

ENDOCRINOLOGY

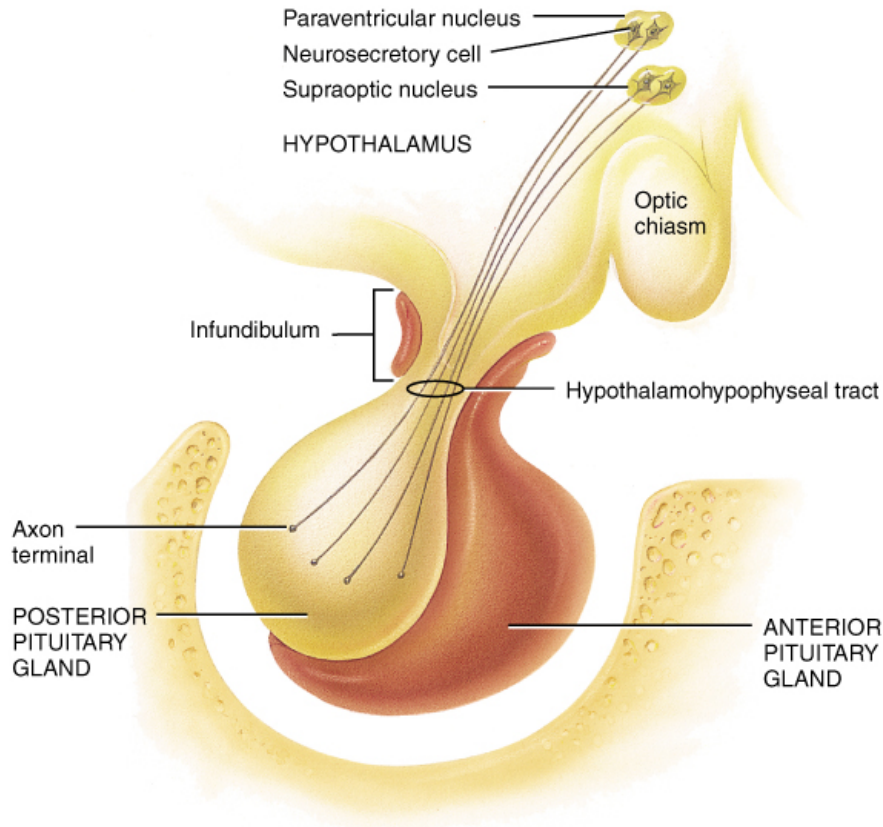
Posterior pituitary

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PHYSIOLOGY OF POSTERIOR PITUITARY GLAND

- ◉ Hypothalamic control
- ◉ Posterior pituitary hormones
 - ADH
 - Physiological functions
 - Control of secretion
 - Osmotic stimuli
 - Non-osmotic stimuli
 - Oxytocin
 - Physiological functions
 - Control of secretion

POSTERIOR PITUITARY GLAND

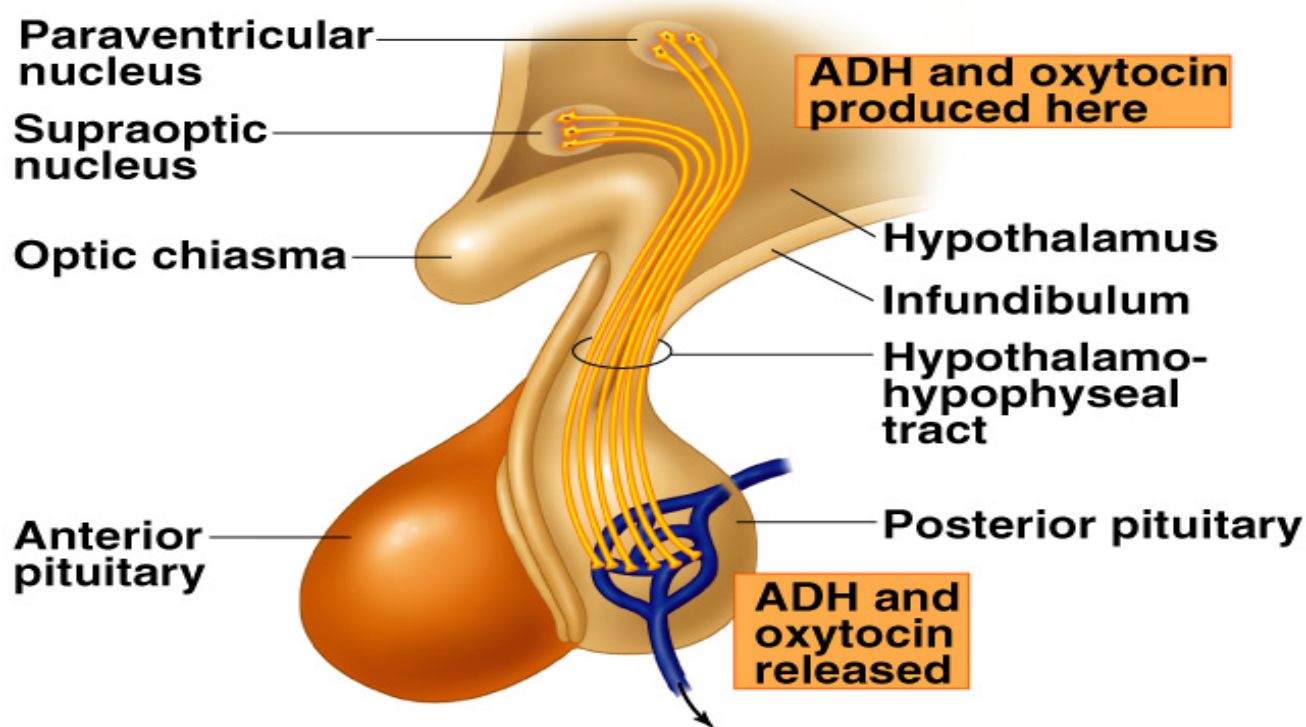


- ◉ Does not synthesize hormones
- ◉ Consists of axon terminals of hypothalamic neurons

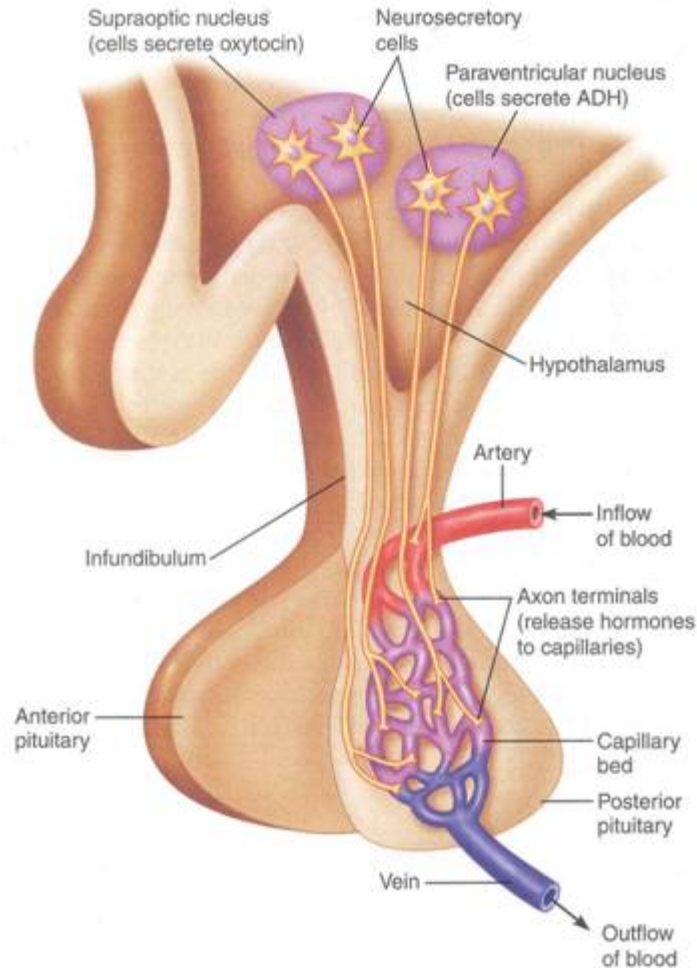
HYPOTHALAMIC CONTROL OF PITUITARY SECRETIONS

- Secretions of the posterior pituitary are controlled by
 - Nervous signals from hypothalamus

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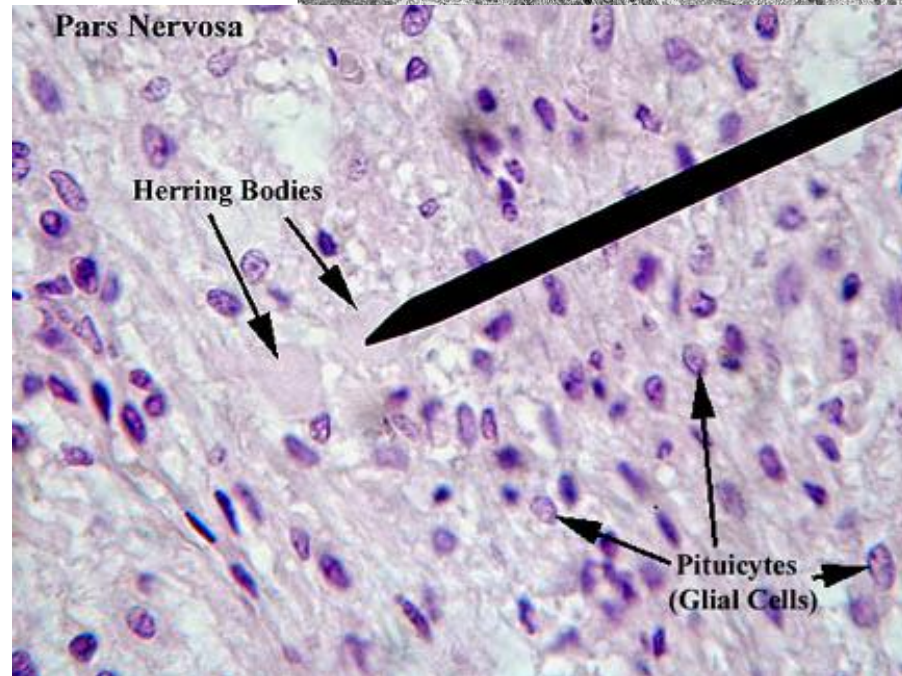
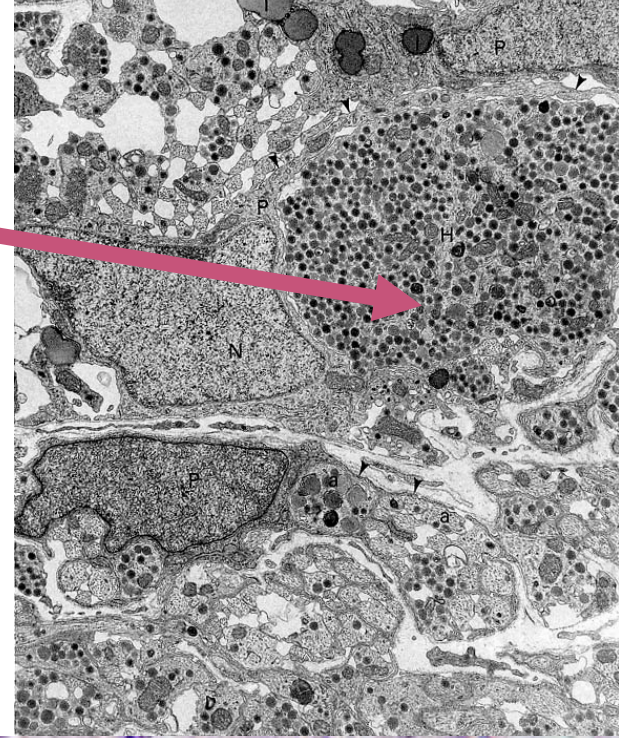


OXYTOCIN AND VASOPRESSIN ARE MANUFACTURED IN THE HYPOTHALAMUS, BUT RELEASED IN THE POSTERIOR PITUITARY



Herring Body

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





ANTIDIURETIC HORMONE

(vasopressin)

SYNTHESIS OF ADH

- 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 neurohypophysis (posterior pituitary)

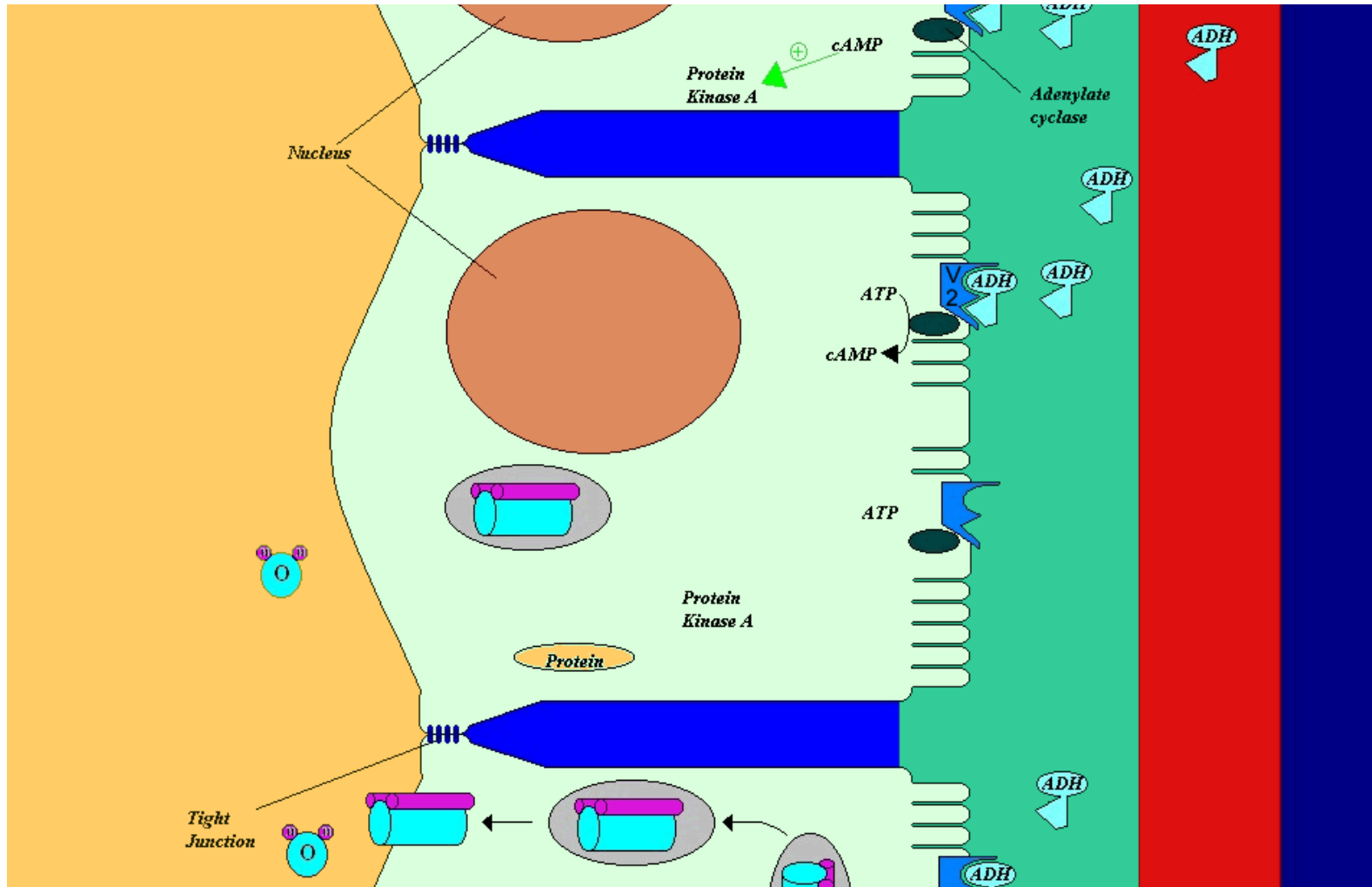
RECEPTORS OF ADH (VASOPRESSIN)

- ⊙ There are 3 types of receptors for ADH:
 - V_{1A}
 - V_{1B}
 - V₂
- ⊙ V_{1A} receptors mediate vasoconstriction
- ⊙ V_{1A} receptors also found in the liver glycogenolysis
- ⊙ V_{1B} receptors are unique to anterior pituitary and mediate increased ACTH secretion
- ⊙ V₂ receptors are located in the principle cells in distal convoluted tubule and collecting ducts in the kidneys

MECHANISM OF ACTION OF ADH: ANTIDIURESIS

- ◉ ADH binds to V₂ receptors on the peritubular (serosal) surface of cells (principle cells) of the distal convoluted tubules and medullary collecting ducts.
- ◉ Via adenylate cyclase/cAMP induces production and insertion of **aquaporin2** into the luminal membrane and enhances permeability of cell to water.
- ◉ Increased membrane permeability to water permits back diffusion of solute-free water, resulting in increased urine osmolality (concentrates urine).

MECHANISM OF ACTION OF ADH



THE SINGLE MOST IMPORTANT FUNCTION
OF ADH IS TO CONSERVE BODY WATER BY
REDUCING URINE OUTPUT



SECRETION OF ADH

OSMOTIC STIMULI

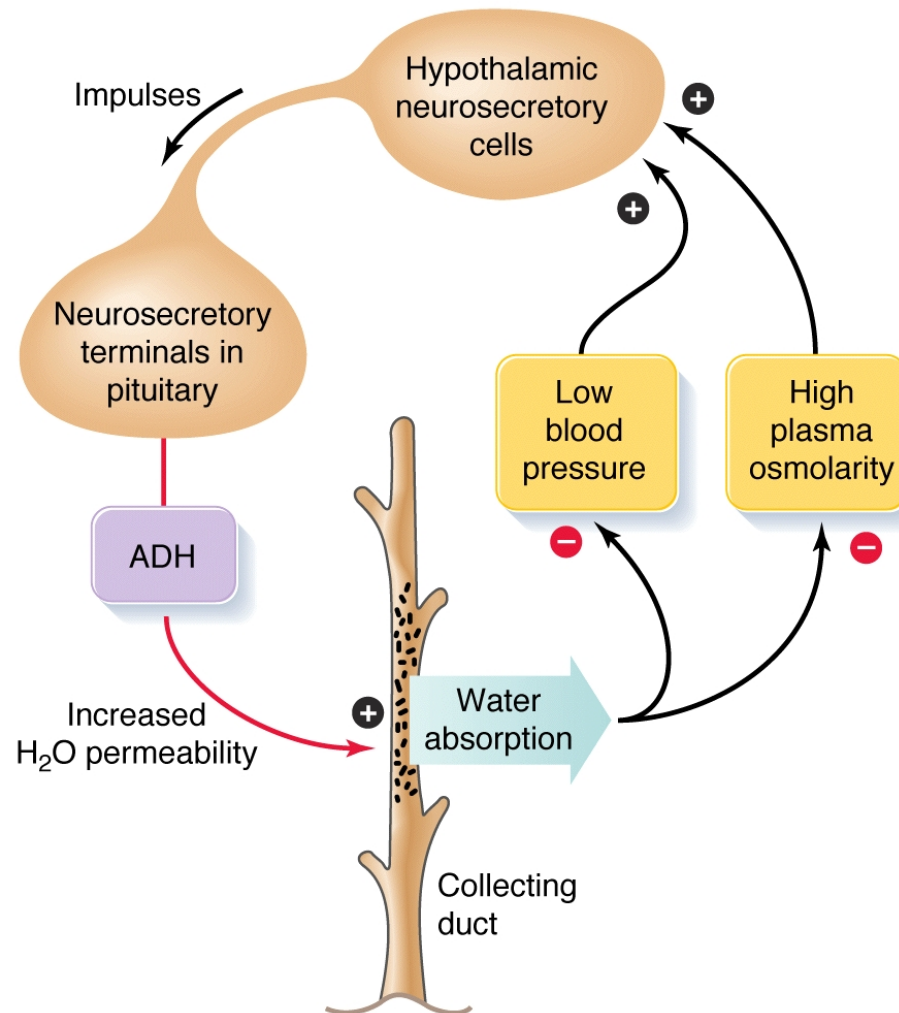
- ◉ If plasma osmolality is directly increased by administration of solutes, only those solutes that do not freely or rapidly penetrate cell membranes, such as sodium, cause ADH release.
- ◉ Conversely, substances that enter cells rapidly, such as urea, do not change osmotic equilibrium and thus do not stimulate ADH release.
- ◉ ADH secretion is very sensitive to changes in osmolality.
- ◉ Changes of 1-2% result in increased ADH secretion.

SECRETION OF ADH

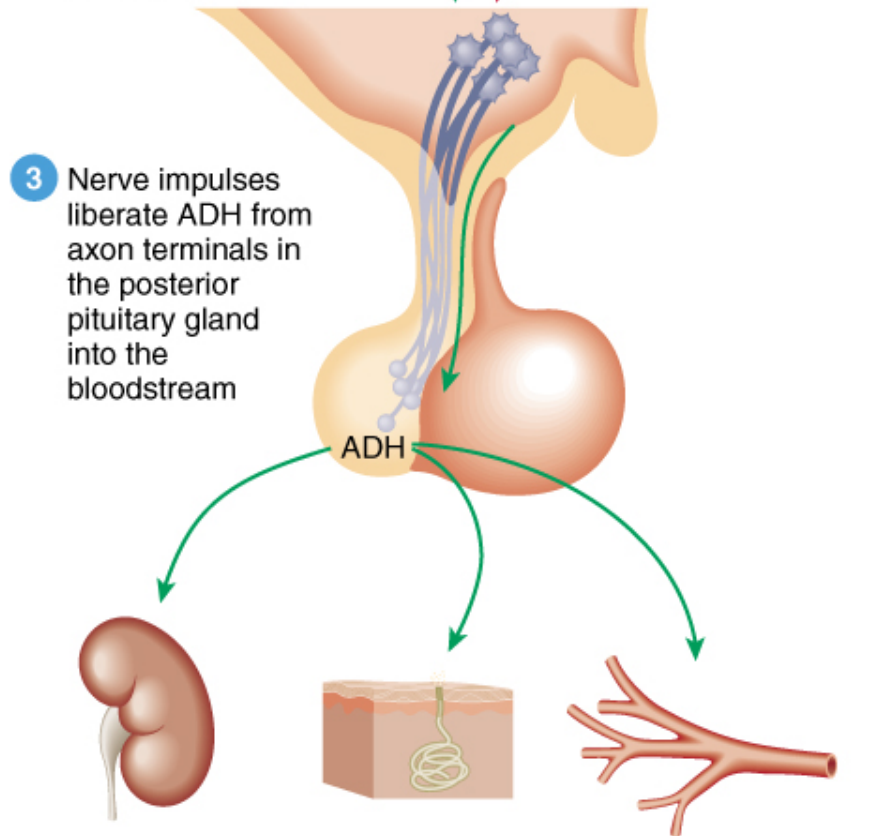
NON-OSMOTIC STIMULI

- Hypovolemia is perceived by “pressure receptors” -- carotid and aortic baroreceptors, and stretch receptors in left atrium and pulmonary veins.
- Normally, pressure receptors tonically inhibit ADH release.
- Decrease in blood pressure induces ADH secretion by reducing input from pressure receptors.
- The reduced neural input to baroreceptors relieves the source of tonic inhibition on hypothalamic cells that secrete ADH.
- Sensitivity to baroreceptors is less than osmoreceptors- senses 5 to 10% change in volume

FUNCTION OF ADH (VASOPRESSIN)



- 1 High blood osmotic pressure stimulates hypothalamic osmoreceptors
- 2 Osmoreceptors activate the hypothalamic neurosecretory cells that synthesize and release ADH
- 5 Low blood osmotic pressure inhibits hypothalamic osmoreceptors
- 6 Inhibition of osmoreceptors reduces or stops ADH secretion



- 3 Nerve impulses liberate ADH from axon terminals in the posterior pituitary gland into the bloodstream

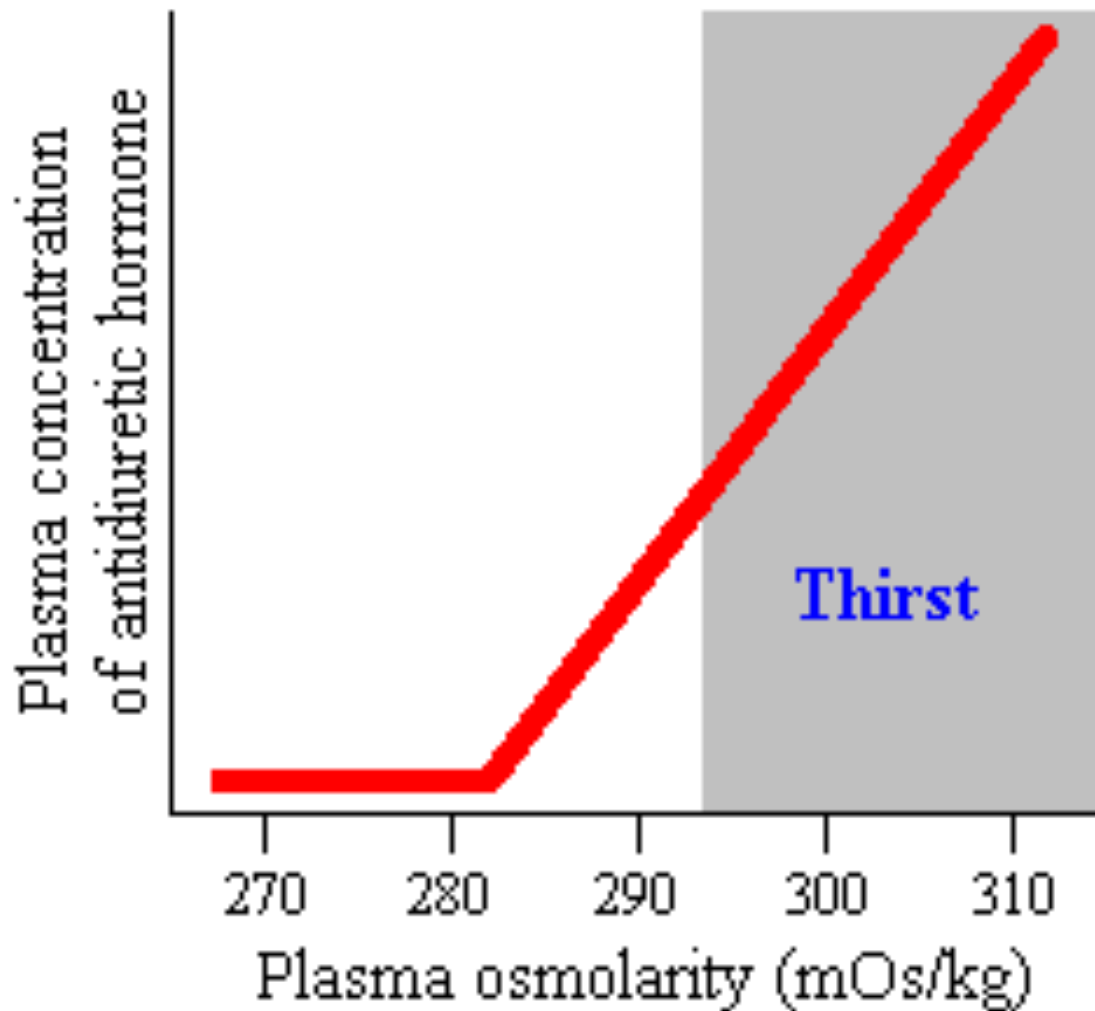
- 4 Kidneys retain more water, which decreases urine output

Sudoriferous (sweat) glands decrease water loss by perspiration from the skin

Arterioles constrict, which increases blood pressure

REGULATION OF ADH

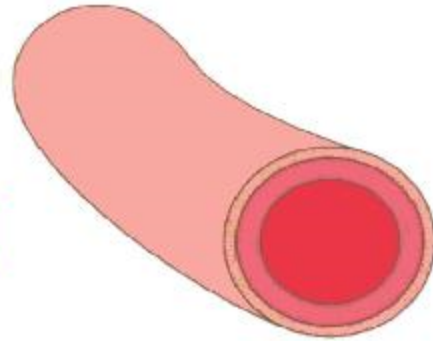
- Dehydration
 - ADH released
- Overhydration
 - ADH inhibited



**Plasma Osmolarity stimulates both
ADH release and thirst via
OSMORECEPTORS**

Effects on Blood Vessels

Normal



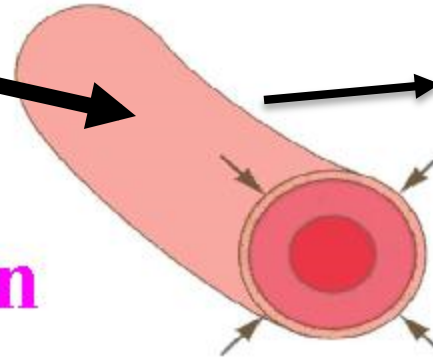
Angiotensin II

ADH

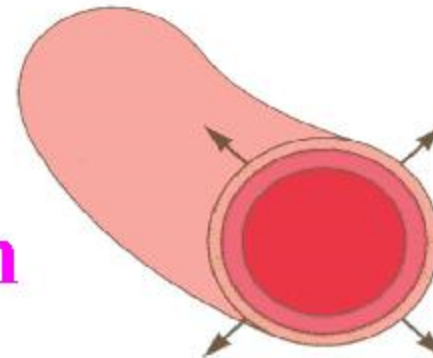


Increased
Blood
Pressure

Vasoconstriction



Vasodilation



OTHER STIMULI THAT AFFECT ADH SECRETION

- Stimuli that increase ADH secretion:
 - Pain
 - Nausea
 - Surgical stress
 - Emotional stress
- Stimuli that decrease ADH secretion:
 - Alcohol intake

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

CONTROL OF ADH RELEASE

⊙ **Osmotic pressure:**

- Osmoreceptor mediated
- \uparrow osmolality \rightarrow \uparrow ADH secretion
- \downarrow osmolality \rightarrow \downarrow ADH secretion

⊙ **Volume effects**

- Baroreceptor mediated (vagus nerve)
- \uparrow blood pressure \rightarrow \downarrow ADH secretion
- \downarrow blood pressure \rightarrow \uparrow ADH secretion

وَبَشِّرِ الصَّابِرِينَ



OXYTOCIN

FUNCTION OF OXYTOCIN

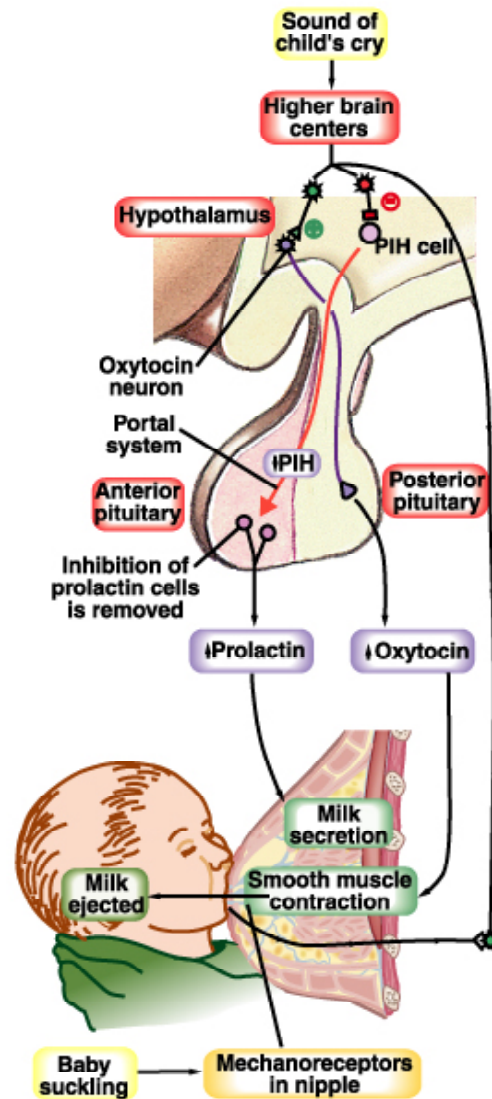
◉ **Breast-feeding**

- contracts the myoepithelial cells of the alveoli (classic neuroendocrine reflex)

◉ **Childbirth (parturition)**

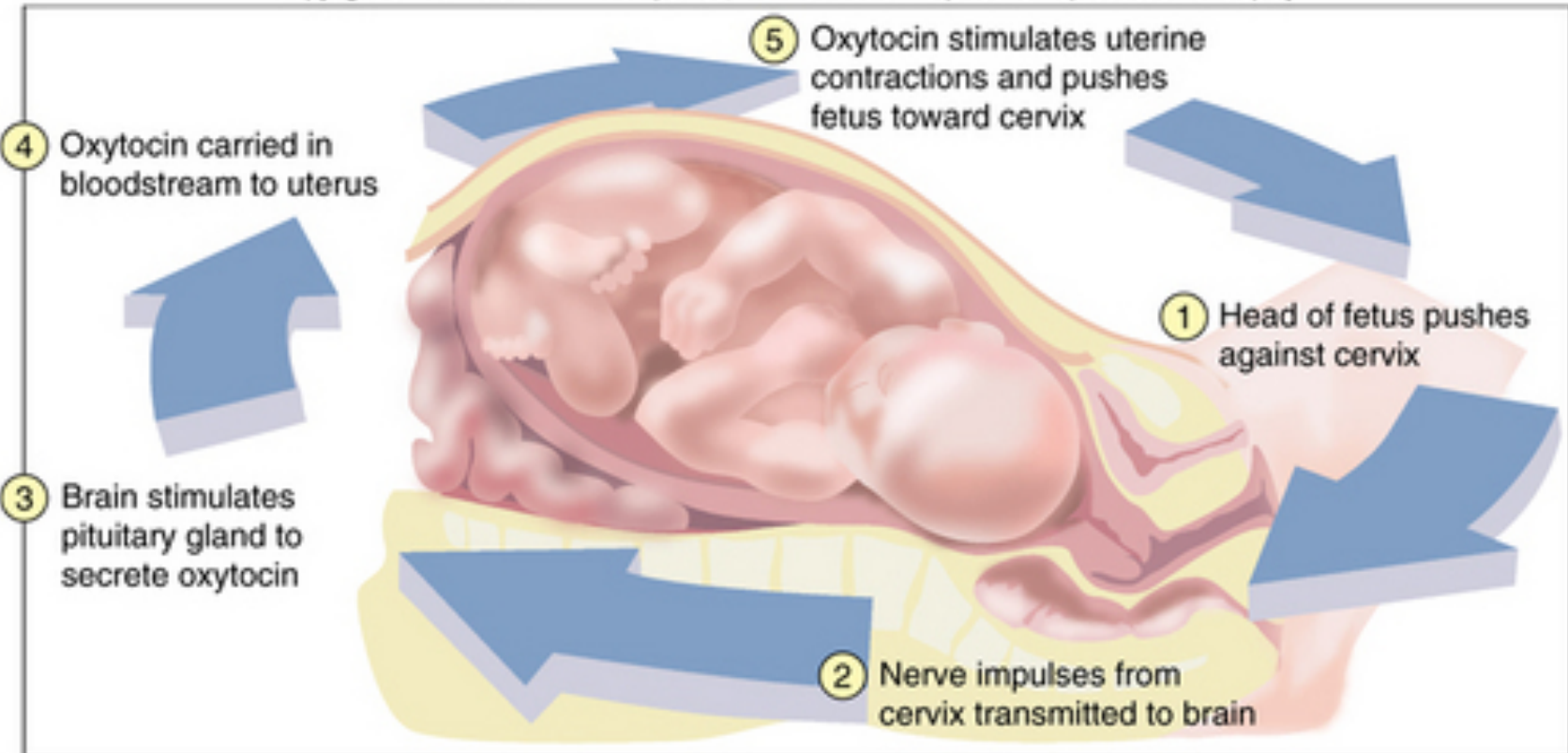
- in late pregnancy, uterine smooth muscle (myometrium) becomes sensitive to oxytocin (positive feedback)

BREAST FEEDING



CHILDBIRTH

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OTHER STIMULI THAT CONTROL RELEASE OF OXYTOCIN

- In humans, oxytocin is thought to be released during hugging, touching, and orgasm in both sexes.
- Release increased during stress
- Release inhibited by alcohol
- In males secretion increases at time of ejaculation (contraction of smooth muscle of vas deferens)



OXYTOCIN AND AUTISM

- 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
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SUMMARY OF POSTERIOR PITUITARY HORMONES ACTIONS

