

# **ANATOMY OF THE ENDOCRINE SYSTEM**

**Meidona N Milla  
Anatomy Department  
Faculty of Medicine  
Sultan Agung Islamic University**

# LEARNING OBJECTIVES

- *At the end of the lecture, students should be able to describe :*
  - The **position** and **structur** of the glands of endocrine system: hypothalamus, pituitary, pineal, thyroid, para thyroid, adrenal, pancreas, ovarium, testis
  - Hormones which producing of endocrine system

# LEARNING OBJECTIVES

- **the structures of hypothalamus related to the pituitary gland.**
- Describe **the blood supply** of endocrine system gland .
- Describe **the blood supply** of pituitary gland & the **hypophyseal portal system.**
- **The nervous system** of endocrine

# THE ENDOCRINE SYSTEM

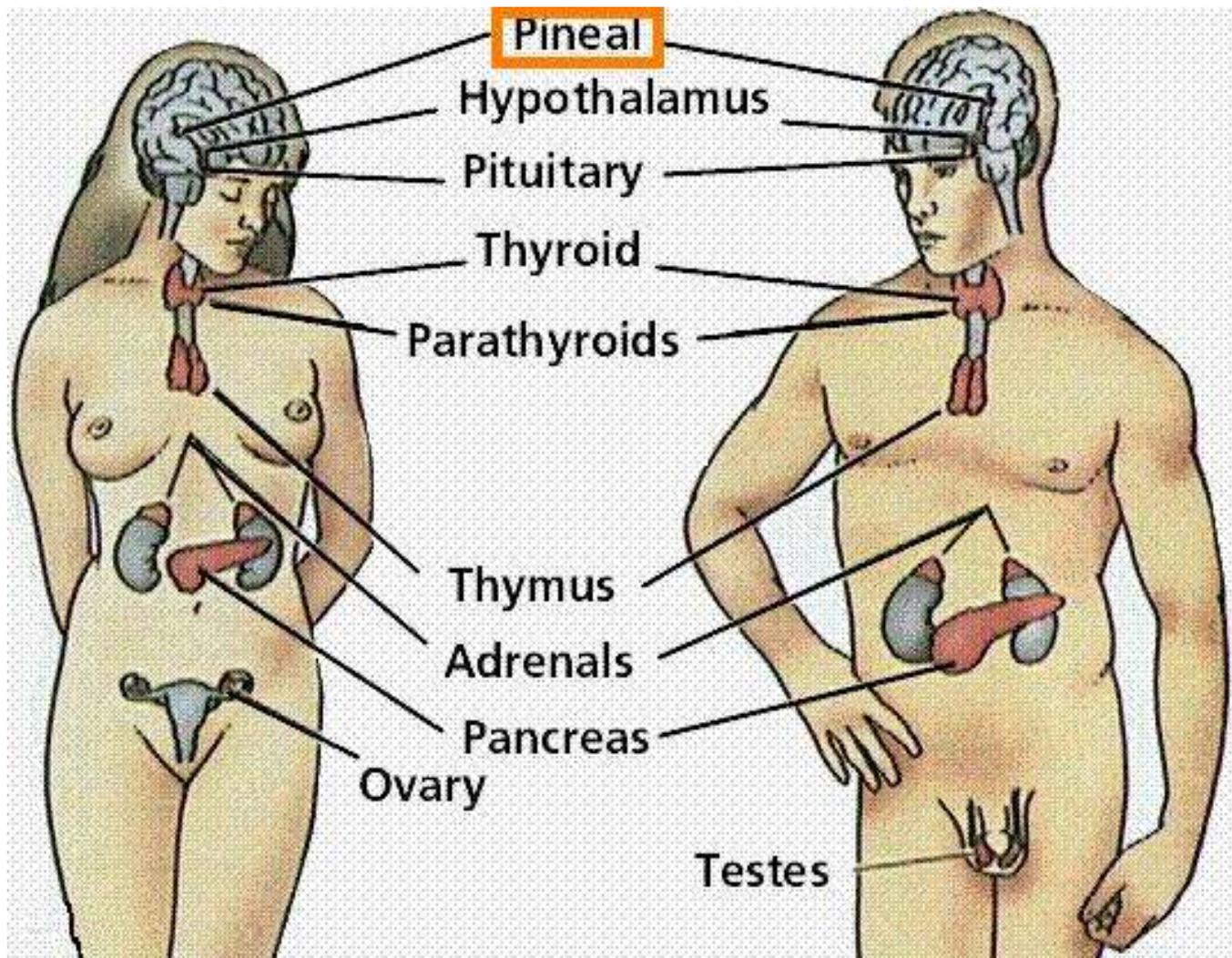
- The endocrine system is made up of seven different glands that make chemicals called **HORMONES**.
- **HORMONES** are substances that act as messenger to control many body function.

**The endocrine system makes more the 20  
mayor hormones that help control:**

- **Growth**
- **Reproduction**
- **Sexsual development**
- **Use and Storage of energy**
- **Responses to physical stress or trauma**
- **Level of fluid salt and sugar in blood**

# GLANDS OF ENDOCRINE SYSTEM

- **Hypothalamus**
- **Pineal**
- **Pituitary**
- **Thymus**
- **Thyroid**
- **Para thyroid**
- **Adrenal**
- **Pancreas**
- **Gonade ( Ovarium and Testis)**

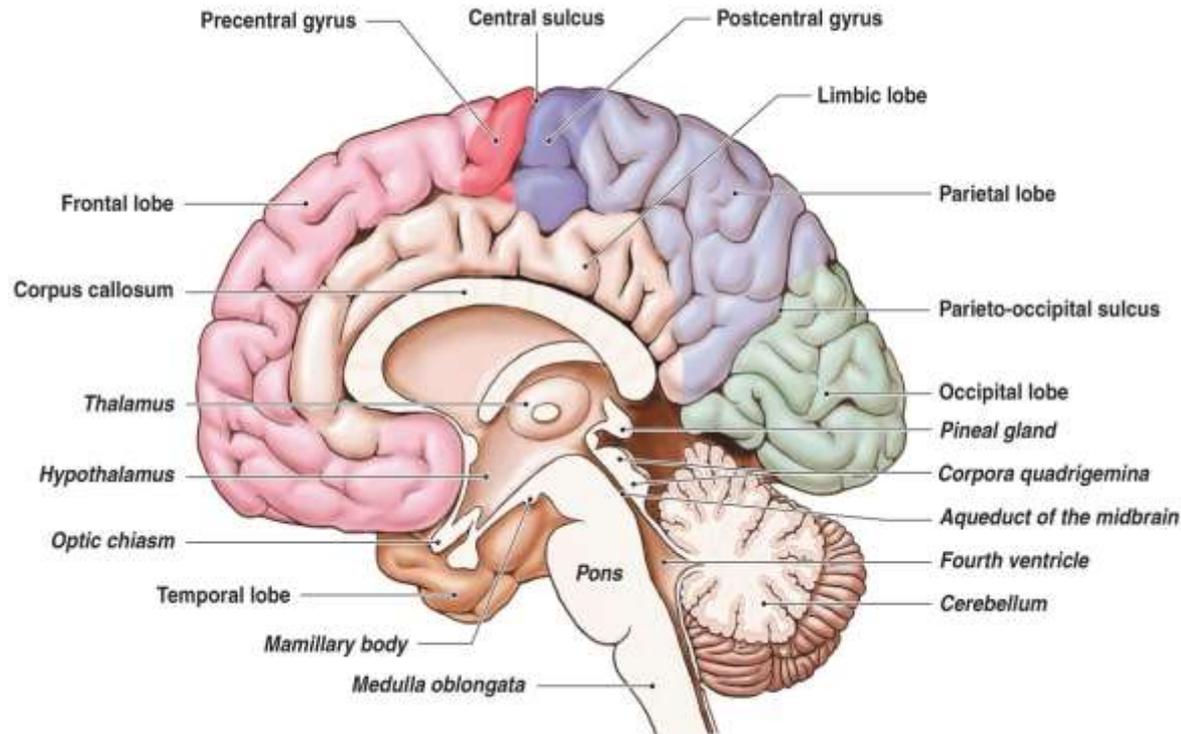


# HYPOTHALAMUS

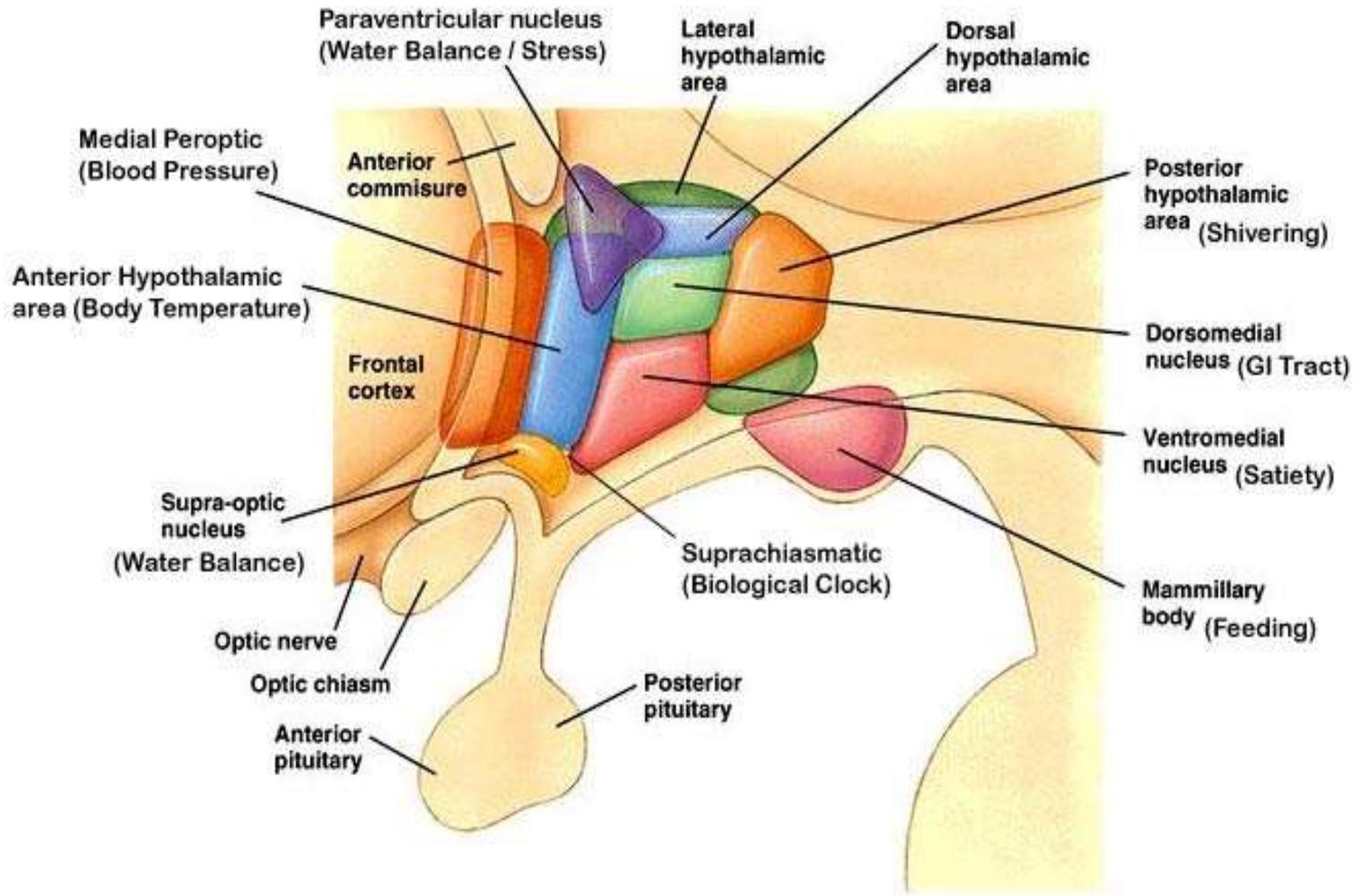
The hypothalamus is located in the center of the brain.

It makes hormones that increase or decrease the release of the hormones made in the pituitary gland it also makes hormones that help to control water balance, sleep, temperature, appetite and blood pressure.

A midsagittal view showing the inner boundaries of the lobes of the cerebral cortex (Structures outside of the cerebrum are labeled in italics.)



## ► Nuclei of the Hypothalamus



# **Hormones Which produced by hypothalamus**

## **Releasing Hormones ( RH)**

**Growth Hormone RH**

**Gonadotrophin RH**

**Thyrotropin RH**

**Prolactin RH**

**Corticotropin RH**

## **Release- inhibiting Hormones:**

**Somatostatin**

**Dopamin**

# PITUITARY GLAND (HYPOPHYSIS CEREBRI)



- ❑ It is referred to as the **master of endocrine glands**.
- ❑ It is a small oval structure 1 cm in diameter.

# POSITION

It lies in the middle cranial fossa

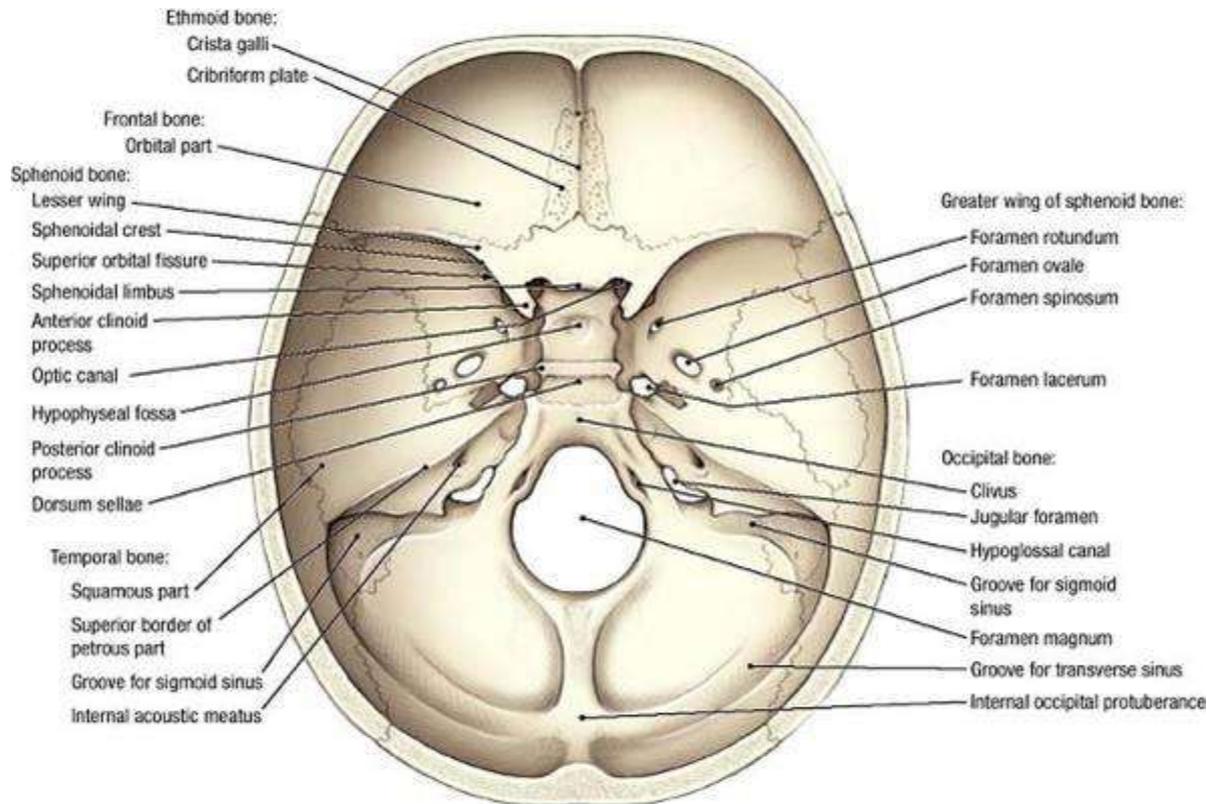
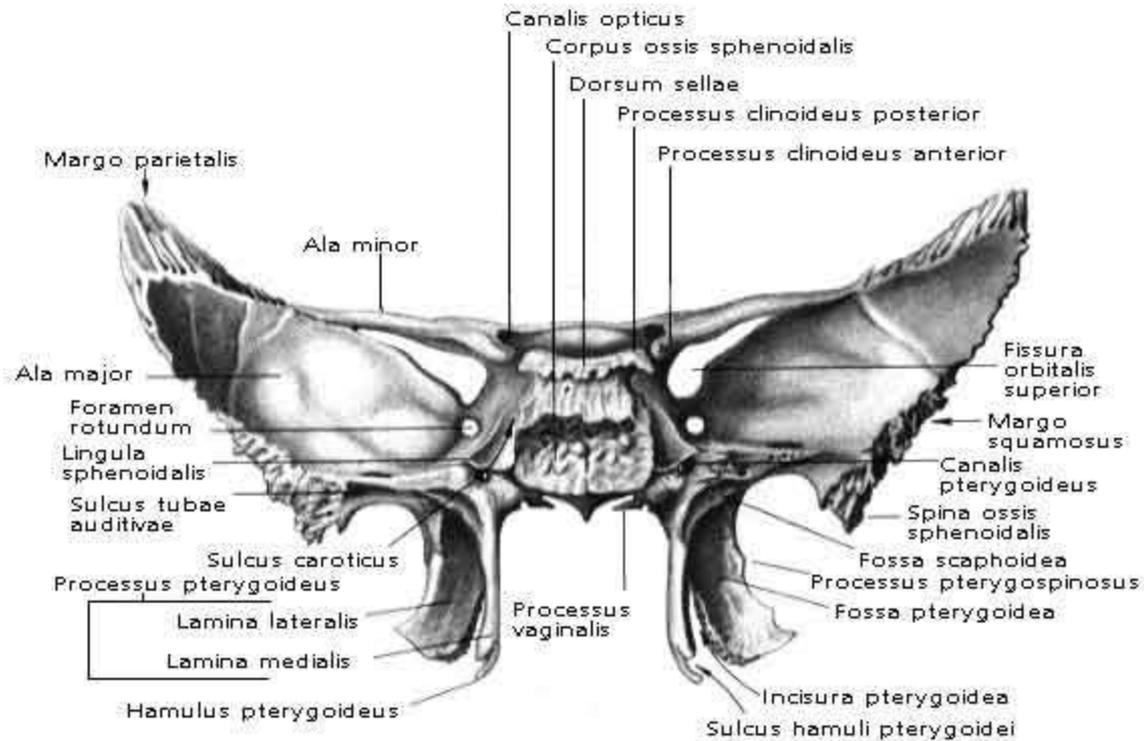
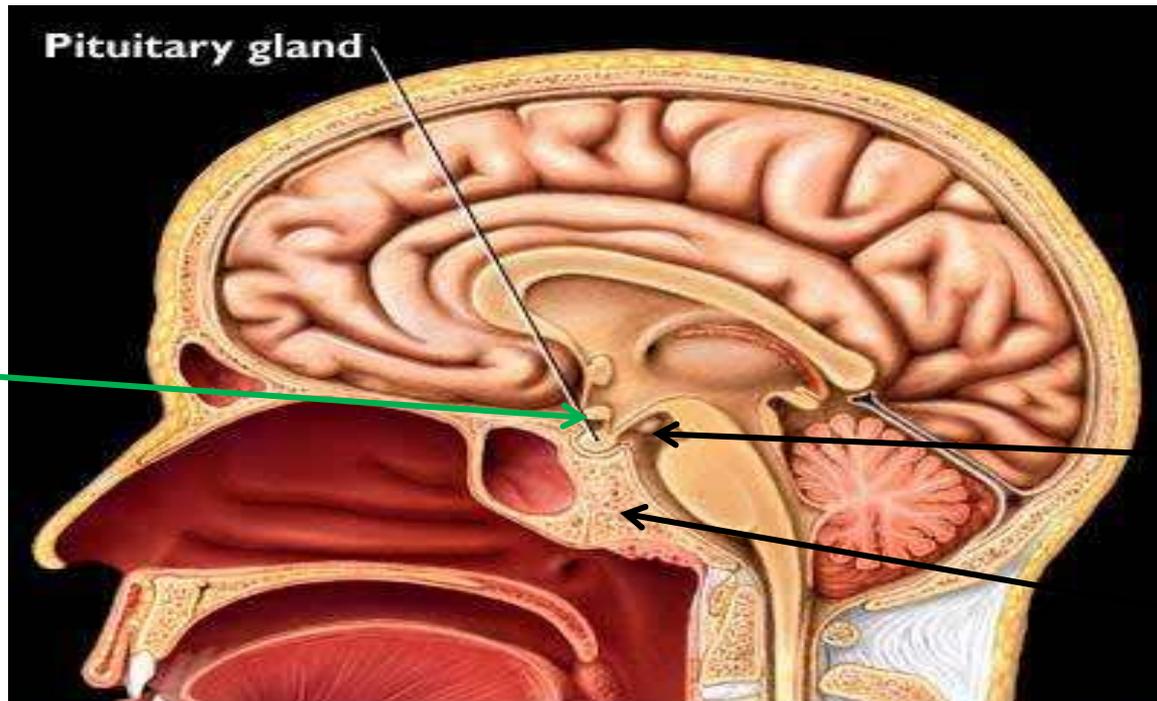


Figure 7.49. Features of the three cranial fossae.



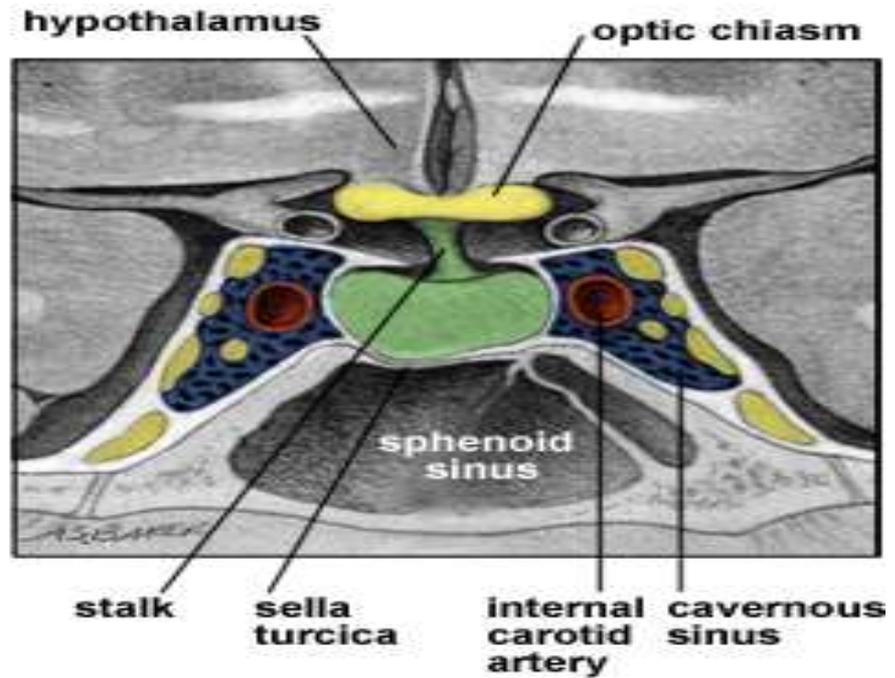


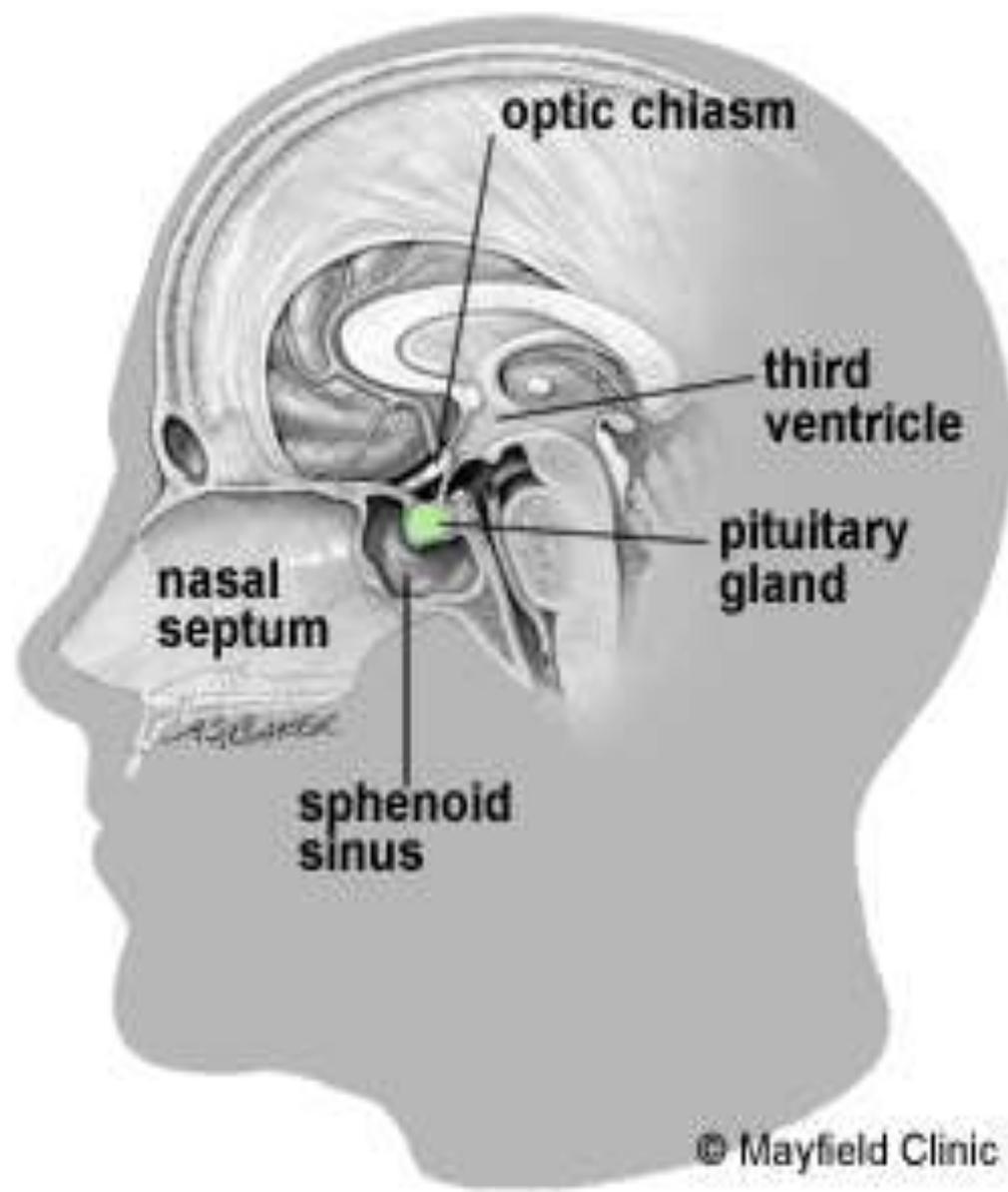
□ it lies between **optic chiasma** (anteriorly) & **mamillary bodies** (posteriorly).

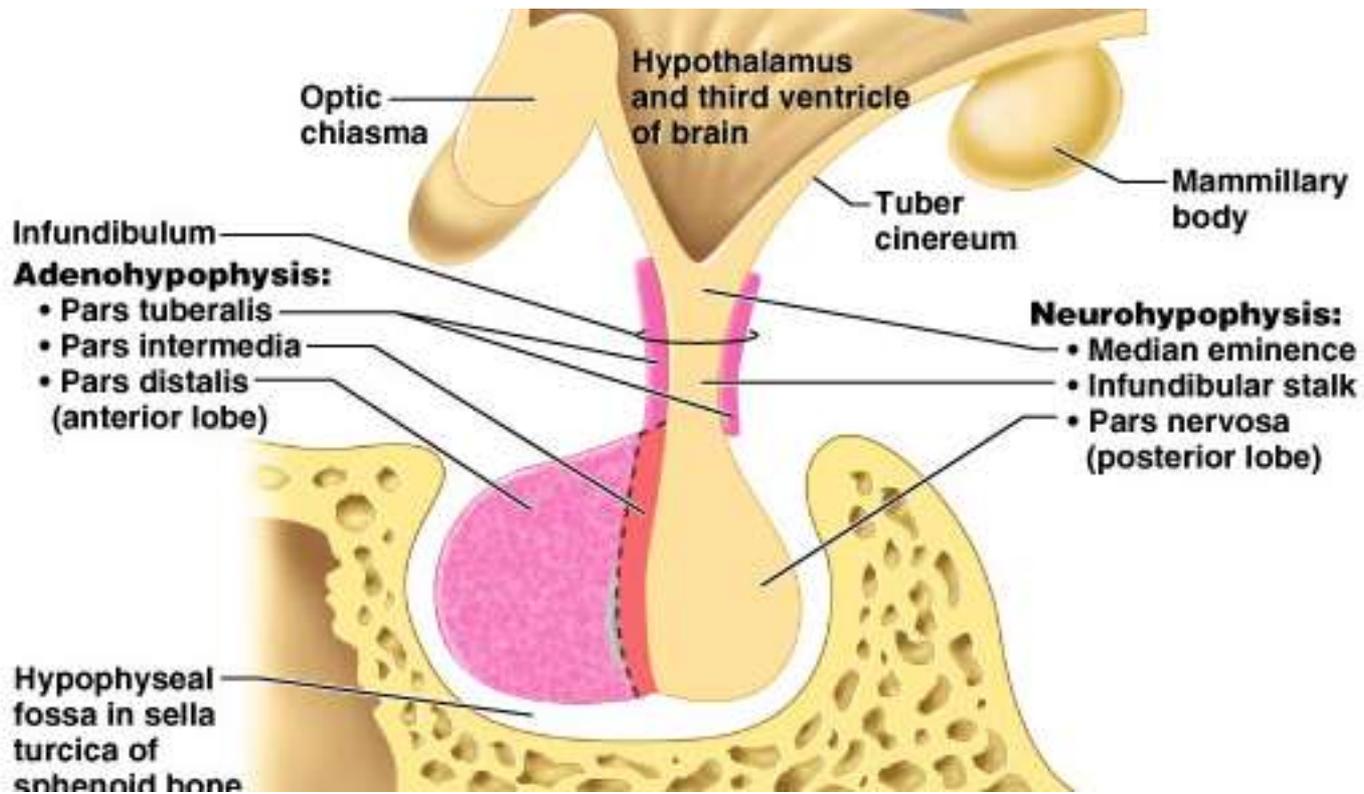
**SUPERIOR:** Diaphragma sellae

**INFERIOR:** Sphenoidal air sinuses

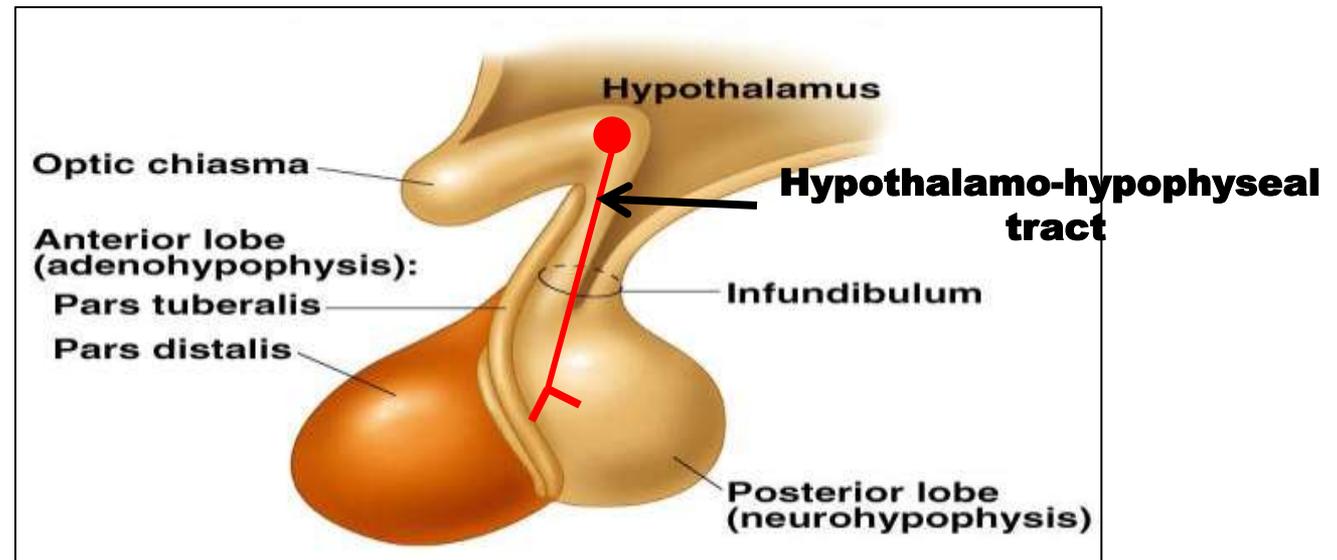
**LATERAL:** Cavernous sinuses







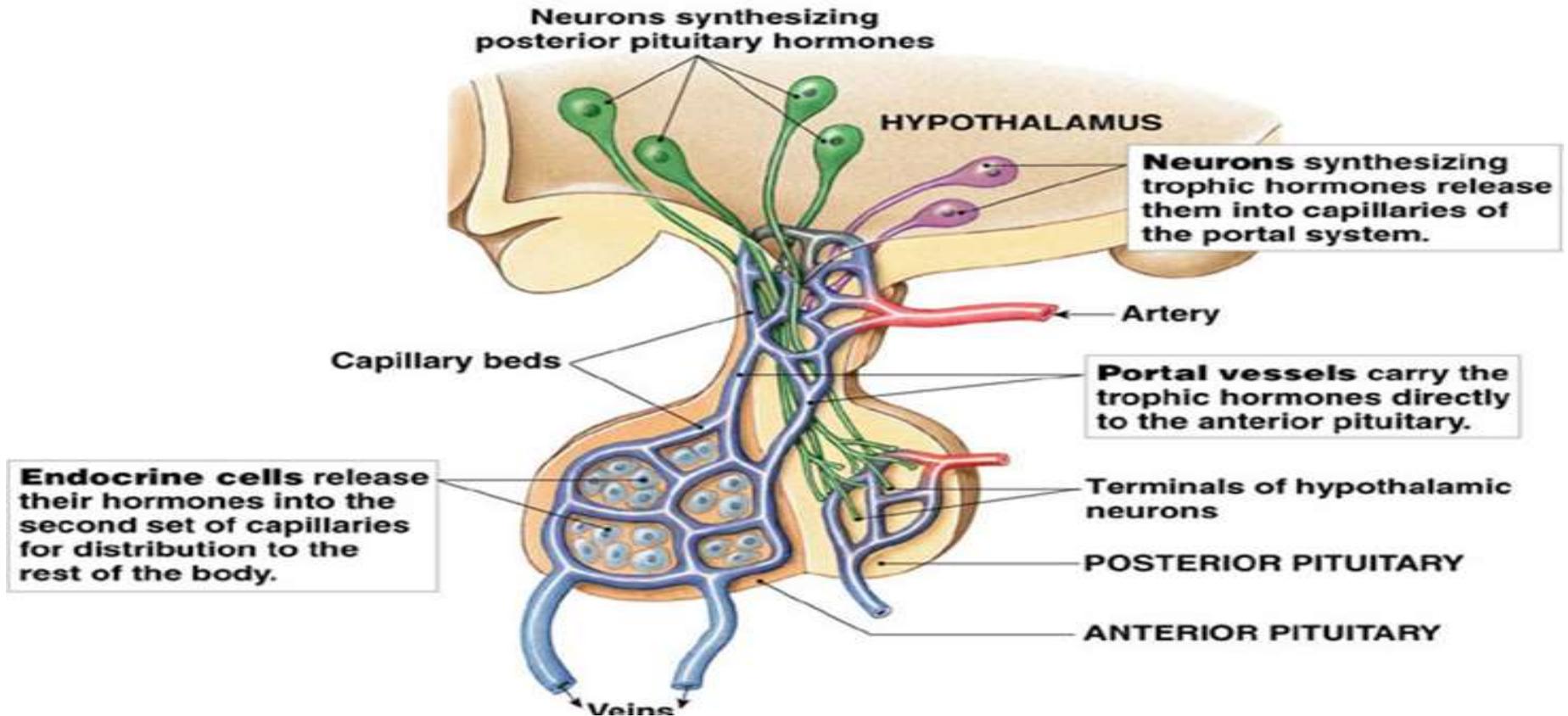
## SUBDIVISIONS OF PITUITARY GLAND



The gland is divided into:

- 1) **Anterior lobe (Adenohypophysis):** it is the True gland, Secretes hormones
- 2) **Posterior lobe (Neurohypophysis):** connected to hypothalamus through hypothalamo-hypophyseal tract, Stores hormones secreted by hypothalamic nuclei

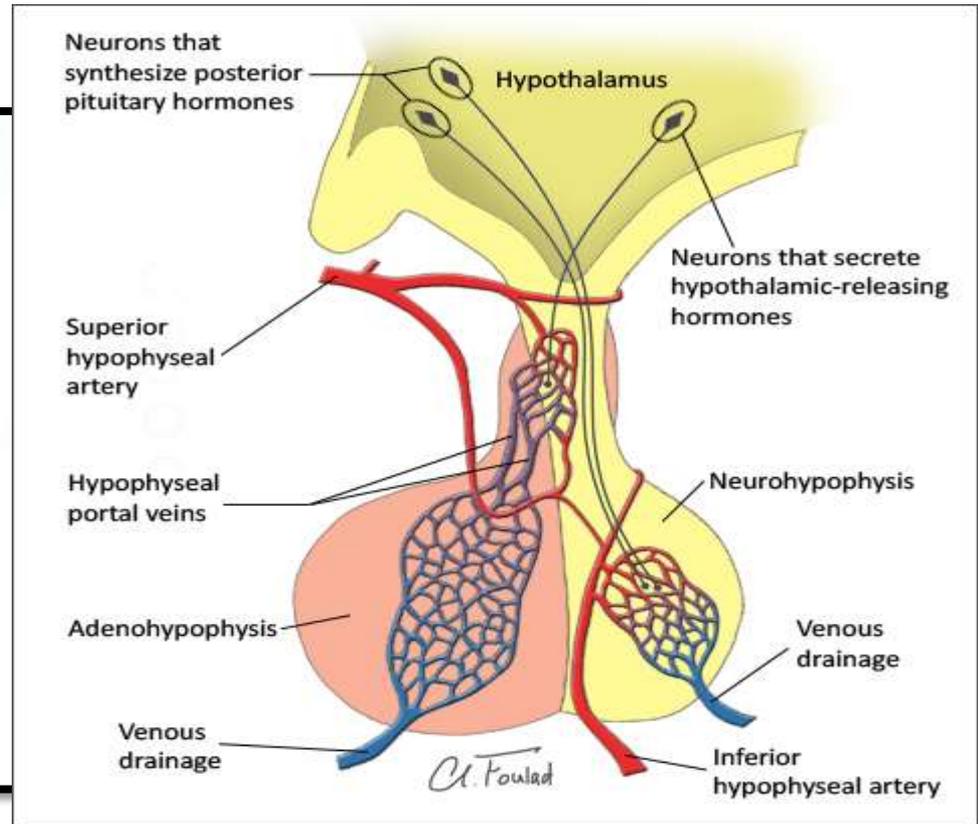
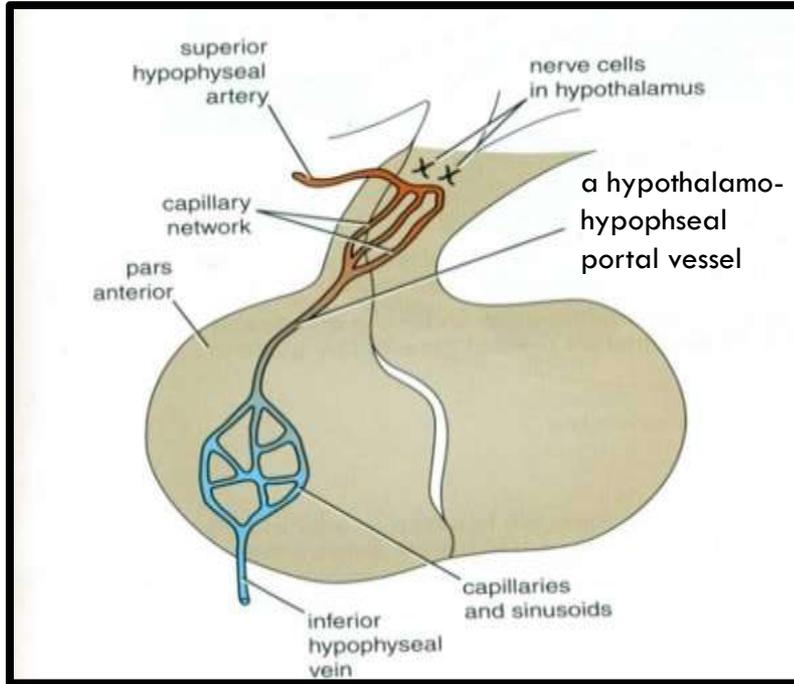
# BLOOD SUPPLY OF PITUITARY GLAND



**ARTERIES:** Superior & inferior hypophyseal arteries (branches of internal carotid artery)

**VEINS:** Hypophyseal veins drain into Cavernous Sinuses.

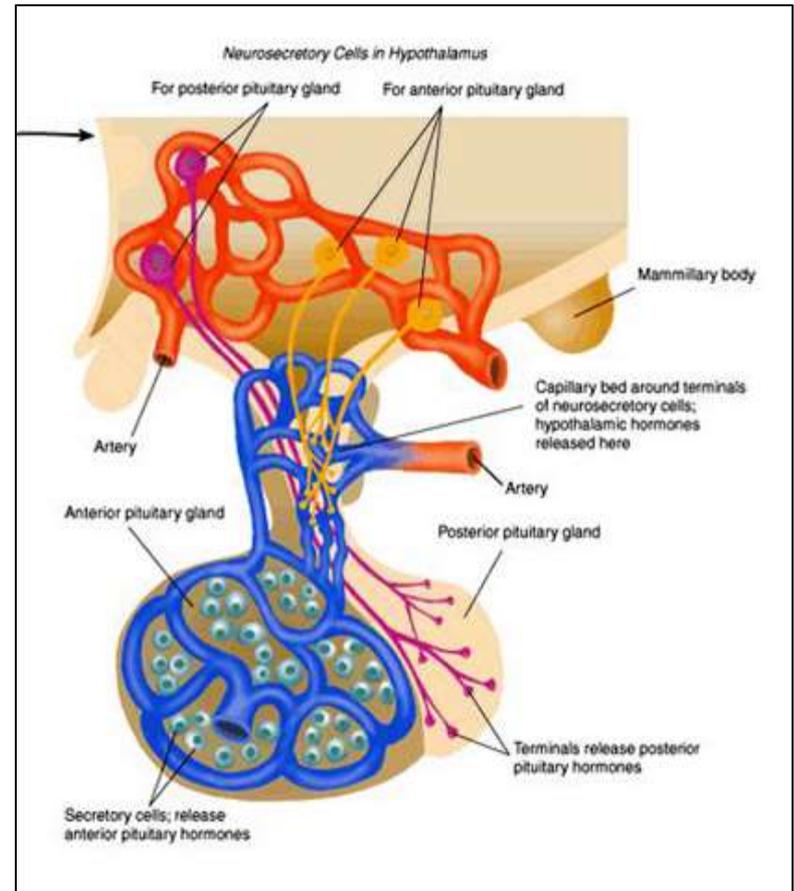
# DISTRIBUTION OF ARTERIES



- **Superior hypophyseal:** supplies infundibulum & forms a capillary network from which vessels pass downward & form sinusoids into the anterior lobe of pituitary gland (**hypophyseal portal system**).
- **Inferior hypophyseal:** supplies posterior lobe of pituitary gland

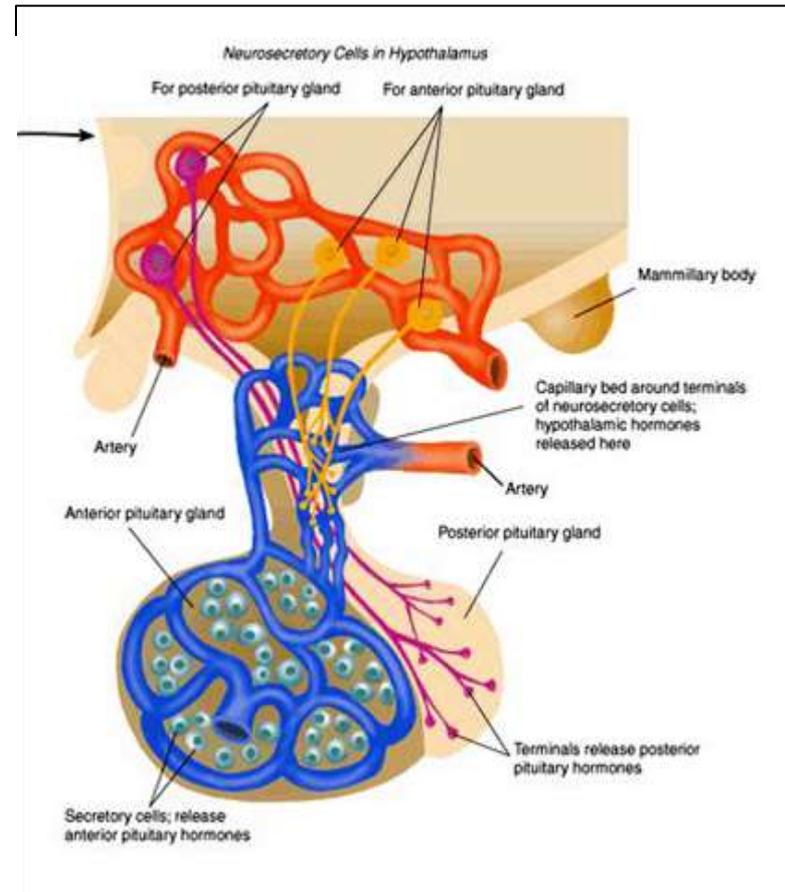
# ANTERIOR LOBE

■ Hormone-releasing & inhibiting factors produced by hypothalamus use Hypophyseal Portal System of vessels to reach the Anterior lobe of pituitary gland



# POSTERIOR LOBE

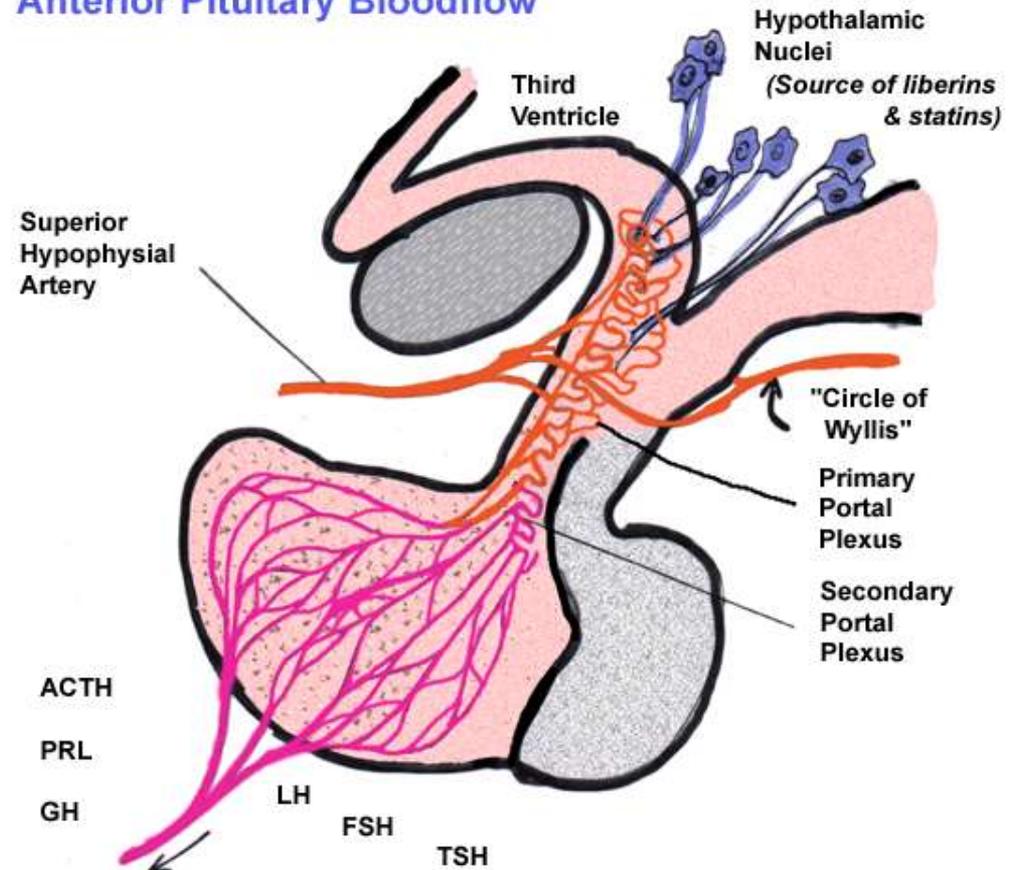
- The neurohypophysis receives a nerve supply from some of the hypothalamic nuclei (**supraoptic & paraventricular**)
- The axons of these nuclei convey their neurosecretion to the Posterior lobe of pituitary gland through Hypothalamo-Hypophyseal tract from where it passes into the blood stream.



## Hormones which producing of anterior pituitary glands

- Growth hormone (GH)
- Luteinizing hormone (LH)
- Follicle Stimulating hormone (FSH)
- Thyrotropin hormone (TSH)
- Prolactin (PRL)
- Adrenocorticotrophic hormone (ACTH)
- Melanocyte-stimulating hormone (MSH)

### Anterior Pituitary Bloodflow

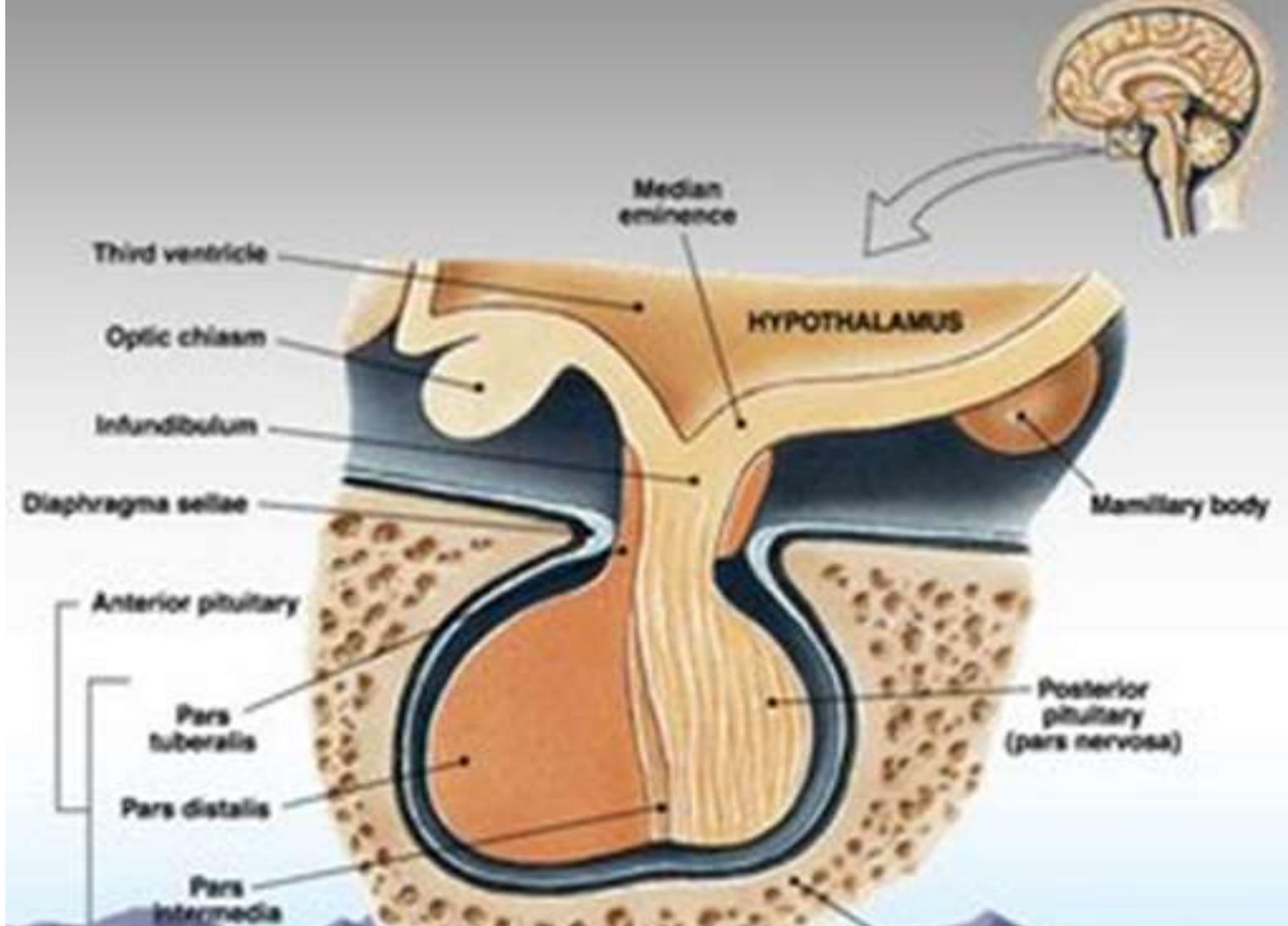


The primary portal plexus, a "privileged" or "leaky" portion of the brain vasculature, provides a port of entry for the neuroendocrine secretions of the cells of many hypothalamic nuclei. These are carried by pulsing capillary blood flow to the cells of the adenohypophysis (anterior pituitary) where they bind and modulate the synthesis and secretion of the six anterior pituitary hormones. Note that the products of the anterior, posterior, and intermediate (where it exists) lobes may diffuse back to the hypothalamus during the nadir of capillary blood flow.

*Table 14–1.* Anterior pituitary hormones and substances that control their release.

Hormone	Releasing hormone (RH)	Release-inhibiting hormone
Growth hormone	Growth hormone RH/ dopamine	Somatostatin
Luteinizing hormone	Gonadotropin RH	
Follicle-stimulating hormone	Gonadotropin RH	
Thyrotropin	Thyrotropin RH	
Prolactin	Prolactin RH	Dopamine
Adrenocorticotrophic hormone	Corticotropin RH	
Melanocyte-stimulating hormone <sup>1</sup>	Corticotropin RH	

<sup>1</sup>In humans, the intermediate lobe of the pituitary gland is vestigial. Secretory cells containing melanocyte-stimulating hormone are located in the anterior lobe.



# POSTERIOR PITUITARY HORMONES

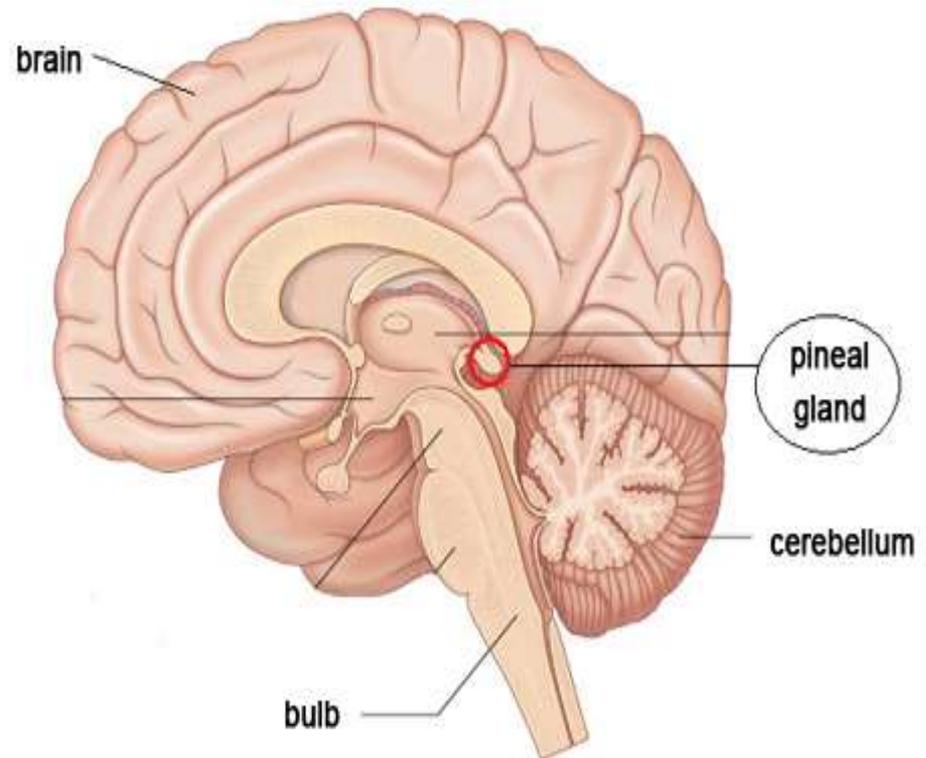
**OXITOCIN**

**VASOPRESSIN ( Anti Diuretic Hormones/ADH,  
Arginin Vasopressin/AVP,or Argipressin)**

➔ Posterior pituitary hormones are synthesized by the hypothalamus. They are then store in neurosecretory vesicles before secreted by pituitary into blood stream.

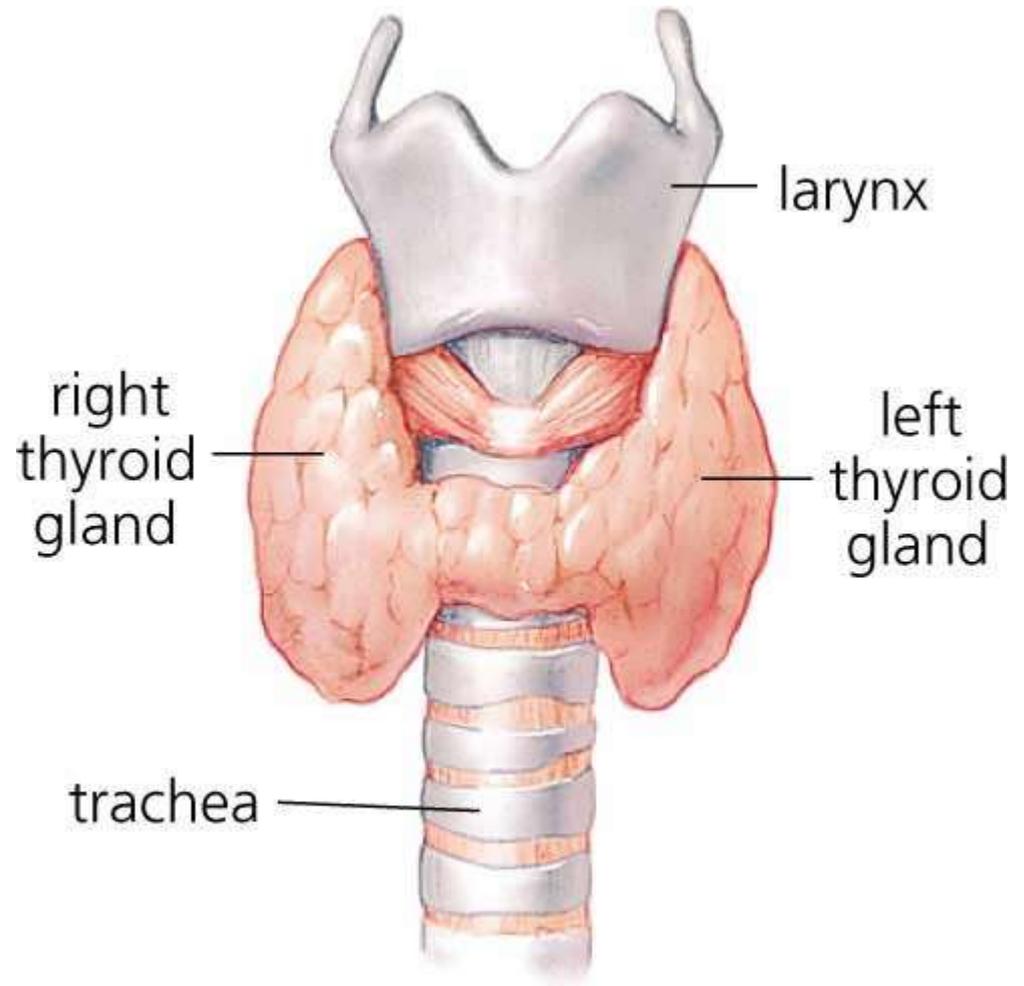
# PINEAL

- The pineal gland located in the centre of the brain, to the between the cerebral hemisphere attached to the third ventricle
- It produced the melatonin hormone, with is used the body to keep normal body sleep cycle .



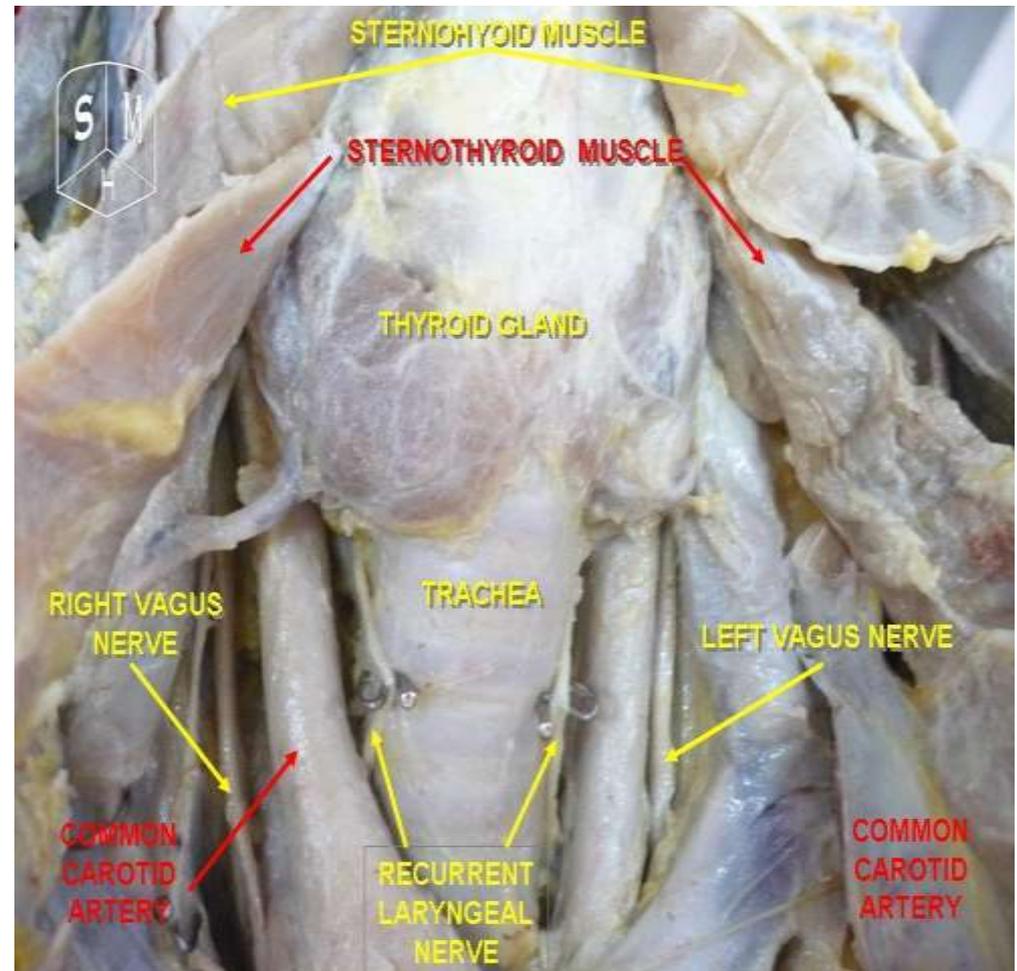
# The Thyroid Gland

- Brownish-red and soft during life .
- Located in the neck below the larynx , and anterior to the trachea
- Each lobe—pear-shaped and ~5cm long
- Usually weighs about 25-30g (larger in women)

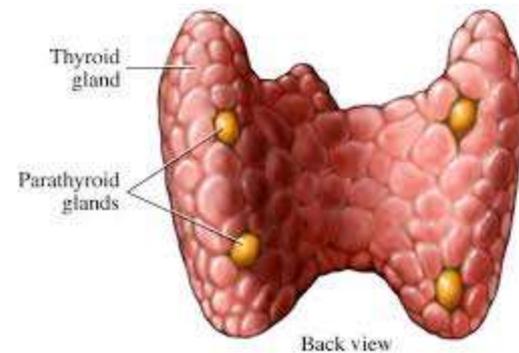
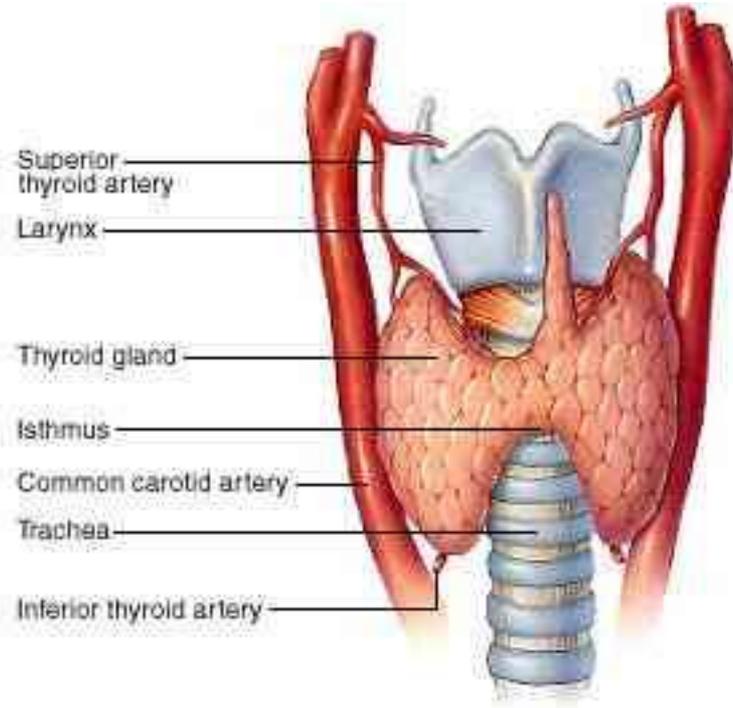


Carlyn Iverson

- Surrounded by a thin, fibrous capsule of connective tissue
- External to this is formed by **pretracheal fascia**
- Right and left lobes are connected by band of tissue called **isthmus**.
- Thyroid gland attached to arch of cricoid cartilage and to oblique line of thyroid cartilage
- –moves up and down with swallowing and oscillates during speaking



- Isthmus: extends across the trachea anterior to second and third tracheal cartilages Pyramidal lobe”exists, ascending from the isthmus towards hyoid bone
- Lies deep to sternothyroid and sternohyoid muscles
- Internal jugular vein and common carotid artery lie postero-lateral to thyroid

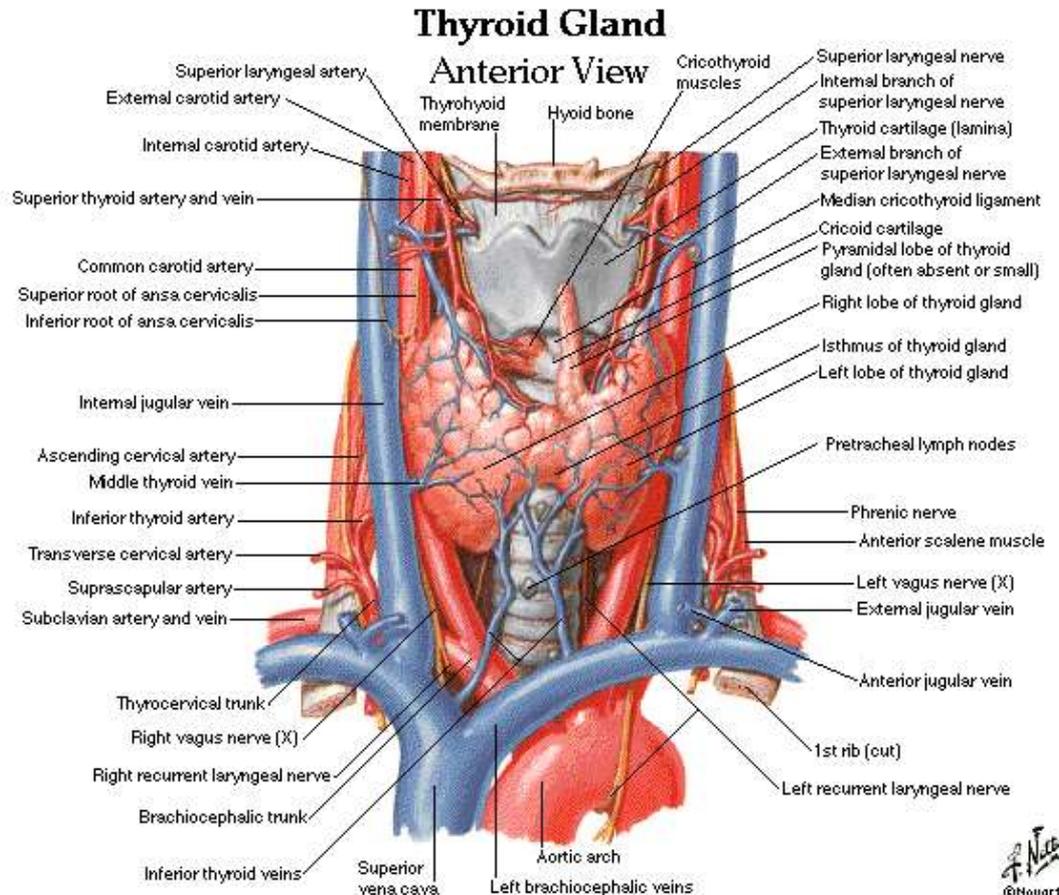


## ARTERIAL SUPPLY

Arterial supply from **superior and inferior thyroid arteries**

–lie between capsule and pretracheal fascia (false capsule)

- all thyroid arteries anastomose with one another on and in the substance of the thyroid, but little anastomosis across the median plane .



**Recurrent laryngeal nerves ( branch of vagus nerve)** an important structure lying between trachea and thyroid

–may be injured during thyroid surgery  
→ipsilateral paralysis, of vocalis plica, hoarse voice .

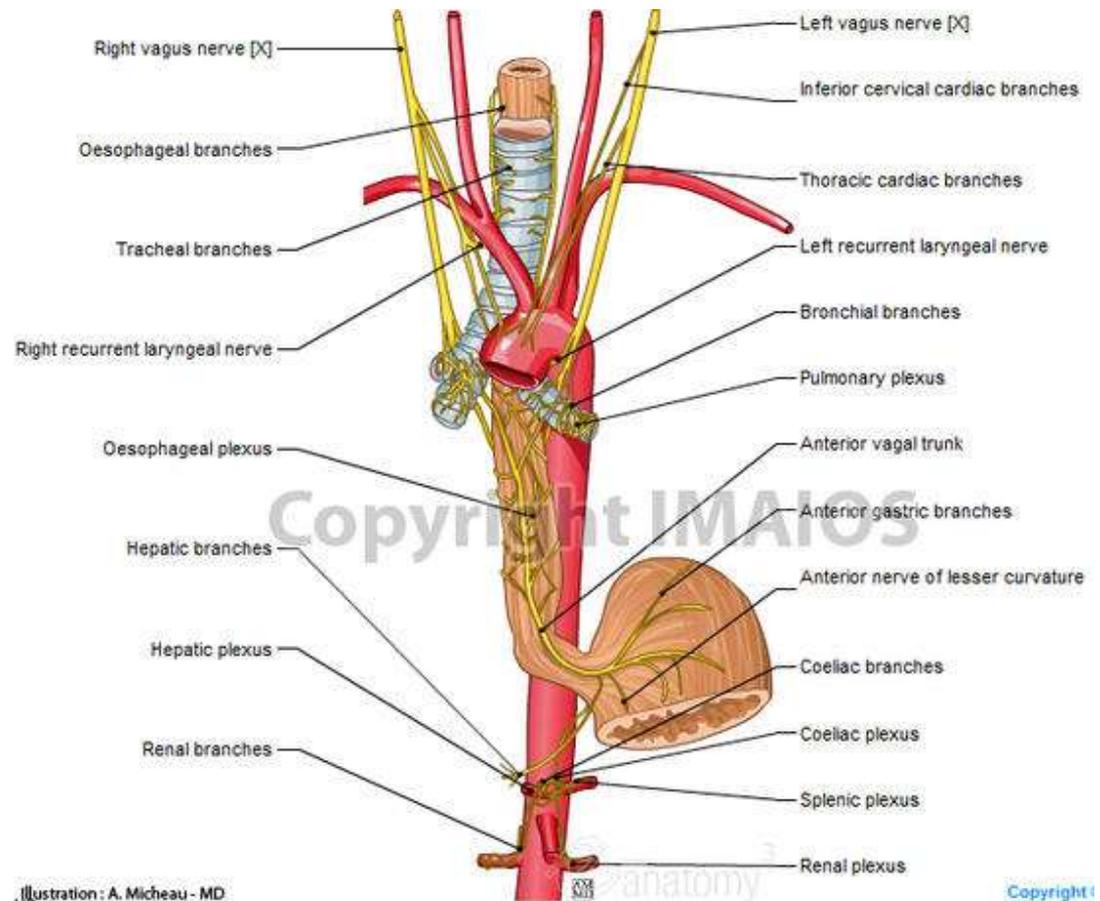
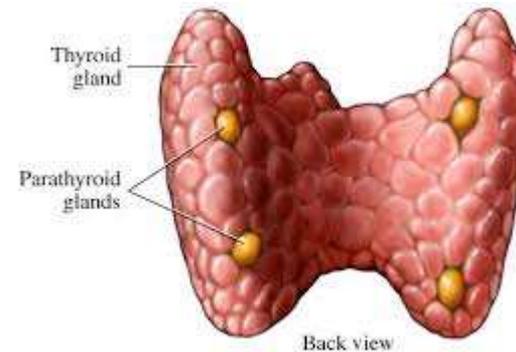


Illustration: A. Micheau - MD

- Calcitonin a hormones that stimulates deposition of calcium from the blood into the bones, balancing the action of parathyroid
- Thyroid hormones they control the Basal Metabolic Rate (BMR), Influence cell differentiation and growth

# PARATHYROID GLAND

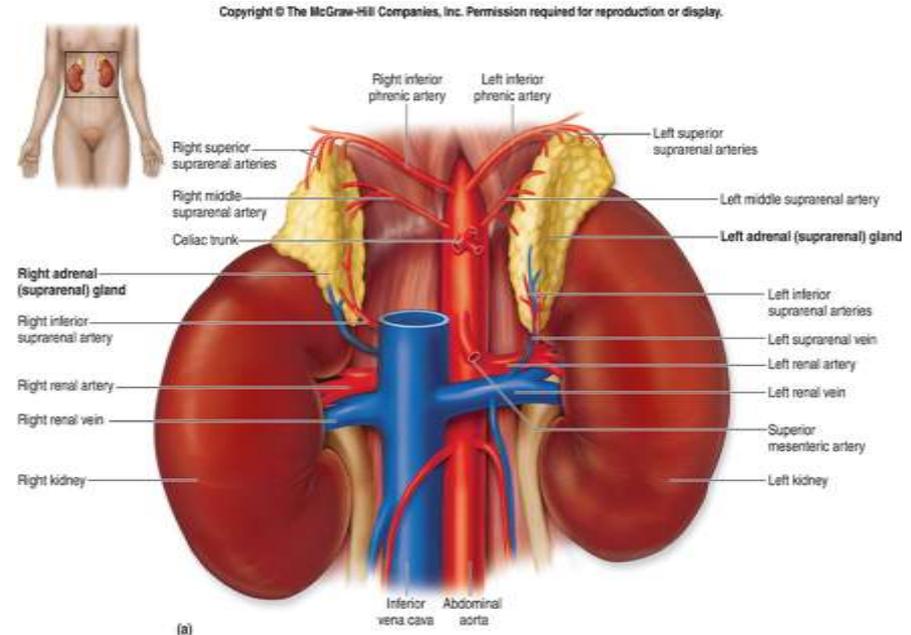
- Four parathyroid glands are found near the posterior aspect of the thyroid gland.
- They are small 20 -40 mg and have a bean like shape.
- Parathyroid glands usually lie between posterior border of thyroid gland and its sheath



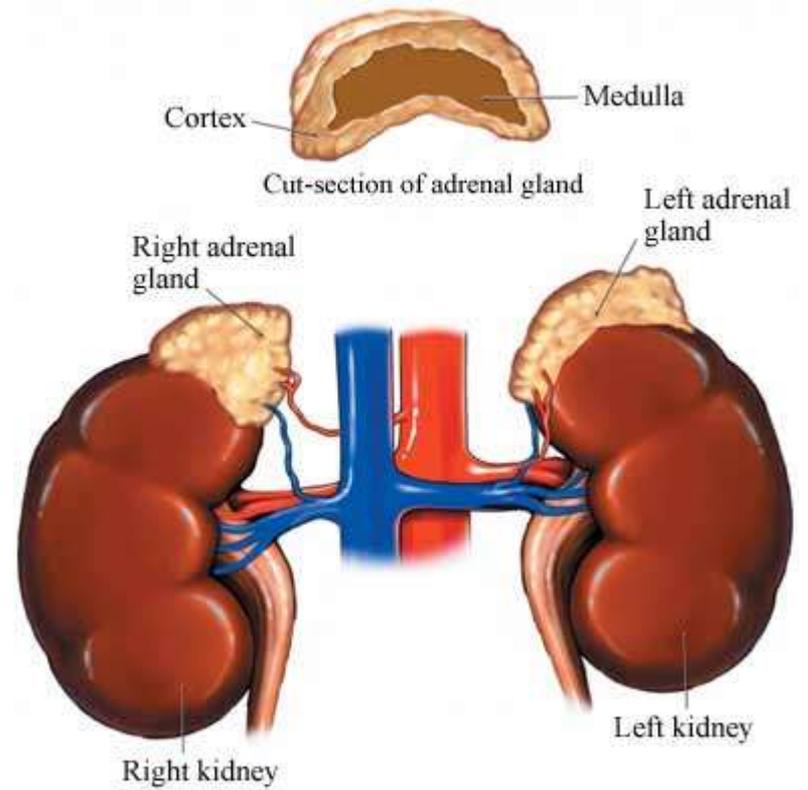
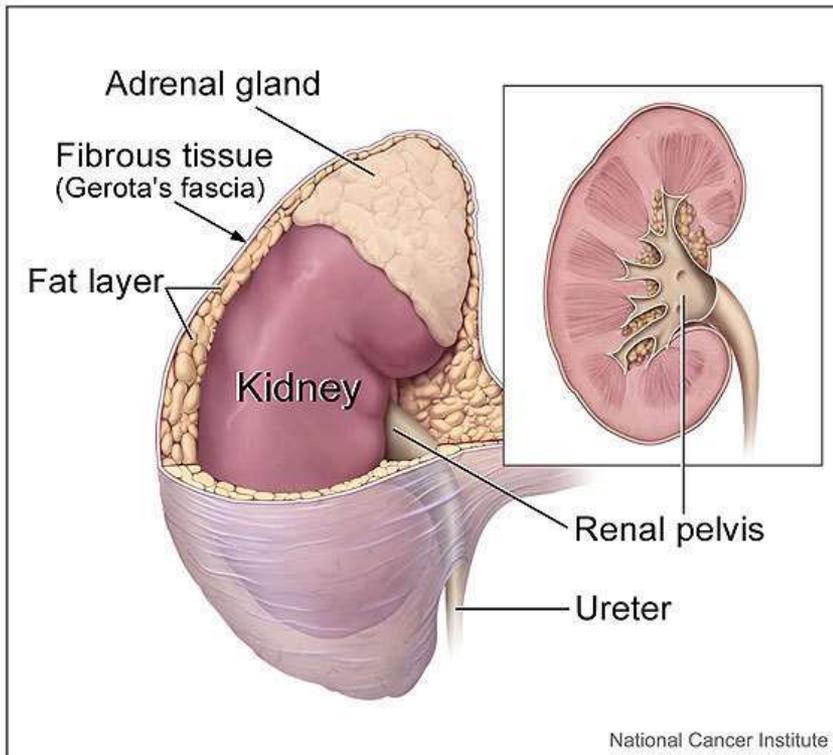
These 4 glands produce parathyroid hormone (PTH), which help to maintain calcium homeostasis by acting on the renal tubule as well as calcium store in the skeletal system and by acting indirectly on the gastrointestinal tract through the activation of vit D.

# ADRENAL GLAND/ SUPRARENAL GLAND

- The adrenal gland is a small triangular gland located on top of the kidney.
- Adrenal glands are orange colored endocrine glands that are about
- 1,5 x 3 inch.
- The gland consists of a medulla and is surrounded by cortex.
- It is responsible for producing epinephrin and nor epinephrin , as well as the hormones related with stress though the process of corticosteroids.



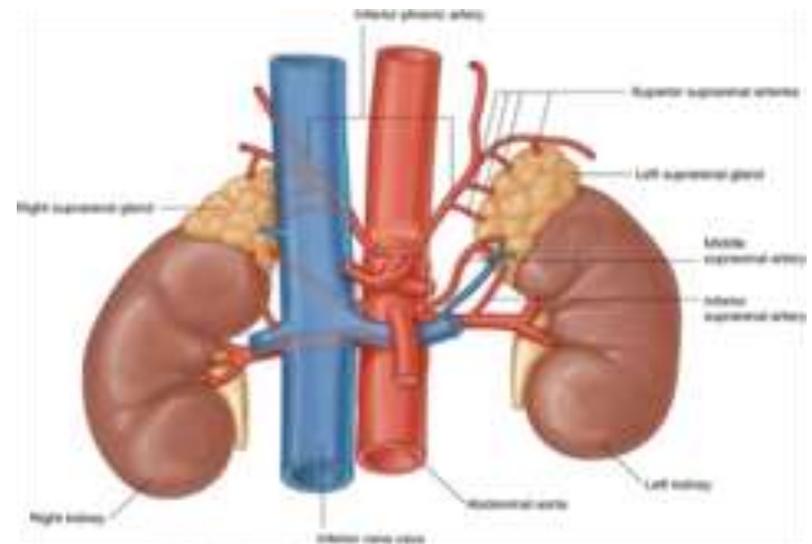
# ADRENAL GLAND



- One the main function of the adrenal gland is to work with the hypothalamus and the pituitary .
- The hypothalamus produced **corticotrophin-Realeasing Hormone** that stimulated the adrenal glands to produce hormone called **corticosteroid**.

## BLOOD SUPPLY

- The arterial blood supply to each adrenal gland is via three adrenal arteries:
- **The superior suprarenal artery**, a branch of the inferior phrenic artery
- - **The middle suprarenal artery**, a branch of the aorta
- - **The inferior suprarenal artery**, a branch of the renal artery

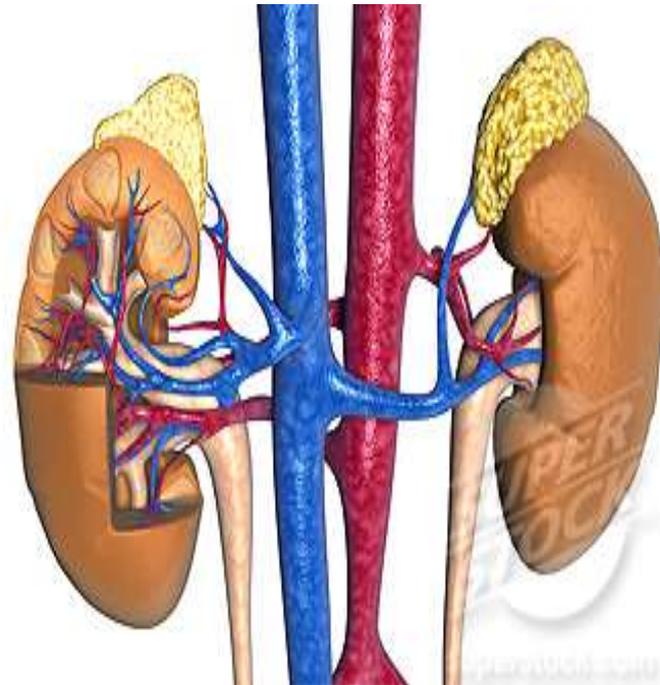


## The Venous drainage

-The venous drainage of the adrenal is via **the suprarenal veins** which drain into different main veins on each side.

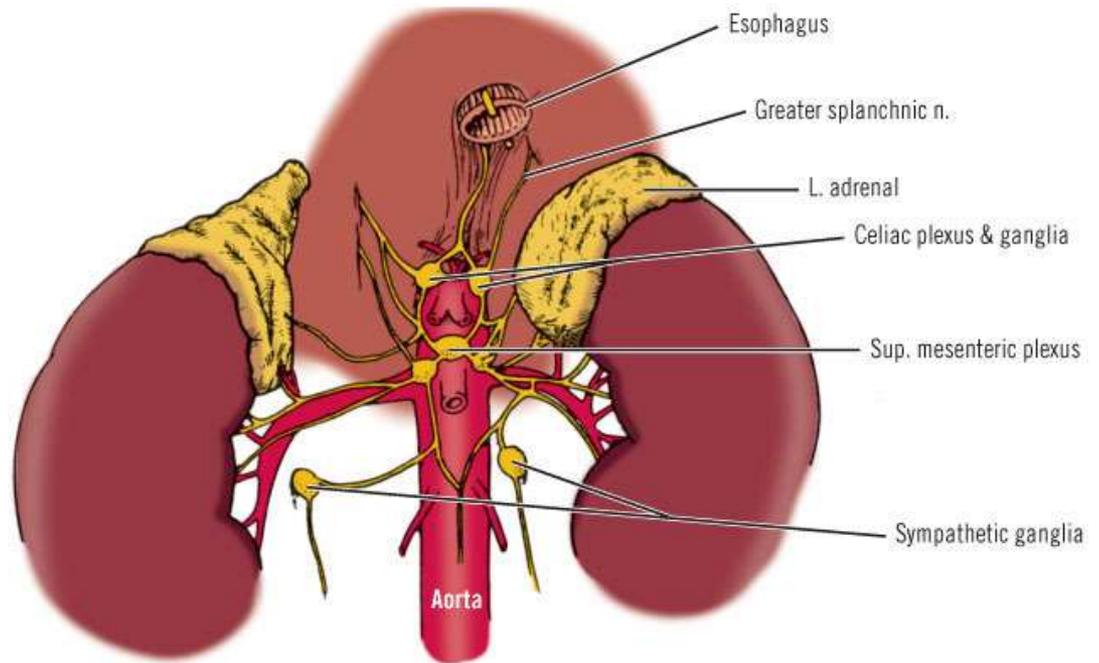
- **The right** into the inferior vena cava

- **The left** into the left renal or left inferior phrenic vein

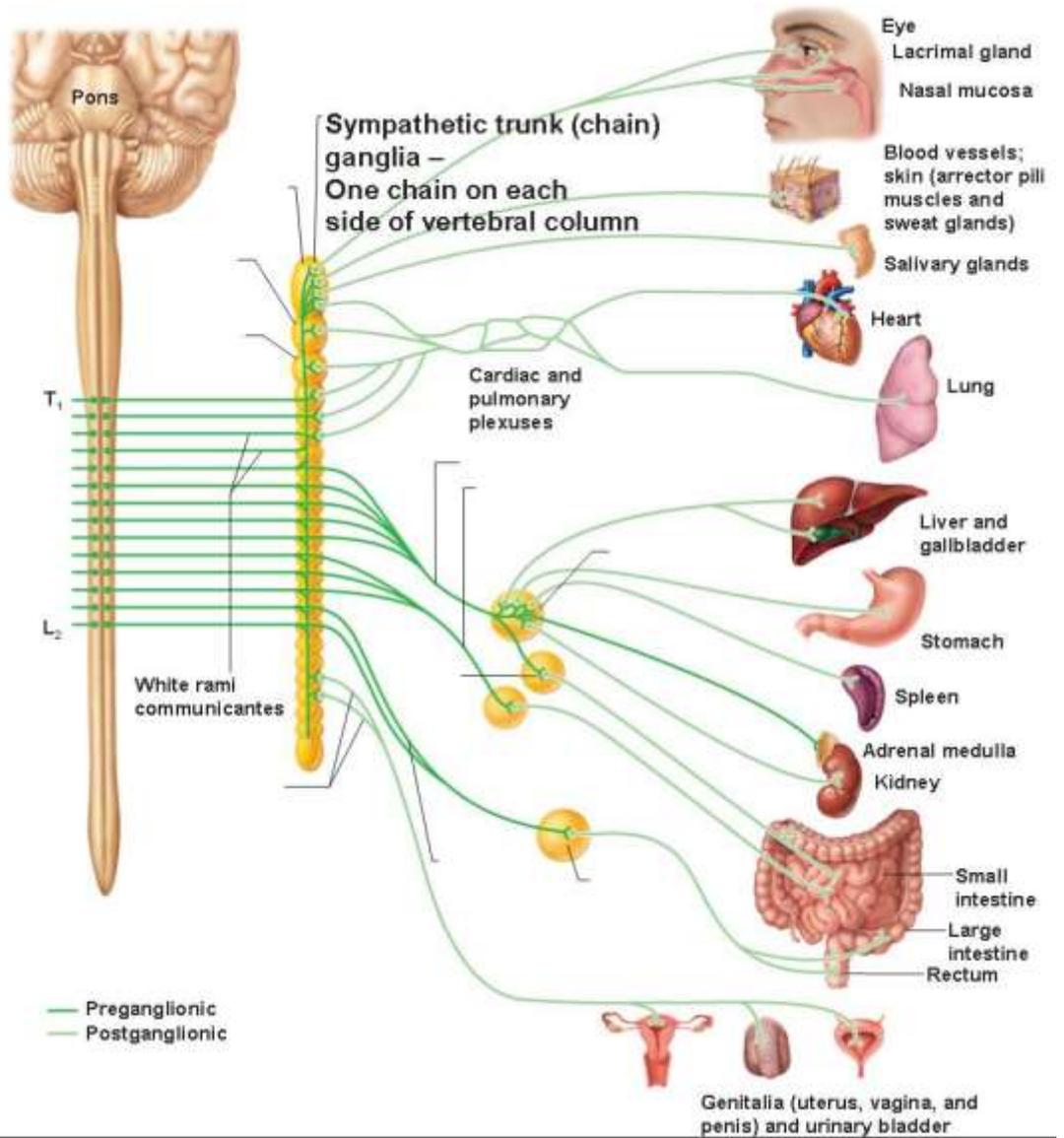


## NERVE SUPPLY

The adrenal gland have a rich nerve supply , **branch from Coeliac plexus and the thoracicus splancnic**



Copyright ©2006 by The McGraw-Hill Companies, Inc.  
All rights reserved.



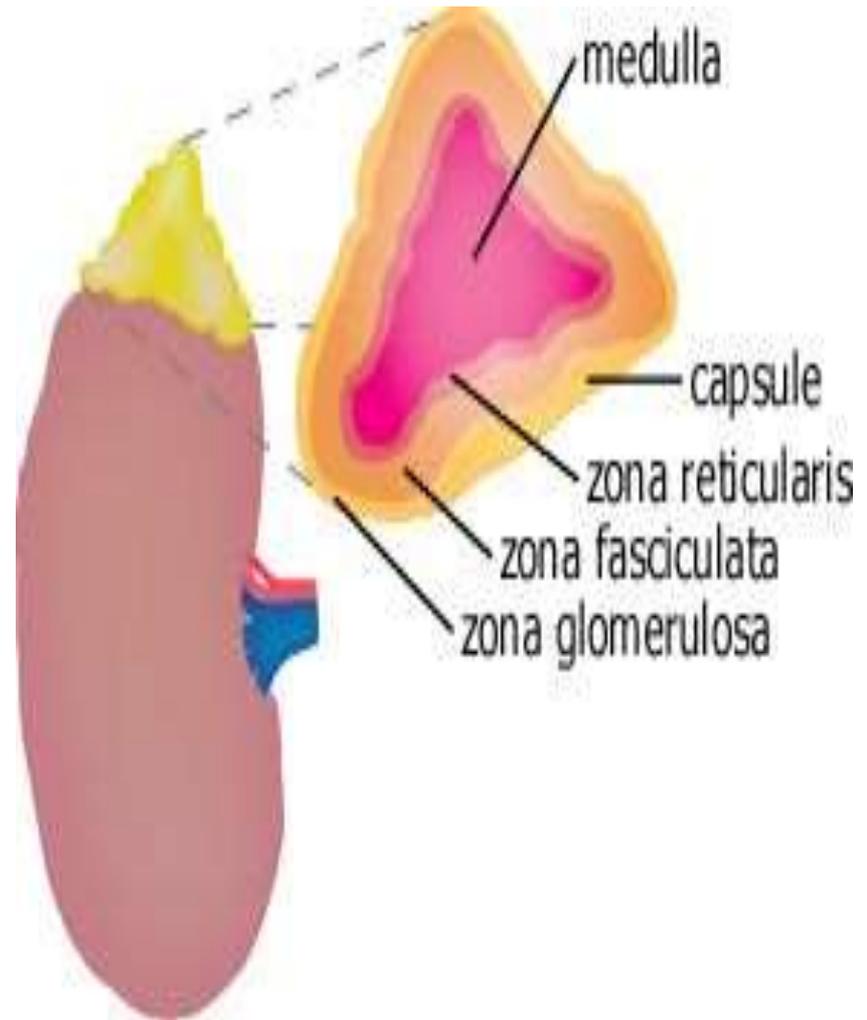
## FUNCTIONAL ANATOMY

The adrenal gland can be divided into two zones, each of which produces specific hormones.

The inner part of the adrenal gland called **medulla** secretes adrenalin (epinephrine) and noradrenalin (nor epinephrine)

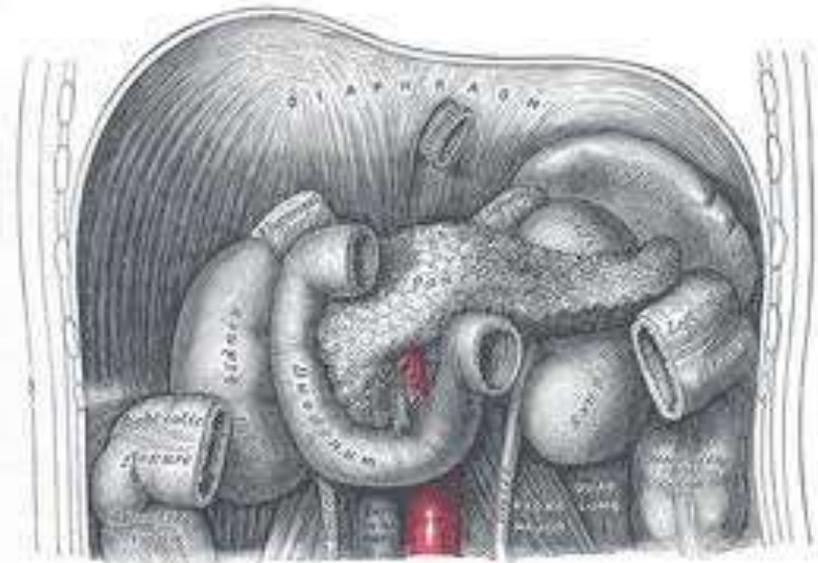
The outer part of the adrenal gland called **cortex** secretes:

- **Mineralocorticoid** → Aldosterone (zona glomerulosa)
- **Glucocorticoid** → cortisol (Zona fasciculata)
- **Androgen** (Zona reticularis)



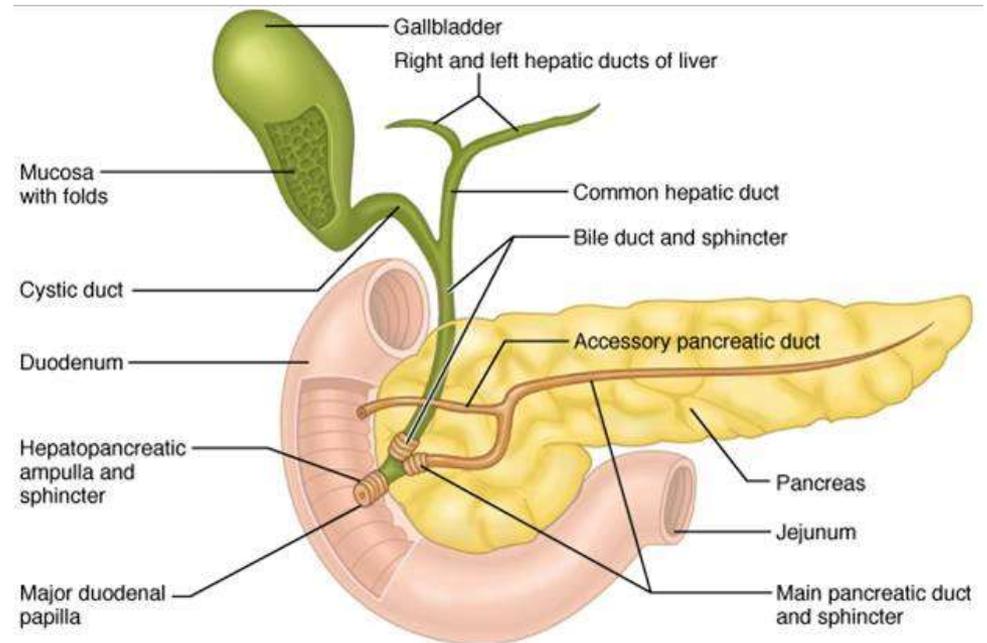
# PANCREATIC GLAND

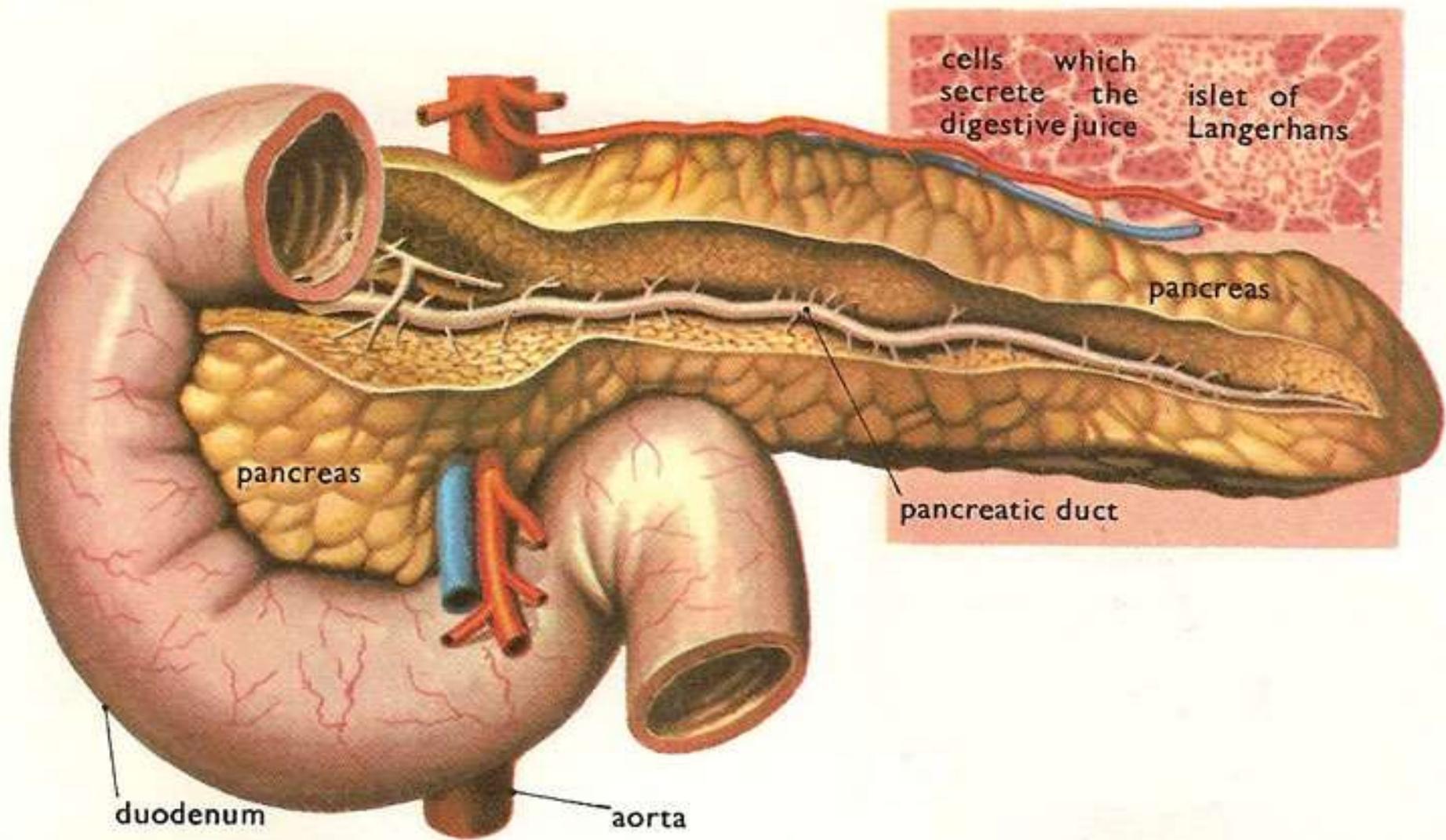
- Gland with both exocrine and endocrine functions
- 15-25 cm long
- 60-100 g
- Location: in epigastric and left hypochondric region. Retro-peritoneum, 2<sup>nd</sup> lumbar vertebral level
- Extends in an oblique, transverse position
- Parts of pancreas: head, neck, body and tail



# PANCREATIC DUCT

- - Wirsungi duct runs the entire length of pancreas
- Santorini duct drains superior portion of head and empties separately into 2<sup>nd</sup> portion of duodenum
- - Common Bile duct behind first portion of duodenum then through head of pancreas
- Terminates at ampulla of Vater

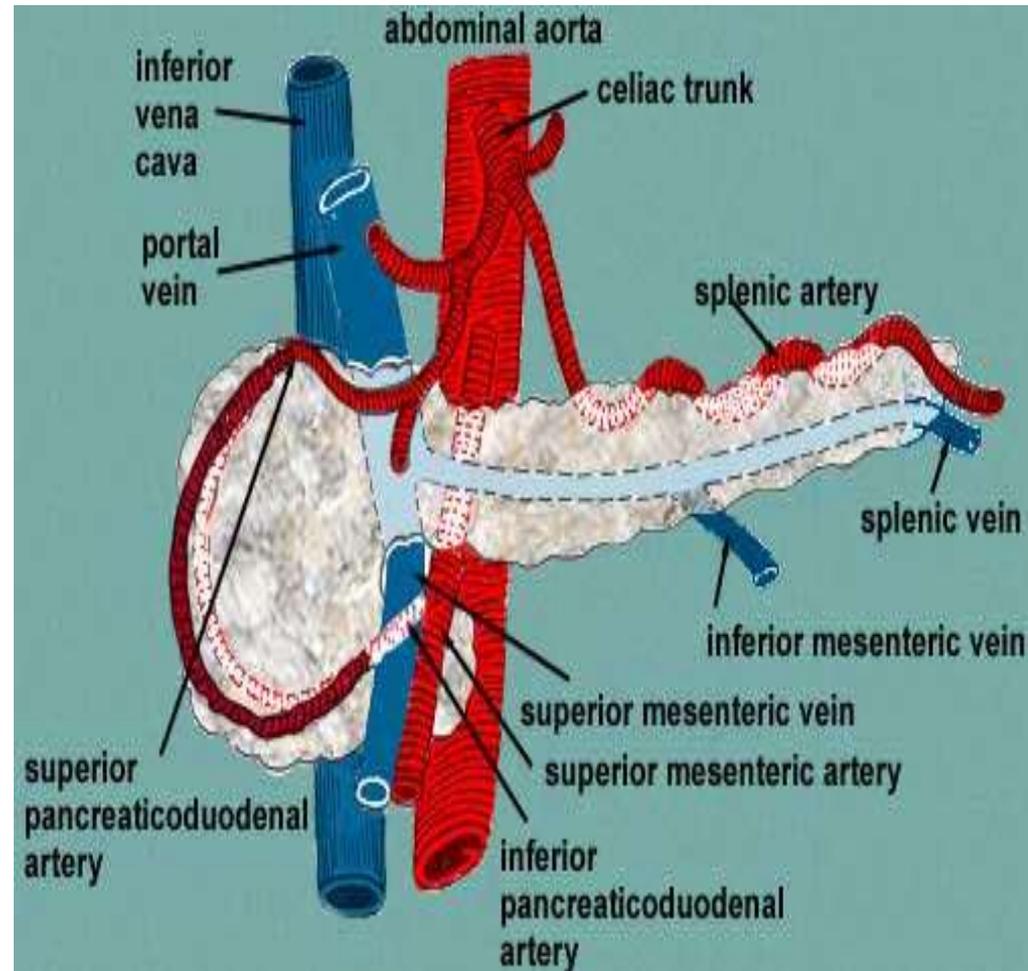




- The pancreas is an endocrine gland which has exocrine and endocrine tissue.
- The exocrine secretes pancreatic juice, a solution containing enzyme for carbohydrate, protein and triacyl glycerol digest.
- Pancreatic juice drains into the small intestine.
- The endocrine part secretes hormones for the regulation of blood glucose concentration, include insulin, glucagon and somatostatin .

## BLOOD SUPPLY

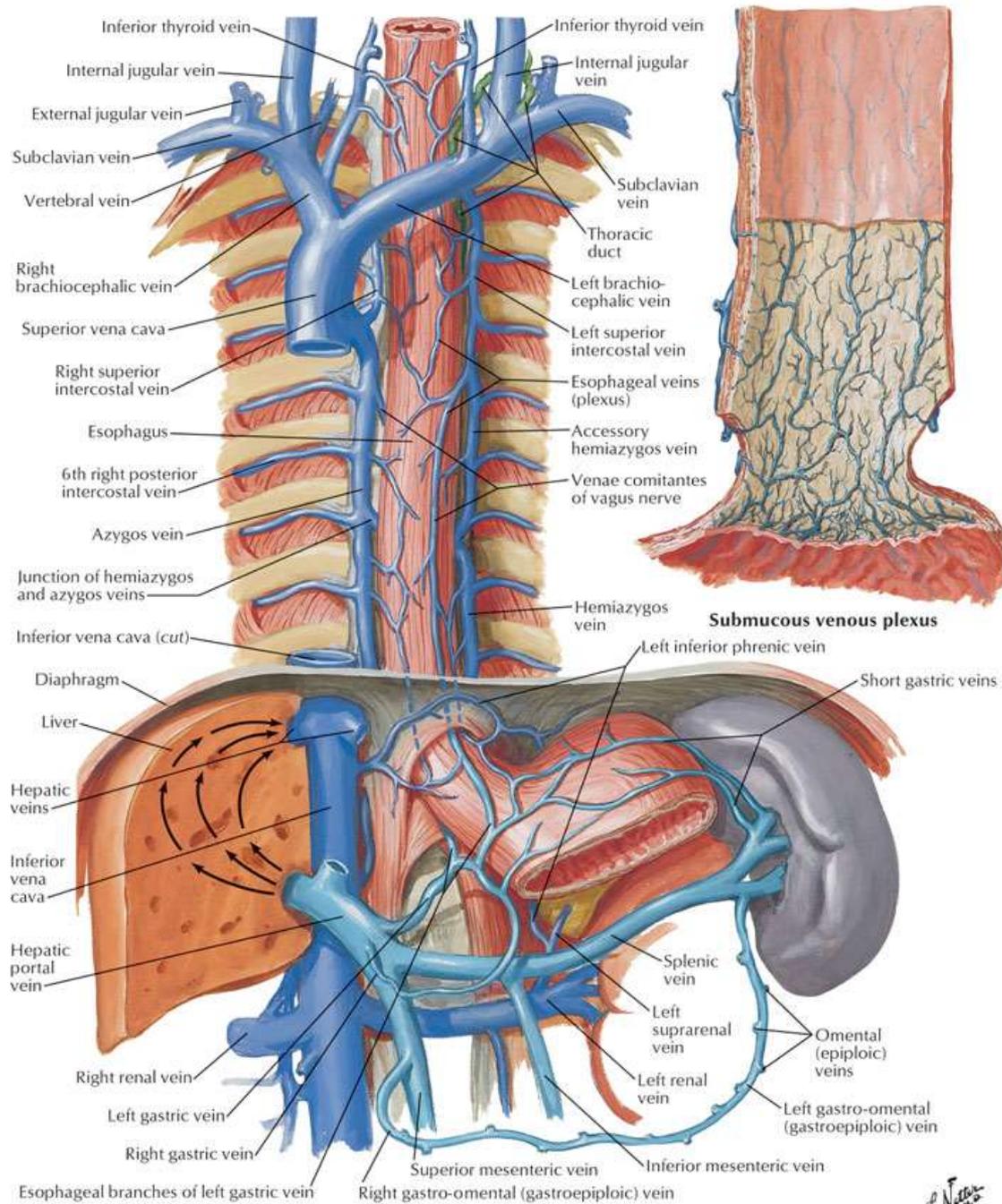
Blood supply from **Splenic artery**, **Hepatic artery** and **Superior Mesenteric Artery**  
**Celiac** → **Common Hepatic Artery** → **Gastrooduodenal Artery** → **Superior pancreaticoduodenal artery** which divides into anterior and posterior branches  
**SMA** → **Inferior pancreaticoduodenal artery** which divides into anterior and posterior branches



# Venous Drainage of Pancreas

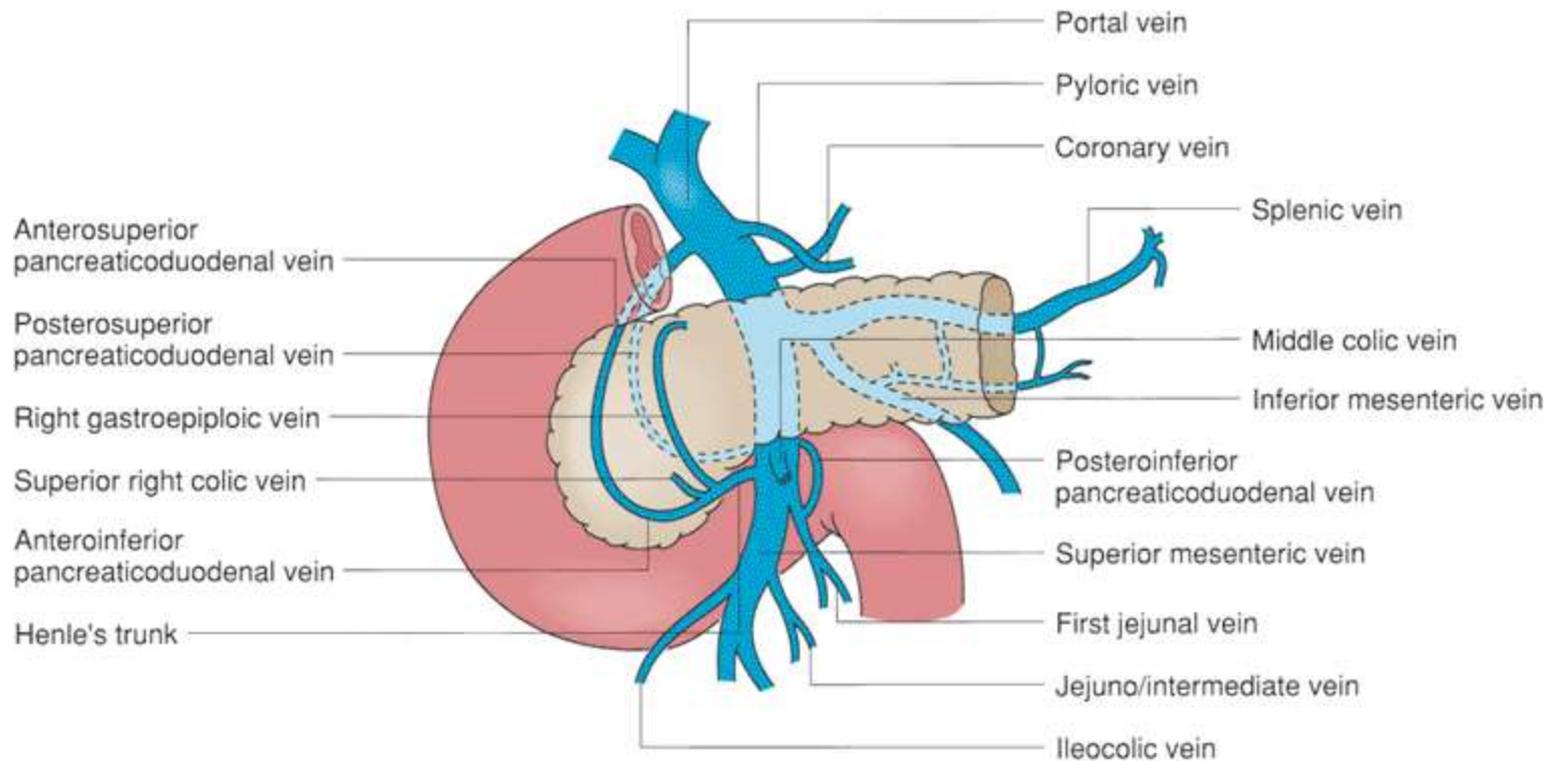
- Follows arterial supply
- Anterior and posterior arcades drain head and the body
- **Splenic vein**
- **Superior and inferior mesenteric vein** pass deep to pancreas, merge with **splenic vein**, terminates in **portal vein**

# Veins of Esophagus



F. Netter

# Venous Drainage of the Pancreas



# Innervation of Pancreas

- Sympathetic fibers from the splanchnic nerves
- Parasympathetic fibers from the vagus
- Both give rise to intrapancreatic periacinar plexuses
- Parasympathetic fibers stimulate both exocrine and endocrine secretion
- Sympathetic fibers have a predominantly inhibitory effect

# Production of Pancreatic Hormones by Three Cell Types

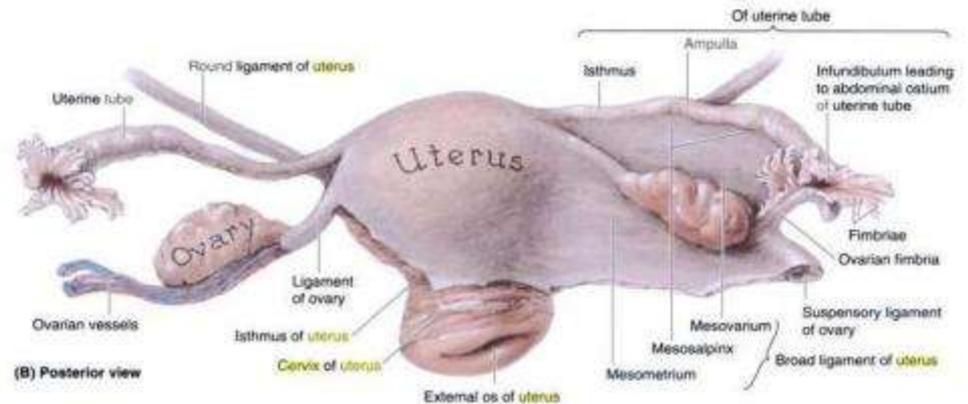
Alpha cells produce glucagon.

Beta cells produce insulin.

Delta cells produce somatostatin.

# OVARY

- The ovaries are the female pelvic reproduction organ and are responsible for the production of **sex hormones**.
- The ovaries are small
- They are paired organ located on either side of the uterus within the Broad Ligament below the uterine fallopian tube.

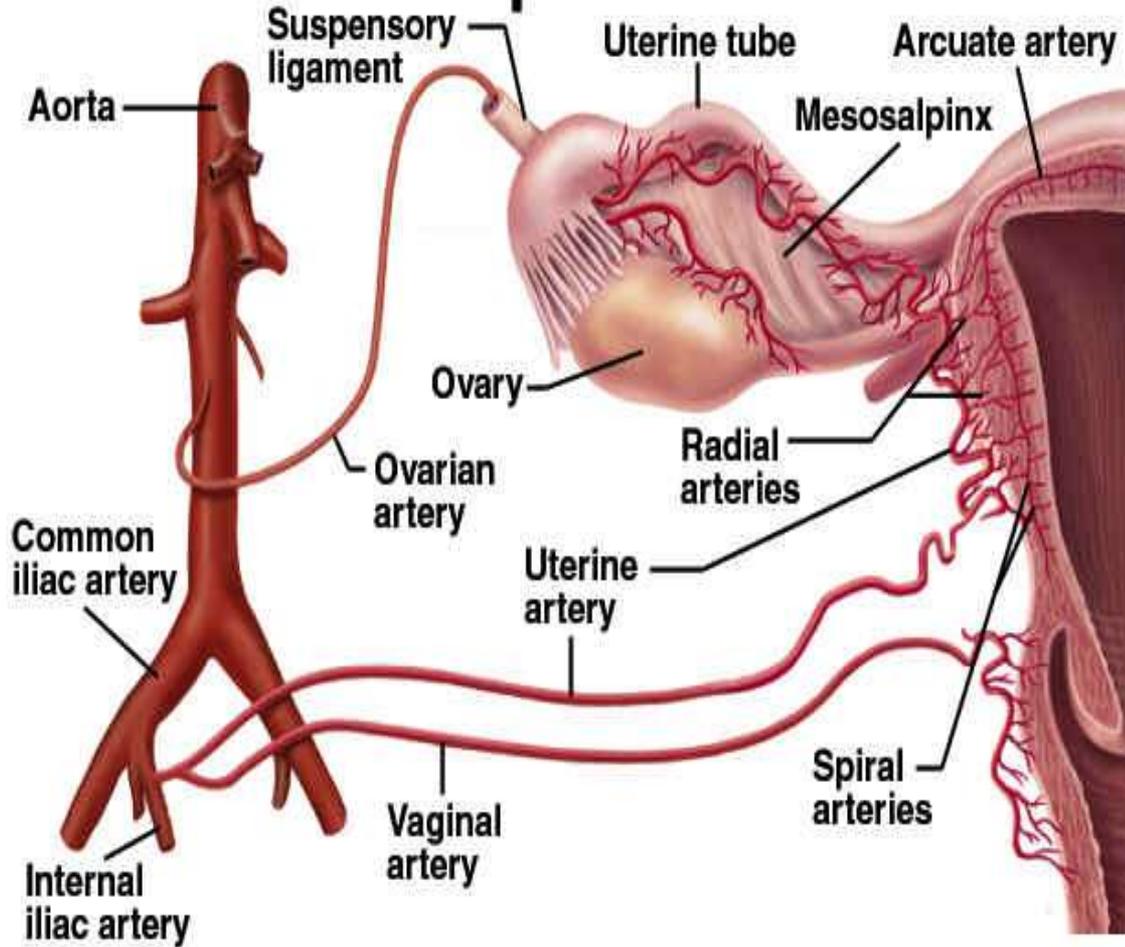


**Figure 3.31. Female pelvic viscera.** A. In this dissection of the female genital organs, the bladder and adjacent anterior pelvis (superior ramus and bodies of pubic bones) have been coronally sectioned and the anterior segment has been removed. On the right side, the uterine tube, ovary, broad ligament, and peritoneum covering the lateral wall of the pelvis have been removed to display the ureter and branches of the internal iliac artery. B. This dissection reveals the uterus, ovaries, uterine tubes, and related structures. The broad ligament is removed on the right side.

## BLOOD SUPPLY

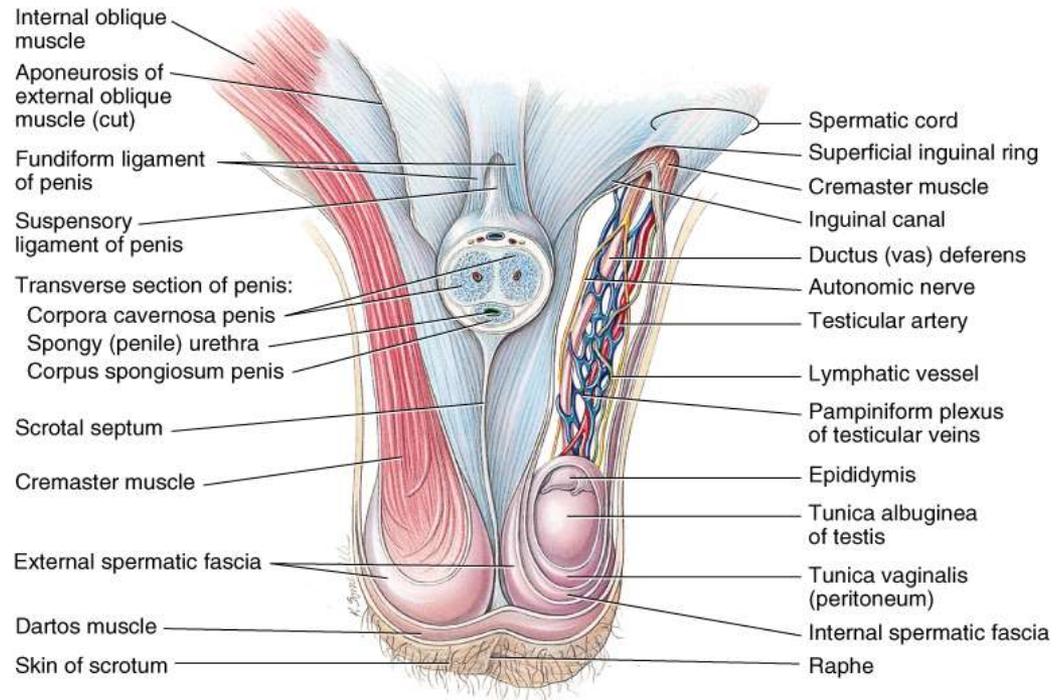
- Blood supply to the ovary is via the **ovarian artery**, both the right and left arteries originate directly from the aorta.
- The **left ovarian vein** drain into the **left renal vein** and the **right ovarian vein** empties into the **inferior venae cava**.
- Hormones produce by the ovary are **estrogen** and **progesteron**.

# Blood Supply to Female Reproductive Tract



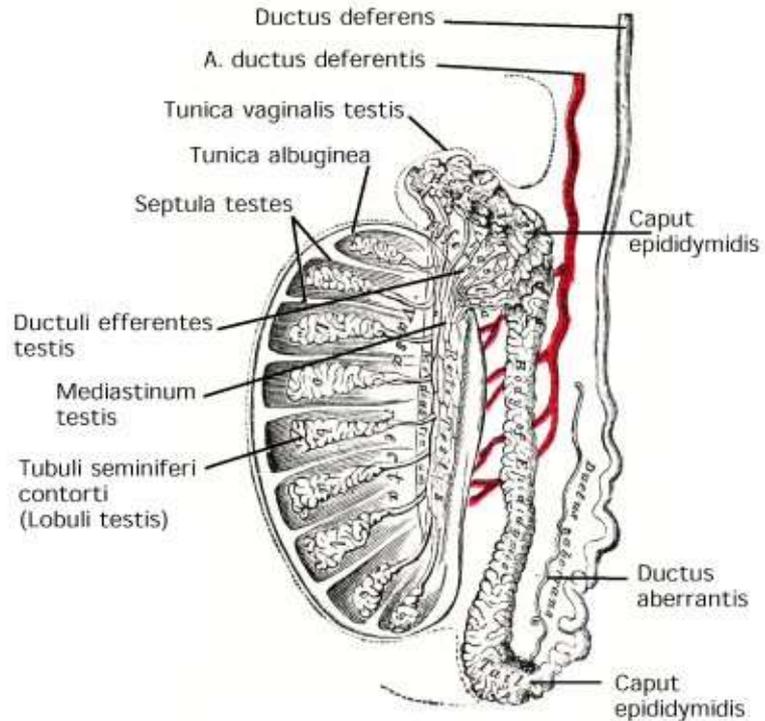
# The TESTES

- TESTES are the male gonads, located in the scrotum.
- Testes are component of both the reproduction system and the endocrine system.

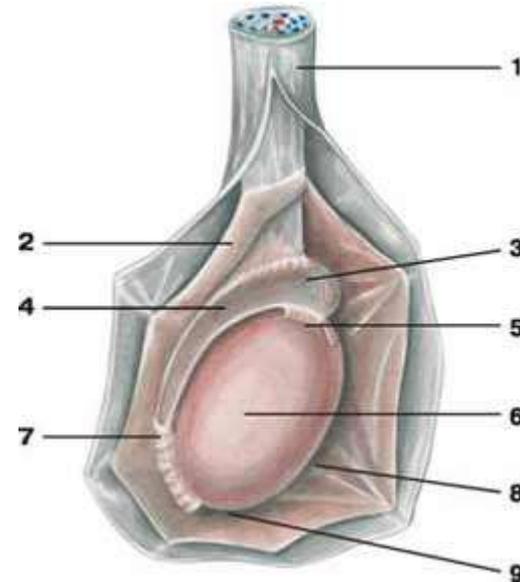


Anterior view of scrotum and testes and transverse section of penis

- Each testis is enclosed by the **tunica vaginalis**, a continuation of the peritoneum that lines the abdominopelvic cavity.
- A fibrous capsule covers each testis called the **tunica albuginea**



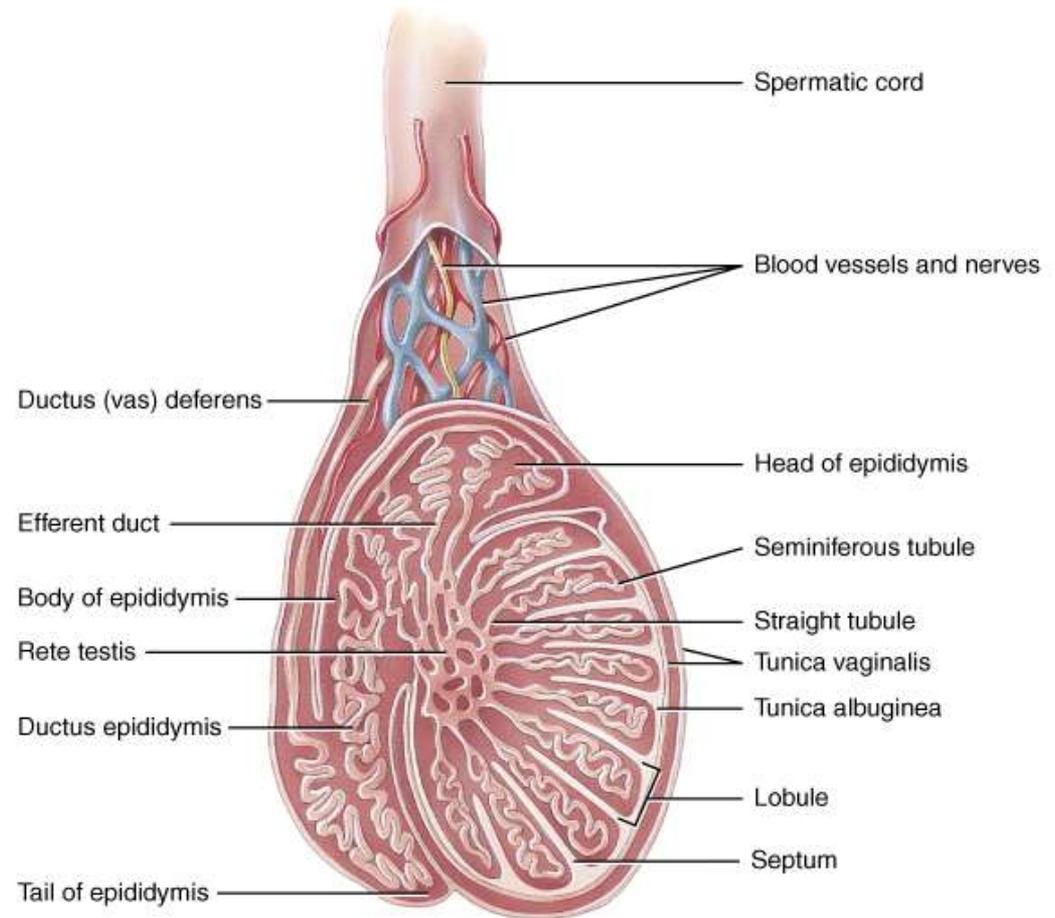
- The primary function of the testes are produce sperm ( spermatogenesis) and to produce androgen (ex, testosteron)
- Gonadotropin Hormon produced by the anterior pituitary:  
LH → Testosteron release  
FSH → Spermatogenesis



## BLOOD SUPPLY

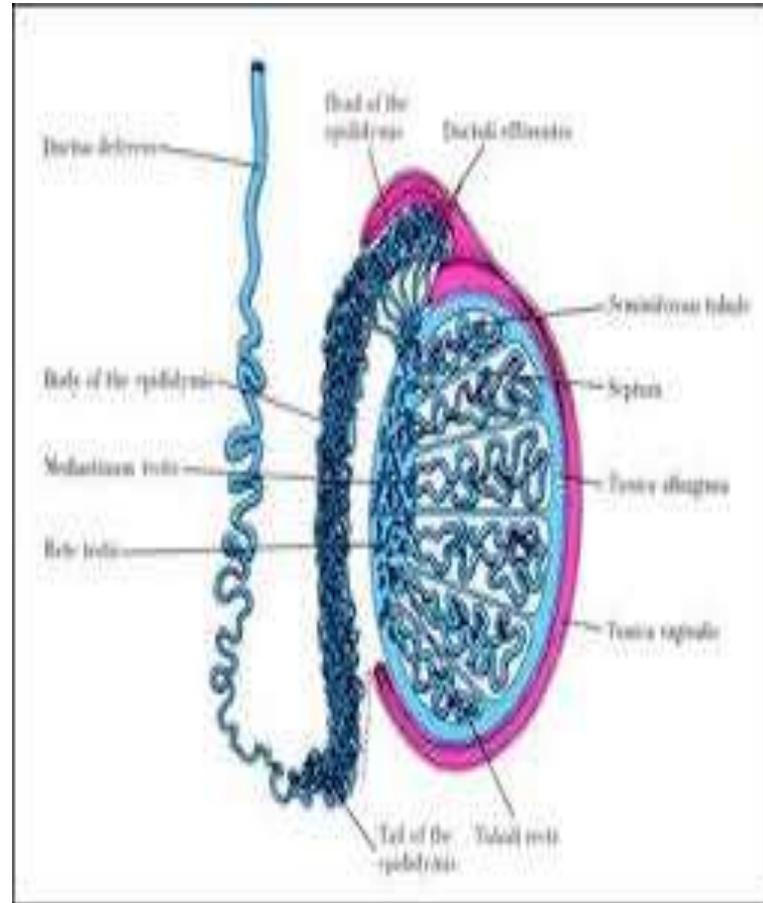
- The paired **testicularis artery** arise directly from the abdominal artery and descend through the inguinal canal.

The **left testicularis vein** drain into the left renal vein and the **right testicularis vein** empties into the inferior venae cava.

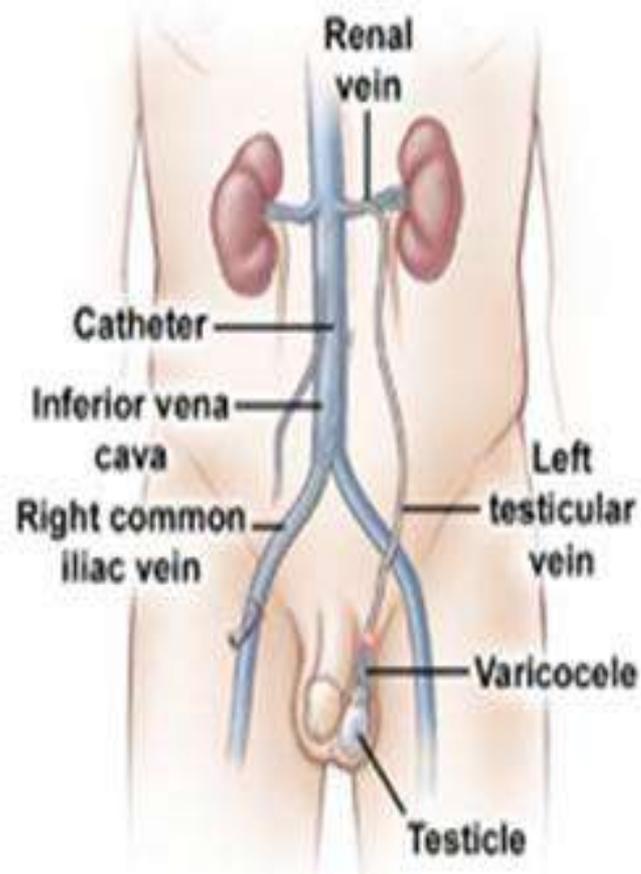


(a) Sagittal section of a testis showing seminiferous tubules

- The tunica albuginea gives rise to septa (partitions) that divide the testis into lobules (about 250)
- Each lobule contains 3 or 4 highly coiled seminiferous tubules
- These converge to become rete testis which transport sperm to the epididymis



- The testicular arteries branch off the abdominal aorta near the kidneys.
- The right testicular vein drains directly into the inferior vena cava, while the left testicular vein drains into the left renal vein and then into the inferior vena cava.
- Note how the vessels cross over the ureters and enter and exit the inguinal canal with the spermatic cord via the deep and superficial inguinal rings, respectively.



**THANK YOU**