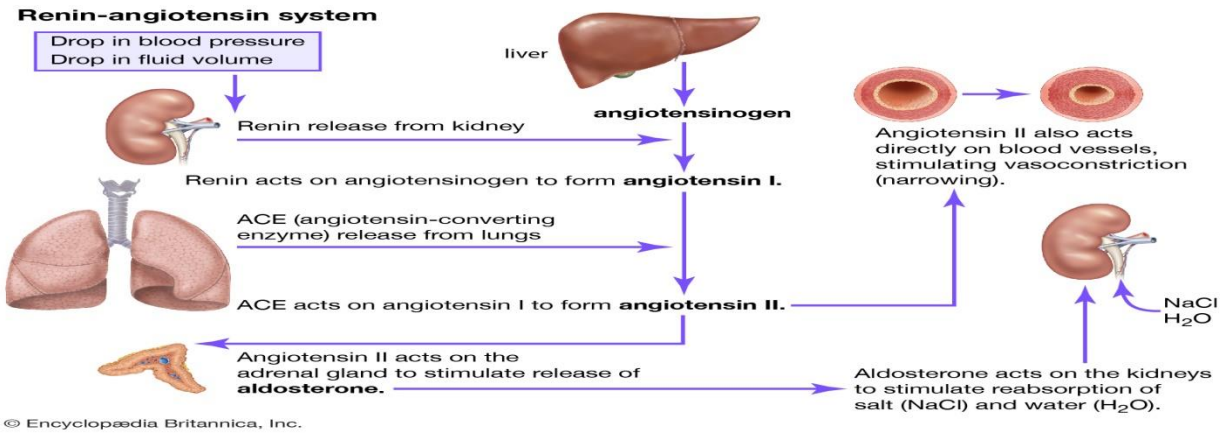
- It increases sodium reabsorption from renal tubules. This action is more predominant on proximal tubules.

On brain:

- Angiotensin II inhibits the **baroreceptor reflex** and thereby indirectly increases the blood pressure. Baroreceptor reflex is responsible for decreasing the blood pressure.
- It increases water intake by stimulating the thirst center
- It increases the secretion of Corticotropin-releasing hormone (CRH) from hypothalamus. CRH in turn increases secretion of adrenocorticotropic hormone (ACTH) from pituitary.
- It increases secretion of antidiuretic hormone (ADH) from hypothalamus.

Other actions:

- Angiotensin II acts as a growth factor in heart and it is thought to cause muscular hypertrophy and cardiac enlargement.
- Angiotensin III increases the blood pressure and stimulates aldosterone secretion from adrenal cortex. It has 100% adrenocortical stimulating activity and 40% vasopressor activity of angiotensin II.
- Angiotensin IV also has adrenocortical stimulating and vaso pressor activities.



Aldosterone

- Increase the retention of sodium and water and the excretion of potassium by the kidneys (and to a lesser extent by the skin and intestines).
- It acts by binding to and activating a receptor in the cytoplasm of renal tubular cells.
- The activated receptor then stimulates the production of ion channels in the renal tubular cells, thereby increasing sodium reabsorption into the blood and increasing potassium excretion into the urine.