



## ADRENAL CORTEX

	Zona glomerulosa	Zona fasciculata	Zona reticularis
general features	<b>outer</b> most narrow <b>beneath</b> the capsule <b>13%</b> of the cortical volume.	<b>middle thick</b> <b>80%</b> of the cortical volume.	<b>Inner</b> <b>7%</b> of the cortical volume.
L/M:	1. cells are <b>columnar</b> or <b>pyramidal</b> arranged in closely packed, <b>rounded</b> or <b>arched</b> clusters surrounded by <b>blood capillaries</b> <u>nuclei : rounded</u> <u>cytoplasm : acidophilic</u> Containing some lipid droplets 2. cells have the typical ultrastructure of <b>steroid secreting cells</b> .	1. The cells are <b>large</b> and <b>polyhedral</b> in shape <b>arranged</b> in <b>long straight cords</b> . <u>nuclei : large lightly staining spherical nuclei.</u> <u>cytoplasm : acidophilic</u> Containing numerous lipid droplets <b>dissolve</b> during histological preparation, SO appears <b>pale, foamy</b> and <b>acuolated</b> . So these cells are called <b>spongiocytes</b>	Its cells are <b>small</b> in size and <b>polyhedral</b> in shape arranged in <b>irregular cords</b> that form a <b>network around blood capillaries</b> . <u>cytoplasm is deeply acidophilic</u> , and contains <b>large amount of lipofuscin pigments and few fat droplets</b> .
EM:	The cells have <b>abundant SER</b> . <u>-Golgi complexes</u> <u>Large mitochondria with tubular cristae</u> <u>-Free ribosomes and some rER.</u> -lipid droplets and lipofuscin pigments <u>-desmosomes</u> and small gap junctions join cells -Some cells have <b>short microvilli</b> . -The capillaries have <b>wide fenestration</b> .	Cells have all the <b>ultrastructural features of steroid secreting cells</b>	.....
Function	The cells secrete the <b>mineralocorticoid hormones</b> mainly <b>aldosterone</b> which <u>controls water and electrolyte balance in the body</u> .	1-These cells secrete mainly <b>glucocorticoid hormones (cortisol and corticosterone)</b> stimulated by <b>ACTH</b> 2-secrete also little amount of sex hormones mainly <b>androgens</b>	Synthesis & secretion of <b>androgens</b> and small amounts of <b>glucocorticoids</b> . Stimulated by <b>ACTH of pars distalis</b> .

# Adrenal Medulla

## General features

**cente** of the adrenal gland.

Its cells can be regarded as modified **sympathetic postganglionic neurons** that have **no** axons and **no** dendrites which innervated by **cholinergic sympathetic nerve fibers**.  
**preganglionic**

## LM

The cells are **large, polyhedral** in shape arranged in **clusters** or **short cords**, surrounded by a **rich network of capillaries** and **supported** by **reticular fibers**.

**Nuclei: large, pale-staining**

**cytoplasm: basophilic containing fine granules.**

## EM

The cytoplasm of chromaffin cells has a  
**1. well developed juxtannuclear Golgi complex.**

**2. some rER, numerous**

**3. mitochondria**

**4. abundance of electron dense granules.**

These granules contain either epinephrine (**adrenaline**) or norepinephrine (**noradrenaline**).

So there are two different cell types:

**One secretes epinephrine** *granules are small, less electron dense*

**other type secretes norepinephrine** *granules are large, more electron dense*

• Both types of granules contain also:

1. **Protein chromOgranins** serve as **binding proteins for catecholamine**
2. **Dopamine B-hydroxylase** **converts dopamine** **norepinephrine**
3. **Opiate-like peptides**
4. **ATP.**

# Its cells are called **chromaffin cells** (or **chromaffin positive**) because they develop an **intense brown color** when **exposed** to a **strong Oxidizing agent** (chromate salts e.g. **potassium dichromate**). This is called chromaffin reaction. This reaction is specific for cells containing **catecholamines**.

# In addition to chromaffin cells, there are **postganglionic sympathetic ganglion cells** which are **scattered** among the chromaffin cells.

Unlike the **cortex** which does **not store steroids**, cells of medulla accumulate and store their hormones in granules.

Epinephrine and norepinephrine are released to the blood in **large quantities** during **intense emotional** reactions, such as **fright**, and produce **vasoconstriction**, **increased blood pressure**, changes in **heart rate**, and elevated **blood glucose levels**.

The conversion of norepinephrine to epinephrine (adrenalin) occurs only in chromaffin cells of the adrenal medulla) About 80% of the catecholamine secreted from the adrenal is epinephrine.

## ISLETS OF LANGERHANS

	Islets of Langerhans
General features	<ul style="list-style-type: none"> <li># <b>endocrine</b> portion of the pancreas.</li> <li># <b>appear</b> as <b>pale rounded clusters</b> of secretory epithelial cells <b>embedded</b> within darkly stained <b>exocrine pancreatic acini</b>.</li> <li># There may be more than one (<b>million islets</b>) in <b>human pancreas</b> which are more <b>abundant</b> in the <b>tail region</b>.</li> </ul>
LM	<ul style="list-style-type: none"> <li># <b>Stroma</b>: fine capsule of <b>reticular fibers</b> surrounds each <b>islet</b> <i>separating</i> it from <b>exocrine pancreatic tissue</b>.</li> <li># Each islet consists of lightly stained <b>polygonal</b> Or <b>rounded</b> cells arranged <b>CORDS</b> separated by a network of <b>fenestrated blood capillaries</b></li> <li># Using immunocytochemical methods, <b>4 types</b> of cells have been located in the islets</li> </ul>
EM	<p>The cells have the <b>ultrastructure of cells synthesizing polypeptides</b>. They contain:</p> <p><b>rER,</b>  <b><u>well developed Golgi,</u></b>  <b><u>mitochondria</u></b>  <b><u>specific secretory granules</u></b></p> <p><b><u>Their nuclei are large and vesicular.</u></b></p> <div data-bbox="446 1456 1133 1870"> <pre> graph LR     IL[Islets of Langerhans] --&gt; A["α or A cells secrete primarily glucagon and are usually located peripherally."]     IL --&gt; B["β or B cells produce insulin (L. insula, island), are the most numerous, and are located centrally."]     IL --&gt; D["δ or D cells, secreting somatostatin, are scattered and much less abundant."] </pre> </div> <ul style="list-style-type: none"> <li># <b>4 types</b> of cells have been located within the <b>head</b> of the pancreas, are <b>PP cells</b>, which secrete pancreatic <b>polypeptide</b>.</li> <li># <b>Gap junctions</b> between cells help in the <b>transfer of the ionic changes</b></li> </ul>

# Pineal Gland

also known **epiphysis cerebri** regulates bodily activities.

**Small pine** cone-shaped organ develops from **neuroectoderm** and remains **attached** to the **brain** by a short stalk.

•Pineal gland contains two parenchymal cels:

**Prominent and abundant** secretory cells called **pinealocytes** with **basophilic** cytoplasm and **irregular euchromatic** nuclei.

These cells produce **melatonin**, a **low molecular-weight tryptophan derivative**.

**interstitial glial cells** that are modified **astrocytes** staining **positively** for **glial fibrillary acidic** protein,

**elongated** nuclei more **heavily** stained than those of pinealocytes

## important formation

# A characteristic feature of the pineal gland is the presence of variously sized concretions of **calcium** and **magnesium** salts called **corpora arenacea, brain sand**

Concretions appear during childhood and **gradually increase in number and size with age**, with no apparent effect on the gland's function.

# **Unmyelinated sympathetic nerve fibers** enter the pineal gland and end among **pinealocytes**, with some forming synapses.

# Melatonin release from **L pinealocytes** is promoted by **darkness** and **inhibited by daylight**. The resulting diurnal fluctuation in blood **melatonin levels induces rhythmic changes in the activity of the hypothalamus, pituitary gland**, and other **endocrine tissues** that characterize the circadian (24 hours, day/night) rhythm of physiological functions and behaviors.

## DIFFUSE NEUROENDOCRINE SYSTEMS

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General features	<p><b>endocrine cells</b> present among <b>non-endocrine cells</b>.</p> <p><u>Origin</u>: They are <b>endodermal</b> in origin</p> <p><u>Sites</u>: these cells are <b>wide spread</b> throughout the body</p>
LM	<p>Many DNES cells are stained by solutions of <b>chromium salts</b> and have therefore called (<b>enterochromaffin cels</b>) or stained with <b>silver Salts</b>, so they are also called (<b>entatfin or argyrophil cells</b>), or can be identified by <b>immunocytochemical methods</b>.</p>
EM	<ul style="list-style-type: none"> <li>- <u>Small amount of RER.</u></li> <li>- <u>Supranuclear Golgi.</u></li> <li>- <u>Basal secretory granules.</u></li> </ul>
Function	<p>These cells synthesize and release <b>polypeptide hormones or amines</b> (<b>epinephrine, norepinephrine &amp; serotonin</b>) with, hormonal activity.</p> <div data-bbox="884 1666 1522 2058"> <p>These cells are able to take up <b>amine precursors</b> and exhibit <b>amino acid decarboxylase activity</b>. This explain its old name (<b>APUD</b> cells) (<b>amine precursor uptake and decarboxylation</b>), but as <b>not all</b> of these cells are able to <b>concentrate</b> (amine precursors,, the <b>APUD</b> name has been replaced by <b>DNES cells</b> (<b>diffuse neuroendocrine system</b>)).</p> </div>