Vasopressin

- Also called as anti diuretic hormone
- **Source of Secretion**
  - Secreted mainly by **supraoptic and paraventricular** nucleus in small quantity.
  - From here, this hormone is transported to posterior pituitary through the nerve fibers of hypothalamo-hypophyseal tract, by means of axonic flow.

- **Chemistry and Half-life**
  - Polypeptide containing 9 amino acids.
  - Its half-life is 18 to 20 minutes

Actions

- Antidiuretic hormone has two actions:
  - **Retention of water**
  - **Vasopressor action**

Retention of water

- Major function of ADH is retention of water by acting on kidneys.
- It increases the **facultative reabsorption of** water from distal convoluted tubule and collecting duct in the kidneys.

- **Mode of action on renal tubules**
  1. Without ADH, the luminal membranes of the tubular epithelial cells of the collecting ducts are almost impermeable to water.
  2. Immediately inside the cell membrane are a large number of special vesicles that have highly water permeable pores called **aquaporins.**
  3. When ADH acts on the cell, it first combines with membrane receptors **(V2 Receptors)** that activate adenylyl cyclase and cause the formation of cAMP inside the tubular cell cytoplasm

4. This causes phosphorylation of elements in the special vesicles, which then causes the vesicles to insert into the apical cell membranes, thus providing many areas of high water permeability.
5. All this occurs within 5 to 10 minutes.
6. Then, in the absence of ADH, the entire process reverses in another 5 to 10 minutes.
7. Thus, this process temporarily provides many new pores that allow free diffusion of water from the tubular fluid through the tubular epithelial cells and into the renal interstitial fluid

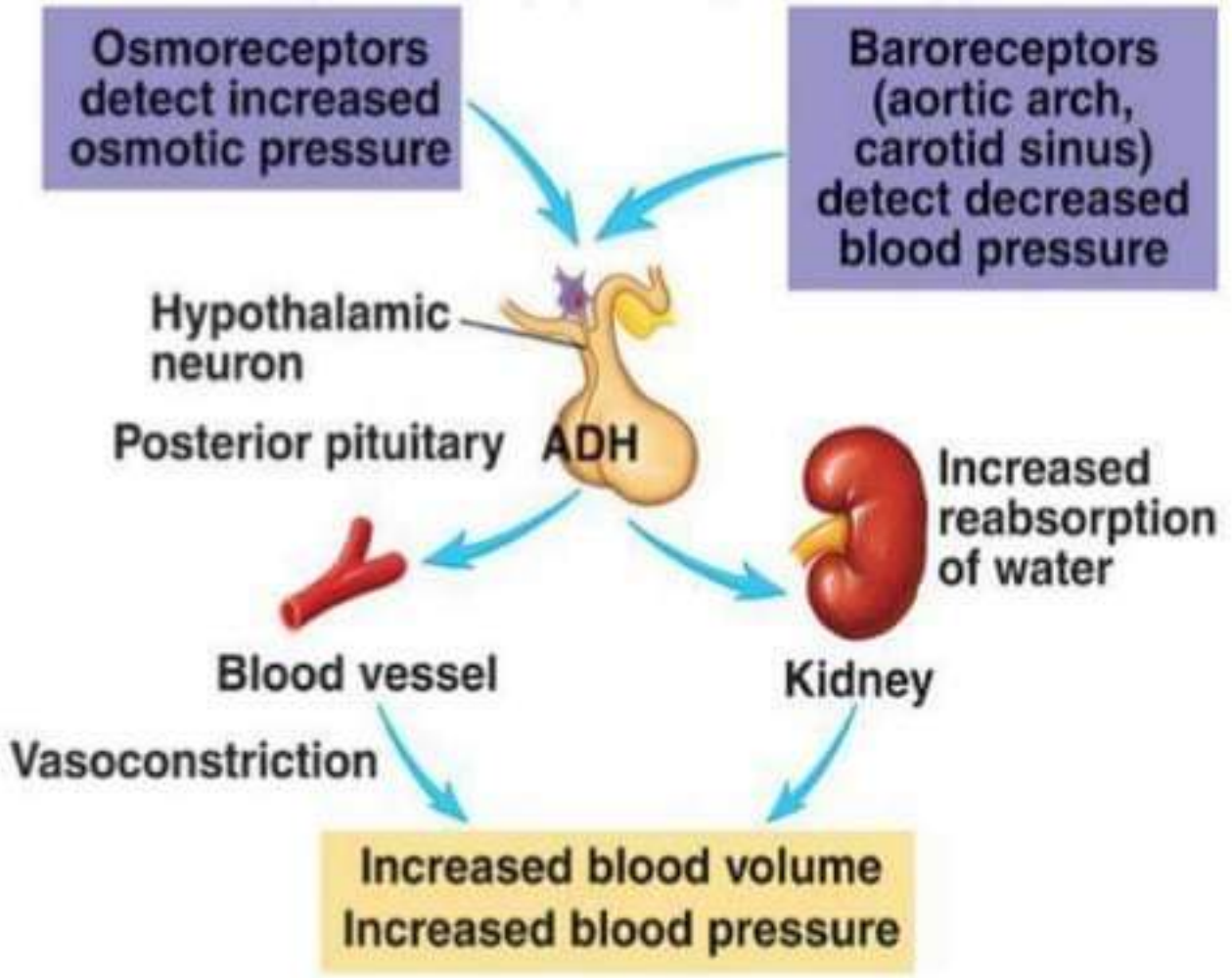
Vasopressor action

- In large amount, ADH shows vasoconstrictor action.
- Particularly, causes constriction of the arteries in all parts of the body.
- Due to vasoconstriction, the blood pressure increases.
- ADH acts on blood vessels through **V1A receptors.**
- However, the amount of ADH required to cause the vasopressor effect is greater than the amount required to cause the **antidiuretic effect.**

- One of the stimuli for causing intense ADH secretion is decreased blood volume.
- This occurs especially strongly when the blood volume decreases 15 to 25 per cent or more; the secretory rate then sometimes rises to as high as 50 times normal.

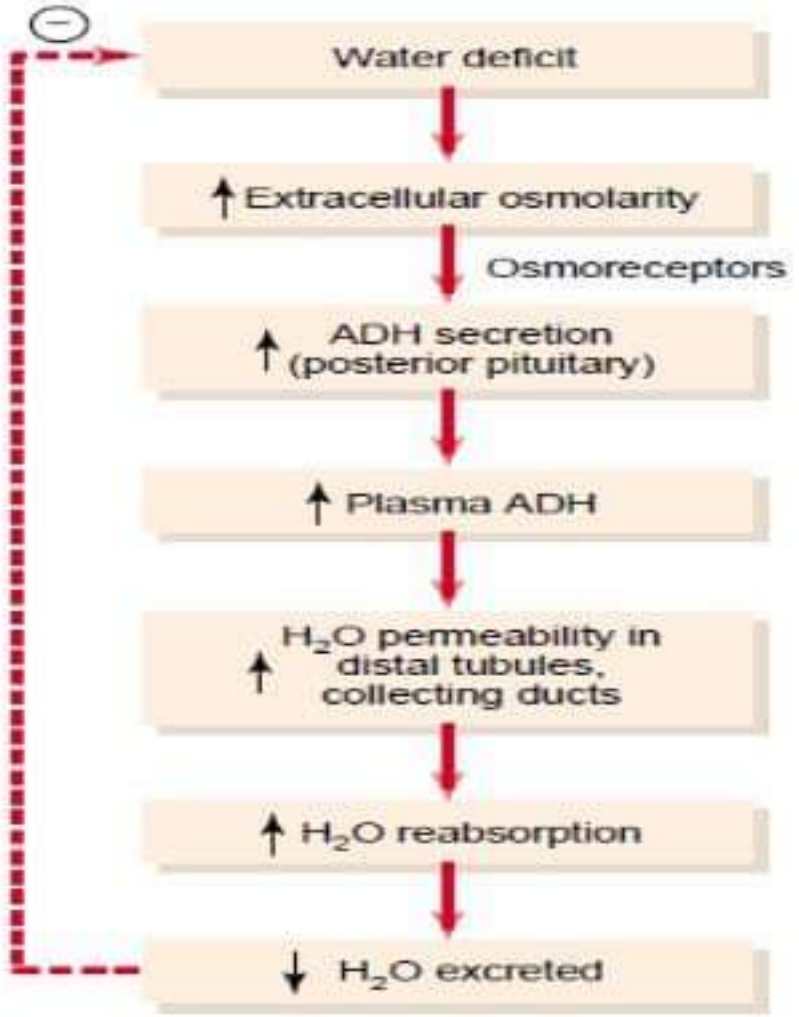
Mode of action

1. The atria have stretch receptors that are excited by overfilling.
2. When excited, they send signals to the brain to inhibit ADH secretion.
3. Conversely, when the receptors are unexcited as a result of underfilling, the opposite occurs, with greatly increased ADH secretion.
4. Decreased stretch of the baroreceptors of the carotid, aortic, and pulmonary regions also stimulates ADH secretion



Regulation of secretion

- ADH secretion depends upon the volume of body fluid and the osmolarity of the body fluids.
- Potent stimulants for ADH secretion are:
  - **Decrease in the extracellular fluid (ECF) volume**
  - **Increase in osmolar concentration in the ECF.**


Water deficit
↑ Extracellular osmolarity
Osmoreceptors
↑ ADH secretion (posterior pituitary)
↑ Plasma ADH
↑ H_2O permeability in distal tubules, collecting ducts
↑ H_2O reabsorption
↓ H_2O excreted

Applied physiology

- Hypersecretion
  - Syndrome of Inappropriate Hypersecretion of Antidiuretic Hormone (SIADH)
- Hyposecretion
  - Diabetes insipidus

SIADH

- SIADH is the disease characterized by loss of sodium through urine due to hypersecretion of ADH
- **Causes**
  - SIADH occurs due to cerebral tumors, lung tumors and lung cancers because the **tumor cells and cancer cells** secrete ADH.
  - In normal conditions, ADH decreases the urine output by facultative reabsorption of water in distal convoluted tubule and the collecting duct.
  - Urine that is formed is concentrated with sodium and other ions.

Signs and symptoms

1. Loss of appetite
2. Weight loss
3. Nausea and vomiting
4. Headache
5. Muscle weakness, spasm and cramps
6. Fatigue
7. Restlessness and irritability.
8. In severe conditions, the patients die because of convulsions and coma.

Diabetes insipidus

- Diabetes insipidus is a posterior pituitary disorder characterized by excess excretion of water through urine due to a defect in ADH secretion
- **Causes:**
  - This disorder develops due to the deficiency of ADH, which occurs in the following conditions:
    - Lesion (injury) or degeneration of supraoptic and paraventricular nuclei of hypothalamus
    - Lesion in hypothalamo-hypophyseal tract
    - Atrophy of posterior pituitary
    - Inability of renal tubules to give response to ADH hormone. **(Nephrogenic diabetes insipidus)**

Signs and symptoms

- Polyuria
- Polydipsia
- Dehydration