Posterior Pituitary gland hormones

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Learning outcomes

- Hormones secreted by the posterior pituitary
- Synthesis amd secretion of ADH amd Oxytocin
- Actions of ADH amd Oxytocin
- Diabetes Insipidus

Hormones released by posterior pituitary

- Oxytocin
- Vasopressin
- Both are neural hormones
- Synthesized as larger precursor molecules

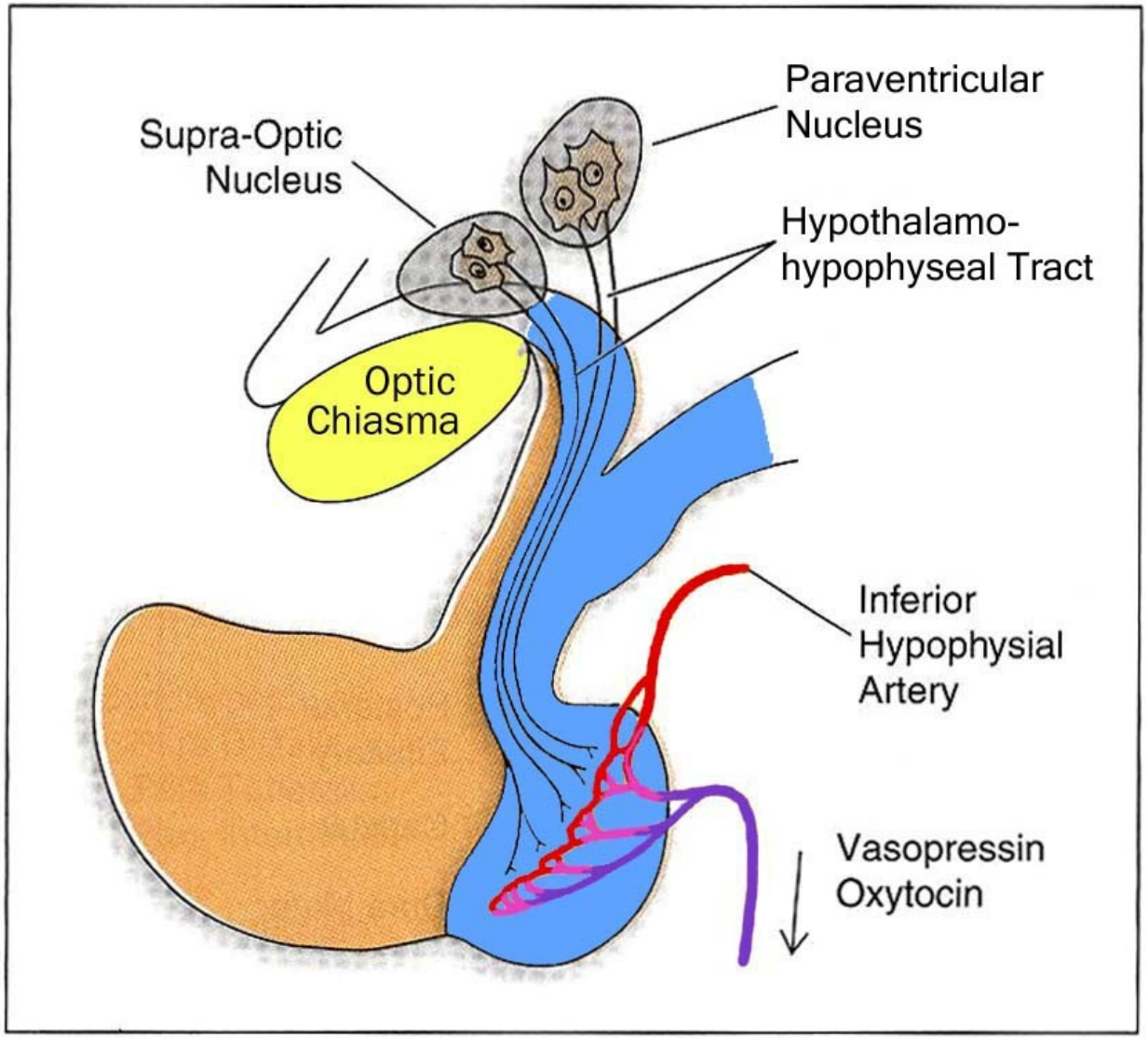
Synthesis of hormones

- In the cell bodies of the magnocellular neurons in the supraoptic and paraventricular nuclei of Hypothalamus

- Transported down the axons to the nerve endings in posterior lobe.

- When there's electrical activity at the nerve ending hormones are released by Ca dependant exocytosis

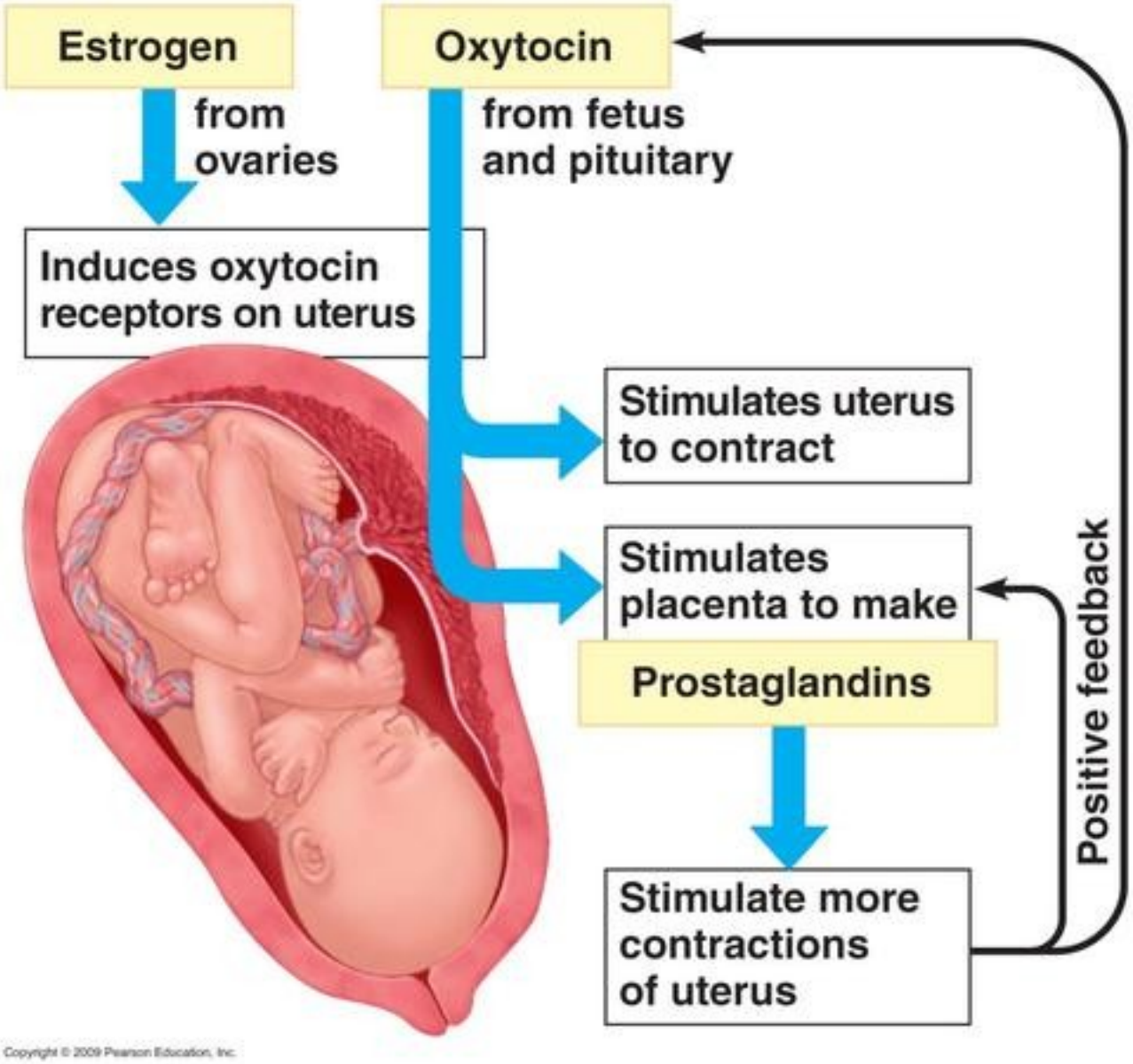
Figure 5.5 Neural components of the pituitary gland of humans.



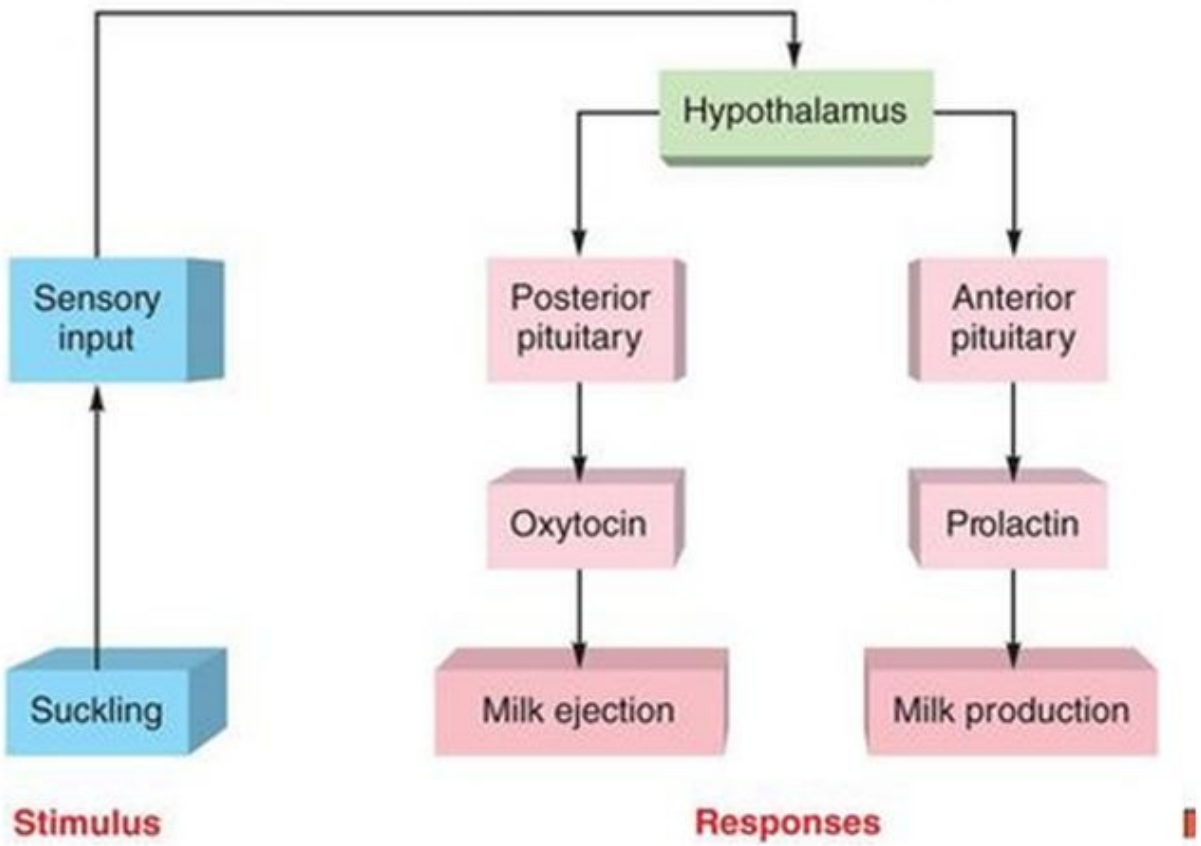
Actions of oxytocin

1. Contraction of smooth muscles of the uterus → enhance labor.
2. Contraction of mammary gland myoepithelial cells of the alveoli & the ducts → Ejection of milk
3. Act on non pregnant uterus to facilitate sperm transport
4. In men → ejaculation (contraction of vas deferens propelling sperms towards urethra)

Remember: Oxytocin is concerned with releasing or ejection of milk, while prolactin is concerned with synthesis & production of milk.



milk-ejection reflex



Physiology of breast-feeding

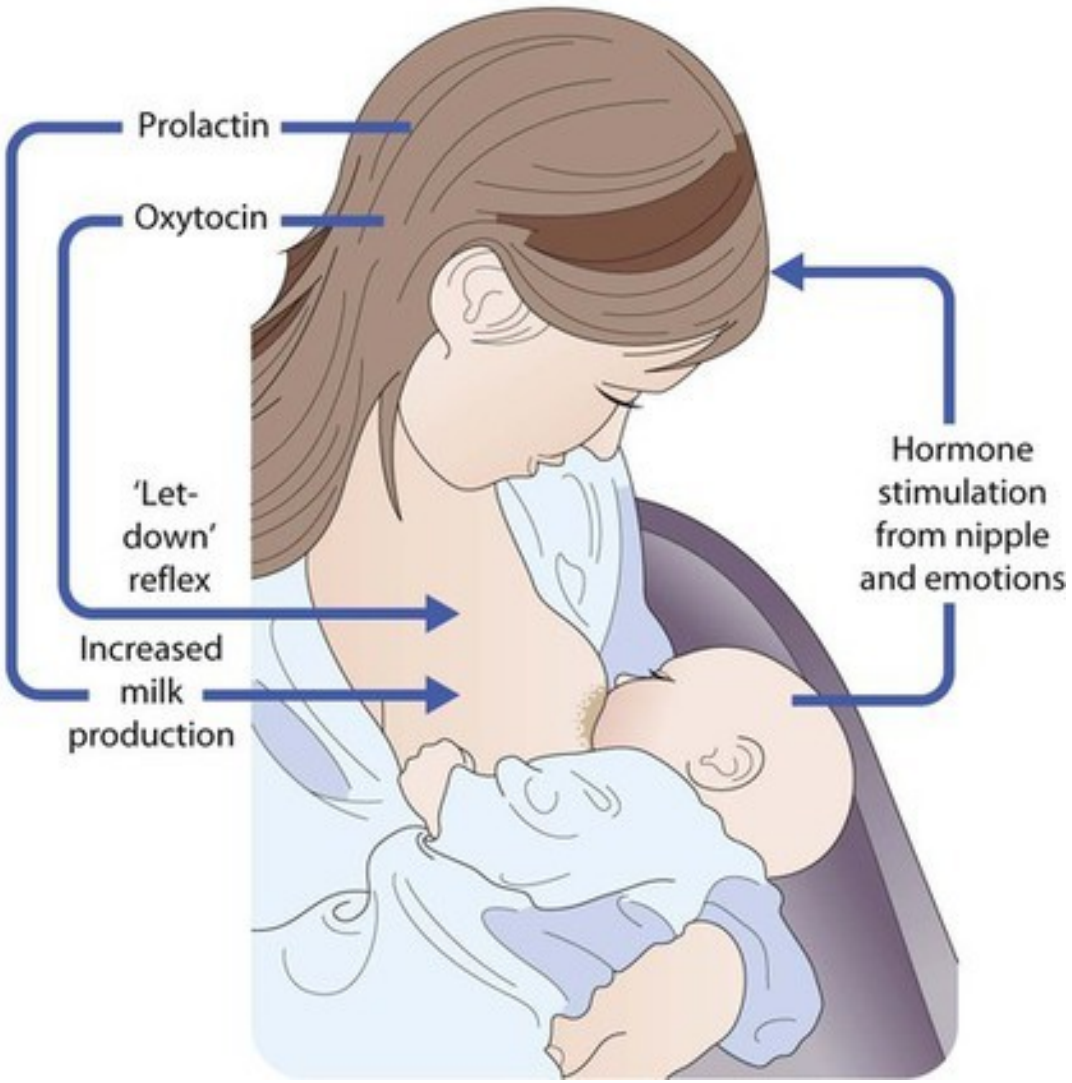
1. **Baby** uses rooting, sucking and swallowing reflexes to locate nipple and feed

2. **Tactile receptors** in nipple activated

3. **Hypothalamus** sends efferent impulses to anterior and posterior pituitary

4. **Anterior pituitary**
Prolactin secretion stimulates milk secretion by cuboidal cells in the acini of the breast

5. **Posterior pituitary**
Oxytocin secretion results in contraction of myoepithelial cells in the alveoli, forcing milk into larger ducts – the so-called 'let-down' reflex



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.
4. During coitus → oxytocin secretion.
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.

Antidiuretic Hormone (ADH)

- Is a peptide hormone
- The primary function of ADH in the body is to regulate extracellular fluid volume
- The hormone acts at two basic sites:
  - AVP acts on renal collecting ducts via V_2 receptors to increase water permeability (cAMP-dependent mechanism), which leads to decreased urine formation.

- A secondary function of ADH is vasoconstriction.

- ADH binds to V_1 receptors on vascular smooth muscle to cause vasoconstriction

Mechanism of action and regulation of ADH

Hypovolemia

- During hemorrhage and dehydration, results in a decrease in atrial pressure.

- Specialized stretch receptors within the atrial walls and large veins entering the atria decrease their firing rate when there is a fall in atrial pressure.

- Afferent nerve fibers from these receptors synapse within the nucleus tractus solitarius of the medulla, which sends fibers to the hypothalamus.

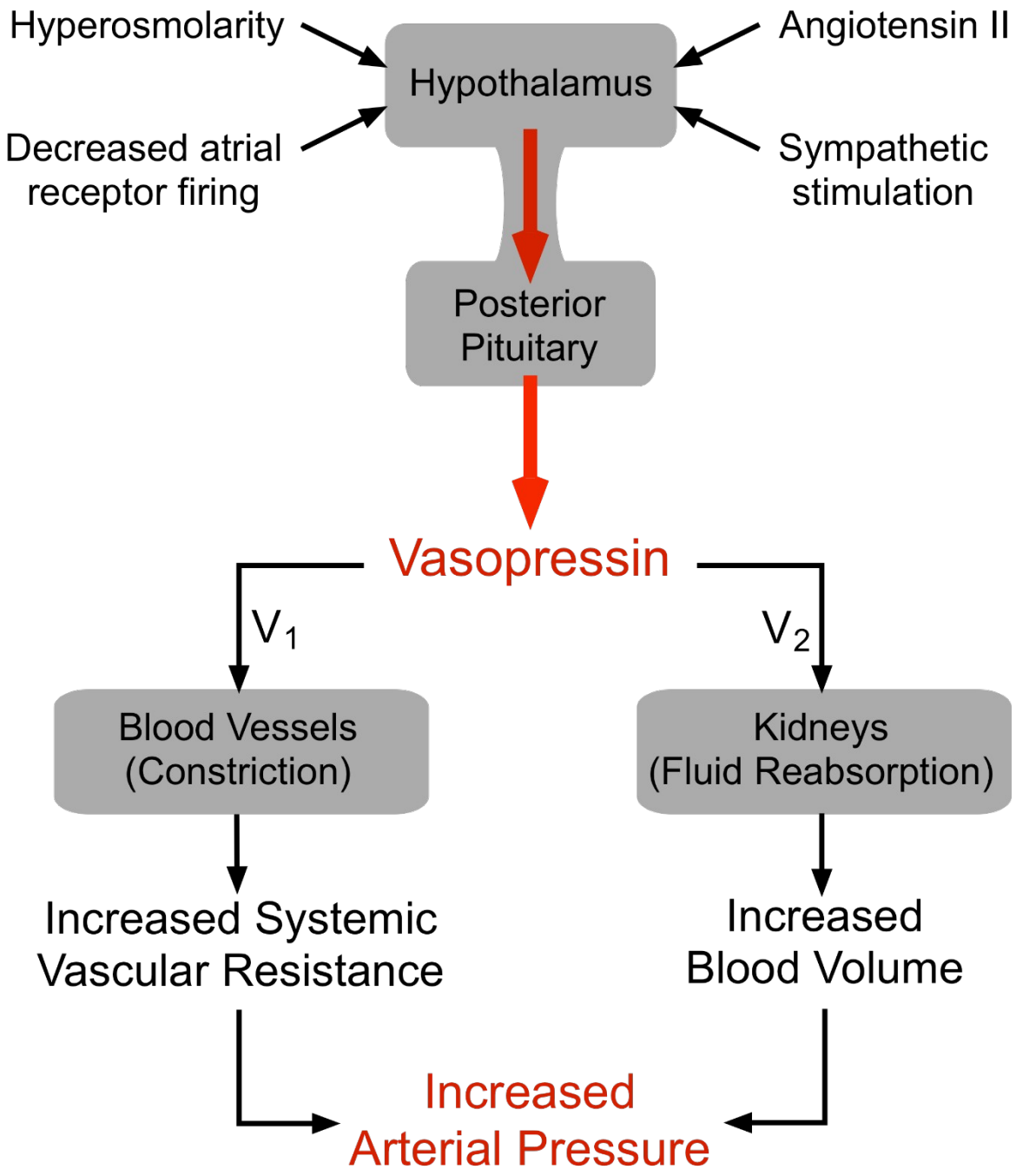
- Atrial receptor firing normally inhibits the release of AVP by the posterior pituitary.
- With hypovolemia or decreased central venous pressure, the decreased firing of atrial stretch receptors leads to an increase in AVP release.

Hypotension

- Decreases arterial baroreceptor firing, leads to enhanced sympathetic activity that increases AVP release.

- Hypothalamic osmoreceptors sense extracellular osmolarity and stimulate AVP release when osmolarity rises, as occurs with dehydration.

- Angiotensin II receptors located in a region of the hypothalamus regulate AVP release – an increase in angiotensin II simulates AVP release.


Hyperosmolarity
Angiotensin II
Hypothalamus
Decreased atrial receptor firing
Sympathetic stimulation
Posterior Pituitary
Vasopressin
V1
V2
Blood Vessels (Constriction)
Kidneys (Fluid Reabsorption)
Increased Systemic Vascular Resistance
Increased Blood Volume
Increased Arterial Pressure

Diabetes Insipidus

- DI is a disorder resulting from deficiency of anti-diuretic hormone (ADH) or its action and is characterized by the passage of copious amounts of dilute urine.

- It must be differentiated from other polyuric states such as primary polydipsia & osmotic duiresis.

- Central DI is due to failure of the pituitary gland to secrete adequate ADH.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Types of DI

- Central DI
- Nephrogenic DI

Causes of central DI

- Idiopathic (30% Of Cases)
- Suprasellar lesions (30% Of cases)
- Infections (ENCEPHALITIS, TB, etc)
- Non infectious granuloma
- Trauma

Water Deprivation Test (1)

- Investigation of Diabetes Insipidus (DI)
- Principle: Deprive patient of fluids to allow serum osmo to rise and see whether urine concentrates (i.e., urine osmo increases).
- Protocol:
  - Patient usually fasted overnight. May or may not be allowed fluids overnight.
  - Serum and urine osmo measurements performed approx every hour (and patient's weight and urine volume recorded)

Water Deprivation Test: Interpretation

Condition	Urine osmolality After fluid deprivation	After administrationof vasopressin
Normal	>800	>800
Central DI (a defect in ADH production)	< 300 mosmol/kg	>800 mosmol/kg
Nephrogenic DI (a defect in the kidneys' response to ADH)	< 300 mosmol/kg	< 300 mosmol/kg

Summary

- Oxytocin and Vasopressin are neurohormones
- Synthesized in hypothlamus and secreted from posterior pituitary
- Oxytocin mainly involved in uterine contraction during labour and mlk ejection
- ADH is involved in water retension