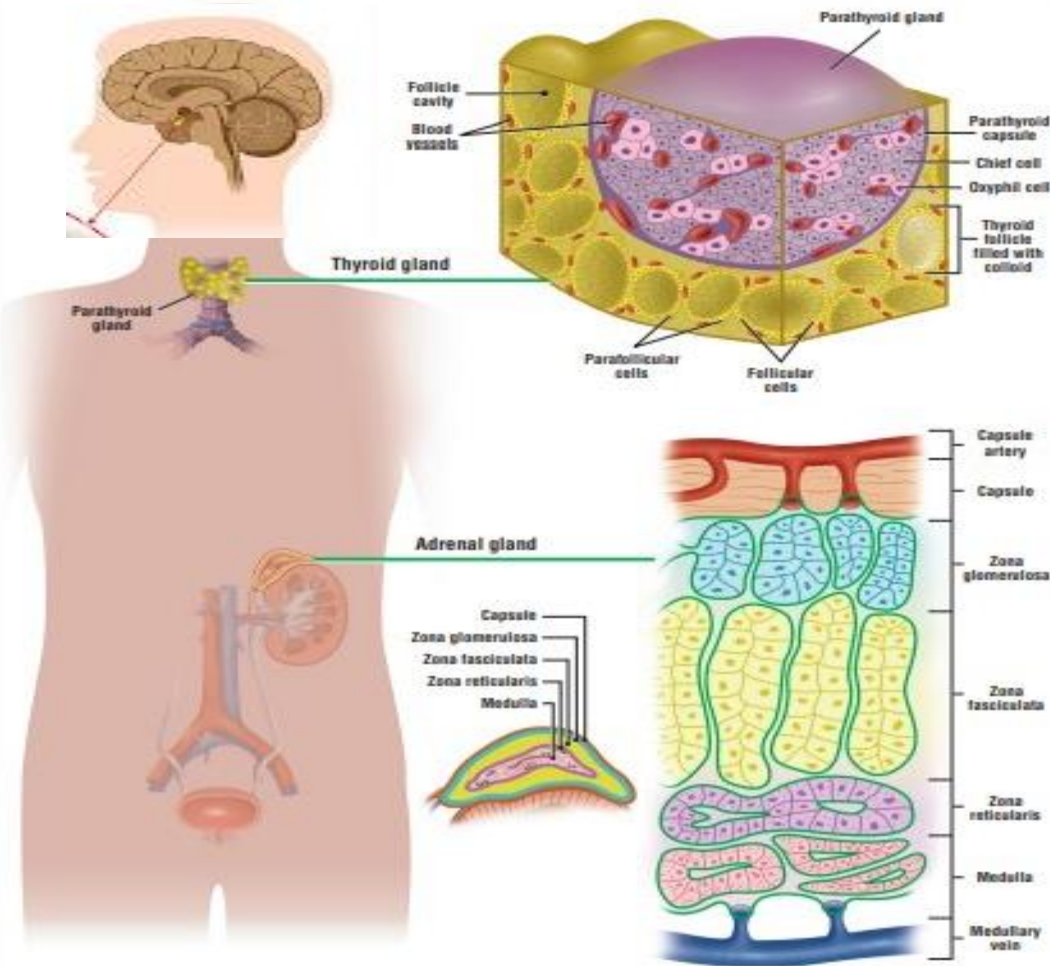




# General Histology / Year 2



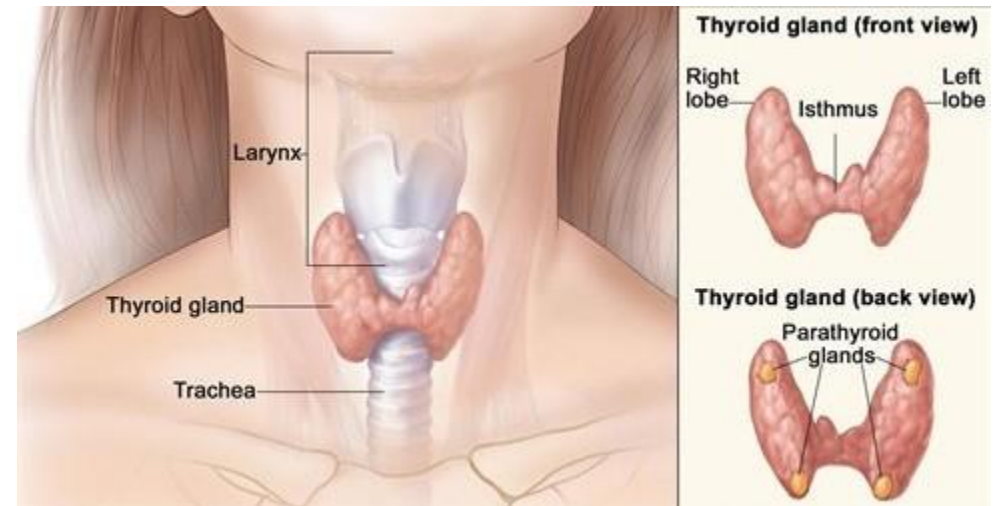
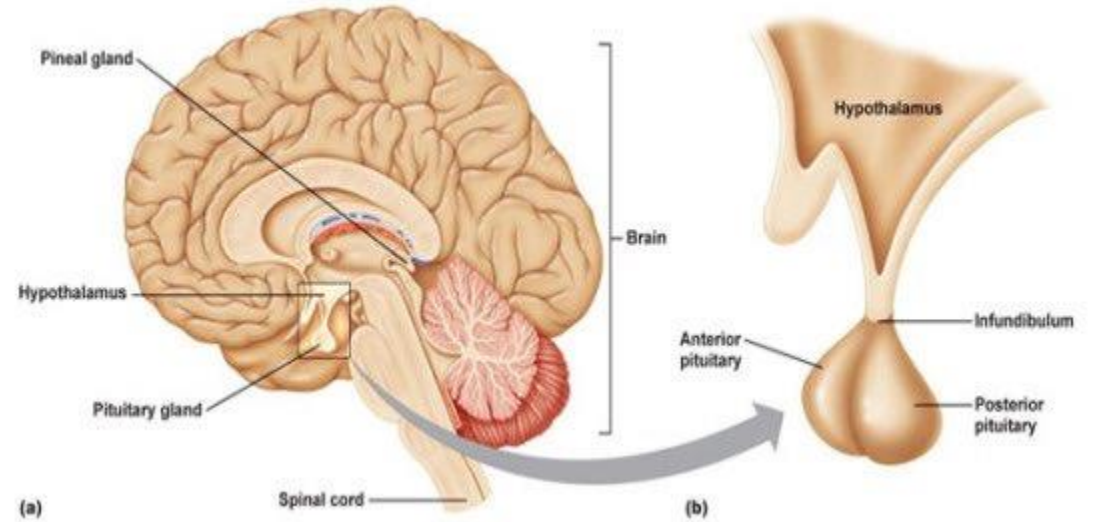
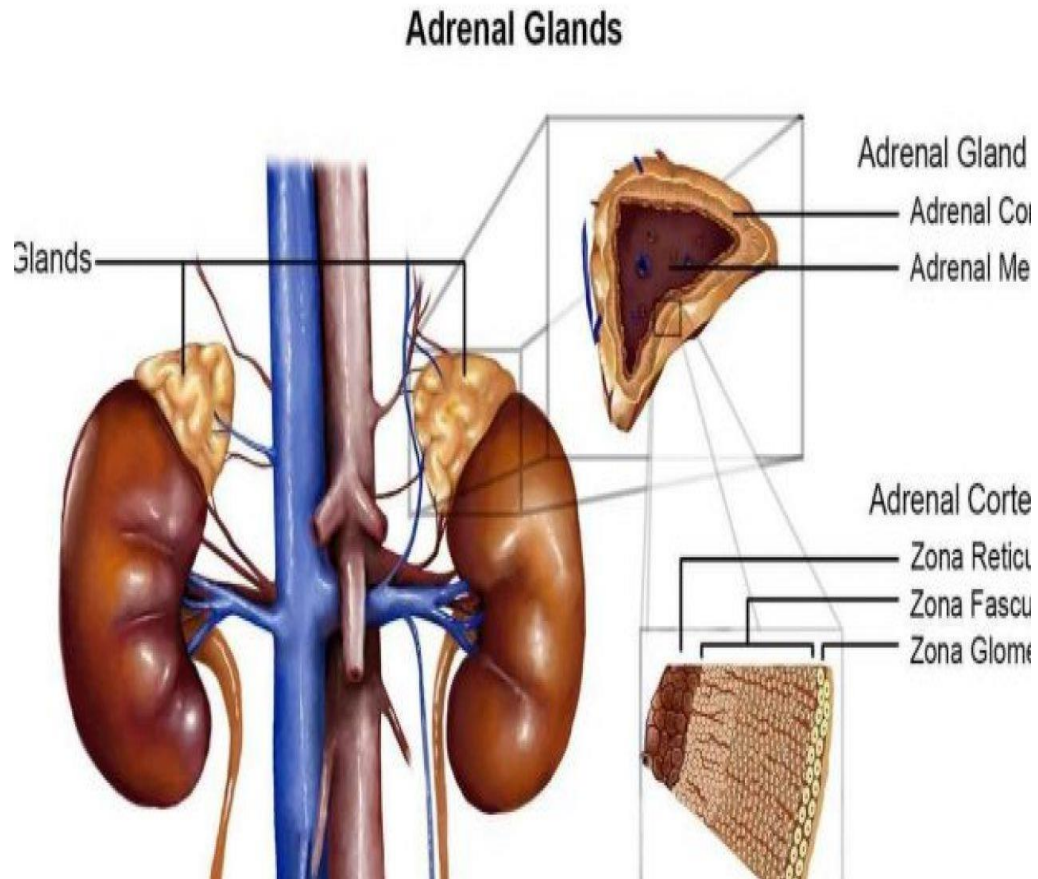
## *Endocrine System* Pituitary Gland, Thyroid Gland Parathyroid Glands, Adrenal Glands Lecture 10

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# Endocrine System

- The endocrine system consists of cells, tissues, and organs that synthesize and secrete products called hormones. The hormones are then released into the interstitial connective tissue from which the hormones pass directly into blood or lymph circulation.
- As a result, endocrine cells, tissues, glands, and organs are called ductless because they do not have excretory ducts for the release of their hormones.
- The cells in most endocrine tissues and organs are arranged into cords and clumps or follicle and are surrounded by an extensive capillary network.
- Hormones produced by endocrine cells include polypeptides, proteins, amino acid, and steroids.
- Hormones act at a distance from the site of their release, they enter the circulatory system to be transported to the target organs.
- Hormone receptors can be located either on the cell membrane, in the cytoplasm, or in the nucleus of target cells.
- There are complete endocrine organs and mixed organs with endocrine cells and tissues.

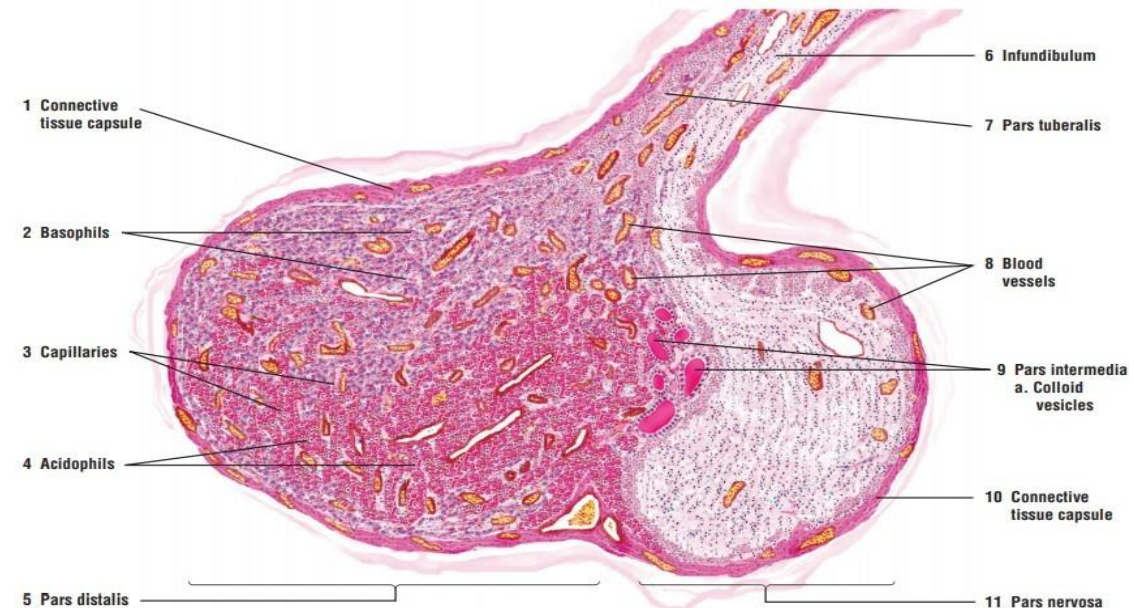
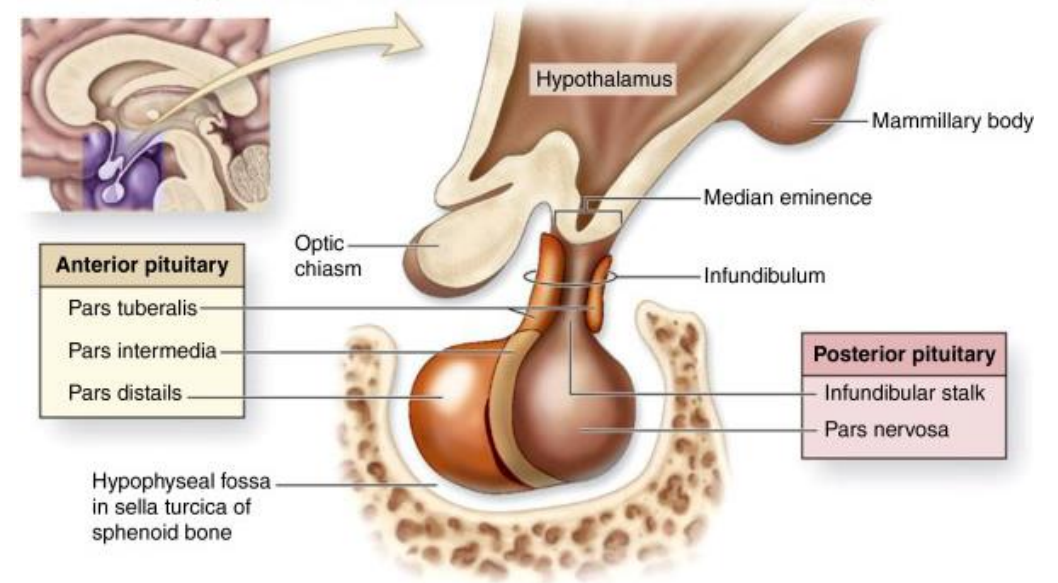
# Endocrine system





# Pituitary gland

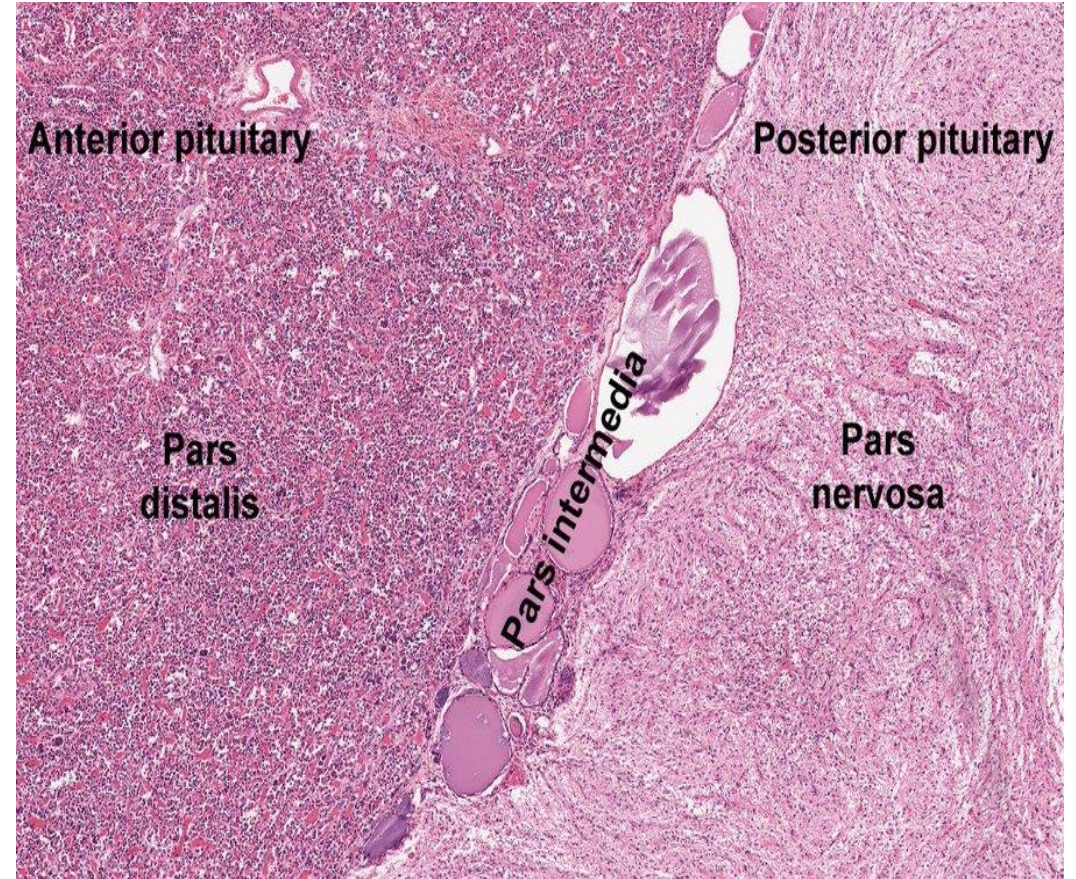
- The pituitary gland, also known as the hypophysis, is found at the base of the brain.
- **Adenohypophysis (anterior pituitary)** has three subdivisions:-
- **Pars distalis** is the largest part accounts for 75% of the adenohypophysis and is covered by fibrous capsule. The main components are cords of epithelial cells interspersed with fenestrated capillaries. Fibroblasts are present and produce reticular fiber supporting the cords of hormone-secreting cells.
- **Pars intermedia** is a rudimentary in humans. The pars intermedia is situated between the pars distalis and the pars nervosa .
- The pars intermedia normally contains colloid-filled vesicles that are surrounded by the cells of the pars intermedia.
- **Pars tuberalis** it is a superior extension that surrounds the infundibulum of the neurohypophysis. Most of the cells are basophilic gonadotropic cells. ( Highly vascular ).





# Pituitary gland

- Neurohypophysis (posterior pituitary) consists of three parts:-
- **Median eminence** is located at the base of hypothalamus.
- **Infundibulum** is the neural stalk that connects neurohypophysis to hypothalamus.
- **Pars nervosa** is the largest portion that consists of unmyelinated axons and pituicytes.
- A connective tissue capsule, surrounds the pars distalis and pars nervosa.



# Cells and Hormones of Adenohypophysis

- **Adenohypophysis** - Pars distalis ( irregular cords of polygonal cells ).
- Based on stains, there are three cell types: **chromophils** cells (acidophils, basophils) they have granular darkly stained cytoplasm. And **chromophobes** cells They are smaller than the chromophils, have a non granular pale cytoplasm ( few organelles).
- **Acidophils** are subdivided into somatotrophs and mammotrophs :-
- **1-Somatotrophs:-** Secrete somatotropin or growth hormone for cell metabolism and general body growth.
- **2-Mammotrophs:-**Produce prolactin that stimulates mammary gland development during pregnancy. Prolactin maintains milk production after Childbirth.
- These cells are small, but in pregnant and lactating females they become large and numerous and are called pregnancy cells.

# Cells and Hormones of Adenohypophysis

- **Basophils** are subdivided into thyrotrophs, gonadotrophs, and corticotrophs :-
  - **1-Thyrotrophs:-** Release thyroid-stimulating hormone that stimulates thyroid gland hormones (TSH).
  - **2-Gonadotrophs:-** Secrete both follicle-stimulating hormone (FSH), and leuteinizing hormone (LH)
  - **3-Corticotrophs:-** Secrete adrenocorticotrophic hormone (ACTH) to regulate adrenal gland.

# Cells and Hormones of Neurohypophysis

- Contains axonal hypothalamohypophyseal tract and supportive cells pituicytes.
- Does not have any secretory cells; secretory neurons are located in hypothalamus of brain.
- Releases two hormones from axon terminals, oxytocin and antidiuretic hormone (vasopressin)
- **Oxytocin**:- Stimulates contraction of smooth uterine muscles during Childbirth. Activates milk ejection in lactating glands by stimulating contraction of myoepithelial cells.
- **Antidiuretic Hormone (ADH)**:- Increases permeability to water in distal convoluted tubules and collecting ducts of kidney. Creates more concentrated urine after water is reabsorbed.



# Hypothalamus

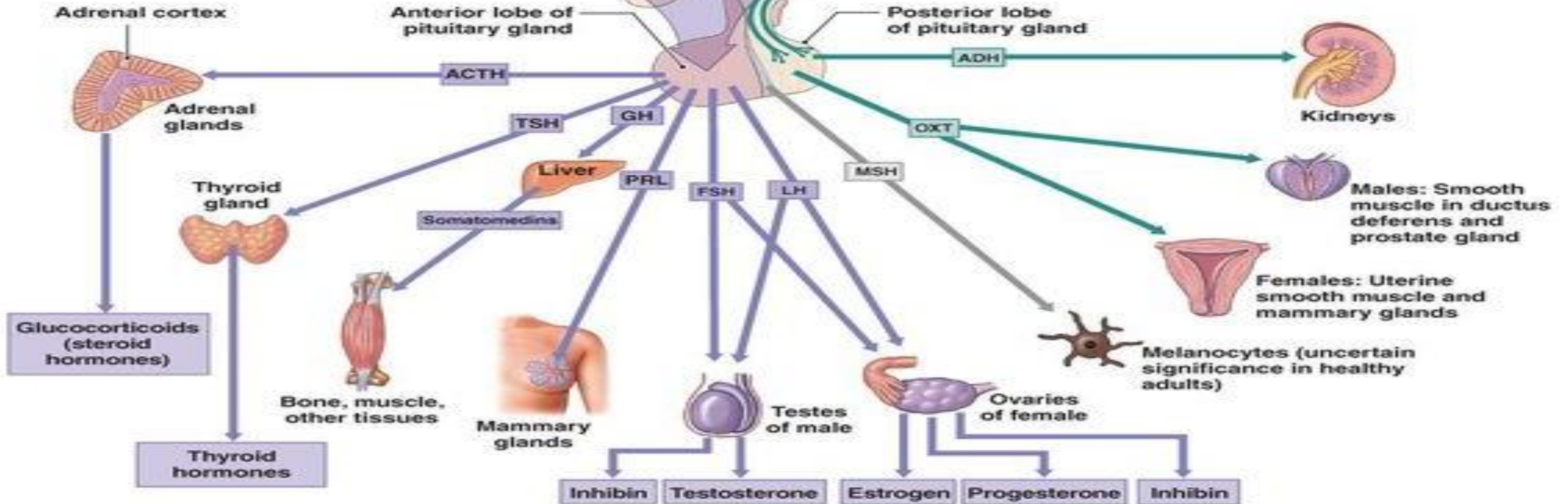
## Indirect Control through Release of Regulatory Hormones

- Corticotropin-releasing hormone (CRH)
- Thyrotropin-releasing hormone (TRH)
- Growth hormone-releasing hormone (GH-RH)
- Growth hormone-inhibiting hormone (GH-IH)
- Prolactin-releasing factor (PRF)
- Prolactin-inhibiting hormone (PIH)
- Gonadotropin-releasing hormone (GnRH)

## Direct Release of Hormones

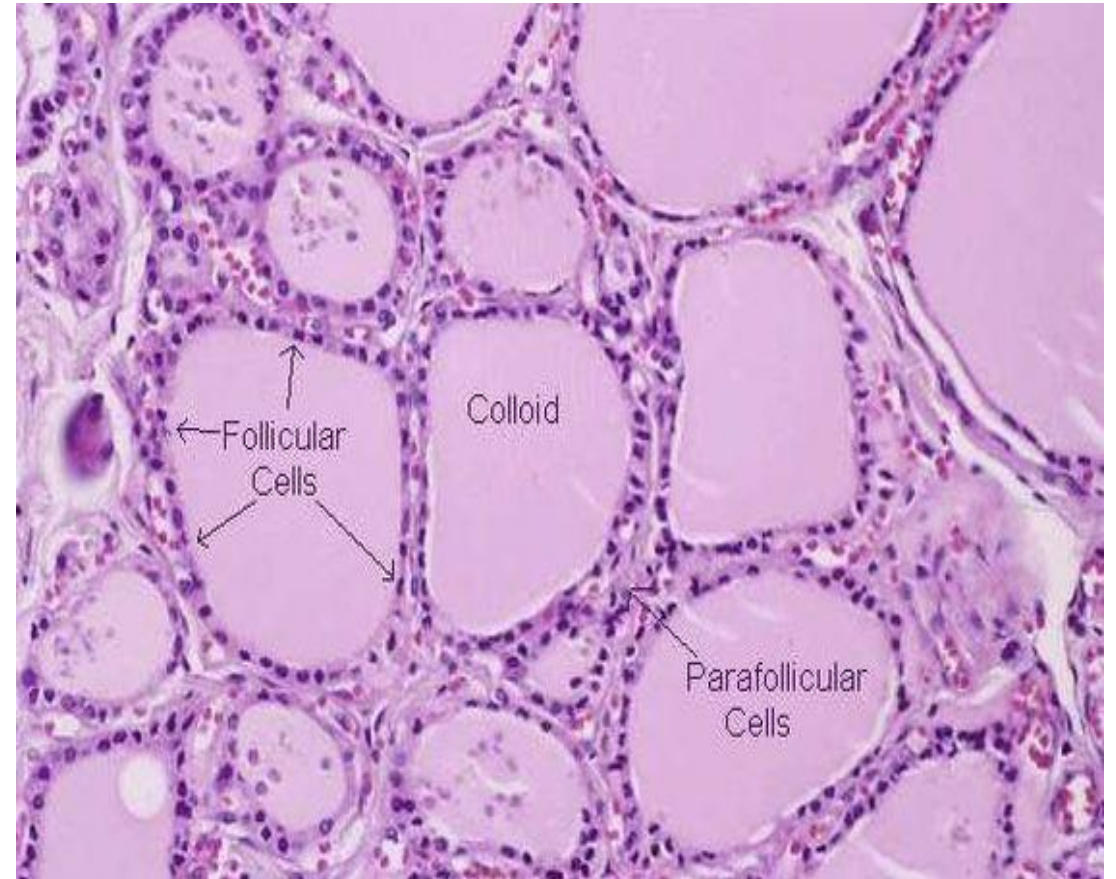
- Sensory stimulation
- Osmoreceptor stimulation

Regulatory hormones are released into the hypophyseal portal system for delivery to the anterior lobe of the pituitary gland.



# Thyroid Gland

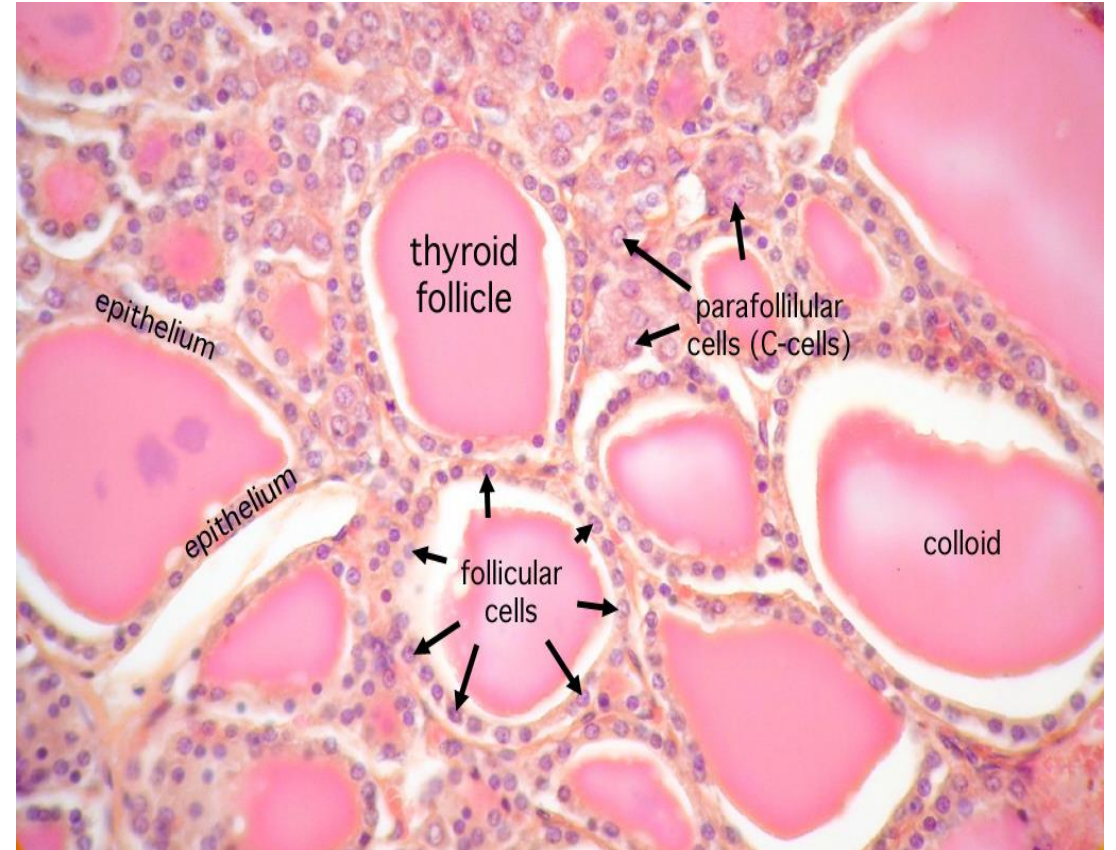
- The thyroid gland lies in the anterior aspect of the lower part of the neck. It consists of two lobes connected by an isthmus.
- The thyroid gland is a unique endocrine organ in that its cells are arranged into spherical structures, called follicles, where the hormones are stored extracellular and not intracellular.
- Each follicle is lined with a single layer of follicular cells and surrounded by reticular fibers.
- The follicular epithelium can be simple squamous, cuboidal, or low columnar, depending on the state of activity of the thyroid gland.





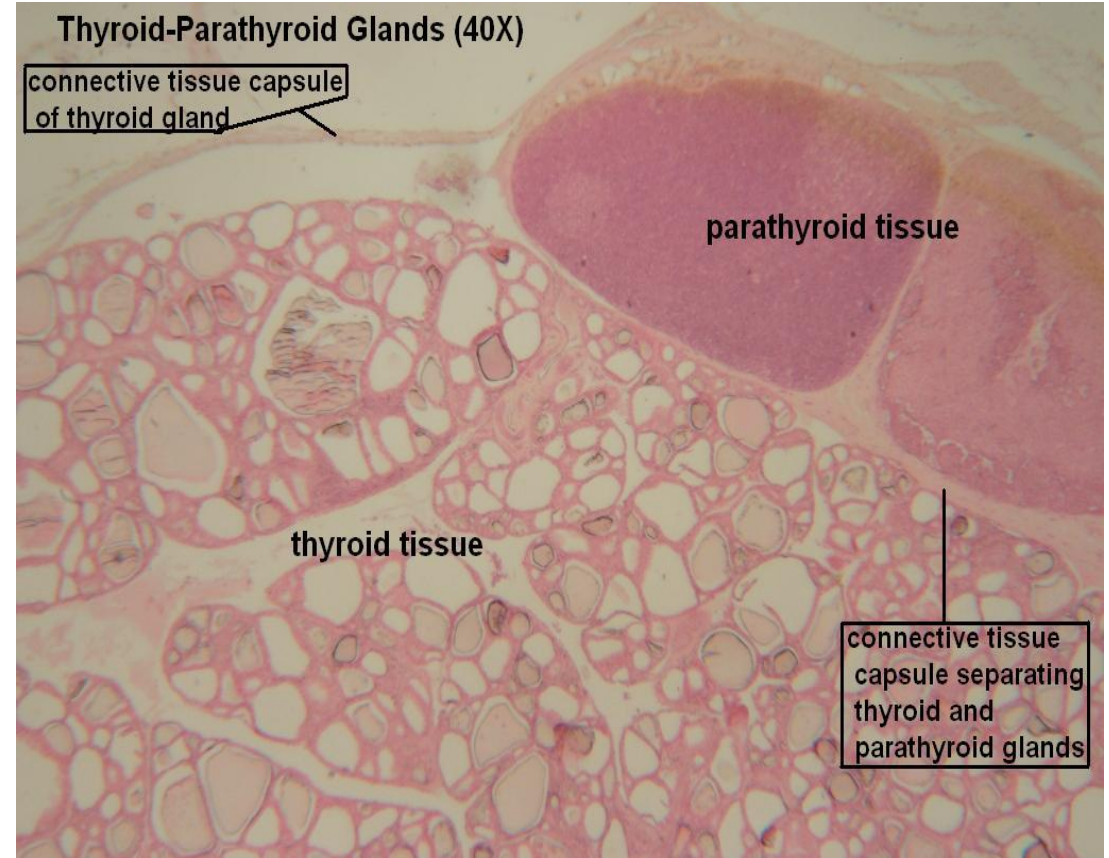
# Thyroid Gland

- Follicles are the structural and functional units of the thyroid gland. Secretion Thyroid hormone Triiodothyronine and tetraiodothyronine (T3 and T4)
- **Thyroid hormones** increase metabolic rate, growth, differentiation, and body development.
- Para follicular cells (C or clear cells):- Cells are located in follicular peripheries of thyroid gland.  
Parafollicular cells secrete **calcitonin**, to lower blood calcium by inhibiting osteoclasts.  
- Cells act independent of pituitary gland hormones, but depend on calcium levels.



# Parathyroid Glands

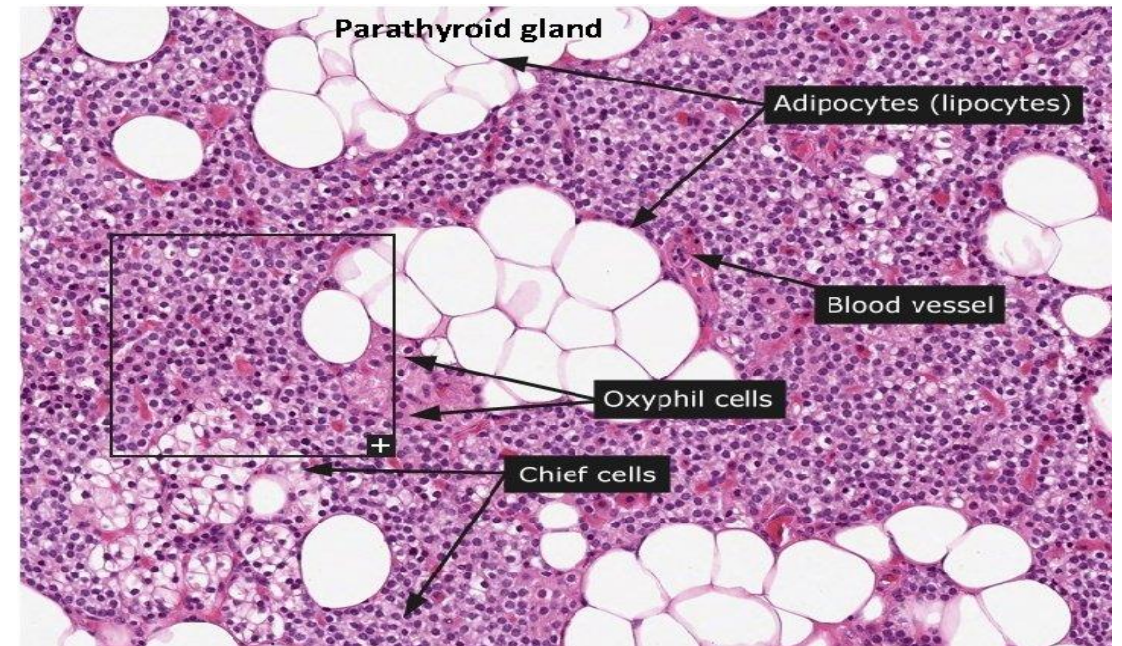
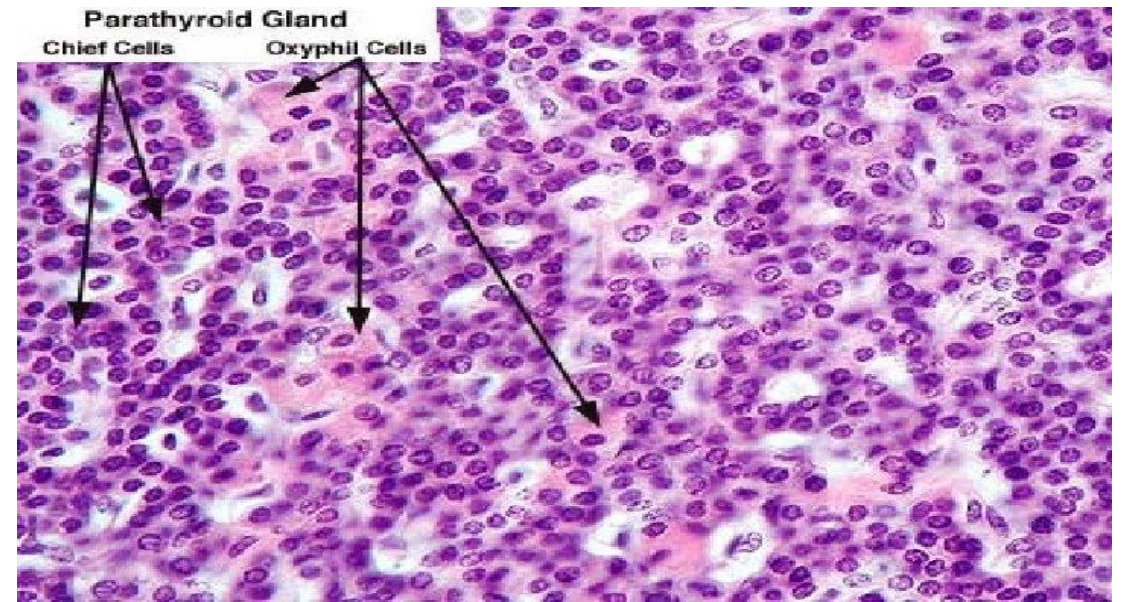
- In human generally have four parathyroid glands. These small oval glands are embedded on the posterior surface of the thyroid gland but are separated from the thyroid gland by a thin connective tissue capsule.
- The cells of the parathyroid glands are arranged into cords or clumps, surrounded by a rich network of capillaries.
- There are two types of cells in the parathyroid glands: **functional principal**, or **chief cells**, and **oxyphil cells**.





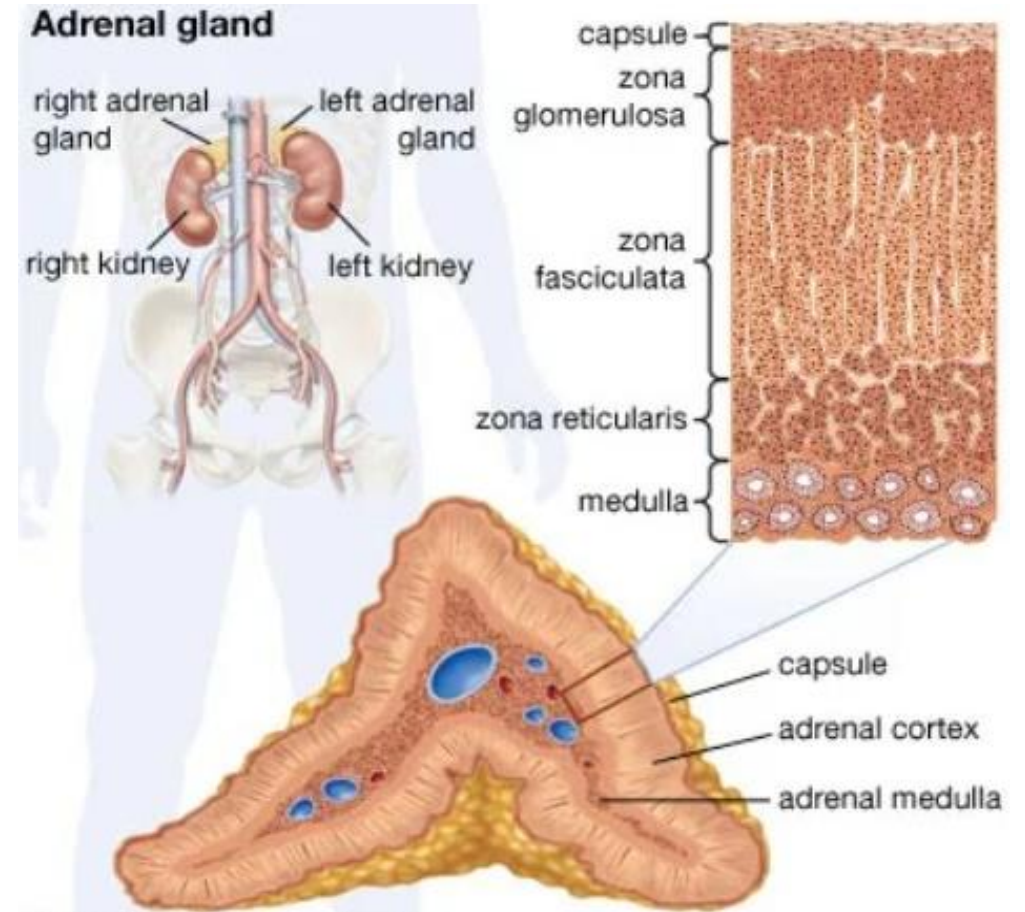
# Parathyroid Glands

- Oxyphil cells are larger, are found singly or in small groups, and are less numerous than the principal (chief cells).
- Function of oxyphil cells not presently known but may represent old chief cells.
- Function Chief cells produce parathyroid hormone (parathormone) to maintain proper calcium
- Parathyroid hormone counterbalances calcitonin action. It stimulates osteoclasts activity to release more calcium into blood.
- With increasing age: the chief cells are replaced by fat cells which may constitute more than 50% of the gland. The number of oxyphil cells increases.



# Adrenal Glands

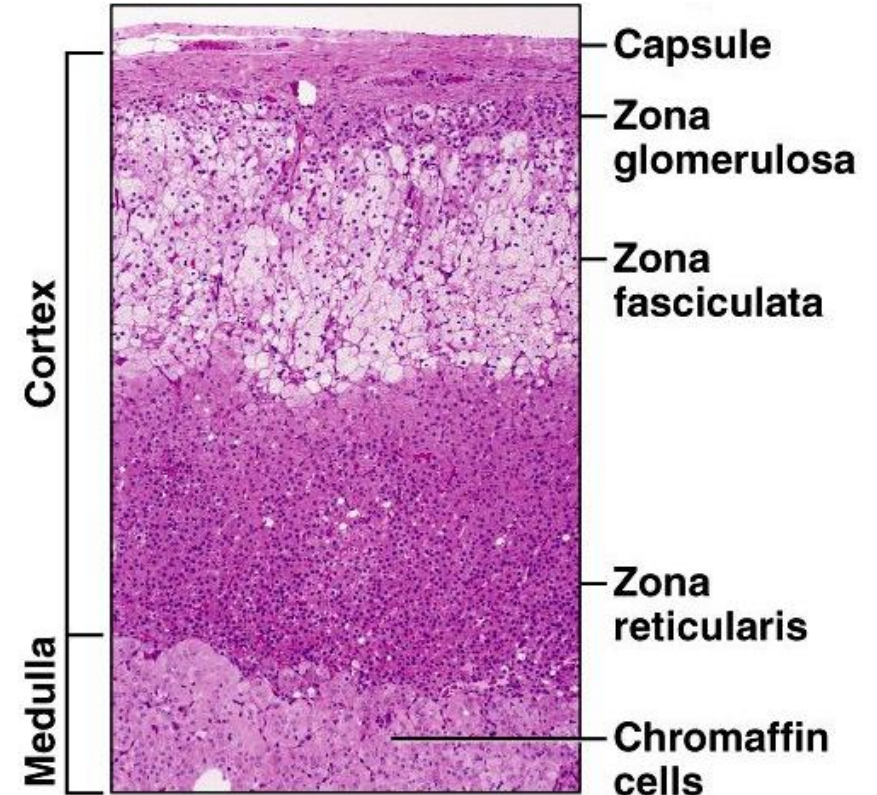
- The adrenal glands are endocrine organs situated near the superior pole of each kidney.
- Each adrenal gland is surrounded by a dense irregular connective tissue capsule and embedded in the adipose tissue around the kidneys.
- The secretory portion of each adrenal gland consists of an outer cortex and an inner medulla.
- Fenestrated capillaries and large vessels throughout regions.
- **Cortex :-**
- Under direct influence of adrenocorticotrophic hormone from anterior pituitary gland.
- Releases three steroid hormones: mineralocorticoids, glucocorticoids, and androgens.





# Adrenal Glands

- The adrenal cortex exhibits three zones: the zona glomerulosa, zona fasciculata, and zona reticularis.
- **Zona glomerulosa:-**
- Cells in zona glomerulosa secrete **mineralocorticoids**, primarily aldosterone
- **Aldosterone** release is caused by decreased arterial blood pressure and low sodium levels ( control blood volume & blood pressure ).
- The zona glomerulosa is a thin zone inferior to the adrenal gland capsule. It consists of cells arranged in small clumps (ovoid groups).

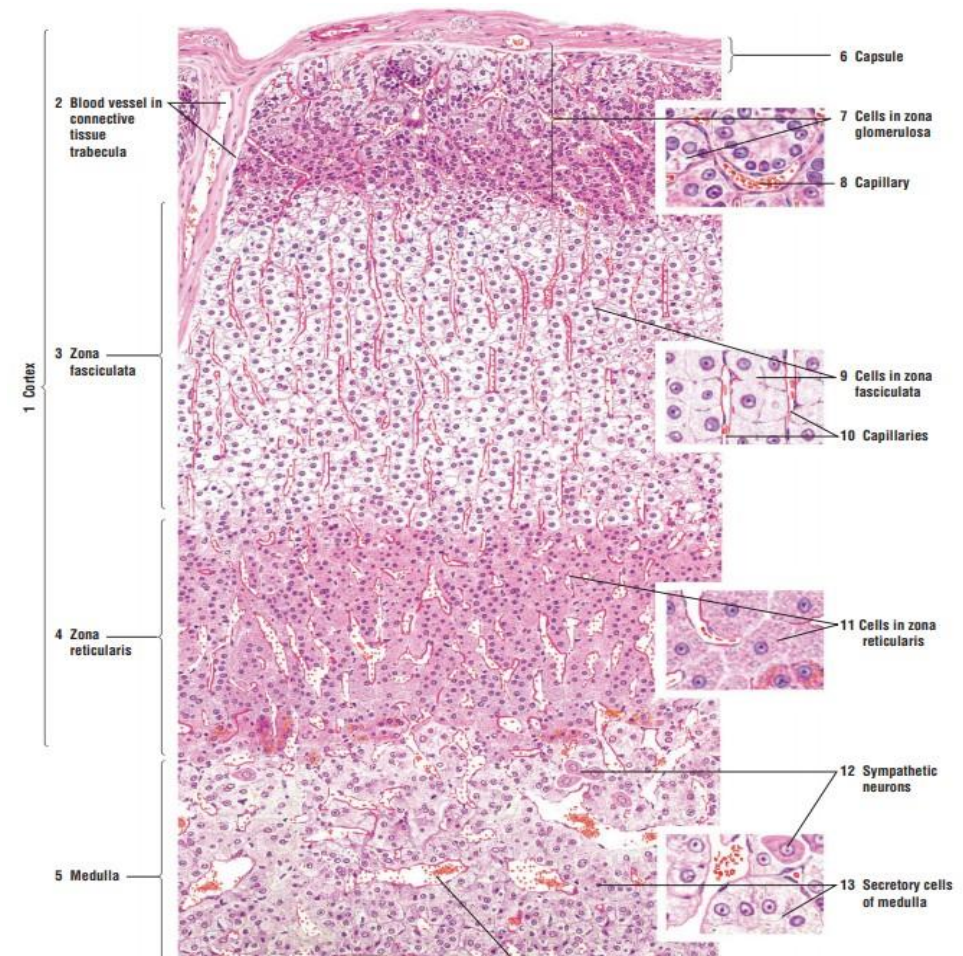


# Adrenal Glands

- **Zona fasciculata:-**
- Cells of zona fasciculata secrete glucocorticoids (cortisol and cortisone ).

**Glucocorticoids** are released in response to stress, increase metabolism and glucose levels, and suppress inflammatory responses. The zona fasciculata is intermediate and the thickest zone of the adrenal cortex.

- Cells of the zona fasciculata are arranged into columns or plates oriented in a radial direction.
- The cords are one or two cells thick & separated by blood capillaries. Abundant lipid droplets in the cytoplasm give the cells a greatly vacuolated appearance, they are often called spongiocytes.

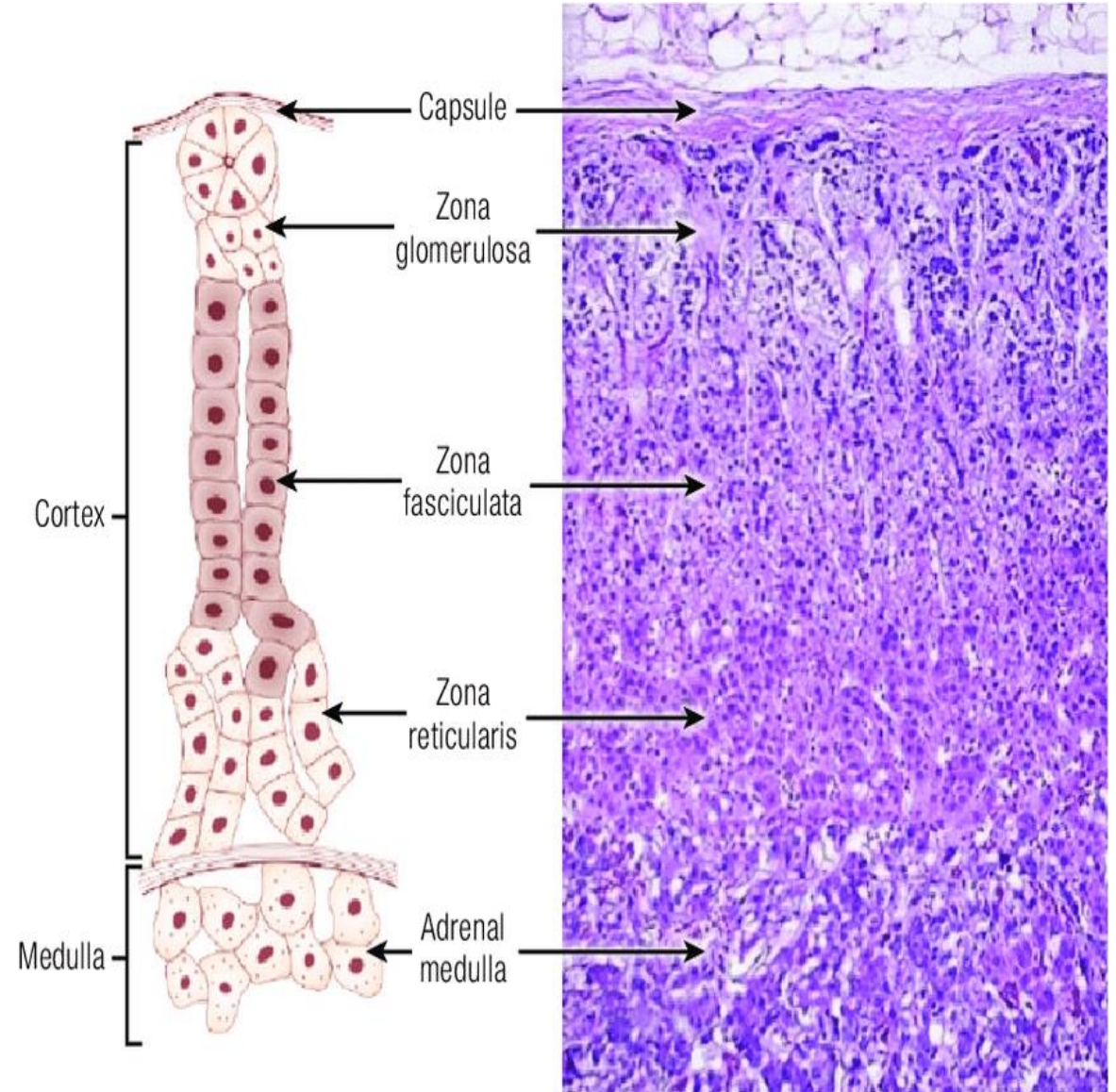




# Adrenal Glands

## Zona reticularis:-

- Cells of zona reticularis produce weak **androgens**.
- The zona reticularis is the innermost zone that is adjacent to the adrenal medulla. The cells in this zone are arranged in cords or clumps, enclosing fenestrated capillaries in between.



# Adrenal Glands

- **Medulla:-** It contains two types of cells:
- **Chromaffin cells & Sympathetic ganglion cells.**
- Medulla cells can be considered as ganglion cells without dendrites and axons.
- Action controlled by sympathetic division of autonomic nervous system, not pituitary gland
- Chromaffin cells contain catecholamines (**epinephrine and norepinephrine**) and respond to stress. Prepares the individual for flight or fight response.
- The medulla lies in the center of the adrenal gland. The cells are larger and also arranged into clumps or irregular cords enclosing the blood capillaries.

