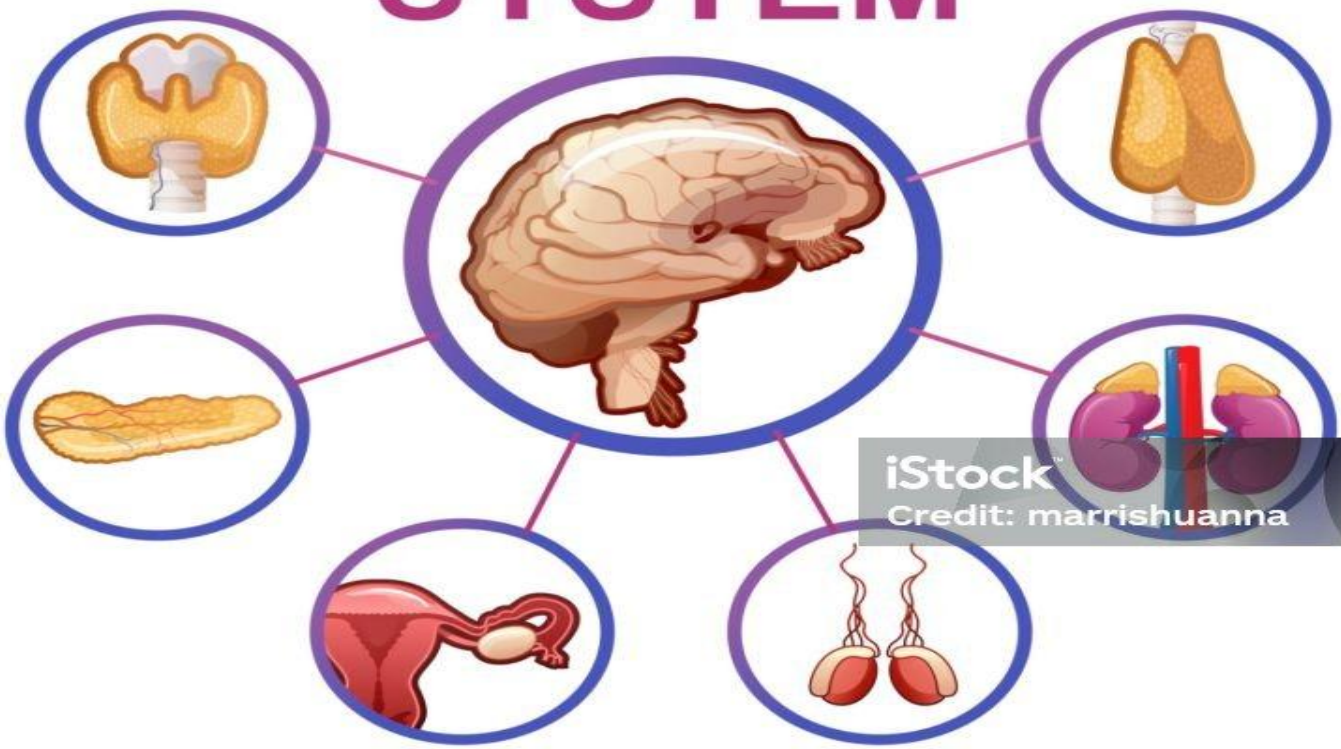
ENDOCRINE SYSTEM



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By

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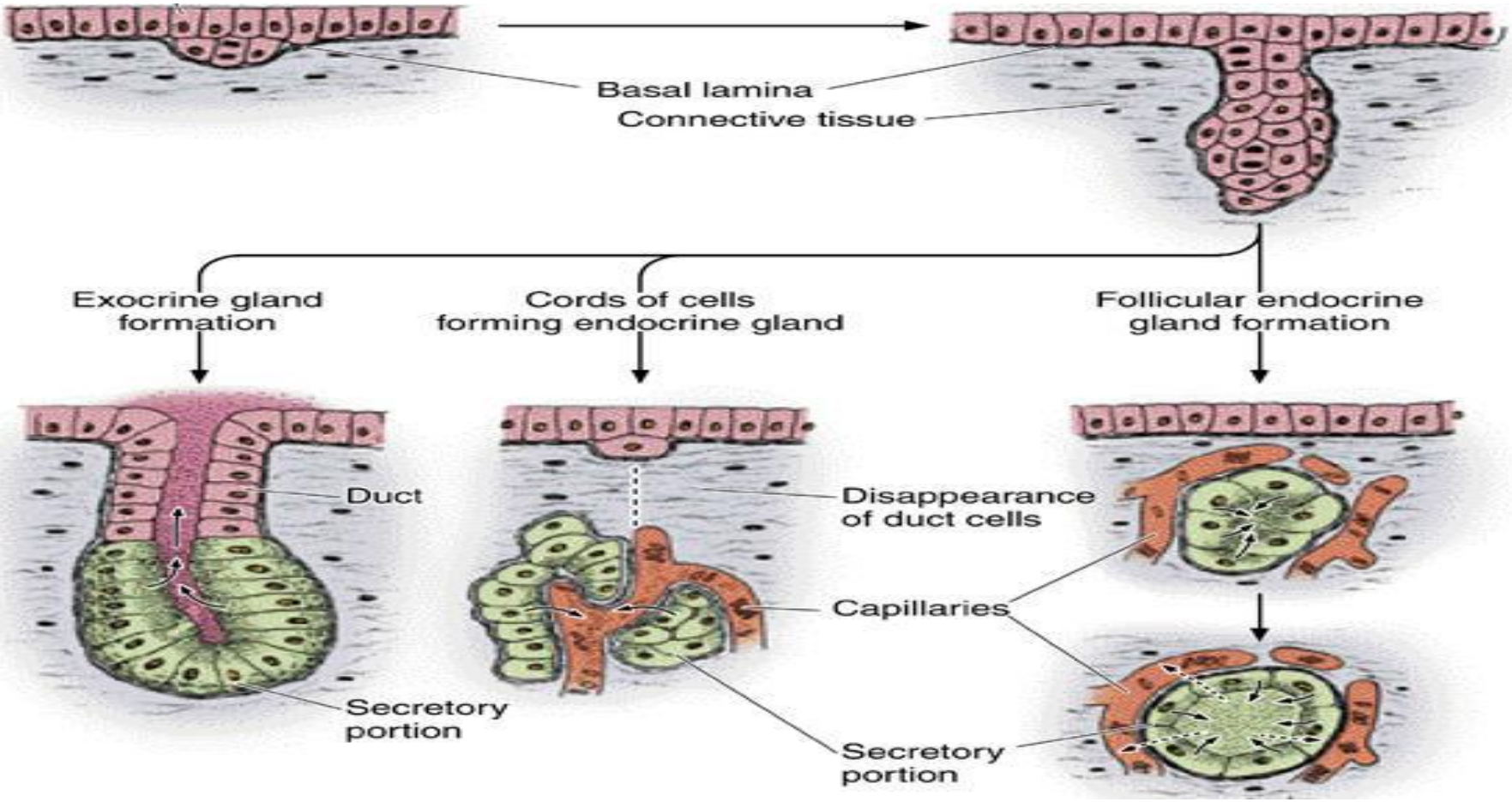
ILOS

- Describe the histological structure of the following endocrine glands: Pituitary, Adrenal, Thyroid, Parathyroid.
- Know the histological structure of primary sex organs secrete hormones (testis and ovary).
- Identify different types of cells present in each gland.
- Differentiate between different types of endocrine glands.
- Relate the composition of each gland to its specific function.
- Predict the special type of hormones secreted by each gland.

Origin of gland

They develop as invagination from surface epithelium, then separate.



Types of glands

1- Ducts present: Exocrine glands.

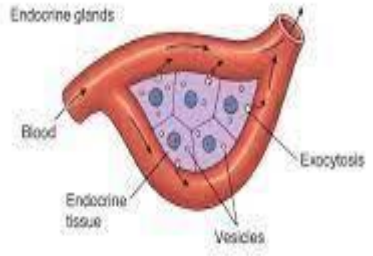
- They retain their connection with the surface epithelium
- Have ducts to carry their secretion outside
- Examples: Salivary glands and sweat glands

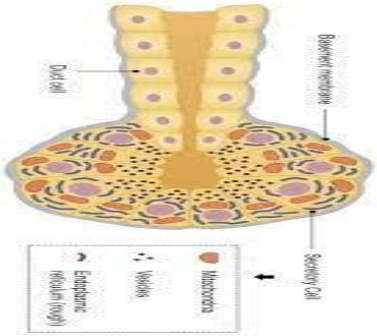
2- Ducts absent: Endocrine glands.

-connection with the surface was obliterated-

-They secret hormones directly in the blood

Example: Thyroid gland





3- Mixed glands:

-Have both exocrine and endocrine functions

- Example: pancreas

Endocrine System

- It consists of the endocrine glands *or* cells.
- They deliver their secretion (hormones) into the blood stream.
- Hormone

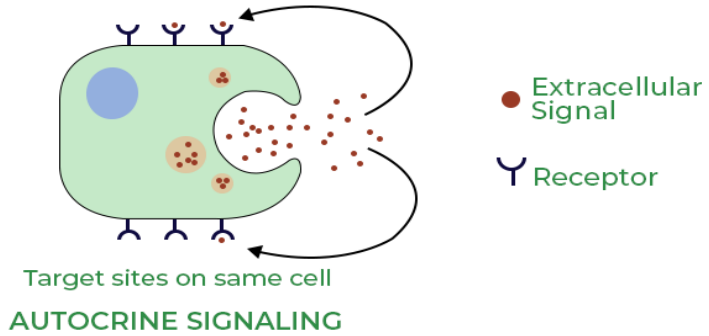
-is a small chemical molecule can enter the blood stream and cause an action at Target cells or tissue at a distance from the site of their secretion.

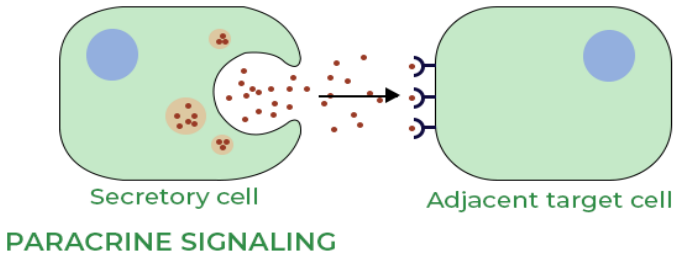
- regulate functions of different organs.

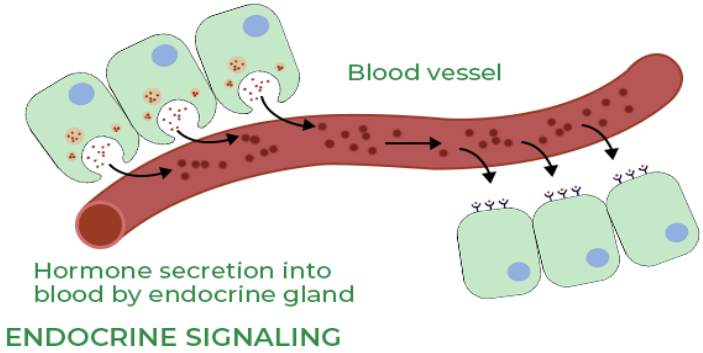
- Target cells have receptors for those hormones.
- The endocrine system and nervous system work together.

Patterns of hormone Action

- **Endocrine:** circulated by blood to distant target cells.
- **Paracrine:** Hormones that affect neighboring cells.
- **Autocrine:** Hormones that act on the cells that secrete them.







General characters of endocrine glands

- They have no ducts.
- Each gland consists of groups of secretory epitheloid cells.
- The cells are surounded by have fenestrated blood capillaries and stromal reticular network.

Chemical types of hormones

- **Steroids:** hormones of adrenal cortex.
- **Proteins:** hormones of pituitary gland.
- **Aminoacids:** catecholamine of adrenal medulla.

Protein synthesizing cells

Sites: ***e.g:*** thyroid gland

LM

Cells pyramidal.
Nucleus central rounded.
Apical Acidophilia (secretory granules).
Basal Basophilia
(RER).

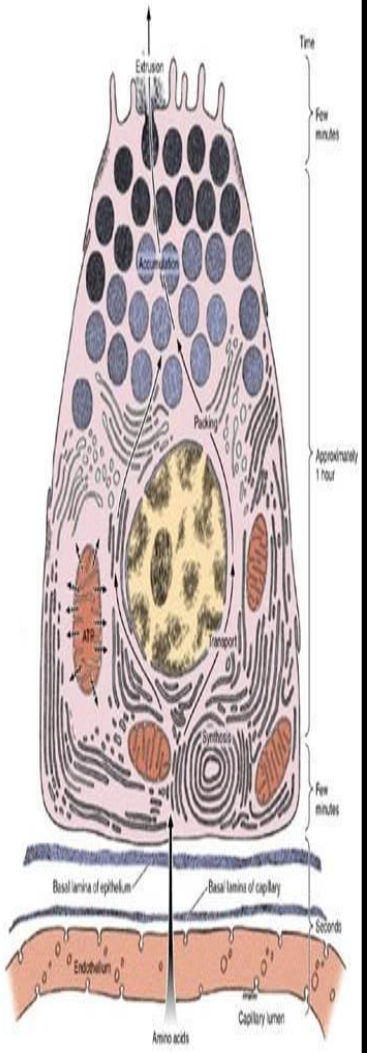
E/M

In the basal region:

- Infranuclear parallel arrays of rER
- Abundant ribosomes.
- Mitochondria are interspersed among rER.

In the apical region:

- Golgi complex supranuclear
- Secretory granules



Steroid secreting cells

Sites: testes, ovaries and adrenal glands.

L/M: -polyhedral

-acidophilic cytoplasm

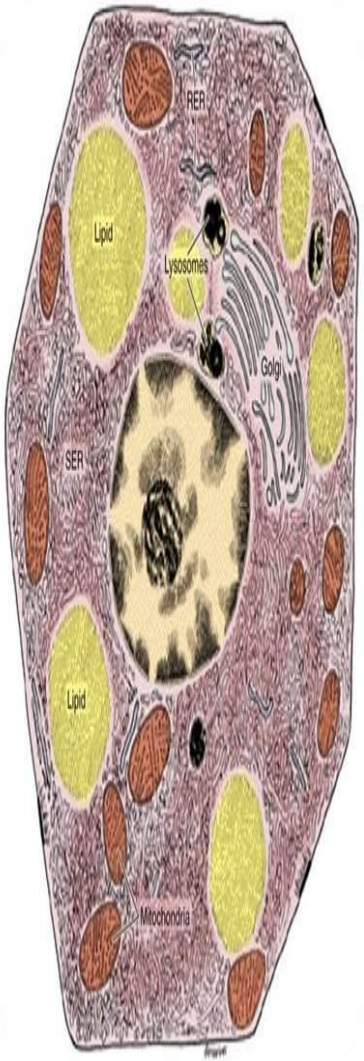
-central nucleus.

-Rich in lipid droplets

E/M:

- Microvilli on the surfaces facing blood capillaries
- Rich in SER.
- Rich in lipid droplets
- mitochondria with tubular cristae

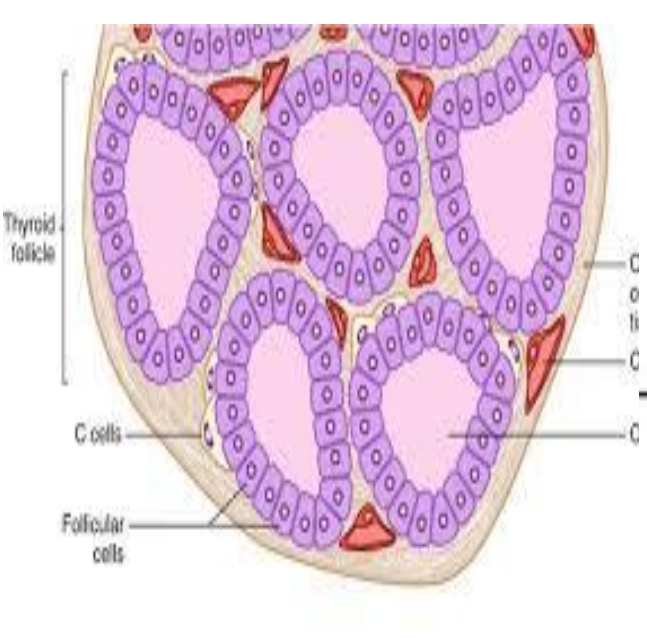
Golgi apparatus, lysosomes, and few RER

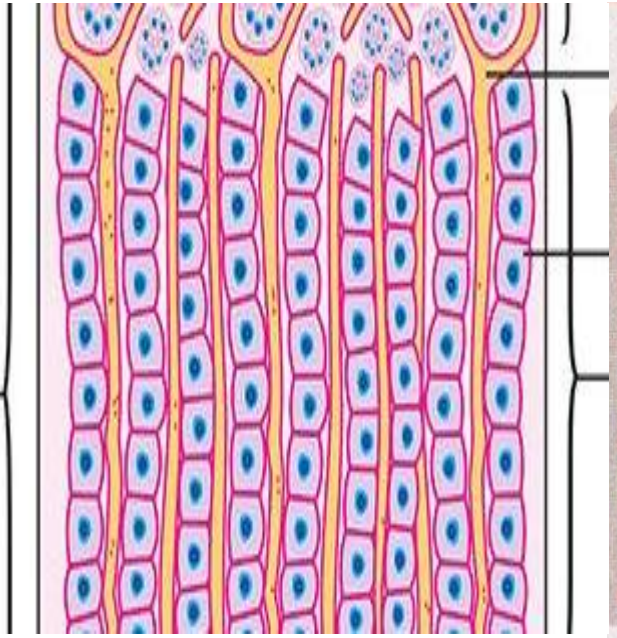


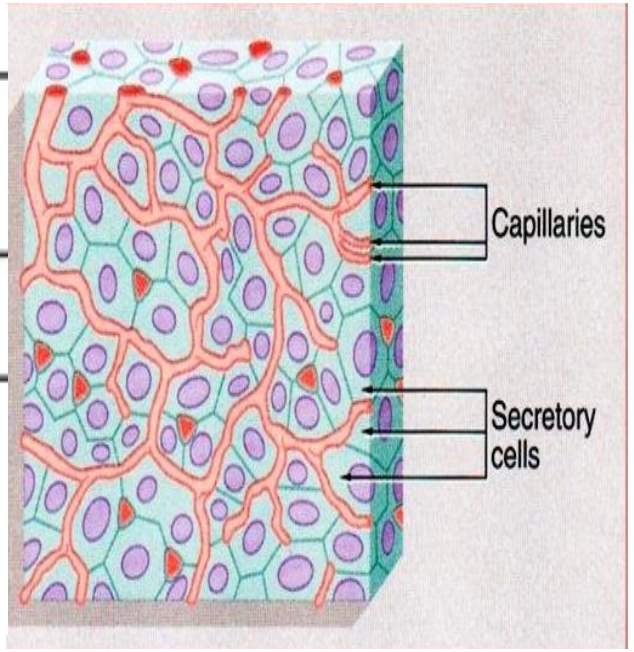
The endocrine glands structure

- Stroma:
  - Thin capsule
  - Septa: divid the gland into compartments.
  - Network of reticular fibers.
- Parenchyma:
  - Polyhydral cells.
  - Arranged as cords or follicles. Or have irregular pattern.
  - Separated by fenestrated blood capillaries.

Follicles **Cords** **irregular pattern**







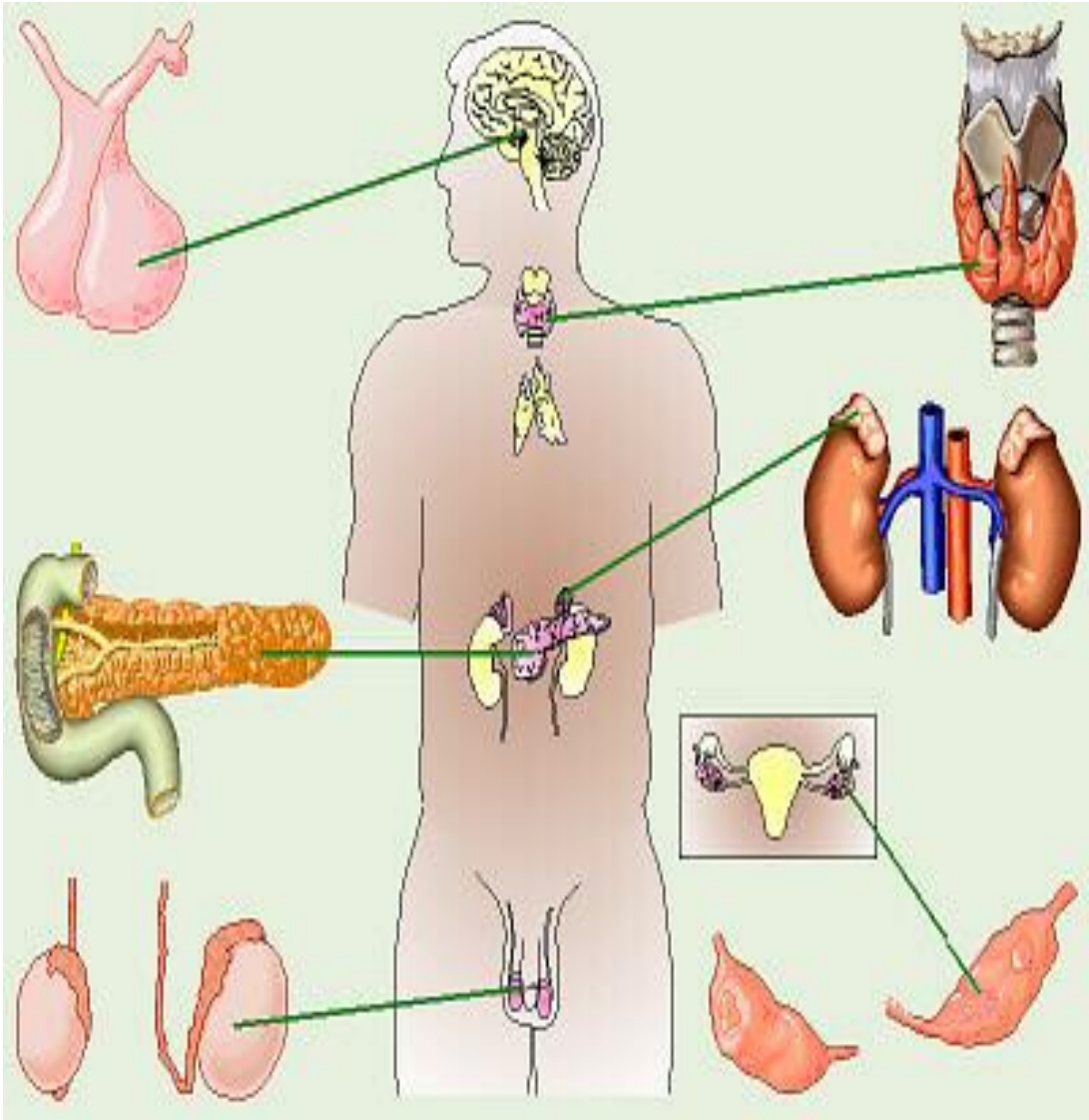
Endocrine glands

1-Pituitary gland.
2-Pineal gland.

3-Thyroid gland.
4-Parathyroid gland.

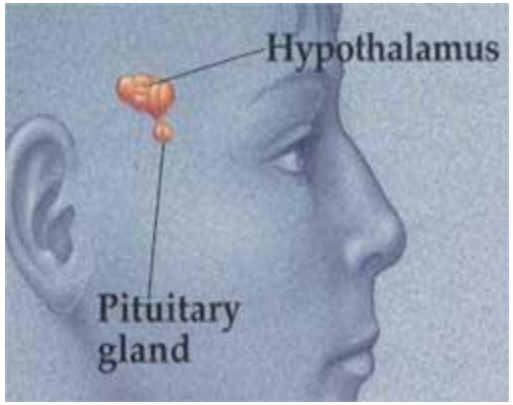
5-Islets of Langerhans.
6- Adrenal gland.

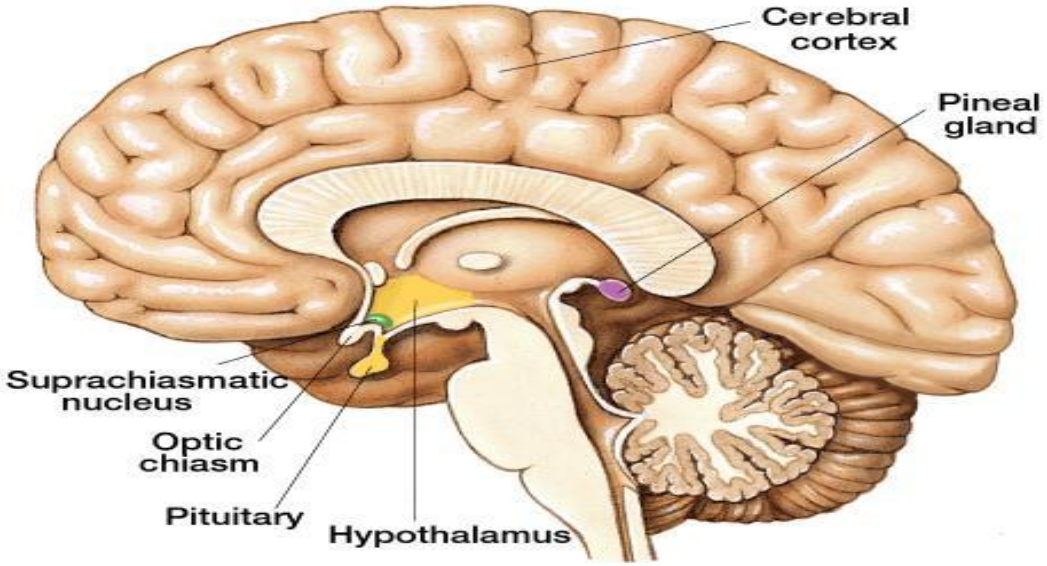
7-Testes.
8-Ovaries.



Pituitary gland
(Hypophysis Cerebri)

- Attached to base of brain by a slender stalk called the infundibulum.
- The master endocrine gland.
- Controls other endocrine glands.
- Controlled by hypothalamus





It is divided anatomically into two parts:

Anterior Pituitary (adenohypophysis)

It includes:

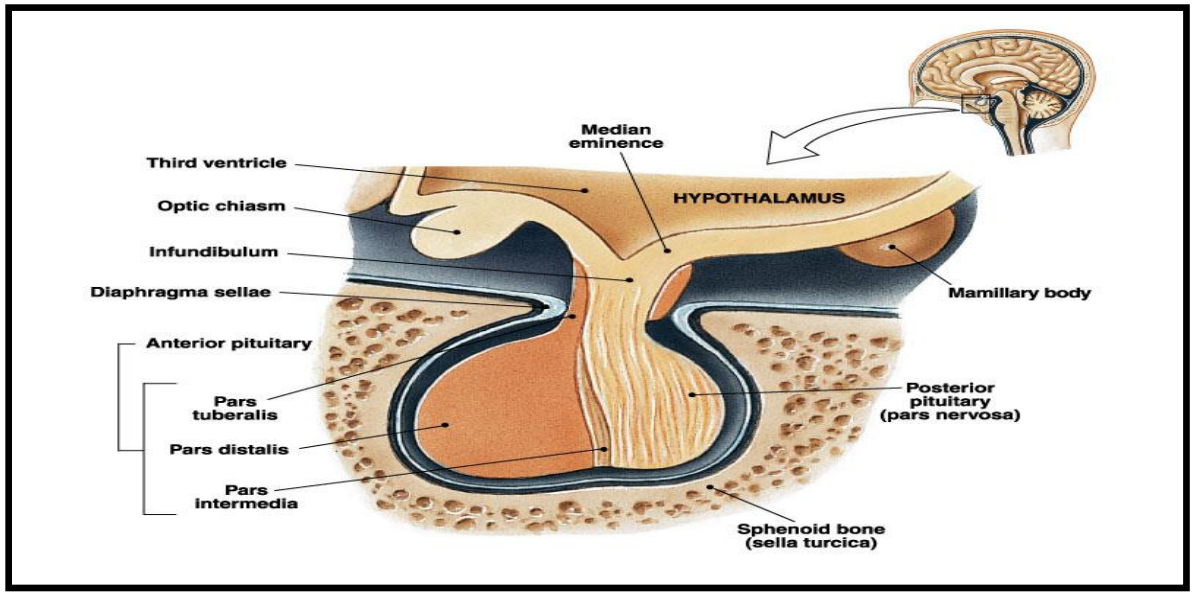
a) Pars Distalis
b) Pars Tuberalis
c) Pars intermedia

Posterior Pituitary (neurohypophysis)

It includes:

a) Pars nervosa.
b) Infundibulum

Both the adenohypophysis and the neurohypophysis are joined and covered by C.T. capsule.



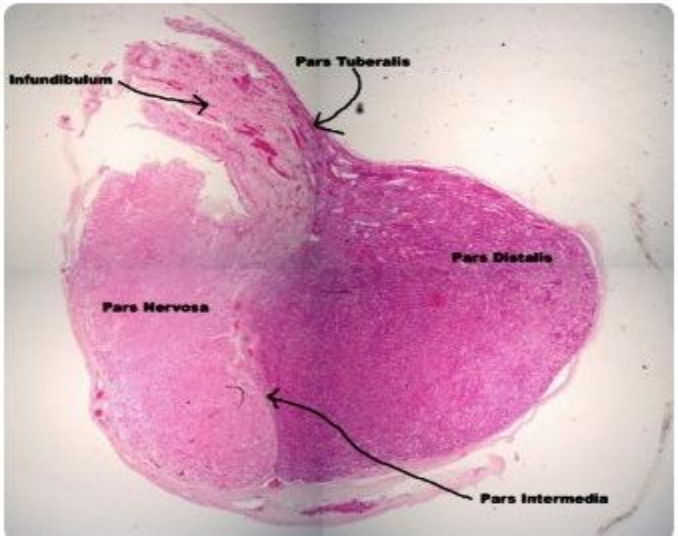
The adenohypophysis

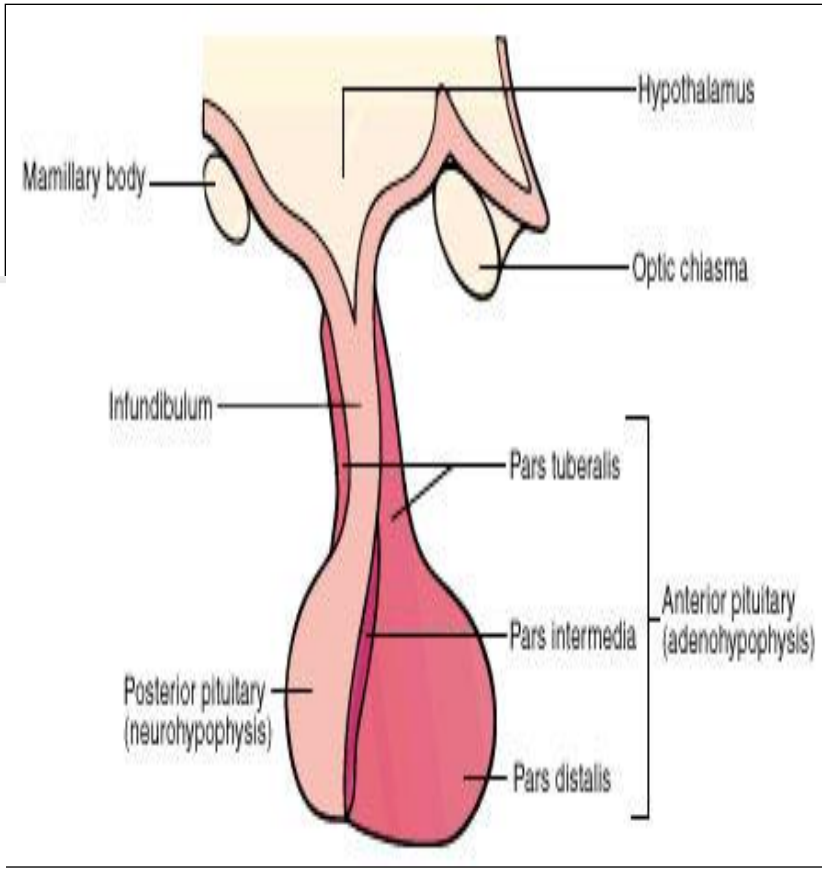
- ***Pars distalis:*** anterior largest part.
- ***Pars tuberalis***: superior extension.
- ***Pars intermedia***: between distalis & nervosa.

The neurohypophysis

- ***Pars nervosa***: the large part.
- ***Infundibulum (neural stalk):***

small part.





The adenohypophysis
A- Pars distalis

- **Composed of irregular cords of cells separated by fenestrated capillaries.**
- The parenchymal cells either:

1- Chromophobes: 50%

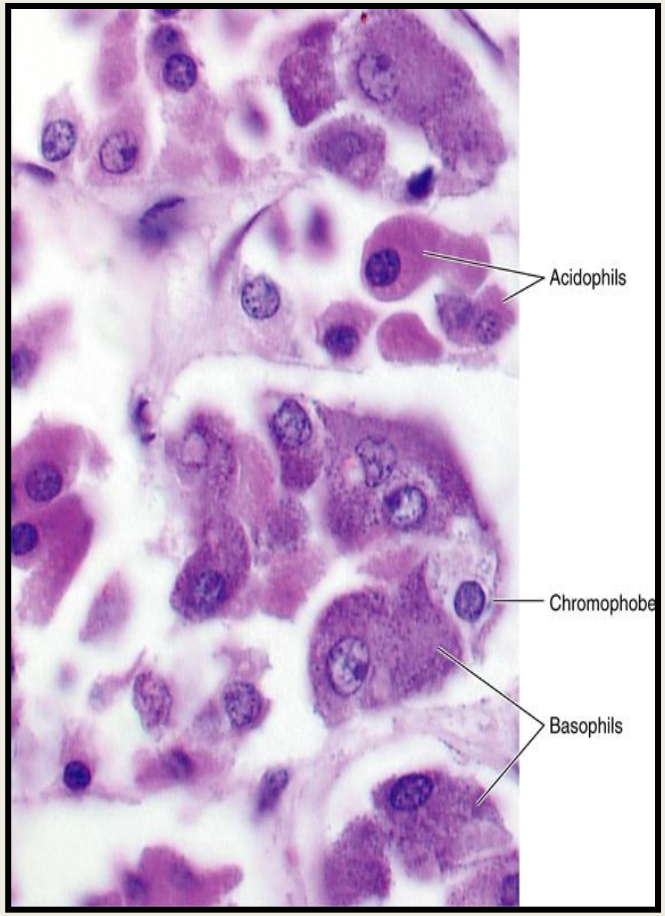
- have no affinity for stains
- represent stem cells ***or*** exhausted chromophils

2- Chromophils: 50%

-have affinity for stains.

a) Acidophils (stain with acid dyes).

b) Basophils (stain with basic dyes).



Acidophils (40%)

L/M:

- **large in number**
- contains acidophilic granules.

A2=SM

E/M

The secretory granules have characteristic size, shape and electron density by which the different cell types can be recognized.

are of two types:

1-Somatotrophs:

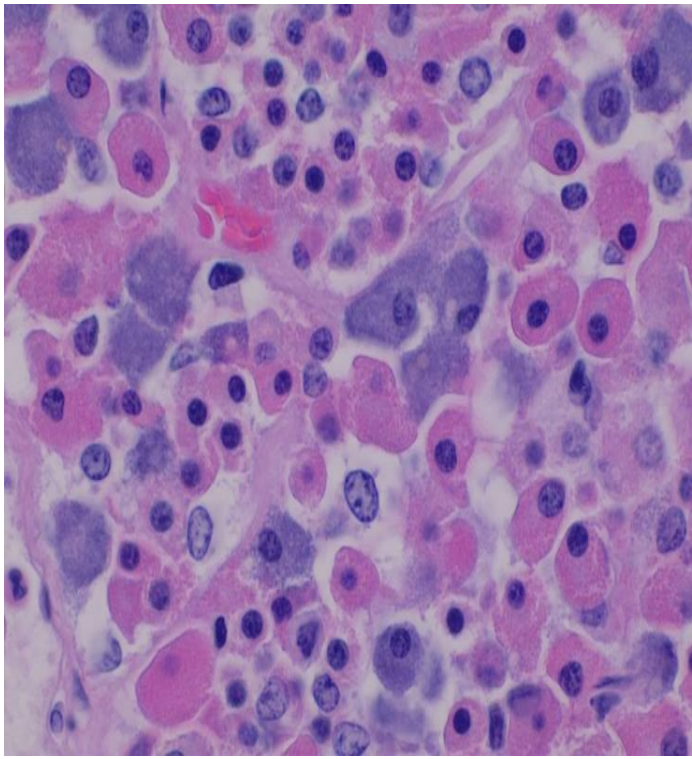
secrete growth hormone

- stimulate growth of long bone.

2-Mammotrophs:

secrete prolactin hormone

- stimulate mammary gland development.
- stimulates milk secretion.



Basophils (10%)

LM:

- few in number
- contains basophilic granules.

B3= CGT

EM: are of different types:

1-Corticotrophs:

- secrete **adrenocorticotropic hormone [ACTH]**
- stimulates suprarenal cortex.

2-Thyrotrophs:

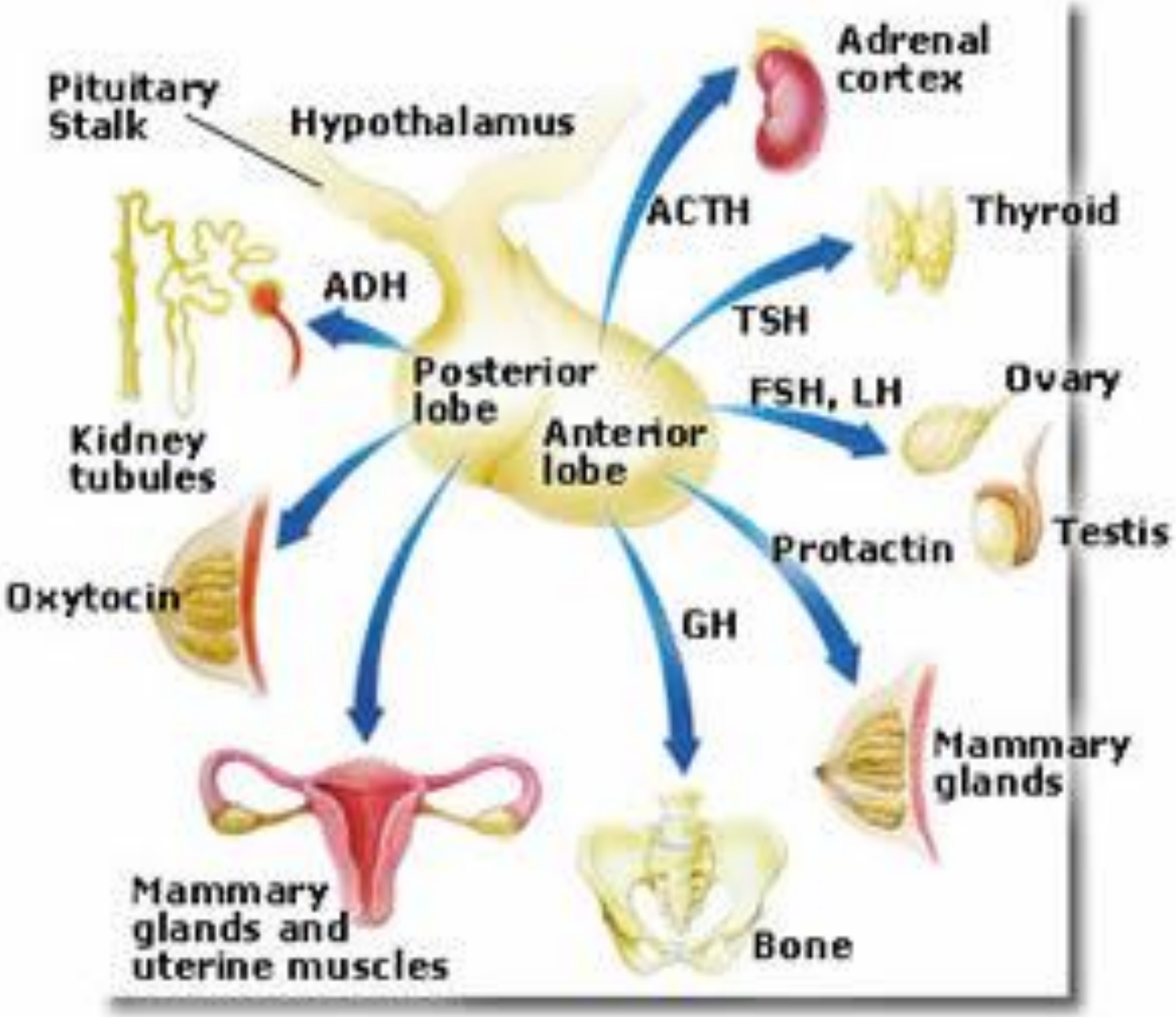
- secrete **thyroid stimulating hormone (TSH)**
- stimulates thyroid gland.

3-Gonadotrophs: secrete:

A- Follicle stimulating hormone (FSH) stimulates ovarian follicles development and estrogen secretion.

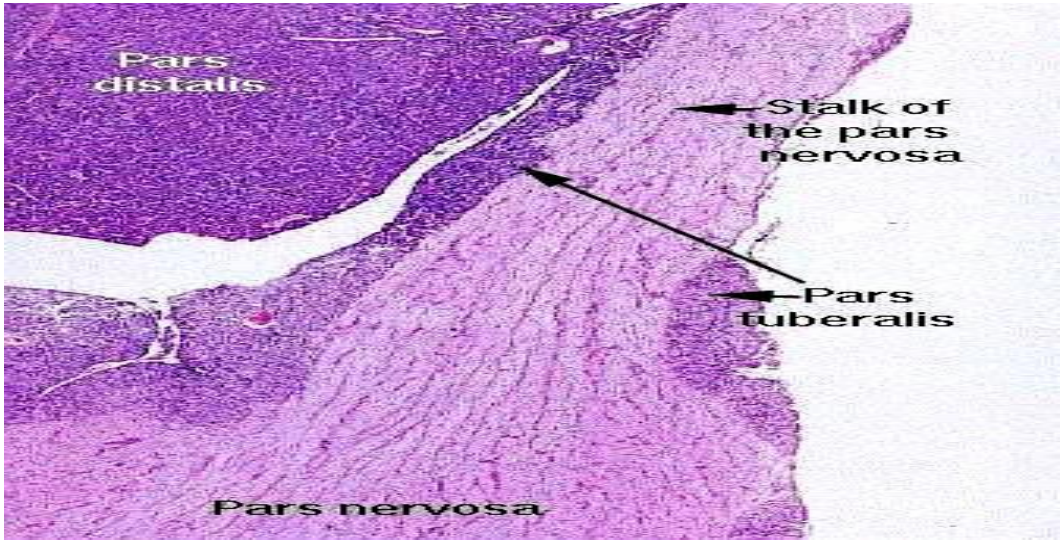
B- Luteinizing hormones (LH) stimulates ovarian follicle maturation and progesterone secretion

C- Interstitial cell stimulating hormone (ICSH) stimulates production of androgens by interstitial cells of testes.


Pituitary Stalk
Hypothalamus
Adrenal cortex
ACTH
Thyroid
TSH
ADH
Kidney tubules
Posterior lobe
Anterior lobe
FSH, LH
Ovary
Testis
Protactin
Oxytocin
GH
Mammary glands
Mammary glands and uterine muscles
Bone

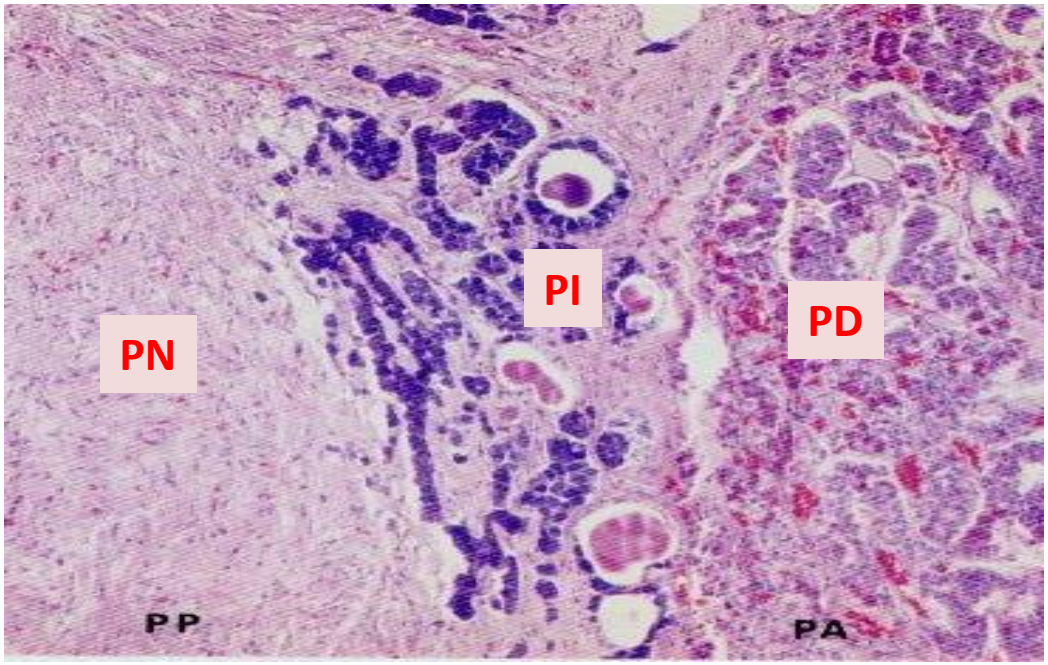
B- Pars tuberalis

- Funnel-shaped superior extension of pars distalis.
- Wraps the **pituitary stalk** (infundibulum).
- highly vascularized.
- cells are cuboidal arranged in longitudinal cords alongside the blood vessels.
- Secrete gonadotropins [FSH & LH]



C- Pars intermedia

- Thin part between pars distalis & nervosa.
- Rudimentary in humans.
- Made up of *follicles* and blood capillaries.
- Secrete melanocyte stimulating hormone (MSH).



Pars nervosa

- Stained Pale in Hx & E sections.
- Contains *no secretory cells*.
- Composed of:

1- Nerve fibers: axons of hypothalamohypo-physeal tract.

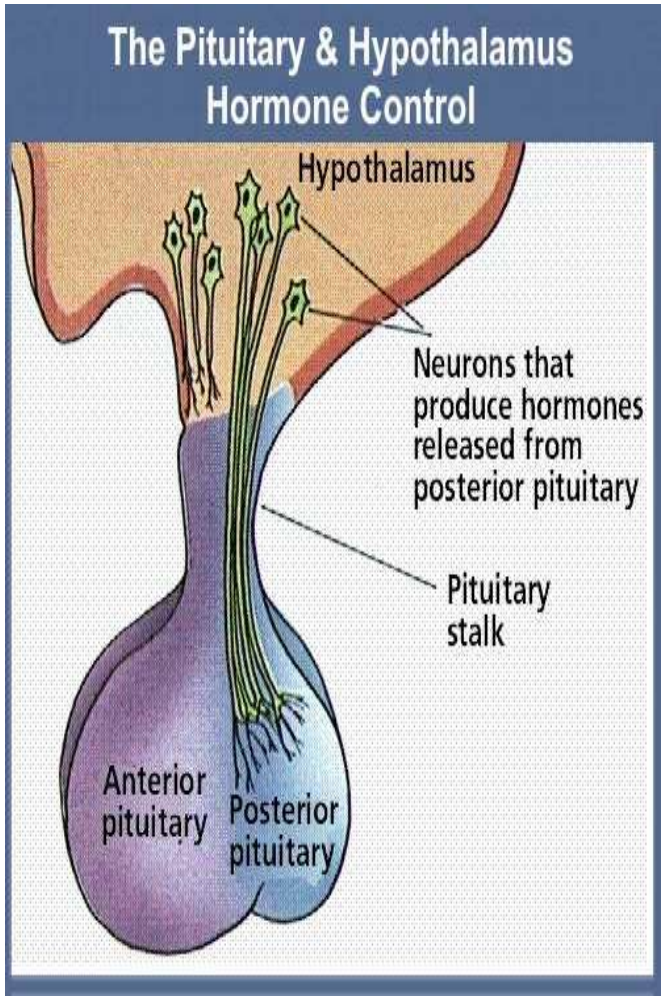
2- Supportive cells: pituicytes.

3-Herring bodies: accumulations of neuro-secretion in dilated terminals of axons.

4- Wide fenestrated blood capillaries.

Pituicytes

- Similar to neuroglial cells.
- Highly branched cells.
- Support axons of pars nervosa.



Functions of pars nervosa (Hypothalamo-hypophyseal tract)

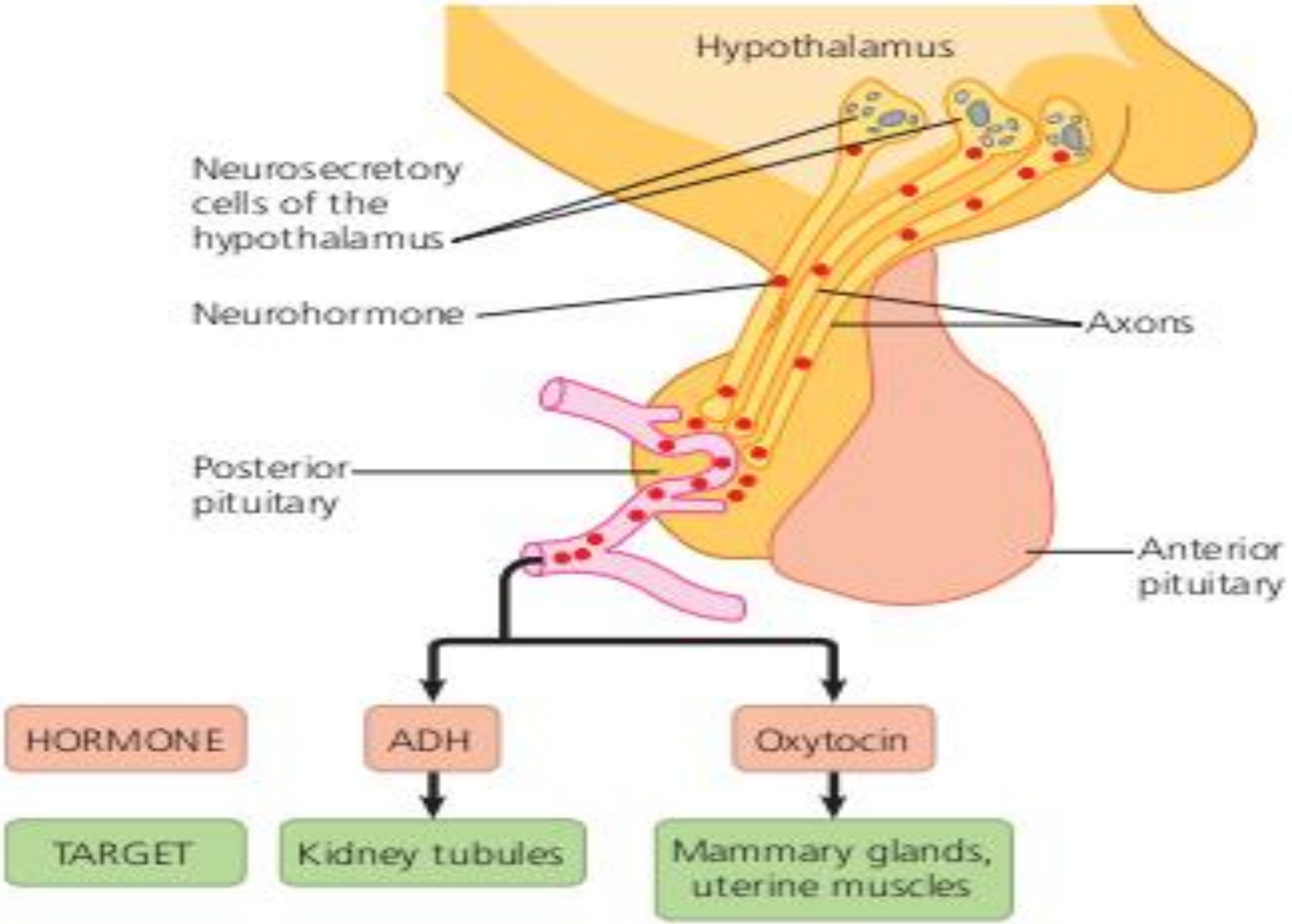
- Oxytocin and ADH are
  - synthesized in nuclei of hypothalamus.
  - travel within axons of hypothalamo-hypophyseal tract in neural stalk to reach pars nervosa.
  - accumulate as Herring bodies.
  - pass through fenestrated capillaries to blood.

1- *Oxytocin:*

- Stimulates contraction of smooth muscle of uterus during labor.
- Stimulate milk ejection during lactation.

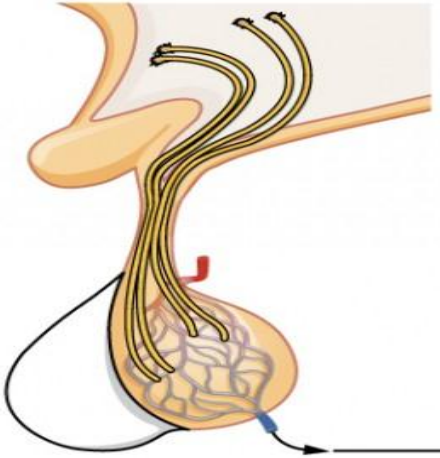
2-Antidiuretic hormone (ADH):

- Stimulates resorption of water from kidneys.
- Stimulates contraction of smooth muscle fibers to increase blood pressure.


Hypothalamus
Neurosecretory cells of the hypothalamus
Neurohormone
Axons
Posterior pituitary
Anterior pituitary
HORMONE
ADH
Oxytocin
TARGET
Kidney tubules
Mammary glands, uterine muscles

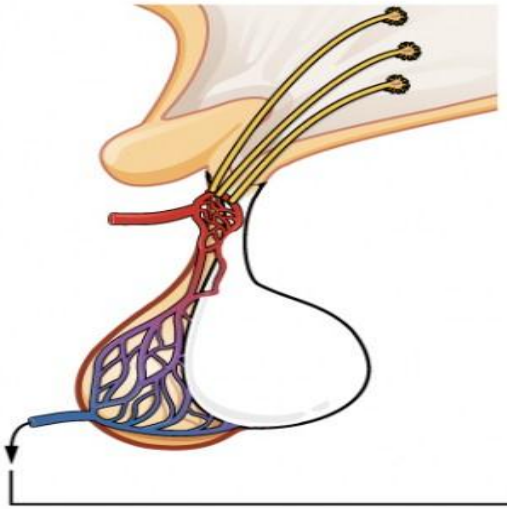
Part		Cells
Adenohypophysis	A- Pars distalis	1-Chromophobes 2- Chromophils: • Acidophils 1-Somatotrophs. 2-Mammotrophs • Basophils 1-Corticotrophs: [ACTH] 2-Thyrotrophs: (TSH) 3-Gonadotrophs: (FSH) (LH) (ICSH)
	B- Pars tuberalis	gonadotropins [FSH & LH]
	C- Pars intermedia	(MSH).
Neurohypophysis	Pars nervosa	Oxytocin: Antidiuretic hormone (ADH)

Posterior Pituitary Hormones

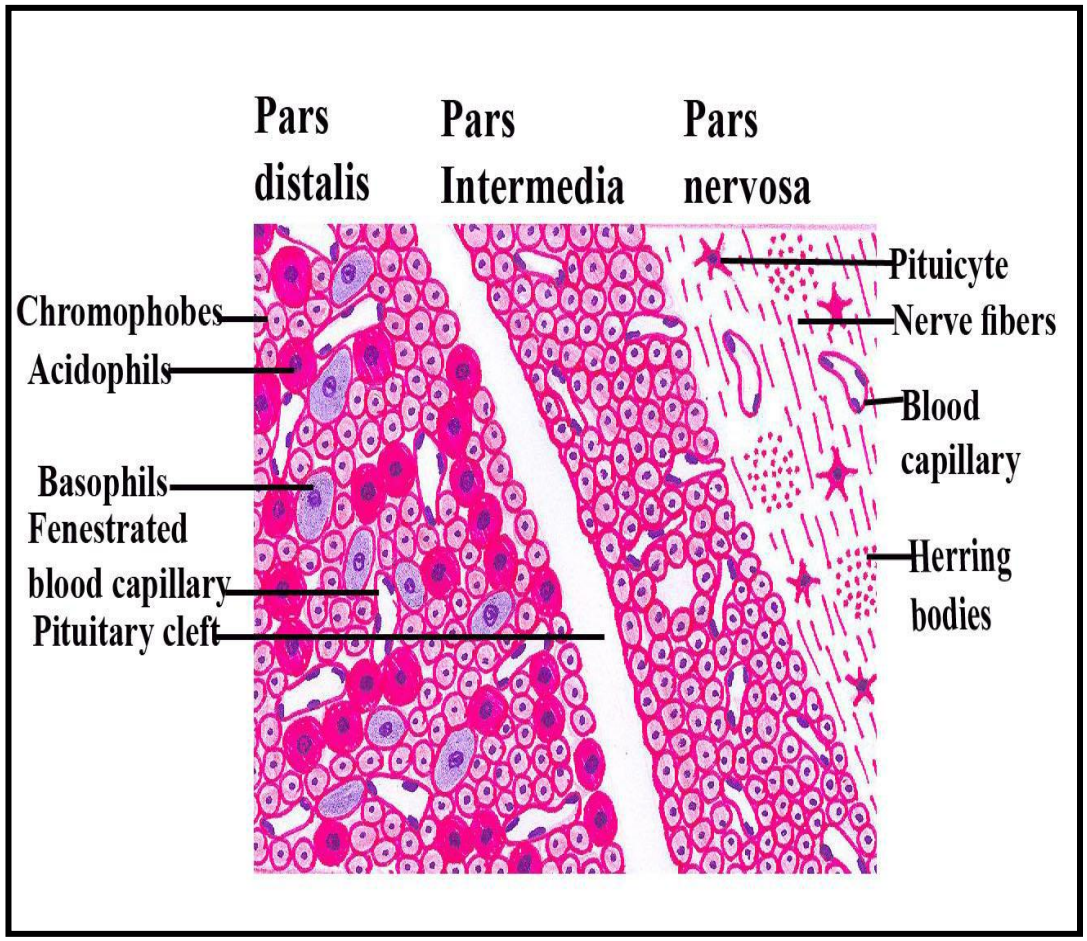


Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
ADH	Stores ADH	Kidneys, sweat glands, circulatory system	Water balance
–	OT	Female reproductive system	Triggers uterine contractions during childbirth

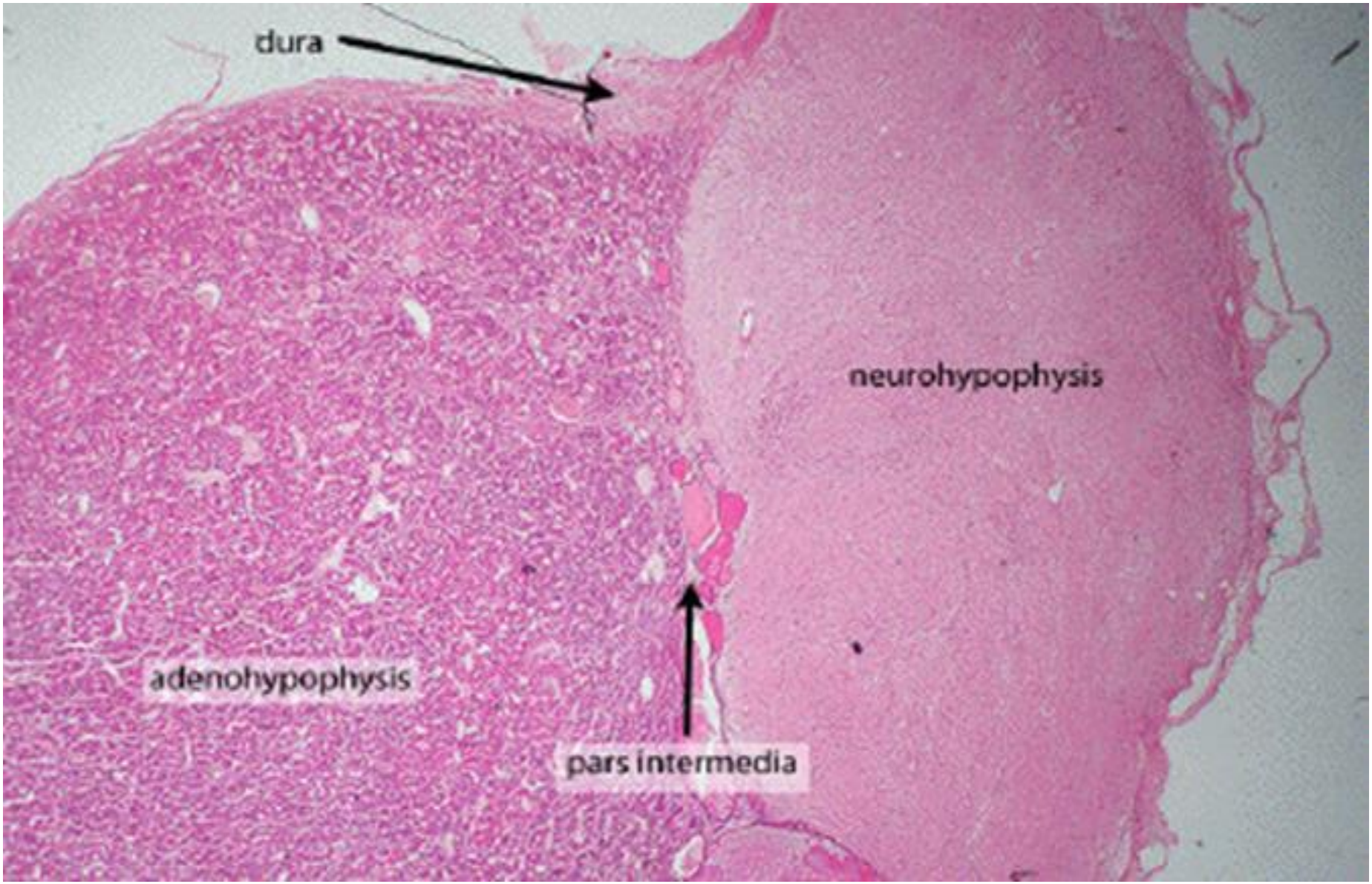
Anterior Pituitary Hormones



Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
GnRH	LH	Reproductive system	Stimulates production of sex hormones by gonads
GnRH	FSH	Reproductive system	Stimulates production of sperm and eggs
TRH	TSH	Thyroid gland	Stimulates the release of thyroid hormone (TH). TH regulates metabolism.
PRH (inhibited by PIH)	PRL	Mammary glands	Promotes milk production
GHRH (inhibited by GHIH)	GH	Liver, bone, muscles	Induces targets to produce insulin-like growth factors (IGF). IGFs stimulate body growth and a higher metabolic rate.
CRH	ACTH	Adrenal glands	Induces targets to produce glucocorticoids, which regulate metabolism and the stress response



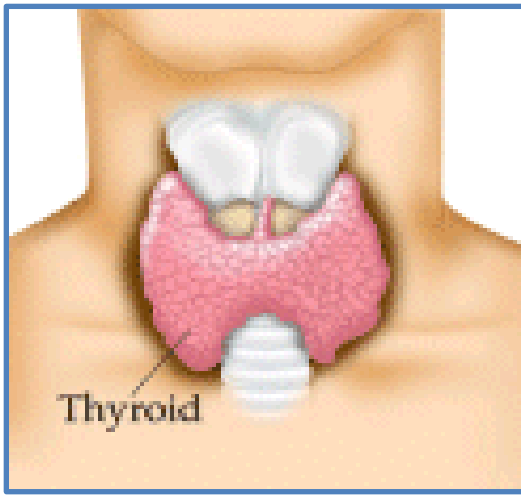
Pituitary gland



Pituitary gland

Thyroid Gland

- Bilobed endocrine gland in neck, anterior to larynx and upper trachea.
- Right and left lobes are connected by isthmus.



Structure:

A- Stroma

1- Capsule: thin.

2- Septa: fine, incomplete

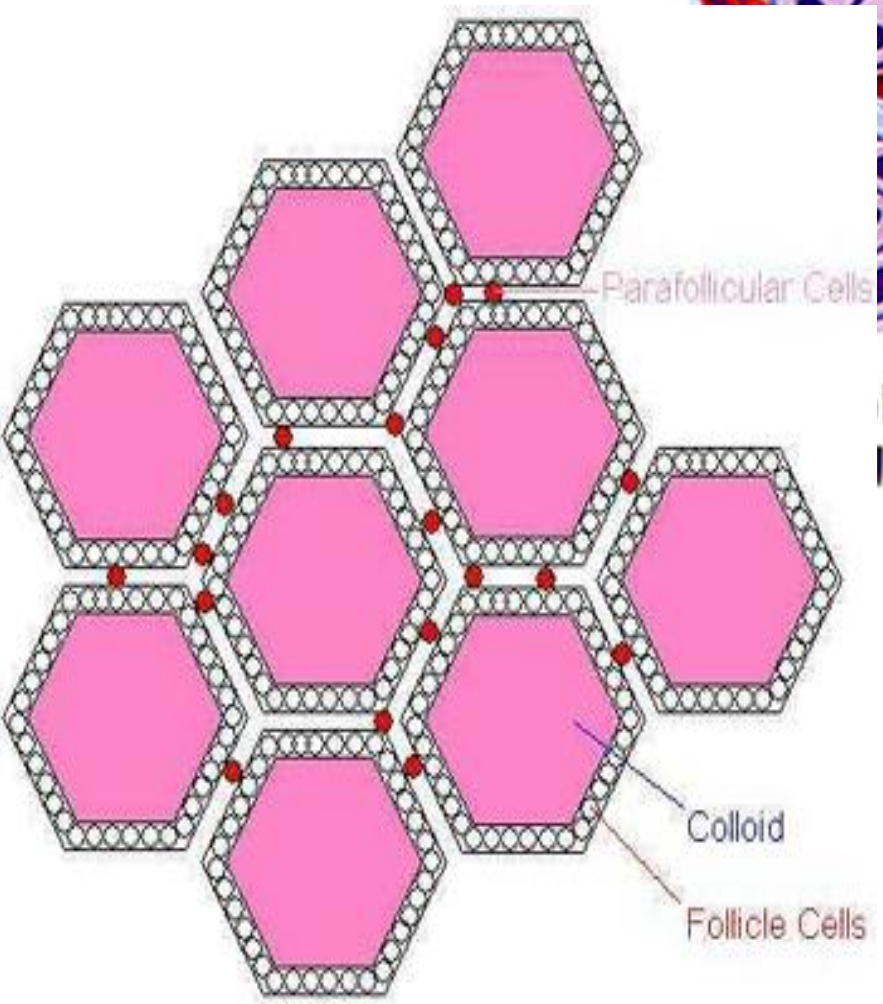
B- Parenchyma (cells) *is in the form of follicles and fenestrated blood capillaries in between.*

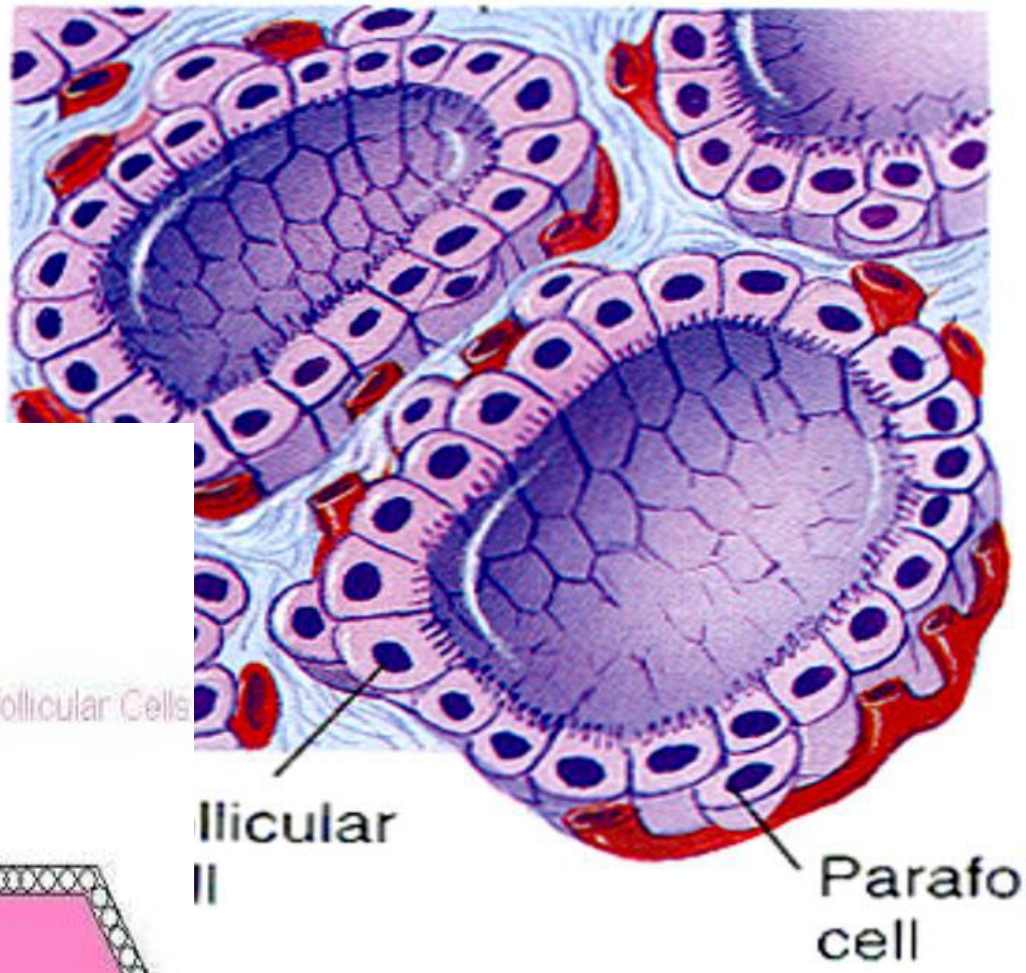
The follicles consists of 2 types of cells:

1- Follicular cells (98%).

2- Parafollicular or (C) cells(2%).

- The follicles contain in their lumen the stored secretion called **colloid.**





Thyroid Gland

- **B- Parenchyma**
- Structural & functional units of thyroid gland are thyroid follicles.
- Packed together by fine reticular network containing fenestrated capillaries.
- Rounded and surrounded by thin basal lamina.
- Lined with:
  - **Follicular cells** (simple cuboidal epithelium)
  - **Parafollicular cells** (few short C cells).

Colloid

- Homogenous acidophilic material filling the central lumen in the follicle.
- It is glycoprotein (thyroglobulin) synthesized & secreted by follicular cells.
- Contains thyroid hormones.

1- Follicular cells (principal cells)

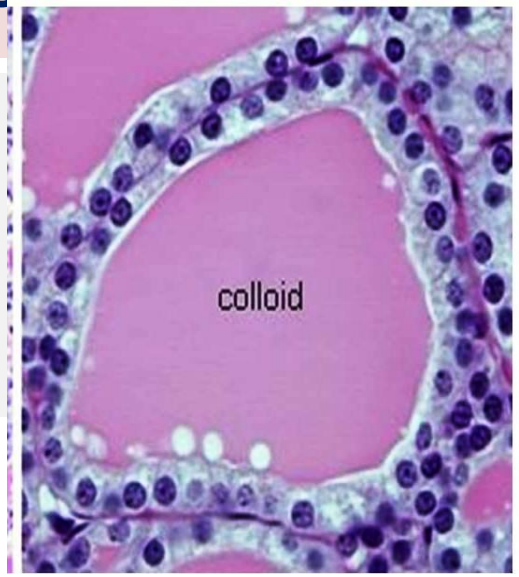
L/M:

- The majority.
- Simple cuboidal cells resting on basal lamina.
- Central rounded nuclei and basophilic cytoplasm.

Hyperactive cells are simple columnar, while inactive cells are simple squamous.

E/M

- Characteristics of a **protein synthesizing cell .**



Function

They secrete thyroid hormones, T3 and T4 (thyroxin).

- **2. Parafollicular or C (clear cells)**
- Found as a part of follicular epithelium or as isolated clusters between thyroid follicles.
- Few, resting on basement membrane of follicles but do not reach lumen.

L/M: **large**, rounded, pale staining cells with central rounded nuclei.

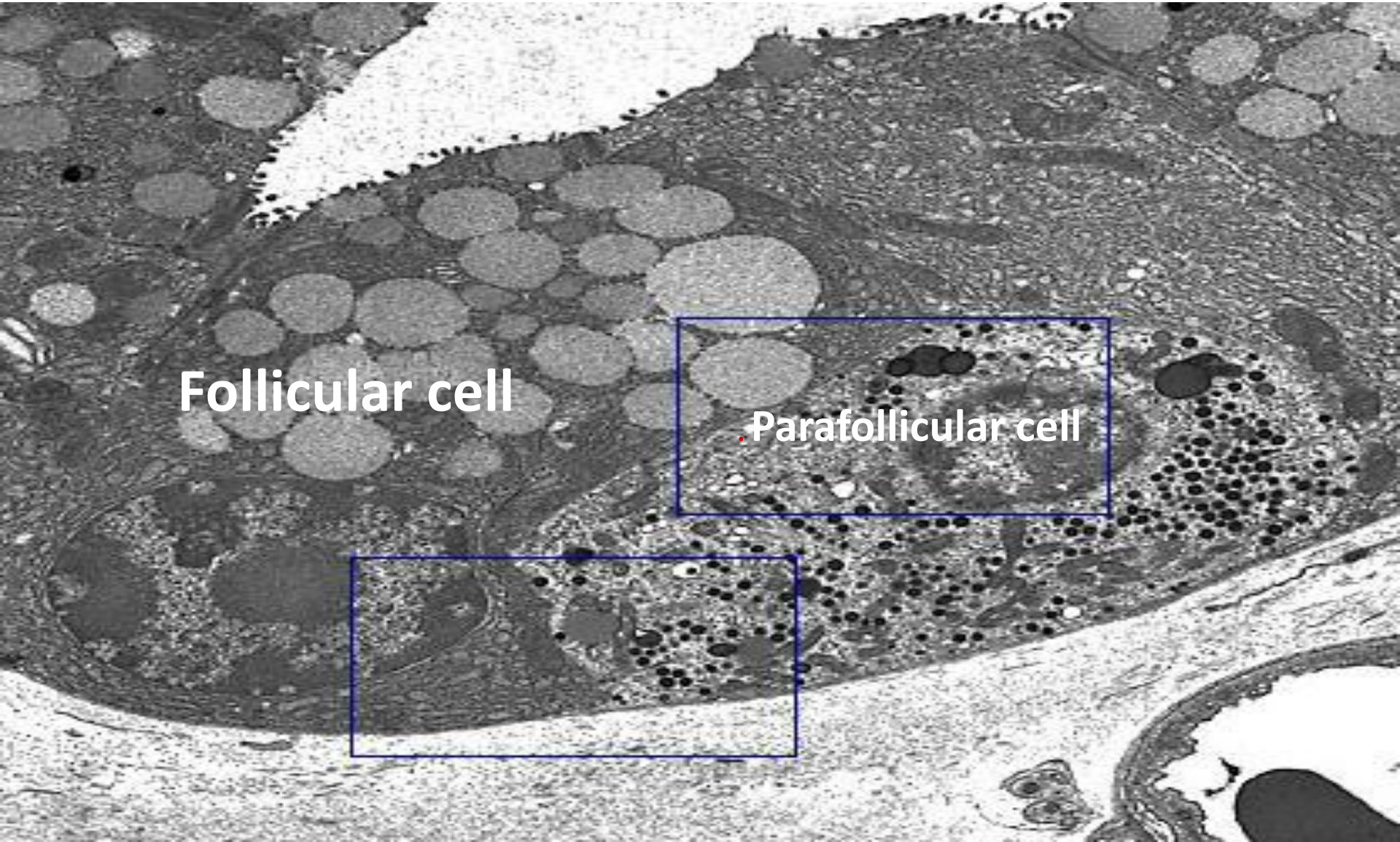
E/M: contain basal small dense granules containing calcitonin hormone.

Function:

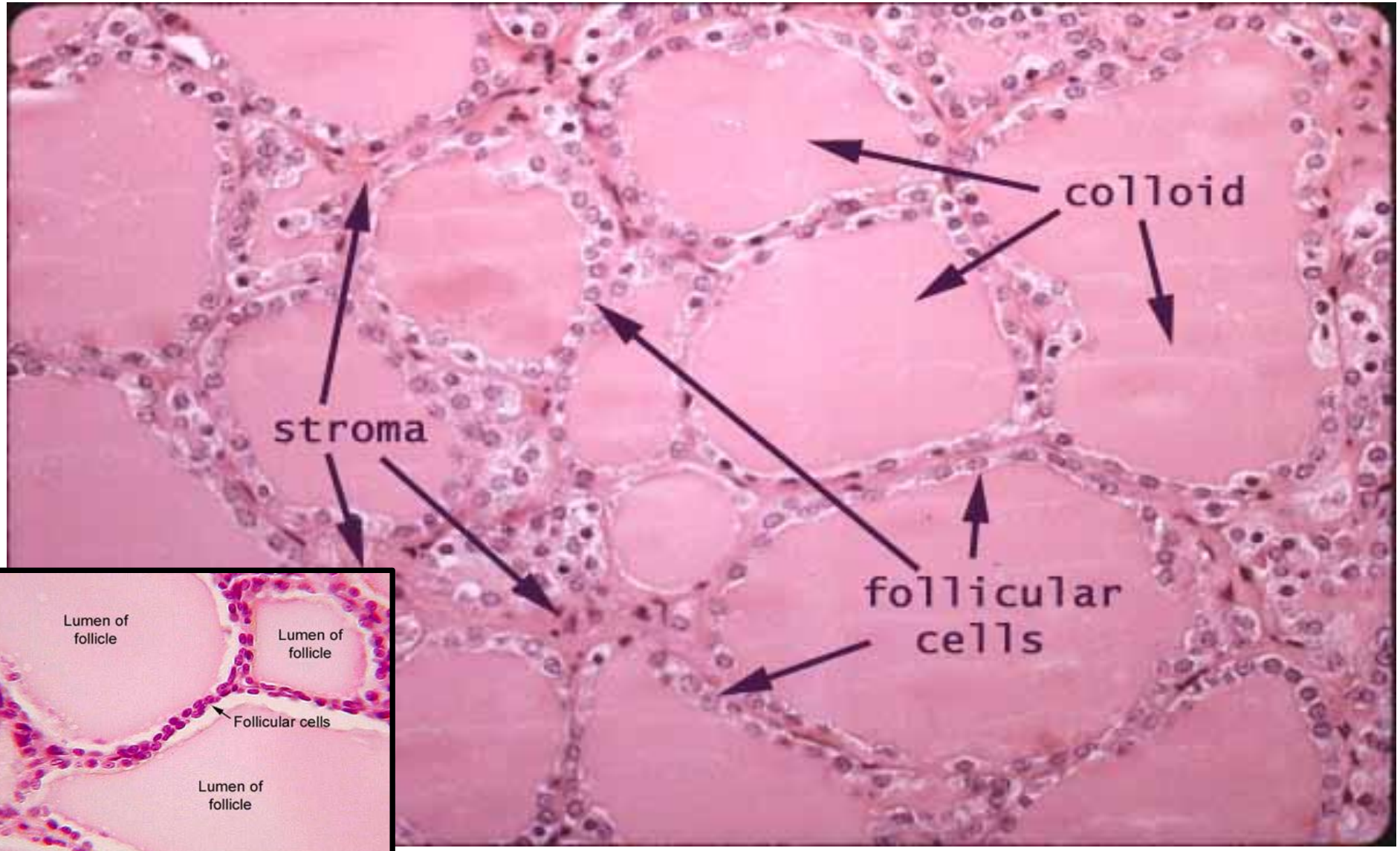
Secrete calcitonin hormone

which *Reduce blood calcium*

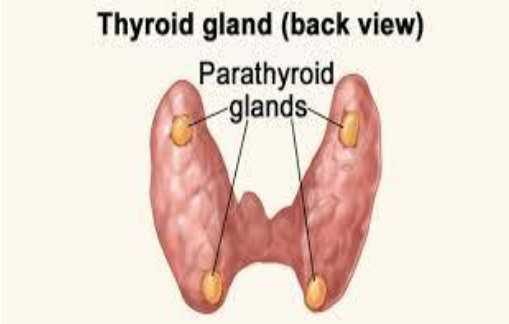
Ultrastructure of thyroid follicles



Thyroid Gland



Parathyroid Glands

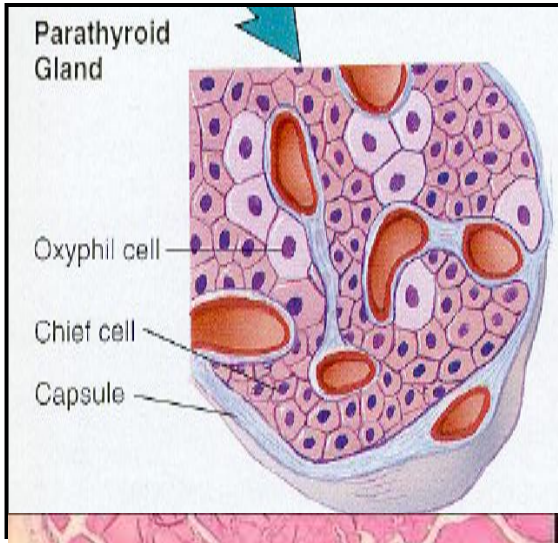


- They are 4 small glands- Behind the thyroid gland.

Each gland consists of:

Stroma: C.T. capsule, incomplete septa , fine reticular fibers.

Parenchyma :clumps or cords of cells with large fenestrated blood capillaries in between.



Types of cells:

- ***Chief cell:***

-It is the *main* type

-small

-pale nucleus.

-It secretes **parathyroid hormone(↑ Blood Calcium level)**

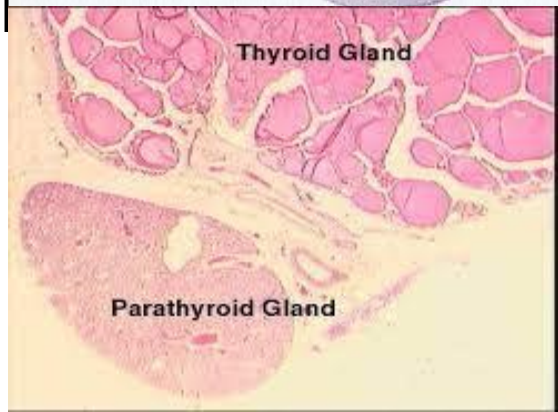
- ***Oxyphil cell:***

-It is larger

-less numerous

-dark nucleus

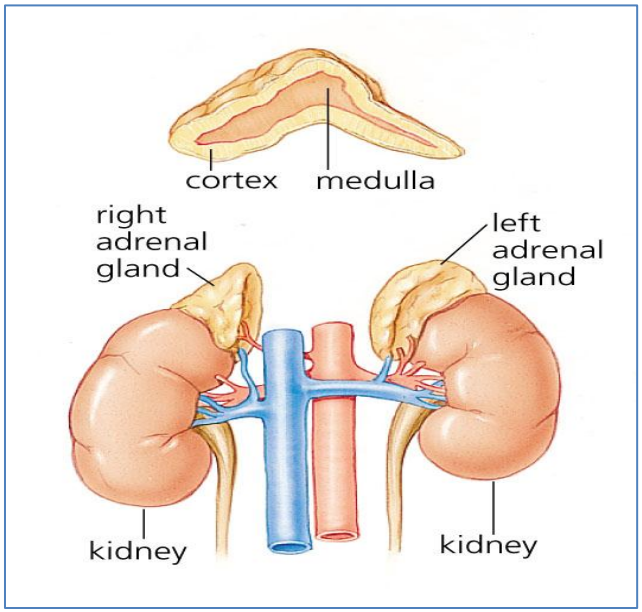
-It is of unknown function.

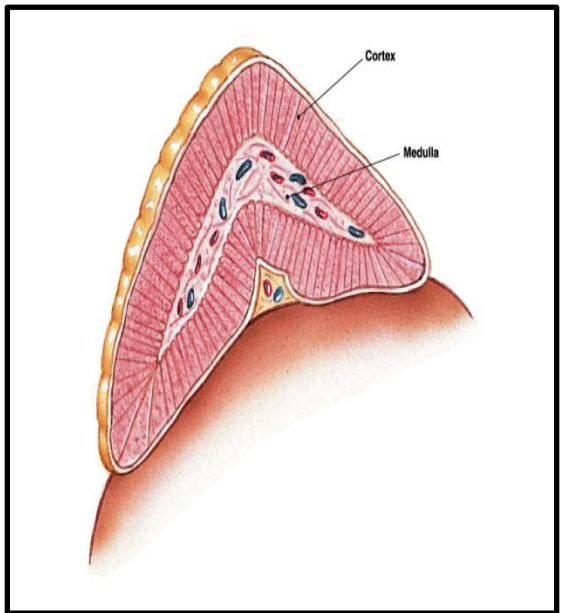


Adrenal glands (Suprarenal glands)

- Parenchyma divided into two embryologically, histologically and functionally different regions:
- Outer large yellowish ***cortex*** (about 90% of the gland), develops from mesoderm and secretes steroid hormones.
- Inner small reddish-brown ***medulla***

develops from ectoderm and secretes catecholamines.





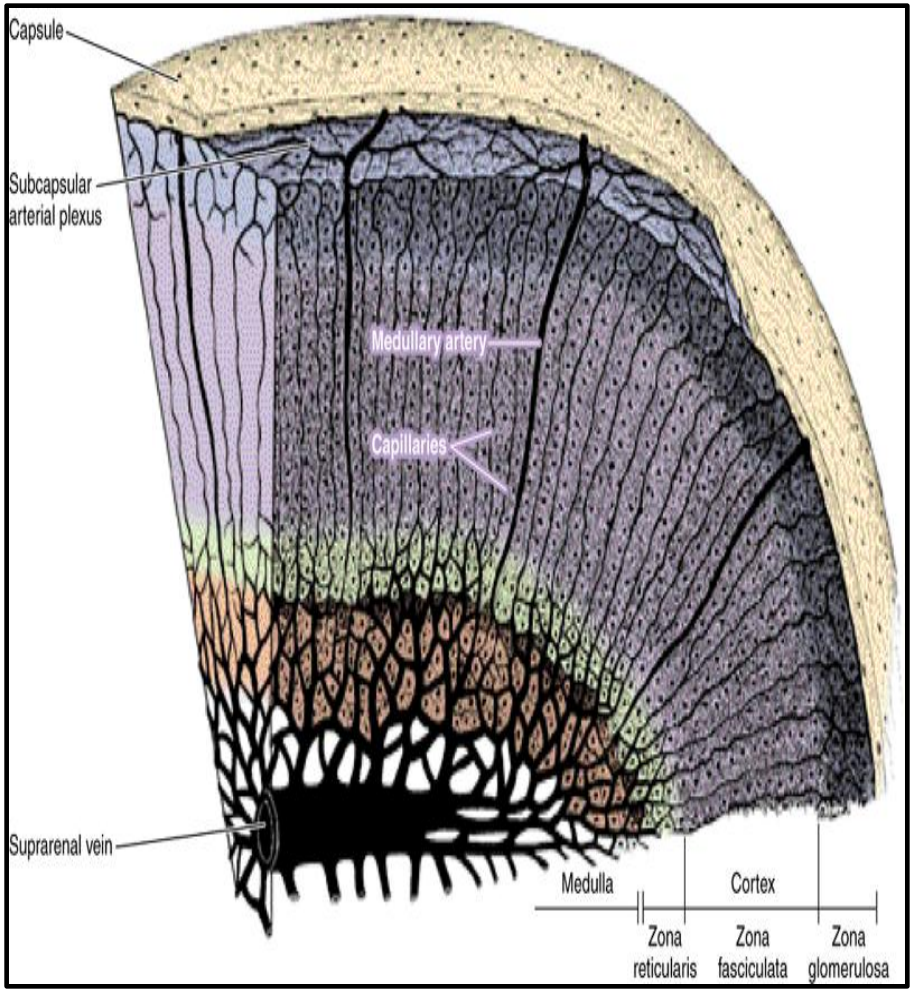
Histological Structure of adrenal gland

A) Stroma

- ***Capsule***.
- ***Trabeculae***.
- ***Fine reticular fibers***.

B) Parenchyma

- **Adrenal cortex.**
- **Adrenal medulla**.



ADRENAL CORTEX

formed of three zones:

- **Zona glomerulosa :**

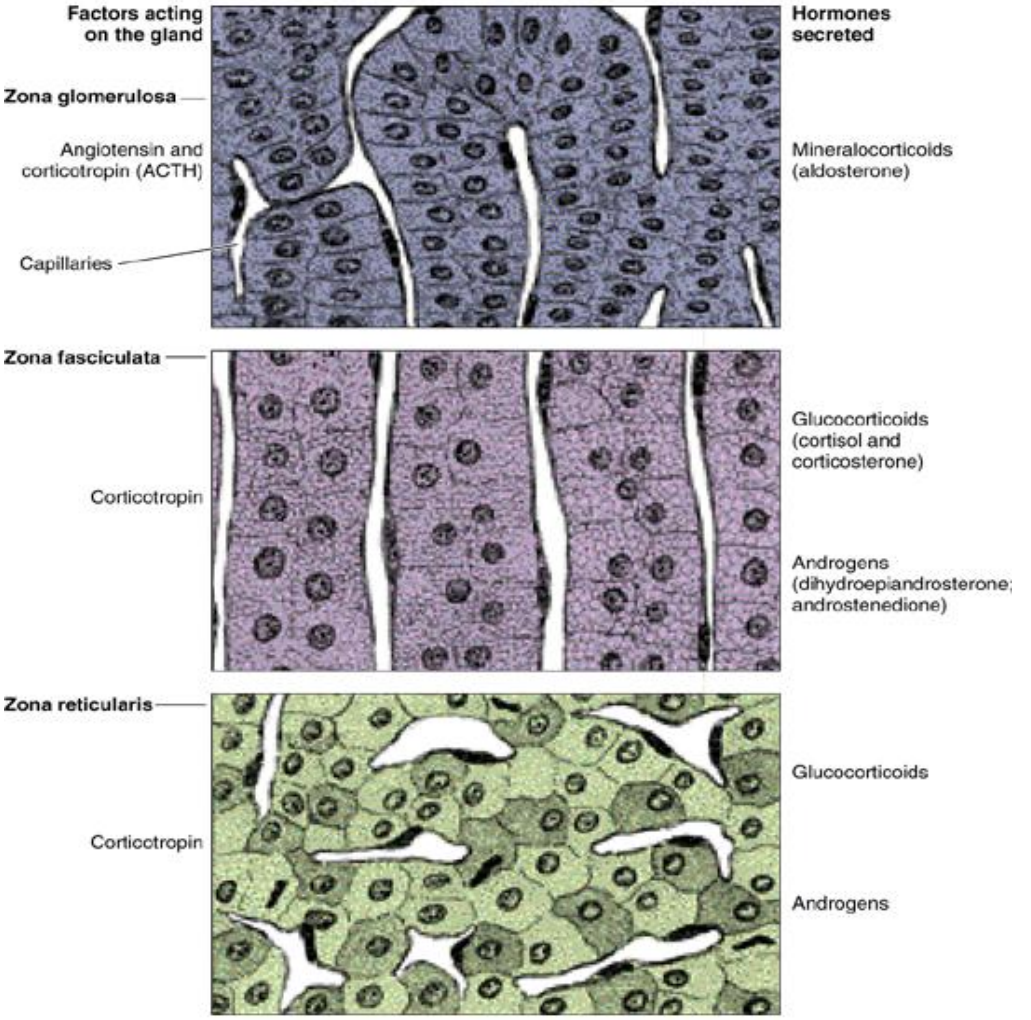
13%(outer narrow zone).

- **Zona fasciculata:**

80% (middle thick zone).

- **Zona reticularis:**

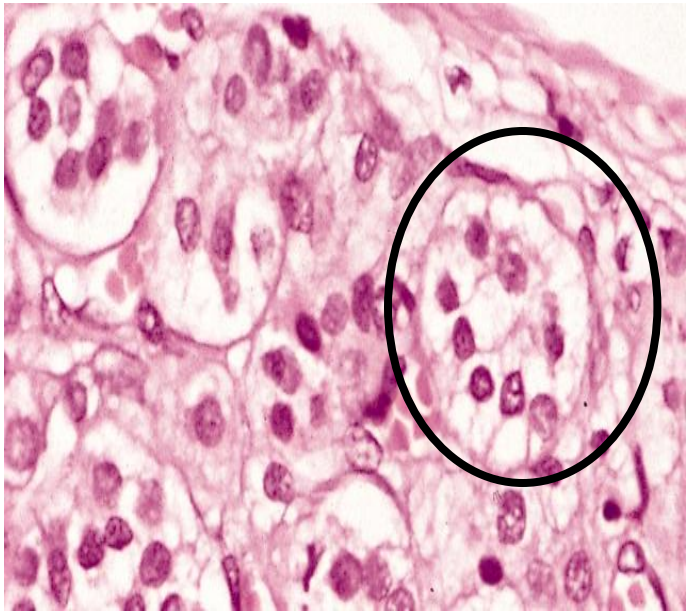
7% (inner narrow zone).



Zona glomerulosa (13%)

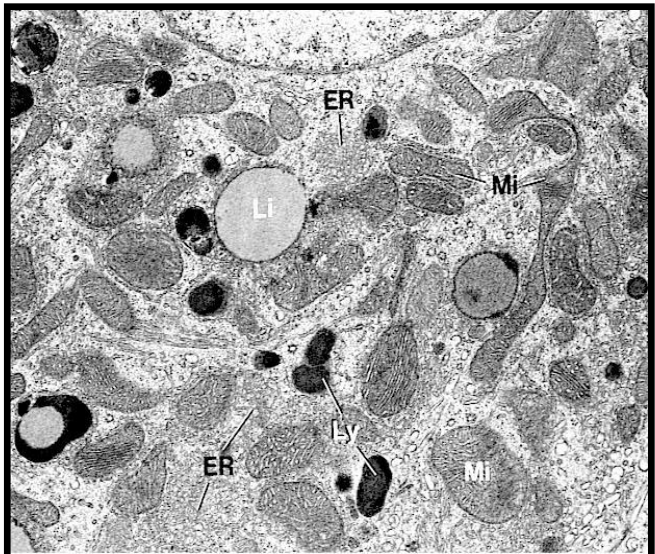
L/M:

- columnar or pyramidal cells
- acidophilic cytoplasm
- arranged in rounded or arched clusters
- surrounded by blood capillaries



E/M:

steroid secreting cells.



Function:

secrete mineralocorticoids (aldosterone).

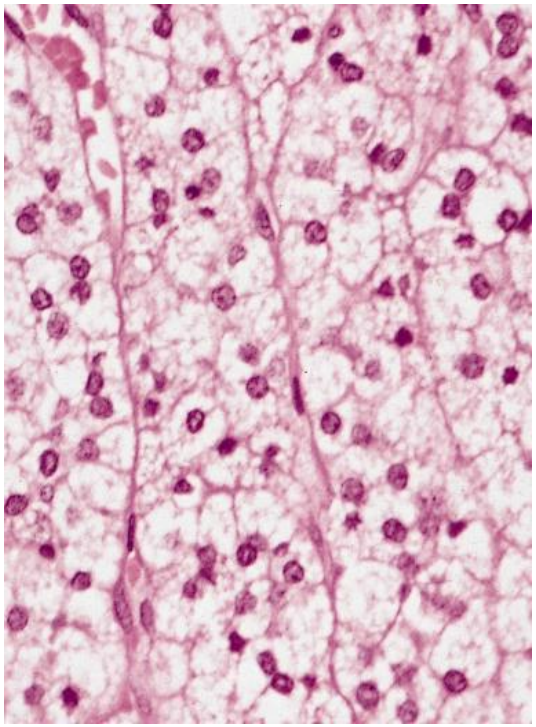
controls water and electrolyte balance

in the body.

Zona Fasciculata (80%)

L/M:

- Cells (spongiocytes): polygonal arranged in long straight cords perpendicular to the surface of the gland.
- Nuclei: large, rounded and lightly stained.
- Cytoplasm: many lipid droplets (spongiocytes).
- Blood capillaries are present inbetween



E/M:

steroid secreting cells with

many lipid droplets.

Function: They secrete glucocorticoids (cortisone) & sex hormones.

Zona reticularis (7%)

- Cells: smaller cells arranged in irregular cords forming network with blood capillaries in between.

Function:

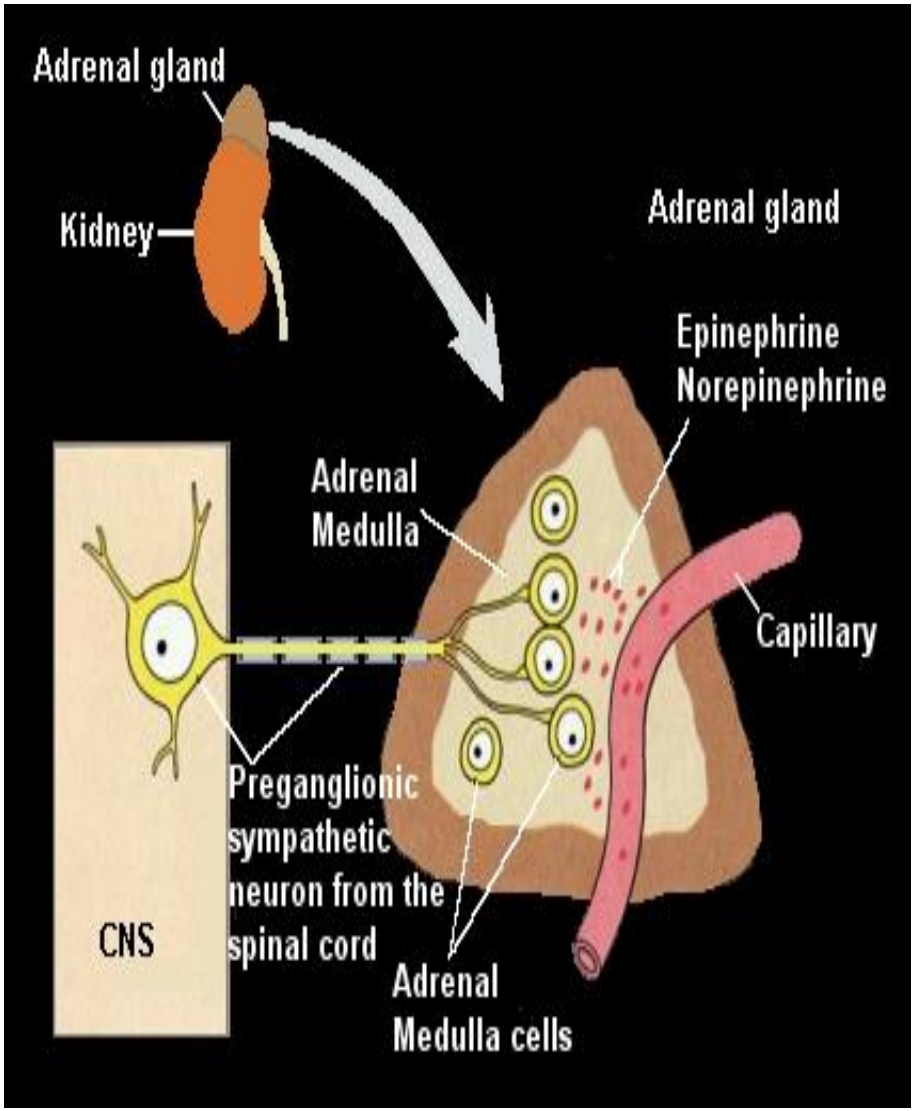
- Secrete androgens
- Secrete of little amount of glucocorticoids.

Adrenal medulla

- It occupies the center of the adrenal gland, and is surrounded by adrenal cortex.

- Its cells (**Chromaffin cells**)

can be regarded as modified neurons that have no axons and no dendrites and specialized *as* secretory cells.



Adrenal medulla

1- Chromaffin cells:

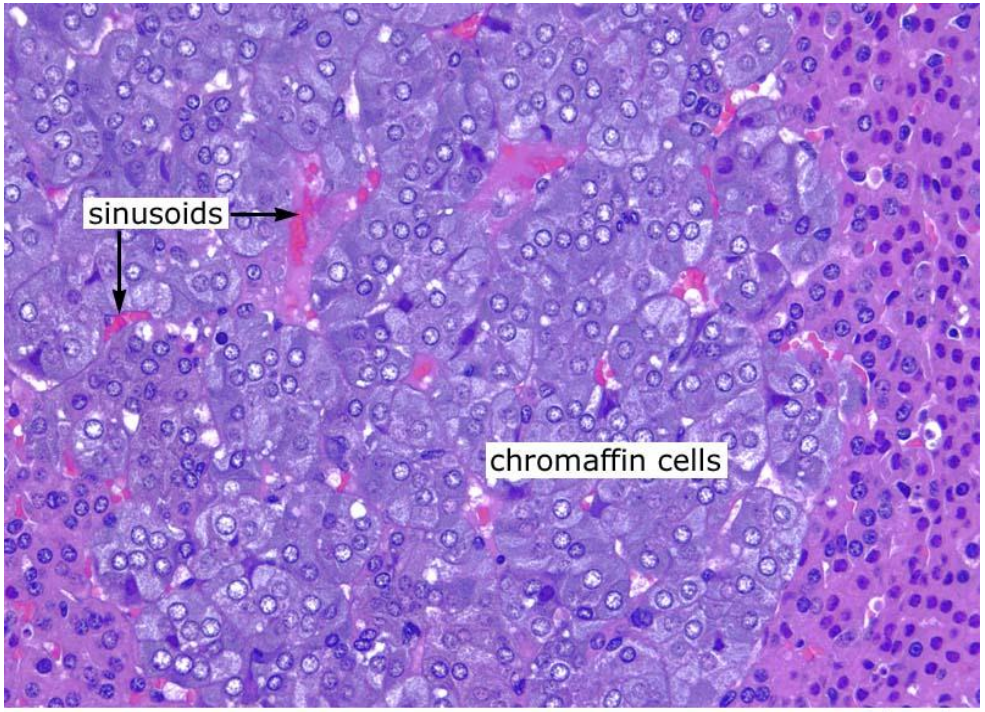
- large, polyhedral
- large, pale-staining nuclei.
- Their cytoplasm is basophilic containing fine granules.
- The cells are arranged in short cords, surrounded by a rich network of capillaries and supported by reticular fibers.

Function:

Secrete **catecholamines**

adrenaline(80%) &

noradrenaline(20%).

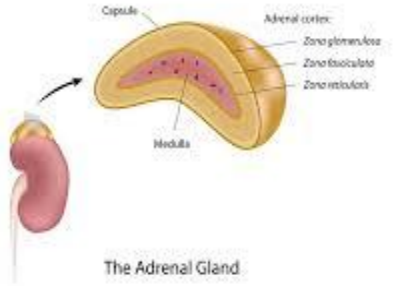


2- Ganglion nerve cells

- are scattered between

chromaffin cells

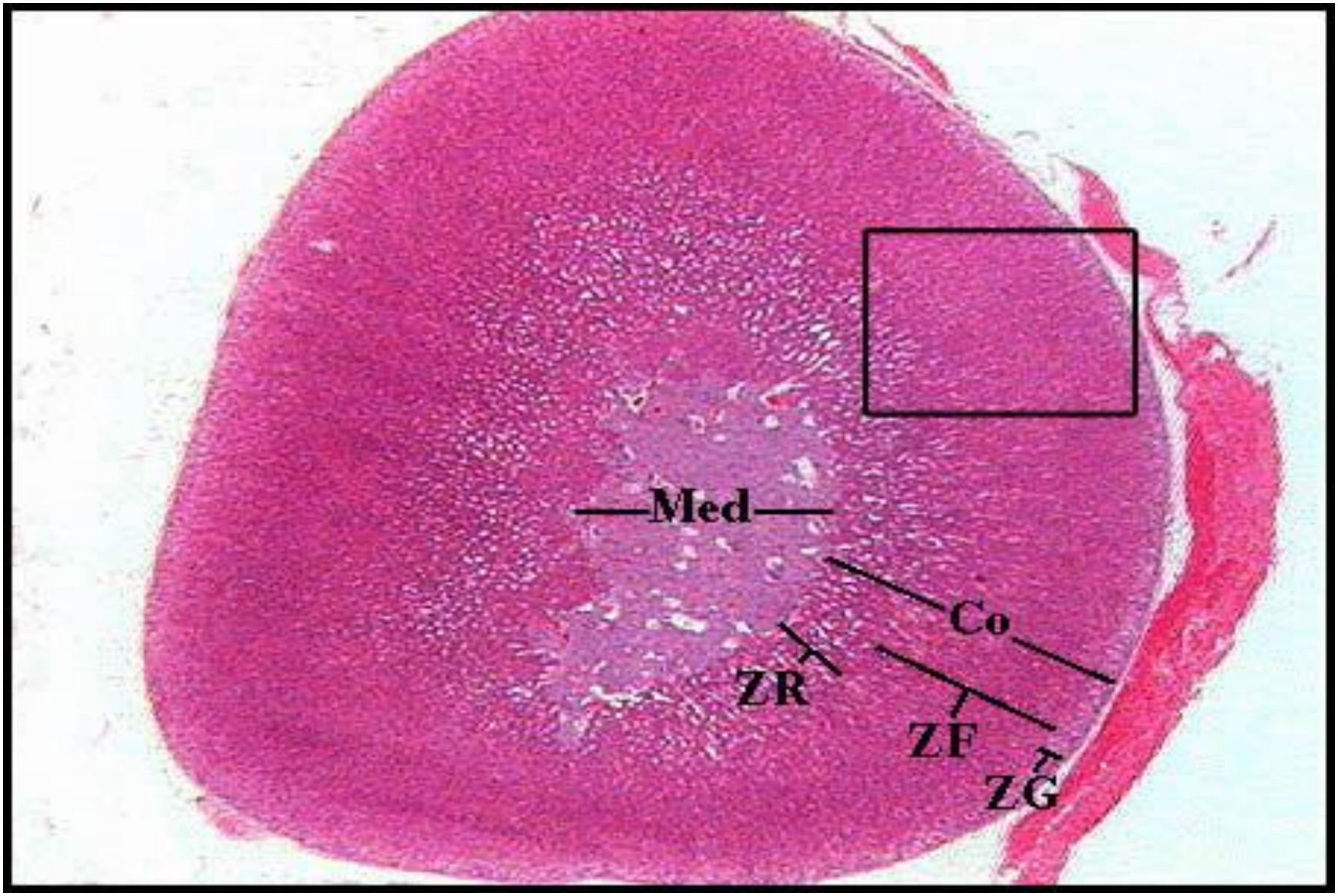
Cortex and Medulla



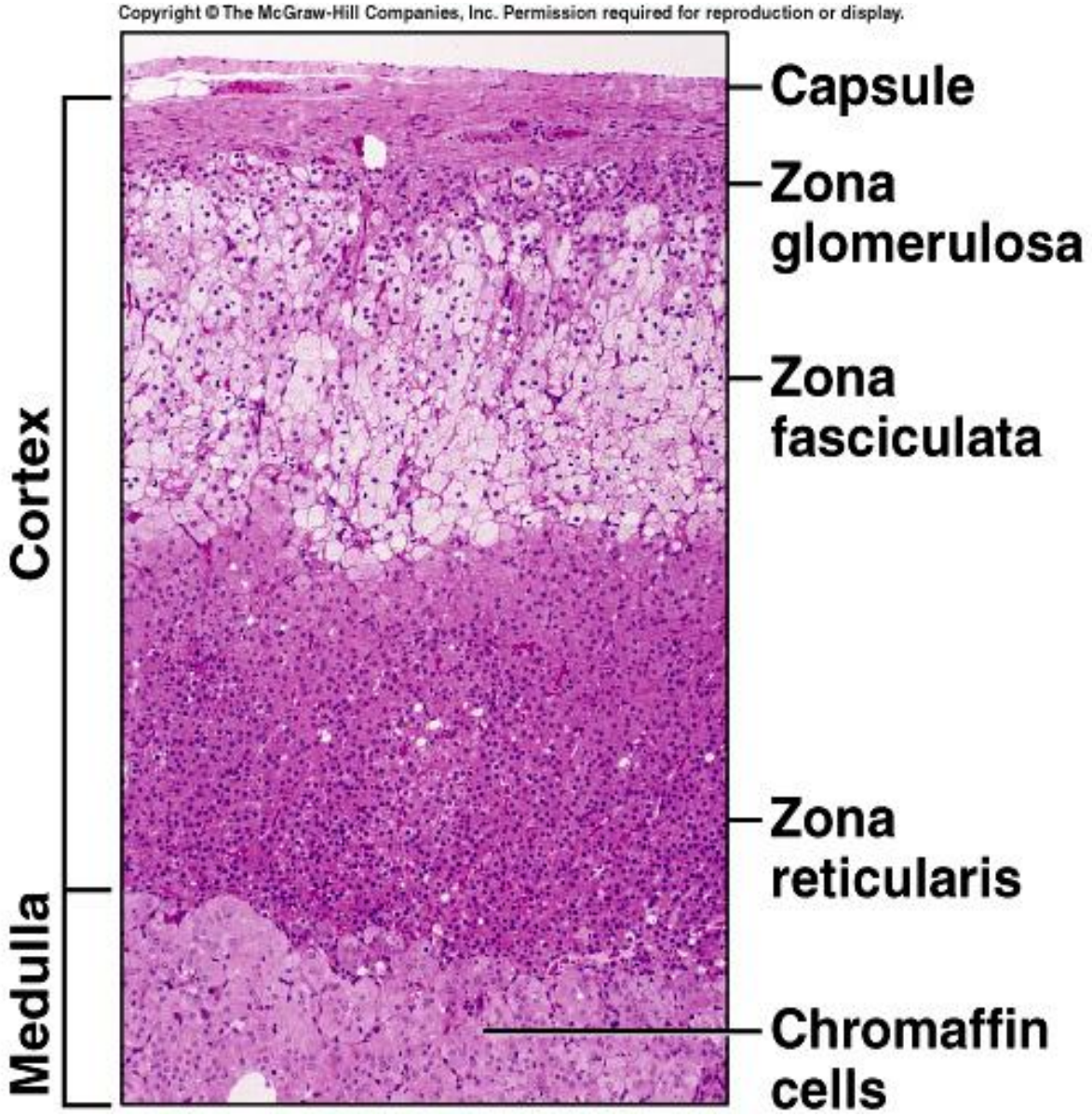
The Adrenal Gland

	Cortex	Medulla
Site	Outer	Inner
Size	large	small
Colour	yellowish	reddish-brown
Origin	mesoderm	ectoderm
Secrete	steroid hormones	catecholamines

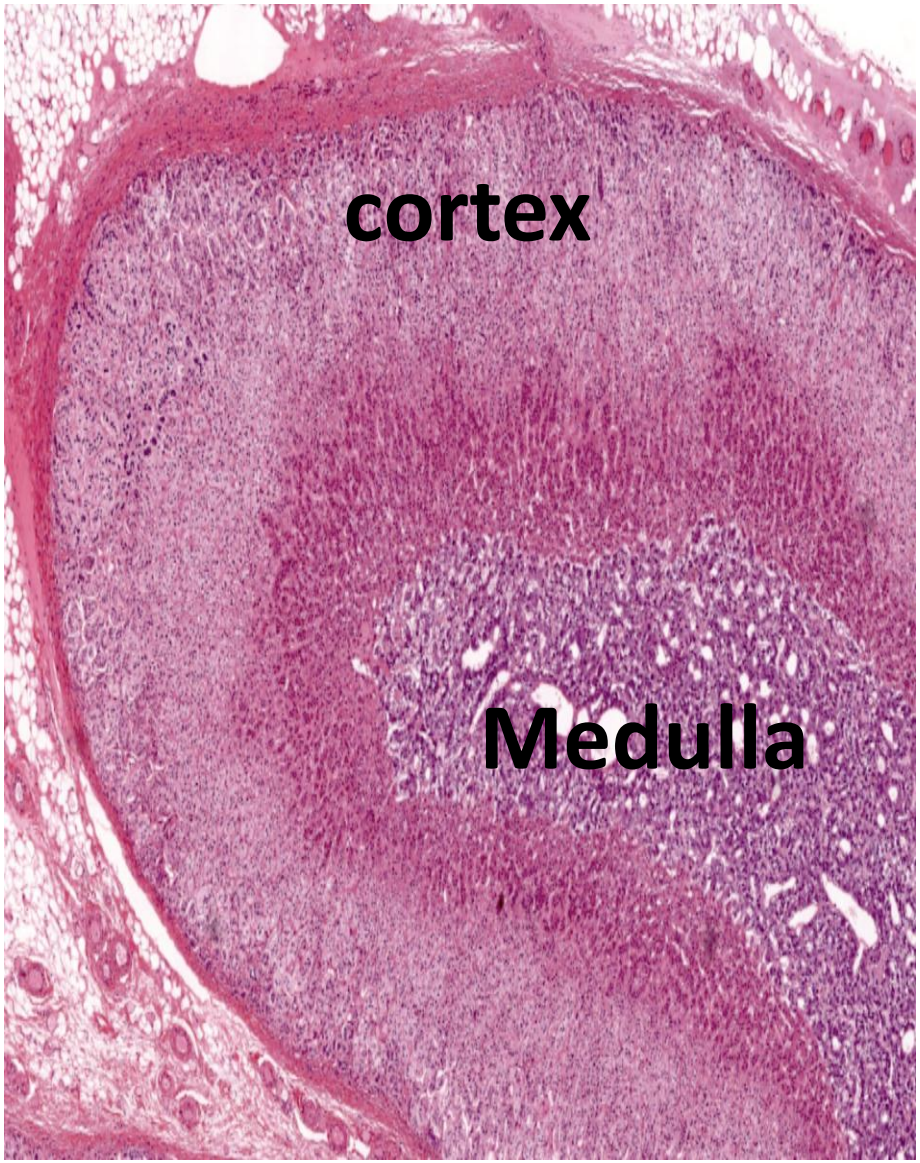
Adrenal gland

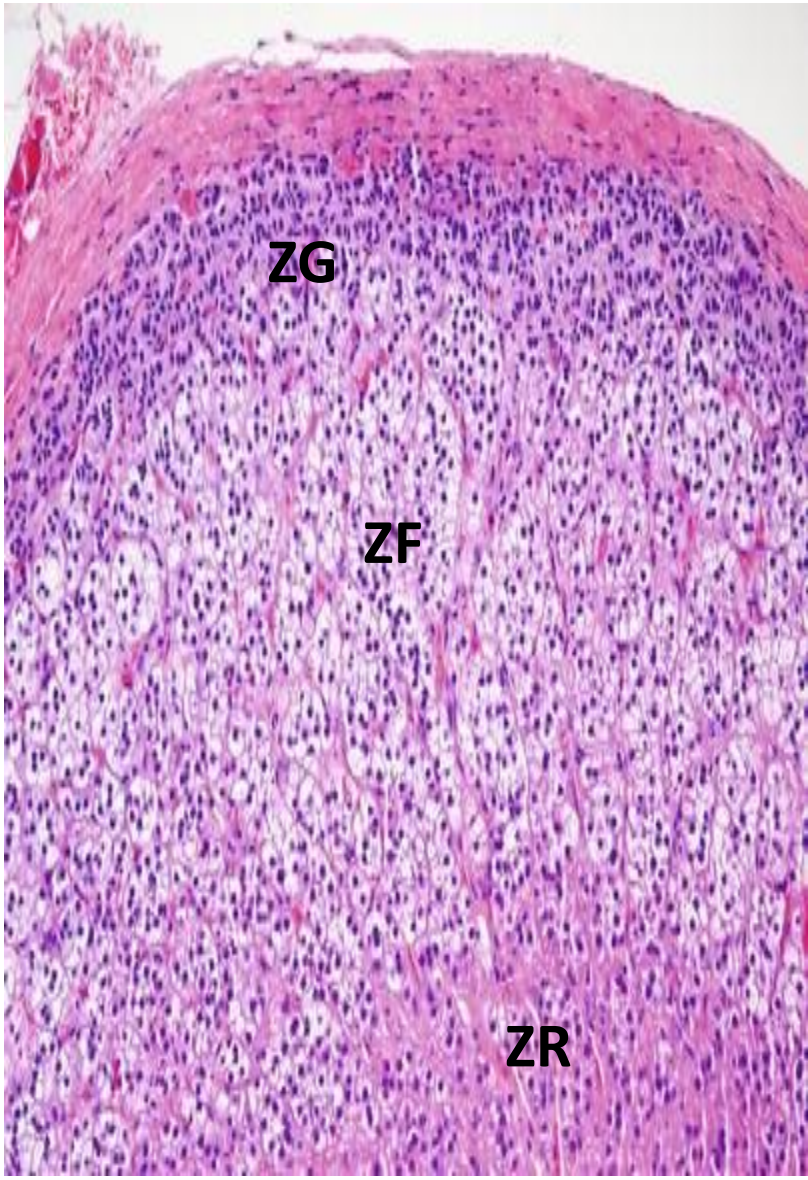


Adrenal gland



Adrenal gland





Male Reproductive System

- Primary sex organs (the paired testes):

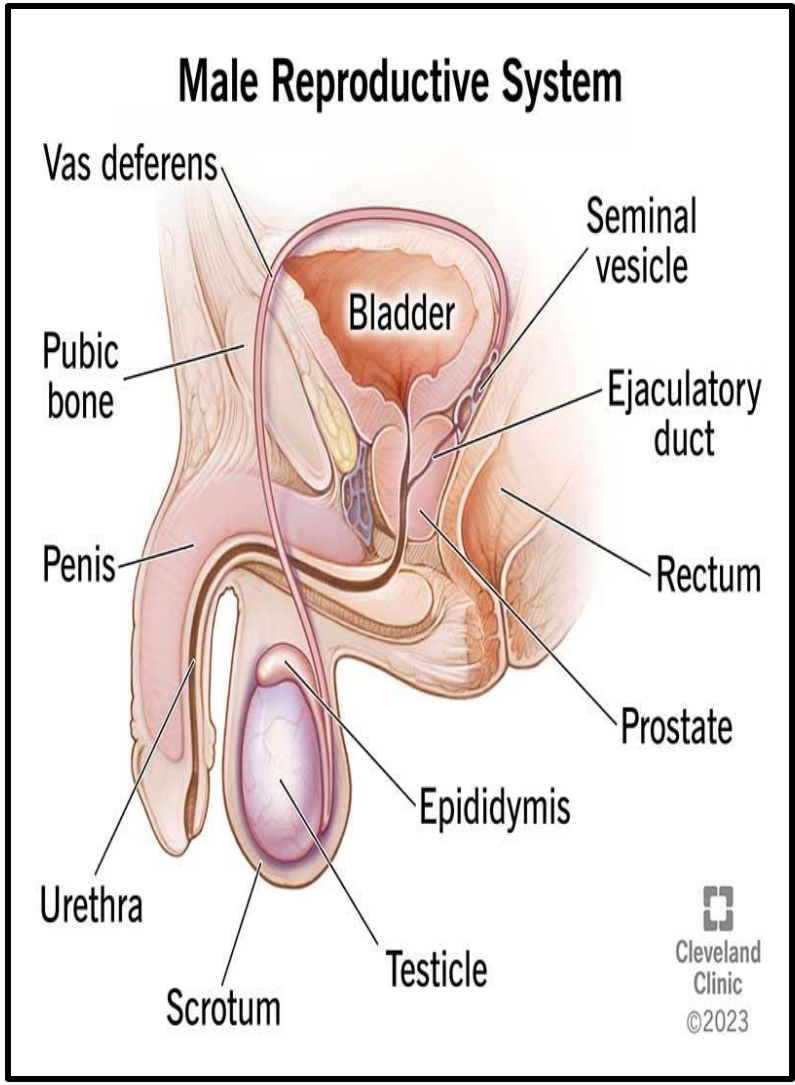
  A) Exocrine part:

  1-Seminiferous tubule

  2- Intratesticular genital ducts

  B) Endocrine part (interstitial cells of Leydig)

- Secondary sex organs:
- Excretory genital ducts (epididymis, vas deferens, ejaculatory duct and urethra)
- Accessory genital glands (seminal vesicle, prostate, bulbourethral glands, glands of Littre and glands of Tyson)
- External genitalia (penis and scrotum)



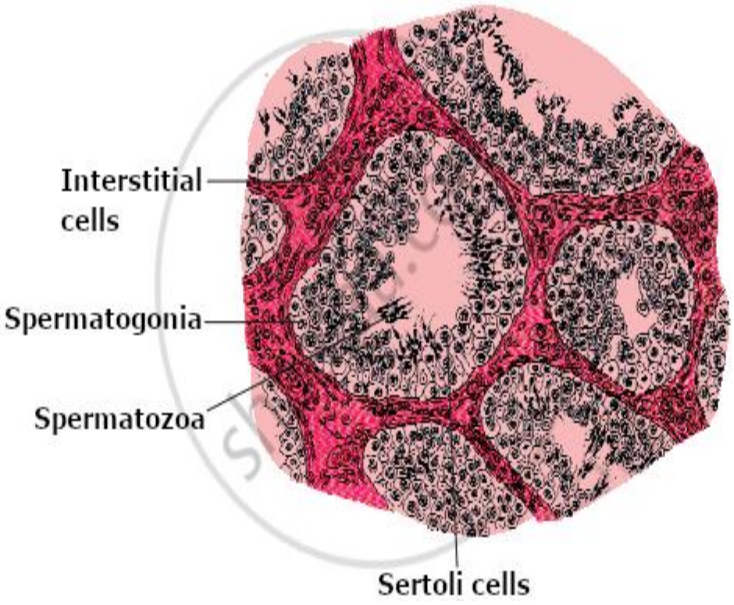
Testes

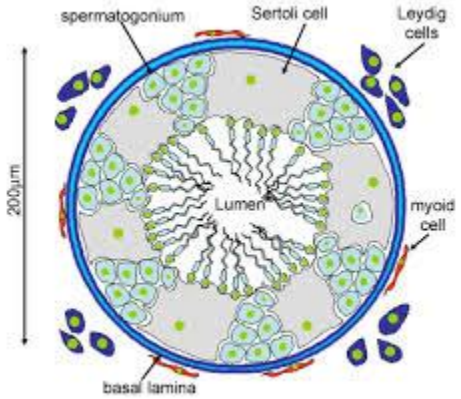
- Each testis is a compact ovoid organ.

- composed of:

1. **Seminiferous tubules** ***(ST)*** **(**many small convoluted tubules).
2. **Interstitial tissue**

(abundant intertubular tissue)

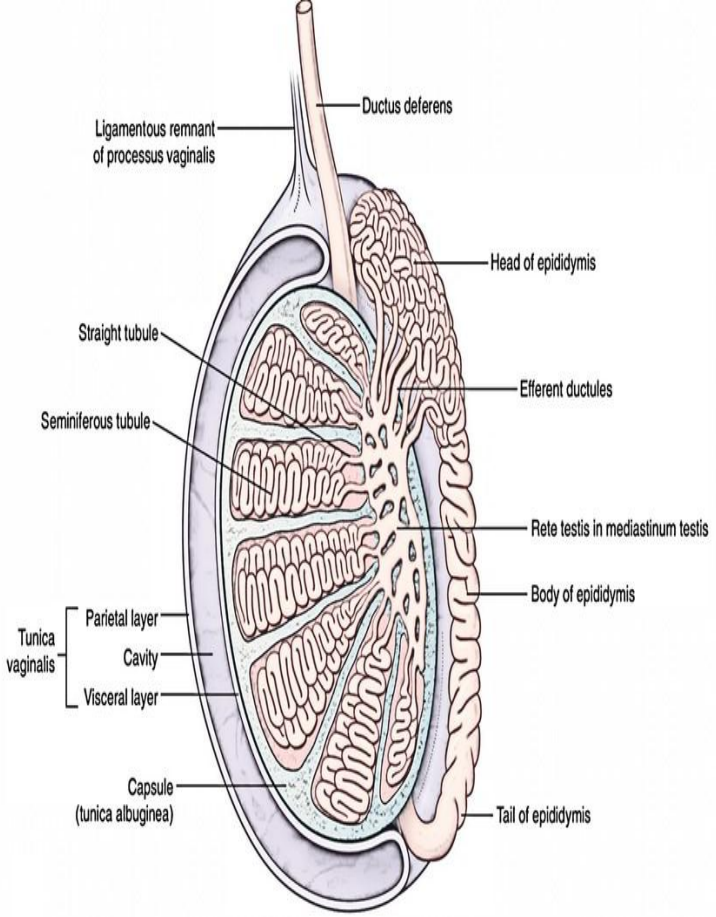




Stroma:

1- Capsule:

- **Tunica vaginalis** is the outer most covering.
- **Tunica albuginea** is a thick capsule of dense C.T. present beneath the first layer.
- **Tunica vasculosa** is a thin delicate layer of C.T. rich in blood vessels.



On the posterior border of the testis

- the tunica albuginea thickens and form the mediastinum testis through which blood vessels enter the testis.

2- Septa:

- From the mediastinum testis, thin C.T. (connective tissue) septa radiate into the testis dividing it into incomplete lobules.

Parenchyma

A. Spermatogenic cells:

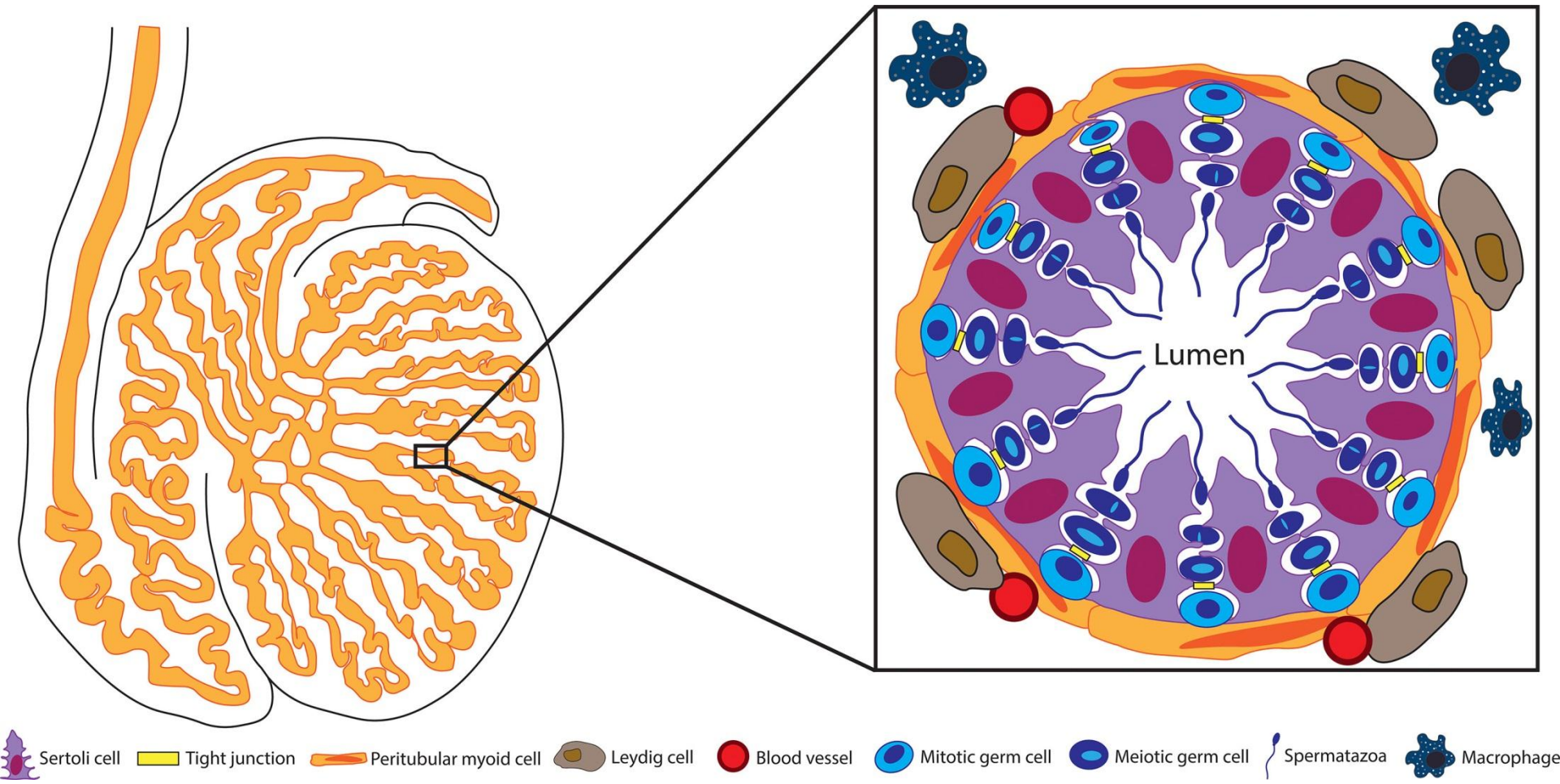
- There are several layers of cells that represent *different stages of spermatogenesis*.
- They are arranged from the basement membrane to the lumen as follows:

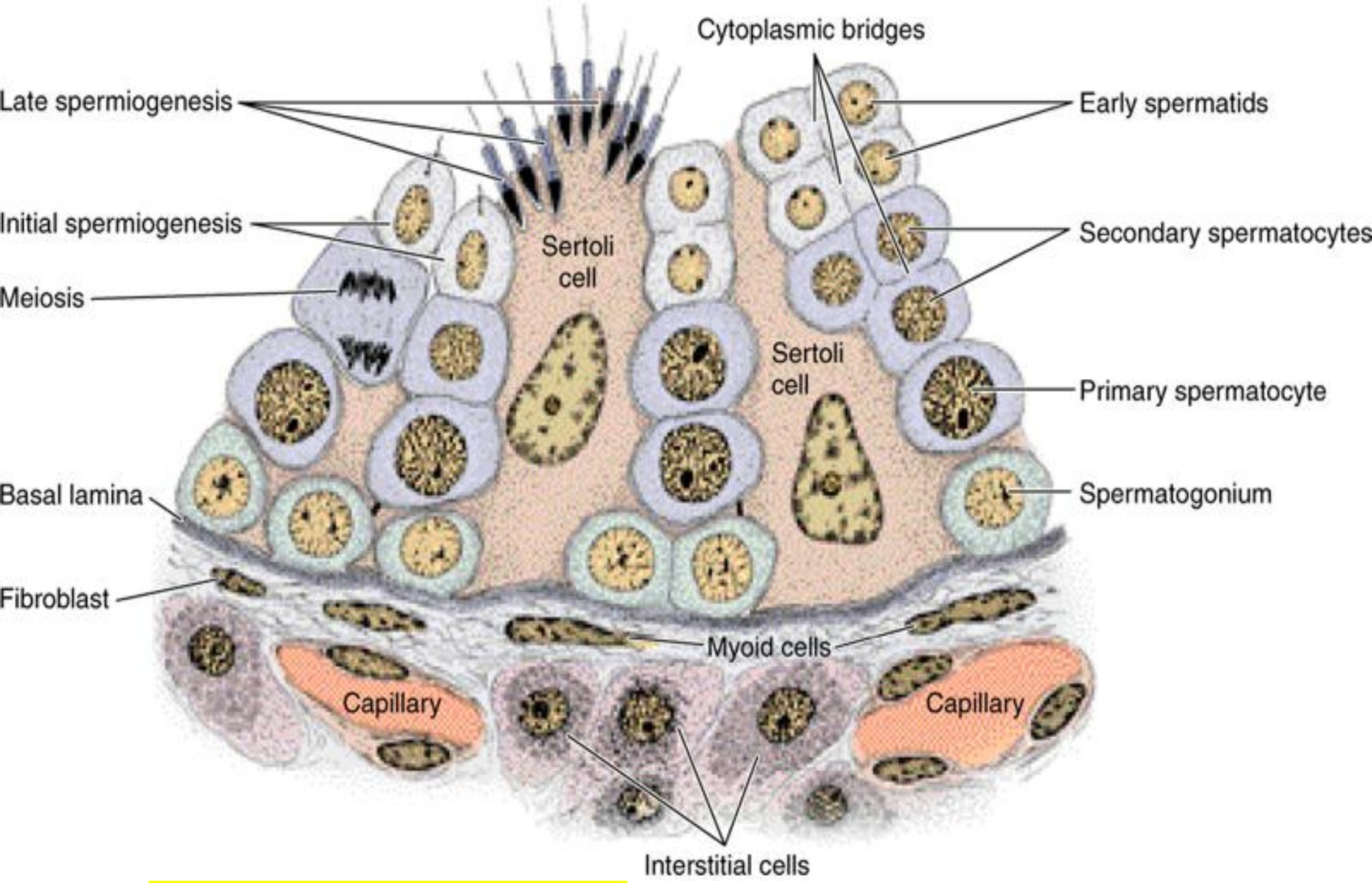
1- Spermatogonia (stem cells).

2-Spematocytes (primary & secondary) (proliferating cells).

3- Spematids (differentiating cells).

4- Spermatozoa (mature germ cells).


Lumen
Sertoli cell
Tight junction
Peritubular myoid cell
Leydig cell
Blood vessel
Mitotic germ cell
Meiotic germ cell
Spermatazoa
Macrophage



Seminiferous tubule

B. Sertoli cells:

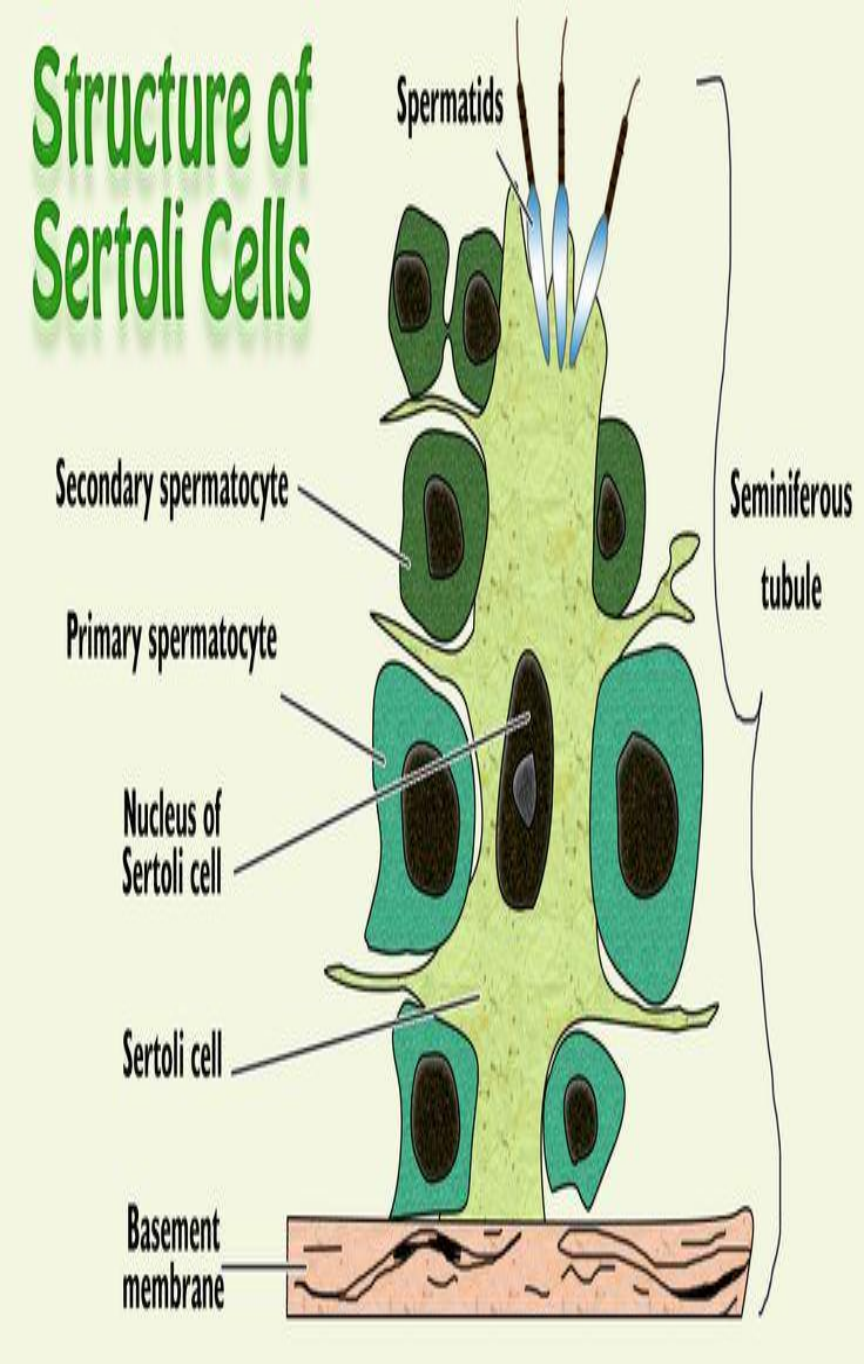
- Nucleus: triangular

- Shape:

➢ Elongated pyramidal cells that extend from the basement membrane to the luminal surface of the ST.

➢ Many lateral cytoplasmic processes that partially envelope the developing spermatogenic cells.

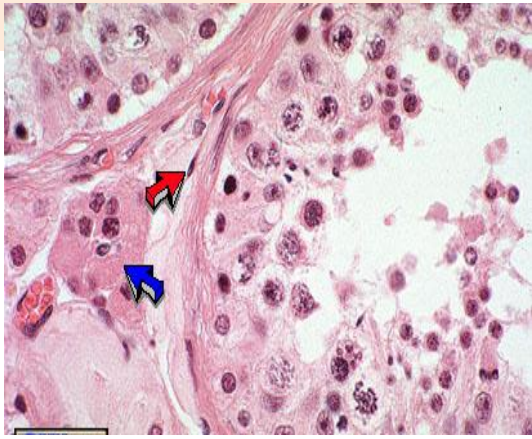
➢ Adjacent Sertoli cells are bound together by tight junctions separating the developing spermatogenic cells from the blood stream (blood– testis barrier).



Functions of Sertoli cells :

1. Formation of the *blood – testis barrier* which protect the developing spermatogenic cells from harmful substances present in the blood.
2. Supportive for spermatogenic cells.
3. Nutritive for developing and mature sperms.
4. Phagocytosis of the residues of the maturing sperms.

B) ENDOCRINE PART



- **Interstitial (Leydig) cells:**

➢ **Site:**

present in the interstitial C.T. between the S.T.

➢ **Shape:**

L.M:

- rounded or polyhedral with large nucleus, prominent nucleoli
- acidophilic cytoplasm
- may contain lipid droplets.
- Form cell groups with Fenestrated blood capillaries are present inbetween

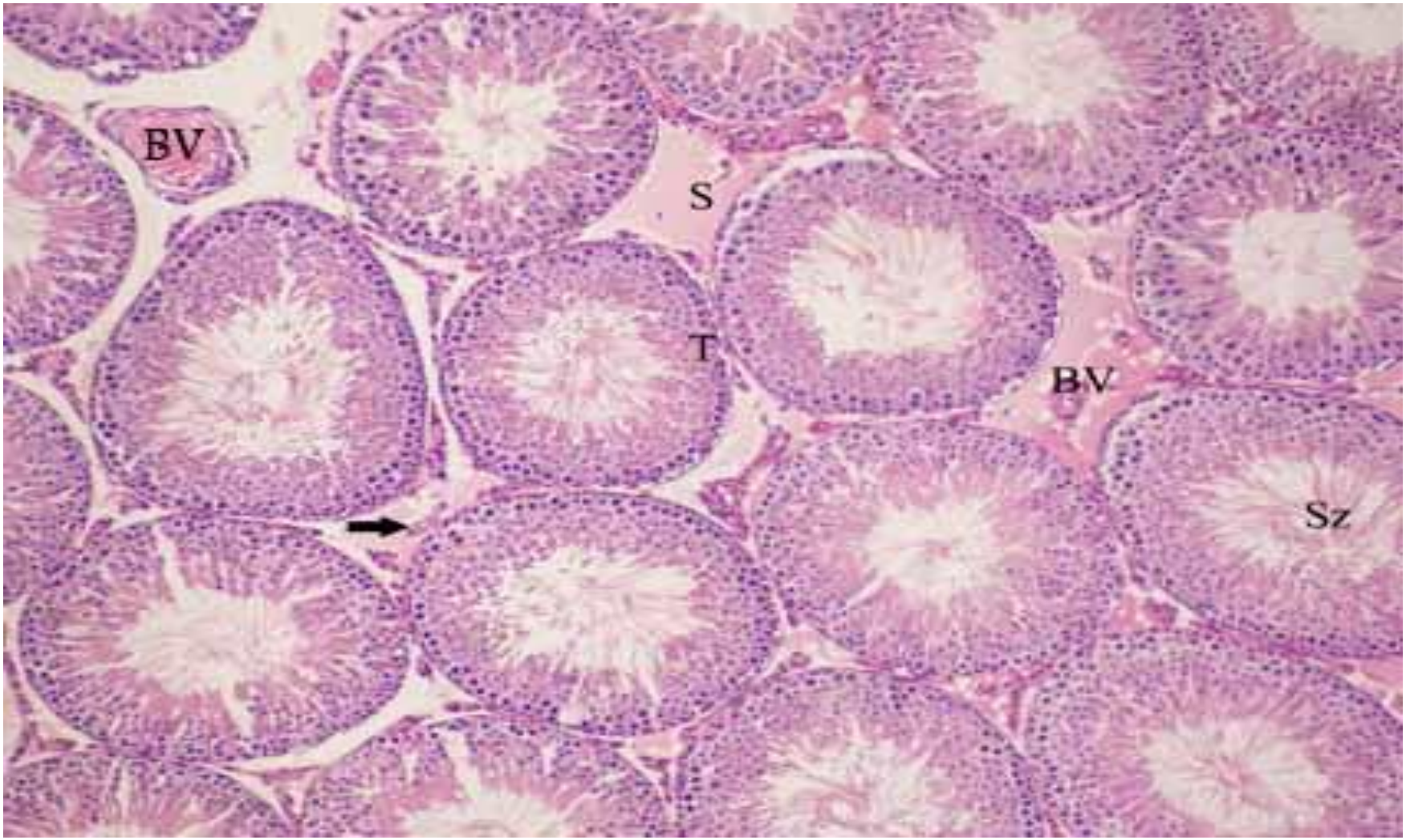
E.M:

steroid secreting cell

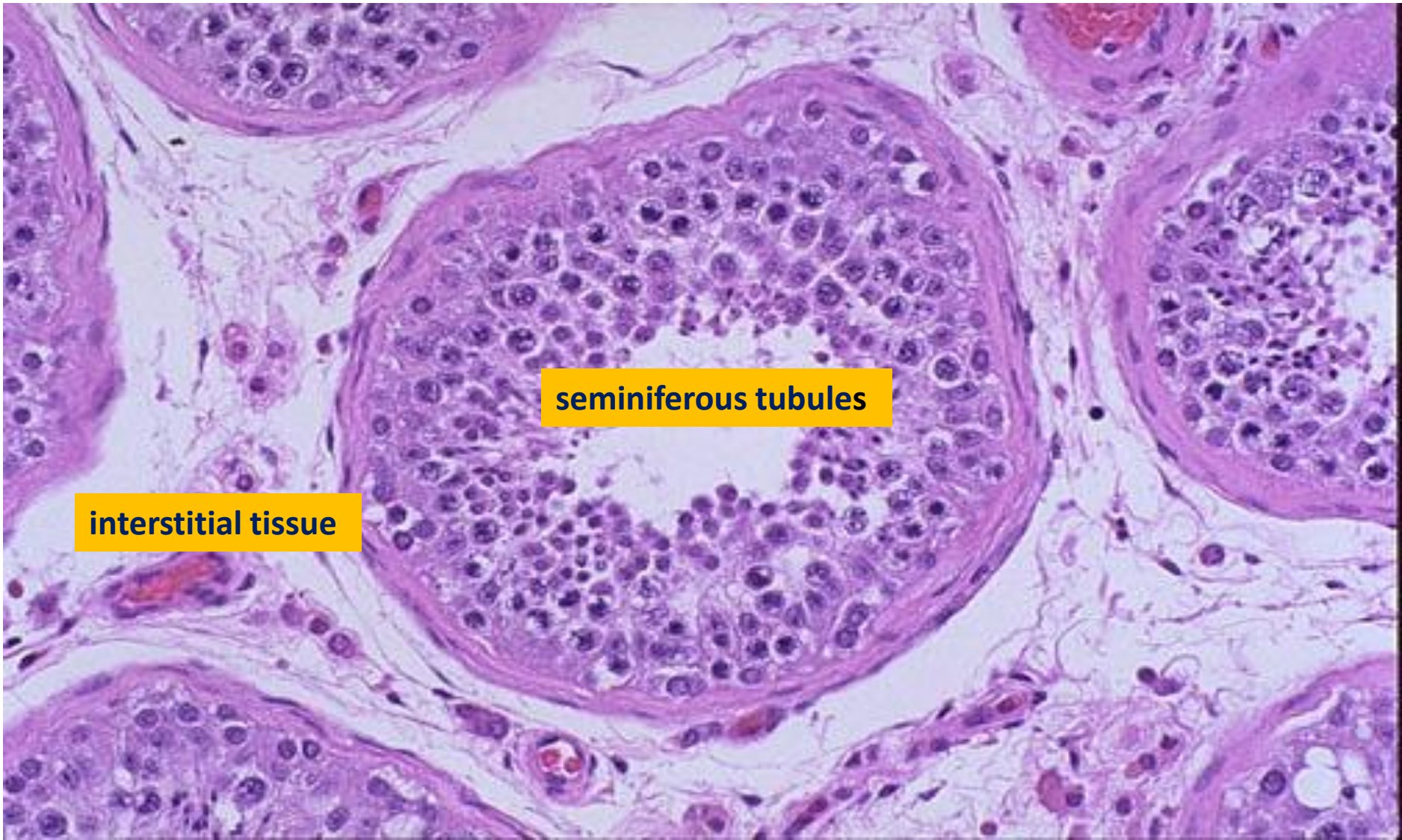
➢ **Function:**

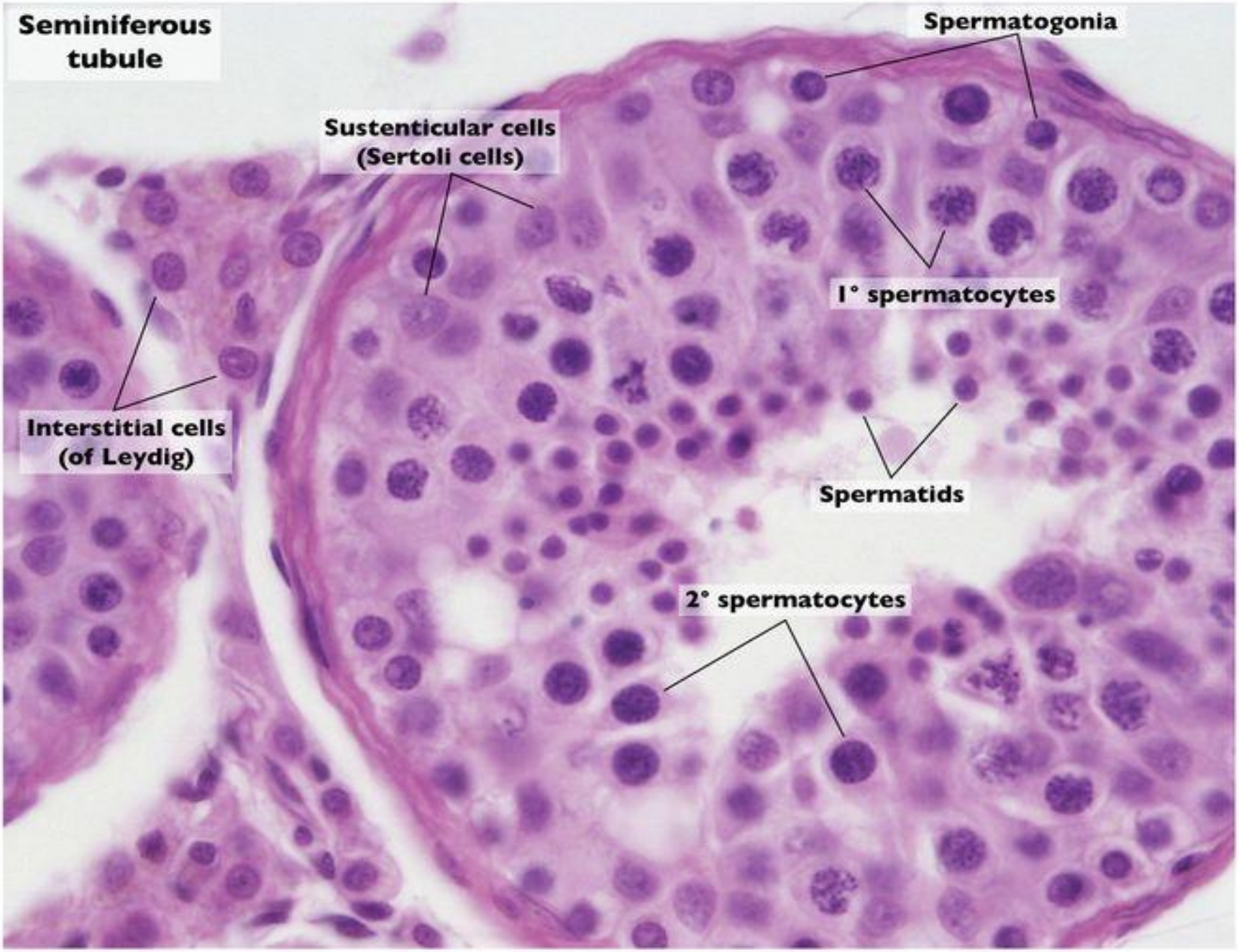
They produce androgenic steroid hormones, mainly testosterone under the control of LH of the anterior pituitary.

Testis



Testis




Seminiferous tubule
Spermatogonia
Sustenticular cells (Sertoli cells)
1° spermatocytes
Interstitial cells (of Leydig)
Spermatids
2° spermatocytes

Female Reproductive System

consists of:

I- <u>Primary</u> sex organs: two ovaries.

II- <u>Secondary</u> sex organs

(1) Two oviducts (uterine tubes).

(2) Uterus.

(3) Vagina & external genitalia.

(4) Mammary glands.

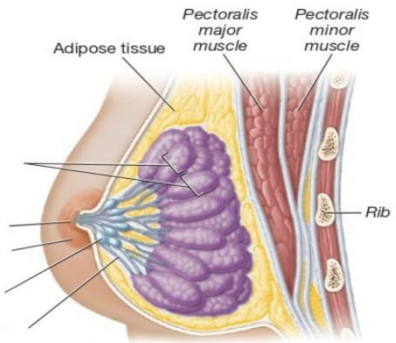
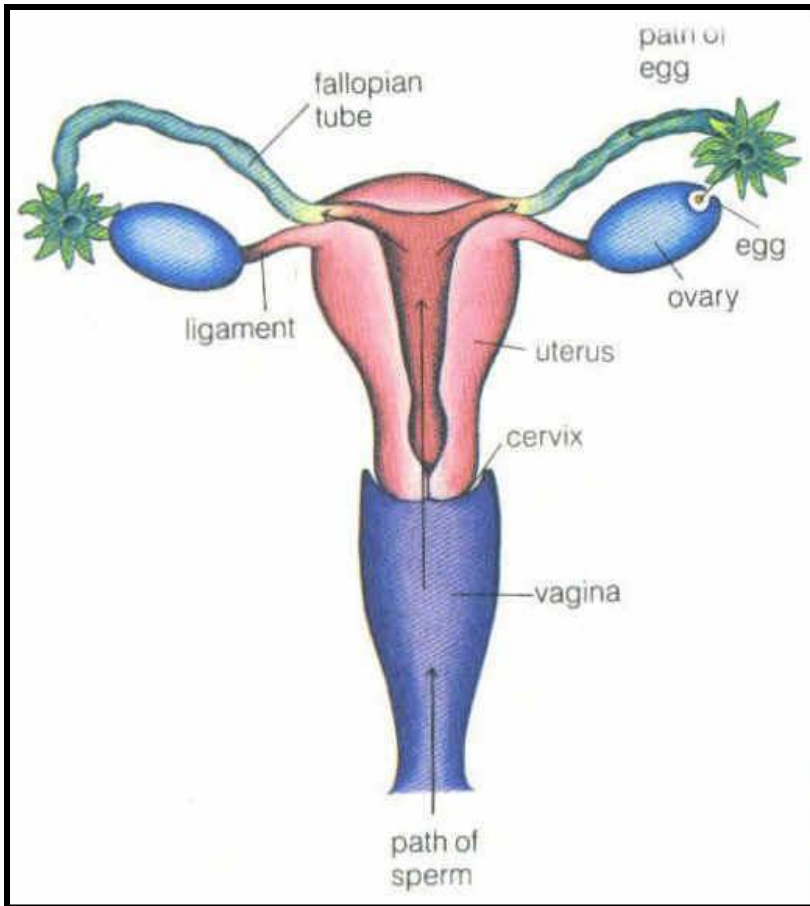


FIGURE **10.8** Structure of a lactating mammary gland.



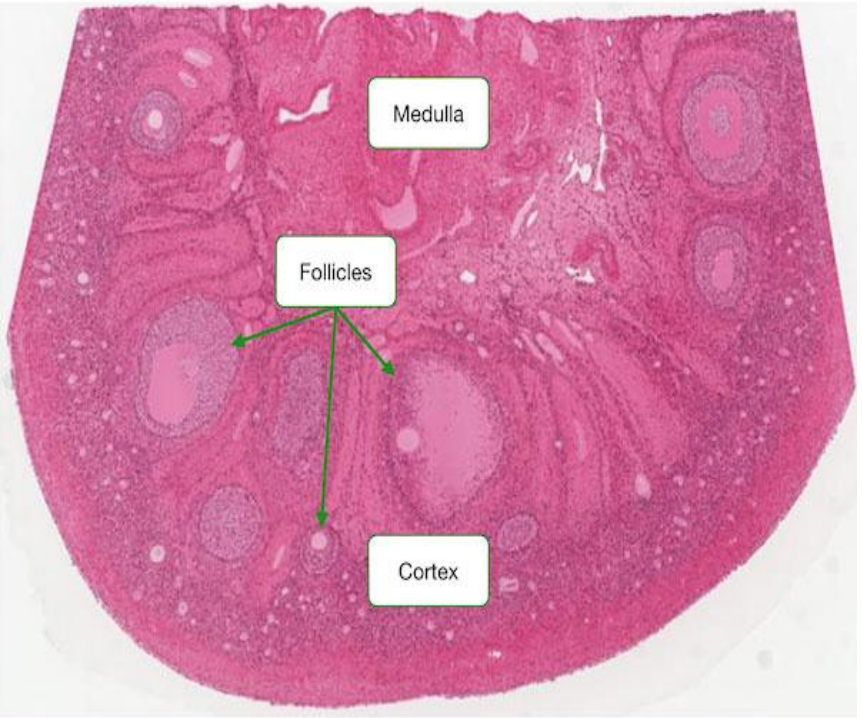
Ovary

- Oval body (3cm long×1.5cm wide×1cm thick).
- Attached to uterus by ovarian ligaments.
- **Functions**

1- Formation of ova.

2- production of female hormones (estrogen & progesterone)

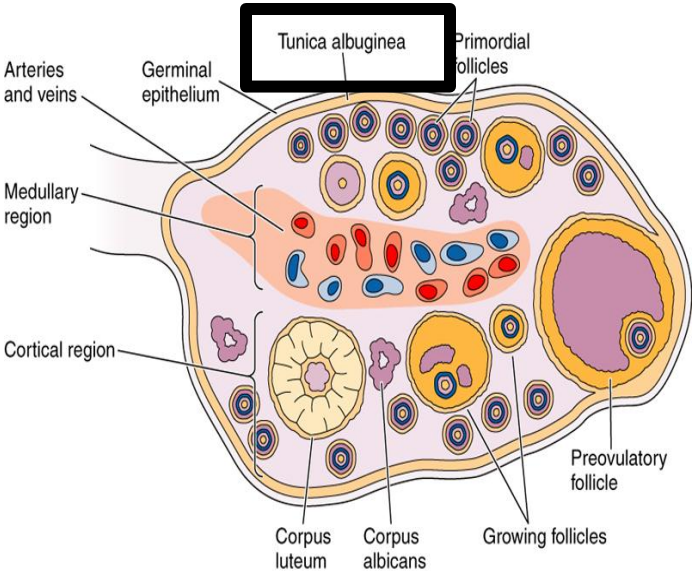
- **Structure:**
  - Stroma:
    - **a) Capsule**
    - **b) Reticular connective tissue**
    - **c) Stromal cells**
  - Parenchyma:
    - **cortex & medulla**
    - **no sharp limits.**

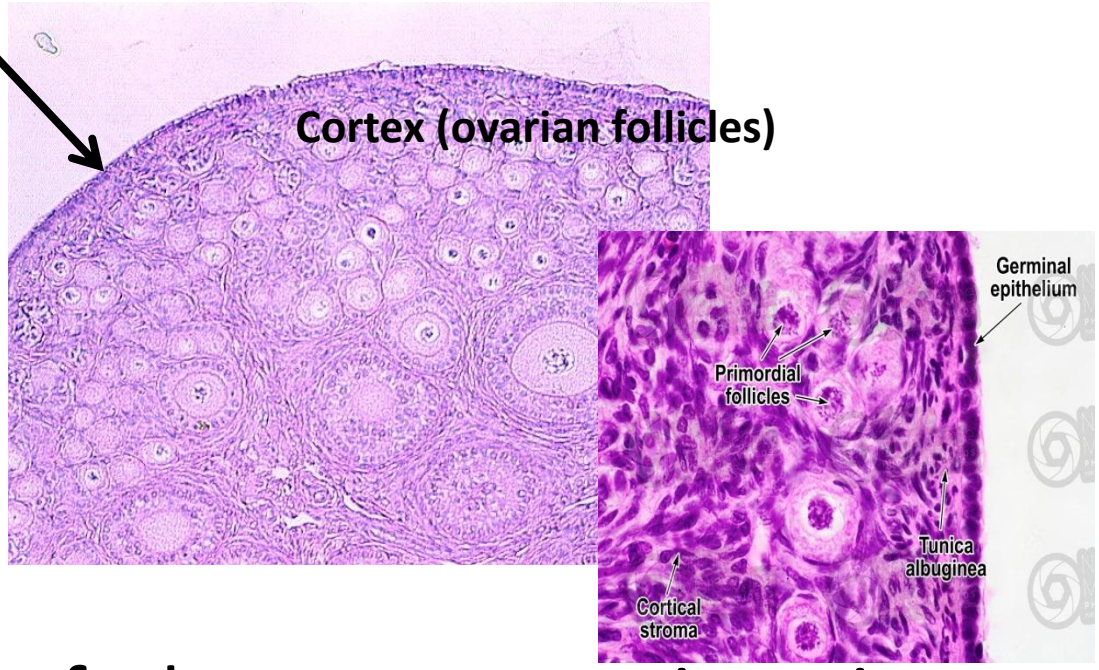


Structure of the ovary

Stroma

Each ovary is covered by simple cuboidal epithelium, called **germinal epithelium.**





- Under it a layer of dense connective tissue called **tunica albuginea.**

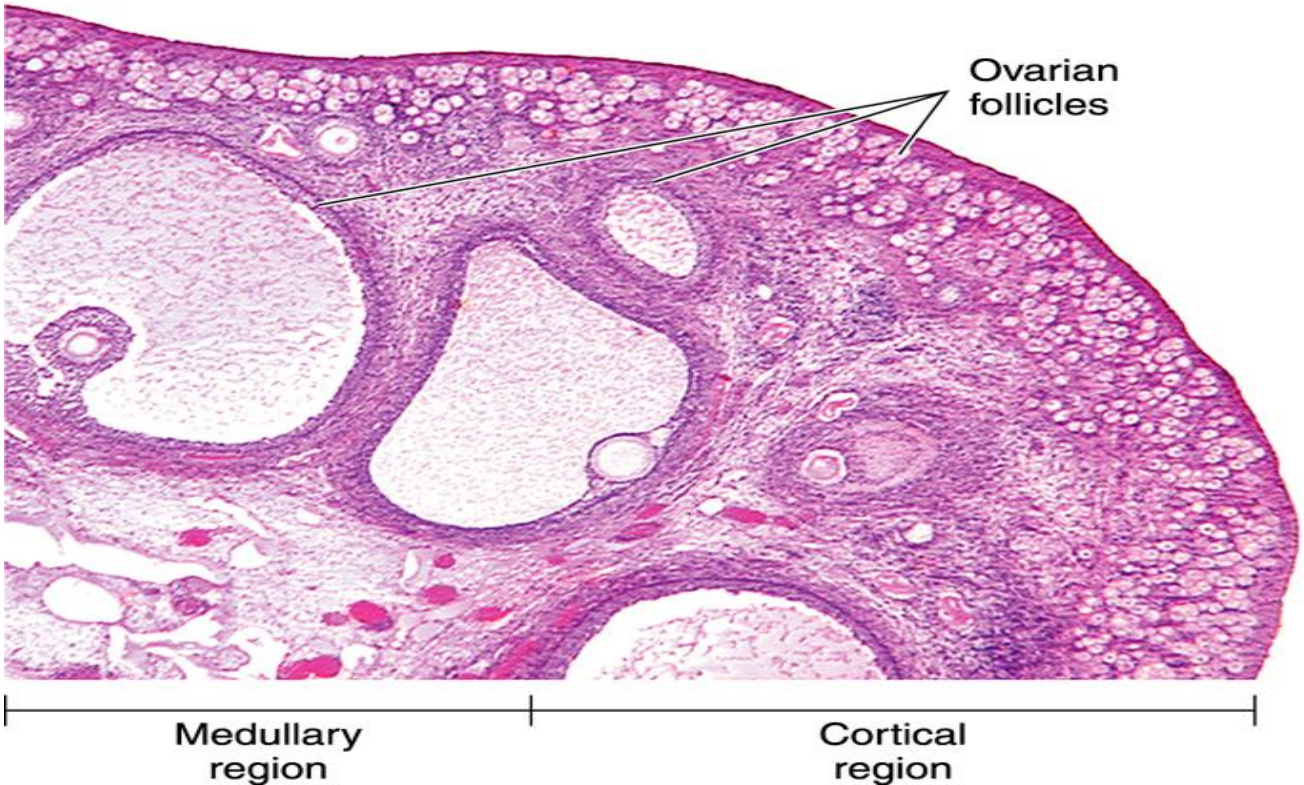
- **Parenchyma**

1-Cortex:

- wide outer region
- contain ovarian follicles at various stages of development & degeneration and separated by CT.

2-Medulla:

vascular C.T.



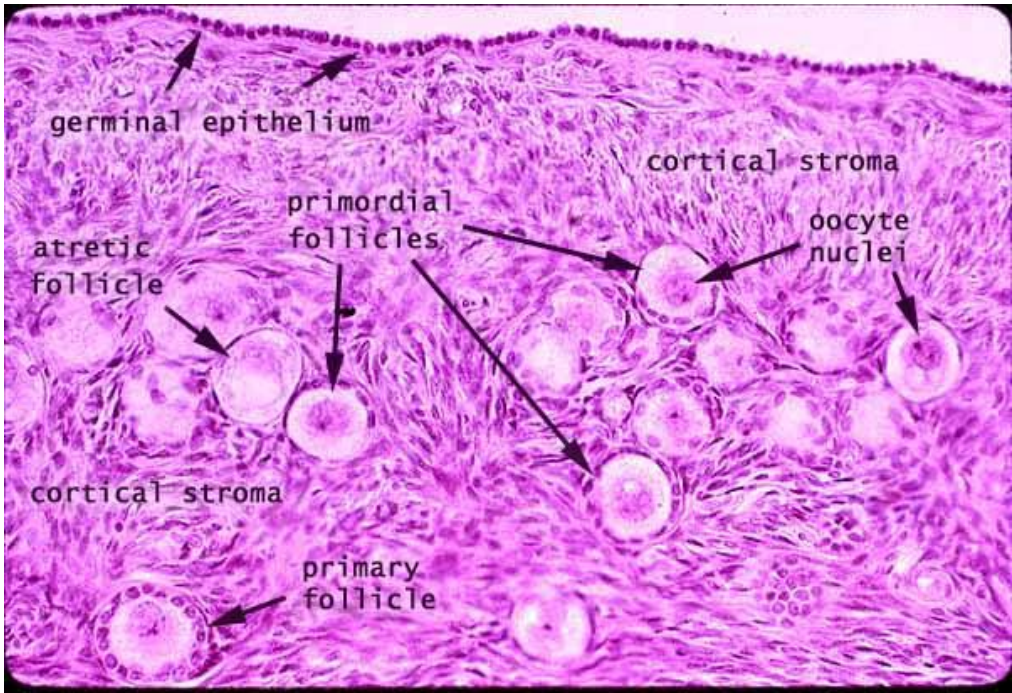
Ovarian Follicles

Site: stroma (C.T) of the cortex

Formation:

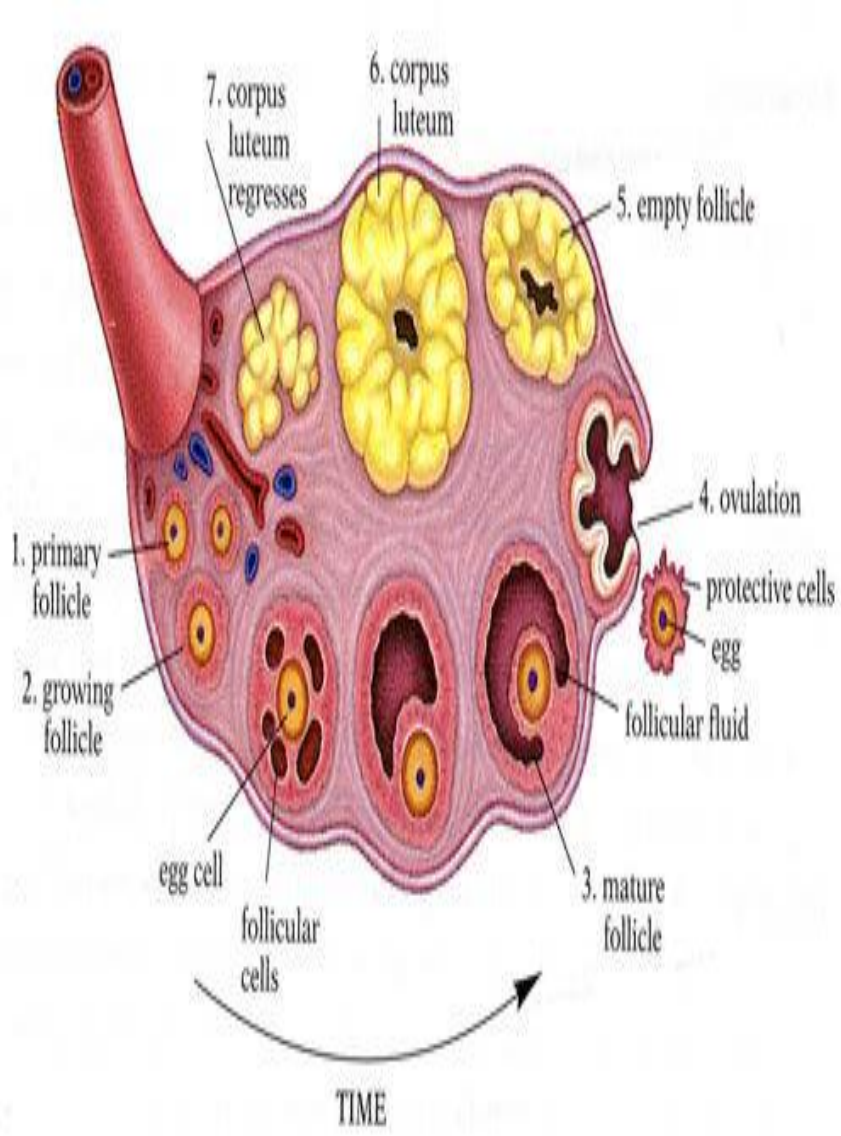
Follicle: oocyte surrounded by follicular cells.

- About 400,000 follicles are present in the two ovaries of an adult female.
  - Only about 450 of them reach maturation and deliver ova during the fertile period.
  - The other follicles undergo degeneration forming **Atretic Follicles**.



Ovarian follicles

1. Primordial follicles
2. Growing follicles:
    1. 1ry (uni & multilaminar)
    2. 2ry
3. Mature (Graafian)
4. Atretic follicles

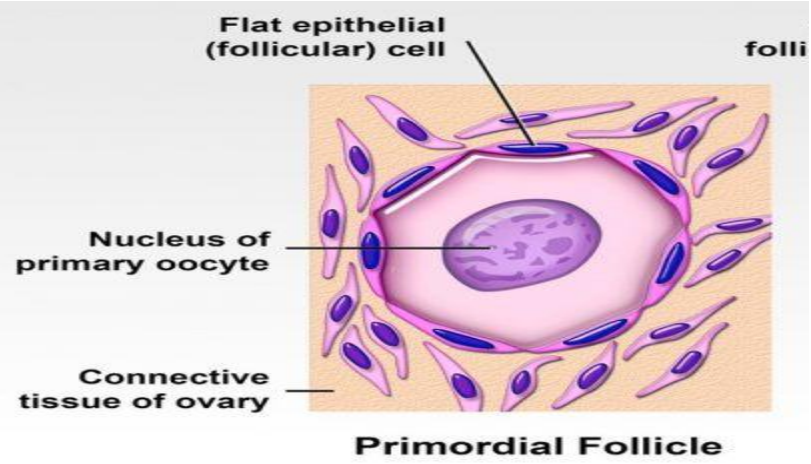


Stages of follicular development

1-Primordial follicles

- Primary oocyte surrounded by single layer of flattened follicular cells.
- At puberty follicular stimulating hormone (FSH) of pituitary gland stimulates primordial follicles to grow.
- The follicular growth involves *follicular cells, oocyte & stroma.*

Oocyte : Primary oocyte
Follicular cells: single layer of flat cells
Stromal CT: Proliferate

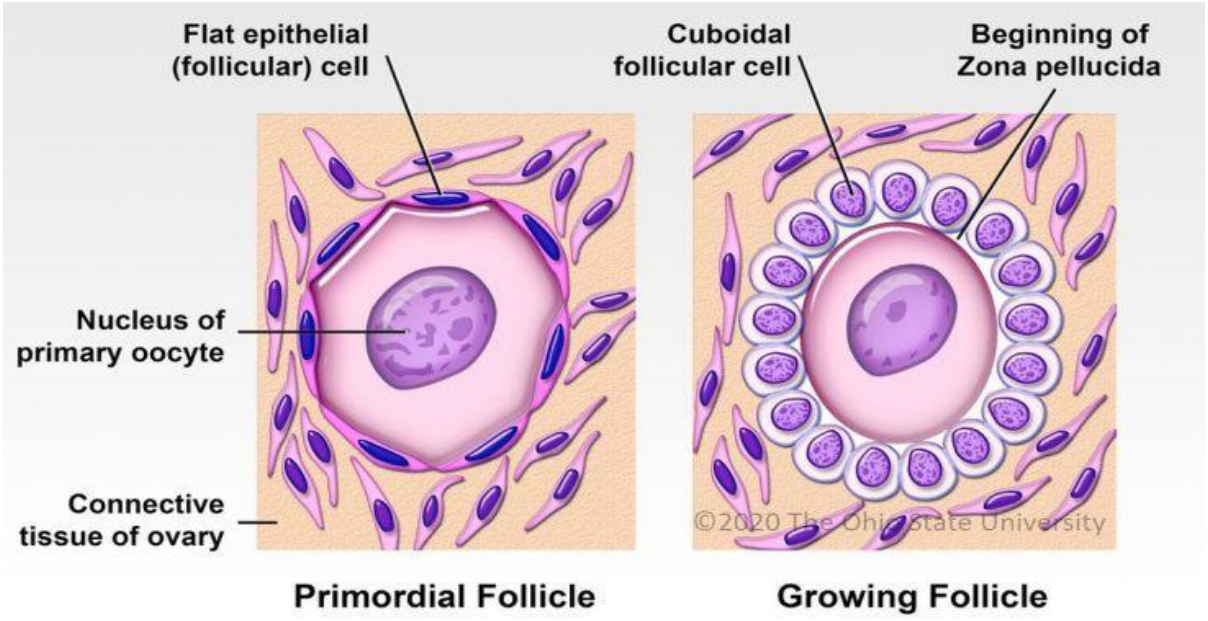


2-Growing follicles

1- Primary Ovarian follicle

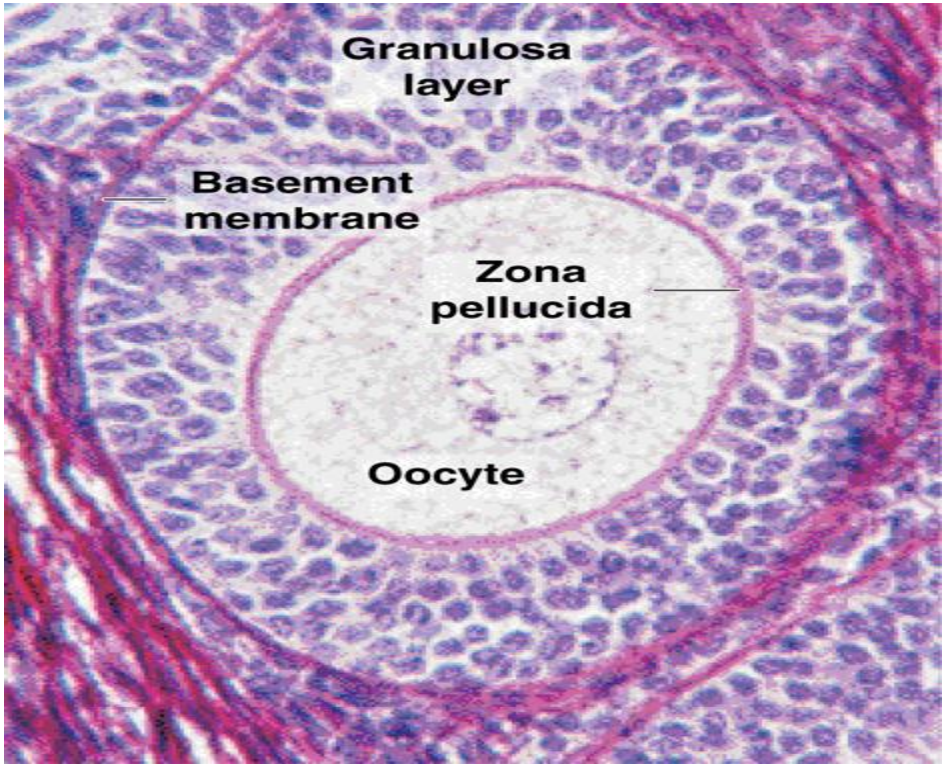
Unilaminar

- Oocyte: increase in size.
- Follicular cells: single layer of cuboidal cells.



Multilaminar

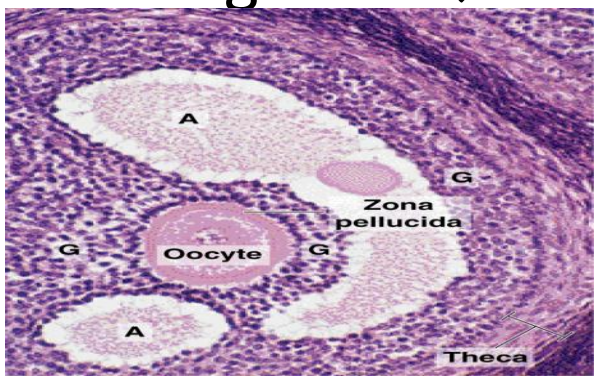
- **Oocyte:** continues to increase in size.
- Zona pellucida: thick coat of acidophilic, homogenous, surround the oocyte.
- **Follicular cells:** proliferate by mitosis forming stratified follicular epithelium *(ganulosa layer).*
- **Stroma:** around follicle differentiates to *theca folliculi.*

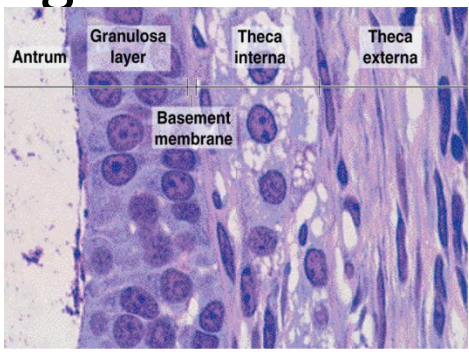


- ***2- Secondary Growing follicles*** **(**Antral follicles)
- **Oocyte** reaches its maximum diameter (150µm).
- **Follicle** grows due to increase in number of follicular cells.
- **Follicular fluid** appear in vesicles between cells and unite forming a cavity called Antrum.
- **Theca folliculi** differentiates into:

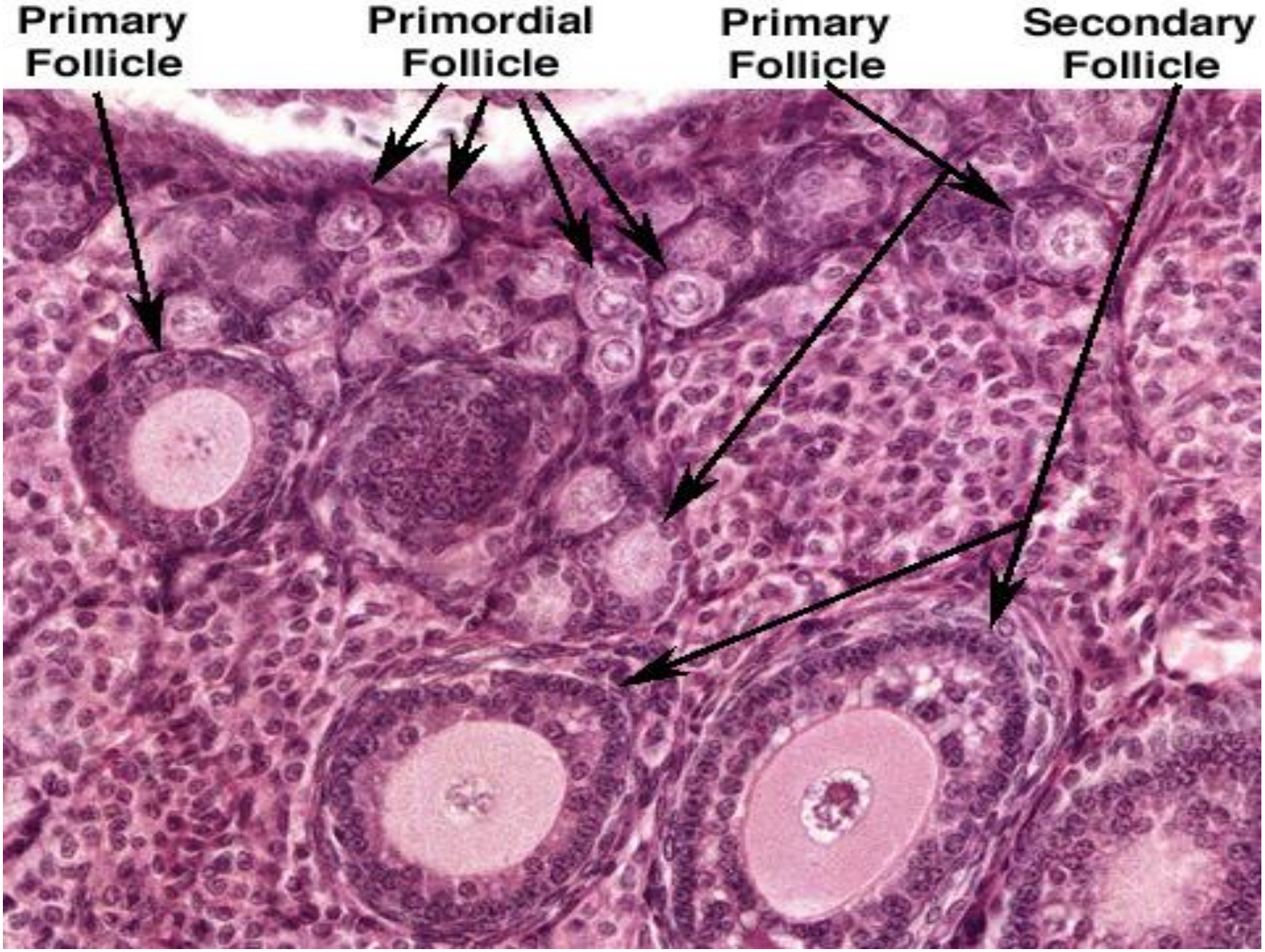
1-Theca interna: steroid secreting cells → estrogen.

2-Theca externa: C.T.



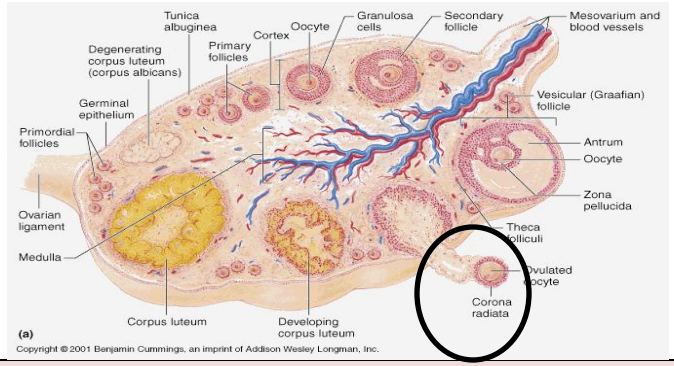


- No sharp boundary between the 2 theca layers or between them and ovarian stroma.
- However, a **thick basement membrane** is found between granulosa layer & theca interna.

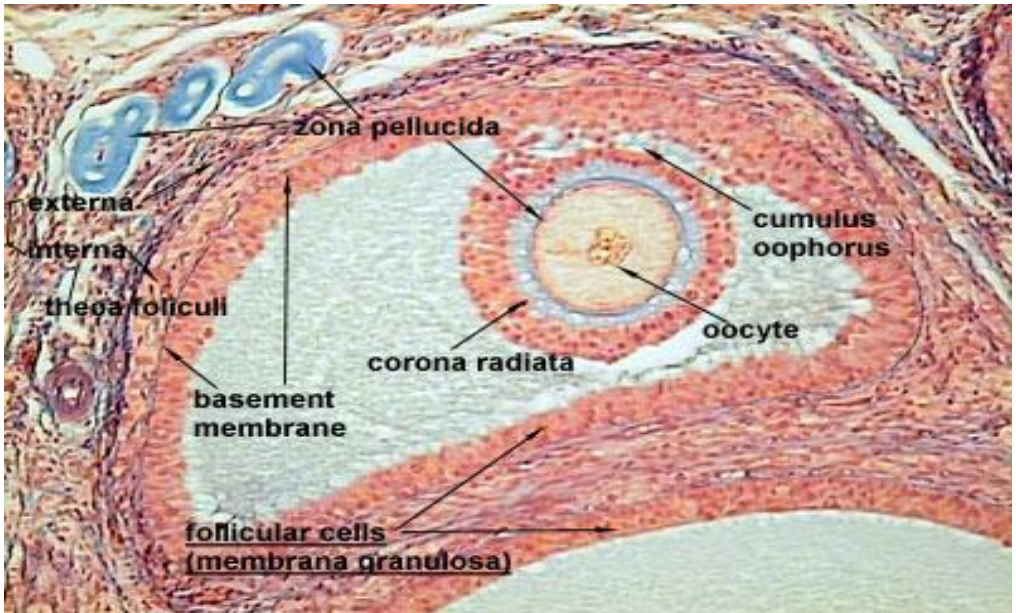

Primary Follicle
Primordial Follicle
Primary Follicle
Secondary Follicle

3-Mature (Graafian) follicle: Reaches up to 5 cm in diameter.

1. Oocyte: adheres to wall of follicle through pedicle of granulosa called **cumulus oophorus**. The first layer of granulosa cells around ovum form **corona radiata**
2. Zona pellucida.
3. Corona radiata: granulosa cells around oocyte.
4. Cumulus oophorus: pedicle connecting oocyte to granulosa layer.
5. Follicular cavity: increases in size forming single large cavity.
6. Granulosa layer becomes thinner forming *membrana granulose.*
7. Basement membrane.
8. **Graffian follicle** is surrounded by theca interna & theca externa.



The process of ovulation takes place in **middle** of menstrual cycle (14th day) by rupture of mature follicle and liberation of ovum accompanied by corona radiata



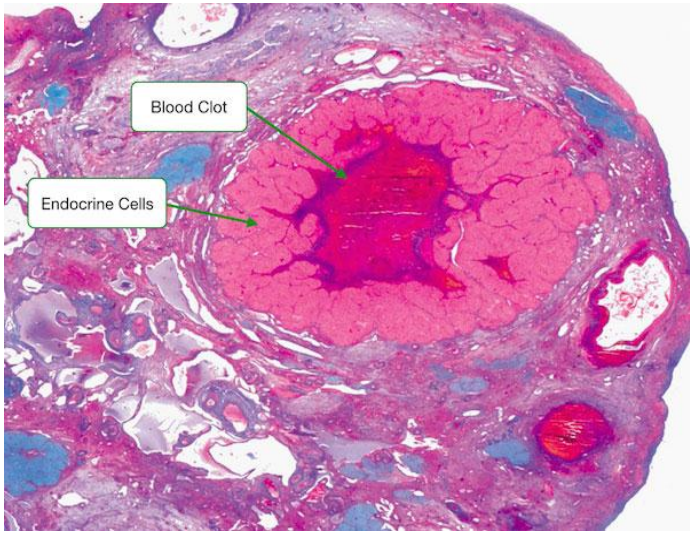
Corpus Luteum

Ovulation results in collapse of wall of Graafian follicle which becomes folded.

- The remaining structure form temporary endocrine gland called corpus luteum formed of the following layers:

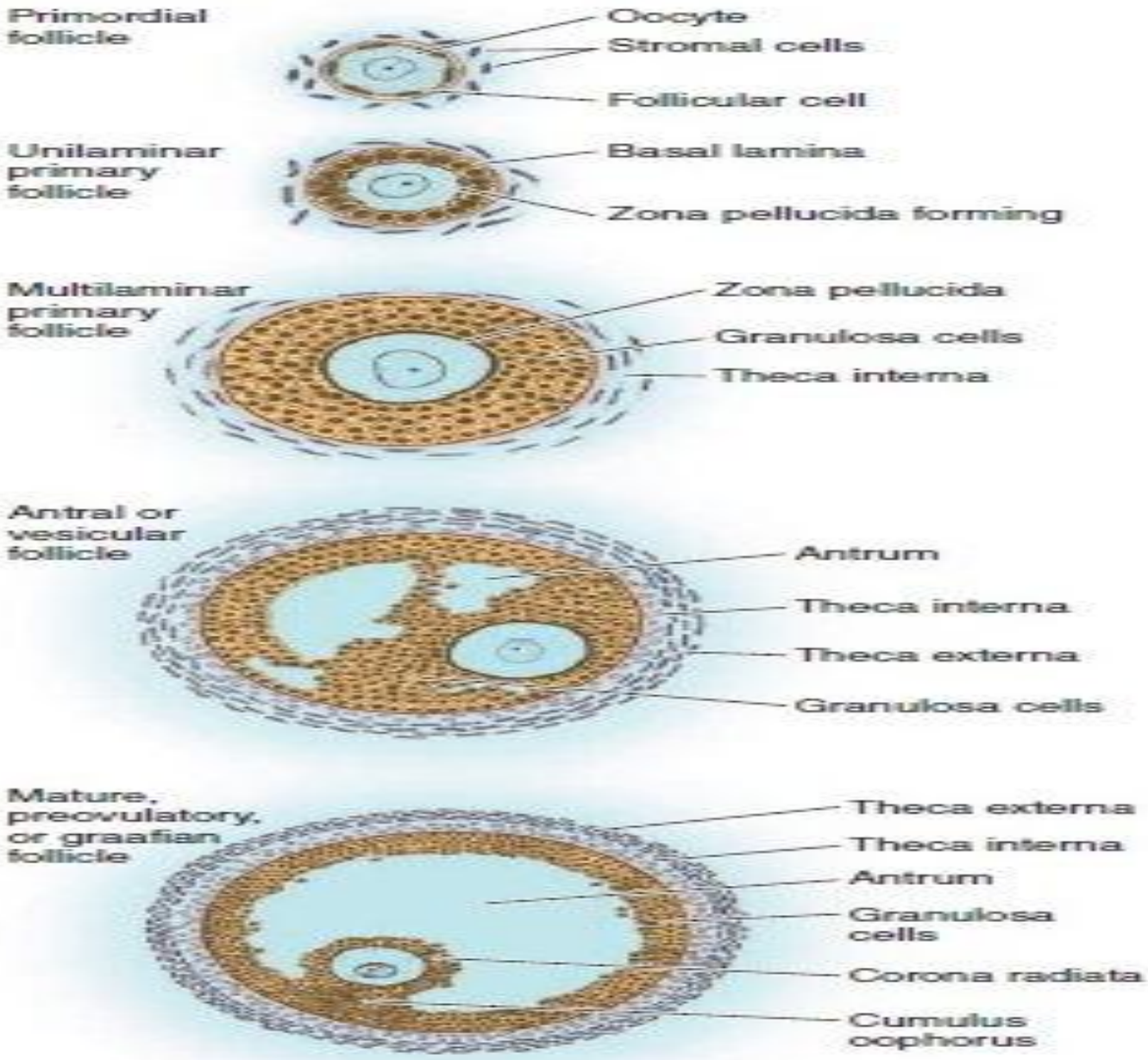
Granulosa Lutein Cells:

- Granulosa cells increase in size
- accumulate **lipochrome** pigment.
- They secrete **progesterone**



Theca Lutein Cells:

- cells of theca interna give rise to small sized darkly stained cells.
- They secrete **estrogen**.


Primordial follicle
Oocyte
Stromal cells
Follicular cell
Unilaminar primary follicle
Basal lamina
Zona pellucida forming
Multilaminar primary follicle
Zona pellucida
Granulosa cells
Theca interna
Antral or vesicular follicle
Antrum
Theca interna
Theca externa
Granulosa cells
Mature, preovulatory, or graafian follicle
Theca externa
Theca interna
Antrum
Granulosa cells
Corona radiata
Cumulus oophorus

Thank you