



PITUITARY GLAND THYROID GLANDS & PARATHYROID GLAND

HISTOLOGY

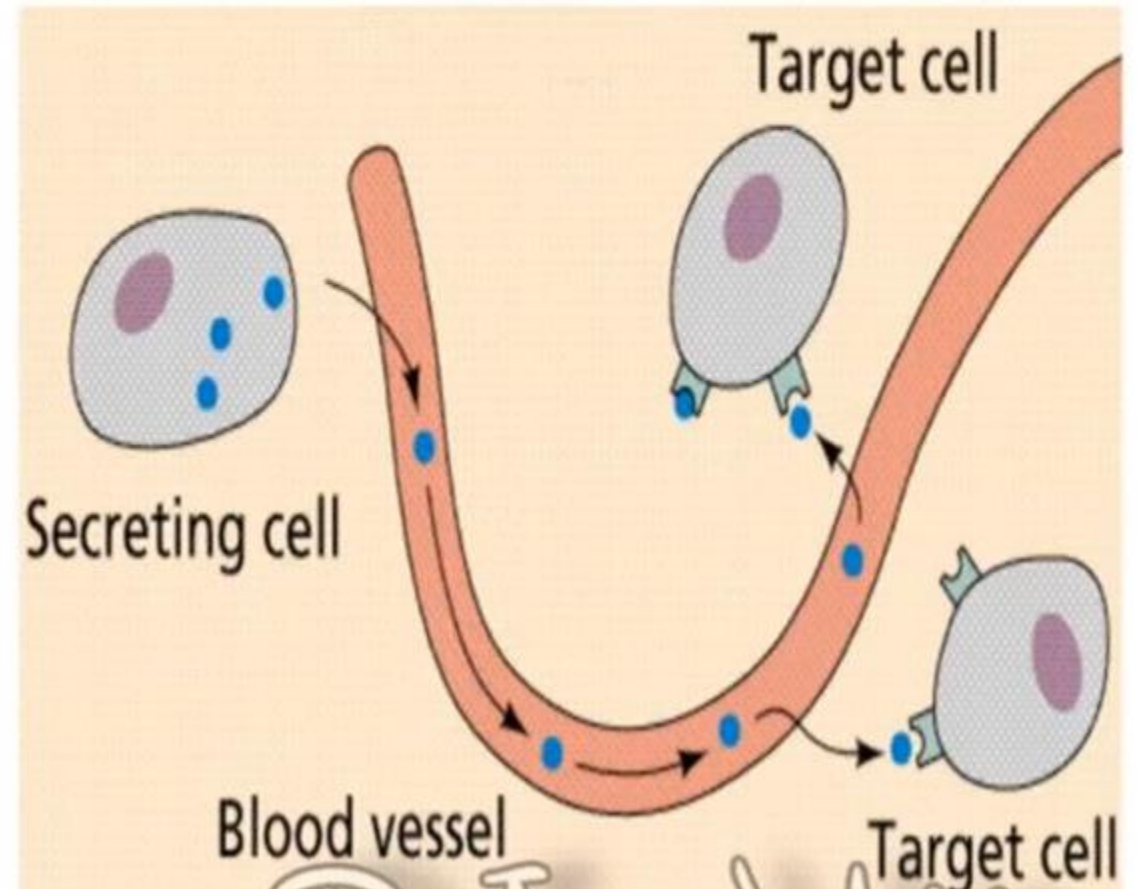
Semester 2, Year 2 •

Dr . Amira Osman

Associate professor of Human histology & Cell Biology

Endocrine glands= ductless glands

- **Definition:** the sites of synthesis and secretion of hormones which spread throughout the body by the bloodstream where they act on target organs.



Endocrine system



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graph TD; A[Endocrine system] --> B[Endocrine glands]; A --> C[Group of endocrine cells in certain organs]; A --> D[Dispersed endocrine cells]; B --> B1[1- Pituitary gland]; B --> B2[2- Thyroid gland]; B --> B3[3- Parathyroid gland]; B --> B4[5- Suprarenal gland]; B --> B5[6- Pineal gland]; C --> C1[1- Pancreas (Islets of Langerhans)]; C --> C2[2- Testis (Leydig cells)]; C --> C3[3- Ovary (ovarian follicles & corpus luteum)]; C --> C4[4- Placenta]; D --> D1[APUD cells];
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Endocrine glands

- 1- Pituitary gland
- 2- Thyroid gland
- 3- Parathyroid gland
- 5- Suprarenal gland
- 6- Pineal gland

Group of endocrine cells in certain organs

- 1- Pancreas (Islets of Langerhans)
- 2- Testis (Leydig cells)
- 3- Ovary (ovarian follicles & corpus luteum)
- 4- Placenta

Dispersed endocrine cells

APUD cells

Types of hormones

Steroid hormones

- 1- Adrenal cortex (cortisol , androgen & aldosterone)
- 2- Ovary (estrogen & progesterone)
- 3- Testes (testosterone)
- 4- Placenta (estrogen & progesterone).

Proteins & peptides

- 1- Pituitary hormones
- 2- Parathyroid hormones
- 3- Hormones of the pancreas

Monoamines

- 1- Thyroid hormones
- 2- Adrenal medullary hormones (catecholamine)

I-Steroid hormones(cholesterol derivative)

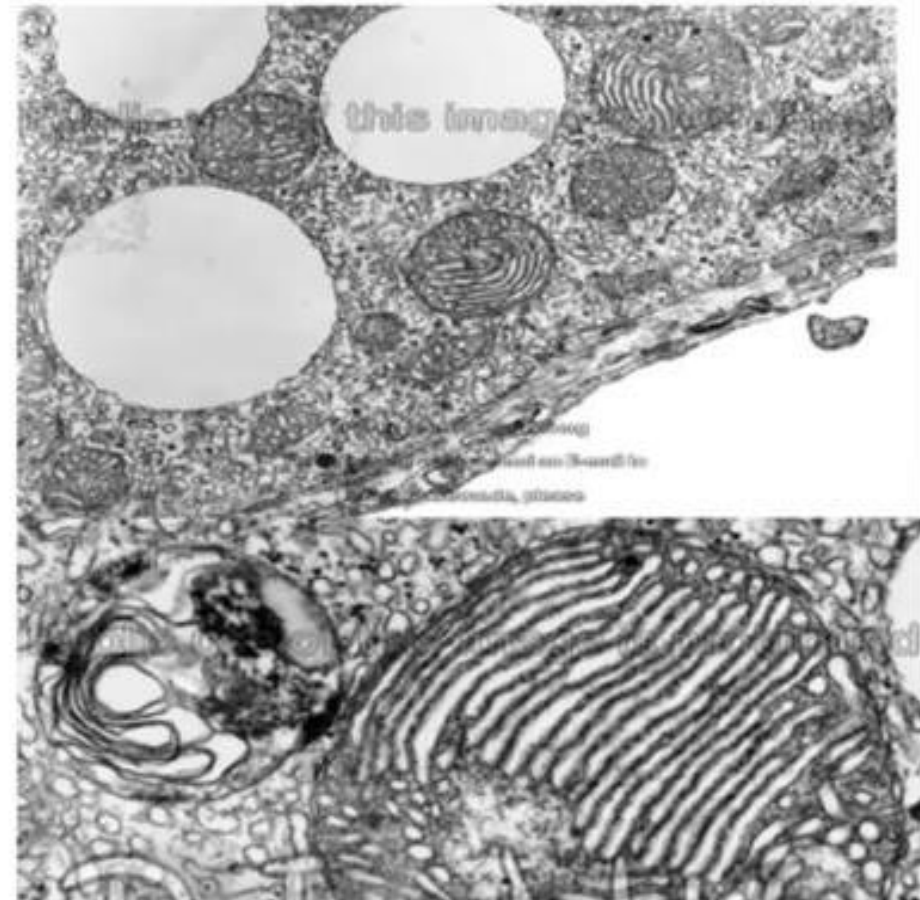
- **General structure of steroid secreting cells:**

EM:

- 1- Well developed smooth endoplasmic reticulum.
- 3- Mitochondria with tubular cristae.
- 3- Lipid droplets.

LM:

Eosinophilic & vacuolated cytoplasm.



II- Proteins, Peptide; monoamines

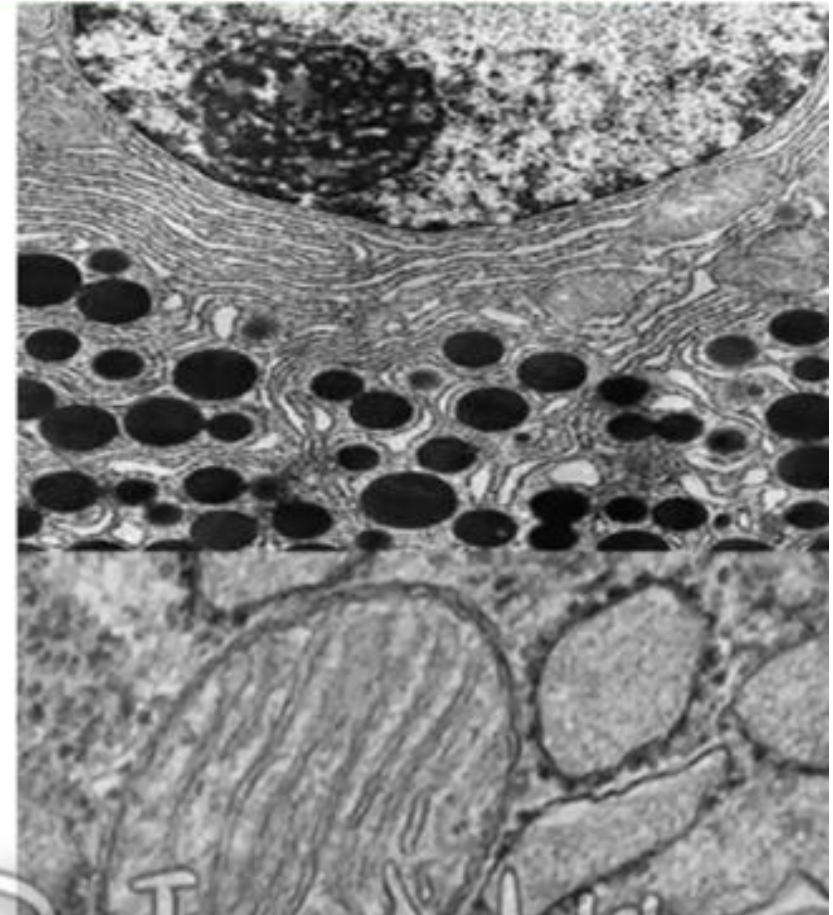
- **General structure of protein secreting cells:**

EM:

- 1- Well developed rough endoplasmic reticulum.
- 2- Well developed Golgi apparatus.
- 3- Mitochondria with lamellar cristae.
- 4- Secretory granules.

LM:

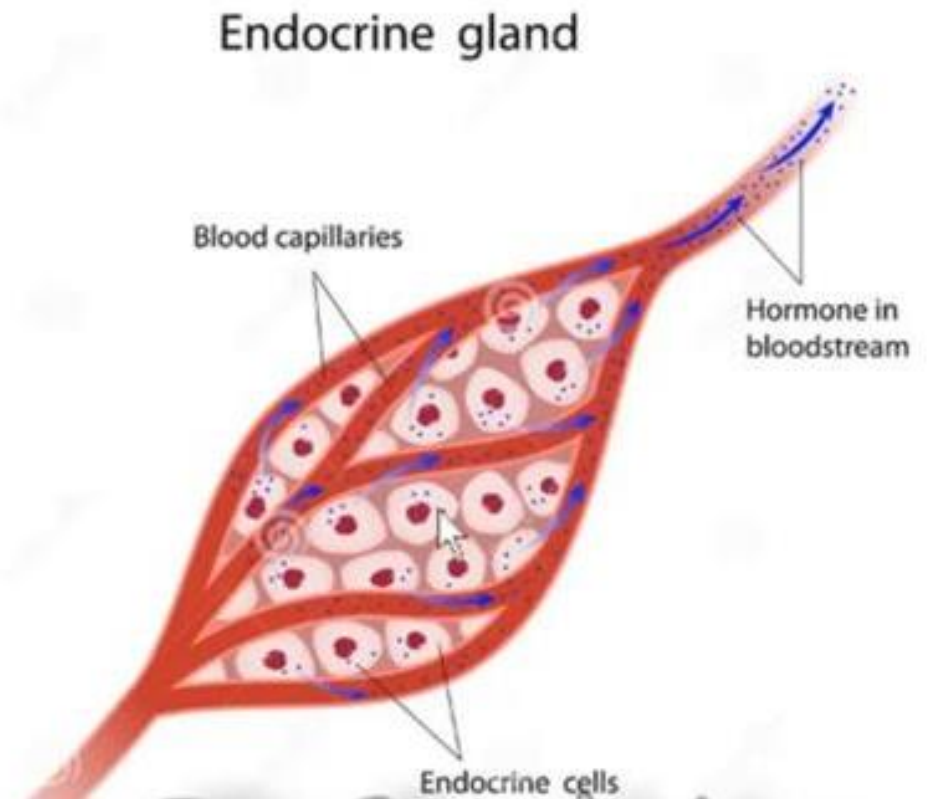
- 1- Euchromatic nucleus with prominent nucleolus.
- 2- Basophilic cytoplasm.



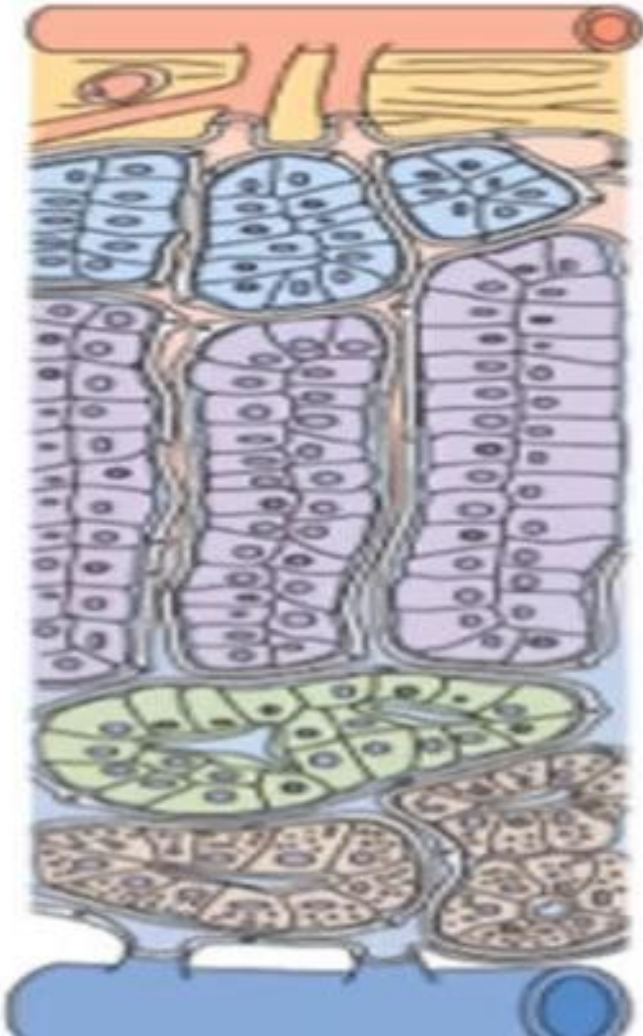
General structure of endocrine glands

- They are composed of:

- 1- A group of secretory cells.
- 2- Fenestrated blood capillaries(sinusoidal capillaries).

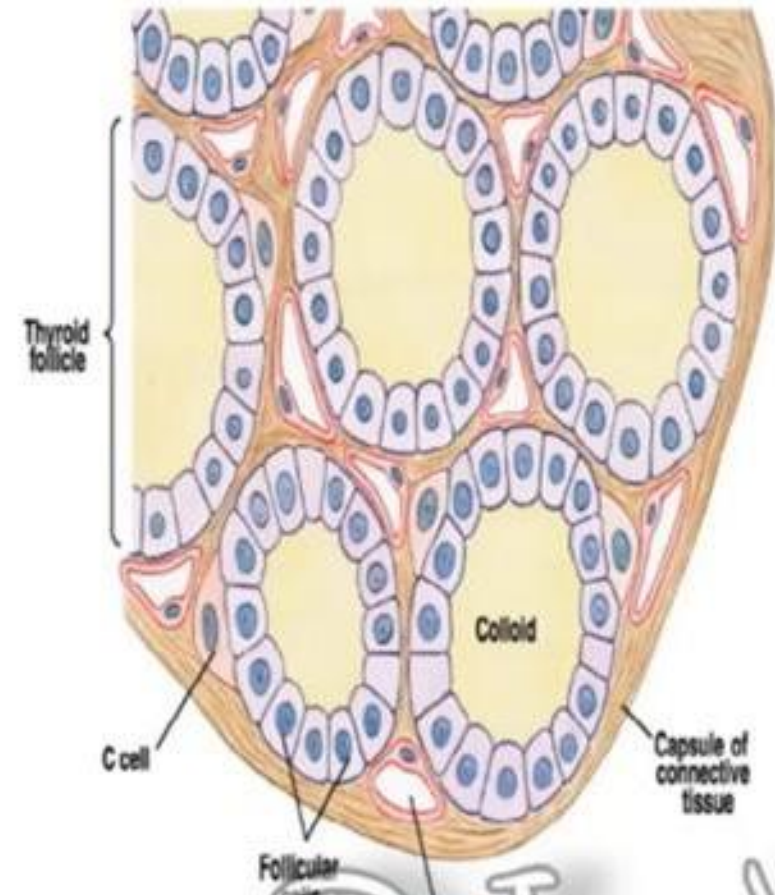


Cords



Follicle

Section of thyroid gland



Pituitary gland (hypophysis cerebri)

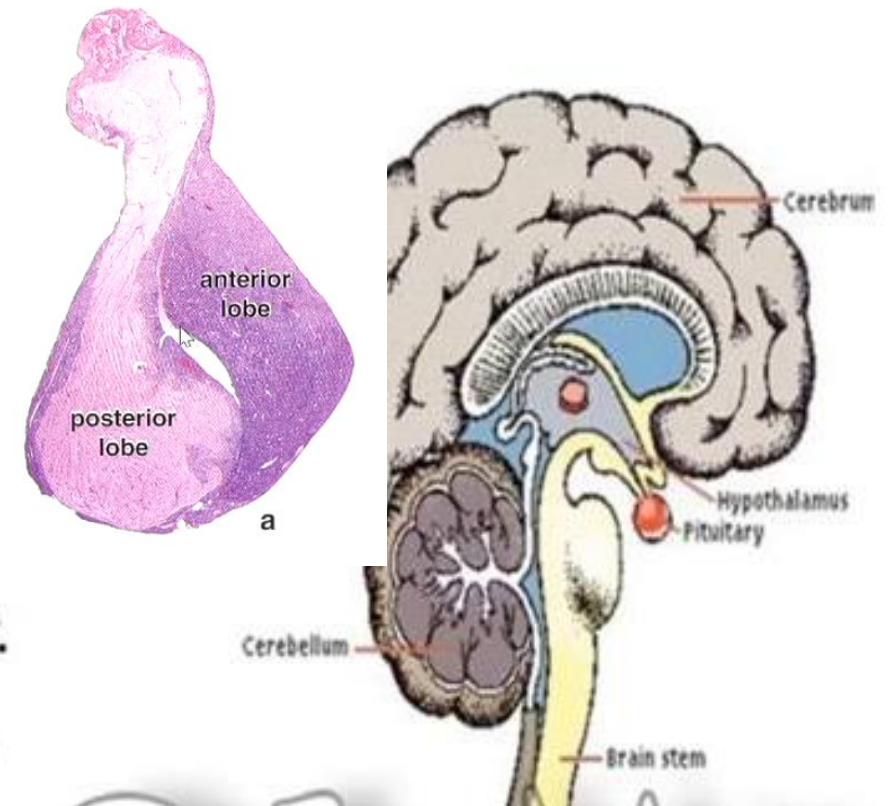
- **Anatomically:**

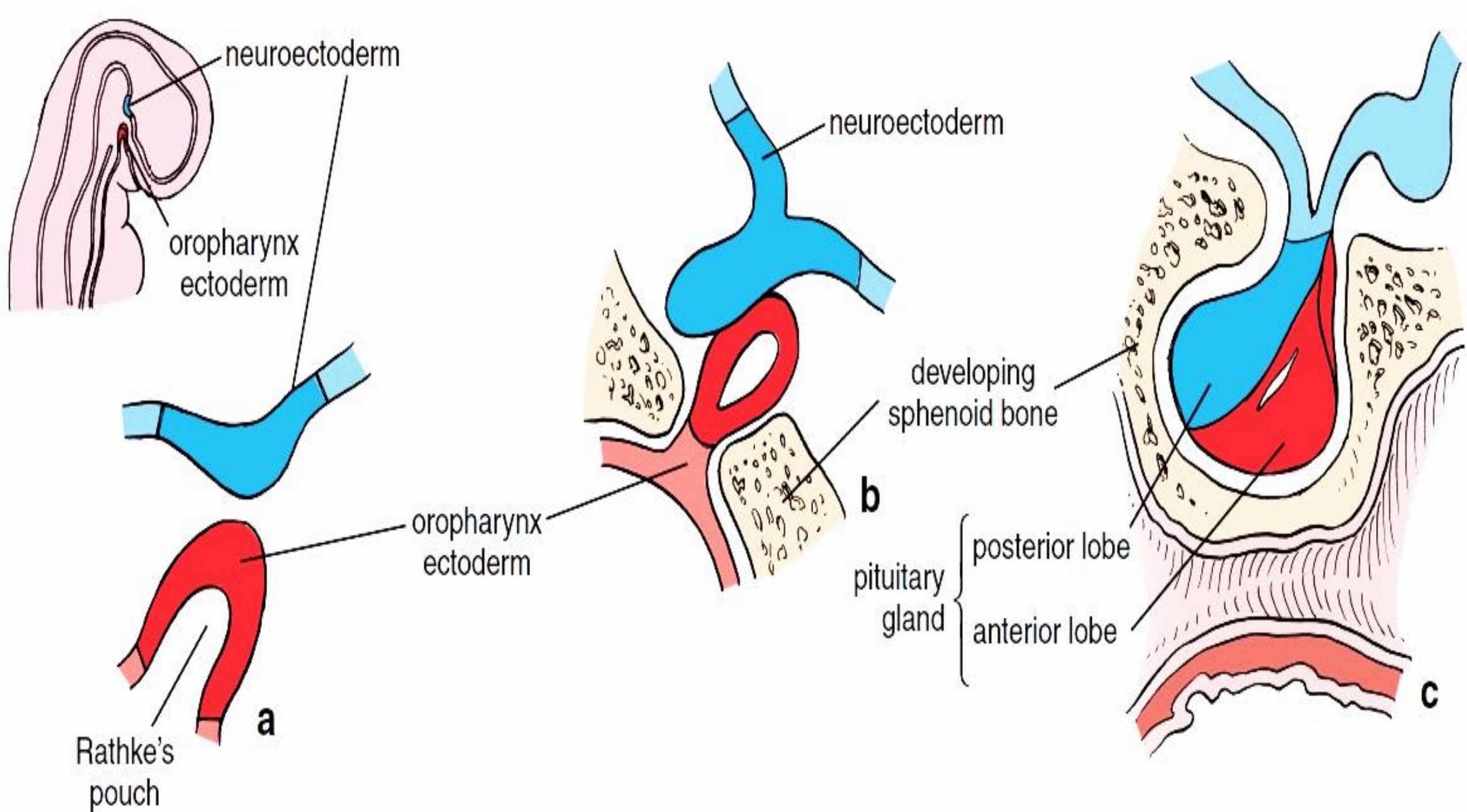
It is situated inside the hypophyseal fossa (sella turcica) of the sphenoid bone, connected to the brain by the infundibular stalk & covered by the diaphragma sellae.

- **Histologically:**

It is divided into:

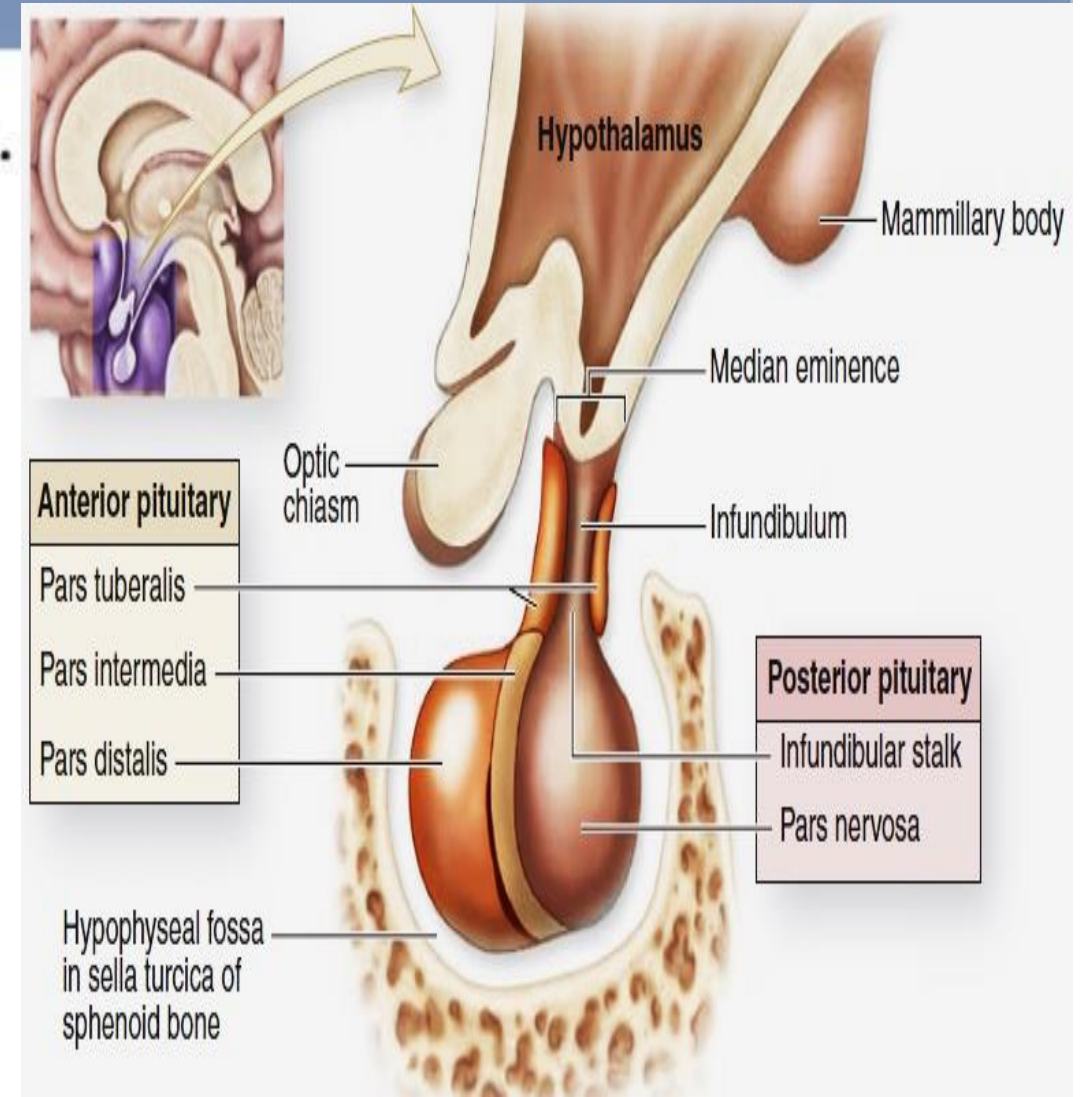
- a) Anterior lobe (adenohypophysis): dark & cellular.
- b) Posterior lobe (neurohypophysis): pale & fibrous.





I- Anterior lobe (Adenohypophysis)

- It lies anterior to the hypophyseal cleft.
- *It is subdivided into 3 parts:*
 - 1- Pars distalis.
 - 2- Pars tuberalis.
 - 3- Pars intermedia.



PARS DISTALIS

Parenchyma

Reticular network

Cords of cells

Fenestrated capillaries

Chromophils

Chromophobes

Acidophils

Basophils

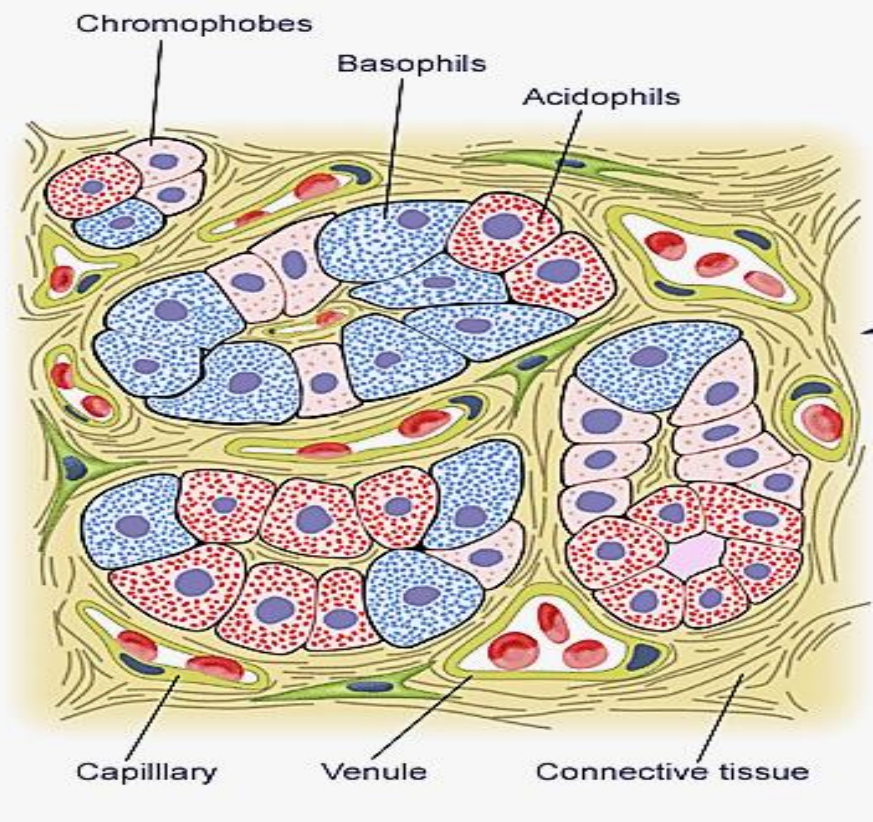
Somatotrophs

Mammotrophs

Thyrotrophs

Corticotrophs

Gonadotrophs



1- Pars distalis

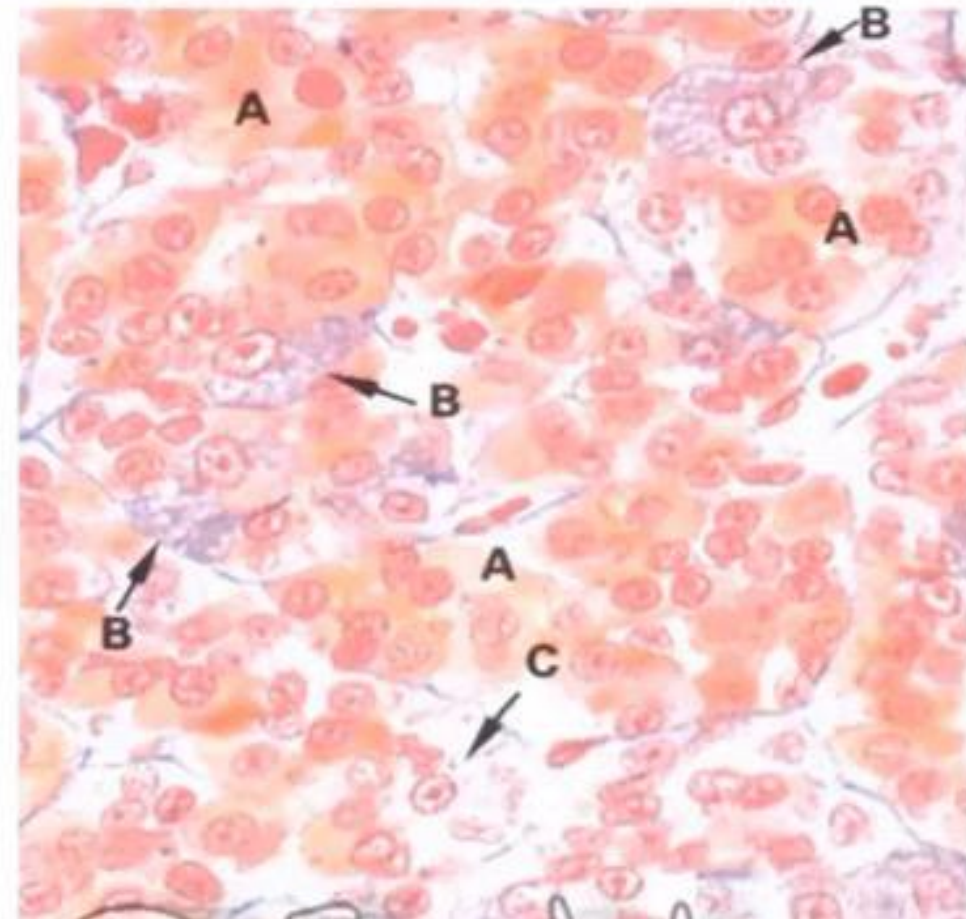
It consists of 2 types of cells:

1- Chromophobes (52%):

- Have weak affinity to stains.
- They are cells smaller than the chromophils
- Have a non granular pale cytoplasm (few organelles).
- **Function:** They do not secrete hormones. They are reserve cells or degranulated chromophils.

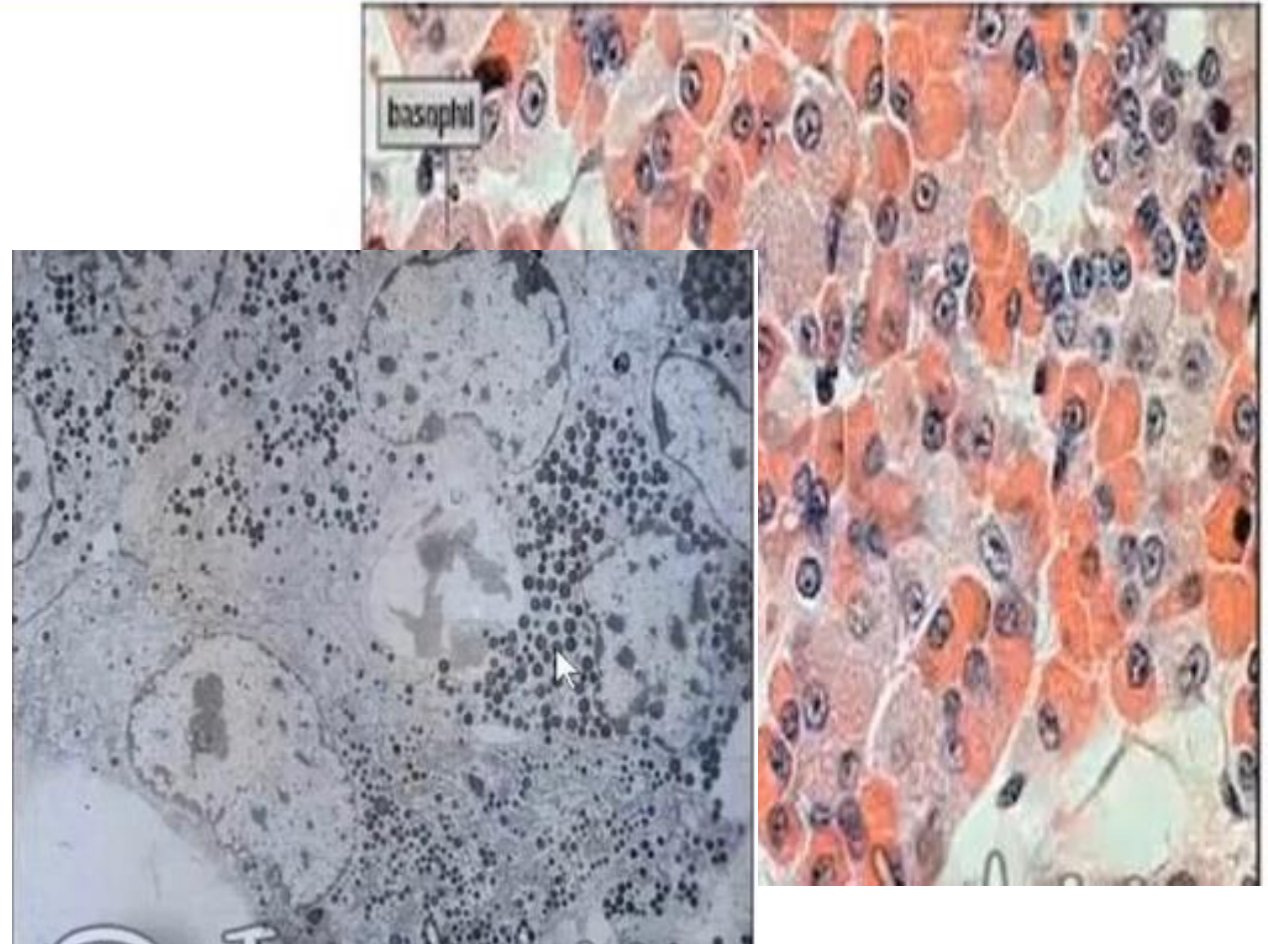
2- Chromophils (48%):

- Have great affinity to stains.
- They have granular darkly stained cytoplasm
- They are classified according to their granules into two types:
 - **Acidophils:** which have great affinity to acidic stains.
 - **Basophils:** which have great affinity to basic stains.



a- Acidophils (37%)

- They secrete hormones of *protein* in nature.
- They are periodic acid Schiff (PAS) negative.
- They are smaller than the basophils but contain larger secretory granules.
- **EM:** protein secreting cells.
- Acidophils are of two types:
 - 1- **Somatotrophs:** secrete growth hormone.
 - 2- **Mammotrophs:** secrete prolactin.

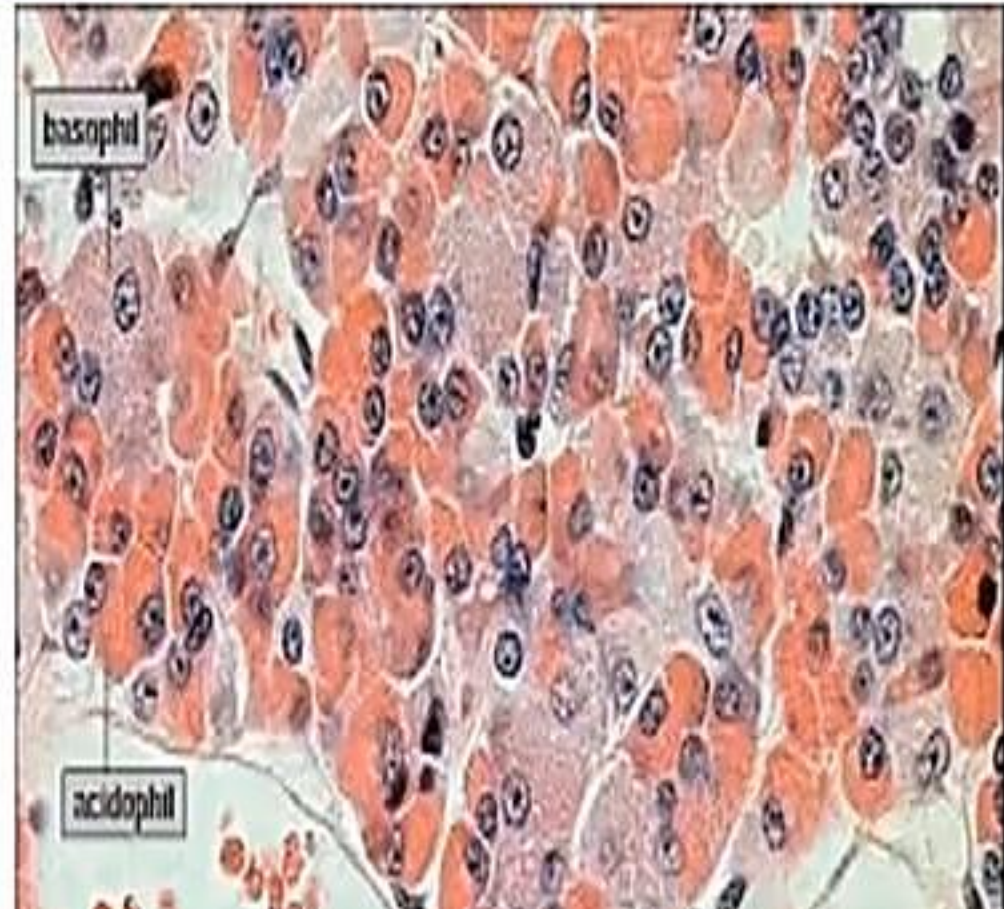


MAMMOTROPHES

- The secretory granules in these cells are small, but in pregnant and lactating females they become large and numerous & are called *pregnancy cells or Erdheim cells*.
- When suckling is terminated, lysosomes eliminate the excess secretory granules, a process known as *crinophagy*.

b- Basophils (11%)

- They secrete hormones of *glycoprotein* in nature.
- They are PAS +ve (*except* the corticotrophs which secrete a polypeptide hormone (so, it is PAS –ve).
- They are larger than the acidophils, but contain smaller secretory granules.
- **EM:** protein secreting cells.
- Basophils are of three types:
 - 1- **Thyrotrophs:** secrete thyroid stimulating hormone (TSH).
 - 2- **Gonadotrophs:** They secrete two hormones:
 - Follicle stimulating hormone (FSH).
 - Luteinizing hormone (LH)
 - 3- **Corticotrophs:** secrete adrenocorticotrophic hormone (ACTH)



Basophils

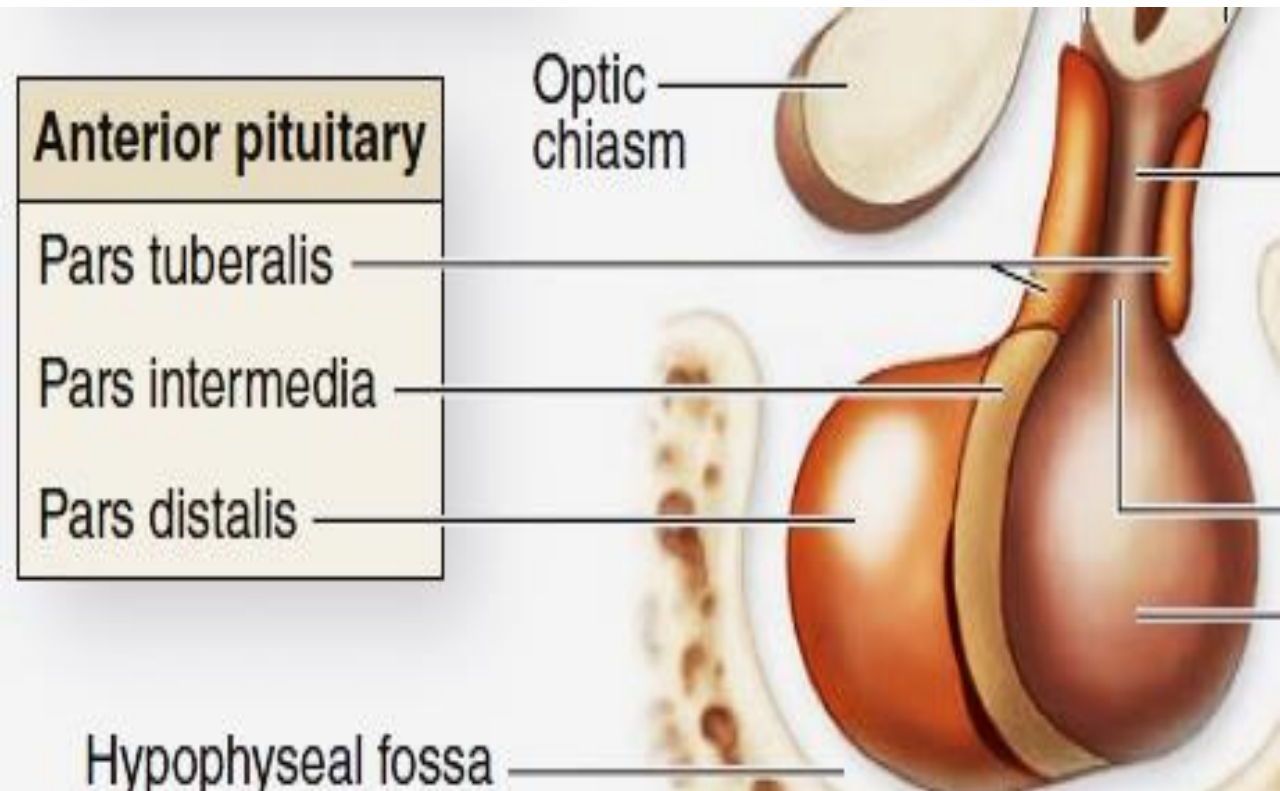
	Thyrotrophs	Corticotrophs	Gonadotrophs
<u>Number:</u>	5%	15 - 20%	10%
<u>Size:</u>	Large	Medium-sized	Small
<u>Functions:</u>	TSH: stimulate thyroid follicles	1. ACTH: adrenal cortex	1. FSH LH (female)
<u>Control:</u>	TRH	CRH	GnRH

PARS TUBERALIS

- ▶ **Highly vascular**
- ▶ **Longitudinal cords**

Cells:

- **Cuboidal basophilic undifferentiated**
- **Acidophils & basophils (gonadotrophs)**



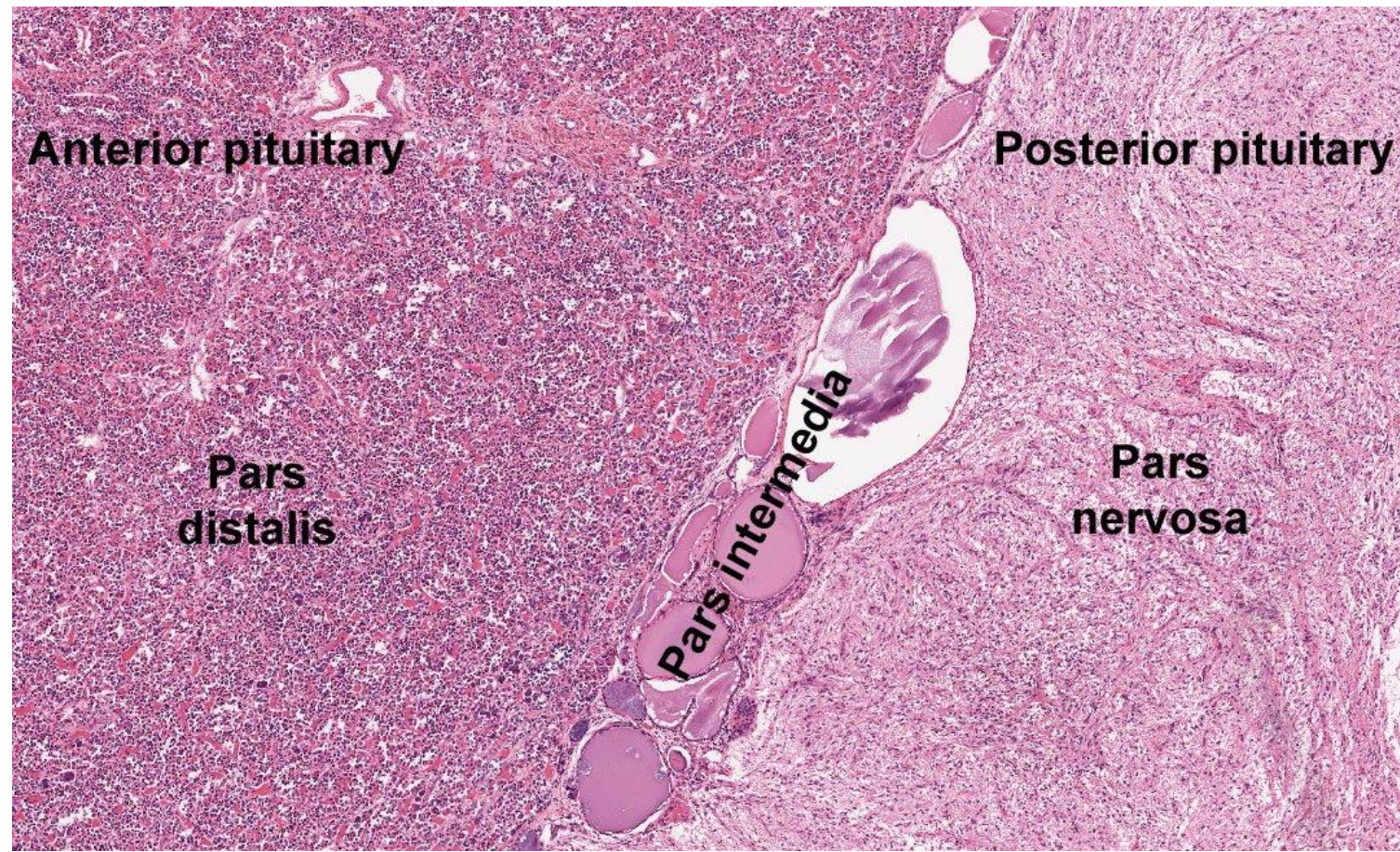
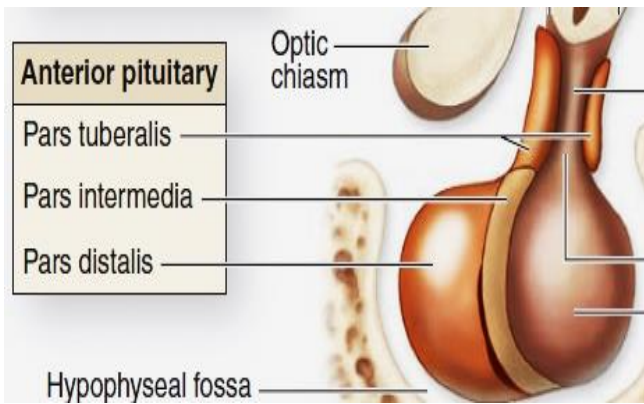
PARS INTERMEDIA

▶ **Poorly vascularized**

▶ **Rathke's cysts**

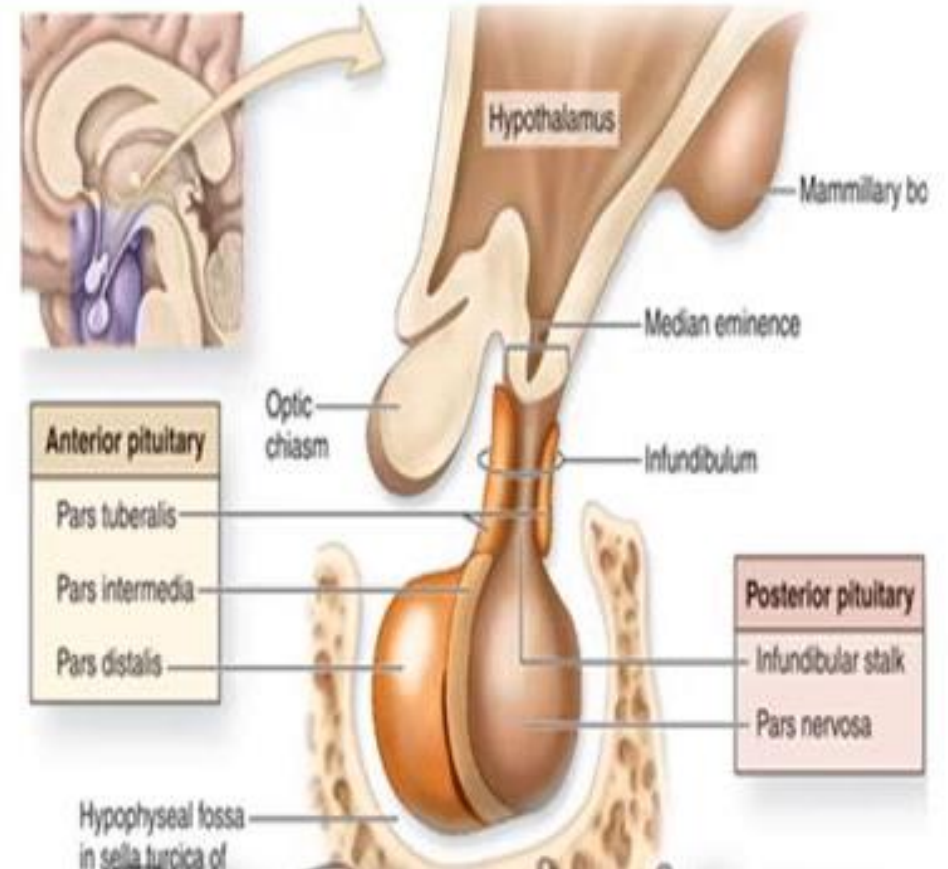
Cells:

- **Corticotrophs (MSH)**



II- Posterior lobe (neurohypophysis)

- It lies posterior to the hypophyseal cleft.
- It consists of 3 parts:
 - 1- The median eminence:** a funnel shaped downward extension of the hypothalamus.
 - 2- The infundibular stalk.**
 - 3- The pars nervosa:** which is connected to the base of the brain by the infundibular stalk and the median eminence



Pars Nervosa

- It consists of:

- 1- **Unmyelinated axons of neurosecretory cells:**

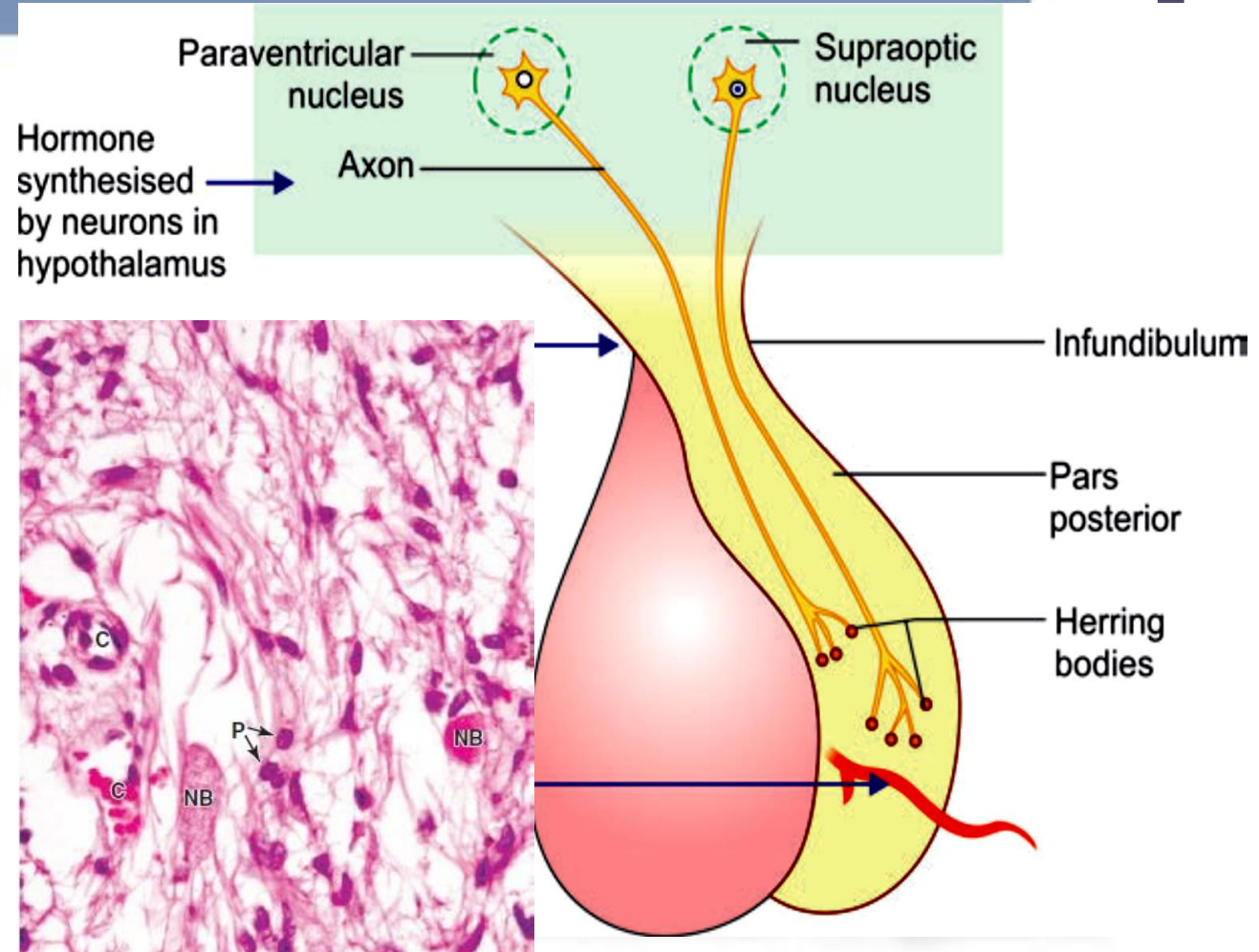
- Their cell bodies present in the supraoptic & paraventricular nuclei of the hypothalamus.
- Their axons form the *hypothalamo-hypophyseal tract* carrying the neurosecretion from the hypothalamic nuclei to the pars nervosa.

- 2- **Herring bodies:**

- acidophilic homogenous bodies.
- Represent accumulation of neurosecretory granules at the dilated terminal ends of axons.

- 3- **Pituicytes:** modified glial cells for support nutrition & isolation.

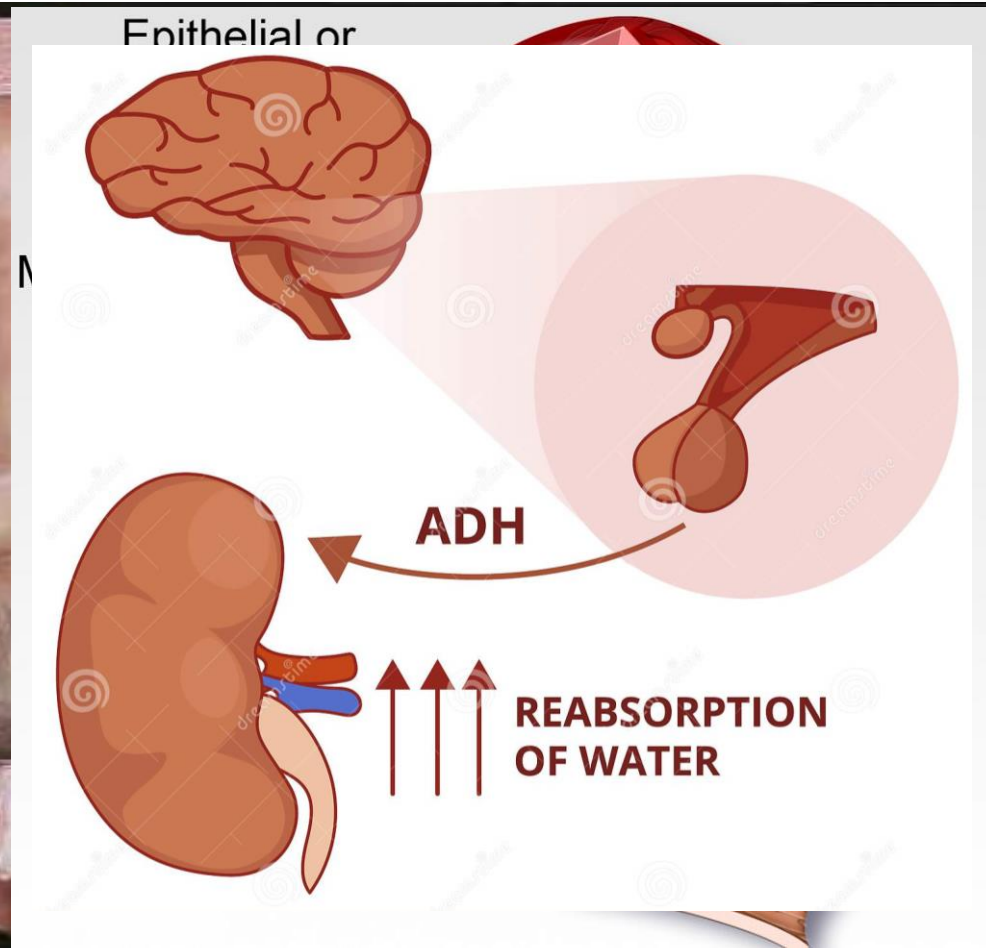
- 4- Rich fenestrated **blood capillaries.**

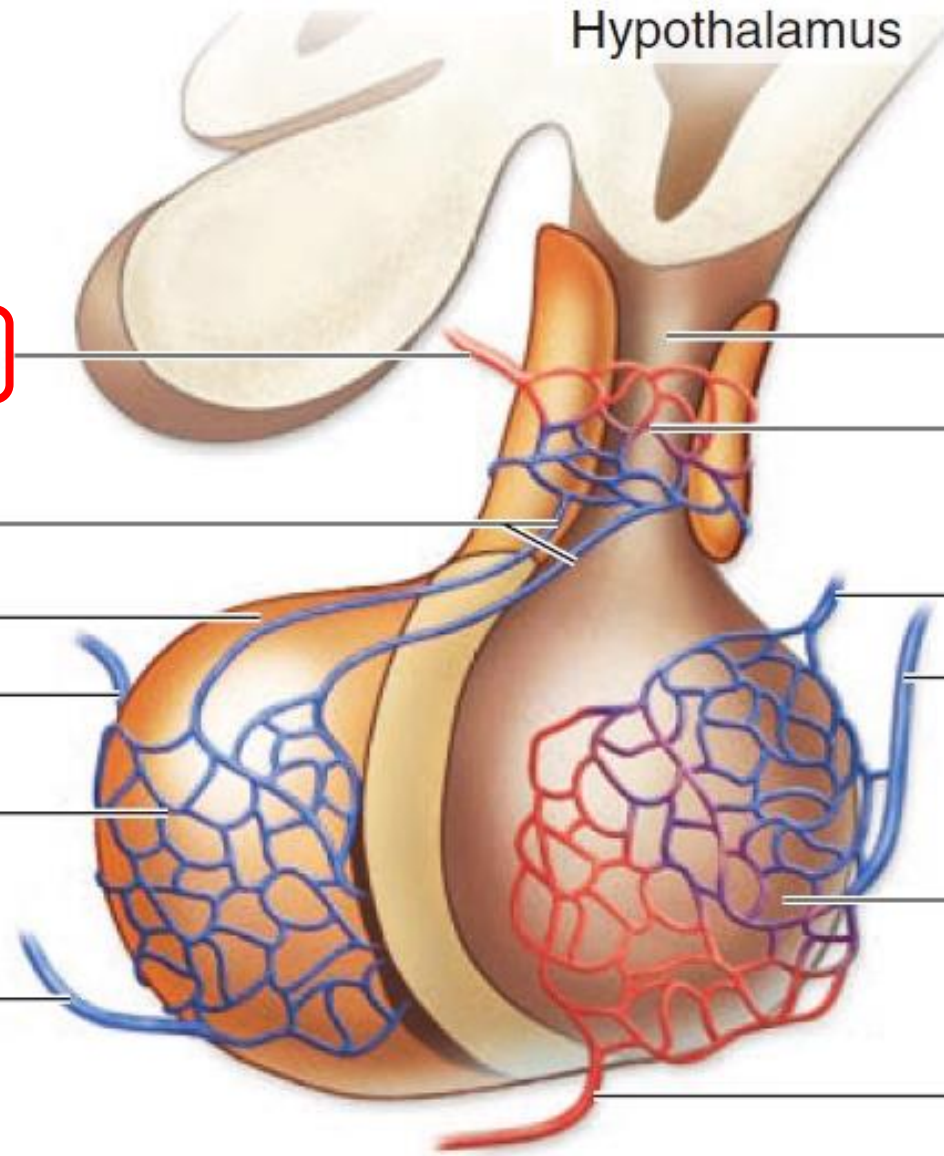


PARS NERVOSA

Functions:

- ▶ **Oxytocin (Paraventricular)**
 - **Uterus**
 - **Mammary gland**
- ▶ **Vasopressin or ADH (Supraoptic)**





Hypothalamus

Superior hypophyseal artery

Infundibulum

Hypophyseal portal veins

Primary plexus of the hypothalamic-hypophyseal portal system

Anterior pituitary

Hypophyseal veins

Hypophyseal vein

Secondary plexus of the hypothalamic-hypophyseal portal system

Posterior pituitary

Hypophyseal vein

Inferior hypophyseal artery



THYROID GLANDS **&** **PARATHYROID GLAND**

THYROID GLAND

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graph TD; A[THYROID GLAND] --> B[Stroma]; A --> C[Parenchyma]; B --> D[Capsule]; B --> E[Trabeculae]; B --> F[Reticular network]; C --> G[Follicles]; C --> H[Fenestrated capillaries];
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Stroma

Parenchyma

Capsule

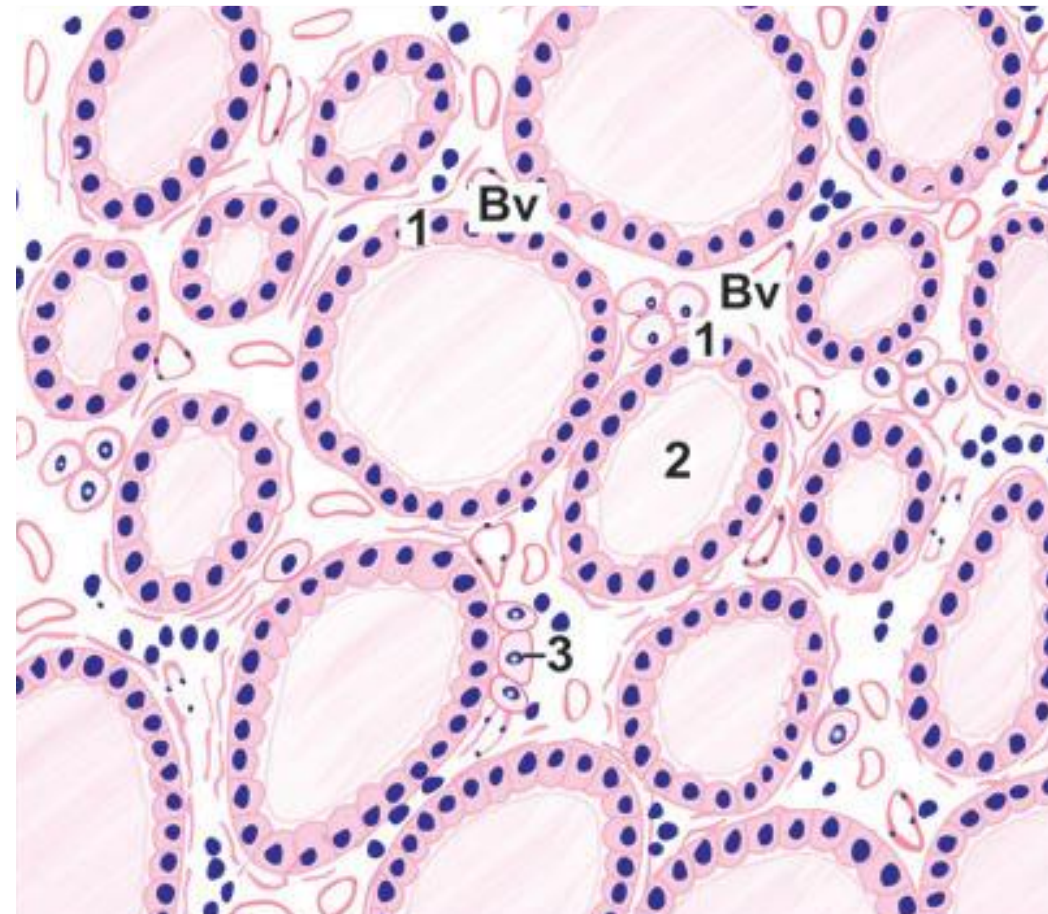
Trabeculae

**Reticular
network**

Follicles

**Fenestrated
capillaries**

Thyroid Follicles



Thyroid Follicles

- ▶ **Structural and functional unit**
- ▶ **Spherical Variable (0.2 - 1 mm)**

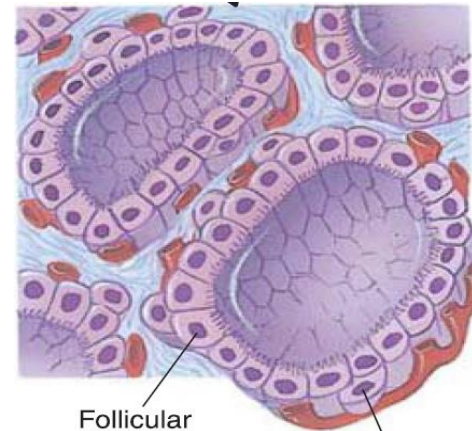
Lining cells:

- **Follicular** **Parafollicular**

Lumen: (colloid)

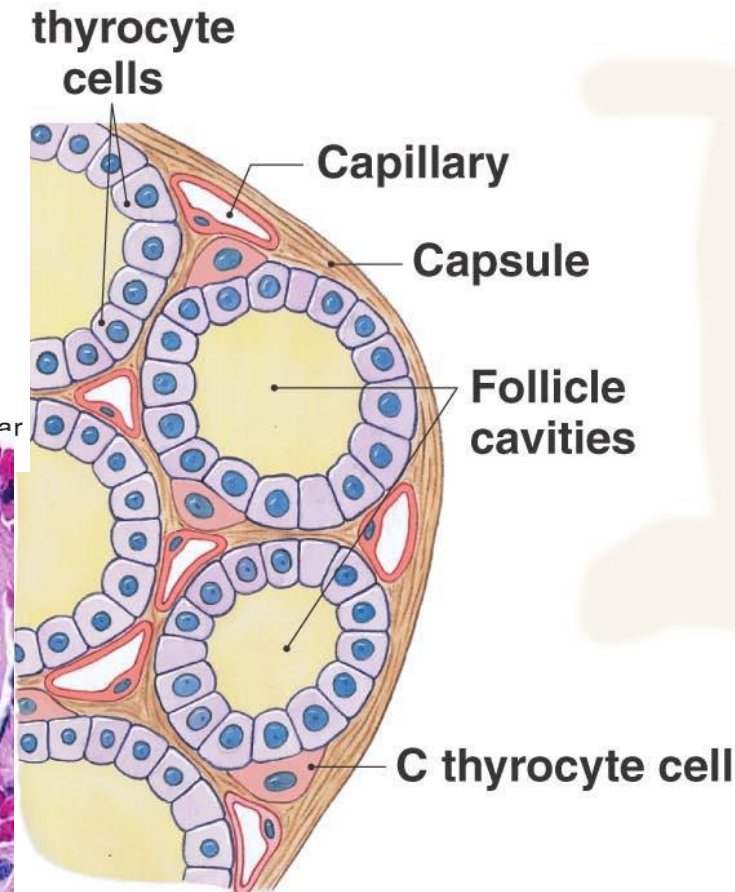
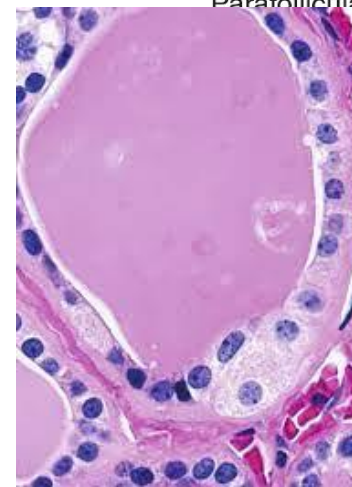
Iodinated thyroglobulin (T3 & T4)

- **H&E: homogenous acidophilic**
- **PAS: +ve (glycoprotein)**



Follicular cell

Parafollicular



Follicular cells

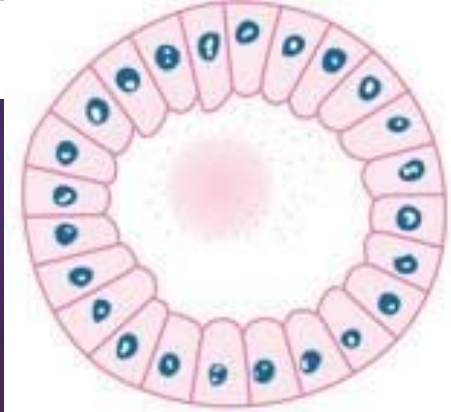
L/M

➤ **Shape:**

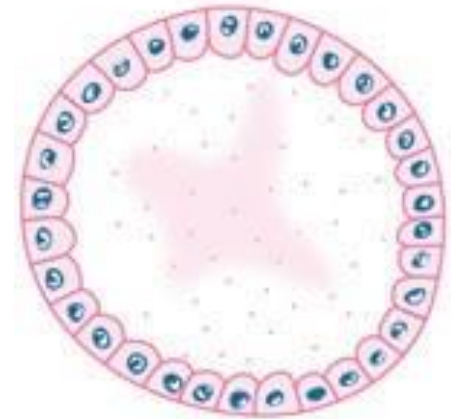
- **Cubical + moderate colloid (Normal)**
- **Columnar + little colloid (Hyperfunction)**
- **Squamous + full of colloid (Hypofunction)**

➤ **Nucleus: central, rounded**

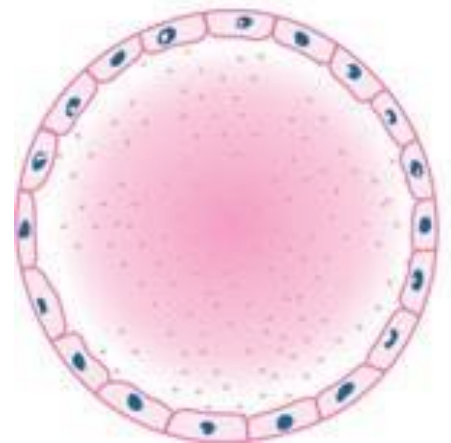
➤ **Cytoplasm: basophilic**



Highly active



Moderately active



Inactive

Follicular cells

E/M

➤ Organelles:

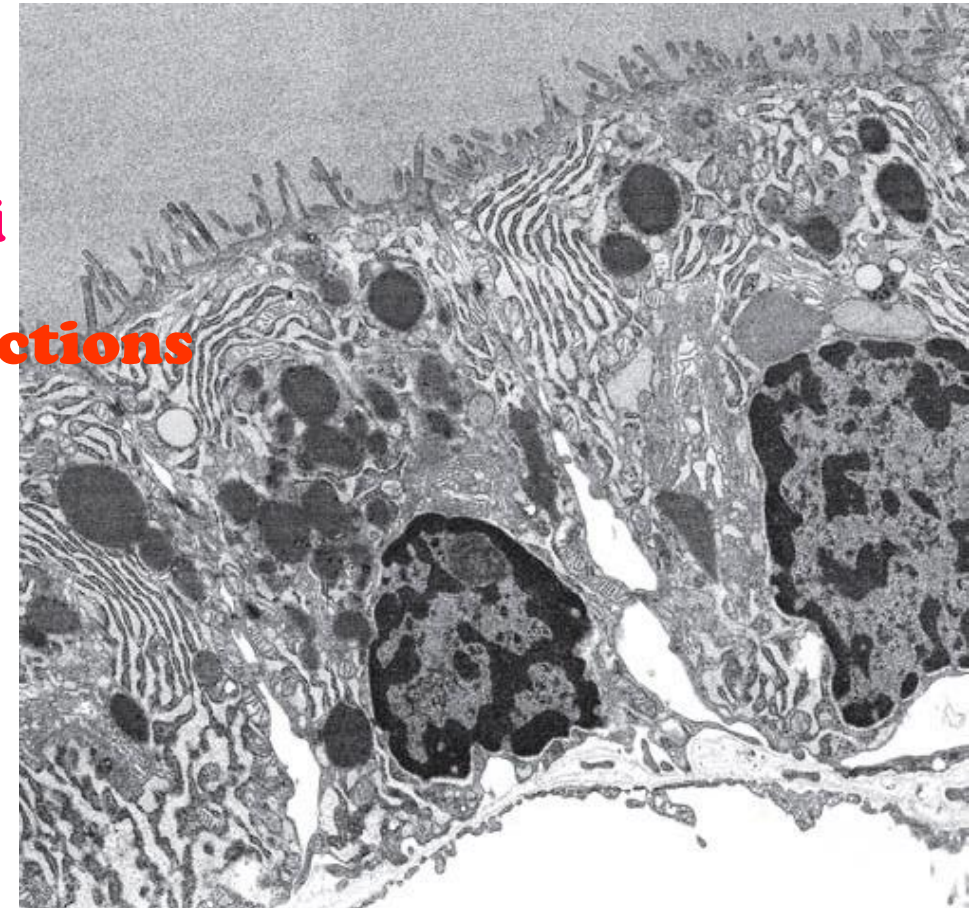
- **rER**
- **Supranuclear Golgi**
- **Mitochondria**
- **Peroxisomes**
- **Secretory vesicles**
- **Colloid droplets**
- **Lysosomes**

➤ Borders:

- **Apical microvilli**
- **Lateral tight junctions**

Functions

T3 & T4 production



Steps of synthesis of thyroid hormones

1- Synthesis of thyroglobulin (glycoprotein):

A- The protein part of the thyroglobulin are synthesized from the amino acids tyrosine by the *rough endoplasmic reticulum*.

B- *The Golgi apparatus* adds carbohydrate to the protein to form the thyroglobulin & packed into secretory vesicles.

C- *The secretory vesicles* are discharged into the lumen of the follicle by exocytosis where thyroglobulin contributes in the formation of the colloid.

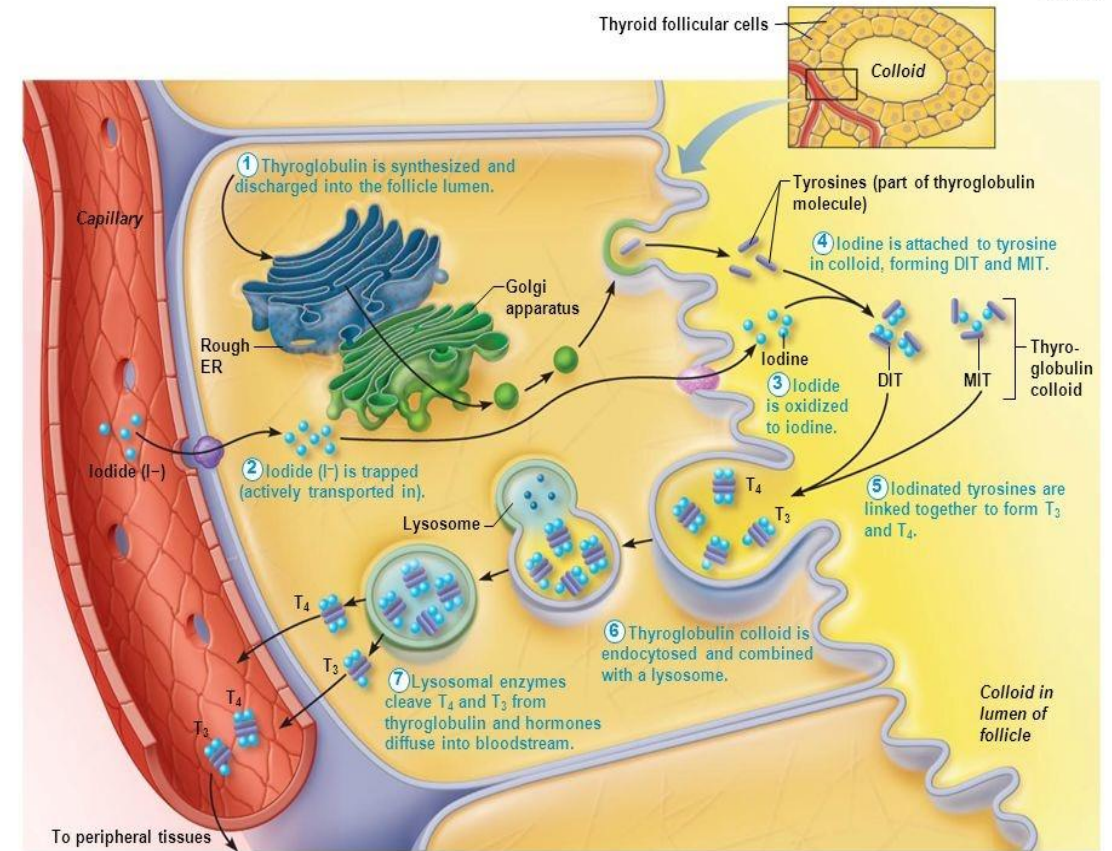
2- Uptake of iodide:

➤ The follicular cells trap the iodide from the capillaries → *oxidation into iodine* → released into the follicular lumen.

3- **Iodination of thyroglobulin:** takes place in the colloid to form *monoiodotyrosine & diiodotyrosine*.

Figure 16.10 Synthesis of thyroid hormone.

Slide 1



Steps of synthesis of thyroid hormones

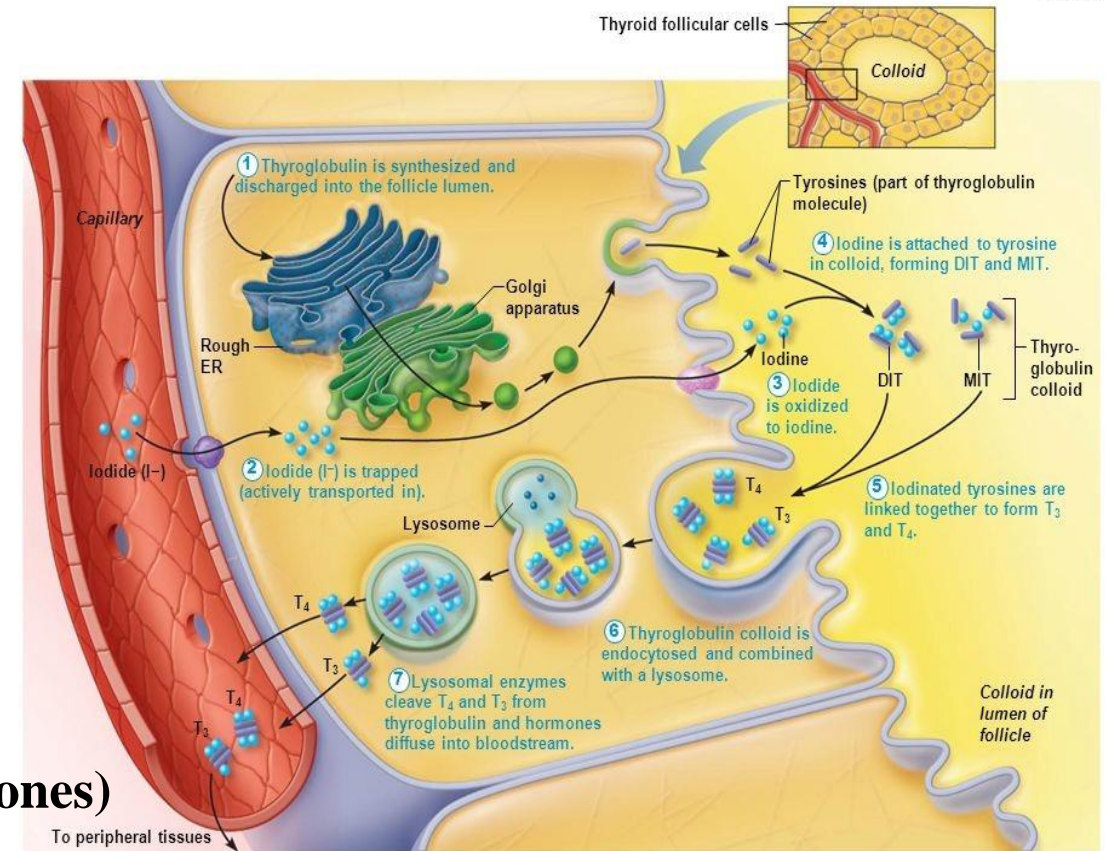
4- Formation of T3 & T4: by coupling reaction in the colloid, where they are stored in the lumen of the follicle.

5- Release of T3 & T4:

➤ In response to TSH → endocytosis of the colloid in endocytotic vesicles by the follicular cells → fusion of the vesicles with lysosomes → hydrolysis → release of T3&T4 → blood stream.

Figure 16.10 Synthesis of thyroid hormone.

Slide 1



T4 is more abundant (90% of circulating thyroid hormones) and less potent while T3 is less abundant and more potent.

Parafollicular cells

D.N.S.

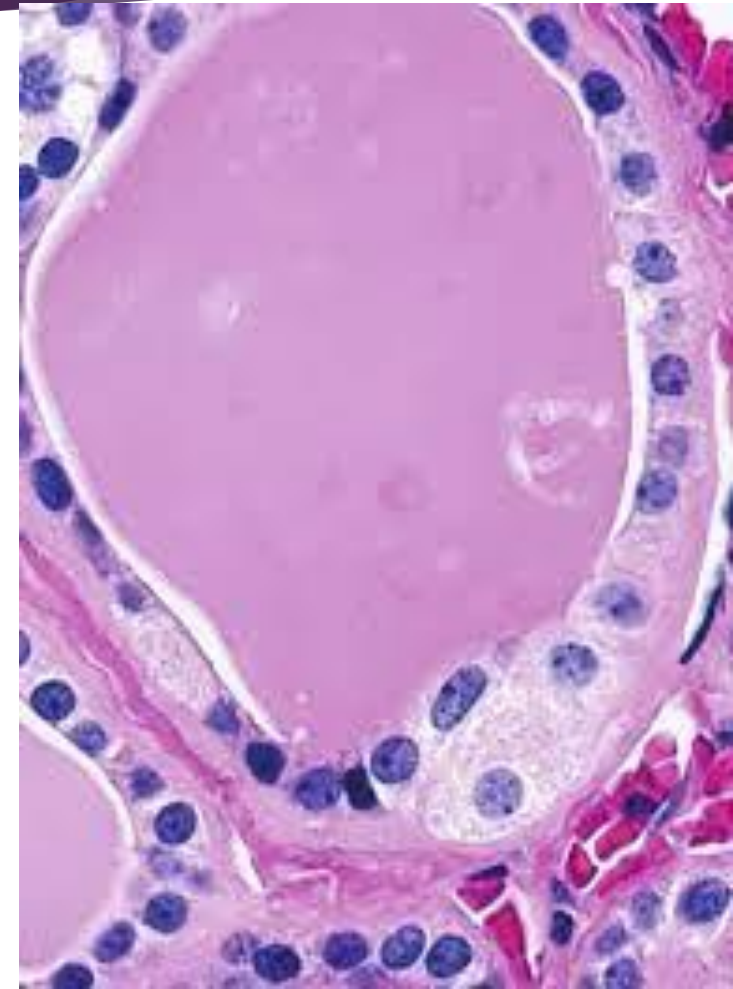
L/M:

- **Site: between follicular**
(not reaching lumen)
- **Size: larger**
- **Shape: polyhedral**
- **Nucleus: eccentric, oval**
- **Cytoplasm: pale, clear**

E/M:

- **Organelles:**
 - **Small rER**
 - **Large Golgi**
- **Granules:**
 - **Spherical electron dense**

Function: calcitonin



PARATHYROID GLANDS

PARATHYROID GLAND

Stroma

Parenchyma

Capsule

Trabeculae

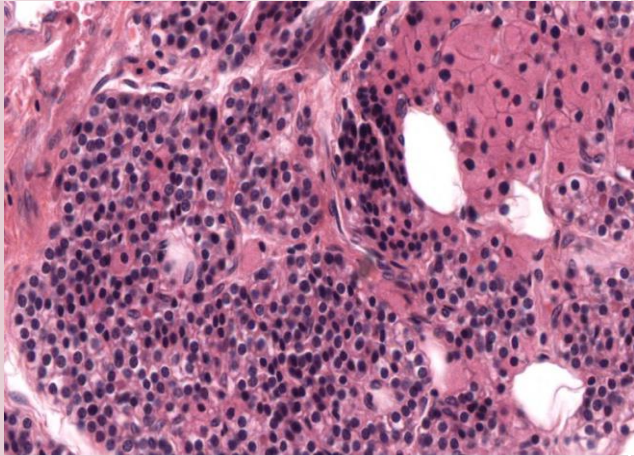
Reticular network

Cords of cells

Fenestrated capillaries

- **Thin**
- **Separating it from thyroid**

	Chief cells	Oxyphil cells
<u>L/M:</u>		
Number:	More numerous	Fewer (↑ with age)
Size:	Smaller	Larger
Shape:	Polygonal	More rounded
Nucleus:	Large, central, vesicular	Small, darkly stained
Cytoplasm:	Pale (glycogen & lipids)	Granular acidophilic
<u>E/M:</u>	<ol style="list-style-type: none"> 1. prominent Golgi, rich rER. 2. Variable sized electron dense granules. 	Mitochondria
<u>Function:</u>	Parathyroid hormone (PTH) secretion ↑ blood calcium level	May be degenerated chief cells.



Thank you
for your
kindness.

