

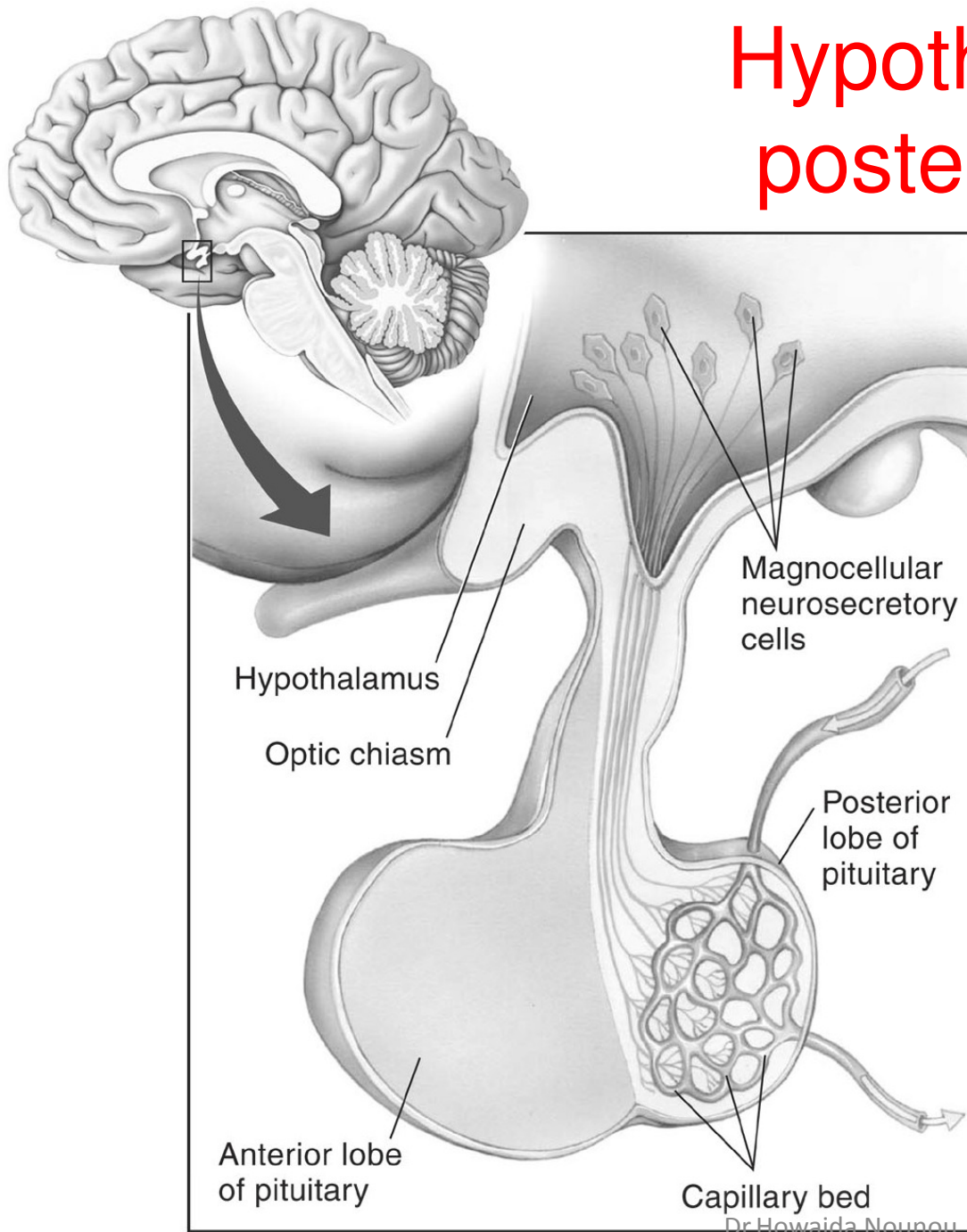
Posterior pituitary hormones

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Posterior Pituitary: neurohypophysis

- **Posterior pituitary:** an outgrowth of the hypothalamus composed of neural tissue.
- Hypothalamic neurons pass through the neural stalk and end in the posterior pituitary.
- The upper portion of the neural stalk extends into the hypothalamus and is called the **median eminence**.

Hypothalamus and posterior pituitary



magnocellular neurons
paraventricular and supraoptic
nuclei **secrete oxytocin and
vasopressin** directly into
capillaries in the posterior lobe

Posterior Pituitary

- Posterior pituitary hormones are actually **produced** in the hypothalamus and **only stored** in the posterior pituitary.

- **Posterior pituitary hormones are:**

1- Antidiuretic hormone (ADH) (Also call *vasopressin*)

2- Oxytocin

Both hormones are produced in hypothalamic nuclei:

- Supraoptic nucleus (SON) → (ADH mainly)
- Paraventricular nucleus (PVN) → (Oxytocin mainly)

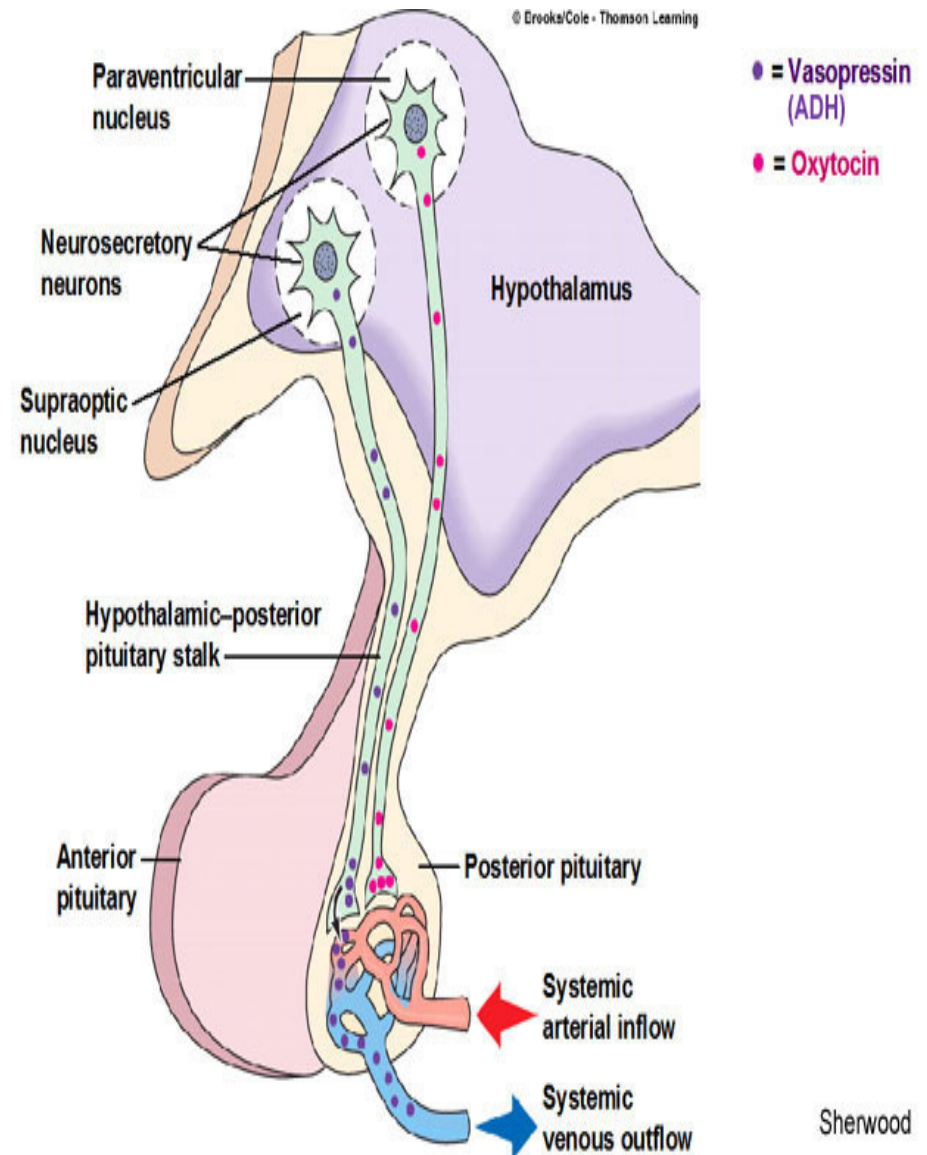
- Both hormones are nanopeptides, each contains 9 amino acid residues, 2 cysteine residues at position 1 and 6 linked by disulfide bridge.



Groups related to physiological action:

- 1- 2 cys residues.
- 2- Disulfide bonds
- 3- 3 carboxamide groups
- 4- OH-group of tyrosine

- Both are transported slowly along the 'hypothalamo-posterior pituitary stalk' in combination with carrier protein called 'neurophysin', to the nerve endings in the posterior pituitary gland where they are stored.



Posterior Pituitary Hormones

- **ADH** contributes to fluid balance by
 - Controlling **renal reabsorption** of water (water retention)
 - It also has potent **vasoconstrictive** properties.
- Oxytocin
 - **Function**
 - Lactation
 - **Stimulates milk let down**
 - Stimulator of smooth muscle (uterine)
 - **Synthetic oxytocin**
 - » **Used to induce or enhance labor contractions**

1. ADH (vasopressin):

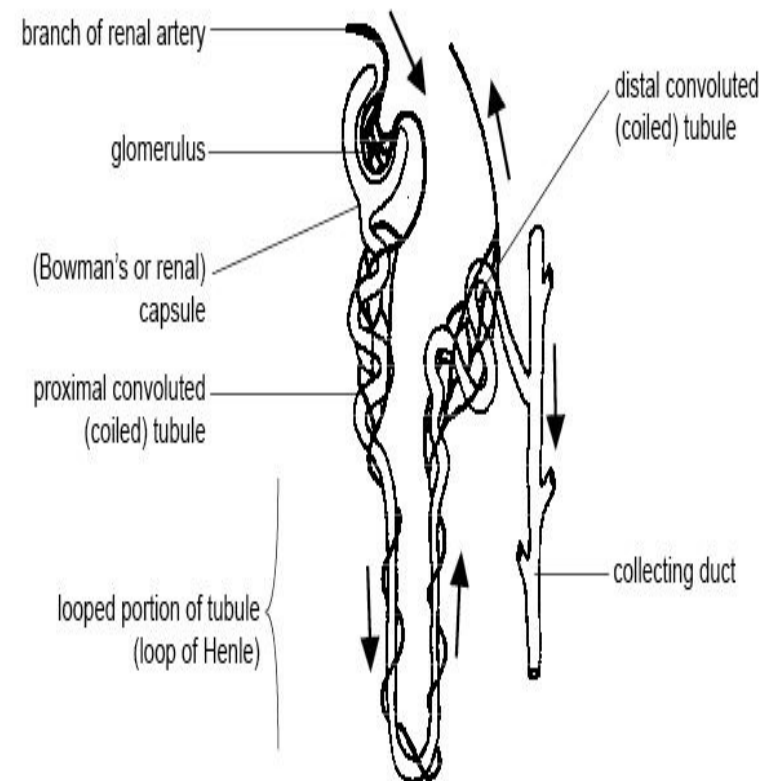
- Antidiuretic hormone (ADH), or arginine vasopressin (AVP), is produced mainly in **SON** of hypothalamus.
- ADH activates (2) second messenger systems:
 1. cAMP
 2. IP₃/Ca²⁺

Action of ADH

ADH has 2 main effects:

1. ↑ water re-absorption (retention) by distal tubules & collecting ducts of the kidneys → decrease osmotic pressure of the blood.

* This effect is regulated by V_2 receptors, through the action of cAMP.

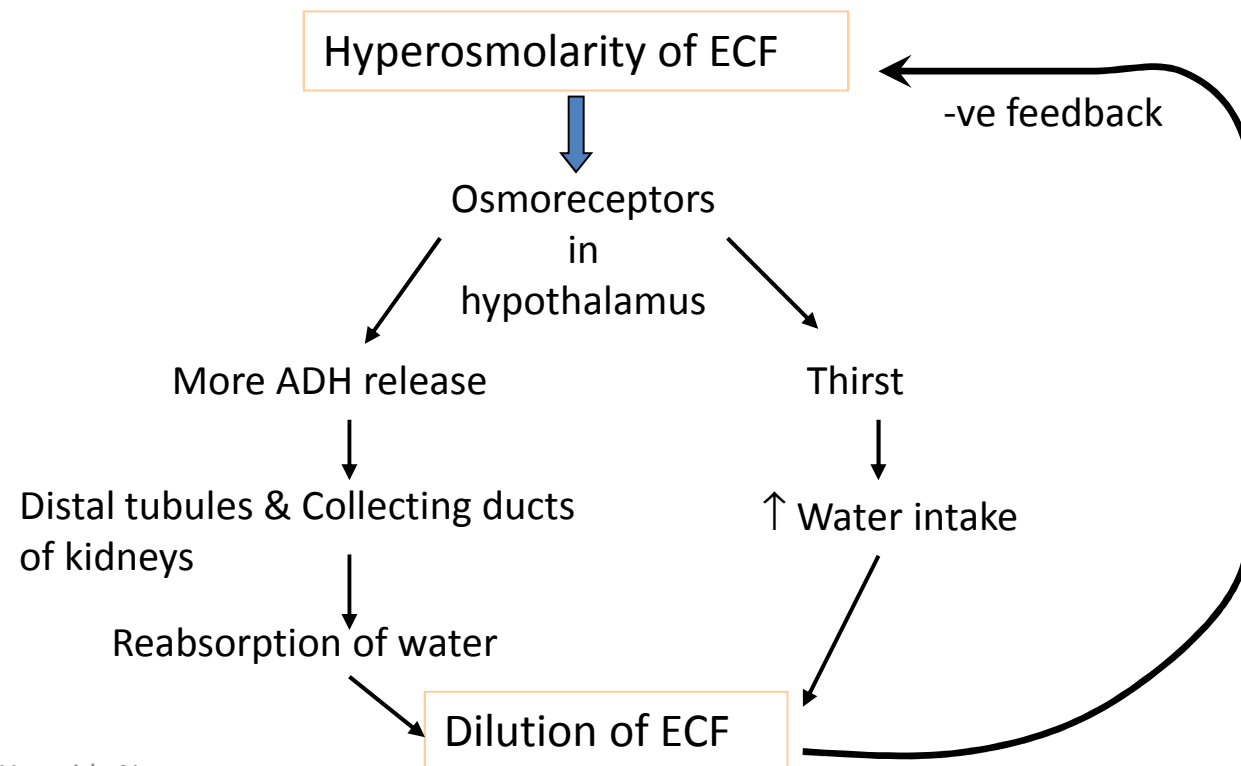


2. Contraction of vascular smooth muscles → generalized vasoconstriction.

* This effect is regulated by V_1 receptors, through the action of IP_3/Ca^{2+} .

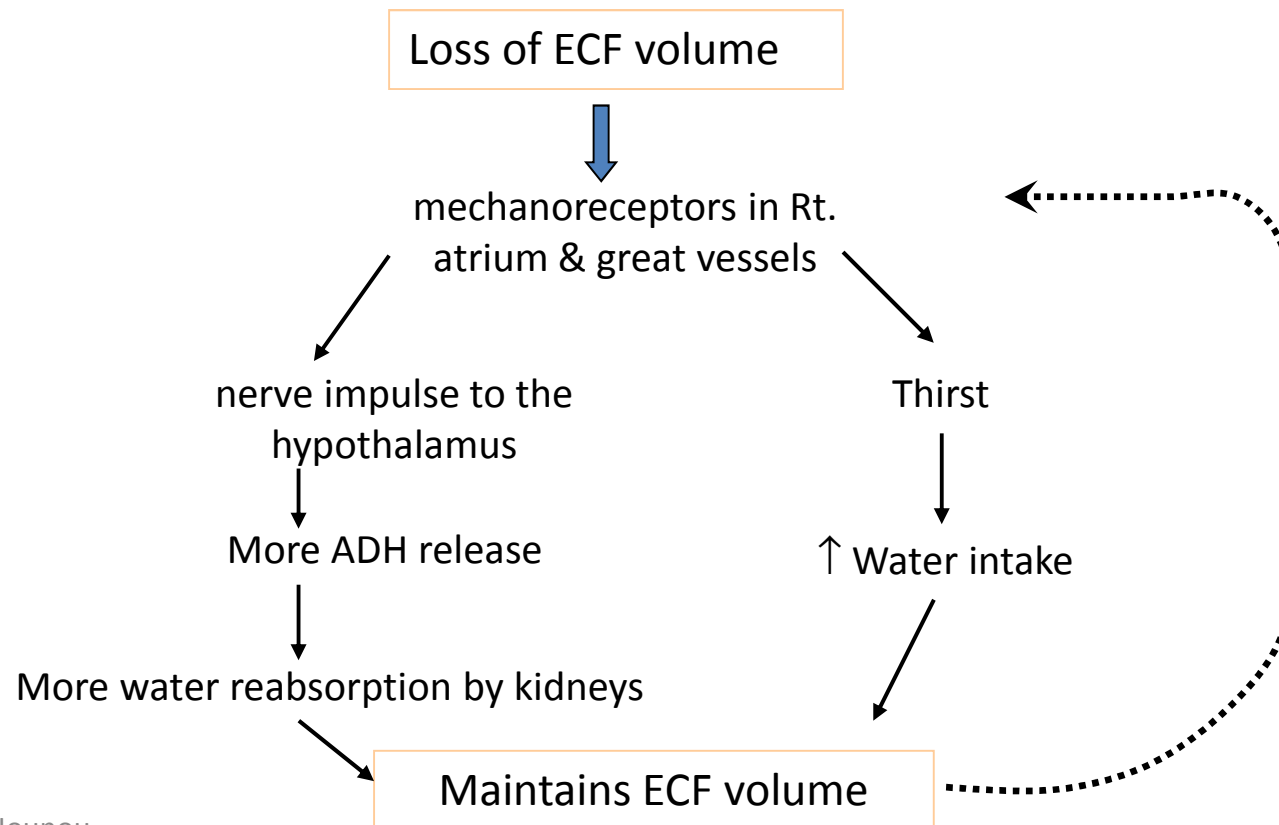
Control of ADH release

1. \uparrow in osmotic pressure of the ECF (\uparrow in plasma osmolality), as in dehydration which will stimulate osmoreceptors in the hypothalamus \rightarrow \uparrow ADH.



Control of ADH release

2. ↓ blood volume ($\geq 10\%$) → stimulate mechanoreceptors in the great arteries & right atrium → ↑ ADH.



Control of ADH release.

3. ↓ arterial blood pressure, due to ↓ blood volume → ↑ ADH.
4. Age: → ↑ ADH secretion → water retention & hyponatremia (↓ Na⁺ conc. In blood) .
5. Pain, emotional stress & physical trauma → ↑ ADH secretion.
6. Drugs, e.g. morphine, barbiturates, & nicotine → ↑ ADH secretion.
7. Alcohol → ↓ ADH secretion.

Abnormalities of ADH release – **Hyposecretion:**

- **Lack of ADH** → Diabetes insipidus. (DI)

2 types of DI: a. Neurogenic (central) (primary DI) ...

- Disease in Hypothalamus or Post pituitary gland; could be 1ry or 2ry.

- Insufficient amount of ADH

is secreted by hypothalamus due basal skull fracture
Treatment: ADH.

b. Hereditary Nephrogenic DI ...

ADH is secreted normally

resistance of V_2 receptors in collecting ducts of the kidney

- No ADH is needed as treatment.

Symptoms: Polyurea(excretion of large volume of diluted urine) \approx 20 L/day (N \approx 1.5 L/d)

Polydipsia (thirst sensation), loss of electrolytes

↓ specific gravity of urine (diluted urine),

↑ plasma osmolality.

Abnormalities of ADH release – **Hypersecretion:**

Excess: Syndrome of Inappropriate ADH secretion (SIADH)

- **↑ ADH:**

- - occurs after surgery.
- adenoma.
- Bronchial carcinoma.

Signs & Symptoms:

- Hyponatremia, i.e. $[Na^+] \downarrow$ extracellularly to 110 mM. (N = 140 mM); resulting in:
 - Mental confusion.
 - Coma.
 - Death, due to ventricular fibrillation.

The posterior pituitary hormones –

2. Oxytocin:

- ★ Produced mainly in the paraventricular (PVN) nucleus of the hypothalamus & stored in the posterior pituitary

Action of oxytocin

- 1. Contraction of smooth muscles of the uterus → at the time of labor (delivery).**
- 2. Contraction of mammary gland myoepithelial cells of the alveoli & the ducts during suckling → Ejection of milk (milk letdown) as a reflex in lactating women.**

Mammary Function

- Oxytocin
 - Causes contraction of myoepithelial cells, allowing milk ejection (release)
- Prolactin
 - Synthesis & production of milk.
 - Growth of mammary glands

Control of oxytocin release

1. Stimulation of nipple (suckling reflex) → ↑ oxytocin.
2. Visual or auditory stimuli from the baby → ↑ oxytocin secretion.
3. Distension of uterus & stretching of cervix during delivery → ↑ oxytocin release.
5. Psychological & emotional factors, e.g. Fear, anxiety & pain → ↓ oxytocin.
6. Alcohol → ↓ oxytocin secretion.
7. Hormones: a. progesterone → ↓ uterine sensitivity to oxytocin.
b. estrogen → ↑ uterine sensitivity to oxytocin.