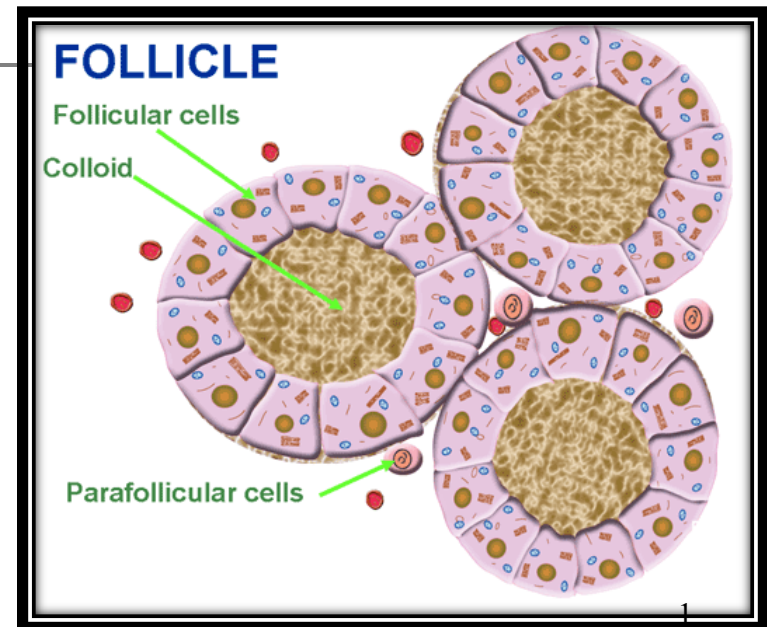


# The Endocrine System

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# Endocrine Glands

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

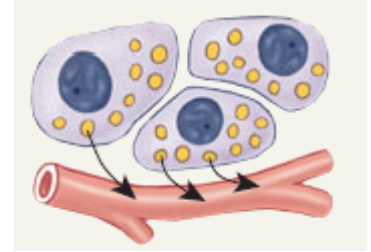


Fig.1: Endocrine secretion.

- Endocrine glands include:
  - Pituitary, thyroid, parathyroid, adrenal, and pineal glands.
  - Hypothalamus, thymus, pancreas, ovaries, testes, kidneys, stomach, liver, small intestine, skin, heart, adipose tissue, and placenta also have endocrine function.

# The Hypothalamus

- Part of the diencephalon of the brain.
- Located inferior to the thalamus.
- *It's a major link between the nervous and the endocrine systems.*
- It's connected to the pituitary gland by blood vessels and nerve fibers.
- It secretes a number of hormones that control the secretions of the pituitary gland.

# The Pituitary Gland (The Hypophysis)

- Located in the hypophyseal fossa of the sphenoid bone.
- Considered as the '*Maestro Gland*' because it releases various hormones that control all the major endocrine glands of the body.
- It's formed of two anatomical and functional parts:
  1. The Adenohypophysis (Anterior Pituitary)
  2. The Neurohypophysis (Posterior Pituitary)

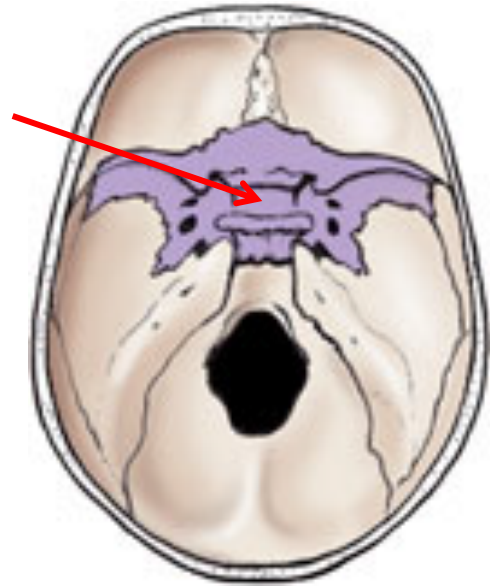
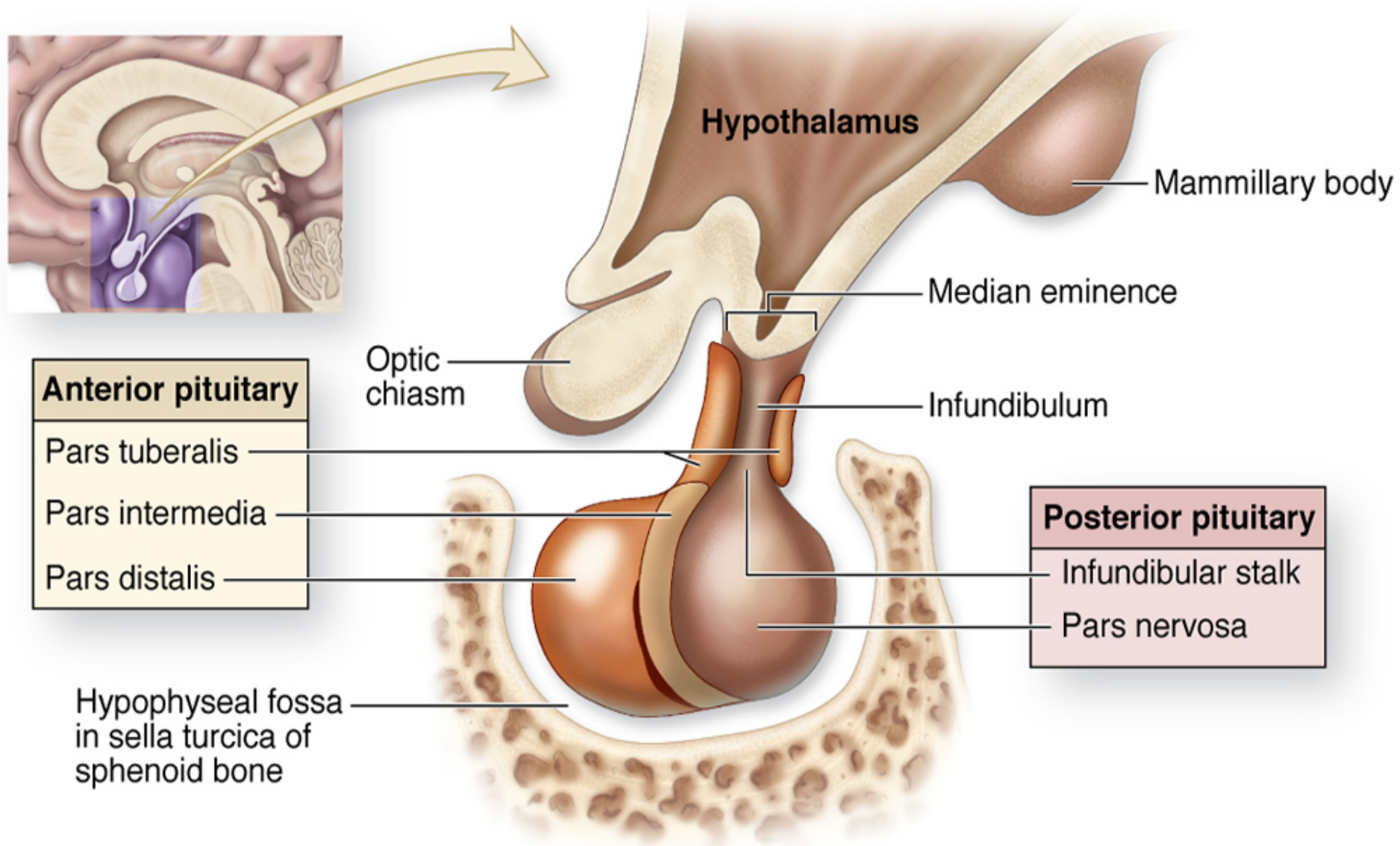


Fig.2: The sphenoid bone.

# 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:
  1. The *inferior hypophyseal arteries* provide blood mainly for the neurohypophysis.
  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.
- Hormone-rich venous blood leaves the pituitary gland by the *anterior and posterior hypophyseal veins*

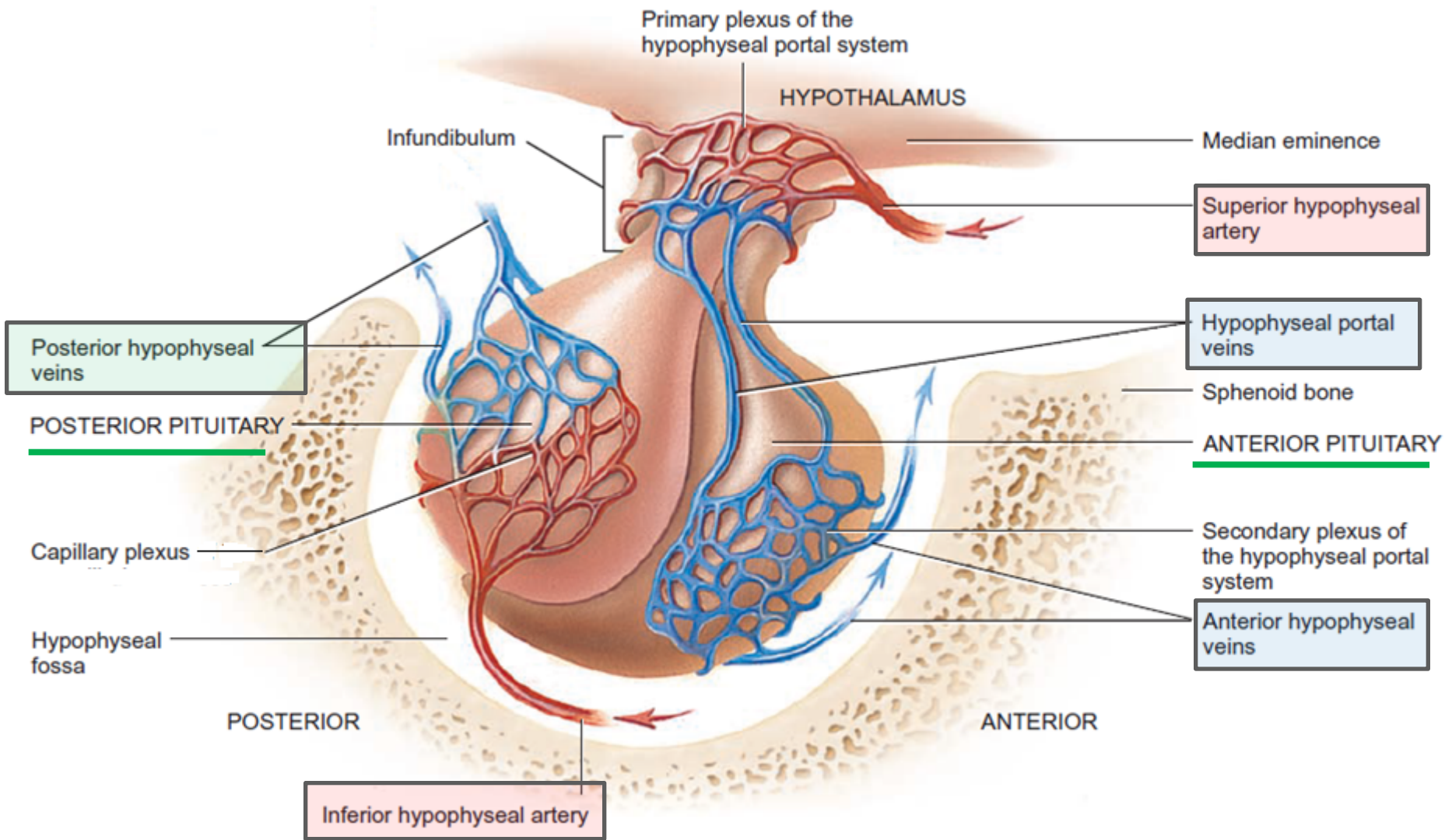


Fig.4: Blood supply of the pituitary gland.

# 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.
- Hypothalamic hormones made by neurosecretory cells transported by axons to hypophyseal portal system.
- Anterior pituitary hormones act on other glands.

| Hormones secreted by the anterior pituitary |                    |
|---------------------------------------------|--------------------|
| Hormone                                     | Target             |
| Growth Hormone (GH)                         | Several            |
| Thyroid Stimulating Hormone (TSH)           | Thyroid gland      |
| Adrenocorticotrophic Hormone                | Adrenal cortex     |
| Follicle Stimulating Hormone (FSH)          | Ovaries and Testes |
| Leutinizing Hormone (LH)                    |                    |
| Prolactin                                   | Breast             |

# Posterior Pituitary

- *Does not synthesize hormones.*
- *Releases the following hormones:*
  1. Oxytocin
  2. Antidiuretic Hormone (ADH) = Vasopressin
- Contains:
  1. Nerve endings
  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.

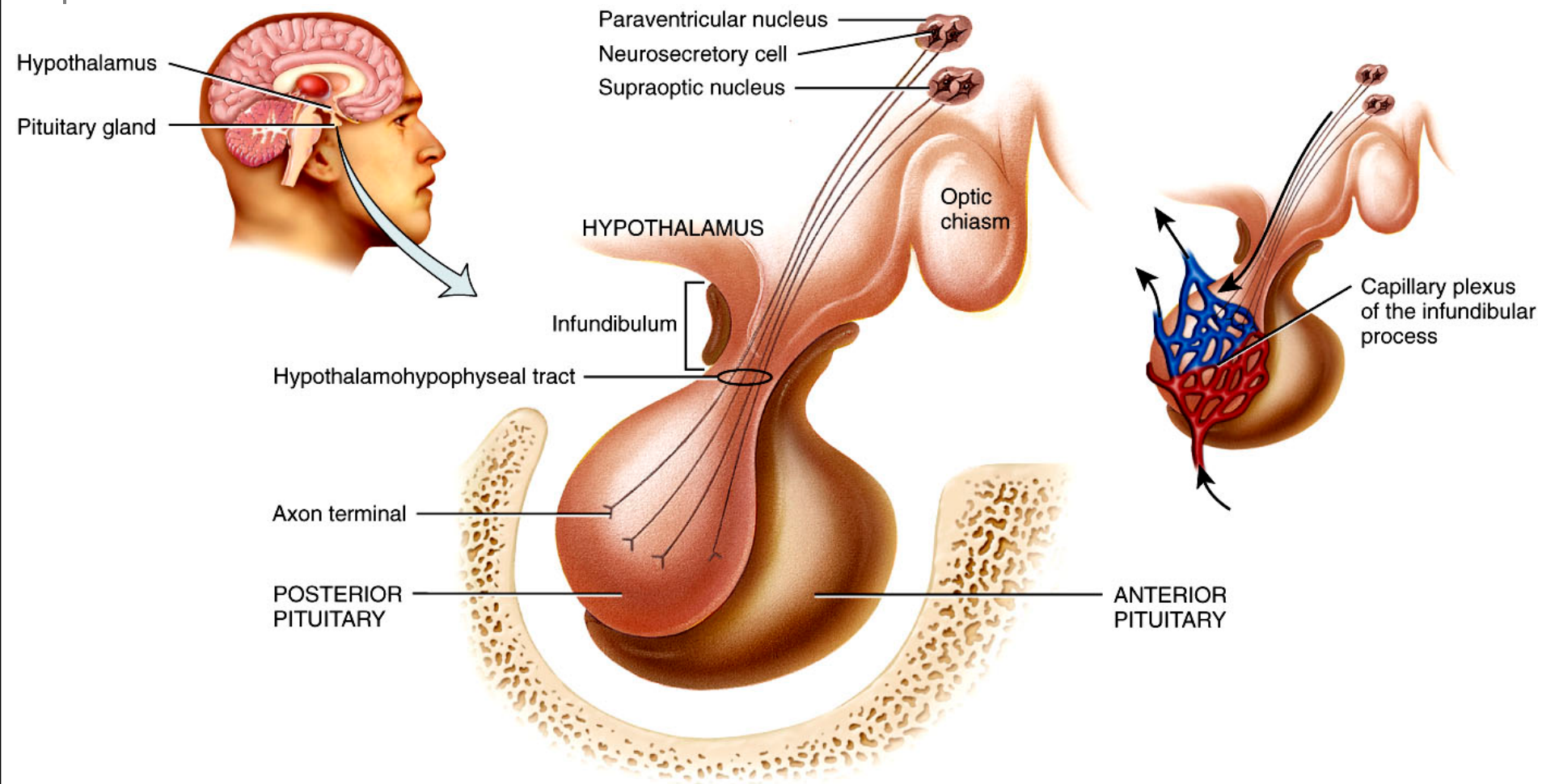


Fig.5: Hypothalamo-hypophyseal tract.

# The Thyroid Gland

Fig.6: The thyroid gland.

- A butterfly-shaped gland located inferior to larynx
- Formed of:
  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:
    - Common carotid artery and internal jugular vein
    - *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.
- 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*.
- 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).
- Within each follicle there is a lumen into which the thyroid hormones are secreted.
- *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.

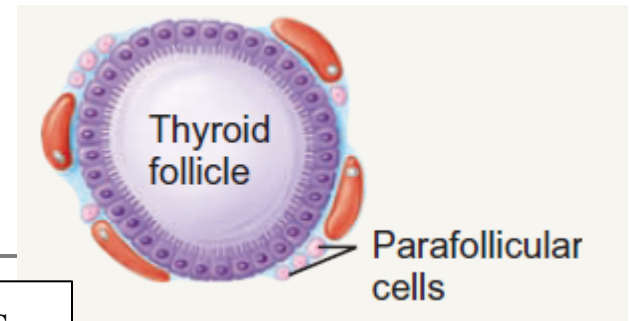
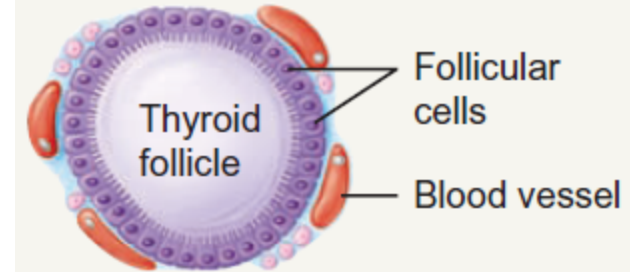


Fig.7: Thyroid follicles and the C-cells.

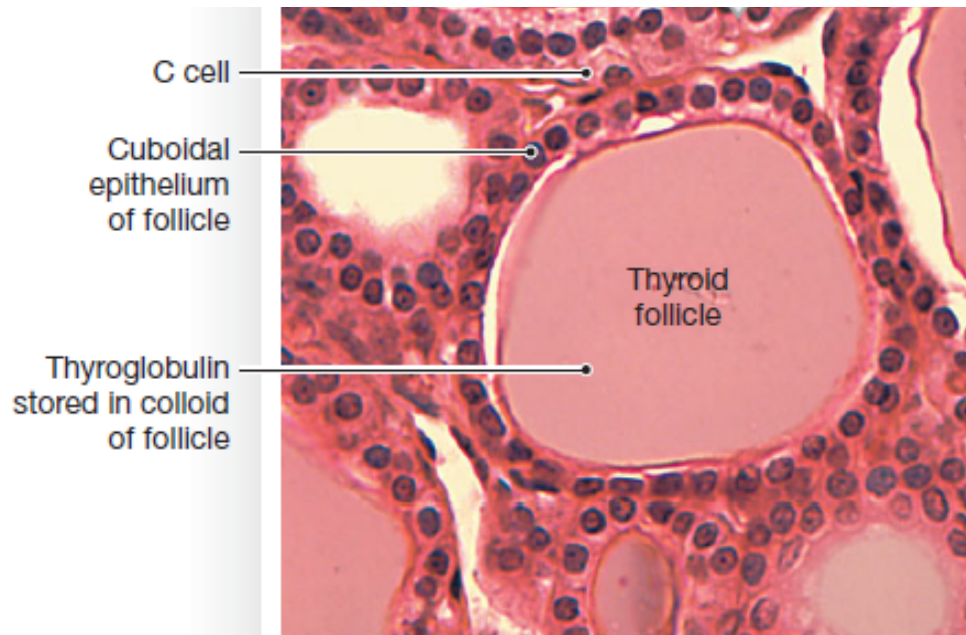


Fig.8: Histology of the thyroid gland.

- The thyroid hormones include:
  - Tri-iodothyronin (T3)
  - Tetra-iodothyronin (T4) = thyroxin
- Both of these hormones affect the body metabolism.
- Both of these hormones are controlled by TSH from the pituitary gland and by feedback mechanism.

# The Parathyroid Gland

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

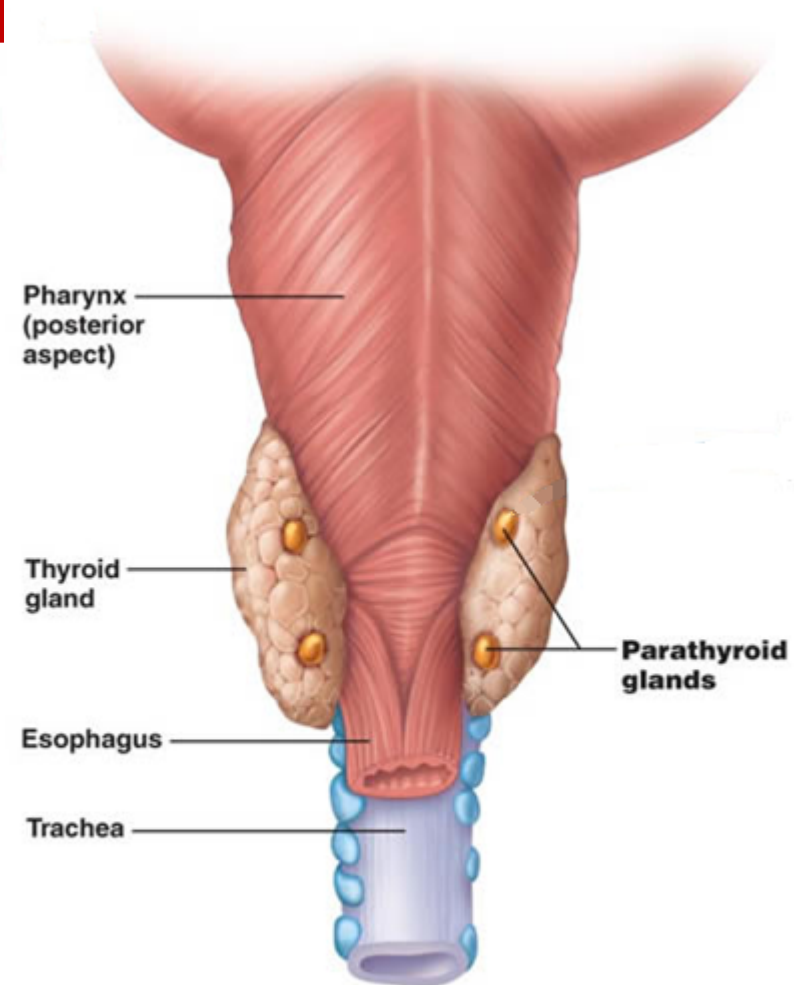


Fig.9: Position of the parathyroid gland.

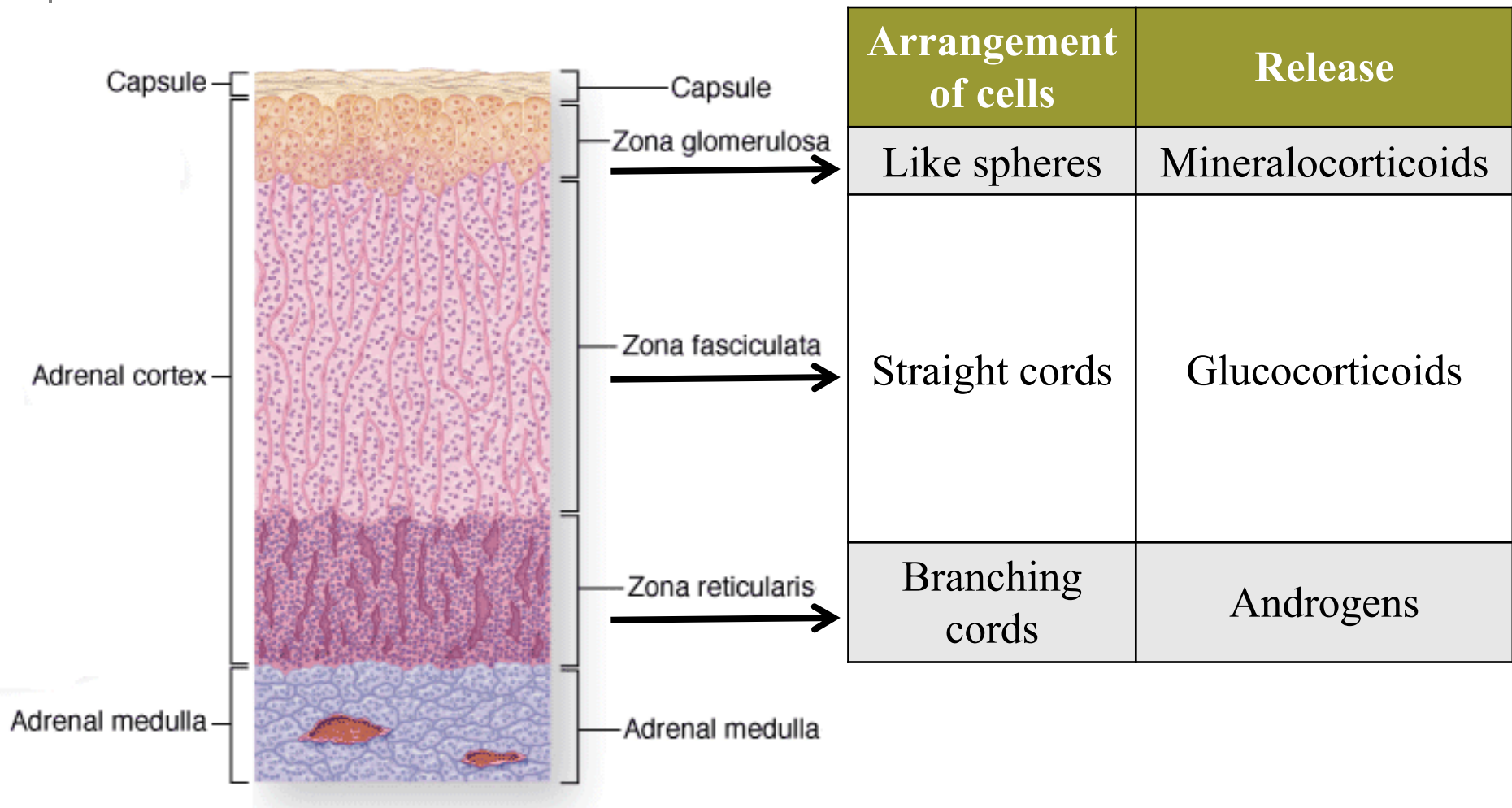


Fig.11: The histology of the suprarenal glands.

# 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.

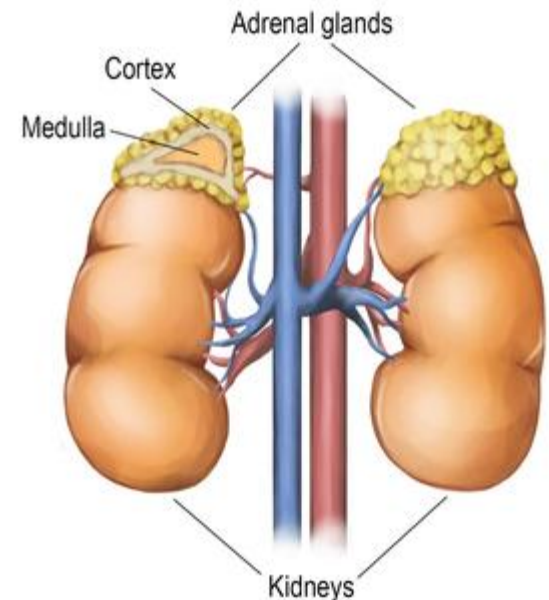


Fig.10: The suprarenal glands.