PITUITARY GLAND

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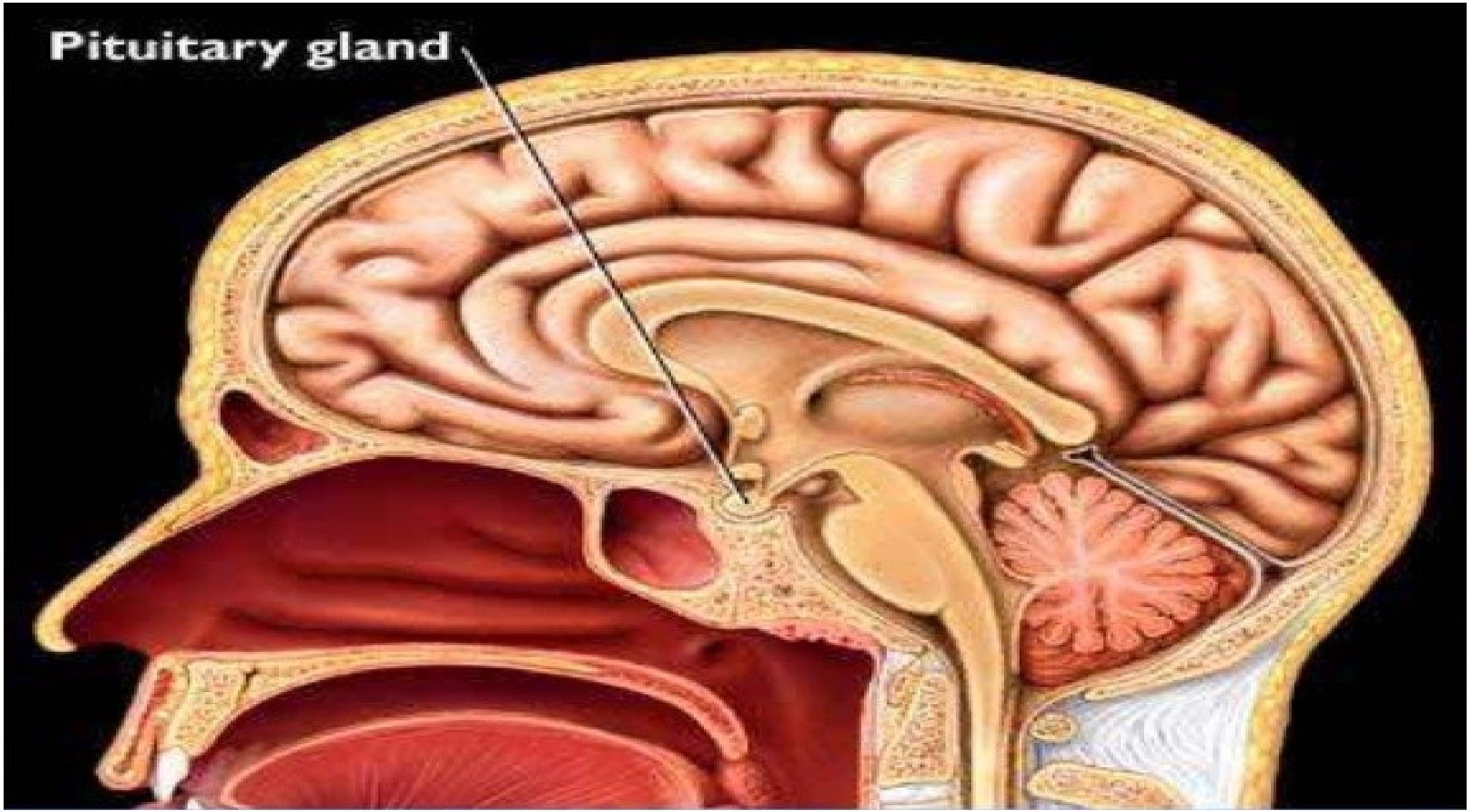
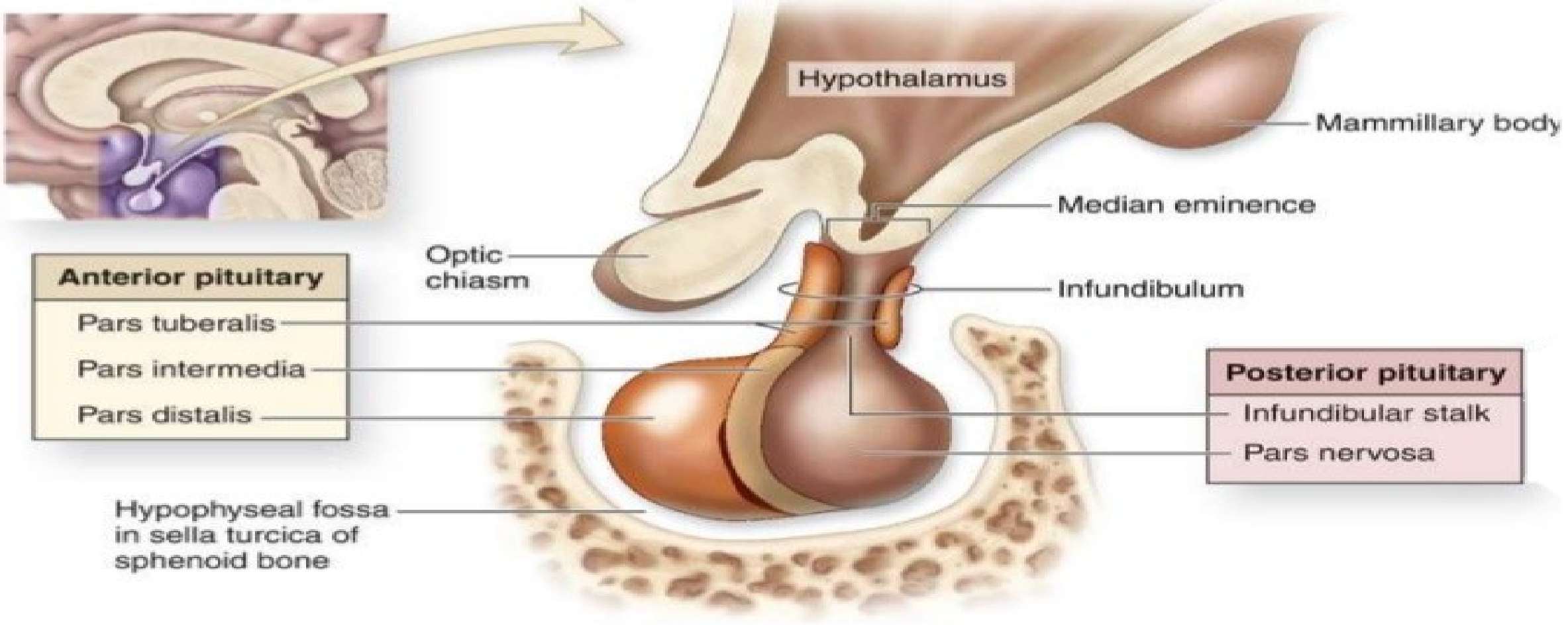
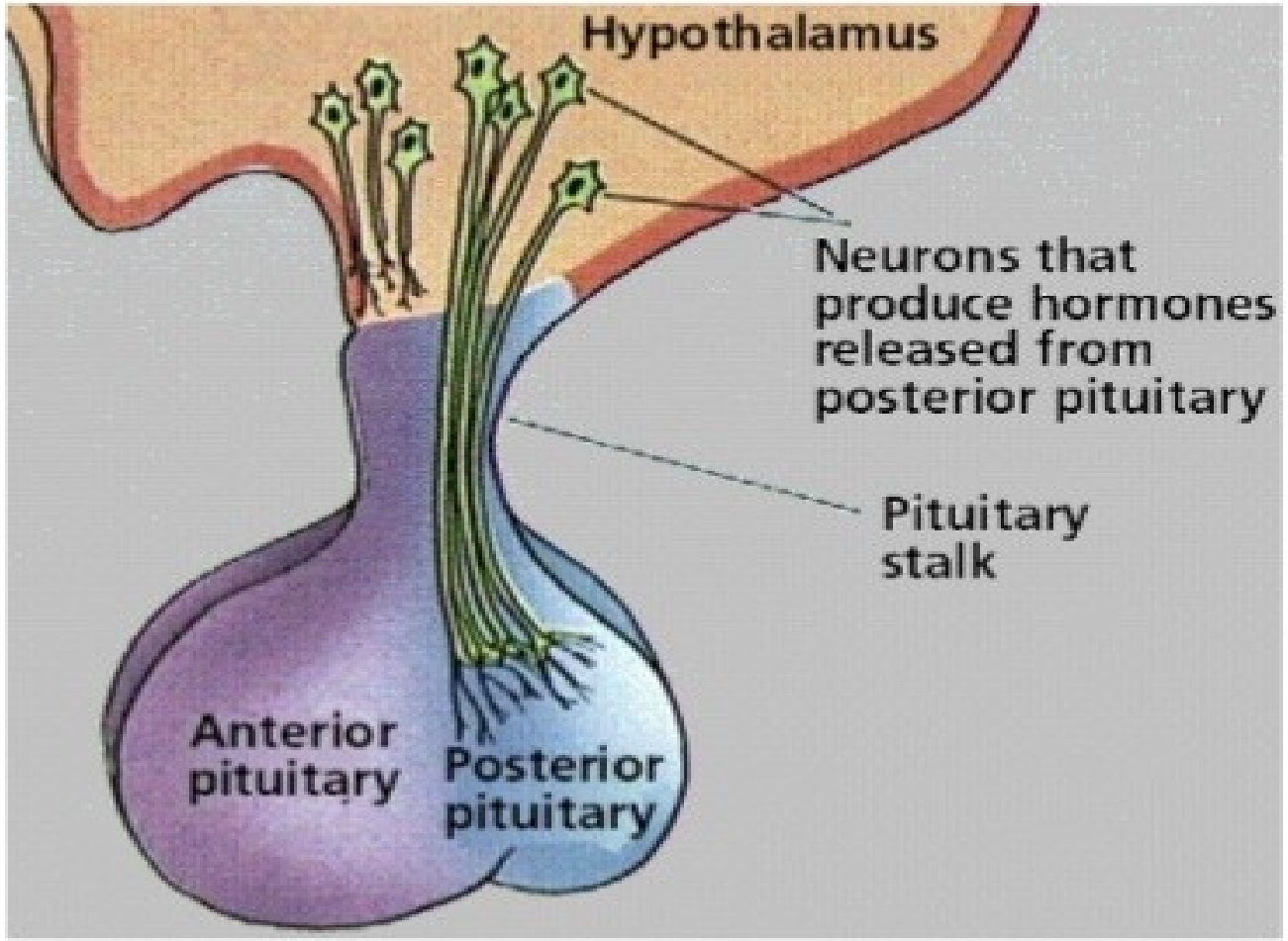
INTRODUCTION

- Pituitary gland or hypophysis is a small endocrine gland.
- Diameter of 1 cm and weight of 0.5 to 1 g.
- It is situated in a depression called 'sella turcica', present in the sphenoid bone at the base of skull.
- It is connected with the hypothalamus by the pituitary stalk or hypophyseal stalk.


Pituitary gland



Division in Two Lobes



- The pituitary is divided into two lobes.
- The anterior Pituitary.
- The Posterior Pituitary.

Development

Anterior pituitary

- Ectodermal in origin
- Arises from pharyngeal epithelium as an upward growth known as Rathke's pouch

Posterior pituitary

- Neuroectodermal in origin
- Arises from base of the Diencephalon as a downward diverticulum known as Infundibulam

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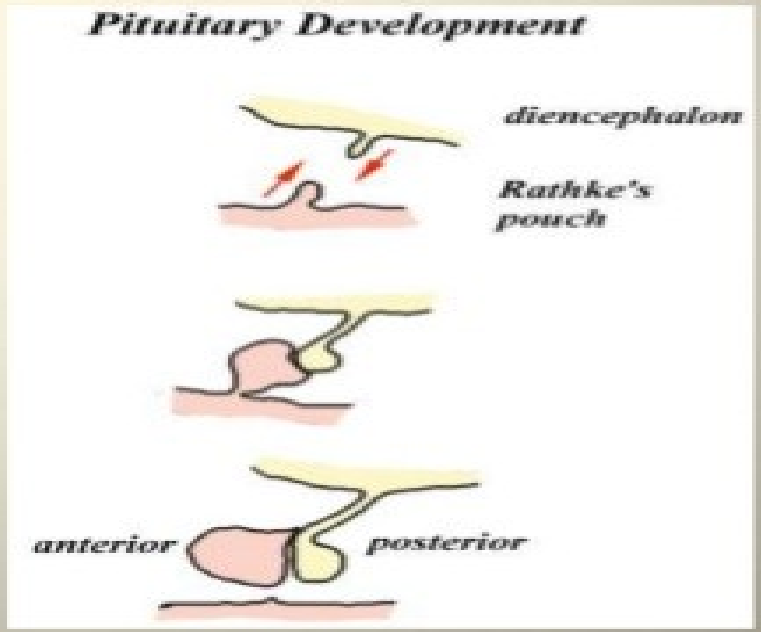
The Rathke's pouch and downward diverticulum from hypothalamus meet midway between

- The roof of the buccal cavity and
- Base of the brain



Anatomy

Location

- Lies at the base of brain in Sella turcica.
- Connected with the Hypothalamus by the pituitary stalk or hypophyseal stalk.

Continued...

Divided into two portions:

- Anterior pituitary or Adenohypophysis
- Posterior pituitary or Neurohypopysis

Between the two portions Pars intermedia is present.

- Very small in humans
- More functional in lower animals

Continued...

Anterior and Posterior pituitary are situated in very close approximation

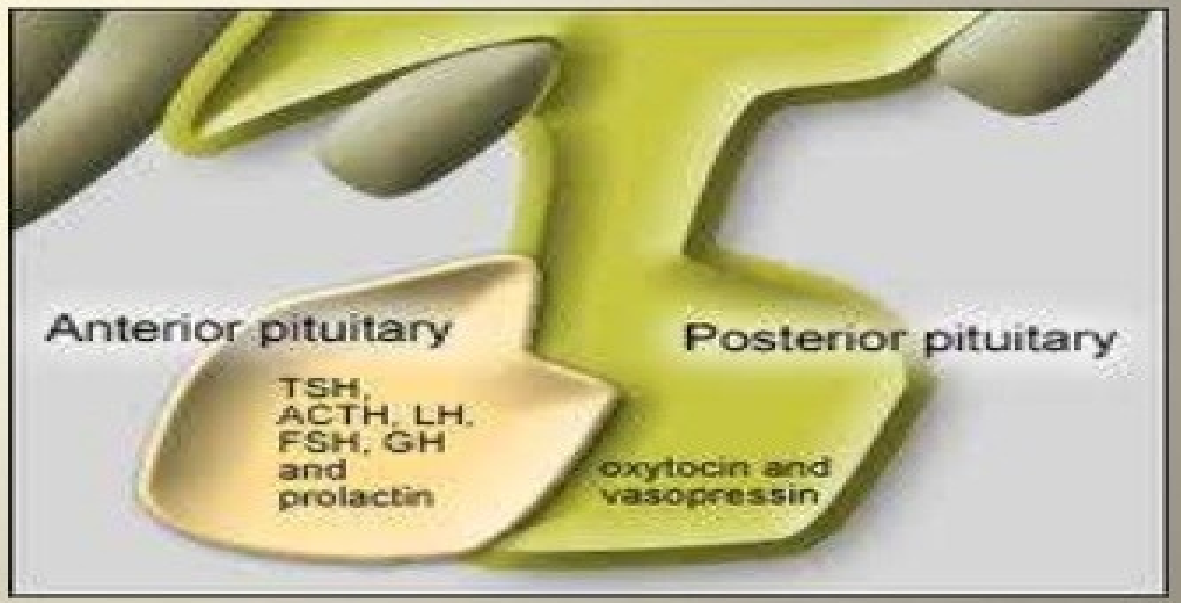
But they are entirely different in their:

- Development
- Structure
- Function

Anterior pituitary

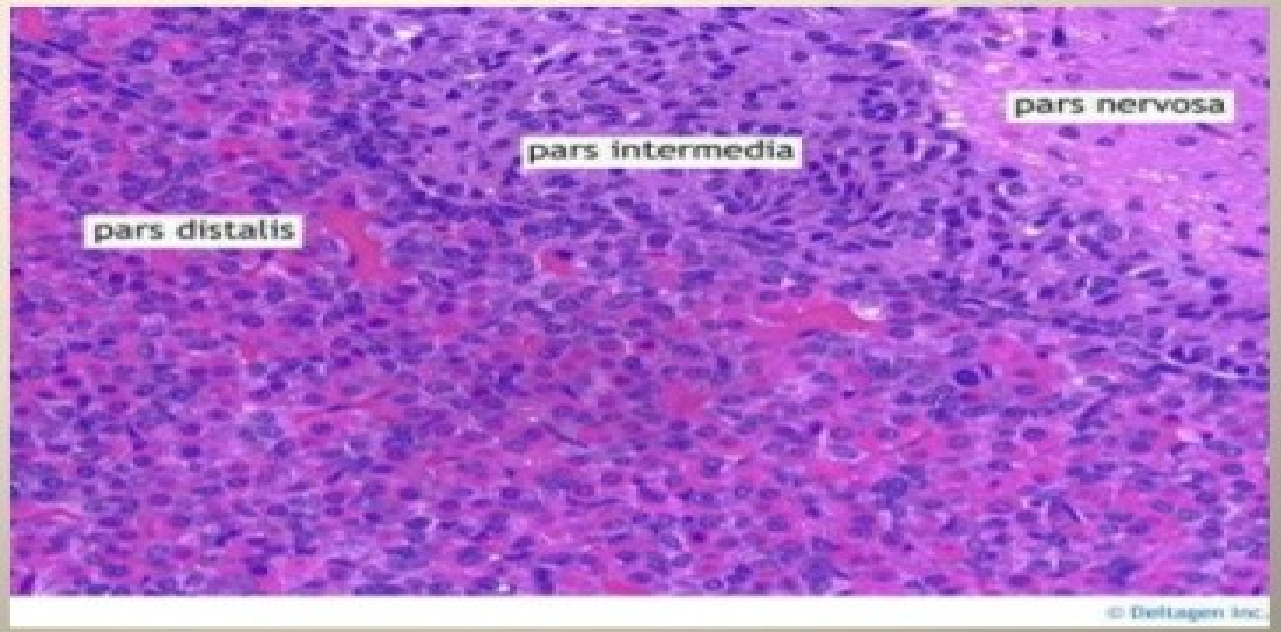
Consists of three divisions

- Pars distalis
- Pars tuberalis
- Pars intermedia



Histology of Adenohypophysis

- Depending upon the staining property-2 types
  - Chromophobe cells
  - Chromophil cells



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Chromophobe cells

- Do not possess granules
- Stained poorly
- Cells are not secretory in nature
- Believed to be the precursors of chromophil cells
- Comprises about 50% of total cells

Continued...

Chromophil cells

- Contain large number of granules
- Darkly stained
- 2 types based on staining nature
  - Acidophilic or Alpha cells - 35%
  - Basophilic or Beta cells - 15%

Continued...

- 5 types based on secretory nature
  - Somatotropes which secrete growth hormone
  - Corticotropes which secrete adrenocorticotropic hormone
  - Thyrotropes which secrete thyroid stimulating hormone
  - Gonadotropes which secrete follicle stimulating and Luteinizing hormone
  - Lactotropes which secrete prolactin

Regulation of secretion

Hypothalamo-Hypophyseal Relationship

- — Hypothalamus secretes several hormones to the
  - Anterior pituitary
  - Posterior pituitary
- — Transportation of hormones
  - To Anterior pituitary by Hypothalamo-Hypophyseal portal system
  - To Posterior pituitary by nerve fibers of Hypothalamo-Hypophyseal tract

Continued...

Regulation of Anterior Pituitary Secretion

- Hypothalamus controls Anterior Pituitary through releasing and inhibitory hormones called neurohormones

Continued...

Releasing and Inhibitory Hormones by Hypothalamus

- Growth hormone releasing hormone (GHRH)
  - Stimulates the release of growth hormone
- Growth hormone releasing polypeptide (GHRP)
  - Stimulates release of GHRH and growth hormone
- Growth hormone inhibitory hormone (GHIH) or Somatostatin
  - Inhibits growth hormone release

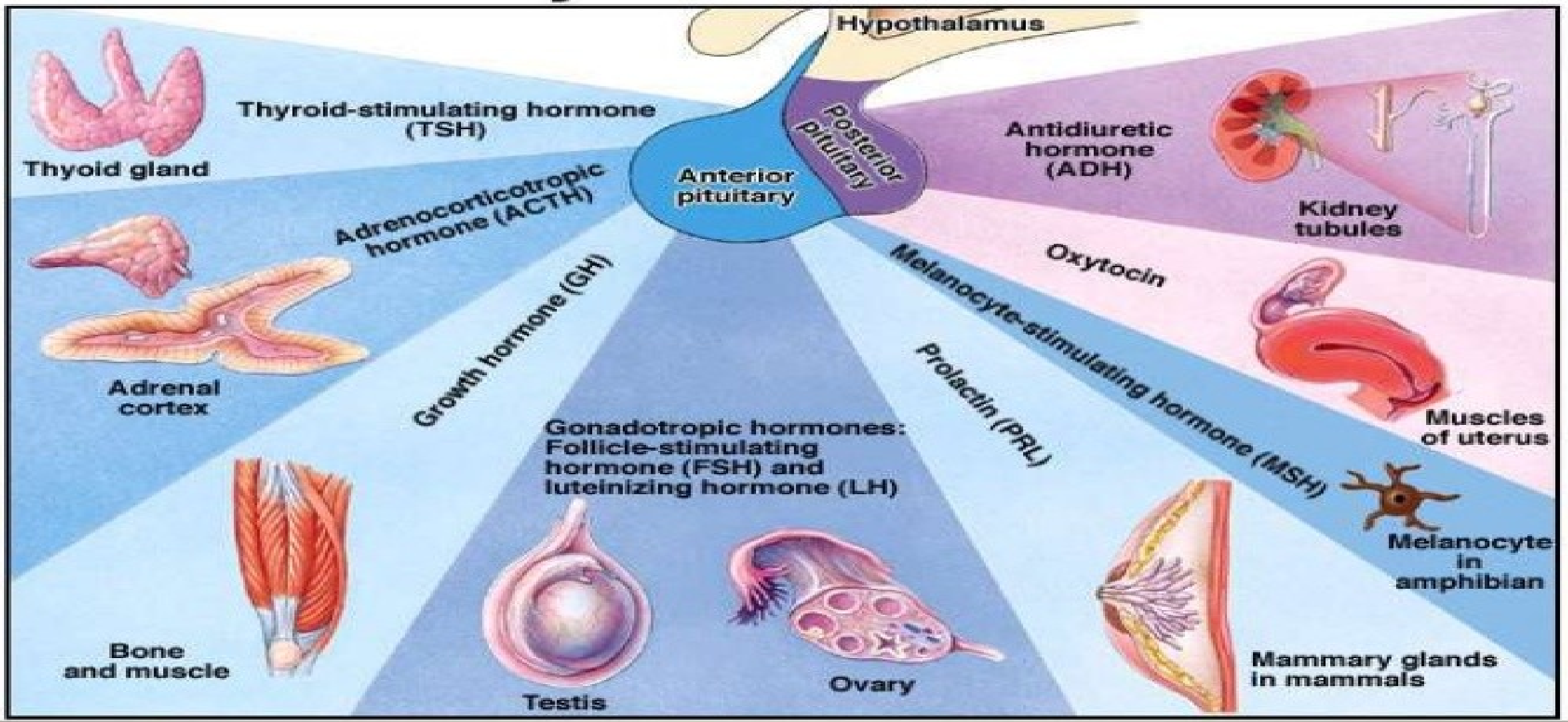
Continued…

- Thyrotropic releasing hormone (TRH)
  - Stimulates the release of thyroid stimulating hormone
- Corticotropin releasing hormone (CRH)
  - Stimulates the release of adrenocorticotropin
- Gonadotropin releasing hormone (GnRH)
  - Stimulates the release of gonadotropins
- Prolactin inhibitory hormone (PIH)
  - Inhibits prolactin secretion

Hormones Secreted by Adenohypophysis

1. Growth hormone (GH) or Somatotropic hormone (STH)
2. Thyroid stimulating hormone (TSH) or Thyrotropic hormone
3. Adrenocorticotropic hormone (ACTH)
4. Follicle stimulating hormone (FSH)
5. Luteinizing hormone (LH in females) or Interstitial cell stimulating hormone (ICSH in males)
6. Prolactin
7. β- Lipotropin (recent)

Pituitary Gland Hormones



THE GROWTH HORMONE

- Protein hormone produced by anterior pituitary under the control of hypothalamus.
- Production through negative feedback mechanism.
- The quantity is greatest during childhood and adolescence.
- The highest blood levels are during sleep and strenous exercis

ACTION of GH

- GH stimulates growth in the body by promoting:
- Cellular Enlargement – Hypertrophy.

  and
- Increase in the number of cells through division – Hyperplasia.
- It acts primarily on bones and muscles.

ACTION of GH

- In Bones:

  It stimulates cell division and protein synthesis resulting in an increase in the length and width of bones.

- In Muscles:

  It increases uptake of amino acids and synthesis of proteins.

EFFECTS of GH

- ***DAWARFISM***

  - Under-secretion during growth phase of a child is one cause of stunted growth.

  - Characterized by small stature.

  - World's smallest girl due to Dawarfism. (weighed 2 lbs, 8 ounces when she was born)

EFFECTS of GH

- ***GIGANTISM:***
  - Over-secretion during growth phase results in gigantism.
  - Giants usually have poor health.

EFFECTS of GH

- ***ACROMAGELY***:

  - Over-secretion after growth phase results in acromagely.

  - Feets, hands and face become overly large.

Thyroid stimulating hormone (TSH)

- Stimulated by Thyroidtropin-releasing hormone (TRH)from hypothalamus
- Inhibit by Somatostatin from hypothalamus
- Stimulate the thyroid gland to secrete hormone thyroxin
- Stimulates growth and activity of the thyroid gland
- When too much TSH is secreted,it cause the thyroid gland to enlarge and secrete too much thyroxin

Adrenocorticotropic hormone (corticotrophin, ACTH)

- Stimulated by Corticotropin-releasing hormone(CRH) from the hypothalamus
- ACTH stimulate the adrenal gland(cortex) to secret a hormone call glucocorticoids.
- Secretion is regulated by negative feedback

  (Suppressed when blood level ACTH raises)

Prolactin

- Also known as lactogenic hormone
- Stimulated by Prolactin-releasing hormone (PRH) from hypothalamus
- Inhibit by Dopamin from hypothalamus
- Target cell is mammary gland
- Stimulates the production of milk in the breast following pregnancy.
- Negative feedback when blood level prolactin increase
- Prolactin hypersecretion in males cause erectile dysfunction.

Gonadotrophins

- LUTENIZING HORMONE (LH) –

~>stimulated by gonadotropin-releasing hormone(GnRH) from hypothalamus

~> In males, stimulates the testes to secrete testosterone

~>In females, stimulates release of ovum by ovary.

~>After ovulation,it stimulate the formation of corpus luteum in ovary and secret hormone progesterone .

- FOLLICLE-STIMULATING HORMONE (FSH)

~>in male,stimulate production of sperm cells in the testes.

~> in females, stimulates maturation of ovarian follicle and secrete estrogen by ovaries

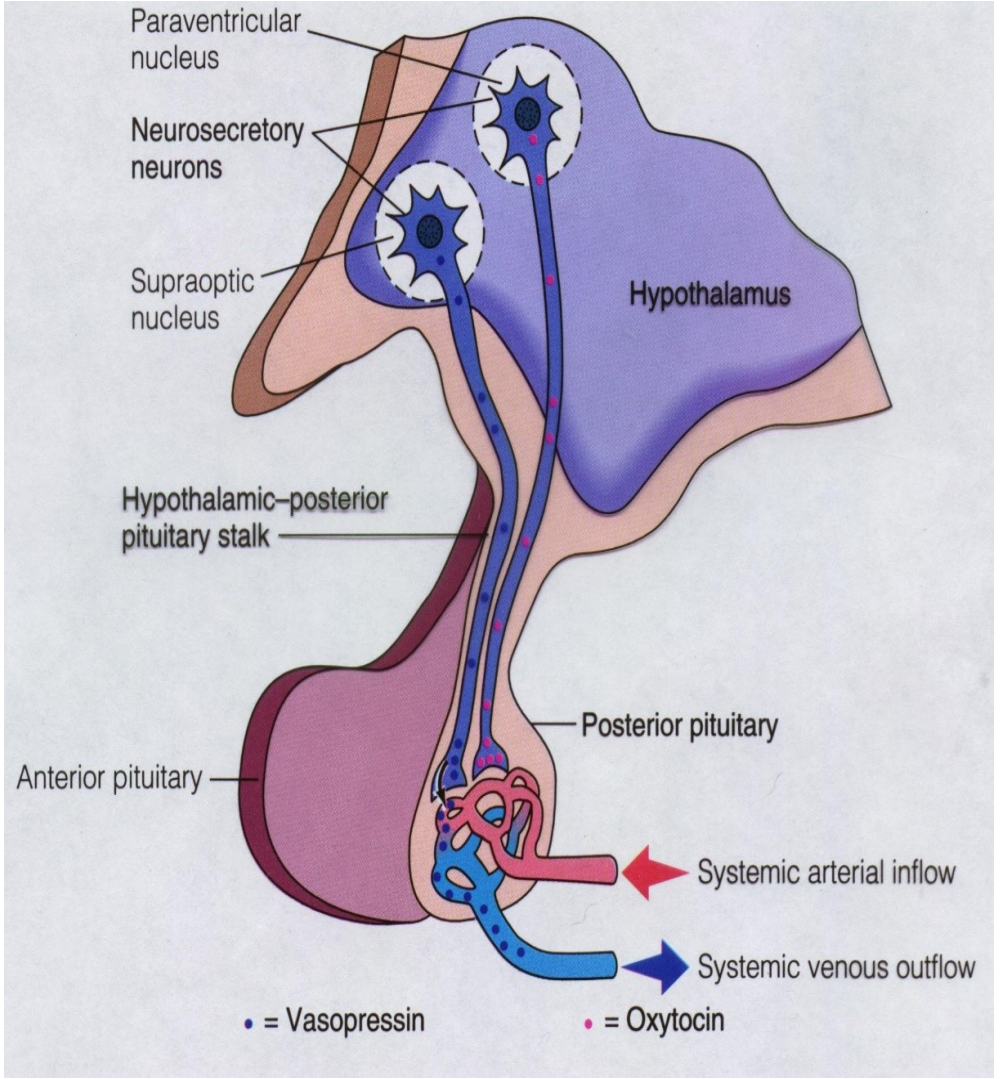
Posterior Pituitary

PARS NERVOSA

Posterior pituitary consists of three parts:

1. Pars nervosa or infundibular process
2. Neural stalk or infundibular stem
3. Median eminence.

Pars tuberalis of anterior pituitary and the neural stalk of posterior pituitary together form the hypophyseal stalk



HISTOLOGY OF NEUROHYPOPHYSIS

Posterior pituitary is made up of neural type of cells called pituicytes and unmyelinated nerve fibers.

1. PITUICYTES

- Pituicytes are the fusiform cells derived from glial cells.
- Pituicytes act as supporting cells and do not secrete any hormone.

2. UNMYELINATED NERVE FIBERS

- Unmyelinated nerve fibers come from supraoptic and paraventricular nuclei of the hypothalamus through the pituitary stalk.

HORMONES OF POSTERIOR PITUITARY

Posterior pituitary hormones are:

1. Antidiuretic hormone (ADH) or vasopressin

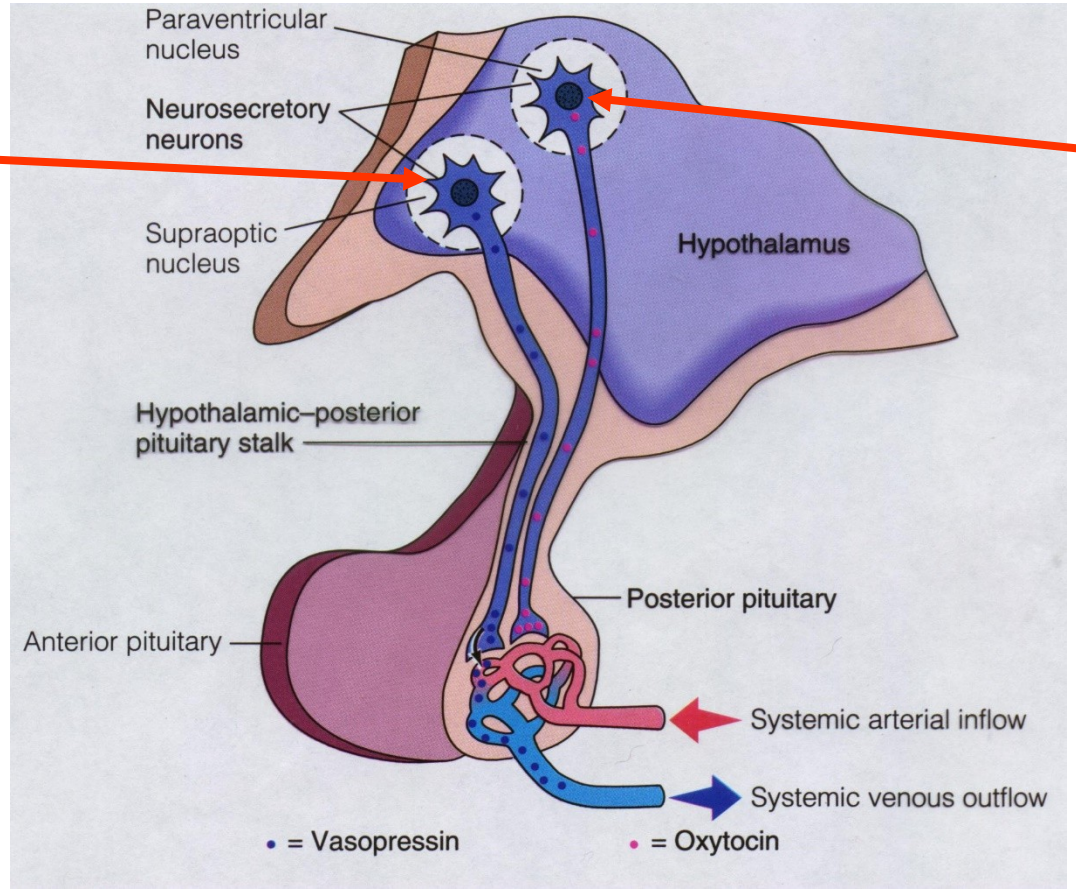
2. Oxytocin

SOURCE OF SECRETION OF POSTERIOR PITUITARY HORMONES

- Actually, the posterior pituitary does not secrete any hormone.
- ADH and oxytocin are synthesized in the hypothalamus.
- From hypothalamus, these two hormones are transported to the posterior pituitary through the nerve fibers of hypothalamo-hypophyseal tract.
- In the posterior pituitary, these hormones are stored at the nerve endings.
- These hormones are released from the nerve endings into the circulation.
- Hence, these two hormones are called neurohormones.

SOURCE OF SECRETION OF POSTERIOR PITUITARY HORMONES

SUPRAOPTIC NUCLEUS
Secreats-ADH



PARAVENTRICULAR NUCLEUS
Secreats-oxytocin

ANTIDIURETIC HORMONE

Source of Secretion

- Antidiuretic hormone (ADH) is secreted by supraoptic nucleus of hypothalamus.
- This hormone is transported to posterior pituitary through the nerve fibers of hypothalamo-hypophyseal tract.

Chemistry and Half-life

- Antidiuretic hormone is a polypeptide containing 9 amino acids.
- Its half-life is 18 to 20 minutes.

Actions

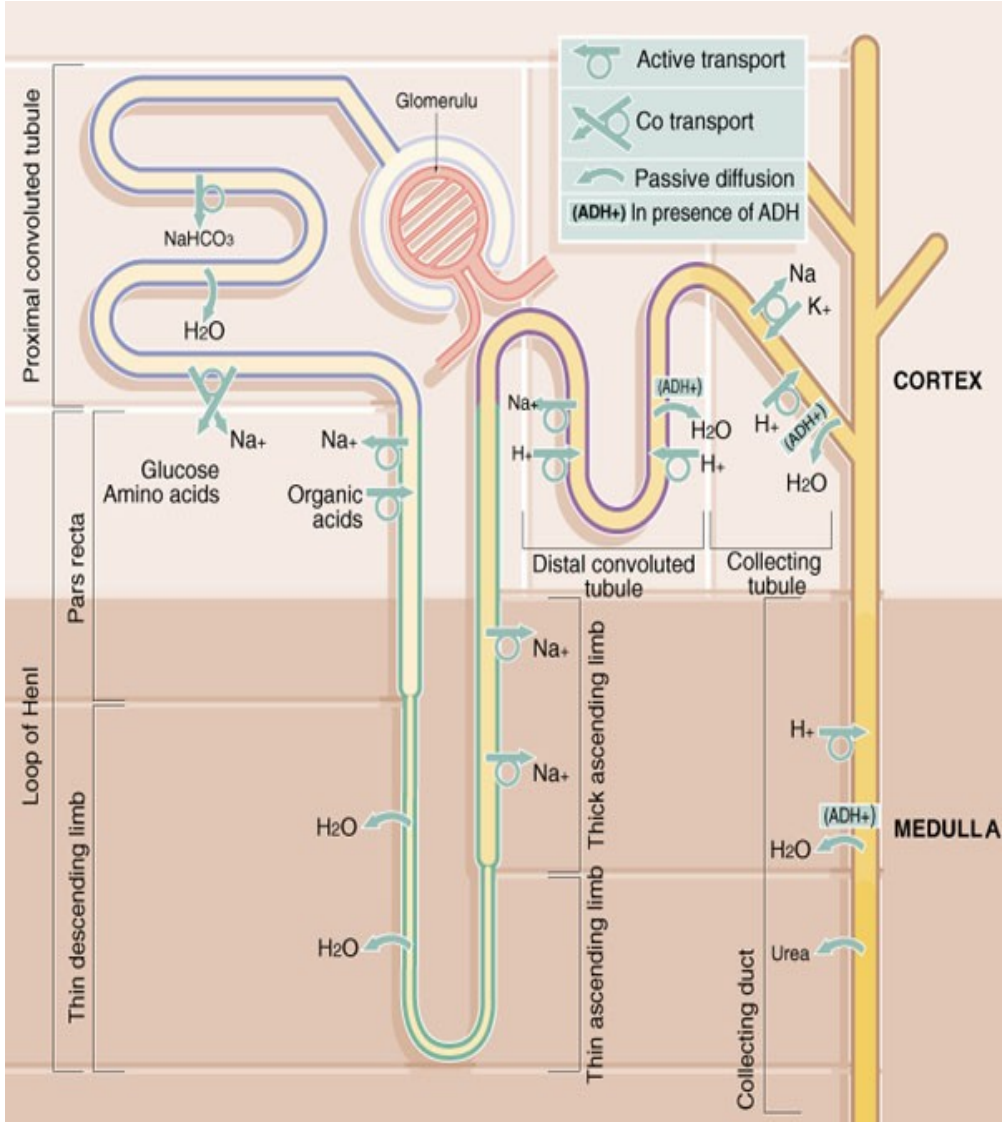
Antidiuretic hormone has two actions:

1. Retention of water
2. Vasopressor action

1. Retention of water

Major function of ADH is retention of water by acting on kidneys.

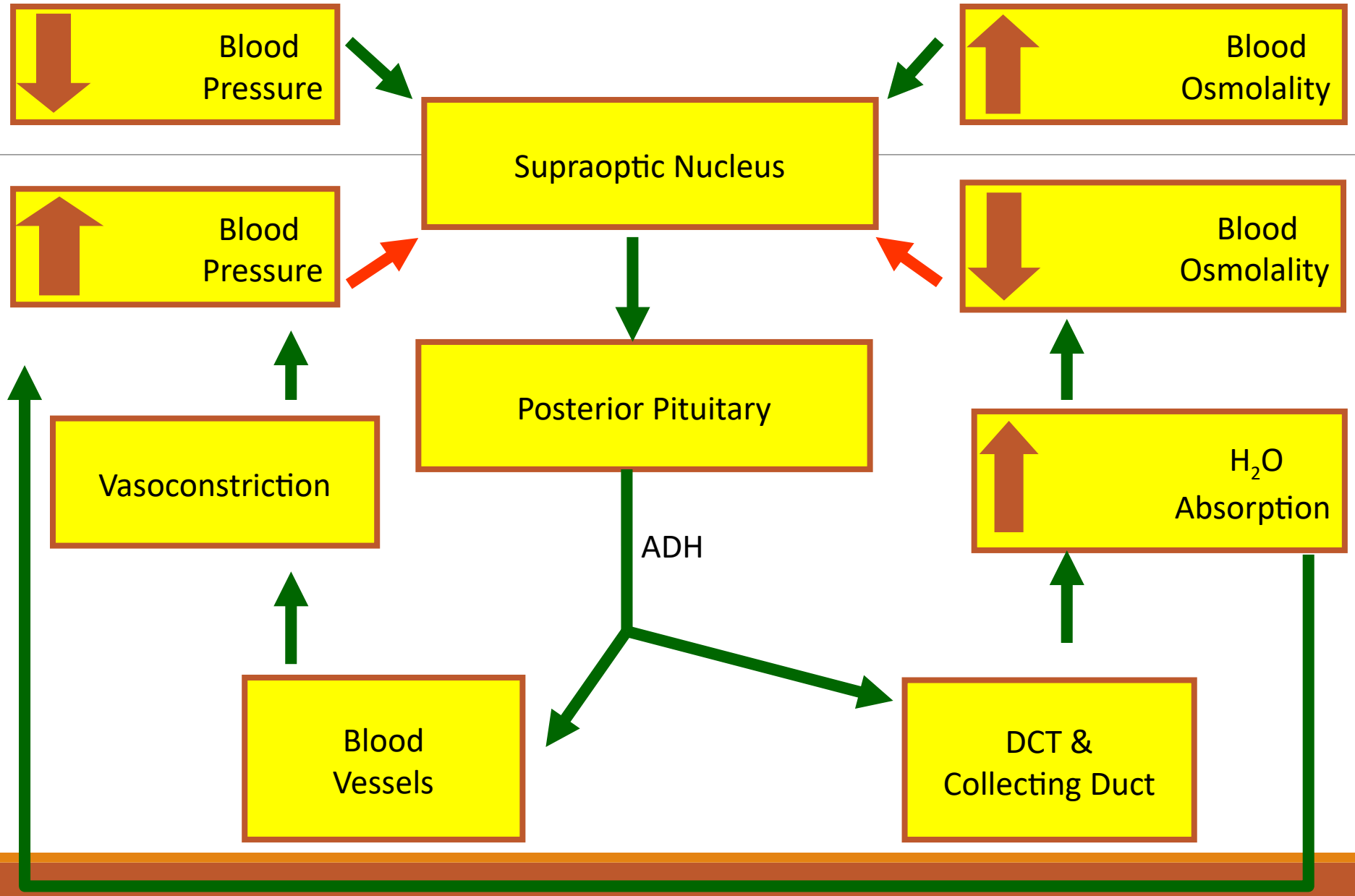
- It increases the facultative reabsorption of water from DCT and collecting duct in the kidneys.
- In the absence of ADH, the DCT and collecting duct are totally impermeable to water.
- So, reabsorption of water does not occur in the renal tubules and dilute urine is excreted.
- This condition is called diabetes insipidus and the excretion of large amount of water is called diuresis.



2. Vasopressor action

- In large amount, ADH shows vasoconstrictor action.
- Particularly, causes constriction of the arteries in all parts of the body.
- Due to vasoconstriction, the blood pressure increases.
- However, the amount of ADH required to cause the vasopressor effect is greater than the amount required to cause the antidiuretic effect.

CONTROL OF ADH



OXYTOCIN (PITOCIN)

Source of Secretion

- Oxytocin is secreted mainly by paraventricular nucleus of hypothalamus.
- It is transported from hypothalamus to posterior pituitary through the nerve fibers of hypothalamo-hypophyseal tract.
- In the posterior pituitary, the oxytocin is stored in the nerve endings of hypothalamo-hypophyseal tract.
- When suitable stimuli reach the posterior pituitary from hypothalamus, oxytocin is released into the blood.
- Oxytocin is secreted in both males and females.

Chemistry and Half-life

- Oxytocin is a polypeptide having 9 amino acids.
- It has a half-life of about 6 minutes.

Actions in Females In females

oxytocin acts on mammary glands and uterus.

Action of oxytocin on mammary glands

- Oxytocin causes ejection of milk from the mammary glands.
- Oxytocin causes contraction of the myoepithelial cells and flow of milk from alveoli of mammary glands to the exterior through duct system and nipple.
- The process by which the milk is ejected from alveoli of mammary glands is called milk ejection reflex or milk letdown reflex.
- It is one of the neuroendocrine reflexes.

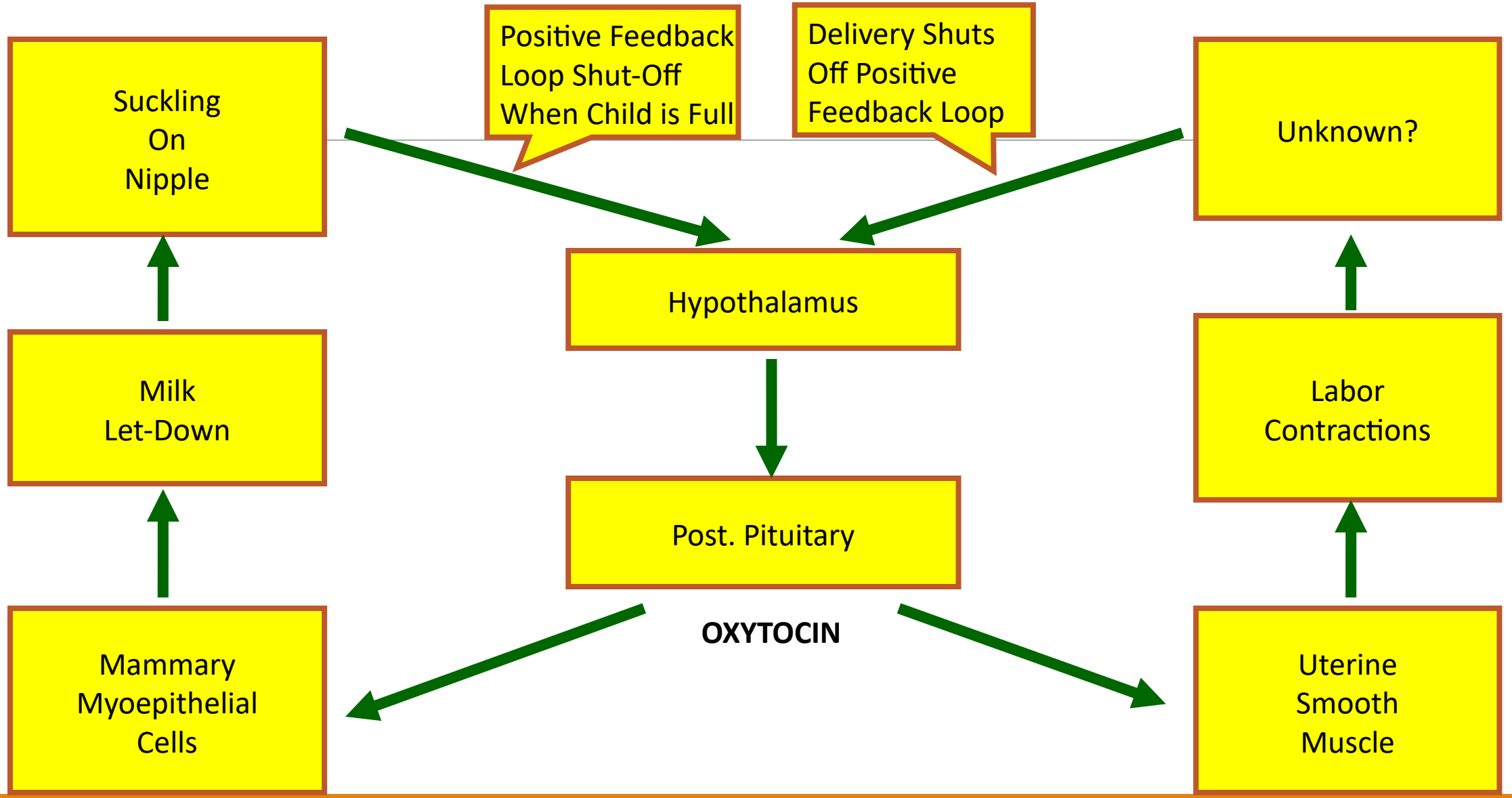
Action on uterus

- Oxytocin causes contraction of uterus and helps in the expulsion of fetus.

Action in Males In males

- The release of oxytocin increases during ejaculation.
- It facilitates release of sperm into urethra by causing contraction of smooth muscle fibers in reproductive tract, particularly vas deferens.

CONTROL OF OXYTOCIN



THANK YOU