# ENDOCRINE SYSTEM

## summary & test bank
## mid – 2023

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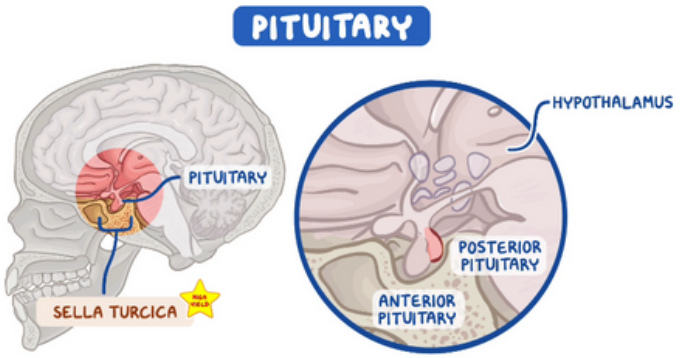
gland !

what

do your job !

in this summary, our goal is to make Memorizing easier, so it will take some more pages.

# Pituitary gland

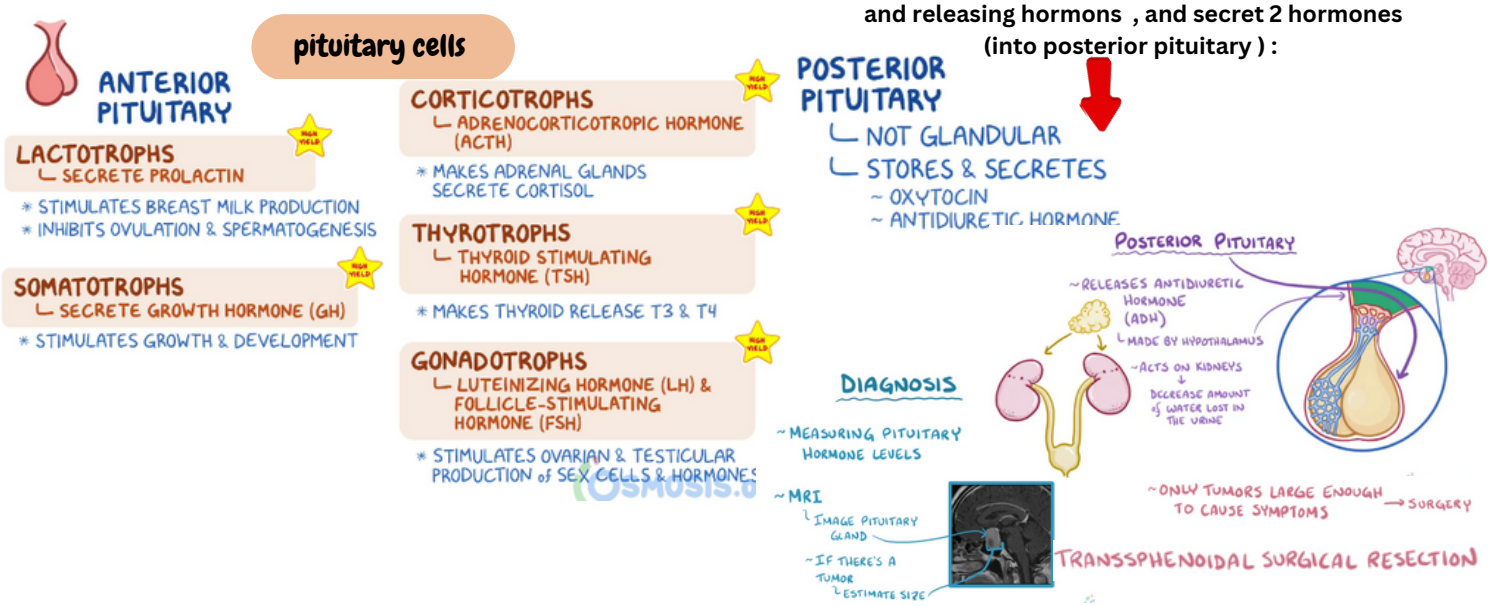



Also called hypophysis cerebri. Relatively small- 0.5 gm.
Centrally located at the base of the brain.
• Rests in a saddle-like bony depression (sphenoid) called hypophyseal fossa of the sella turcica.

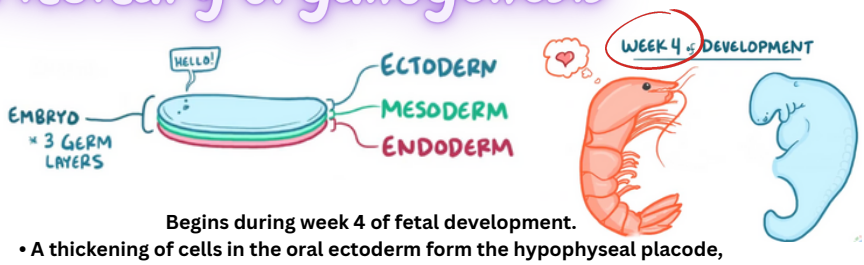
• Has two lobes: adenohypophysis and neurohypophysis.
- Adenohypophysis (anterior lobe).
- Neurohypophysis (posterior lobe).

Adenohypophysis (anterior lobe): • Pars tuberalis. • Pars intermedia. • Pars distalis.
Neurohypophysis (posterior lobe): • Infundibular stalk. • Pars nervosa.

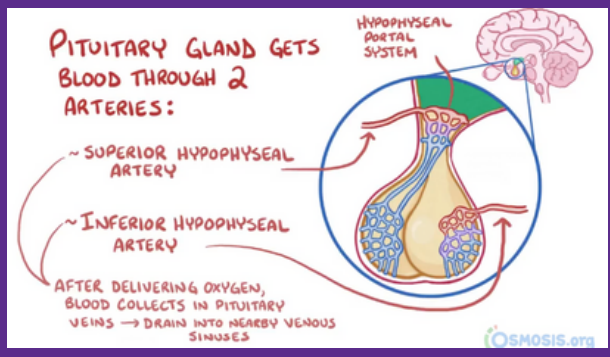
• Connected to the brain (hypothalamus) by a stalk called the infundibulum.
hypothalamus, above it , is Controlling the secretion of the pituitary hormones by: Inhibitory and releasing hormons , and secret 2 hormones (into posterior pituitary ) :




## Pituitary organogenesis




Begins during week 4 of fetal development.
• A thickening of cells in the oral ectoderm form the hypophyseal placode, which gives rise to Rathke's pouch, an upward evagination that extends towards the neural ectoderm.
• A downward extension of the ventral diencephalon forms the posterior lobe (at the same time). • The two nascent lobes connect to form the composite structure of the adult pituitary.
• Rathke's pouch constricts at its base and eventually separates altogether from the oral epithelium during week 6-8.



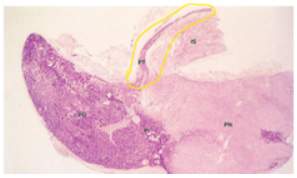

• ACTH acts on adrenal medulla.

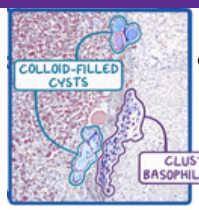
• Hypothalamic releasing hormones reach the pg by the systemic circulation directly.

| Hormone | Function |
|---|---|
| Vasopressin/antidiuretic hormone (ADH) | Increases water permeability of renal collecting ducts |
| Oxytocin | Stimulates contraction of mammary gland myoepithelial cells and uterine smooth muscle |

## Pars tuberalis

- Small funnel-shaped region surrounding the infundibulum.
- Most of the cells of the are gonadotrophs.

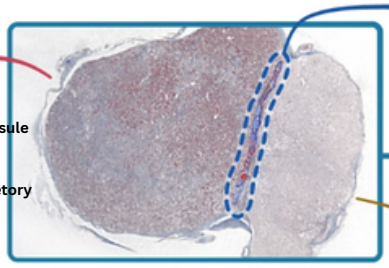




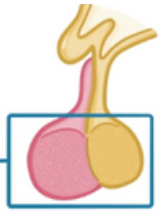

Express POMC (pro-opiomelanocortin) but cleave it differently from cells in the pars distalis ((MSH), γ-LPH, and β-endorphin).

**ANTERIOR**

Biggest
Has a thin fibrous capsule
Chromophils and chromophobes.
Chromophils are secretory cells.



**PARS INTERMEDIA**
└ remnant of RATHKE'S POUCH



**POSTERIOR**
~ mostly UNMYELINATED AXONS
↓
LIGHTER than the ANTERIOR PITUITARY

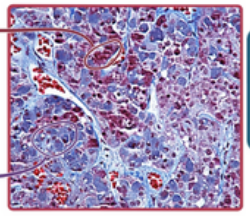
Consists of the pars nervosa and the infundibular stalk • Does not contain the cells that synthesize its two hormones. Neurosecretory (Herring) bodies contin either: antidiuretic hormone (ADH, arginine vasopressin) oxytocin • Carrier proteins: neurophysin I and II.

lac- som = acidophilic

**CHROMOPHILS**
CYTOPLASM stains STRONGLY
↓
DARKER

**ACIDOPHILS**
~ stain dark red ~
* somatotrophs & lactotrophs
* secrete: somatotropin & prolactin

**BASOPHILS**
~ stain purplish-blue ~
* corticotrophs, gonadotrophs, & thyrotrophs
* secrete: MSH, ACTH, LH, FSH, & TSH



**MASSON'S TRICHROME STAIN**

* NUCLEI & BASOPHILIC STRUCTURES = BLUE
* COLLAGEN = BLUE or GREEN
* NON-BASOPHILIC CYTOPLASM & RBCs = RED

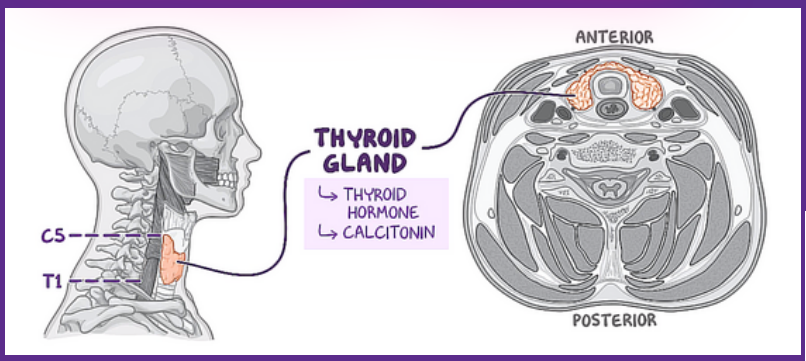
## hypothalamus hormones

| Hormone | Chemical Form | Functions |
|---|---|---|
| Thyrotropin-releasing hormone (TRH) | 3-amino acid peptide | Stimulates release of thyrotropin (TSH) from pituitary to thyroid |
| Gonadotropin-releasing hormone (GnRH) | 10-amino acid peptide | Stimulates the release of both follicle-stimulating hormone (FSH) and luteinizing hormone (LH) |
| Somatostatin | 14-amino acid peptide | Inhibits release of both somatotropin (GH) and TSH |
| Growth hormone-releasing hormone (GHRH) | 40- or 44-amino acid polypeptides (2 forms) | Stimulates release of GH |
| Dopamine | Modified amino acid | Inhibits release of prolactin (PRL) |
| Corticotropin-releasing | 41-amino acid polypeptide | Stimulates synthesis of pro-opiomelanocortin (POMC) and release of both β-lipotropic |

dop-som = inhibithion

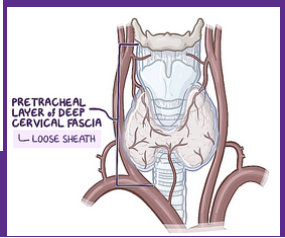
for more : https://youtu.be/BYaR-JgbjCs

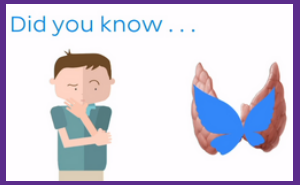
# THYROID GLAND



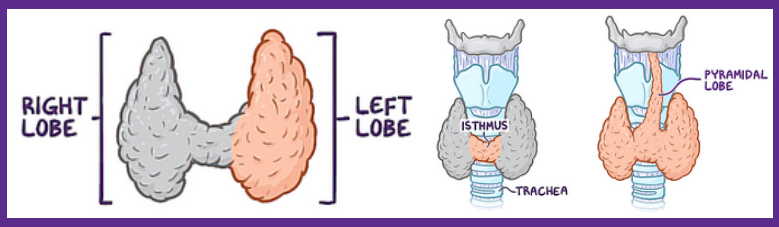

• Highly vascular, butterfly-shaped gland surrounding the anterior surface of the trachea just below the larynx • located in the anterior neck and spans C5-T1 vertebrae • Consists of right and left lobes connected by a narrow isthmus. • Surrounded by a sheath derived from the pretracheal layer of the deep fascia ( attachment to larynx and the trachea).

Berry ligament!!



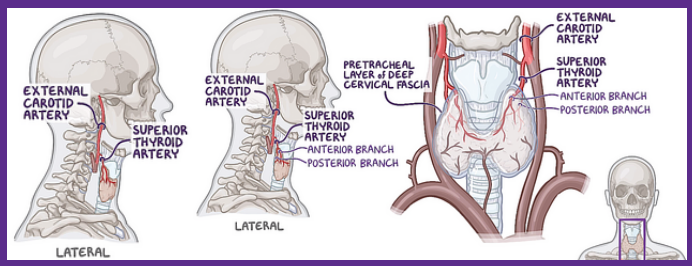
Each lobe is pear shaped--- apex being directed upward--- -- oblique line on the lamina of the thyroid cartilage. Base lies below at the level of the 4th or 5th tracheal ring. The isthmus extends across the midline in front of the 2nd-4th tracheal rings. A pyramidal lobe!!! Is often present, and it projects upward from the isthmus (band connects it to the HB --- levator glandulae thyroideae)




•Anterolateral: sternothyroid, the superior belly of the omohyoid, the sternohyoid, and the anterior border of the sternocleidomastoid

**Posterolateral: carotid sheath with the common carotid artery, the internal jugular vein, and the Vagus nerve**

Posterior: superior and inferior parathyroid glands and the anastomosis between the superior and inferior thyroid arteries

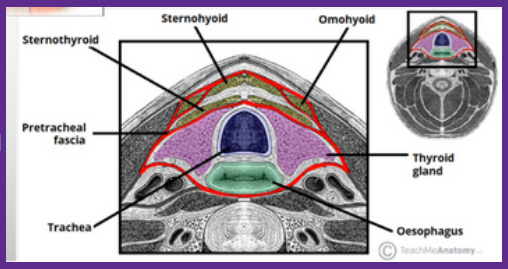


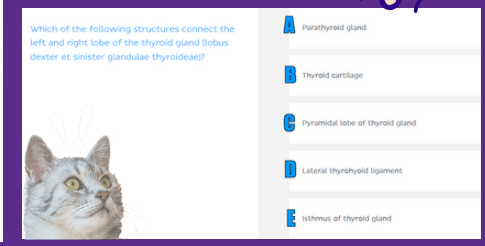

## if we take isthmus as a (0,0)

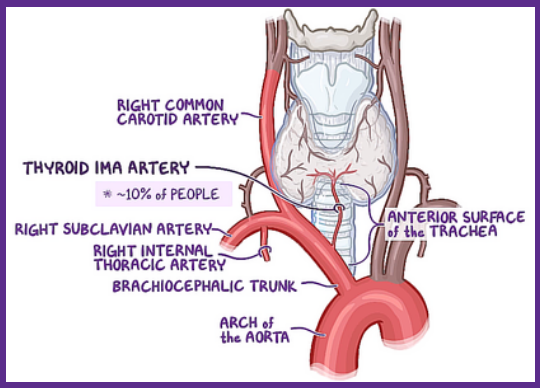
**•Anterior: sternothyroid, the sternohyoid, anterior jugular veins, fascia, and skin**

**• Superior: terminal branches of the superior thyroid arteries anastomose along its upper border**

**• Posterior: second, third, and fourth rings of the trachea**

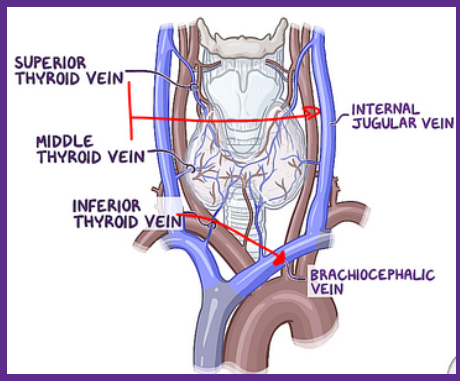


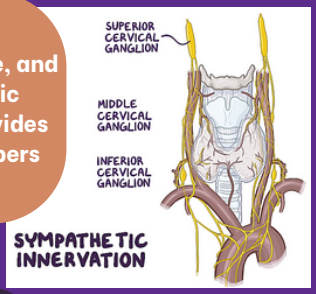



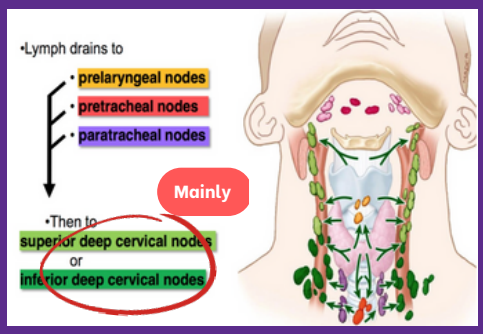

## BLOOD SUPPLY

**1. The superior thyroid artery (ECA), accompanied by the external laryngeal nerve.**
**2. The inferior thyroid artery (TCT) reaches the posterior border of the gland. The recurrent laryngeal nerve crosses either in front of or behind the artery, or it may pass between its branches.**
**3. The thyroidea ima (BCA), if present, It ascends in front of the trachea to the isthmus.**




**Nerve supply : Superior, middle, and inferior cervical sympathetic ganglia. The Vagus nerve provides the main parasympathetic fibers**




## EMBRYOLOGY

diverticular outgrowth from the primitive pharynx

descends inferiorly to reach its final destination in the neck

the thyroid connects to the tongue1&2 by the thyroglossal duct

Around day 20-24, endodermal cells

solidifies during migration forming the follicular elements

Division of the thyroid into right and left lobes

In the fifth week 5

Ultimobranchial bodies arise from the fourth/fifth pharyngeal pouches parafollicular c-cells.

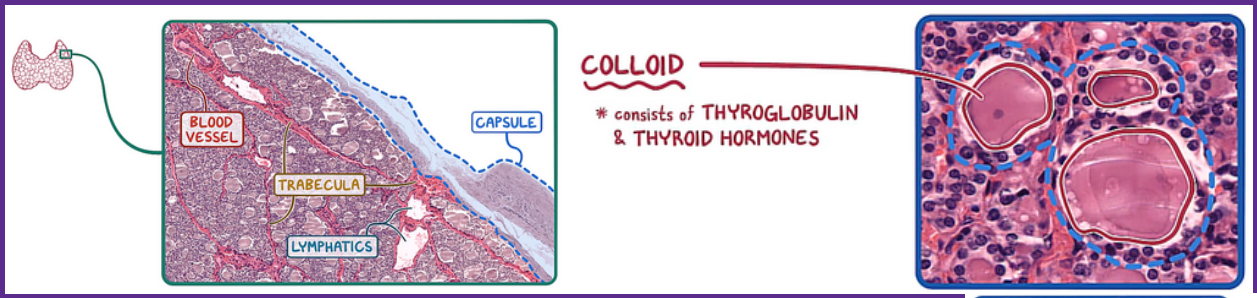
7 By the seventh week: The thyroid has reached its final destination in the neck

The thyroglossal duct degenerates

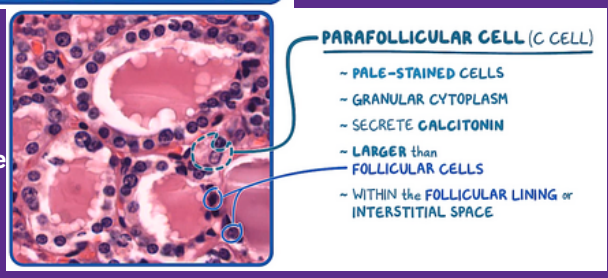
incomplete obliteration of the duct can lead to abnormalities, including thyroglossal duct cysts, or a pyramidal lobe. lingual thyroid!!!!!

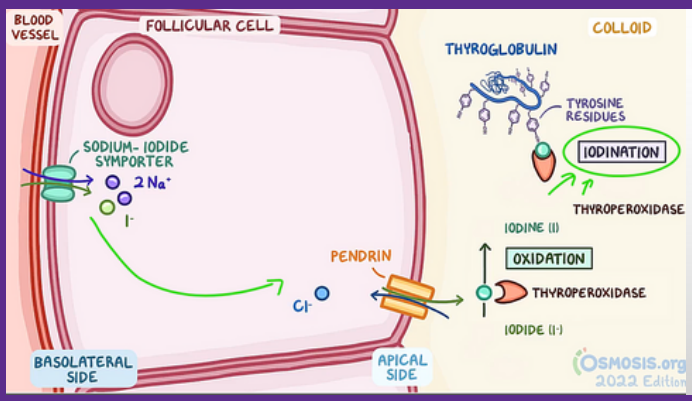
10 By the tenth week

By the twelfth week Functionally mature 12




• The parenchyma is composed of millions of rounded epithelial thyroid follicles of variable diameter, each with simple epithelium and • A central lumen densely filled with gelatinous acidophilic colloid • Only endocrine gland in which a large quantity of secretory product is stored. • Storage is outside the cells, in the colloid of the follicle lumen. • There is sufficient hormone in follicles to supply the body for up to 3 months. • *Thyroid colloid contains the large glycoprotein thyroglobulin---the precursor for the active thyroid hormones.*

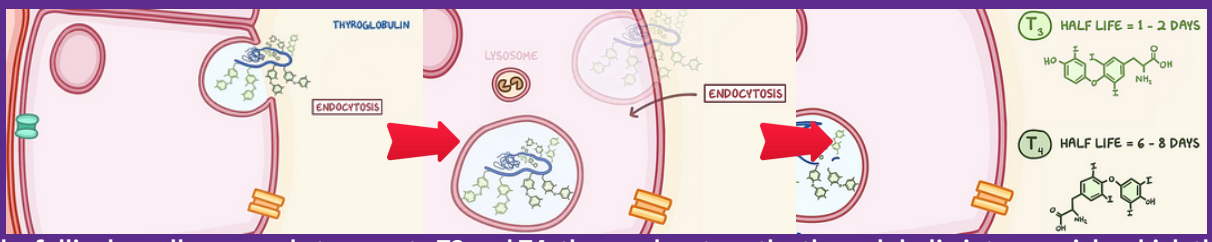


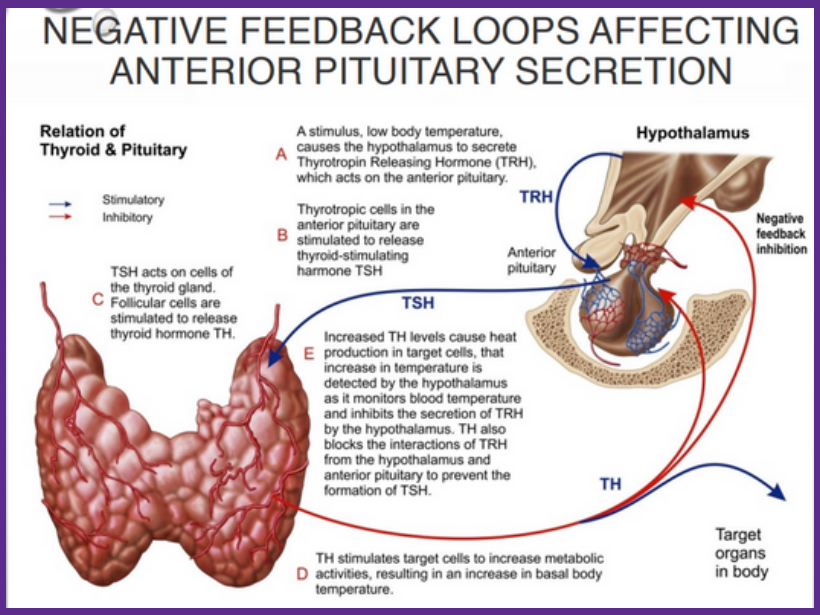

## Production of thyroid hormone & its control

**The major activities of this process**

- The production of **thyroglobulin** (140 tyrosyl residues)
- The uptake of iodide (30-fold concentration)
- Iodination of tyrosyl residues (oxidation of iodide)
- Formation of T3 and T4
- Endocytosis of iodinated thyroglobulin (lysosomal proteases)
- Secretion of T4 and T3




the follicular cells are ready to secrete T3 and T4, they endocytose the thyroglobulin into a vesicle which then fuses with the lysosome. Here, thyroglobulin is cleaved by proteases, and T3 and T4 are released right into the bloodstream




## PARAFOLLICULAR CELLS :

• Parafollicular cell ( C cell), is also found inside the basal lamina of the follicular cells or as isolated clusters between follicles

• Derived from the neural crest or endoderm!!!!! • Somewhat larger than follicular cells and stain less intense.

• Smaller amount of rough ER, large golgi complexes, and numerous small granules containing calcitonin.

• Secretion of calcitonin is triggered by elevated blood ca+2 levels, and it inhibits osteoclast activity.

# Parathyroid glands

why glands ? cuz they are 4 , embedded in the back of thyroid capsule

Blood supp./Venous D./ Lymph D.: same as thyroid

## Superior parathyroid glands

Derived from the fourth pharyngeal pouch

1cm superior to the junction of the recurrent laryngeal nerve (RLN), and the inferior thyroid artery.

## Inferior parathyroid glands

Derived from the third pharyngeal pouch

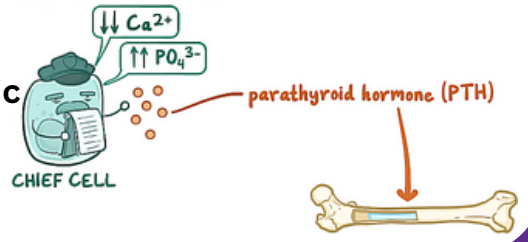
within 1-2 cm of the insertion of the inferior thyroid artery

can even be found along the aortic arch (16%)

many secretory cells are replaced with adipocytes (>50%) of the gland in older people.

## Chief cells:

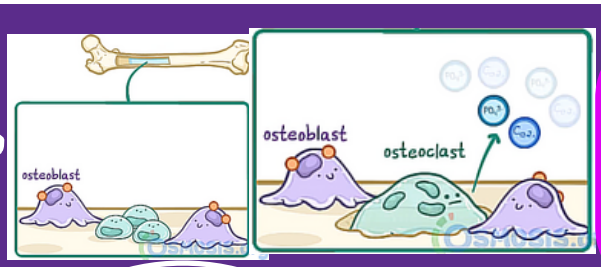
- Manage the secretion of parathyroid hormone (PTH).
- Prominent Golgi apparatus and a developed endoplasmic reticulum (synthesis and secretion of the hormone)
- Smaller than the oxyphil cells, they are more abundant.




## Oxyphil cells:

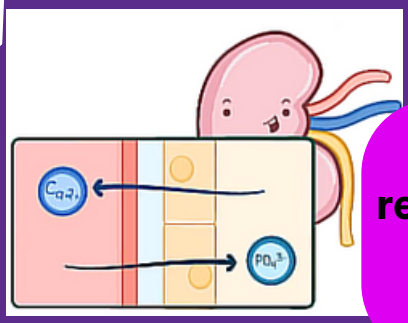
The purpose of these cells is not entirely understood. Larger than the chief cells and seem to increase in number with age

## PTH major targets:




Elevate the number and activity of osteoclasts. • Resorption of the calcified bone matrix and release of Ca2+ increase the concentration of circulating Ca2+


Activated vitamin D promotes the absorption of calcium due to the increased formation of the calcium-binding protein in the intestinal epithelial cells



calcium reabsorption and excretion of phosphate

- Removal of both pairs of the parathyroid gland is extremely uncommon.

A single parathyroid gland should be sufficient!!!!!

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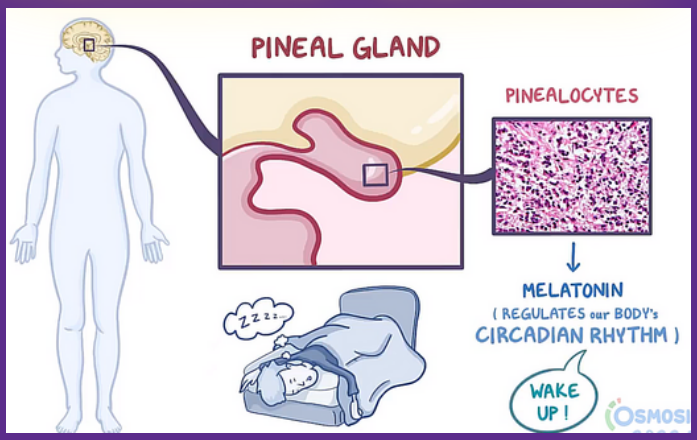
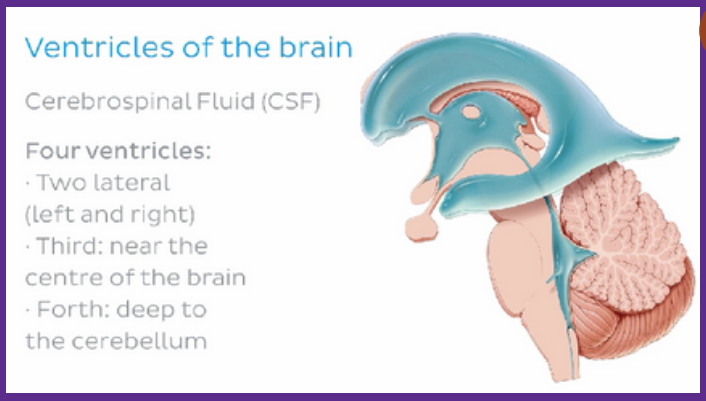
# PINEAL GLAND

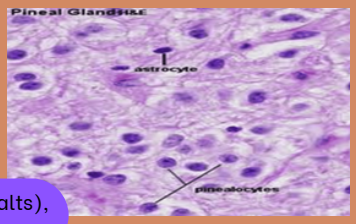



A small, pine cone-shaped organ (5-8 mm by 3-5 mm)
• Also known as the epiphysis cerebri
• Posteriorly from the posterior end of the roof of the third ventricle of the brain.
• Resides between the thalamic bodies.
• Has a rich blood supply
• Innervated by postganglionic sympathetic nerve fibers.
• Covered by connective tissue of the pia mater (septa)




## histology

Prominent and abundant secretory cells-pinealocytes.
• Slightly basophilic cytoplasm and irregular euchromatic nuclei • Secretory vesicles, many mitochondria, and long cytoplasmic processes.
• Produce melatonin: a low-molecular-weight, a tryptophan derivative.
• Unmyelinated sympathetic nerve fibers enter the pineal gland and end among pinealocytes (some form synapses)




astrocytes : elongated nuclei , glial cells darkly stained , larger , increased in number with age , found in perivascular areas , No apparent effect

**Corpora arenacea, or brain sand** (concretions of calcium and magnesium salts), formed by mineralization of extracellular protein deposits.

## ORGANOGENESIS

7th-8th week. • Develops from neuroectoderm (posterior wall of the third ventricle).
• Neuroepithelium that lines the roof of the third ventricle in the prenatal brain, and its maturation continues postnatally.
• The development of the mature gland is seen in the first decade of life.
Basically, the pineal gland will increase in size from birth to about 2 years in age

10

## FUNCTIONS

• Influences the activities of the pituitary gland, the Islets of Langerhans of the pancreas, the parathyroids, the adrenals, and the gonads.
The pineal secretions, reach their target organs via bloodstream or cerebrospinal fluid.
Their actions are mainly inhibitory.
Directly inhibit the production of hormones or iindirectly inhibit the secretion of releasing factors by the hypothalamus.

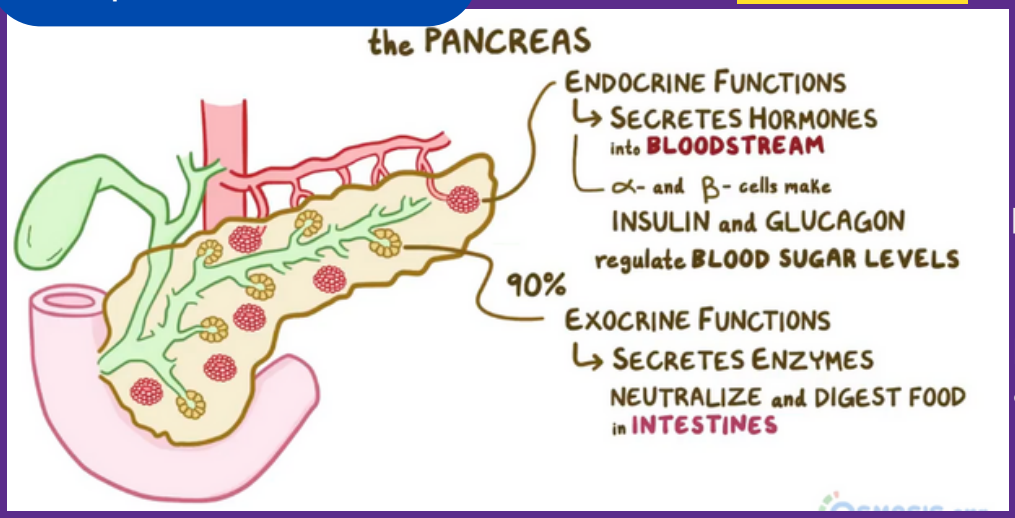
**The pineal gland---a neuroendocrine transducer**

**Melatonin release is promoted by darkness and inhibited by daylight . rhythmic changes in the activity of the hypothalamus, PG, and other endocrine tissues**

**The cycle of light and darkness is detected within the retinas and transmitted to the pineal via the retinohypothalamic tract**

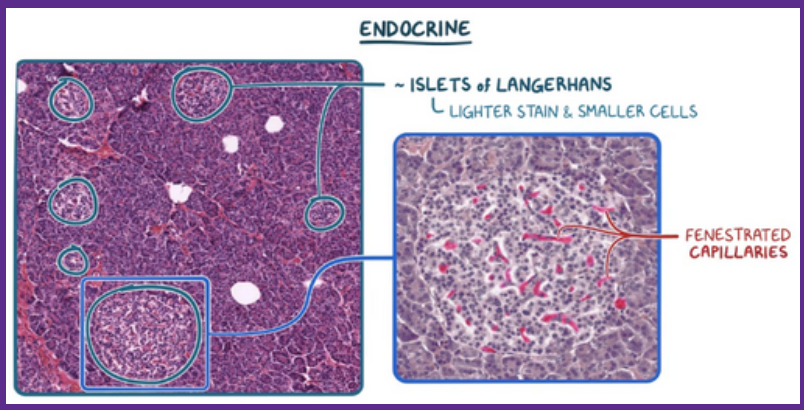
# The pancreatic islets

**endoderm**




Are compact spherical or ovoid masses of endocrine cells embedded within the acinar exocrine tissue of the pancreas. • Most islets are 100-200 μm in diameter and contain several hundred cells, but some have only a few cells. • The pancreas has more than 1 million islets (mostly in tail region).

The cells of islets are polygonal or rounded, smaller, and more lightly stained than the surrounding acinar cells, Arranged in cords separated by fenestrated capillaries. • Most islet cells are acidophilic or basophilic with fine cytoplasmic granules. • Active polypeptide-secreting cells, with secretory granules that vary in size, morphology, and electron density from cell to cell




~ ISLETS of LANGERHANS
- LIGHTER STAIN & SMALLER CELLS
- 4 MAIN TYPES of CELLS, BUT NOT EASILY DISTINGUISHED with H&E
  - * BETA CELLS
    - ~ approx. 70% of ISLET
    - ~ SECRETE INSULIN
  - * ALPHA CELLS
    - ~ SECRETE GLUCAGON
  - * DELTA CELLS
    - ~ SECRETE SOMATOSTATIN
  - * PP CELLS
    - ~ SECRETE PANCREATIC POLYPEPTIDE

centrally — Acts on several tissues to cause entry of glucose into cells and promotes decrease of blood glucose content

peripherally — Acts on several tissues to make energy stored in glycogen and fat available through glycogenolysis and lipolysis; increases blood glucose content

scattered and much less abundant — Inhibits release of other islet cell hormones through local paracrine action; inhibits release of GH and TSH in anterior pituitary and HCl secretion by gastric parietal cells

more common in islets located within the head — Stimulates activity of gastric chief cells; inhibits bile secretion, pancreatic enzyme and bicarbonate secretion, and intestinal motility

from flash card num13

https://quizlet.com/_cek8qv?x=1jqt&i=4golfd

# Physiology

nervous system & endocrine system have control of our bodies to keep it in homeostasis .

nervous system has an immediate action & endocrine system has prolonged & delayed action .

| | Nervous System | Endocrine System |
|---|---|---|
| **Mechanism of Control** | Neurotransmitters released in response to nerve impulses | Hormones delivered to tissues throughout the body by blood |
| **Cells Affected** | Muscle cells, gland cells, other neurons | Virtually all body cells |
| **Type of action that Results** | Muscular contraction or glandular secretion | Changes in metabolic activities whether it was anabolism or catabolism |
| **Time to onset of action** | Typically, within milliseconds It is usually fast | Seconds to hours or days. It is usually delayed and takes days “throughout life“. But sometimes when in need, it is immediate and takes seconds to hours. |
| **Duration of action** | Generally briefer | Generally longer |

Endocrine • No ducts • Secrete hormones into blood

Autocrine produces hormone that affect the same cell

Paracrine produces hormone that affect the neighboring cells

Neuroendocrine are represented by neurons

Pheromonal : hormones are volatile, and affect nearby individuals

In skeletal muscles; Insulin: stimulates glucose uptake, glycolysis, glycogenesis, inhibits glycogenolysis, stimulates amino acids uptake, stimulates protein synthesis, and inhibits protein degradation.

Some hormones are known to have different effects on different types of tissues • Example: testosterone "the male sex steroid" promotes normal sperm formation in the testes, stimulates the growth of accessory sex glands such as prostate and seminal vesicles, and promotes the development of several secondary sex characteristics such as beard growth and deepening of the voice.

A single hormone may be secreted by more than one endocrine gland • Example: hypothalamus and pancreas, both secrete the hormone somatostatin

Several different hormones including insulin, glucagon, epinephrine, thyroid hormones, and adrenal cortisol may regulate liver glycogen metabolism.

Target cells can change the number of receptors.
• Desensitization The chronic exposure of a cell to a hormone may cause the cell to become less responsive to that hormone
• homologous desensitization exposure of a cell to a specific hormone causes a desensitizing effect on the action of the same hormone
• heterologous desensitization exposure of a cell to a specific hormone causes a desensitizing effect on the action of a different hormone
• Sensitization

Some of the glands produce only hormones while others have other functions (mixed organs)

effect of hormones

| | |
|---|---|
| blood circulation | regulate blood pressure by altering cardiac output, vascular constriction, and blood volume via the control of water excretion by the kidneys |
| transport of substrates to tissues (blood composition) | regulate blood plasma concentrations of glucose, minerals (e.g. sodium, potassium, calcium), gases (oxygen, carbon dioxide), blood cells, water, and hydrogen ions (pH regulation) |
| defence against pathogens | regulate immune system responses, including leucocyte activation, inflammation, antibody production, and fever |

structure of hormones: Proteins , Amino acid derivatives , Steroids

**Feedback control**

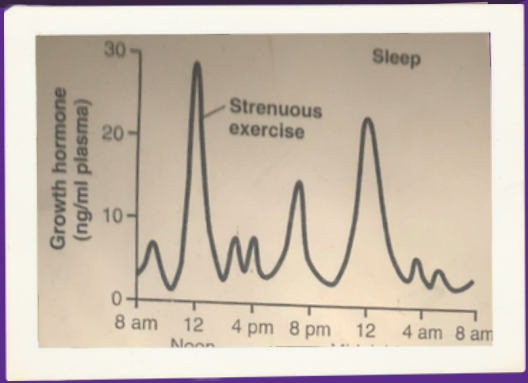
Hormone-hormone
Substrate-hormone
Mineral-hormone

Negative feedback reverse the stimulus

positive feedback more stimulus

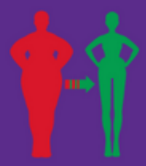
Neural Control Pain, emotion, sexual excitement, fright, injury, and stress; all can affect hormone secretion

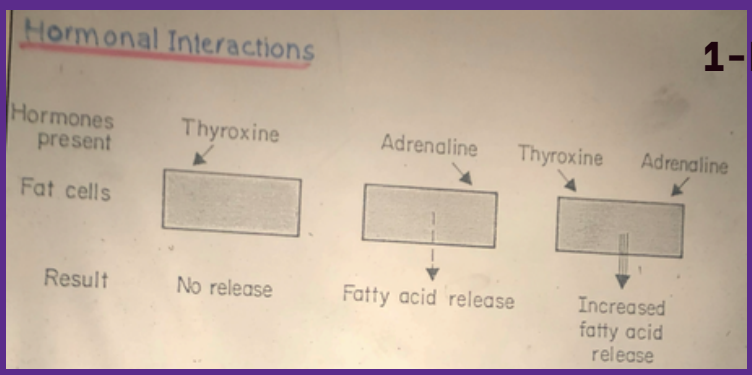
Chronotropic Control :duration and timing of secretion • Oscillating patterns • Pulsatile patterns • Diurnal rhythm "Sleep-wake rhythm" • Menstrual rhythm • Seasonal rhythm • Developmental rhythm




Receptors Regulation :
Up regulation // Sensitization : Low stimulation causes an increase in the number and affinity of the receptors .
Down regulation // Desensitization: High stimulation causes a decrease in the number and affinity of the receptors

Receptors Regulation : treatment of Diabetes Meletus (Type 2) Exercise, good diet, and weight loss






**1-Permissive hormonal interaction**

**Thyroxine → Fat cell → No release of FA**
**Adrenaline → Fat cell → Little release of FA**
**Thyroxine + Adrenaline → High release of FA**

**the effect of one hormone on a target cell requires a previous or simultaneous exposure to another hormone**

**2-Synergism : hormones complement each other**

**Estrogen, Progesterone, Prolactin and Oxytocin → Proper milk production**

**3-Antagonism**

**Opposite effects**

**PTH → increases Calcium. Calcitonin → decreases Calcium**
**Insulin → decreases Glucose. Glucagon → increases Glucose**

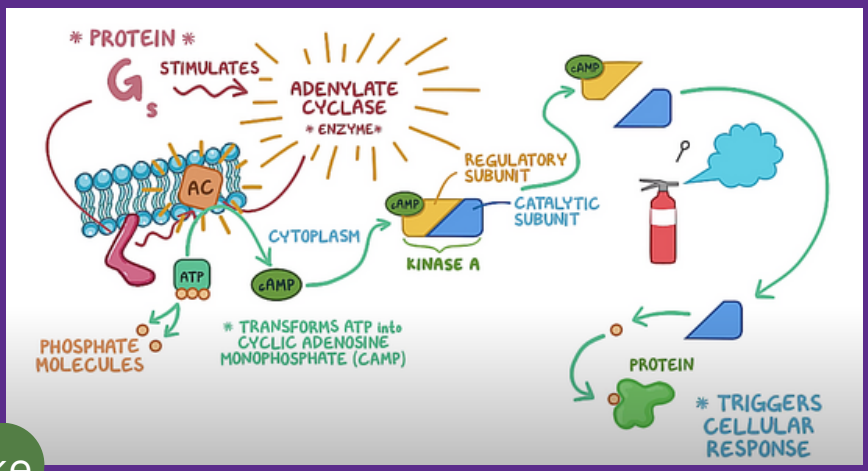
## Hormone receptors

- Cell-surface receptors

for protein hormones and catecholamines
Cannot pass the plasma membrane
Needs second messenger

- Cytoplasmic (or nuclear) receptors

for steroid and amino acid derived hormones (except catecholamines)
Can pass the plasma membrane



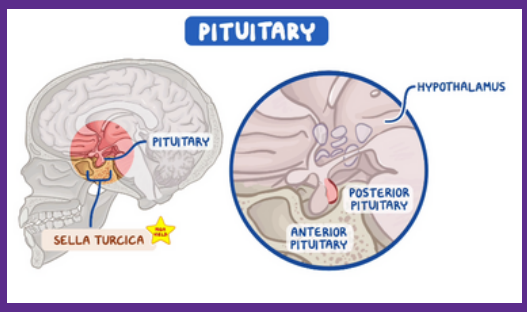

## Cell Surface + Adenylyl cyclase like

Adrenocorticotropic hormone (ACTH)
Angiotensin II (epithelial cells)
Calcitonin
Catecholamines (β receptors)
Corticotropin-releasing hormone (CRH)
Follicle-stimulating hormone (FSH)
Glucagon
Human chorionic gonadotropin (HCG)
Luteinizing hormone (LH)
Parathyroid hormone (PTH)
Secretin
Somatostatin
Thyroid-stimulating hormone (TSH)
Vasopressin ($V_2$ receptor, epithelial cells)

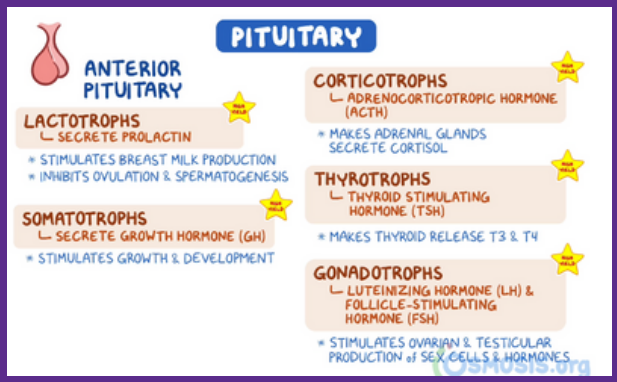
## Cell Surface + Phospholipase C

- Examples:
- Angiotensin II
- Gonadotropin-releasing hormone (GnRH)
- Growth hormone-releasing hormone (GHRH)
- Thyrotropin releasing hormone
- Oxytocin
- Vasopressin (V1 receptors)
- Catecholamines (α receptors)

## pituitary gland




Composed of two parts; each has different embryology, histology and physiology:
1. Anterior Pituitary [Adenohypophysis]
glandular tissue
2. Posterior Pituitary [Neurohypophysis]
nervous tissue
Posterior Pituitary Hormones
[1] Oxytocin delivery & milk ejection
[2] Antidiuretic Hormone (ADH) or Vasopressin Water reabsorption & vasoconstriction
Similar in structure (differ in just 2 amino acids)
Synthesized by Nuclei in the Hypothalamus
1. Paraventricular nucleus mainly oxytocin and a little bit of ADH
2. The Supraoptic nucleus mainly ADH and a little bit of oxytocin




Anterior Pituitary :Not directly connected with the hypothalamus
1. Growth Hormone (GH) Somatotrophs
2. Adrenocorticotropic hormone (ACTH) Corticotropes
3. Prolactin (PRL) Lactotrophs (Mammotropes)
4. Thyroid-stimulating hormone (TSH) Thyrotropes
5. Luteinizing hormone (LH) Gonadotrophs
6. follicle-stimulating hormone (FSH) Gonadotrophs

30-40% of the anterior pituitary are somatotrophs that secrete growth hormone while 20% are corticotropes

# pituitary gland hormones - GH

## Growth Hormone :

• Secreted by Somatotrophs in the Anterior Pituitary • Increases the growth of the cells & the number of cells (which are capable to grow) • Affects almost all body cells .

growth hormone (GH), insulin – like growth factors (IGF-I and -II), insulin, thyroid hormones, Glucocorticoids, androgens & estrogens contribute to the growth process in humans . GH & IGF-I have been implicated as the major determinants of growth in normal post-uterine life.

**Combination of GH and insulin → Much growth.**

**Direct Effects**

**1. Adipose Tissue Decreases adiposity, (by increasing lipolysis and decreasing the glucose uptake)**

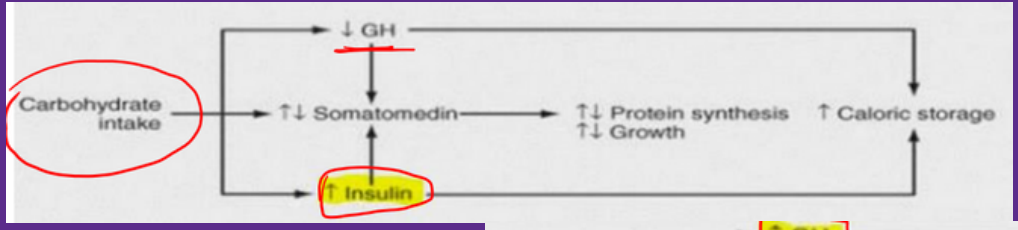
**2. Liver a) Increases RNA synthesis to increase protein production b) Increases the rate of protein synthesis c) Increases Gluconeogenesis d) Stimulate production of Somatomedins "insulin-like growth hormones" (IGF)**

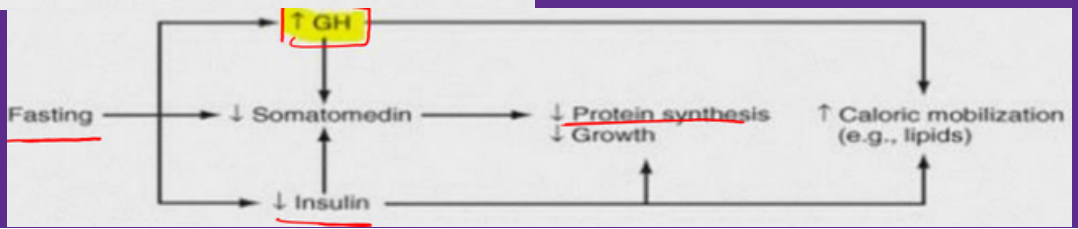
**3. Muscle Tissue a) decrease glucose uptake. b) increase amino acid uptake. c) increase protein synthesis**

**Indirect Effects IGF → increase in organ size and function (growth)**

**Metabolic Effects of Growth Hormone 1. Increase the rate of protein synthesis 2. Increase mobilization of fatty acids from adipose tissue & increased its oxidation to produce energy 3. Decrease the rate of glucose utilization throughout the body Net effect: Growth hormone enhances the body protein, uses up the fatty stores and conserves carbohydrates GH ↑ Glu – Insulin ↓ Glu = (normalize the blood glucose level) It also stimulates beta cells to produce insulin Abnormally high GH → Diabetes (diabetogenic)**

**• Increases the free fatty acids in the blood by increase the lipolysis • Fatty acids concentration increases in body fluids • Under the excessive of GH, great amount of fat is mobilized • ketogenic effect**



## Factors Affecting The Secretion of GH

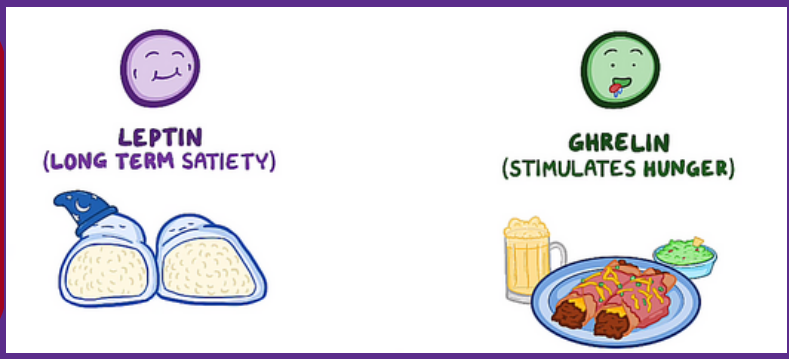
Developmental Rhythm • GH secretion levels are higher in children than adults with a peak period during puberty • GH declines with aging .

Sleep - wake cycle (diurnal Rhythm)

| Stimulate Growth Hormone Secretion | Inhibit Growth Hormone Secretion |
|---|---|
| Decreased blood glucose | Increased blood glucose |
| Decreased blood free fatty acids | Increased blood free fatty acids |
| Increased blood amino acids (arginine) | Aging |
| Starvation or fasting, protein deficiency | Obesity |
| Trauma, stress, excitement | Growth hormone inhibitory hormone (somatostatin) |
| Exercise | Growth hormone (exogenous) |
| Testosterone, estrogen | Somatomedins (insulin-like growth factors) |
| Deep sleep (stages II and IV) | Increased blood glucose |
| Growth hormone–releasing hormone | Increased blood free fatty acids |
| Ghrelin | Aging |

**Control of Food Intake**

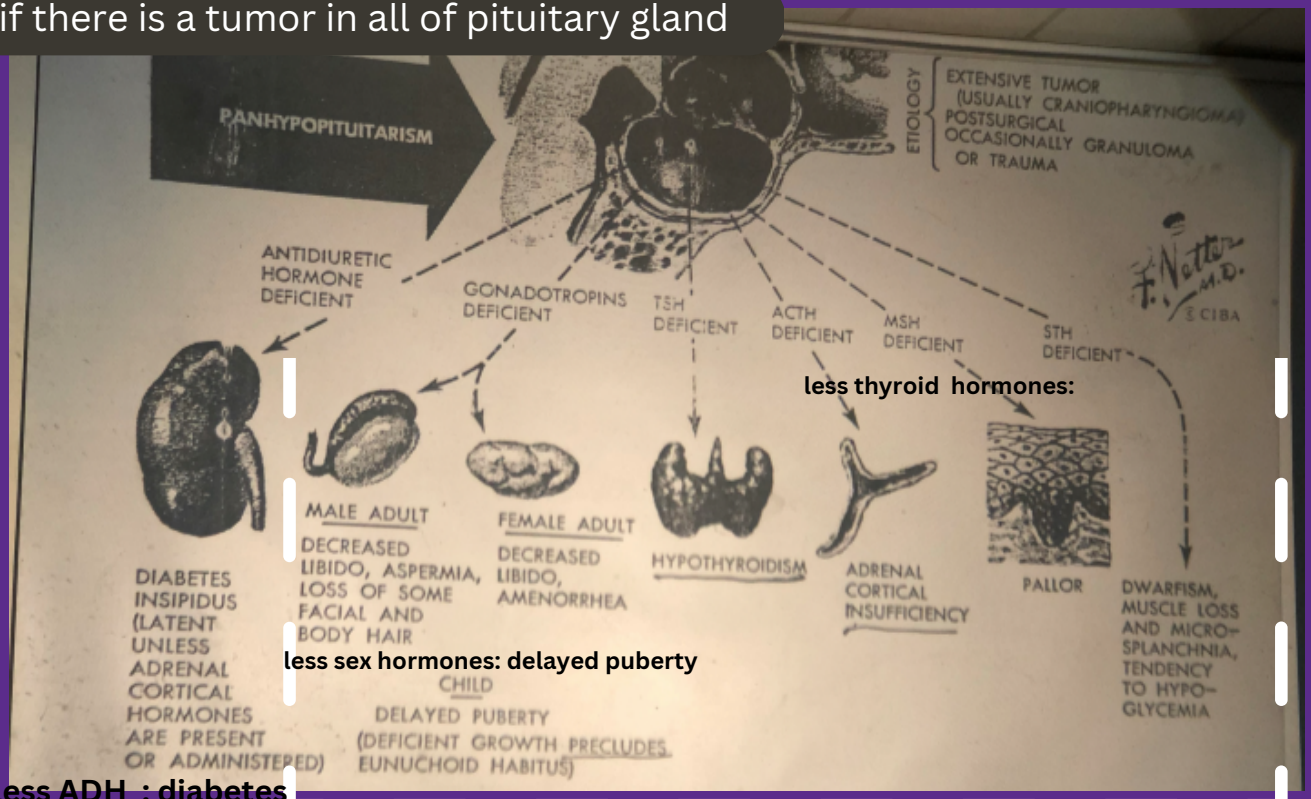
- **Stomach stretch receptors → satiety**
- **Leptin → Satiety**
- **CCK, insulin, → Satiety**
- **Ghrelin → Hunger**




## Hormones abnormalities

- **Panhypopituitarism → ↓ all pituitary hormones**
- **↓ ADH → more water secretion → Diabetes insipidus**
- **↓ Oxytocin → no clear effects**
- **↓ FSH & LH → ↓ Libido + (aspermia, ↓body hair) in males (Amenorrhea) in females**
- **↓ TSH → 2^ hypothyroidism**
- **↓ ACTH → adrenal cortex insufficiency**
- **↓ MSH → pallor**

if there is a tumor in all of pituitary gland




less thyroid hormones:

less sex hormones: delayed puberty

less ADH : diabetes insipidus

**when the tumor is just in the (anterior ) adeno part , only these are affected.**

## anterior pituitary deficiency

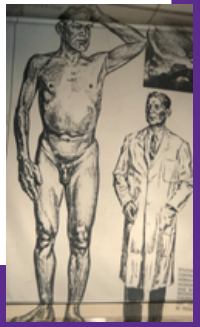
**severe : all hormones are deficient**

**modorate : all hormones are deficient except STH normal : normal growth**

**mild : all hormones are normal except gonadotropins (sex hormones)**

## Gigantism

**all bone will grow rapidly , height 8-9 feet , 10% hyperglycemia , diabetic , without treatment there will be a panhypopituitarism (all the pituitary)**

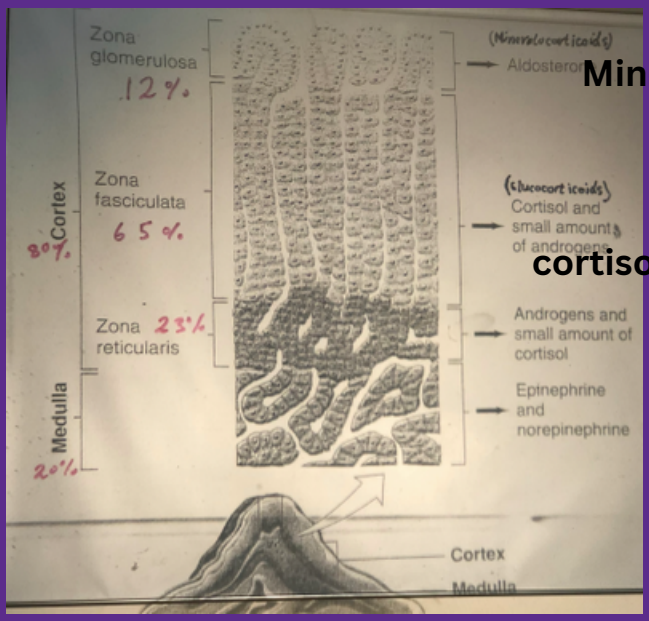


## Acromegaly


**not taller**

# ADRENAL GLAND

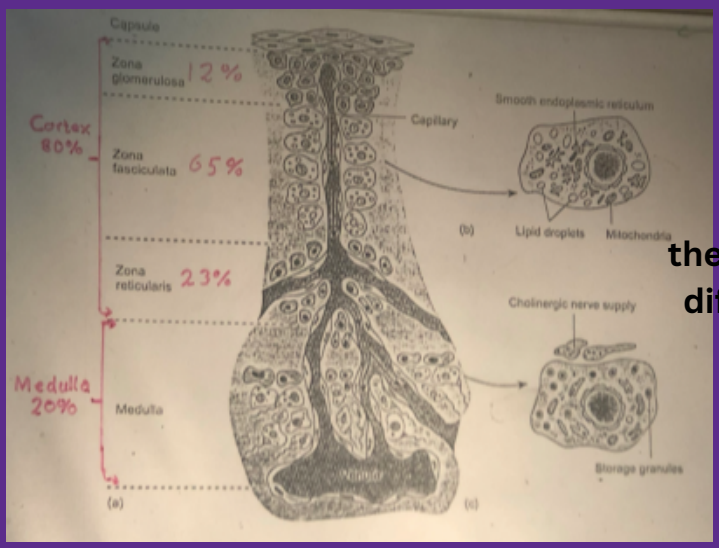
**one should be sufficient , blood supply directly from aorta , consists of cortex and medalla .**
**cortex is more important, patient can't live without it**



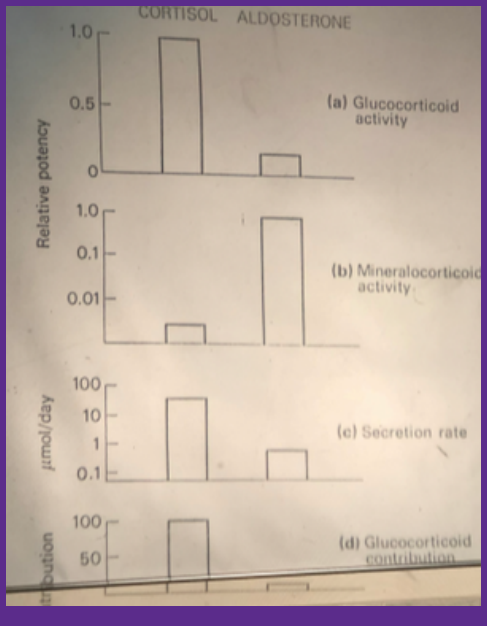

**Minerales**

**cortisol & androgen**

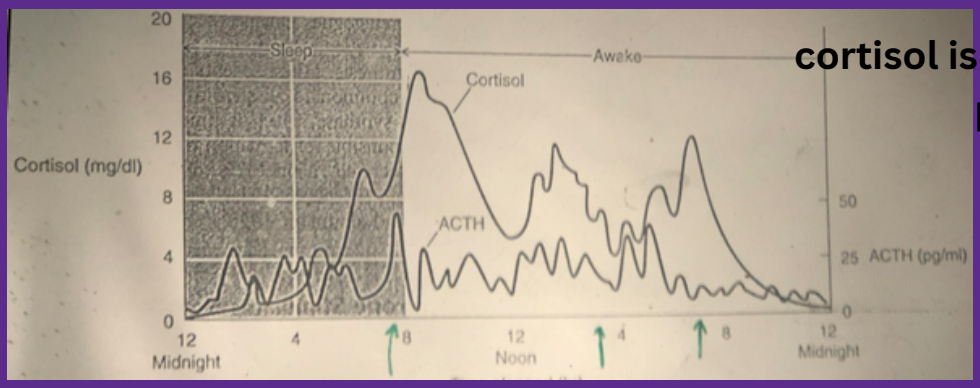
**adrenal gland gets stimulated by ACTH from pituitary gland**




**the zona of reticularis does not fully differentiated until 6-8 years old .**




**A comparison of cortisol and of aldosterone. Glucocorticoid activity was measured as ability to increase glycogen in the liver: cortisol is very potent in this assay Mineralocorticoid effects were measured in terms of the ability to reduce the ratio of the excretion of sodium to the excretion of potassium in urine; aldosterone is much more potent However, since the rate of secretion of cortisol is much higher, it can have significant mineralocorticoid effects**




cortisol is more than ACTH when the person is awake .

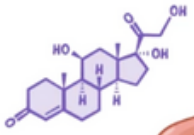
Table 5.4.2 Plasma protein binding of corticosteroids

| | Cortisol (%) |
|---|---|
| Corticosteroid-binding protein (CBG) | 90 |
| Albumin | 6 |

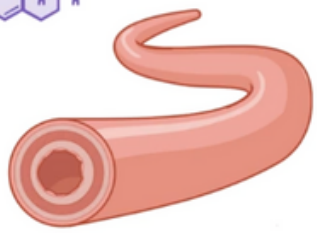
cortisol work freely , so depending on the image there is 4% are free and making effect

magic drug

# CORTISOL



* STRESS HORMONE
  - ↳↑ GLUCONEOGENESIS
  - ↳PROTEOLYSIS
  - ↳LIPOLYSIS
  - –MAINTAIN BLOOD PRESSURE
    - CATECHOLAMINES - EPINEPHRINE & NOREPINEPHRINE
    - NARROWS BLOOD VESSEL LUMEN
  - –DAMPENS INFLAMMATORY & IMMUNE RESPONSE
    - REDUCE PRODUCTION and RELEASE of PROSTAGLANDINS and INTERLEUKINS
    - INHIBITS PROLIFERATION of T-LYMPHOCYTES
  - –RECEPTORS PRESENT IN BRAIN



Glucocorticoids

- Cortisol (very potent, accounts for about 95 per cent of all glucocorticoid activity)
- Corticosterone (provides about 4 per cent of total glucocorticoid activity, but much less potent than cortisol)
- Cortisone (synthetic, almost as potent as cortisol)
- Prednisone (synthetic, four times as potent as cortisol)
- Methylprednisone (synthetic, five times as potent as cortisol)
- Dexamethasone (synthetic, 30 times as potent as cortisol)

is 30times more potent one

The adrenal cortex produces stomids that regulate Na and K balance (mineralocorticoids), steroids that regulate glucose balance (glucocorticoide), and small amounts of sex steroid hormones

Table 5.4.2 Plasma protein binding of corticosteroids

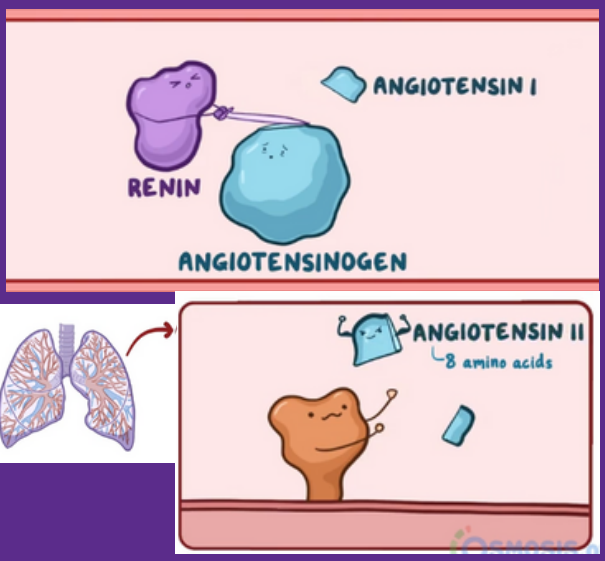
| | Aldosterone (%) |
|---|---|
| Corticosteroid-binding protein (CBG)(Transcortin) | 20 |
| Albumin | 40 |

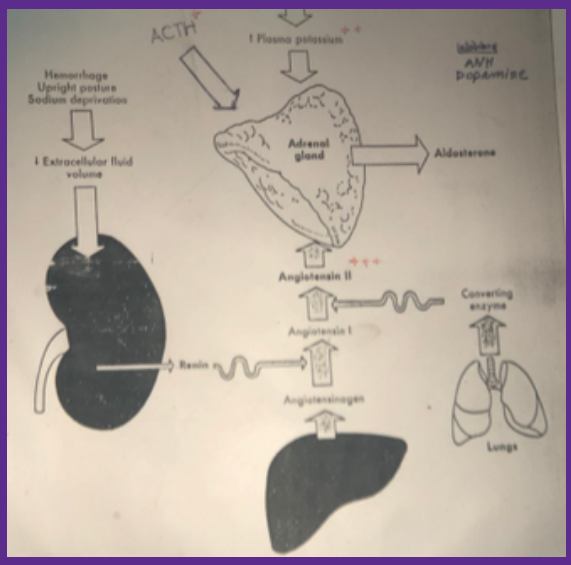
40% free in blood

Mineralocorticoids

- Aldosterone (very potent, accounts for about 90 per cent of all mineralocorticoid activity)
- Desoxycorticosterone (1/30 as potent as aldosterone, but very small quantities secreted)
- Corticosterone (slight mineralocorticoid activity)
- 9α-Fluorocortisol (synthetic, slightly more potent than aldosterone)
- Cortisol (very slight mineralocorticoid activity, but large quantity secreted)
- Cortisone (synthetic, slight mineralocorticoid activity)

## Renin-angiotensin-aldosterone system



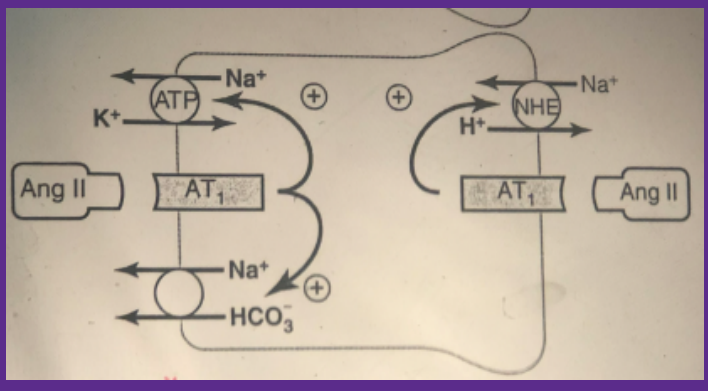




angiotensin II formation increases associated with low blood pressure and/or low extracellular fluid volume, such as during hemorrhage or Joss of salt and water from the body fluide by excessive sweating or severe diarrhea , he increased formation of angiotensin II helps to return blood pressure and extra cellular volume toward normal by increasing sodium and water reabsorption from the renal tubules through three main effects

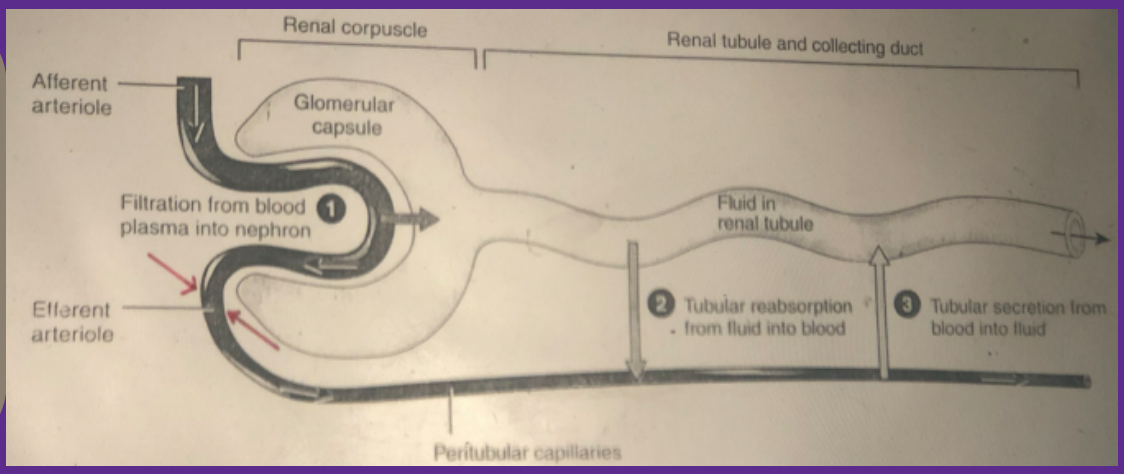
1. Angiotensin II stimulates aldosterone secretion, which in turn increases sodium reabsorption
2. Angiotensin constructs the offerent arterioles, which has two effects on peritubular capillary dynamies that increase sodium and water reabsorption

**direct :**

effect angiotensin II (AngII) to increase proximal tubular sodium reabsorption. Ang II stimulates sodium sodium-hydrogen exchange (NHE) on the luminal membrane and the sodium-potassium ATPase transporter as well as sodium-bicarbonate co-transport on the basolateral membrane



indirect :
Sodium excretion rises, there is a fall in blood-pressure, and plasma concentrations of angiotensin II (AII) and aldosterone are reduced.




## aldosterone affects : slaivary glands , sweat glands , intestants and renal tubules

**Androgens & Estrogens**

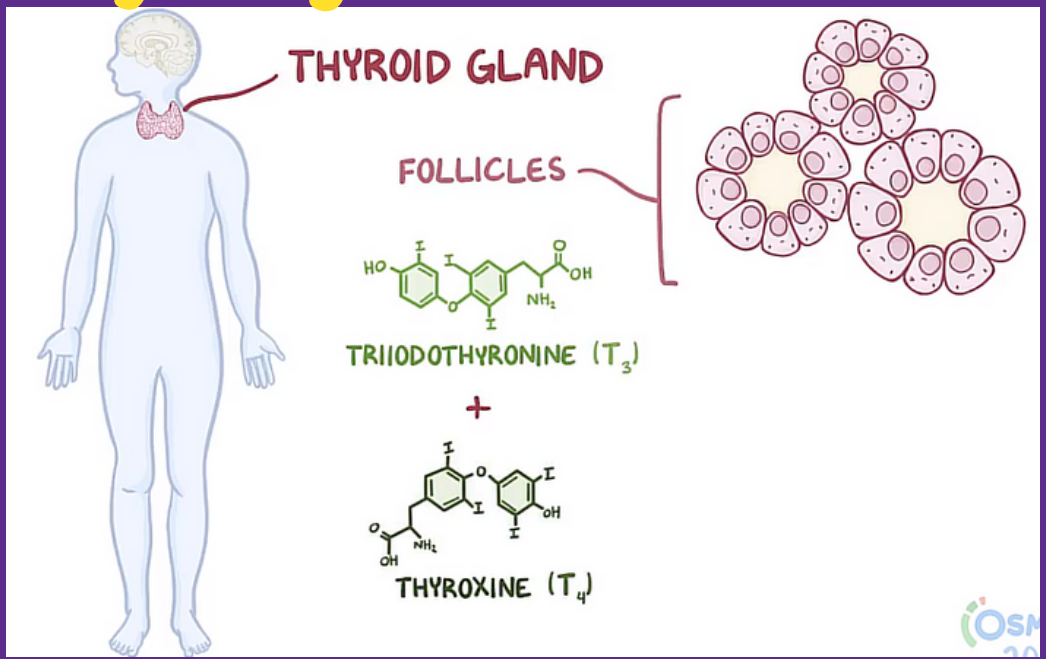
- Weak androgens:
- dehydroepiandrosterone
- androstenedione
- Strong androgens:
- Testosterone
- Dihydrotestosterone (the strongest)
- Estrogens:
- Estradiol
- Estrone
- Estriol

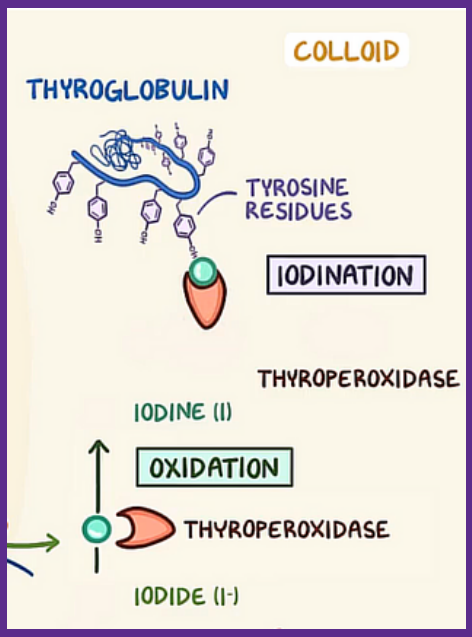
**Androgens Function**

- In males → Secondary sexual characteristics & Spermatogenesis
- *In females → pubic & axillary hair, libido*

Adrenal androgens are more important in females because in males, they are secreted also by the testes

# thyroid gland



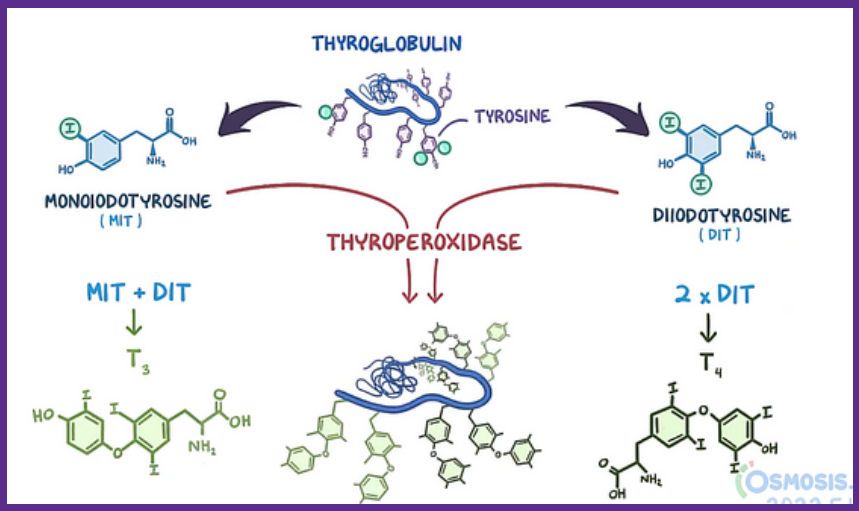



Once iodide is in the colloid, it undergoes oxidation with the enzyme thyroperoxidase, which changes it into an iodine atom.

It's then attached to tyrosine amino acid residues which are found throughout thyroglobulin.

This process is called iodination.

Some tyrosine residues are bound by only one iodine, whereas others are bound by two iodine atoms, yielding monoiodotyrosine or MIT, and diiodotyrosine or DIT, respectively.
These molecules are then linked together by thyroperoxidase.



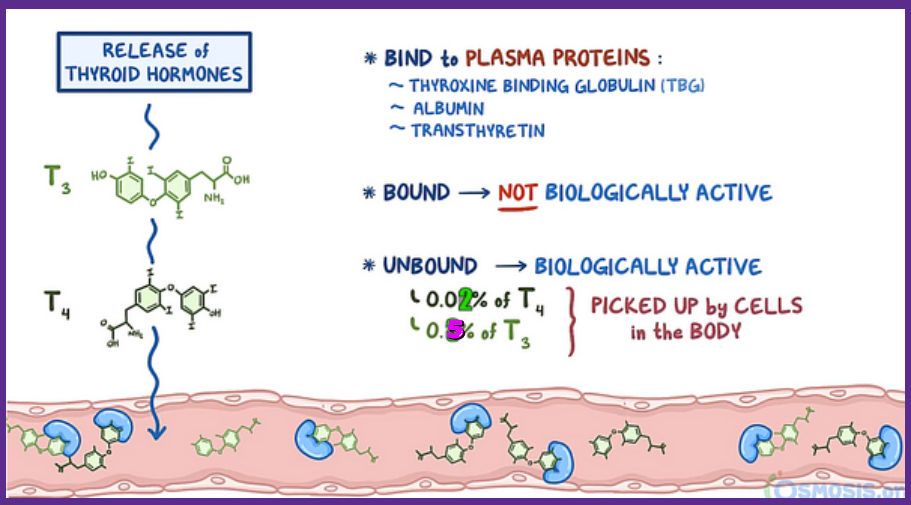

Linking one MIT with one DIT creates T3, while linking two DIT molecules creates T4 - and both T3 and T4 remain bound to thyroglobulin.

You see - thyroglobulin basically serves as a peptide that stores these hormones on it in the colloid, until it's ready to be used. T4 is created in greater amounts than T3.

Once released from the thyroid gland, T3 and T4 enter the blood and bind to circulating plasma proteins - the most important one being thyroxine binding globulin or TBG, but they also bind to albumin and transthyretin.

Bound T3 and T4 acts like a reservoir of hormone that's not biologically active.

In fact, only a small amount of T3 and T4 will travel unbound in the blood - about 0.02% of T4 and 0.5% of T3 - and this fraction is biologically active, which means that this is what gets picked up by virtually every cell in the body.




from slide num 18

https://quizlet.com/_cek8qv?x=1jqt&i=4golfd

**good luck**