

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

— IN THE NAME OF ALLAH —



# THE ENDOCRINE SYSTEM

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# The Suprarenal glands

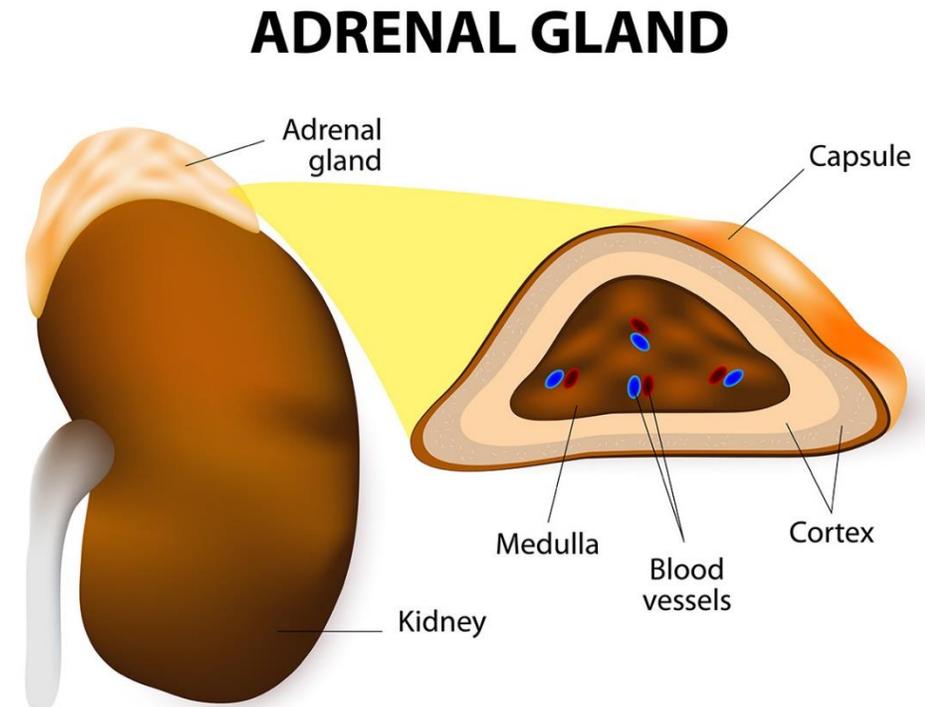
- They are paired glands, lying over the superior margin of the kidney.
- The gland consists of stroma and parenchyma.

## I. The Stroma:

1. Capsule
2. Trabeculae
3. Reticular fibres

## II. The parenchyma:

- Is divided into **cortex** and **medulla**.



# The Suprarenal cortex

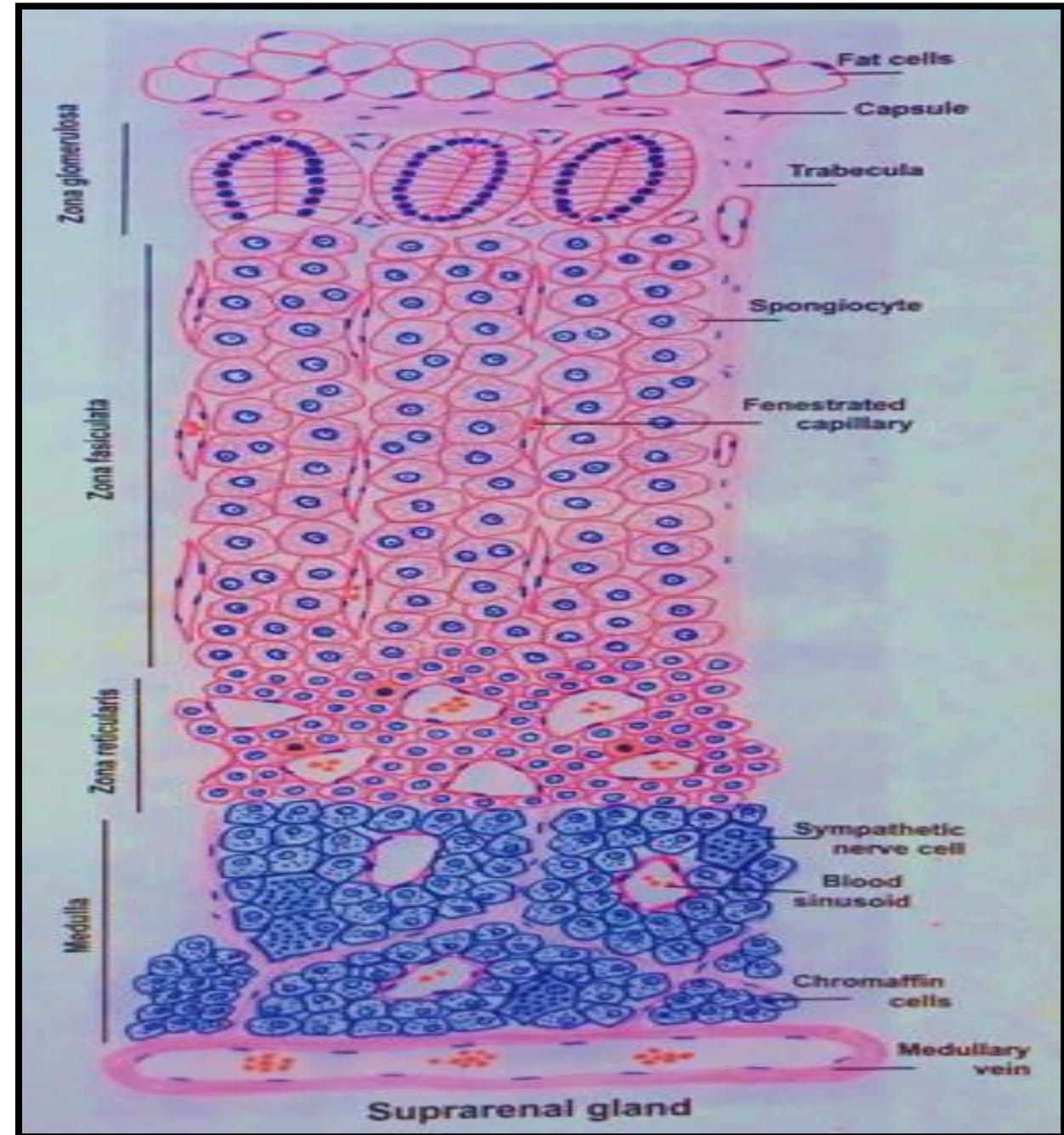
- It is thick and yellowish in colour due to high content of lipid.
- It is essential for life.

It is divided into three zones:

Zona glomerulosa

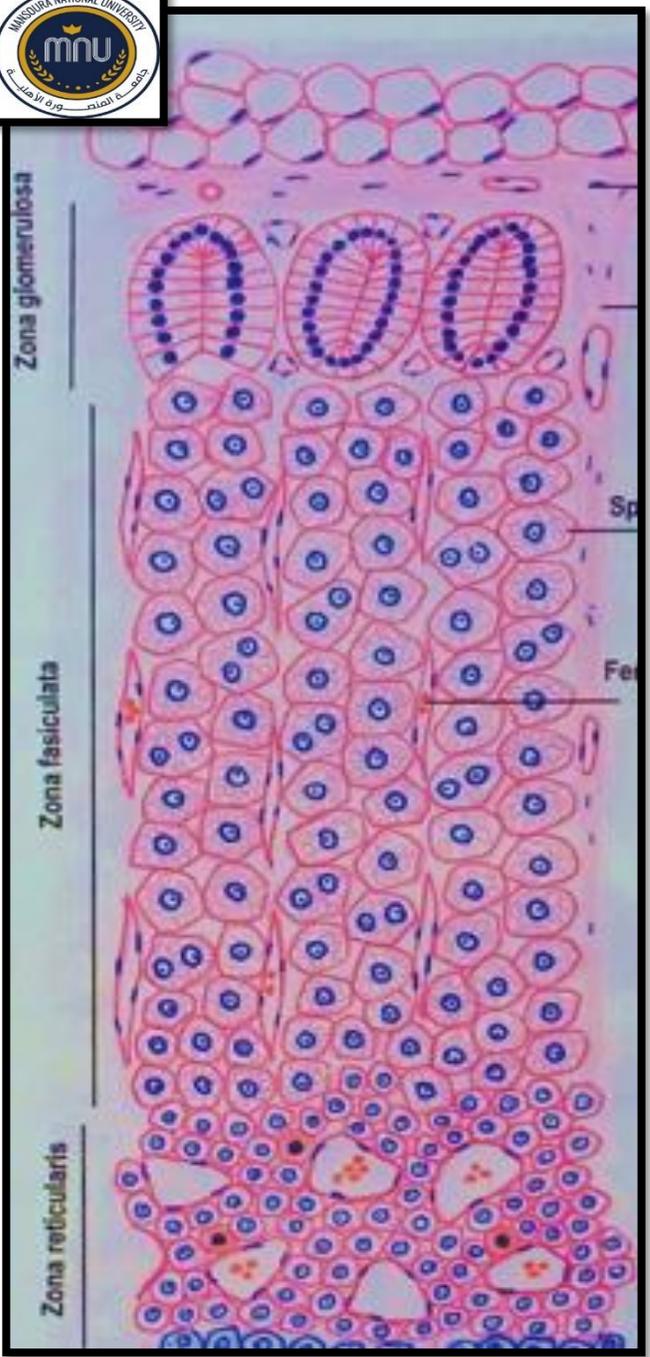
Zona Fasciculata

Zona reticularis





Zona glomerulosa	Zona Fasciculata	Zona reticularis
<p>It is a relatively narrow zone under the capsule. The cells are arranged into round and <b>oval groups</b> (glomeruli) <b>without a central cavity</b>.</p>	<ul style="list-style-type: none"><li>➤ It is the broadest zone, composed of straight <b>parallel cords</b> of cells coursing in a radial direction toward the medulla.</li><li>➤ The cords are usually <b>one or two cells in width</b>, and they are surrounded by a longitudinally oriented network of fenestrated sinusoidal capillaries.</li></ul>	<ul style="list-style-type: none"><li>➤ It is a relatively thin zone as zona glomerulosa.</li><li>➤ It is composed of branching and anastomosing <b>cords of cell</b> which are separated by fenestrated blood sinusoidal capillaries.</li></ul>



### Zona glomerulosa:

The cells are **columnar** and have spherical deeply stained nuclei and few lipid droplets.

A rich network of capillaries surrounds the glomeruli.

**Function:** The cells secrete **mineralo-corticoid (aldosterone)**

### Zona Fasciculata

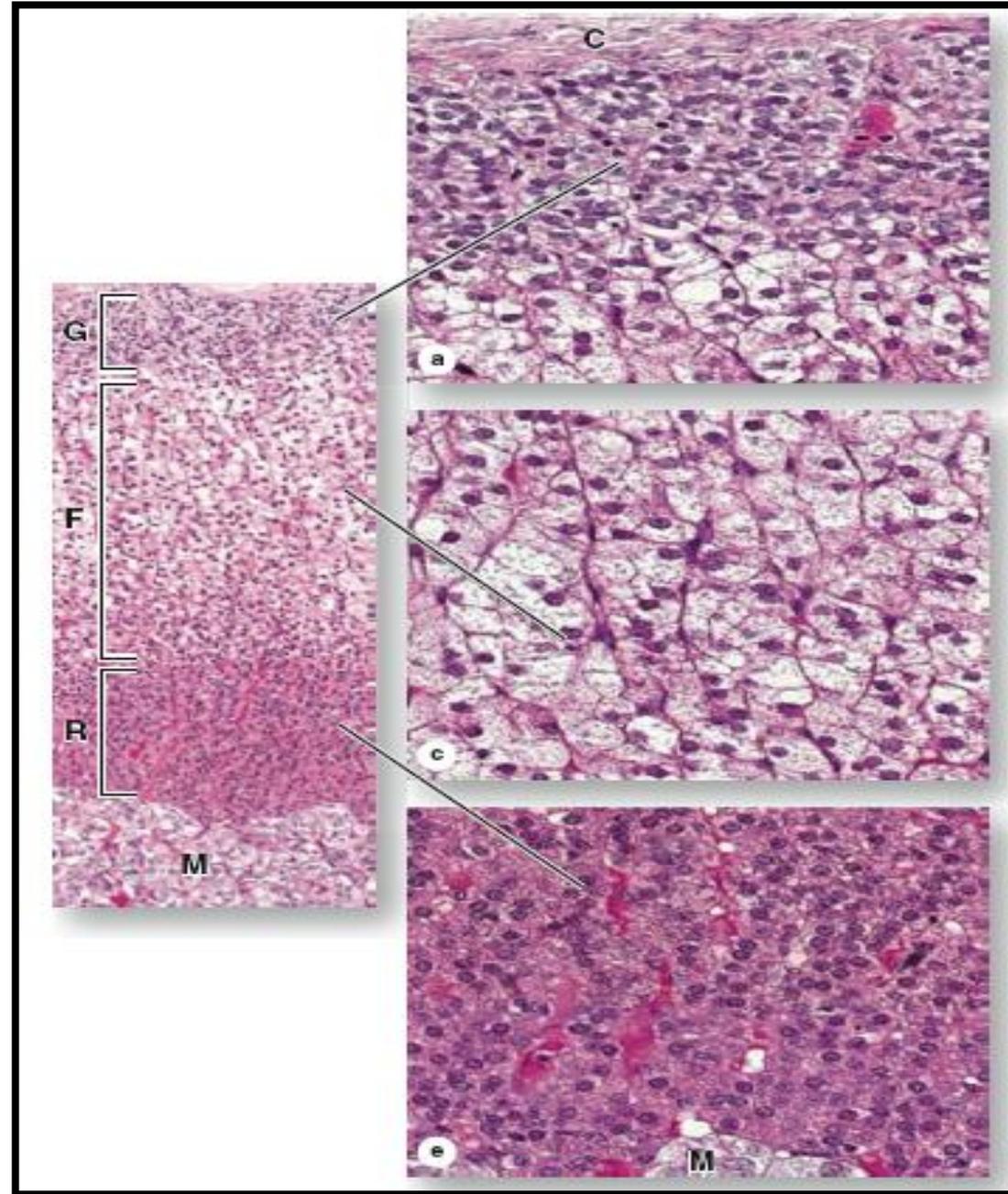
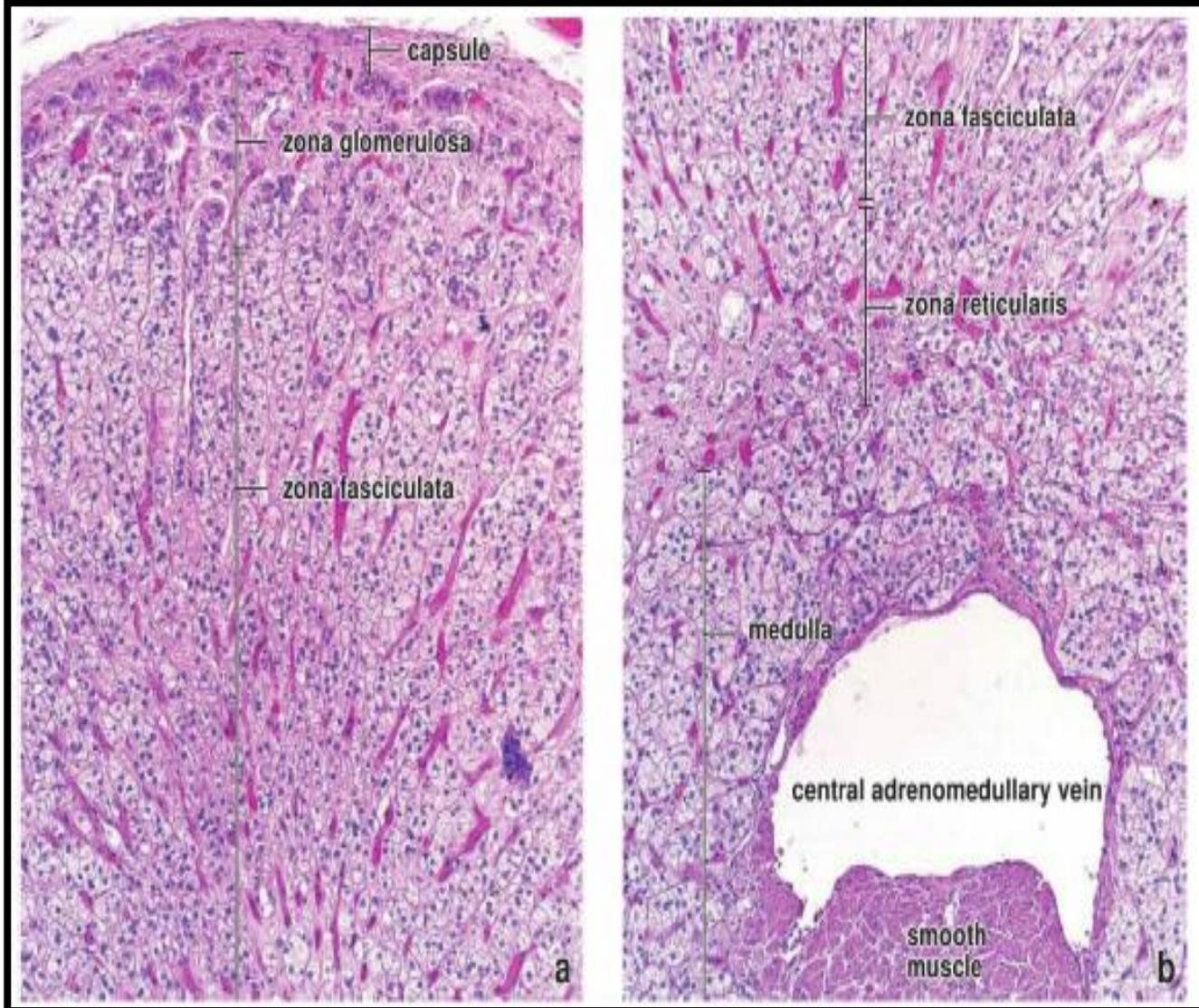
- The cells are **polyhedral**, with large vesicular nuclei, binucleated cells are frequently seen.
- Their cytoplasm is vacuolated (due to dissolved lipid droplets) and has a spongy appearance; therefore the cells are called **spongiocytes**.

**Function:** The cells secrete **gluco-corticoids (Cortisol and hydro-cortisone)**.

### Zona reticularis

- The cells are small, **polyhedral** with few lipid droplets.
- Some cells are darker (**dark cells**) as they contain lipofuscin pigment. They are present toward the inner part of zona reticularis.

**Function:** The cells secrete **sex hormones** and small amounts of **gluco-corticoids**.



# The Suprarenal Medulla

- In the fresh state, it has a pink colour.
- It is not essential for life.

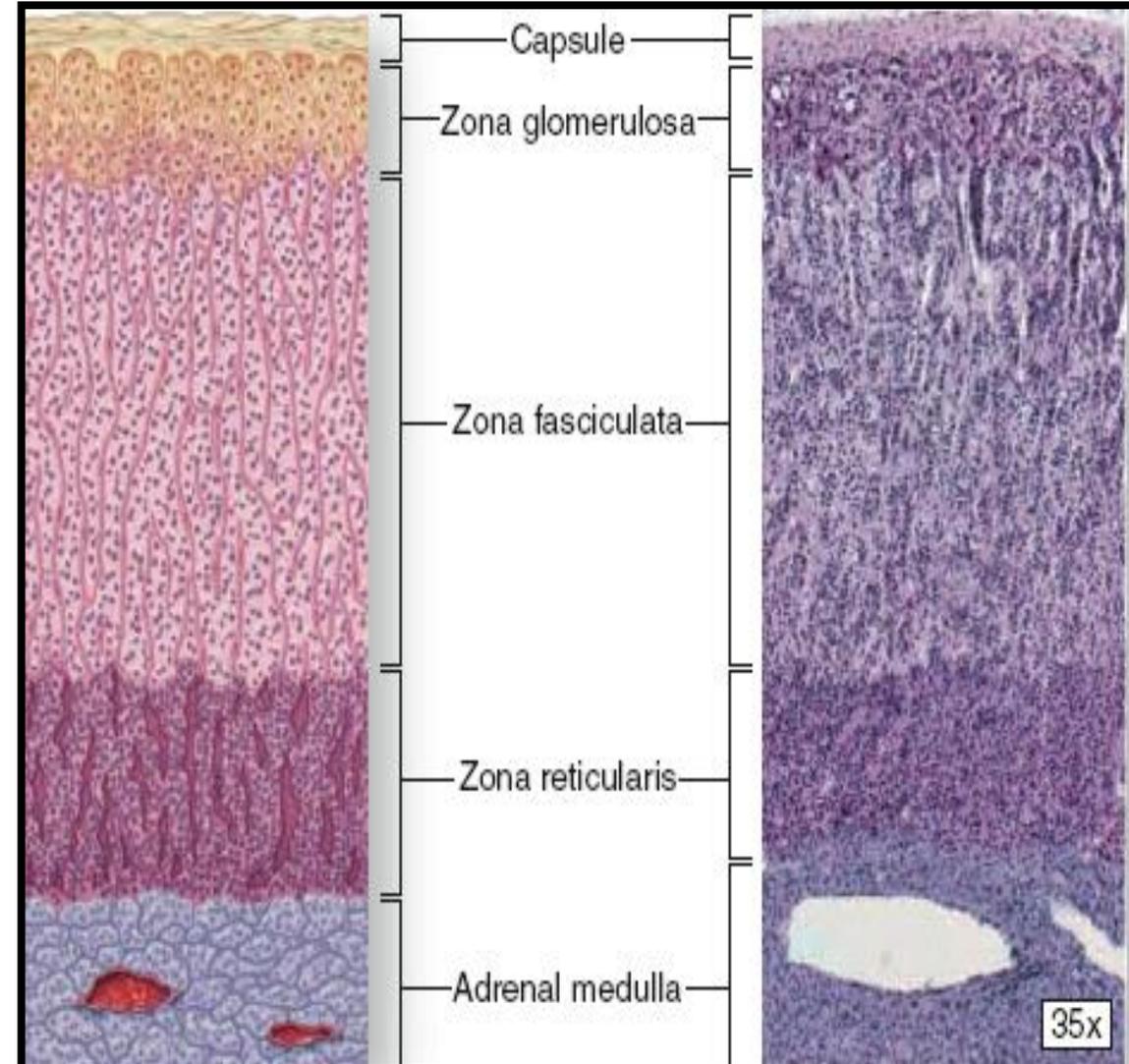
## Structure:

It consists of a stroma and parenchyma.

**I. The stroma:** is a highly vascular connective tissue.

**II. The parenchyma:** is formed of:

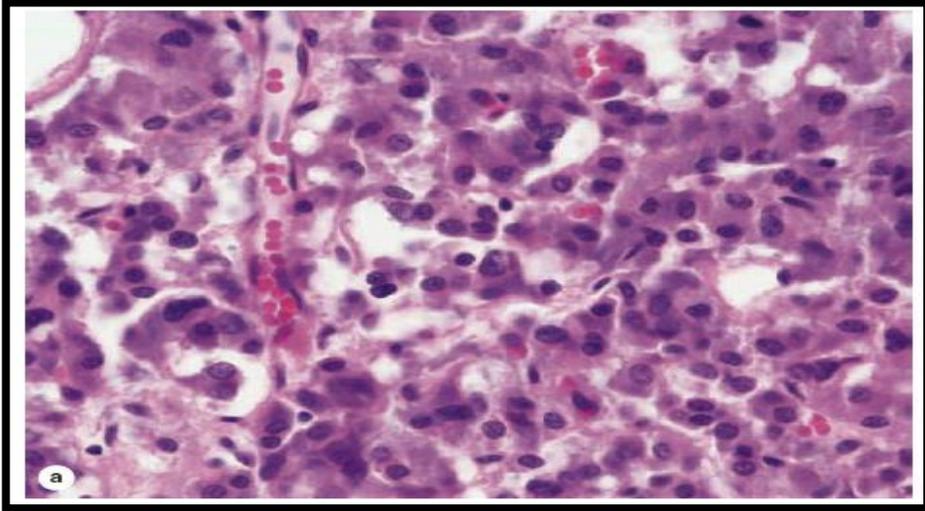
1. Chromaffin cells.
2. Few scattered ganglion cells.
3. sinusoidal capillaries.



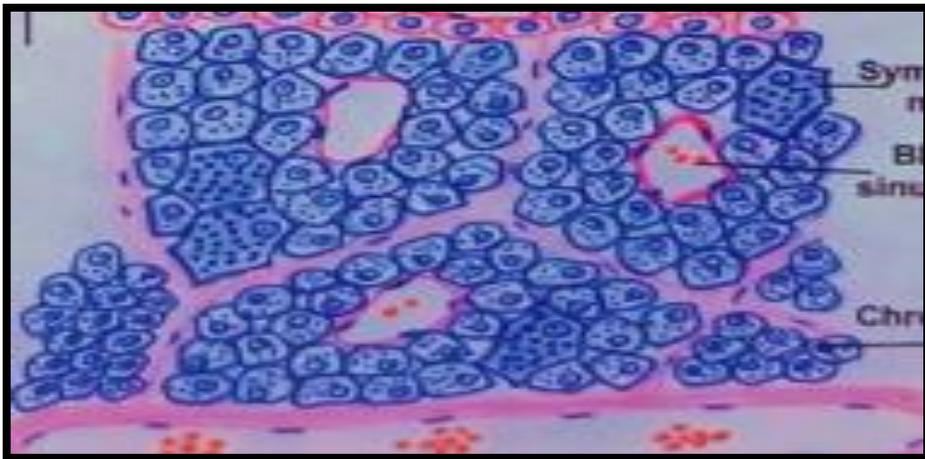


## Chromaffin cells

They are the secretory cells in the medulla.



They are arranged in groups around the blood vessels or in anastomosing cords.



The cells are large, pale-staining polyhedral cells, with eccentric nucleus.

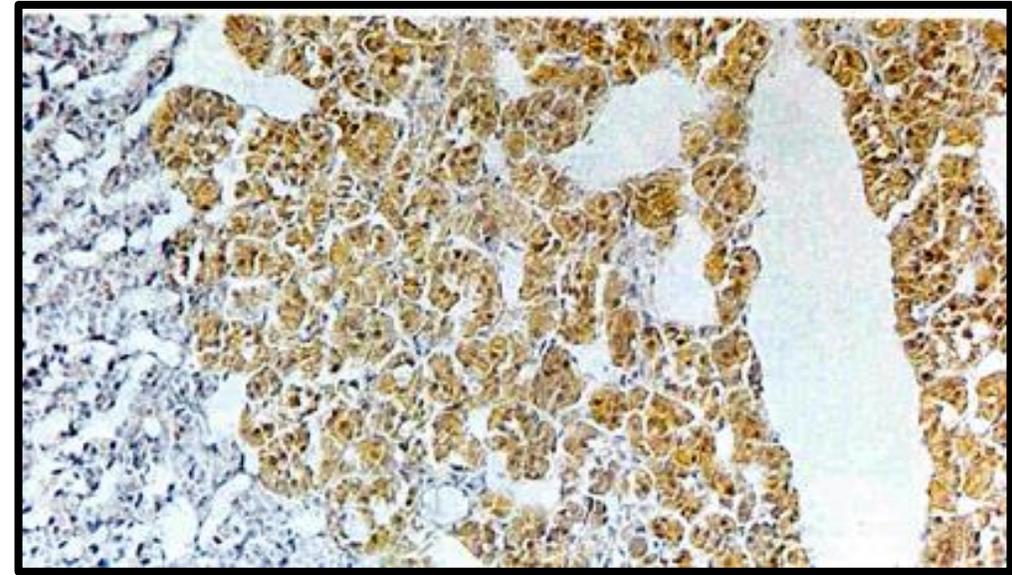
The cytoplasm is basophilic containing fine granules of adrenaline and nor-adrenaline.



## Identification of the medulla from the cortex:

### Chromaffin reaction:

Fresh specimens of the suprarenal gland + potassium dichromate → the cells of the medulla revealed brown granules. (Positive chromaffin reaction).



### Function of chromaffin cells:

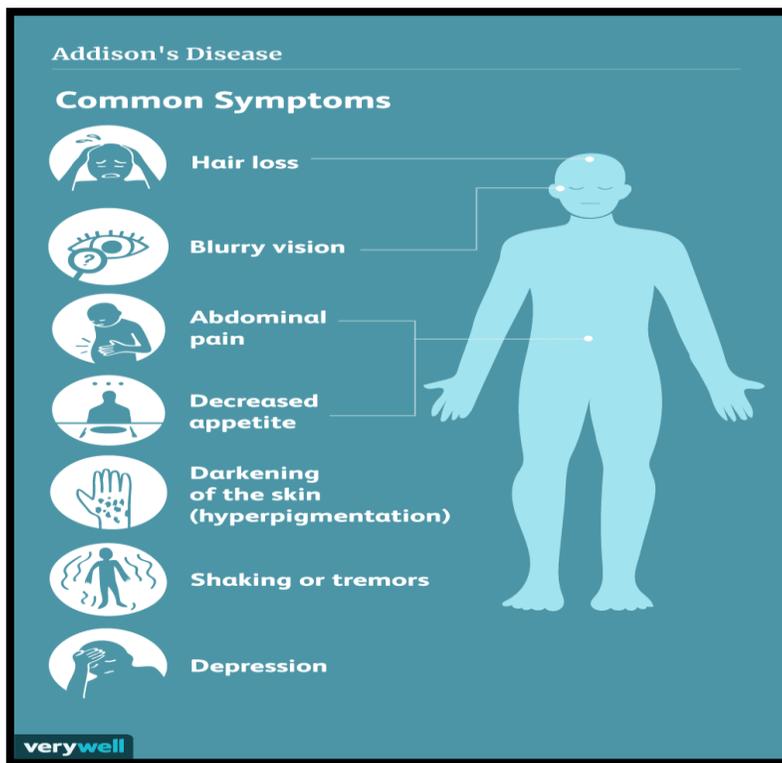
Under stress conditions they secrete **adrenaline and noradrenaline** directly into the blood causing a rapid generalized sympathetic effect to meet emergency situations.



- Destruction of the suprarenal cortex → Addison's disease.
- Hyperfunction of the suprarenal gland → Cushing syndrome (↑ glucocorticoids).
- → Conn syndrome (↑ aldosterone)
- Tumours of the suprarenal medulla are called pheochromocytoma.

### Addison's Disease

#### Common Symptoms

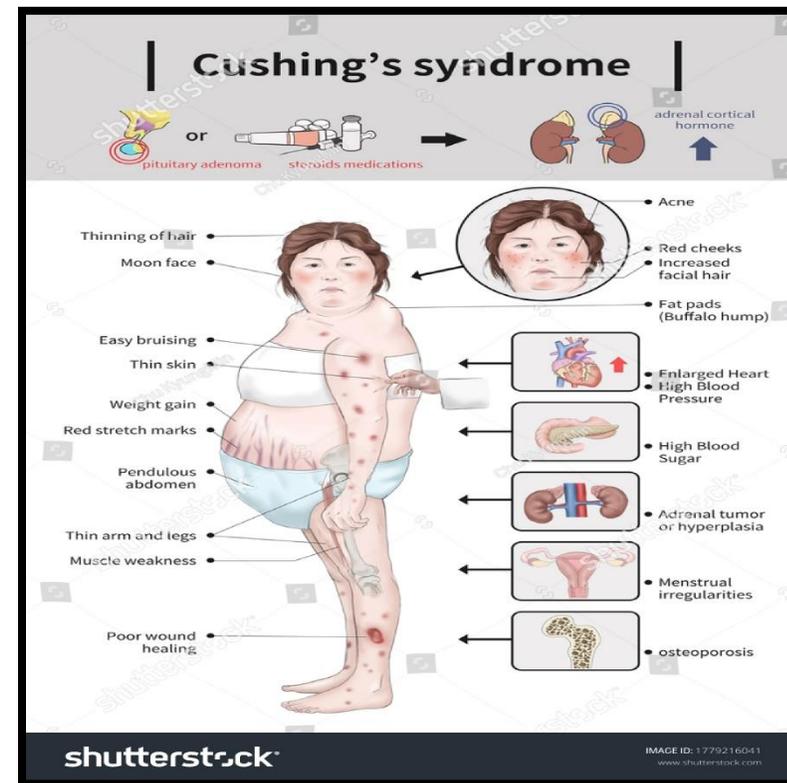


The infographic features a central blue silhouette of a human figure. To the left, eight circular icons represent different symptoms, each with a line pointing to the corresponding area on the silhouette. The symptoms listed are: Hair loss (pointing to the head), Blurry vision (pointing to the eyes), Abdominal pain (pointing to the stomach area), Decreased appetite (pointing to the chest area), Darkening of the skin (hyperpigmentation) (pointing to the hands and feet), Shaking or tremors (pointing to the lower body), and Depression (pointing to the head).

- Hair loss
- Blurry vision
- Abdominal pain
- Decreased appetite
- Darkening of the skin (hyperpigmentation)
- Shaking or tremors
- Depression

verywell

### Cushing's syndrome



The infographic shows a central illustration of a woman with various physical symptoms of Cushing's syndrome. To the left, labels point to these symptoms: Thinning of hair, Moon face, Easy bruising, Thin skin, Weight gain, Red stretch marks, Pendulous abdomen, Thin arm and legs, Muscle weakness, and Poor wound healing. To the right, labels point to internal health issues: Acne, Red cheeks, Increased facial hair, Fat pads (Buffalo hump), Enlarged Heart, High Blood Pressure, High Blood Sugar, Adrenal tumor or hyperplasia, Menstrual irregularities, and osteoporosis. At the top, a diagram shows the causes: pituitary adenoma (with a brain icon), or steroids medications (with a syringe icon), leading to adrenal cortical hormone (with kidney icons and an upward arrow).

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# The Pancreas

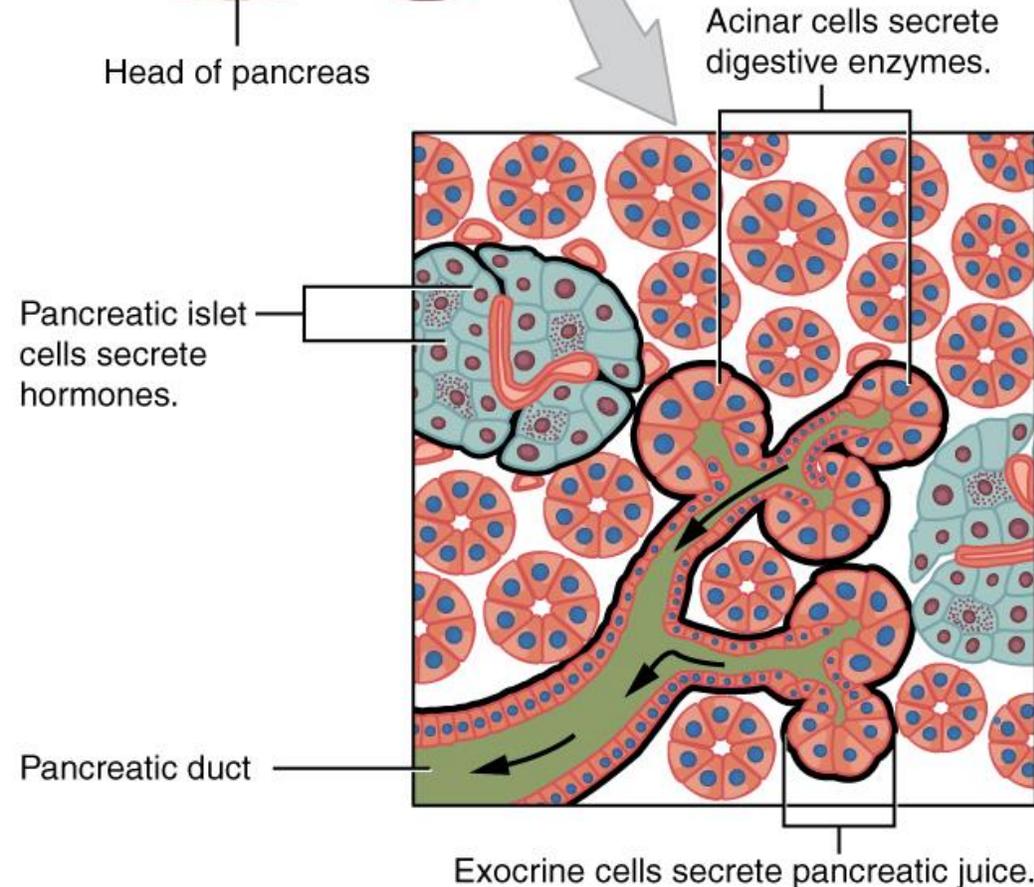
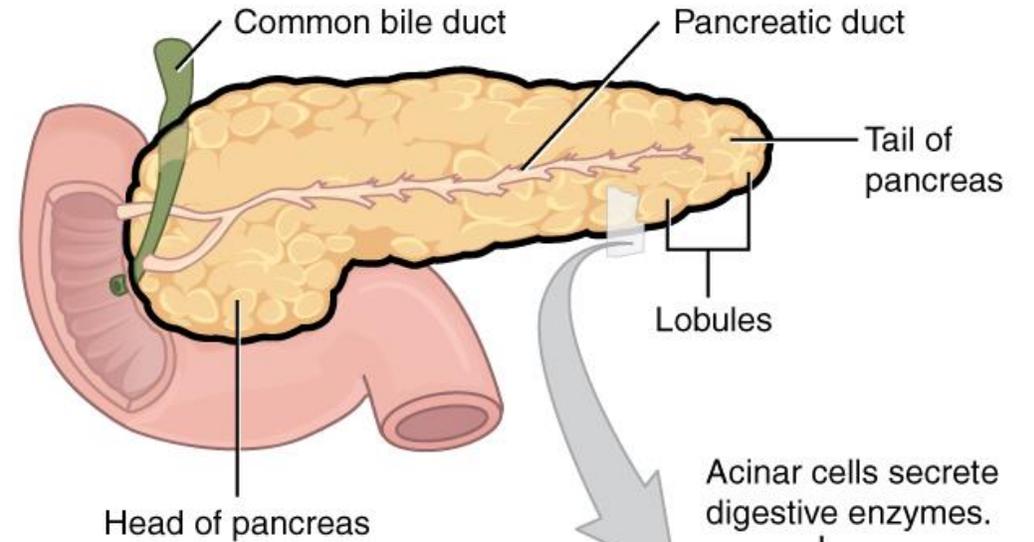
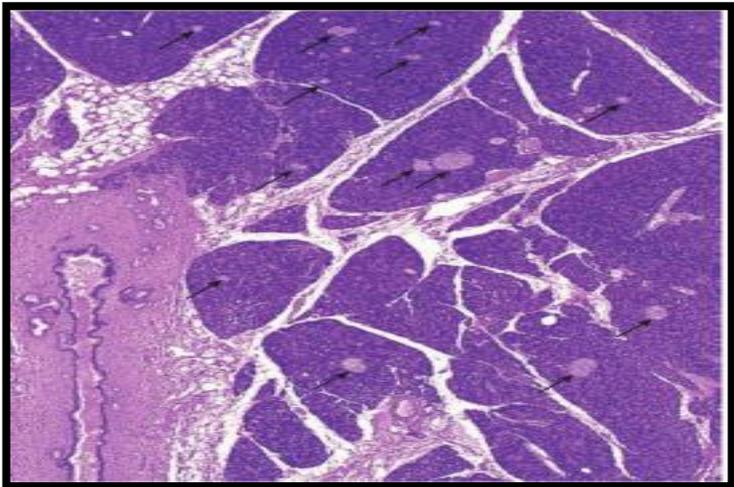
**General structure:**

- It performs both exocrine and endocrine functions. The two functions are performed by two separate parenchyma.

## Exocrine Pancreas

is formed of two parts:

1. Pancreatic acini.
2. Duct system





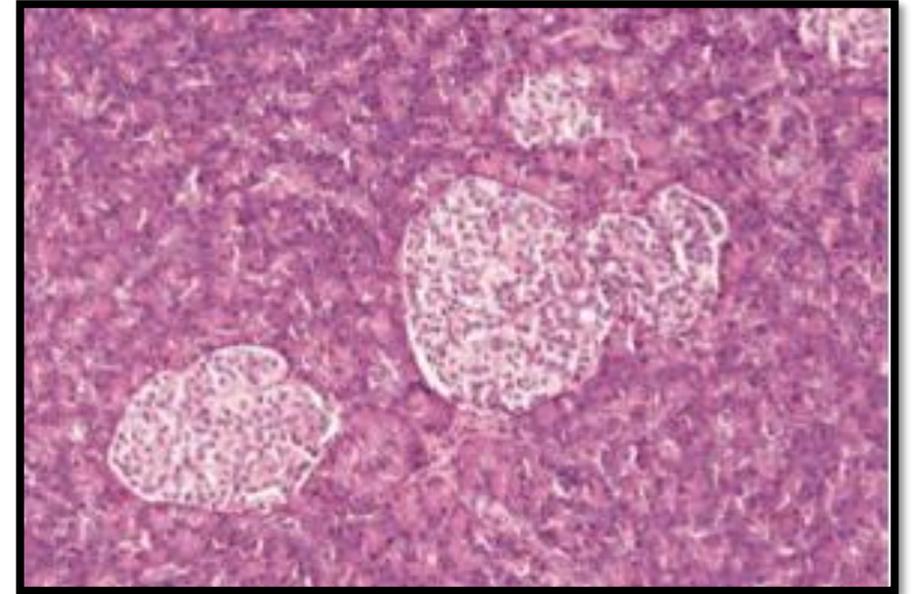
## Islets of langerhans

**Definition:** non capsulated masses of endocrine cells scattered in the pancreatic lobules especially at the tail region.

**Number:** about  $\frac{1}{4}$  -  $\frac{3}{4}$  million (in human).

**Structure:**

1. They are formed of anastomosing cords of epithelial cells separated by fenestrated blood capillaries.
2. They are separated from the exocrine acini by a layer of reticular connective tissue.
3. In H. & E. stained sections they appear as lighter non capsulated areas surrounded by darker acini. The endocrine cells can not be differentiated from each other.





4. Differentiation of the islet cells depends on:

- a. Special stains.
- b. E/M features.
- c. Immunohistochemical techniques.

5. The endocrine cells forming the islets of Langerhans are:

**A ( $\alpha$ ) cells:**  
secrete **glucagon**

**B ( $\beta$ ) cells:**  
secrete **insulin**

**D ( $\delta$ ) cells:**  
secrete **somatostatin**

**F (pp) cells:**  
secrete **pancreatic polypeptide**

6. **Ganglion cells (sympathetic neurons)** scatter between the endocrine cells to regulate their functions.

A ( $\alpha$ ) cells	B ( $\beta$ ) cells	D ( $\delta$ ) cells	F or (PP) cells
Nearly <b>oval</b> in shape.	Nearly <b>oval</b> in shape.	<b>Oval</b> in shape. Variable in size and granular content.	Small <b>oval</b> cells
Present at the <b>periphery</b> of the islets.	Present mainly in the <b>center</b> of the islets.	Scattered between $\alpha$ cells in the <b>periphery</b> of the islets	
Represent about <b>20%</b> of cells.	Represent about <b>60-75%</b> of cells.	Represent about <b>2%</b> of cells.	represent about <b>2%</b>
Can be stained by immunohistochemical technique using a primary antibody against <b>glucagon</b> hormone.	Can be stained by immunohistochemical technique using a primary antibody against <b>insulin</b> hormone.	<div data-bbox="1403 586 2252 1005" data-label="Image"> <p>The diagram illustrates an Islet of Langerhans, a cluster of endocrine cells in the pancreas. It shows a central capillary surrounded by various cell types: Delta cells (green) at the periphery, Alpha cells (purple) scattered throughout, Beta cells (yellow) in the center, and F cells (pink) also present. Labels with arrows point to each cell type and the capillary.</p> </div>	
<p><b><u>Function:</u></b></p> <p>Secretion of <b>glucagon</b> which elevates the glucose level in blood.</p>	<p><b><u>Function:</u></b></p> <p>Secretion of <b>insulin</b> which lowers the glucose level in blood</p>		<p><b><u>Function:</u></b></p> <p>Secretion of <b>somatostatin</b> which suppresses the function of both A and B cells and also inhibits the release of growth hormone.</p>



MCQ

**1. Chromaffin reaction stains cells of suprarenal medulla**

- a. Blue
- b. Brown
- c. Magenta
- d. Black
- e. Turquoise blue

b

**2. B cells of pancreas can be stained immunohistochemical using a primary antibody against**

- a. Insulin
- b. Glucagon
- c. Pancreatic polypeptide
- d. Somatostatin
- e. Digestive enzymes

a



## References

- Student medical histology book, Mansoura university.
- Junqueira's Basic Histology: Text and Atlas, Fourteenth Edition. 14<sup>th</sup> edn. New York, USA: McGraw-Hill Education.
- **Pawlina, W. and Ross, M.H. (2019).** Histology: A Text and Atlas, International Edition: With Correlated Cell and Molecular Biology. 8<sup>th</sup> edn.



*Thank  
you*