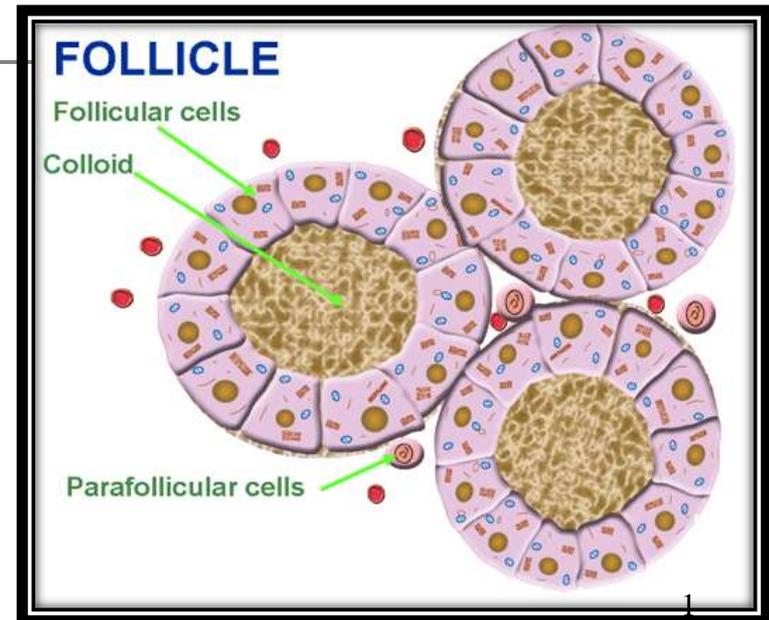


# The Endocrine System

Dr. Mustafa Saad  
(2021)



# Endocrine Glands

the mean of endocrine cell?

A group of secretory cells that release their products, chemical signals called hormones, usually into the circulation. The secretions never pass through ducts

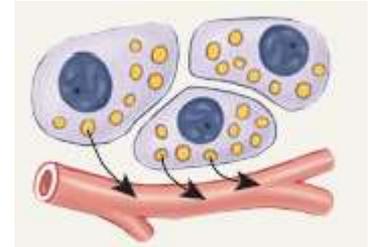


Fig.1: Endocrine secretion.

## ■ Endocrine glands include:

- Pituitary, thyroid, parathyroid, adrenal, and pineal glands.

→ small part inside the brain located below the thalamus

Function :- ① regulate the body temperature ② control hunger and thirst ③ control NS (sympathetic and parasympathetic) ④ hormonal control

- Hypothalamus, thymus, pancreas, ovaries, testes, kidneys, stomach, liver, small intestine, skin, heart, adipose tissue, and placenta also have endocrine function.

# The Hypothalamus

→ indirect effect on the gland

- Part of the diencephalon of the brain.

- Located inferior to the thalamus.

↳ the location?

the function of the hypothalamus? (three function)

- **It's a major link between the nervous and the endocrine systems.**

the hypothalamus control in pituitary by two way?

- It's connected to the pituitary gland by **blood vessels** and **nerve fibers**.

→ the secretion arrives to posterior pituitary by nerve fibers

↳ the secretion arrives to anterior pituitary by blood vessel

- It **secretes a number of hormones that control the secretions of the pituitary gland.**

→ releasing hormone, inhibiting hormone

# The Pituitary Gland (The Hypophysis)

location of pituitary gland?

- Located in the hypophyseal fossa of the sphenoid bone. ~> in sella turcica

- Considered as the **'Maestro Gland'** because it releases various hormones that control all the major endocrine glands of the body. ← السيد العبد ~> pituitary gland لماذا؟

- It's formed of two anatomical and functional parts:

1. The Adenohypophysis (Anterior Pituitary) ~> secretion and synthesis
2. The Neurohypophysis (Posterior Pituitary) ~> just secretion

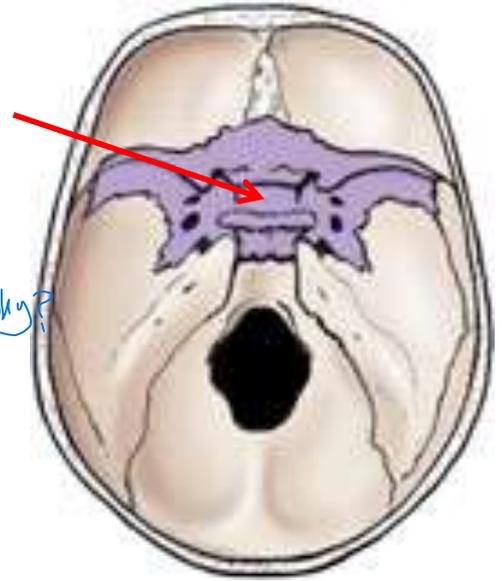
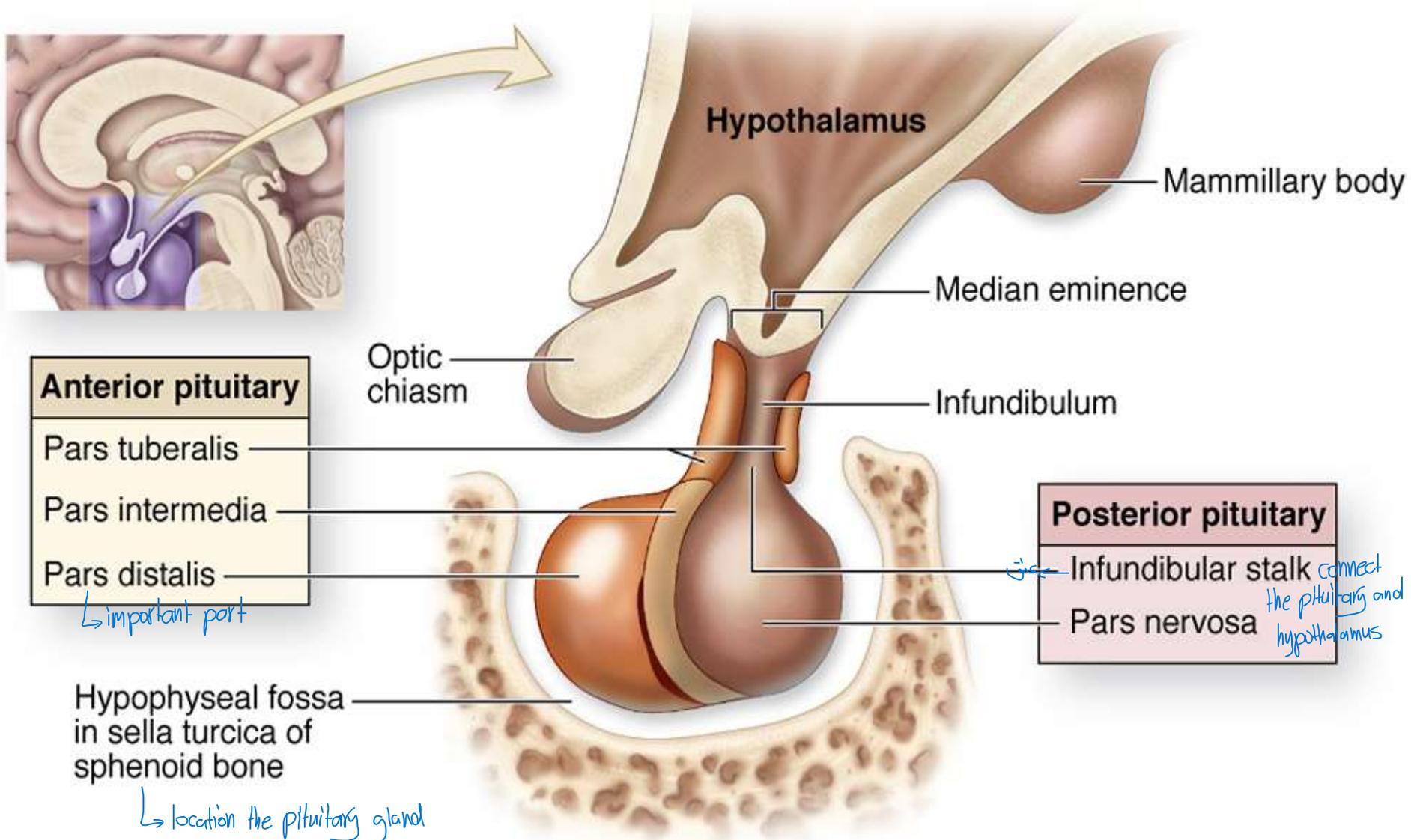


Fig.2: The sphenoid bone.

# Parts of the Pituitary Gland (Fig.3\*)



# Blood supply of the pituitary

- The blood supply derives from two groups of vessels coming off the internal carotid artery: *→ artery that supplied the brain in blood (and supplied pituitary gland)*
  1. The **inferior hypophyseal arteries** provide blood mainly for the neurohypophysis. *↳ supplied posterior pituitary gland*
  2. The **superior hypophyseal arteries** form a primary capillary network irrigating the stalk. The capillaries then rejoin to form venules (the hypophyseal portal veins) that branch again as a larger secondary capillary network in the pars distalis. Through this hypophyseal portal system, hormones from the hypothalamus pass to the anterior pituitary gland. *→ in figure 6*
- Hormone-rich venous blood leaves the pituitary gland by the **anterior and posterior hypophyseal veins**

*→ supplied anterior pituitary but possess more branches*

⇒ anterior pituitary that supplying the blood by?

internal carotid artery → work the network of capillaries artery →  
two hypophyseal portal vein → network from capillaries vein → exit as anterior  
hypophyseal vein (venules)

⇒ because exit from posterior pituitary

⇒ arteries  
⇒ network from capillaries upon the stalk called hypophyseal capillaries

⇒ network from capillaries vein around anterior pituitary

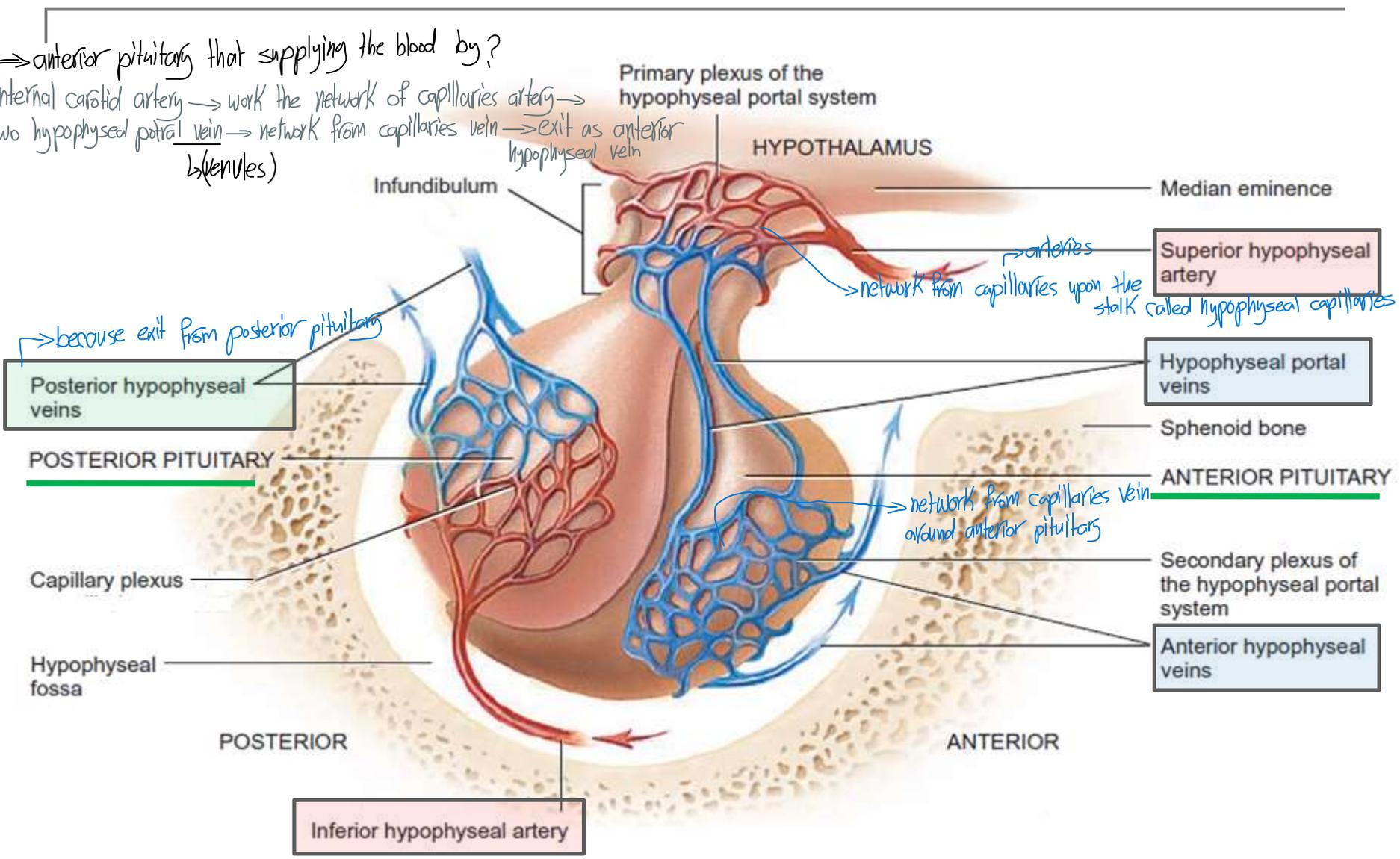


Fig.4: Blood supply of the pituitary gland.

pituitary stimulate the gland to release hormone

# Anterior Pituitary

- The synthesis and release of hormones of the anterior pituitary are controlled by releasing and inhibiting hormones from the hypothalamus and by feedback regulation.  
*↳ from the body (organ)*  
*↳ positive → increase secretion*  
*↳ negative → stop secretion*
- Hypothalamic hormones made by neurosecretory cells transported by axons to hypophyseal portal system.  
*↳ transport to the anterior pituitary*  
*↳ secretion the hormone that responsible on the anterior pituitary*
- Anterior pituitary hormones act on other glands.

## Hormones secreted by the anterior pituitary

Hormone	Target
Growth Hormone (GH) <i>→ from epiphyseal plate in bone</i>	Several
Thyroid Stimulating Hormone (TSH) <i>→ stimulate the gland to secrete T<sub>3</sub>, T<sub>4</sub></i>	Thyroid gland
*Adrenocorticotrophic Hormone	Adrenal cortex <i>→ hormone, medulla → sympathetic</i>
Follicle Stimulating Hormone (FSH)	Ovaries and Testes
Leutinizing Hormone (LH)	
Prolactin <i>→ milk hormone</i>	Breast <i>→ e-s-w</i>

# Posterior Pituitary

↳ not active as the hormone in anterior pituitary

⇒ the part in hypothalamus responsible on :-

- ① the hormone that control in anterior pituitary :- neurosecretory cell
- ② the hormone that control in the posterior pituitary :- cell body of neuron in the hypothalamus

■ **Does not synthesize hormones.**

■ **Releases the following hormones:** two hormone?

1. **Oxytocin**

2. **Antidiuretic Hormone (ADH) = Vasopressin** ⇒ ↓ urine, ↑ absorption Na<sup>+</sup>, H<sub>2</sub>O

■ **Contains:**

1. Nerve endings ⇒ pour the secretion in the posterior pituitary

2. Astrocyte-like cells called **Pituicytes**.

■ Cell bodies of neurons in the hypothalamus synthesize these hormones. They're then transported through axons in the **hypothalamo-hypophyseal tract** to the nerve endings in the posterior pituitary. Here they **remain stored**. **When need arises, they're released from the nerve endings to pass into blood.**

⇒ dendrite + axon + body ⇒ (cell body in hypothalamus, the axon in posterior pituitary)

⇒ transport the hormone from hypothalamus to ending nerve in posterior pituitary

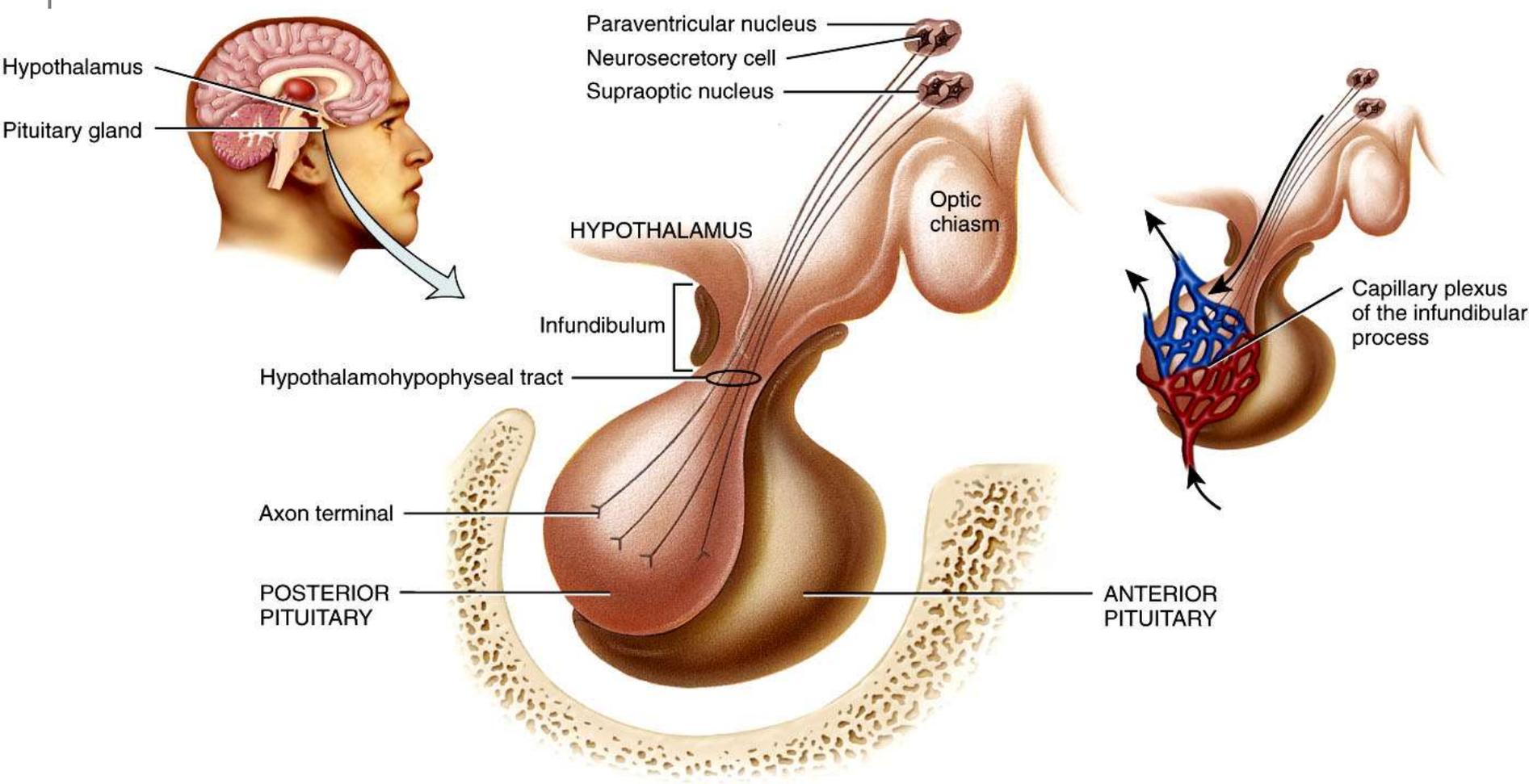


Fig.5: Hypothalamo-hypophyseal tract.

# The Thyroid Gland

↪ extend superior from larynx (thyroid cartilage) to tracheal canal (tracheal cartilage)

Fig.6: The thyroid gland.

- A butterfly-shaped gland located inferior to larynx

- Formed of:

↪ as sphenoid

↪ ↪

1. Two lobes (right and left) that extend from the thyroid cartilage to the level of 5<sup>th</sup> tracheal cartilage. They're related to the:

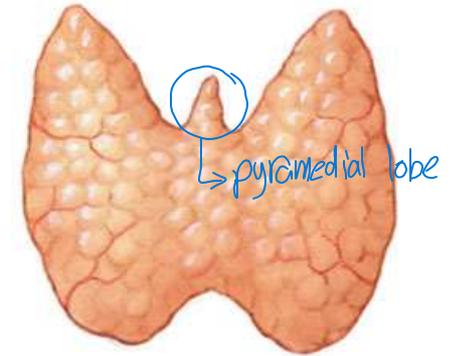
- ① Common carotid artery and internal jugular vein
- ② *External and recurrent laryngeal nerves*

2. Isthmus: a mass of thyroid tissue that connects the two lobes..

3. A Pyramidal lobe may sometimes be present extending superiorly from the isthmus.

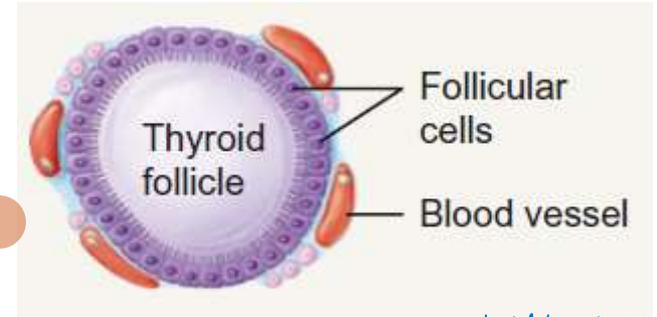
- The gland is highly vascular. It's supplied by the superior and inferior thyroid arteries. ↪ subclavian artery, external carotid artery

- It's covered by a connective tissue capsule.



# Histology of the thyroid gland

- The thyroid gland consist of numerous spherical structures called the **thyroid follicles**.  
*↳ group from the thyroid follicle*



- The follicles are lined by epithelial cells (the **follicular cells**) that range from squamous to columnar according to activity (the more active cells are larger).  
*↳ more secretion*

- Within each follicle there is a **lumen** into which the thyroid hormones are secreted.  
*↳ inside it hormone that secretion by thyroid gland*

- **The thyroid gland is unique in that it's the only endocrine gland in the body that stores its hormones outside the cells.**

- Between the follicles, there's another type of cell, called the **parafollicular or C-cells**, that secrete the hormone calcitonin.  
*حاجات*

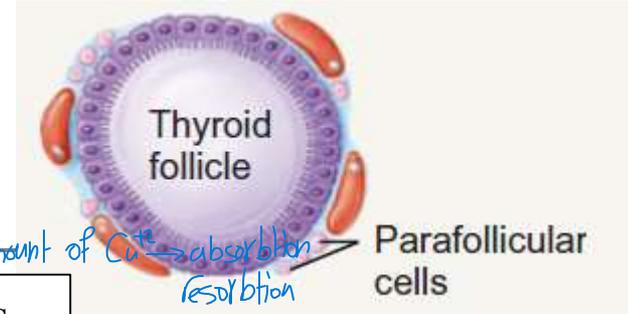


Fig.7: Thyroid follicles and the C-cells.

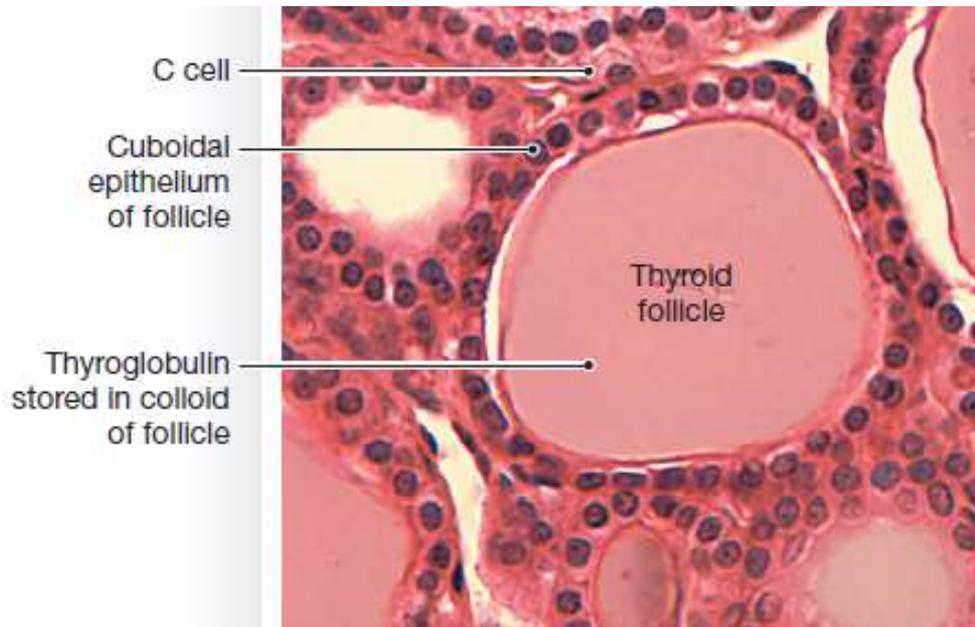


Fig.8: Histology of the thyroid gland.

- The thyroid hormones include: *secretion by thyroid cell or thyroid follicular cell*
  - Tri-iodothyronin (T3)
  - Tetra-iodothyronin (T4) = thyroxin
- Both of these hormones affect the **body metabolism**. *→ catabolism and anabolism*
- Both of these hormones are **controlled by TSH** from the **pituitary gland** and by **feedback mechanism**. *↳ anterior part*

# The Parathyroid Gland → four glands

two hormone that control of the amount  $Ca^{2+}$ :-  
① hormone calcitonin secrete by c-cell.  
② hormone parathyroide secrete by chief cell.

- Four glands Embedded in the posterior aspect of the lobes of the thyroid gland. Each one is surrounded by its own capsule.

- Has two types of cells:

1. **Chief (Principal) cells:** secrete the Parathyroid Hormone (PTH = parathormone) that regulates level of calcium and phosphate in blood.

2. **Oxyphil cells ?!** until now not known

- Blood calcium level directly controls secretion of both calcitonin and PTH.

↳ hypertrophy

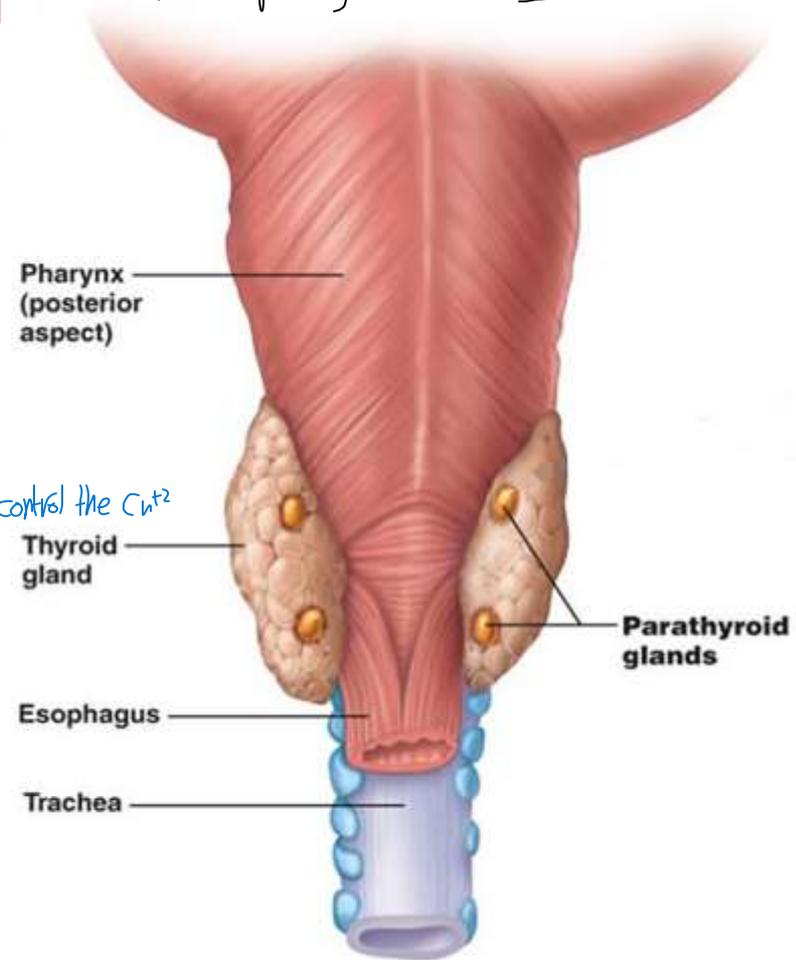


Fig.9: Position of the parathyroid gland.

# The Adrenal (Suprarenal) Glands

- Two yellowish glands located on the **upper poles of the two kidneys**.
- The **right gland is pyramidal in shape**, whereas the **left is crescentic in shape**.
- Each gland is **surrounded by a capsule** and composed of **two anatomically and functionally distinct regions**:
  1. **Outer yellow cortex**: divided into the **zona glomerulosa**, **zona fasciculata** and **zona reticularis**.
  2. **Inner brown medulla**: a modified **sympathetic ganglion** that **synthesizes and secretes the hormones epinephrine and norepinephrine**.

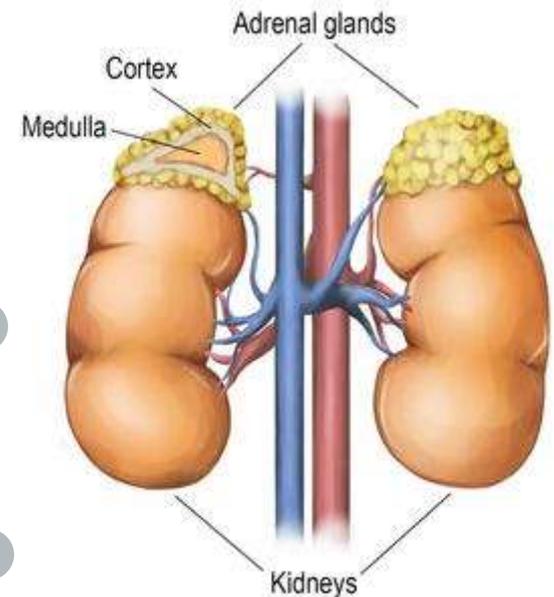


Fig.10: The suprarenal glands.

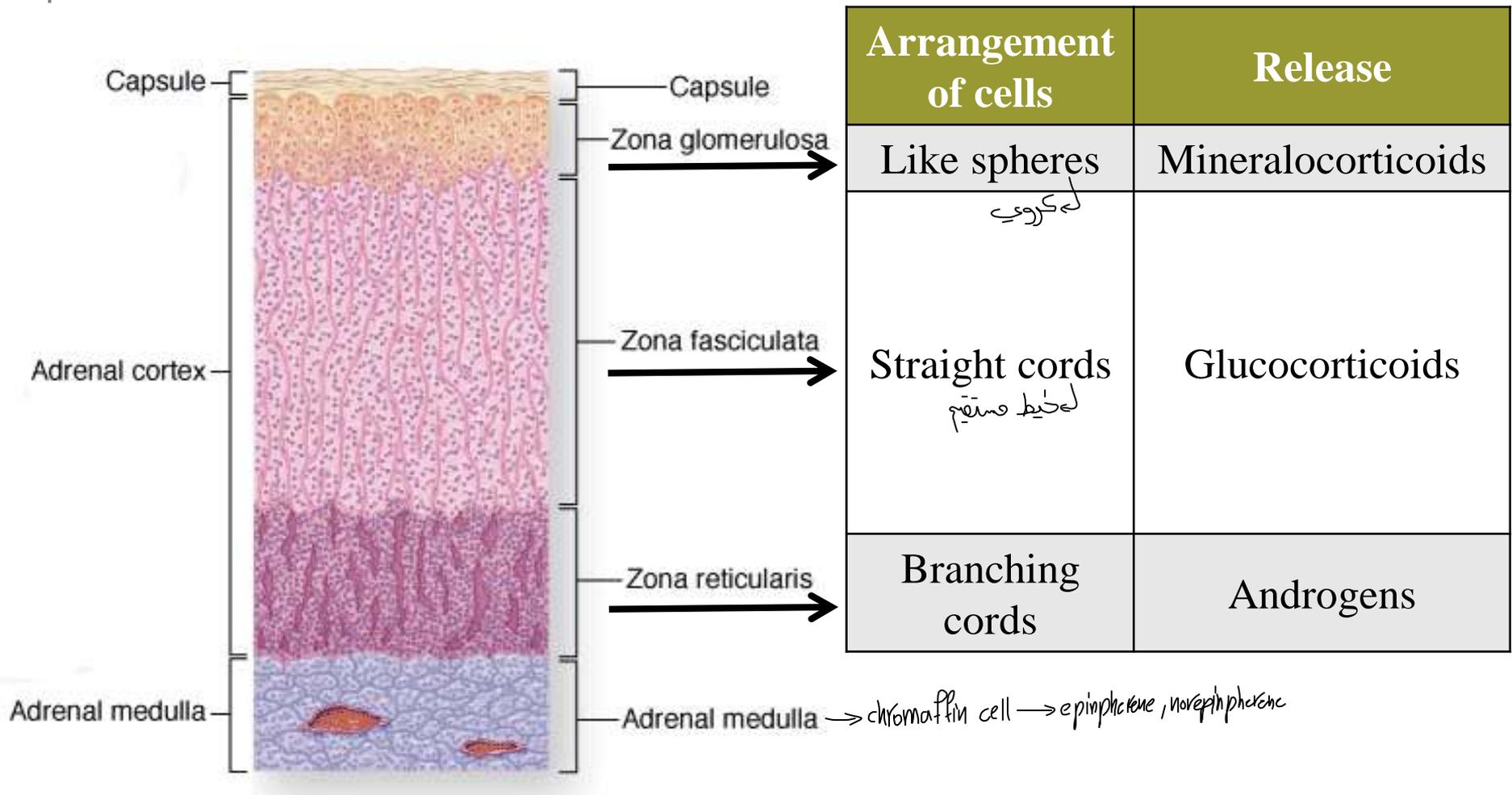


Fig.11: The histology of the suprarenal glands.