

Unit 45: Posterior Pituitary

High yield stuff has ** next to it!

Pituitary overview;

The pituitary has two parts;

Posterior	Anterior
Neurohypophysis = median eminence + infundibular stem + infundibular process (posterior lobe)	Adenohypophysis = pars tuberalis (outer covering of the pituitary stalk) + pars distalis (anterior lobe)
from a downgrowth of the forebrain, is functionally a part of the hypothalamus	develops from Rathke's pouch, of the oral ectoderm

→The pituitary is connected to the hypothalamus by a stalk.

→There is also an intermediate lobe of the pituitary, also called the pars intermedia, which is vestigial in humans and is a layer of cells between the anterior and posterior.

Posterior Pituitary

→Cell bodies in the supraoptic nuclei and paraventricular nuclei of the hypothalamus send axons down through the median eminence and infundibular stem. The cell bodies of these axons produce preprohormones of arginine vasopressin (AVP) and oxytocin. AVP and oxytocin differ by only two amino acids, so that they have different hormonal activities. Each has slight activity in the other's receptors. The two genes are near each other on chromosome 20 and each gene translates to the hormone and the peptide neurophysin. The two versions of neurophysin are slightly different, and both act to stabilize its respective preprohormone. The preprohormone is cleaved into its hormone and neurophysin after the granules have left the Golgi apparatus and before it reaches the axon terminal. Granules remain at the axon terminal until the cell is stimulated.

Cool note; if you section these axons, then they will *regrow*.

** The following chart details where and when the hormones are at each stage;

Preprohormone	Complete amino acid sequence from right after it the gene has been translated.
Prohormones	Are glycosylated versions of the preprohormone and are packaged into the Golgi apparatus
Neurosecretory granule	Transported down as inactive granules
Neurophysin and hormone	Is cleaved within the granules and stored at the axon terminals in the posterior pituitary until it receives a stimulus.

AVP (= ADH)

- Stimulus of AVP comes from either a rise in osmolality (sensed by osmoreceptors) or a decrease in blood pressure (sensed by baroreceptors). Osmoreceptors are sensitive to 1% change, have a threshold of 280 mOsm and the threshold decreases in pregnancy. Baroreceptors are found in various parts of the pulmonary system, detect a 5-10% change, and a severe drop in blood volume is the most potent stimulus of ADH.
- Release is mediated by catecholamines, angiotensin II, and atrial natriuretic peptide (ANP).
- Once released into the body, AVP works to increase water absorption in the kidneys at the collecting ducts. This ends up creating less excretion and more concentrated urine. With no AVP, the collecting ducts are impermeable to water, which would create 16 mL/min of urine going to the bladder. ADH acts on **V2 receptors**, cAMP is increased, and proteins are phosphorylated leading to the insertion of water channels into the membrane so the permeability of the cell membrane to H₂O is increased.
- If there is extreme blood loss then ADH acts on V1 receptors to cause systemic vasoconstriction.

**** ↑ osmolality = ↑ ADH = ↑ thirst (but the stimulus for an increase in ADH occurs before thirst)**

**** ↓ blood pressure = ↑ ADH**

Clinical correlates;

Diabetes insipidus is a disease in which a patient presents with excessive production of flavorless urine (as opposed to the sweet flavor of diabetes mellitus). The neurogenic version results from a decrease in ADH synthesis or release, while the nephrogenic version is from resistance in the kidneys to ADH. The neurologic version can be treated with an ADH mimic, which is actually a stronger antidiuretic than the natural one.

Syndrome of Inappropriate Secretion of ADH (SIADH) is a disease that results from ADH being released without correct stimulus. Sometimes the disease is caused by injury to the brain. Other times, such as lung cancer, cells in other parts of the body actually produce the extra ADH. SIADH can be treated by restricting water, and giving the drug (demeclocyclone) that interferes with cAMP-dependant kinase, effectively decreasing permeability of the collecting duct.

Oxytocin

- The release of oxytocin is stimulated by two actions; breast-feeding and the stretching of the receptors in the cervix at the beginning of childbirth (Ferguson reflex).
- Upon breastfeeding, oxytocin released into the blood stream causes the contraction of myoepithelial cells around the alveoli to cause milk to be released.
- During the birthing process oxytocin stimulates the contraction of muscles in the uterus. Afterwards it helps to return the uterus back to its original shape and to decrease bleeding.

→Oxytocin also has a suspected role in aiding the movement of sperm up the fallopian tubes.

→This will be covered again in the lectures on the Female Reproductive System.

Clinical correlates;

A deficiency causes only problems with nursing, while excess oxytocin has no known significant problems.