



Endocrine

434 Physiology team
presents to you:

The Posterior Pituitary

- Important
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ADH

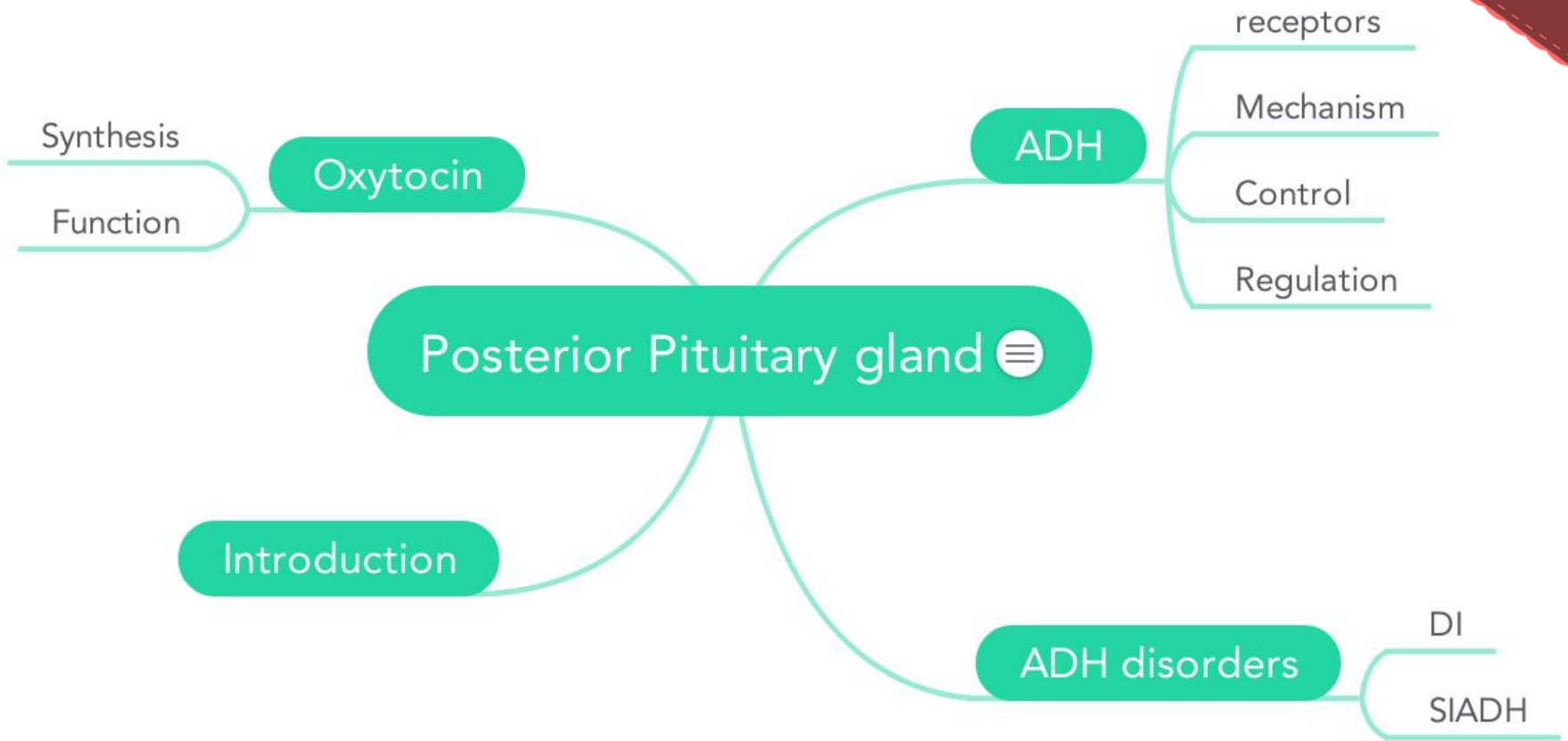


ADH



Oxytocin

Please check out this link before viewing the file to know if there are any additions/changes or corrections. The same link will be used for all of our work [Physiology Edit](#)

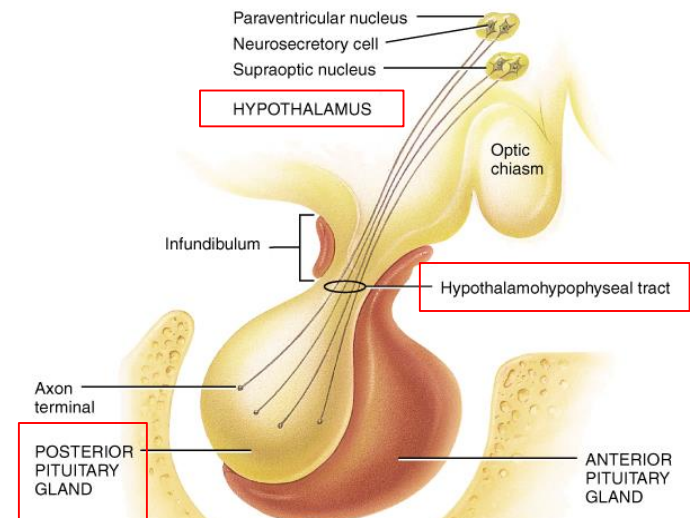
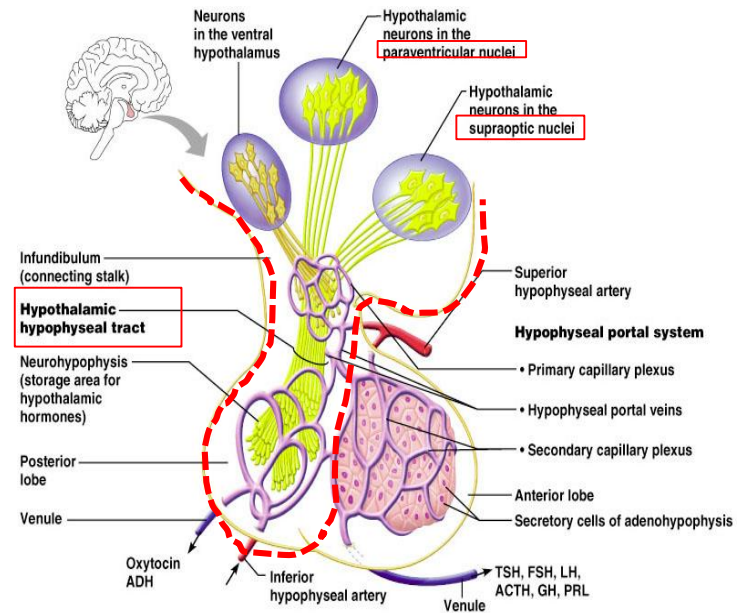


Introduction:

- The posterior lobe is a downgrowth of hypothalamic **neural tissue**.
- Has a neural connection with the hypothalamus (**hypothalamic-hypophyseal tract**).
- Nuclei of the hypothalamus synthesize **oxytocin** and antidiuretic hormone (**ADH**) are homologous nonapeptides.
- These hormones are transported to the posterior pituitary.

➤ **posterior pituitary:**

- **Does not synthesize hormones, just stores them.***
- **Consists of axon terminals of hypothalamic neurons.**



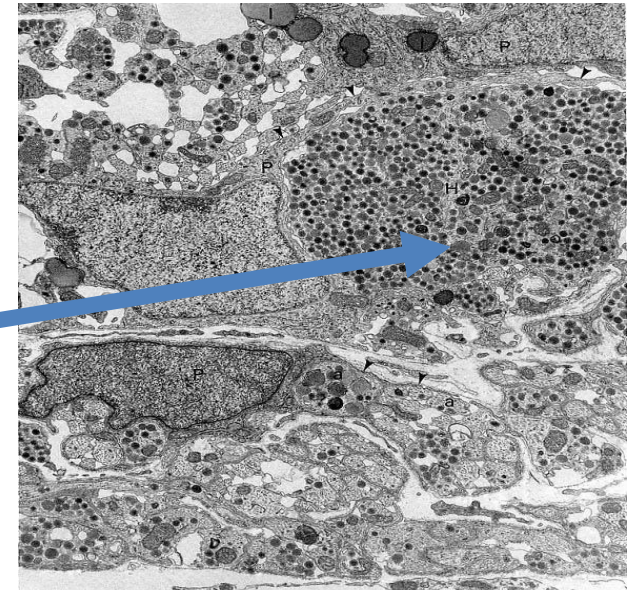
* Hormones are synthesized in hypothalamic nuclei and are packaged in secretory granules with their respective neurophysins (carrier protein) and travel down the nerve axons for **secretion** by the posterior pituitary.

Pituicytes and herring bodies :

➤ Are found in posterior part of Pituitary Gland.

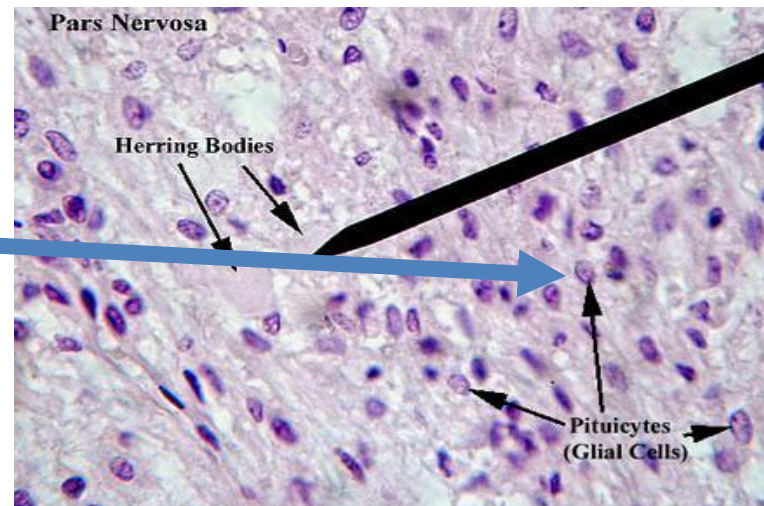
1-Herring Bodies function:

Antidiuretic hormone (ADH) and **oxytocin** are both stored in Herring bodies, but are not stored simultaneously in the same Herring body.



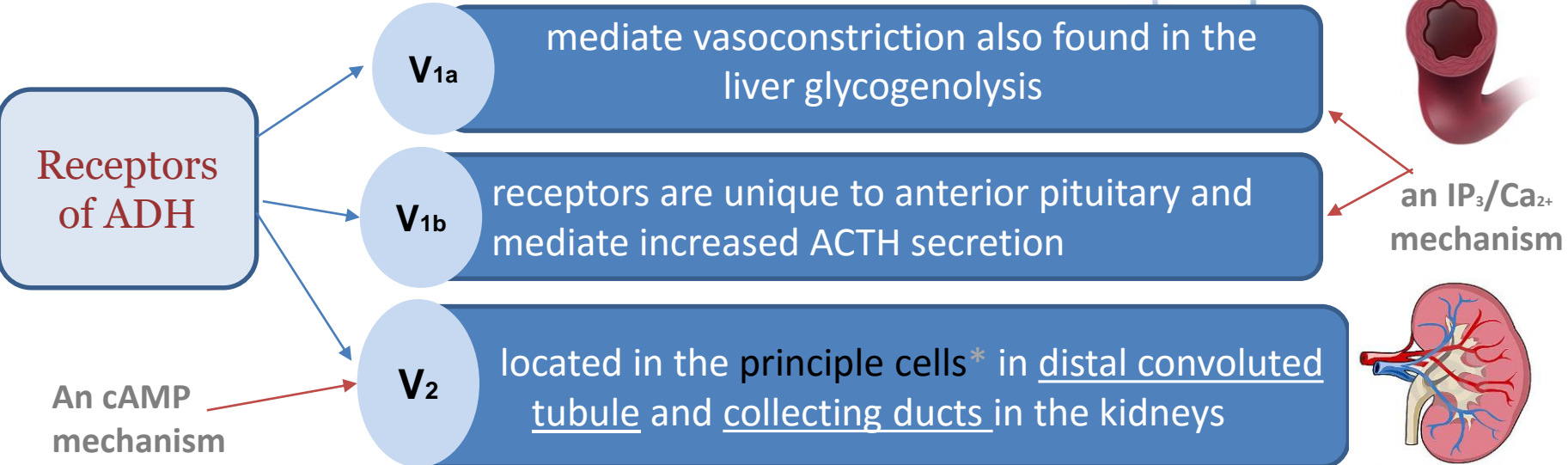
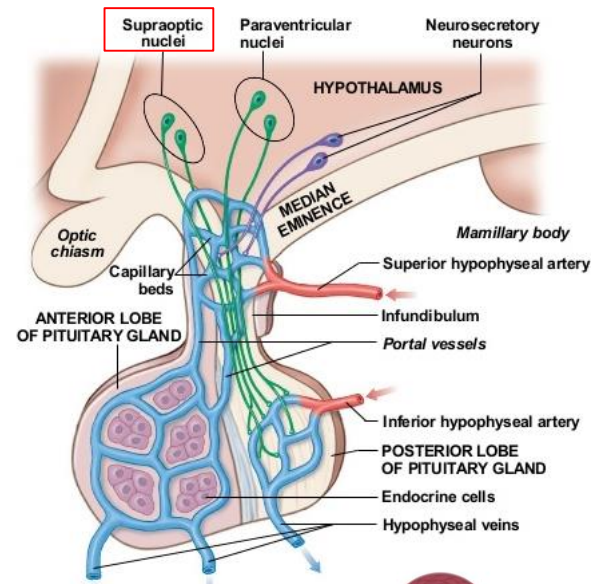
2-Pituicytes function:

It forms physical and chemical barrier between nerve terminal and blood vessels
Amplify auto receptor negative feedback.



Antidiuretic Hormone (ADH) or (vasopressin):

- It is synthesized as **pre-prohormone*** and processed into a **nonapeptide (nine amino acids)**.
- **ADH synthesized in the cell bodies of hypothalamic neurons (supraoptic nucleus).**
- **ADH is stored** in the posterior pituitary



- A **preprohormone** is the precursor protein to one or more prohormones, which are in turn precursors to **peptide hormones**.
- The **principal cell** mediates the **collecting duct's** influence on sodium and potassium balance via **sodium channels** and **potassium channels** located on the cell's **apical membrane**.

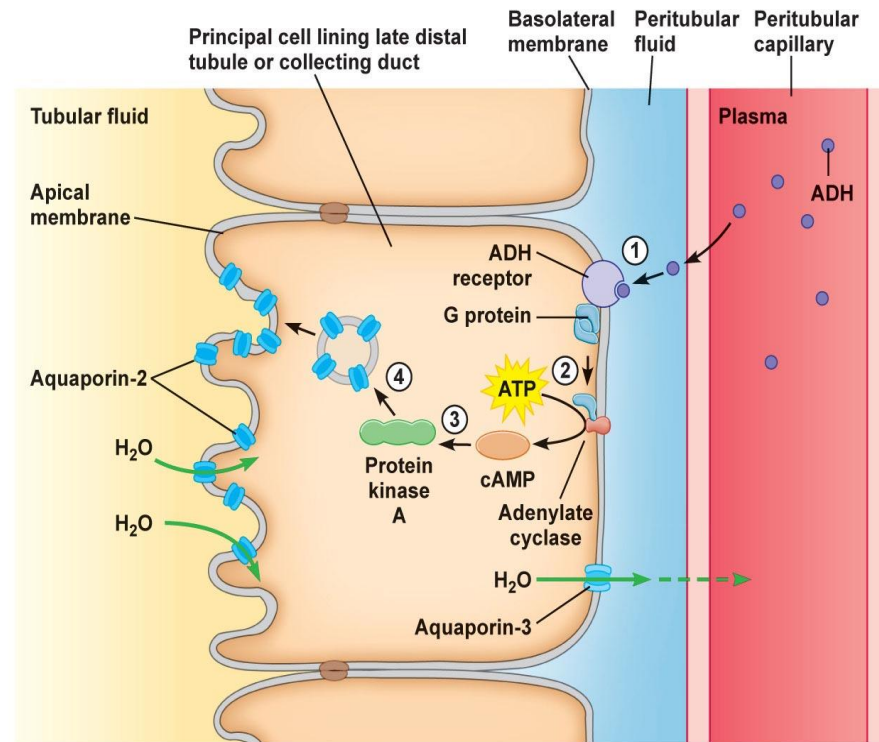
Mechanism of action of ADH:

ADH binds to **V2 receptors** on the *principle cells* of the distal convoluted tubules and collecting ducts.

Via **adenylate cyclase/cAMP** induces production of specific proteins (**aquaporin2**)* into the luminal membrane and **enhances permeability of cell to water**.

* ↑ H₂O permeability via (aquaporin 2, AQP2)

Increased membrane permeability to water permits back diffusion of free water, resulting in **increased urine osmolality** (concentrates urine).



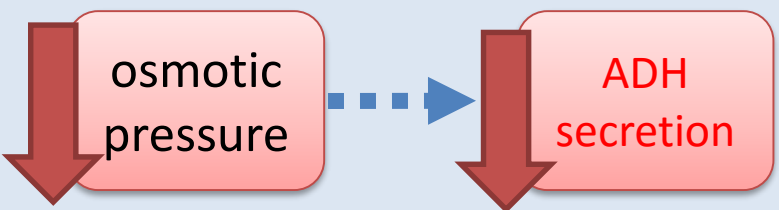
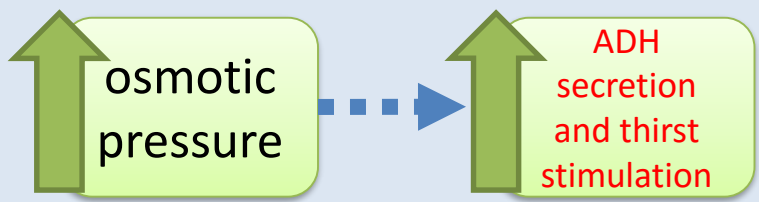
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Control of ADH Release:

Osmotic pressure

is the minimum pressure which needs to be applied to a solution to prevent the inward flow of water across a semipermeable membrane.

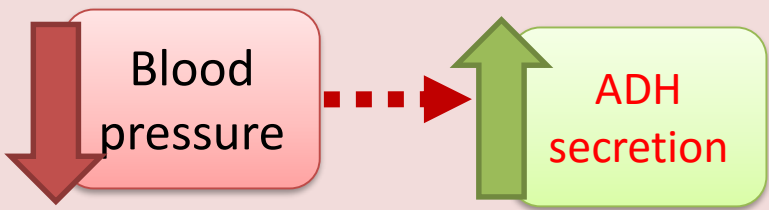
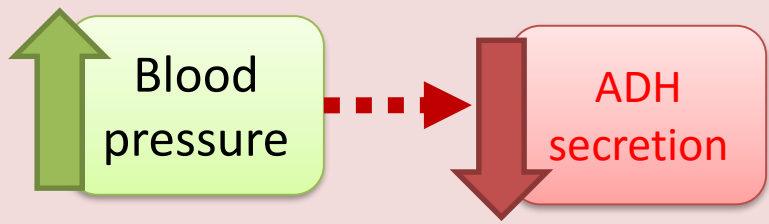
Osmoreceptors in hypothalamus



Here is the result of ADH effect

Blood volume

Baroreceptor in carotid artery and aortic arch, and Stretch receptors in left atrium



Here body trying to buffer the pressure through ADH

Regulation of ADH :

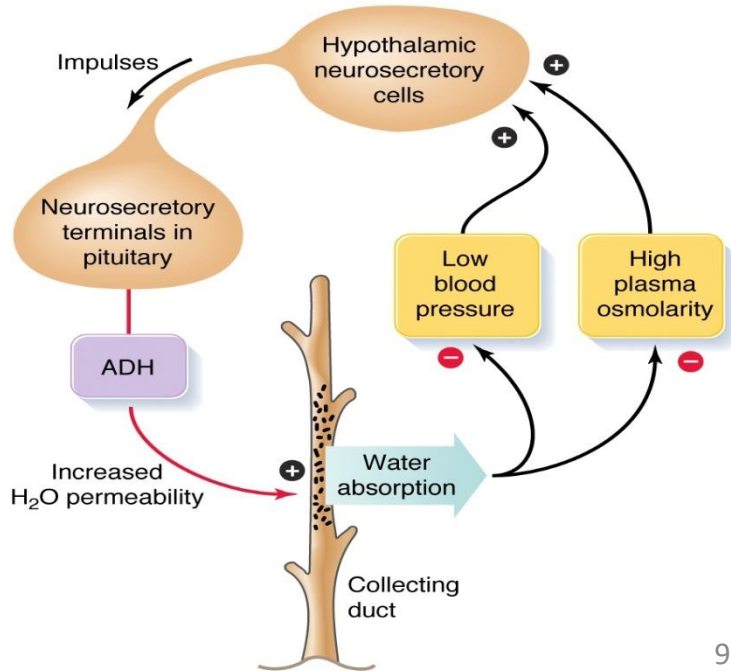
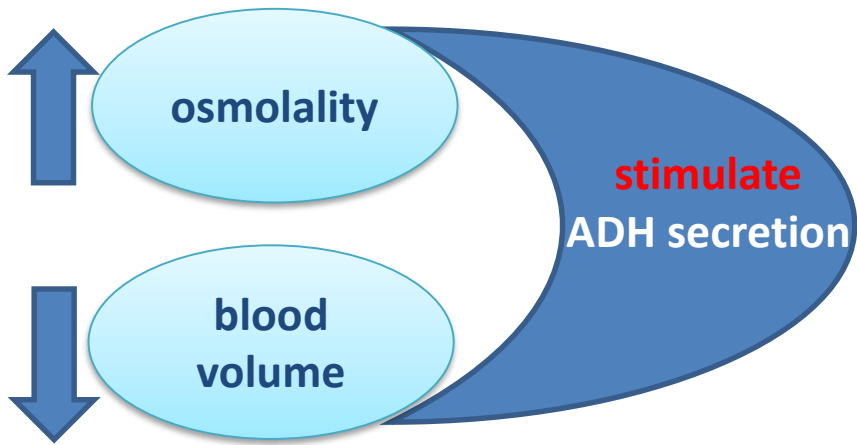
Hypothalamus receives feedback about **the volume of fluids in the body** from:

Osmoreceptors

Aortic arch baroreceptors

Carotid baroreceptors

Atrial stretch receptors and pulmonary vein



Factors that increase or decrease ADH Secretion:

t a b l e

7.4

Regulation of ADH Secretion

Factors that Increase ADH Secretion

Serum osmolarity
Volume contraction
Pain
Nausea (powerful stimulant)
Hypoglycemia
Nicotine, opiates, antineoplastic drugs

Factors that Decrease ADH Secretion

↓ Serum osmolarity
Ethanol
α-Agonists
ANP

ADH = antidiuretic hormone; ANP = atrial natriuretic peptide.

*the schedule is important.

*solutes that do not freely or penetrate cell membranes **slowly**, such as **sodium**, cause **ADH release**.

***Stress** increases ADH Secretion.

*substances that enter cells **rapidly**, such as **urea**, do not change osmotic equilibrium and thus **do not stimulate ADH release**.

	Serum ADH	Serum Osmolarity/ Serum [Na ⁺]	Urine Osmolarity	Urine Flow Rate	C _{H₂O}
Primary polydipsia	↓	Decreased	Hyposmotic	High	Positive
Central diabetes insipidus	↓	Increased (because of excretion of too much H ₂ O)	Hyposmotic	High	Positive
Nephrogenic diabetes insipidus	↑ (Because of increased plasma osmolarity)	Increased (because of excretion of too much H ₂ O)	Hyposmotic	High	Positive
Water deprivation	↑	High-normal	Hyperosmotic	Low	Negative
SIADH	↑↑	Decreased (because of reabsorption of too much H ₂ O)	Hyperosmotic	Low	Negative

ADH = antidiuretic hormone; C_{H₂O} = free water clearance; SIADH = syndrome of inappropriate antidiuretic hormone.

ADH Disorders:

SIADH

The syndrome of inappropriate antidiuretic hormone (ADH) secretion (SIADH):

is defined by the **hyponatremia** and **hypo-osmolality*** resulting from inappropriate, **continued secretion or action of the hormone** despite normal or increased plasma volume, which results in impaired water excretion.

Diabetes Insipidus

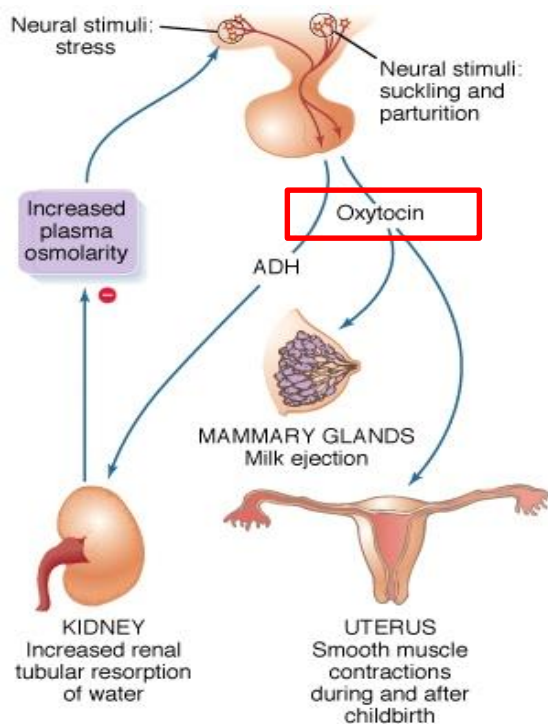
- 1. Neurogenic (central):** (failure of neurohypophysis to **synthesize or secrete ADH**)
- 2. Nephrogenic:** (failure of the **kidney to respond** appropriately to ADH)

* Of body not urine

Oxytocin :

Synthesis:

- Oxytocin is synthesized in the **cell bodies** of hypothalamic neurons (**paraventricular nucleus**).
- Oxytocin is stored in the posterior pituitary.



Does it have an effect on male?

[click](#)



Function:

- Oxytocin is a **strong stimulant of uterine contraction**.
- Regulated by a **positive feedback mechanism**.

This leads to increased intensity of uterine contractions (myometrium), ending in birth.

- Oxytocin **triggers milk ejection** (“**letdown**” reflex) Contracts the myoepithelial cells of the alveoli.

Oxytocin can be used to induce labor and reduce postpartum bleeding

Oxytocin Stimuli :

- Other stimuli that control release of oxytocin:

1-oxytocin is thought to be released during hugging, touching, and orgasm in both sexes, (it is also called “the love hormone”.

2-Release increased during stress.

3-Release **inhibited by alcohol**

4-In males secretion **increases at time of ejaculation (contraction of smooth muscle of vas deferens).**



Oxytocin and autism

مرضى التوحد

Autistic group had significantly lower plasma oxytocin levels than in the non-autism group

Elevated oxytocin was associated with higher scores on social and developmental measures for the non-autistic children

Oxytocin	Posterior pituitary	Milk ejection; uterine contraction
Antidiuretic hormone (vasopressin) ADH	Posterior pituitary	Stimulates H ₂ O reabsorption by renal collecting ducts and contraction of arterioles

cAMP Mechanism IP₃ Mechanism

ACTH	GnRH
LH and FSH	TRH
TSH	GHRH
ADH (V ₂ receptor)	Angiotensin II
HCG	ADH (V ₁ receptor)
MSH	Oxytocin
CRH	α ₁ Receptors
β ₁ and β ₂ Receptors	
Calcitonin	
PTH	
Glucagon	

table 7.4 Regulation of ADH Secretion

Factors that Increase ADH Secretion

Serum osmolarity
 Volume contraction
 Pain
 Nausea (powerful stimulant)
 Hypoglycemia
 Nicotine, opiates, antineoplastic drugs

Factors that Decrease ADH Secretion

↓ Serum osmolarity
 Ethanol
 α-Agonists
 ANP

ADH = antidiuretic hormone; ANP = atrial natriuretic peptide.

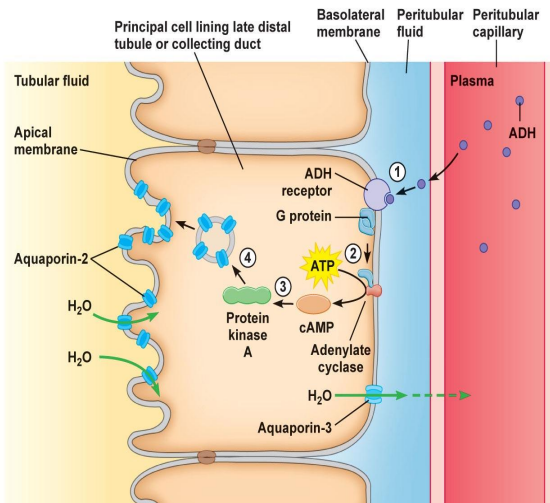


table 5.6 Summary of ADH Pathophysiology

	Serum ADH	Serum Osmolarity/ Serum [Na ⁺]	Urine Osmolarity	Urine Flow Rate	C _{H₂O}
Primary polydipsia	↓	Decreased	Hyposmotic	High	Positive
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ADH = antidiuretic hormone; C_{H₂O} = free water clearance; SIADH = syndrome of inappropriate antidiuretic hormone.

Table summarizes the major characteristics of Osmoreceptors and Baroreceptors

Receptors	Osmoreceptors	Baroreceptors
Location	Anterolateral hypothalamus	Carotid sinus & aortic arch
Value Measured	Plasma osmolality	Circulating volume
ADH Release Stimulated By	Activation of receptor	Suppression of receptor
Change Required for Action	1% above 280 mosm/kg	10-15% decrease
Resulting Amount of ADH	Small	Large (vasoconstriction)
Override Other?	no	yes

General comparison between Anterior and posterior pituitary glands

Pituitary	Anterior (Adenohypophysis)	Posterior (Neurohypophysis)
Origin	Rathke's pouch (oral cavity)	Down growth of hypothalamic neural tissue
Hormones released	GH, TSH, FSH, LH, ACTH, PRL	Oxytocin, ADH
Hormones synthesis	Hormones are synthesized in anterior pituitary	Synthesized in hypothalamus and stored in posterior pituitary
Blood supply	Superior hypophyseal	Inferior hypophyseal
Hypothalamic control	Hormonal signals (releasing and inhibitory hormones)	Neural signals

Answer key: 1:D, 2:B, 3:A, 4:C, 5:D, 6:A, 7:B, 8:B

1-Antidiuritic Secretion is increased by:

- A.Alcohol
- B.Decreased effective osmotic pressure
- C.Increased ECF Volume
- D.Standing

2-Action of Oxytocin include all of the following except:

- A.Contraction of Pregnant Uterus
- B.Synthesis of Milk
- C.Ejection of Milk
- D.Contraction of Vas Deferens

3-Antidiuretic hormone is synthesized in the:

- A.Hypothalamus
- B.Posterior Pituitary
- C.Thalamus
- D.Anterior Pituitary

4-triggers milk release in lactating females

- A.Glucagon
- B.ADH
- C.Oxytocin
- D.Luetinizing Hormone

5-Whis is inhibit ADH:

- A.Alcohol
- B.Stress
- C.Coffee
- D.A&C

6- V1 Receptor id mediated by:

- A.cAMP
- B.IP3/Ca
- C.Tyrosine Kinase
- D.cGMP

7-Oxytocin Synthesized in:

- A.Supraoptic Nucleus
- B.Paraventricular Nucleus
- C.Both
- D.None of them

8-Blood Supply of Neurohypophysis:

- A.Superior Hypophyseal
- B.Inferior Hypophyseal
- C.Clavicle
- D.External Carotid

Q1:What is the function of Pituicytes?

Ans:

**It forms physical and chemical barrier between nerve terminal and blood vessels
Amplify auto receptor negative feedback.**

Q2: Diabetes Insipidus Occurs by two routes:

Ans:

- 1. Neurogenic (central): (failure of neurohypophysis to synthesize or secrete ADH)**
- 2. Nephrogenic: (failure of the kidney to respond appropriately to ADH)**

Q3:when ADH will increases in its secretion?

Ans: **when there are: Increase in the osmolality or Decrease in the volume**

Q4:What are the stimuli of Oxytocin?

Ans: **Hugging – touching – orgasm – Stress – ejaculation in male.**

Thanks for checking our work 😊

Good Luck

Done by:

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