**Endocrine system -2**

**-Adrenal gland**
 Composed of two major parts:
1-cortex : outside.
2-medulla: inside.

**-Embryological development :**
Cells of the medulla originate from neural crest (neural ectoderm).
They’re called ***postganglionic neurons*** (neurons without axons or dendrites, just the cell body and they are secretory without neural function)

-Medulla secrets two hormones ***(adrenalin – noradrenalin*)
"*epinephrine and norepinephrine*** are another names"
each will be secreted from special cells within the medulla and cannot be secreted from the same cell.

**-Stimulation:**
Stimulation of the ***cortex*** comes from pituitary gland.

***Medulla*** is controlled by the sympathetic nervous system.

**Medulla contains cells called sympathetic ganglion cells
control the secretion of medulla.**

**-Blood supply of adrenal gland :**

**In cortex:**

***Sub-capsular plexus*** between the capsule and the cortex forms plexus of arterioles then this plexus is distributed and branched in the cortex to capillaries and sinusoids.

**In medulla:**

Some arterioles go through the cortex (without dividing) and continue to medulla where they divide into capillaries and sinusoids.
These arterioles are called ***medullary arteries***.

Finally, all these capillaries assemble together to form adrenal veins out of the adrenal gland .

**-Layers of adrenal cortex:**

The order (outside to inside) is :

***1-zona glomerulosa.***

***2-zona fasciculata.***

***3-zona reticularis***

**-Layers of cortex and medulla :**

***Shape of the cells****:*

**Cortex :**

1-**Zona glomerulosa** :columnar or pyramidal in shape arranged in folded cords .

2-**Zona fasciculata** : polyhedral cells arranged in straight cords.

3-**Zona reticularis** : polyhedral cells arranged in irregular cords.

**Medulla :**

Polyhedral cells arranged in irregular cords.

***Secretion :***

**Cortex :**

1-**Zona glomerulosa :** aldosterone “ mineralcorticoids.”

2-**Zona fasciculata** : glococorticoids

3-**Zona reticularis** : glococorticoids

 **Medulla :**

Epinephrine – norepinephrine ( catecolamenes ).

- **We see within the medulla sympathetic ganglion cells and modified postganglionic neurons which are responsible for the secretion of epinephrine and norepinephrine .**

In zona glomerulosa the sinusoid and capillary have thin wall fenestrated and adjacent to it there is a space contains microvilli of the cells with in order to decrease the space and increase surface area of contact with the capillaries and sinusoids .

Mineralcorticoids and glococorticoids are derived from cholesterol , ***so all cells of the cortex are considered as lipid synthesizing cells .***

In zona glomerulosa the lipid droplets are small and few in number so they can be seen by electron microscope not the light microscope, whereas in zona fasciculata they are bigger and much more in number so they can be seen by light microscope.

**Zona fasciculata**: more basophilic than zona glomeruloza because more RER in these cells .

**Zona reticularis**: same as zona glomeruloza with the lipid droplets so it is a special characteristic for zona fasciculata .

**Zona reticularis**: acidophilic cells because of the ***lipofuscin*** pigment in it .

**-Controlling of secretion:**

 ACTH is secreted by certain cells in pars (One of the basophilic cells).

Cells of the adrenal medulla produce and store the secretions and release them when stimulated .

When catecholamines are secreted all the effects of the sympathetic nervous system will occur like blood vessels constriction that leads to high blood pressure ,and so on.

**-Thyroid gland :**

It is composed of follicles filled with colloid. Around the colloid there is cuboidal cells called ***follicular cells*** responsible for secretion of T4 , T3 ( thyroid hormones ) " T4 = thyroxin "

Another cells in between follicles called ***parafollicular cells*** secret calcitonin … these cells are called also ***"C cells"***.

**“ Calcitonin decreases the level of calcium in blood by inhibition of osteoclast cells** . “

Colloid contains a protein called ***iodinated thyroglobulin*** produced by follicular cells and stored in the colloid region.
When there is a stimulus to secret thyroid hormones, the cells uptake ( by endocytosis) part of the colloid and these endocytotic vesicles fuse with lysosomes and then freeing of thyroid hormones in form of T3,T4,T1and T2 occurs .

**T3-T4 : Secreted.
T1-T2: Recycled “Removing of the iodine to have only tyrosine amino acid”**

Tyrosine amino acid is used in the formation of the thyroglobulin that contains many type of tyrosine residues which are iodinated either 1,2,3,4 according to this we have T1,T2,T3,T4.

The majority is T4 **, (T4: T3=20:1 )** but the most potent is T3, so some organs like kidney, liver and heart convert T4 to T3 .

If the follicle cells are inactive they convert from ***cuboidal(active)*** to ***simple squamous(inactive)***.

**-Control of the thyroid hormones secretion:**

**Two types of control :**
**Minor** :by ANS (sympathetic and parasympathetic)
**Major** : by thyrotropin “produced by type of basophilis in para distalis of pituitary gland .”

Thyrotropin releasing factors from hypothalamus control the secretion of thyrotropin(TSH) by adenohypophysis (pituitary gland).

Negative feedback happens when the level of thyroid hormones increases to down regulate the hypothalamus in the secretion of TSH.

**-Parathyroid glands:**

Four glands 2 right and 2 left , superior and inferior.

The hormone of paraythyroid gland has the opposite function of calcetonin , it increases the level of calcium in the blood by increasing the activity of osteoclast.

 Removal of parathyroid gland cause titanic seizures due to low ca++ level so the muscles function will be interrupted.

**Cells of parathyroid glands:**

 **1- Chief.**

**2-Oxyphil.**

**3- Adipose cells**: which are not secretory cells.

**\*\*Before age of 7 years we only have chief cells, after 7 years oxiphil cells start to appear .**

***Oxyphil cells:***

Unknow function but it may has a role in parathyroid hormones secretion.

-Bigger size; so the ratio Nucleus/Area(Cell) is small so the cell appears lighter.

***-Chief cells***

Smaller , nucleus occupies most of the cell and appears more basophilic and darker .

Cytoplasm is acedophilic “in oxyphil also”.

Per surface area there are more chief cells than oxyphil cells because they are smaller .

زملائي ، لابد من الإطلاع على سلايدات المحاضرة عند دراستها حيث أنها مليئة بالمعلومات التي اكتفى الدكتور بقراءتها ولم أعد كتابتها هنا !
الشيت يتضمن المعلومات الإضافية والشرح التفصيلي لبعض النقاط فقط ☺
بالتوفيق .. ☺

