



Hormones

University Of Fallujah
College Of Medicine

Lecture : (3)

Stage : 2th Stage

Lecturer : Dr. Mohammed amer

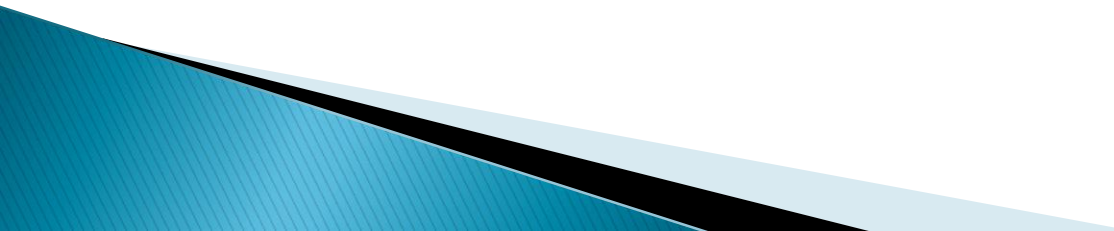
Department: Chemistry and Biochemistry

Biochemistry and Disorders of Hormones of the Hypothalamic and pituitary gland

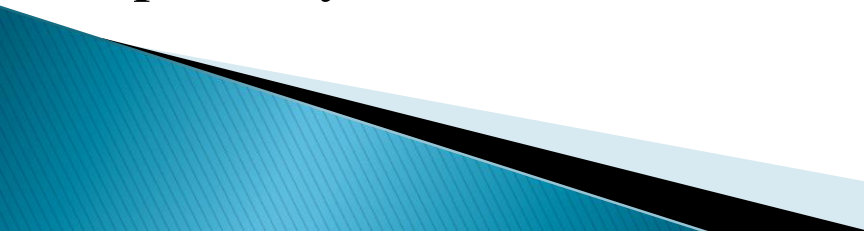
(Hormones of the pituitary gland)



❑ Objectives:

- ▶ to list the hormones secreted from the pituitary gland
 - ▶ state the peripheral effects of hormone release for each hormone synthesized or stored in the pituitary gland.
 - ▶ to state the peripheral effects of increased and decreased hormone release for each hormone synthesized or stored in the pituitary gland.
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□ **pituitary gland**

- The pituitary gland, also known as the **hypophysis**, is a roundish organ that lies immediately beneath the hypothalamus.
 - Careful examination of the pituitary gland reveals that it composed of two distinctive parts.
 - ▶ The **anterior pituitary** (adenohypophysis) is a classical gland composed predominantly of cells that secrete protein hormones.
 - ▶ The **posterior pituitary** (neurohypophysis) is not really an organ, but an extension of the hypothalamus.
 - ▶ It is composed largely of the axons of hypothalamic neurons which extend downward as a large bundle behind the anterior pituitary.
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- ▶ The target cells for most of the hormones produced in these tissues are themselves endocrine cells.
- ▶ **The pituitary gland is often called the "master gland" of the body.**
- ▶ The anterior and posterior pituitary secretes a number of hormones that collectively influence all cells and affect virtually all physiologic processes

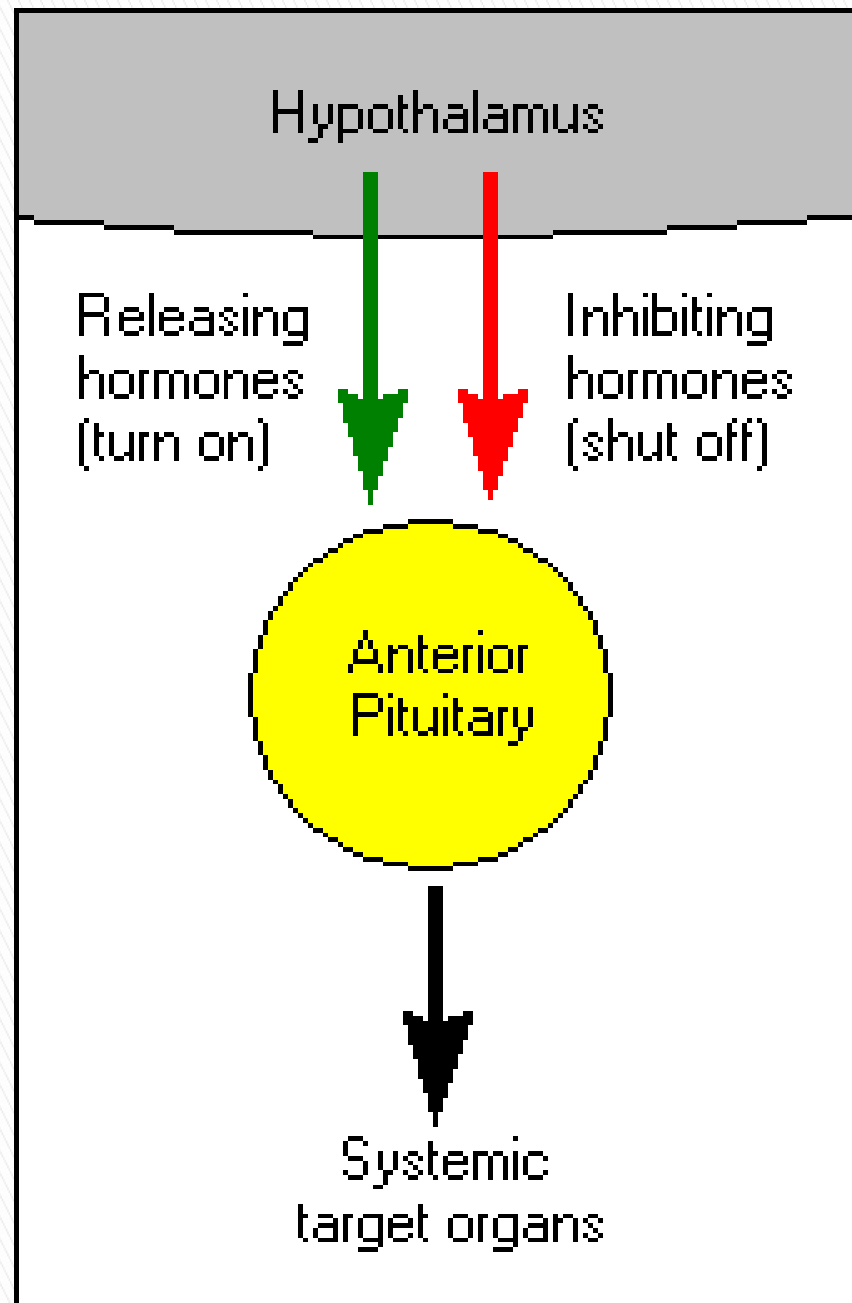
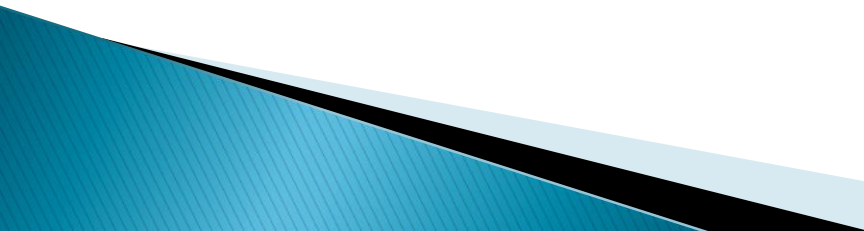


Table: The major hormones synthesized and secreted by the pituitary gland, along with summary statements about their major target organs and physiologic effects.

	Hormone	Major target organ(s)	Major Physiologic Effects
Anterior Pituitary	Growth hormone	Liver, adipose tissue	Promotes growth (indirectly), control of protein, lipid and carbohydrate metabolism
	Thyroid-stimulating h.	Thyroid gland	Stimulates secretion of thyroid hormones
	Adrenocorticotrophic h.	Adrenal gland (cortex)	Stimulates secretion of glucocorticoids
	Prolactin	Mammary gland	Milk production
	Luteinizing hormone	Ovary and testis	Control of reproductive function
	Follicle-stimulating h.	Ovary and testis	Control of reproductive function
Posterior Pituitary	Antidiuretic hormone	Kidney	Conservation of body water
	Oxytocin	Ovary and testis	Stimulates milk ejection and uterine contractions

- ❑ **Hormonal cascade of signals from CNS to ultimate hormone.**
 - ▶ The target "gland" is the last hormone-producing tissue in the cascade, which is stimulated by an appropriate anterior pituitary hormone.
 - ▶ Examples are **thyroid gland, adrenal cortex, ovary** and **testes**.
 - ▶ Ultimate hormone feedback negatively on sites producing intermediate hormones in the cascade.
 - ▶ Amounts (nanogram (ng), microgram (μg), and milligram (mg)) represent approximate quantities of hormone released
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Posterior Pituitary Hormones

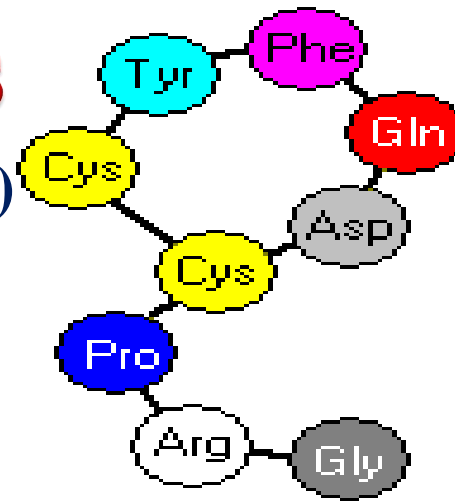
1. Antidiuretic Hormone (Arginine Vasopressin)

▶ Roughly, 60% of the mass of the body is water, and despite wide variation in the amount of water taken in each day, body water content remains incredibly stable.

▶ Such precise control of body water and solute concentrations is a function of several hormones acting on both the kidneys and vascular system, but there is no doubt that antidiuretic hormone is a key player in this process.

▶ Antidiuretic hormone, also known as **vasopressin**, is a nine amino acid peptide secreted from the posterior pituitary.

▶ The single most important effect of antidiuretic hormone is to conserve body water by reducing the output of urine

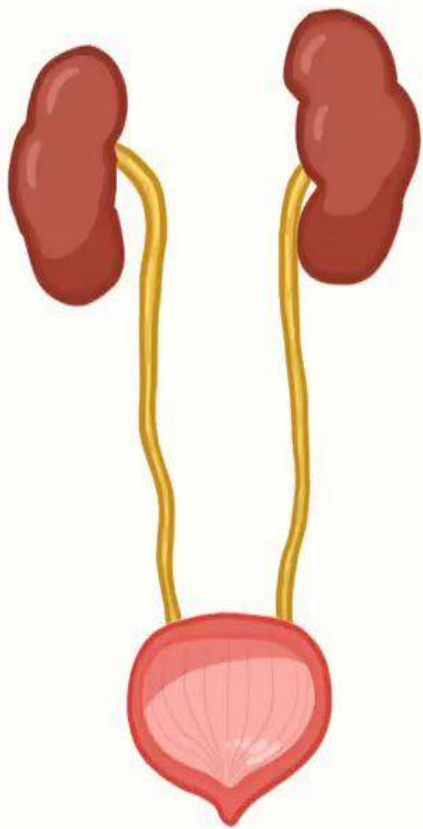


Antidiuretic hormone

❑ **Effects of Antidiuretic Hormone**

1. stimulates contraction of the muscles of the capillaries and arterioles, raising blood pressure.
2. promotes contraction of the intestinal musculature , increasing peristalsis.
3. stimulates water reabsorbption by stimulating insertion of "water channels" or aquaporins into the membranes of kidney tubules.
 - These channels transport solute-free water through tubular cells and back into blood, leading to a decrease in plasma osmolarity and an increase osmolarity of urine.

ANTIDIURETIC HORMONE (ADH)



(against) (excessive urine production)

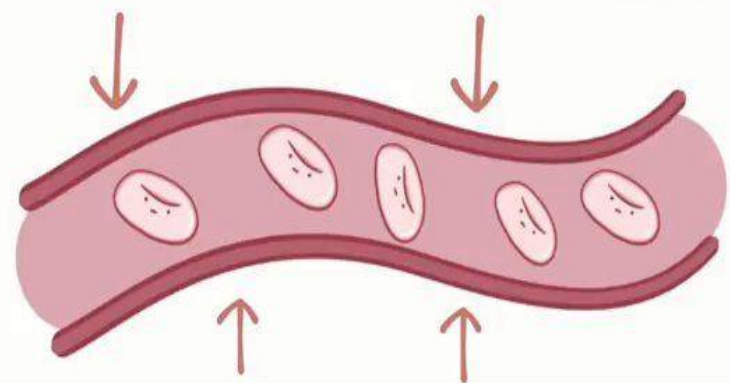
ANTI-DIURESIS

↳ PREVENTS making too much URINE

↓
WATER RETENTION

"VASOPRESSIN"

VASOCONSTRICTION

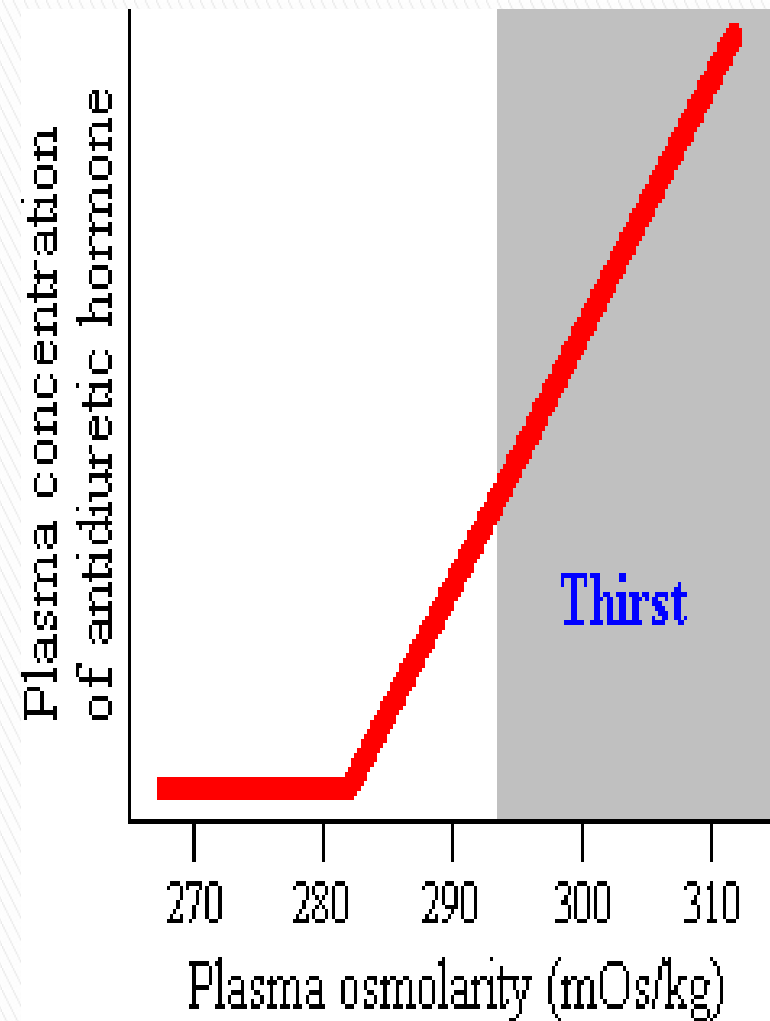


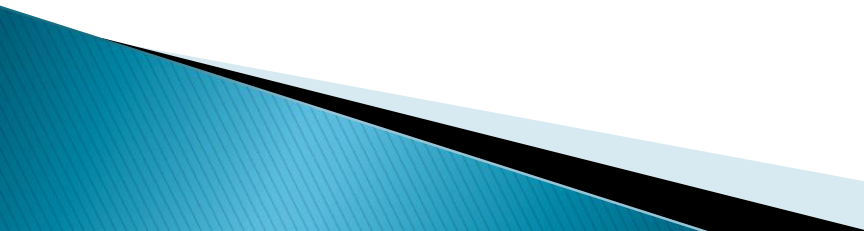
↑ **BLOOD PRESSURE**



❑ Control of Antidiuretic Hormone Secretion

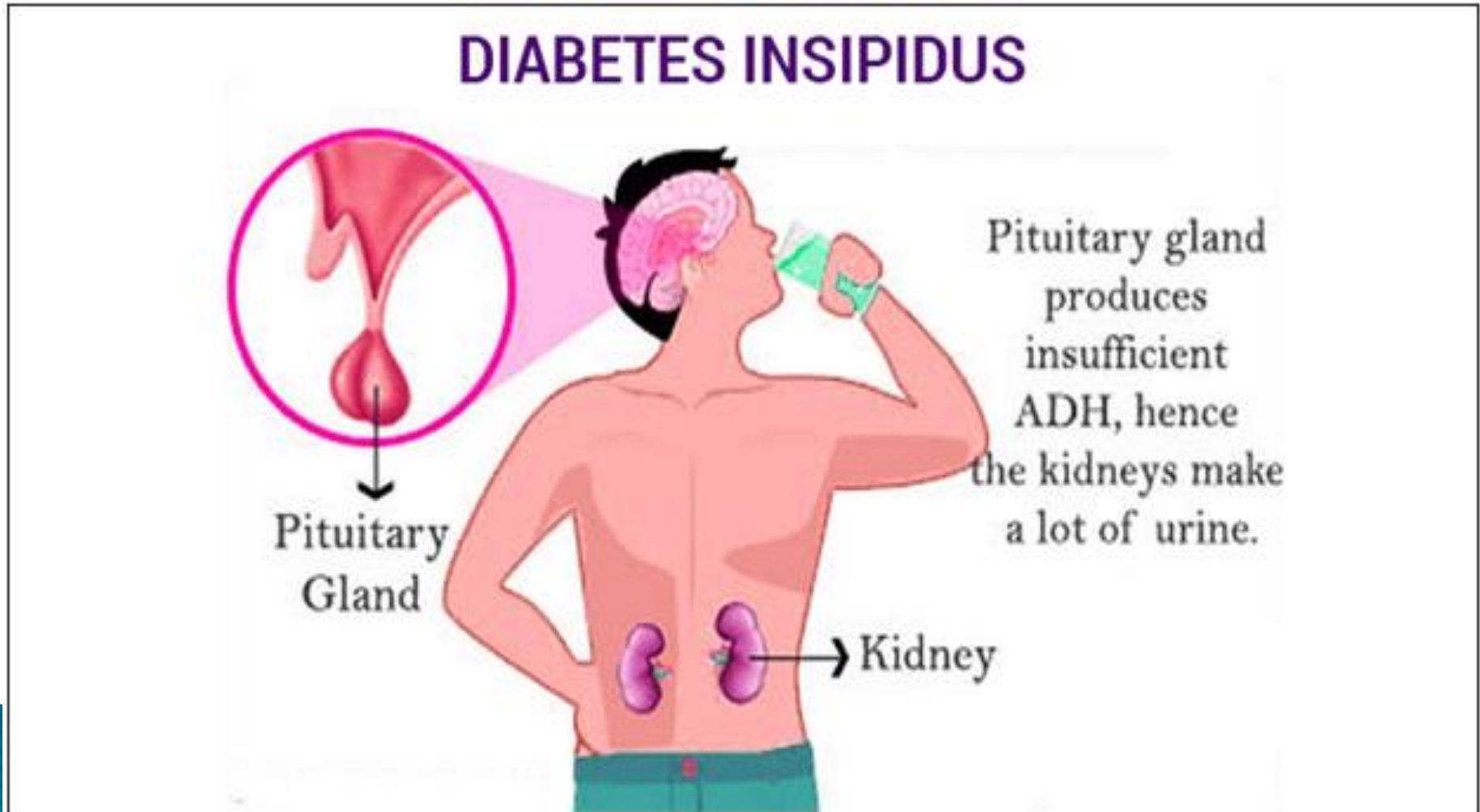
- ▶ 1. The most important variable regulating antidiuretic hormone secretion is plasma osmolarity, or the concentration of solutes in blood. When plasma osmolarity is below a certain threshold,
- ▶ the osmoreceptors are not activated and antidiuretic hormone secretion is suppressed.
- ▶ When osmolarity increases above the threshold, the ever-alert osmoreceptors recognize this and stimulate the neurons that secrete antidiuretic hormone.
- ▶ As seen the figure, antidiuretic hormone concentrations rise steeply and linearly with increasing plasma osmolarity



- 2. Secretion of antidiuretic hormone is also simulated by decreases in blood pressure and volume,** conditions sensed by stretch receptors in the heart and large arteries.
- ▶ Changes in blood pressure and volume are not nearly as sensitive a stimulator as increased osmolarity, but are nonetheless potent in severe conditions. For example, Loss of 15 or 20% of blood volume by hemorrhage results in massive secretion of antidiuretic hormone.
 - ▶ Another potent stimulus of antidiuretic hormone is nausea and vomiting.
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❑ Disease States

- ▶ The most common disease of man and animals related to antidiuretic hormone is **diabetes insipidus**.



▶ This condition can arise from either of two situations:

✓ **Hypothalamic ("central") diabetes insipidus :**

- results from a deficiency in secretion of antidiuretic hormone from the posterior pituitary. Causes of this disease include head trauma, and infections or tumors involving the hypothalamus.

✓ **Nephrogenic diabetes insipidus :**

- this is occurs when the kidney is unable to respond to antidiuretic hormone. Most commonly, this results from some type of renal disease, but mutations in the ADH receptor gene or in the gene encoding aquaporin-2 have also been demonstrated in affected humans.

❑ **The major sign of either type of diabetes insipidus is excessive urine production.**

▶ Some human patients produce as much as 16 liters of urine per day! If adequate water is available for consumption, the disease is rarely life-threatening, but withholding water can be very dangerous.

▶ **To confirm diagnosis of diabetes isipidus:**

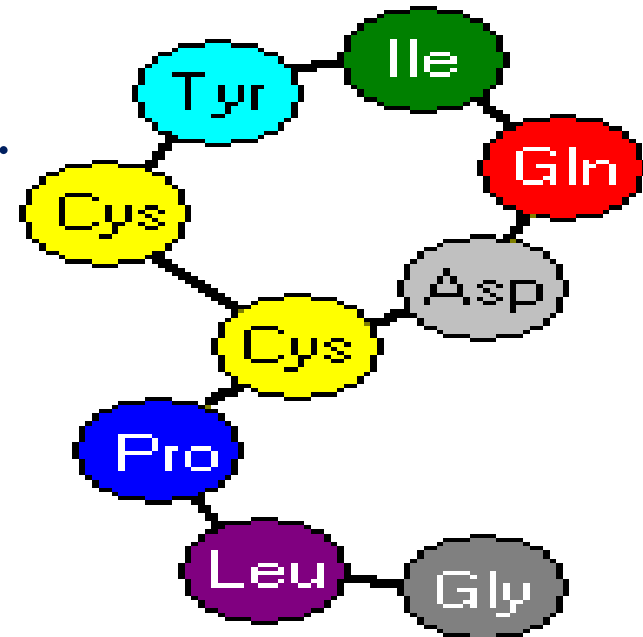
1. Urine (S.G.)- Normal urine (S.G.) is between 1.015-1.025 If low:
 - A. Diabetes insipidus
 - B. Glomerular nephritis
 - C. Tubular damage

2. **Water deprivation test helps determine whether diabetes insipidus is caused by one of the following:**

- ✓ Excessive intake of fluid
 - ✓ A defect in ADH production
 - ✓ A defect in the kidneys' response to ADH
- ▶ This test measures changes in body weight, urine output, and urine composition when fluids are withheld.
- Plasma vasopressin at end of water deprivation test:
- ✓ Low for plasma osmolality (central)
 - ✓ Normal for plasma osmolality (nephrogenic)

2. Oxytocin :

- ❑ Oxytocin is a nine amino acid peptide that is synthesized in hypothalamic neurons and transported down axons of the posterior pituitary for secretion into blood.
- ✓ Oxytocin differs from **antidiuretic hormone** in two of the nine amino acids. Both hormones are packaged into granules and secreted along with carrier proteins called neurophysins .



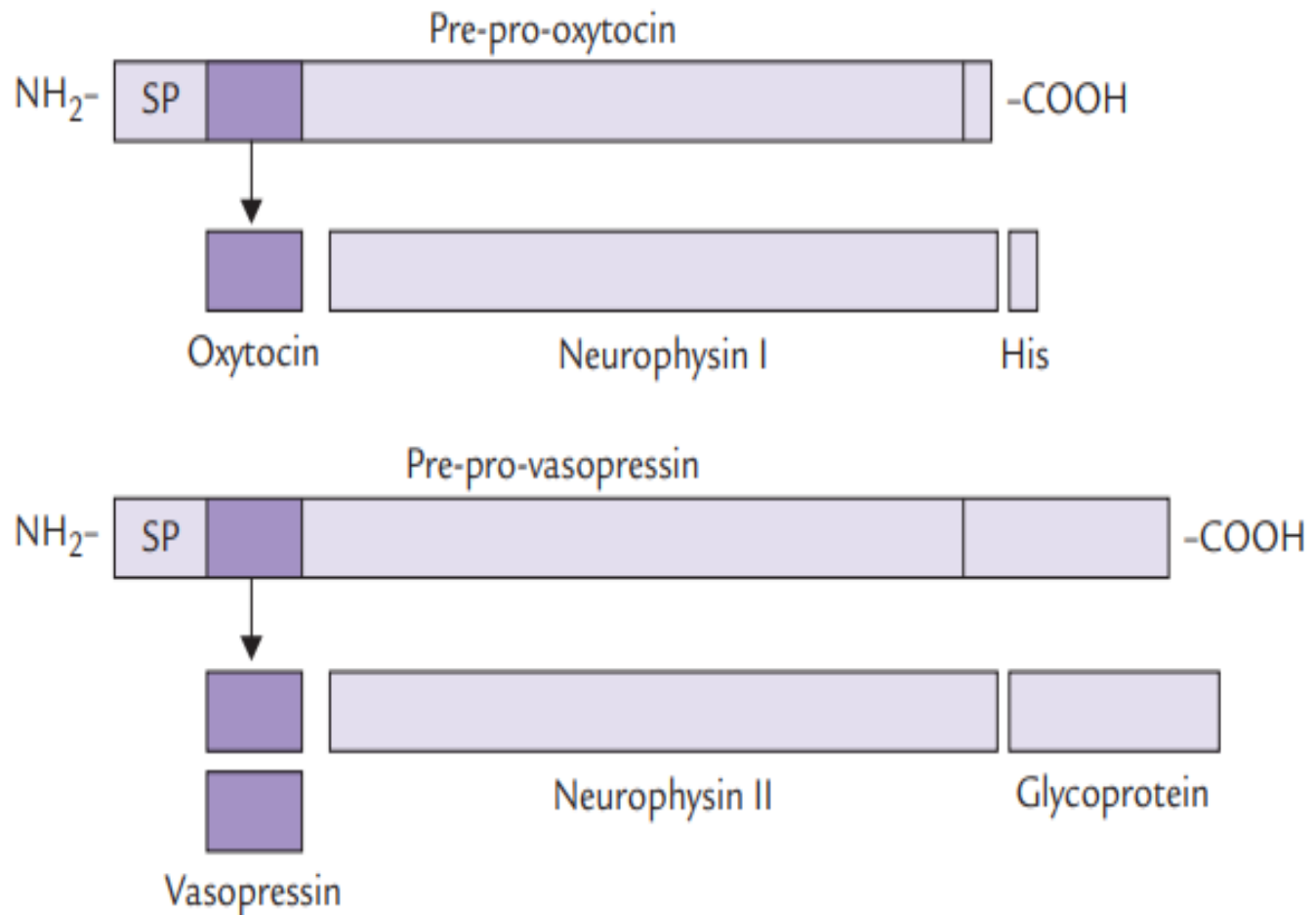
Oxytocin

❑ **Biological activities** of oxytocin are linked to parturition (child-birth) and expression of milk from breast. The hormonal release from posterior pituitary occurs in response to nipple stimulation (suckling). As with prolactin, suckling

❑ **Control of Oxytocin Secretion :**

A number of factors can inhibit oxytocin release, among them acute stress. For example, oxytocin neurons are repressed by

Catecholamine , which are released from the adrenal gland in response to many types of stress, including fright.



Proteolytic maturation of pre-pro-vasopressin and pre-pro-oxytocin (SP = signal peptide).

❑ **Functions**

1. **Uterine contraction:** Oxytocin stimulates contraction of uterine smooth muscles in pregnant women at term.

Blood oxytocin levels have been observed to increase just before parturition. Some synthetic analogues of oxytocin such as syntocinon and syntometrine are used to induce labor at term.

2. **Milk ejection:** Oxytocin stimulates contraction of the myoepithelial cells of breast, leading to milk ejection in response to suckling.

✓ Oxytocin exerts its effects by binding to receptors on myometrial or myoepithelial cell membranes and initiating formation of cAMP or cGMP.

The hormone appears to be metabolized by the liver and kidneys or the lactating mammary gland

Thank you
for listening