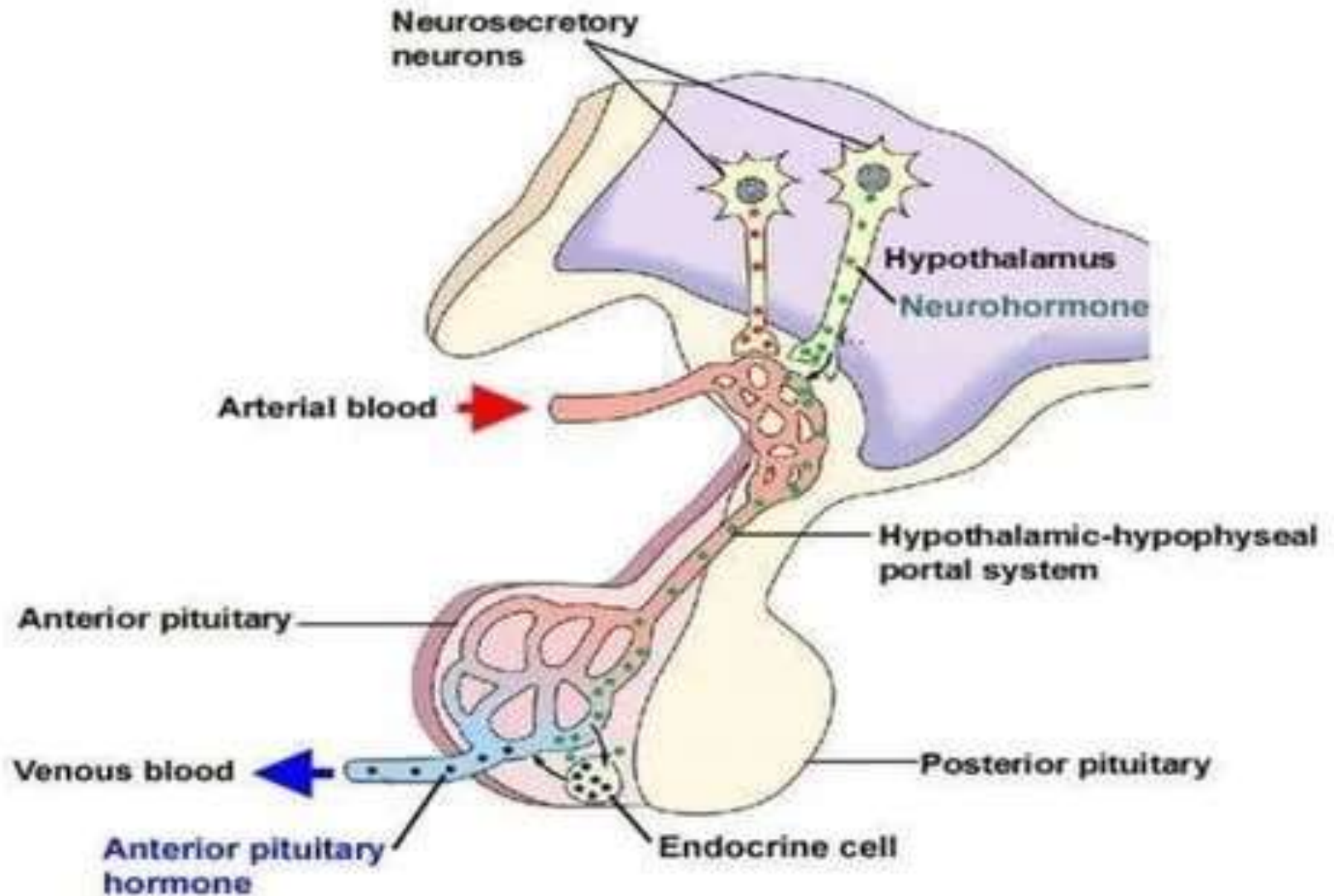


Hormones of Pituitary Gland

Pituitary Gland



HORMONES:

Anterior lobe:

- ✗ Growth hormone (GH)
- ✗ Prolactin
- ✗ Thyroid stimulating hormone (TSH)
- ✗ Adrenocorticotrophic hormone (ACTH)
- ✗ Follicle stimulating hormone (FSH)
- ✗ Luteinizing hormone (LH)

Intermediate lobe:

- A and B melanocyte stimulating hormone

Posterior lobe:

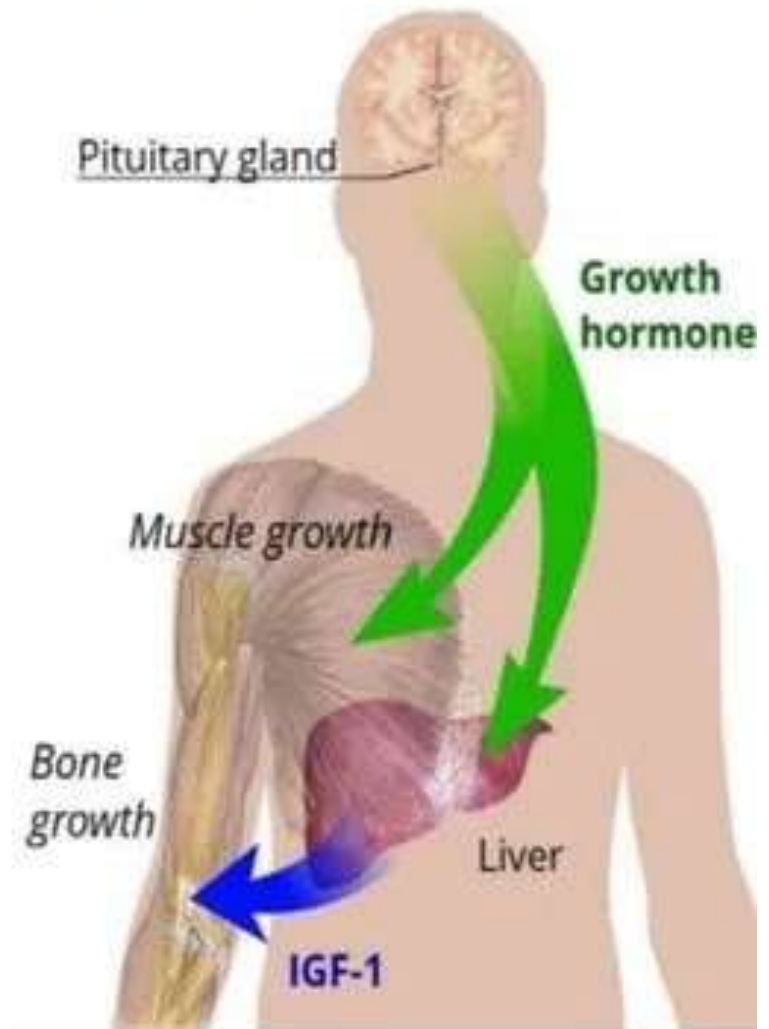
1. Vasopressin (ADH)
2. oxytocin



GROWTH HORMONE (GH):

Action of growth hormone

1. Stimulating of growth of bones, cartilage and connective tissue:
 - ✘ *Somatomedins* are synthesized in the liver, in response to stimulation by the GH
 - ✘ The effects of GH on skeletal growth are mediated by *somatomedins*



action of GH continue...

2. Effect on Protein and Mineral Metabolism:

- ✘ **On protein metabolism**: GH is protein anabolic hormone.
- ✘ **On mineral metabolism**:
 - Increase calcium absorption from GIT
 - Decrease sodium, potassium, calcium and phosphorous excretion from kidney



action of GH continue...

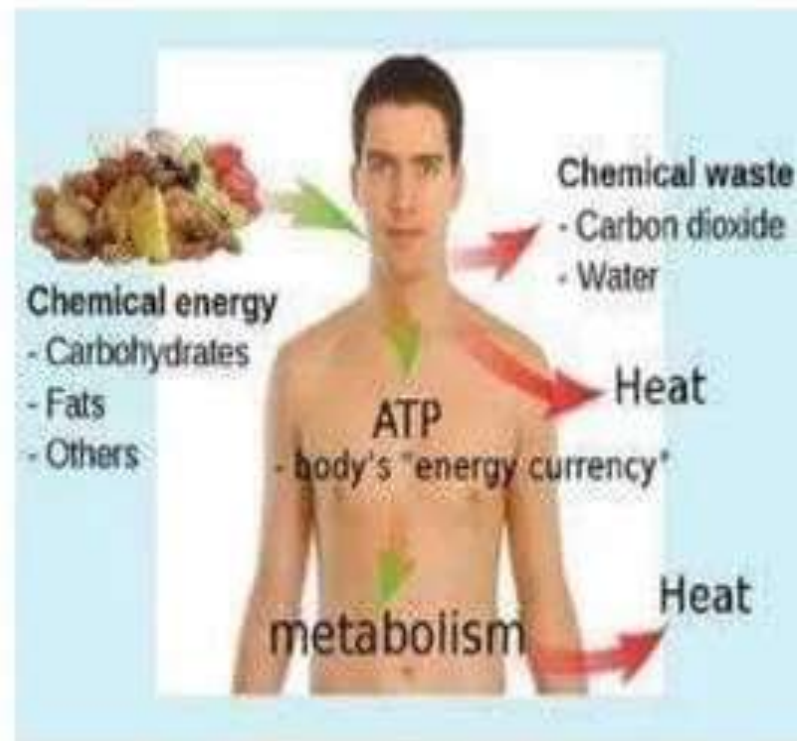
3. Effect on carbohydrate and fat metabolism:

✦ On carbohydrate-

GH is diabetogenic, because it produce *hyperglycemia*

✦ On fat metabolism-

GH has catabolic effect i.e. Increases mobilization of fats from adipose tissues



CONTROL OF GROWTH HORMONE

The release of GH is primary under the control of two hypothalamic hormones:

- *GH releasing hormone*
- *GH inhibiting hormone*

Stimuli increases GH

Secretions by stimulating GHRH release. E.g. during *exercise* and *stress*

Stimuli decrease GH secretion by release of **GHIH** also called **Somatostatin**



DISEASES RELATED TO GROWTH HORMONE

1. Gigantism: It is due to *overproduction of GH* during adolescence.

It is characterized:

- ✘ Tall stature
- ✘ Bilateral gynaecomastia.
- ✘ Large hand and feet.



diseases continue...

- ✦ **Acromegaly**: It is due excessive secretion of GH during adulthood

It is characterized by:

- Broad, thick nose
- Thickening of the skin
- Prominent brow
- Pronathism: elongation and widening of the mandible



diseases continue...

3. Dwarfism: Deficiency of GH secretion.

- Shortness of stature
- Small genitalia
- Delicate extremities.



Hormones of anterior pituitary continue...

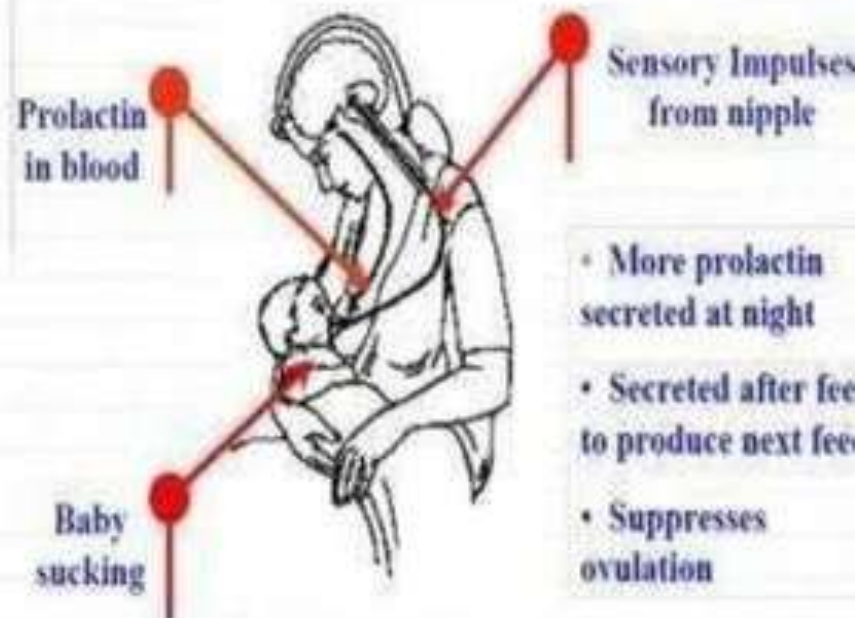
2. Prolactin:

Actions of prolactin:

- ✦ Prolactin plays an important role in the development of the mammary gland and in milk synthesis.

Breastmilk Production

The Prolactin reflex



prolactin continue...

Control of prolactin secretion:

A. Stimulating factors:

They act via stimulating
Prolactin releasing factor.
e.g. Exercise, emotional
stress, pregnancy and
breast feeding.



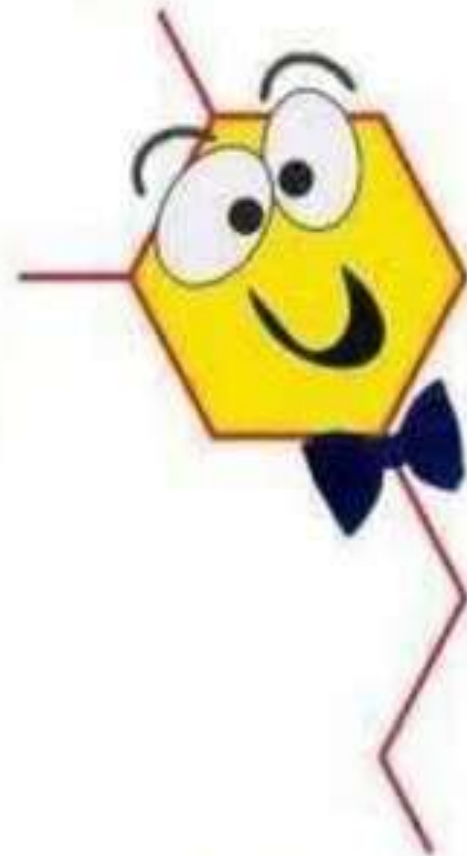
continue...
COUCIUNG...

B. Inhibitory factors:

which is released by the
hypothalamus

inhibits prolactin secretion
from the **anterior pituitary**

Dopamine may be the main
prolactin inhibiting factor.



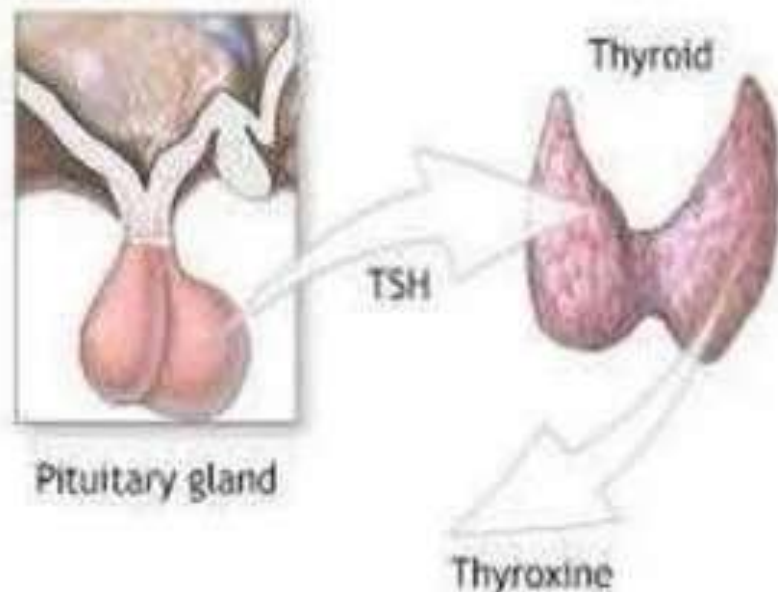
Dopamine

Hormones of anterior pituitary continue...

3. Thyroid-stimulating hormone (TSH) :

It stimulates the thyroid gland to produce:

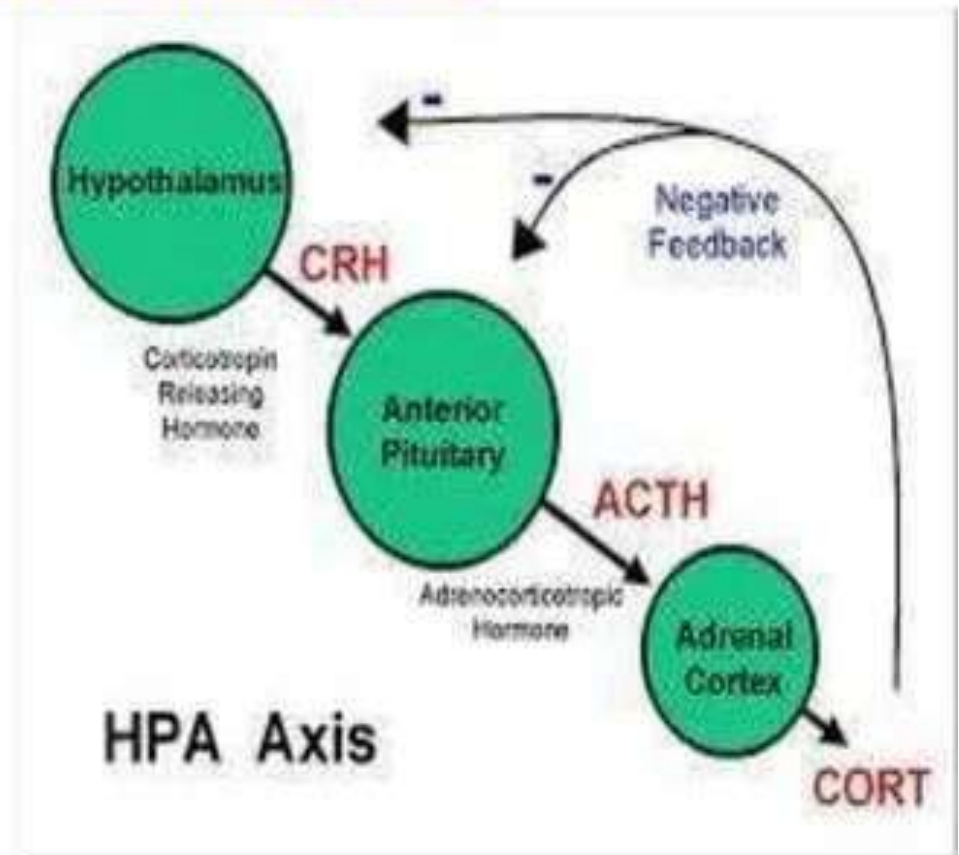
- Thyroxin (T_4), and
- Triiodothyronine (T_3)



Hormones of anterior pituitary continue...

4. ADRENOCORTICOTROPIC HORMONE (ACTH):

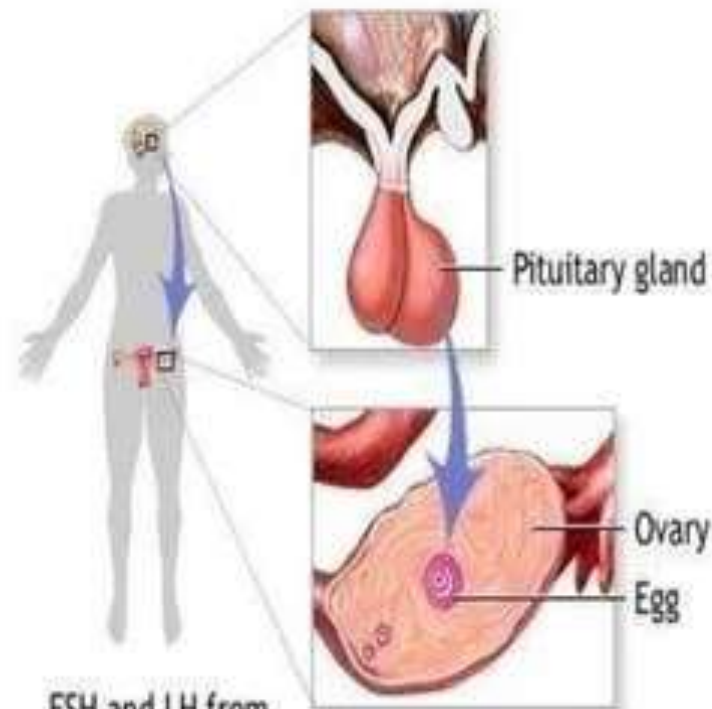
- ✘ It is secreted by the anterior pituitary gland.
- ✘ It is often produced in response to biological stress.
- ✘ Its principal effects are increased production and release of corticosteroids.



Hormones of anterior pituitary continue...

5. FOLLICLE STIMULATING HORMONE(FSH):

- It is synthesized and secreted by anterior pituitary gland
- FSH regulates the development, growth, pubertal maturation and reproductive processes of the body

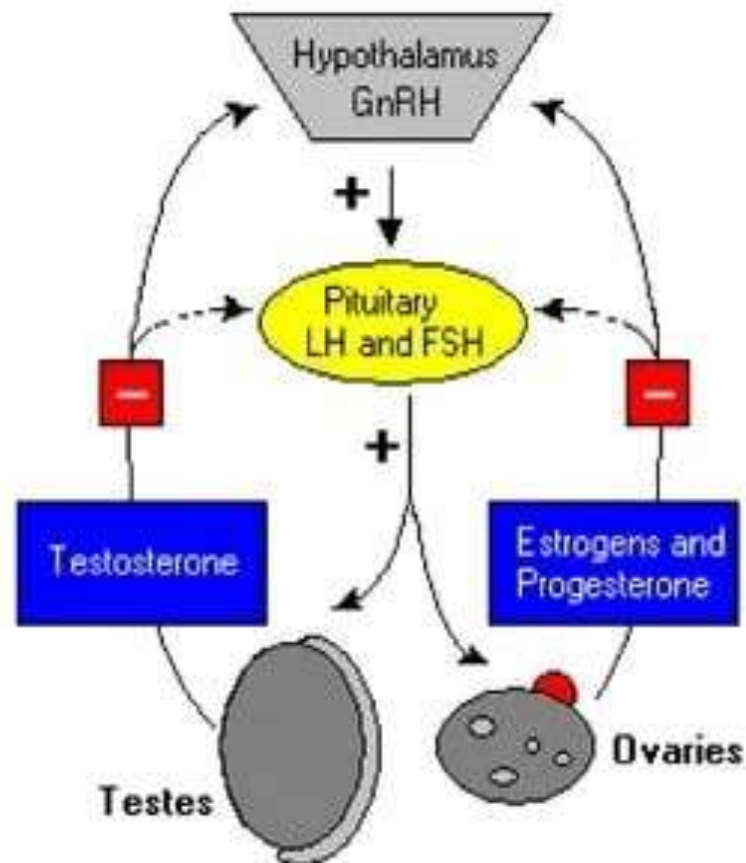


FSH and LH from pituitary gland cause egg to mature

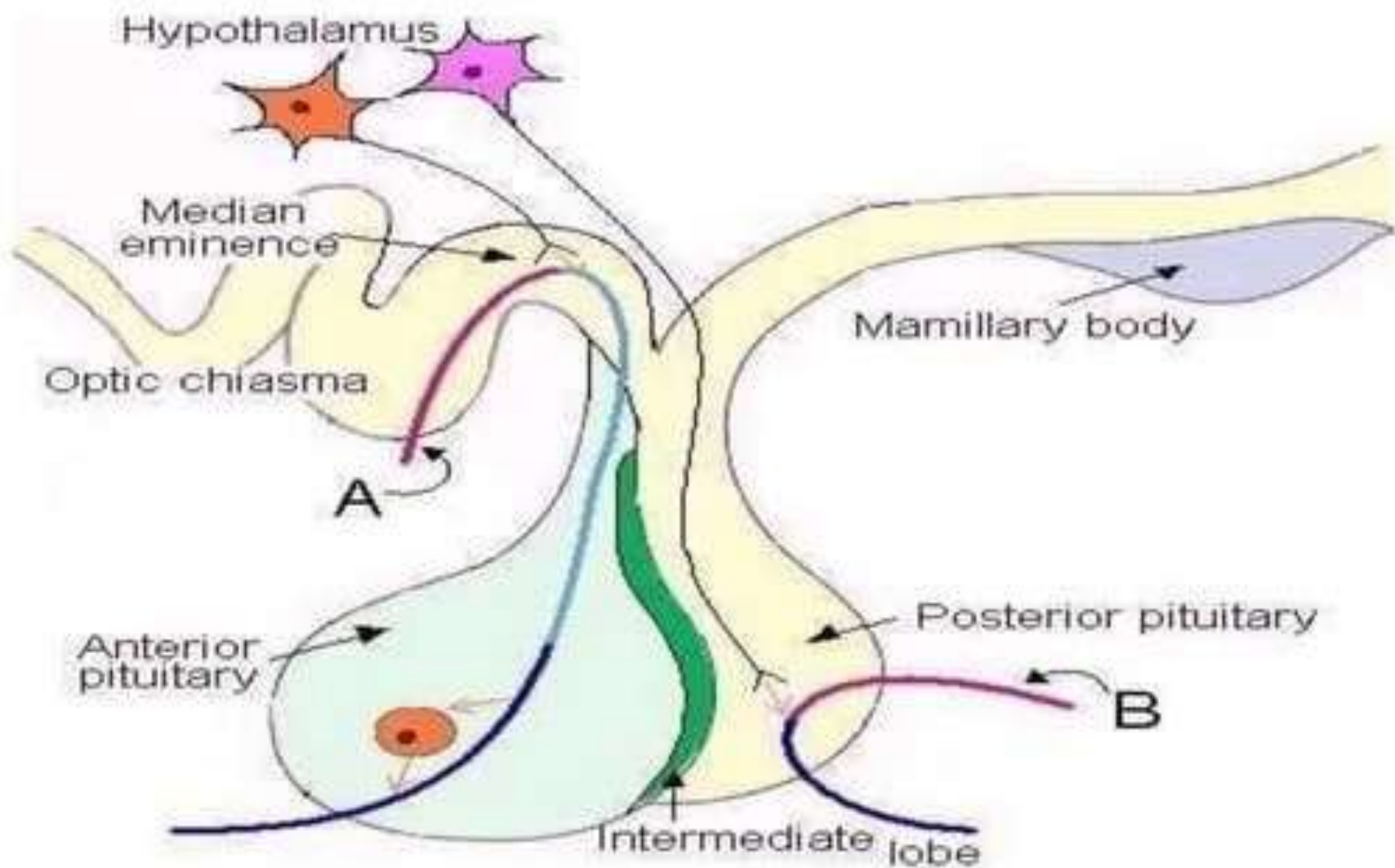
Hormones of anterior pituitary continue...

6. LUTEINIZING HORMONE(LH):

- It is a hormone produced by the anterior pituitary gland.
- In females, an acute rise of LH triggers ovulation and development of the corpus luteum
- In males, it stimulates the production of testosterone



INTERMEDIATE LOBE



intermediate lobe continue...

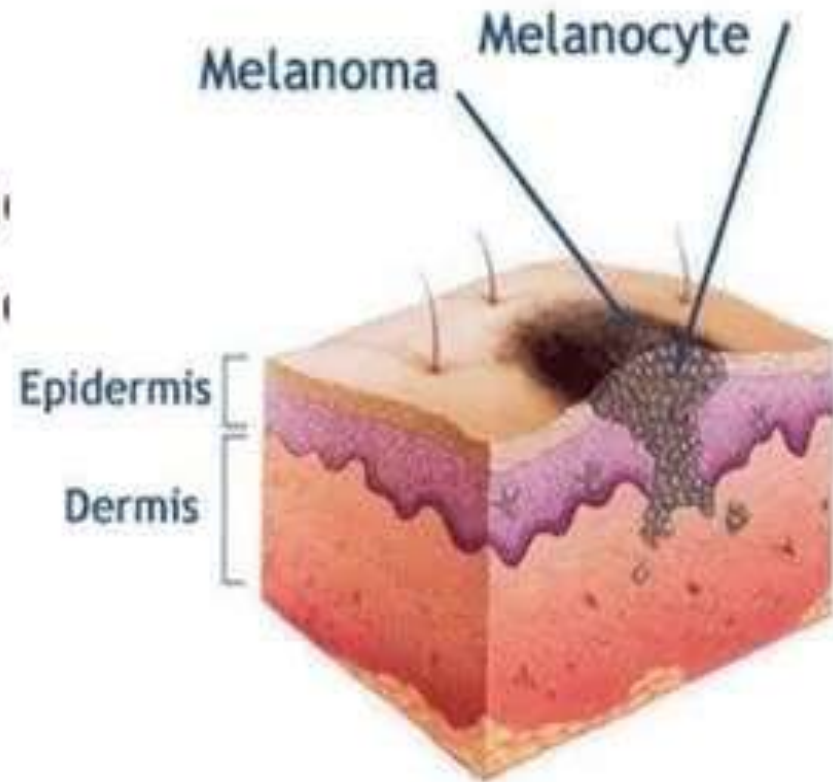
HORMONES OF INTERMEDIATE LOBE:

It secretes:

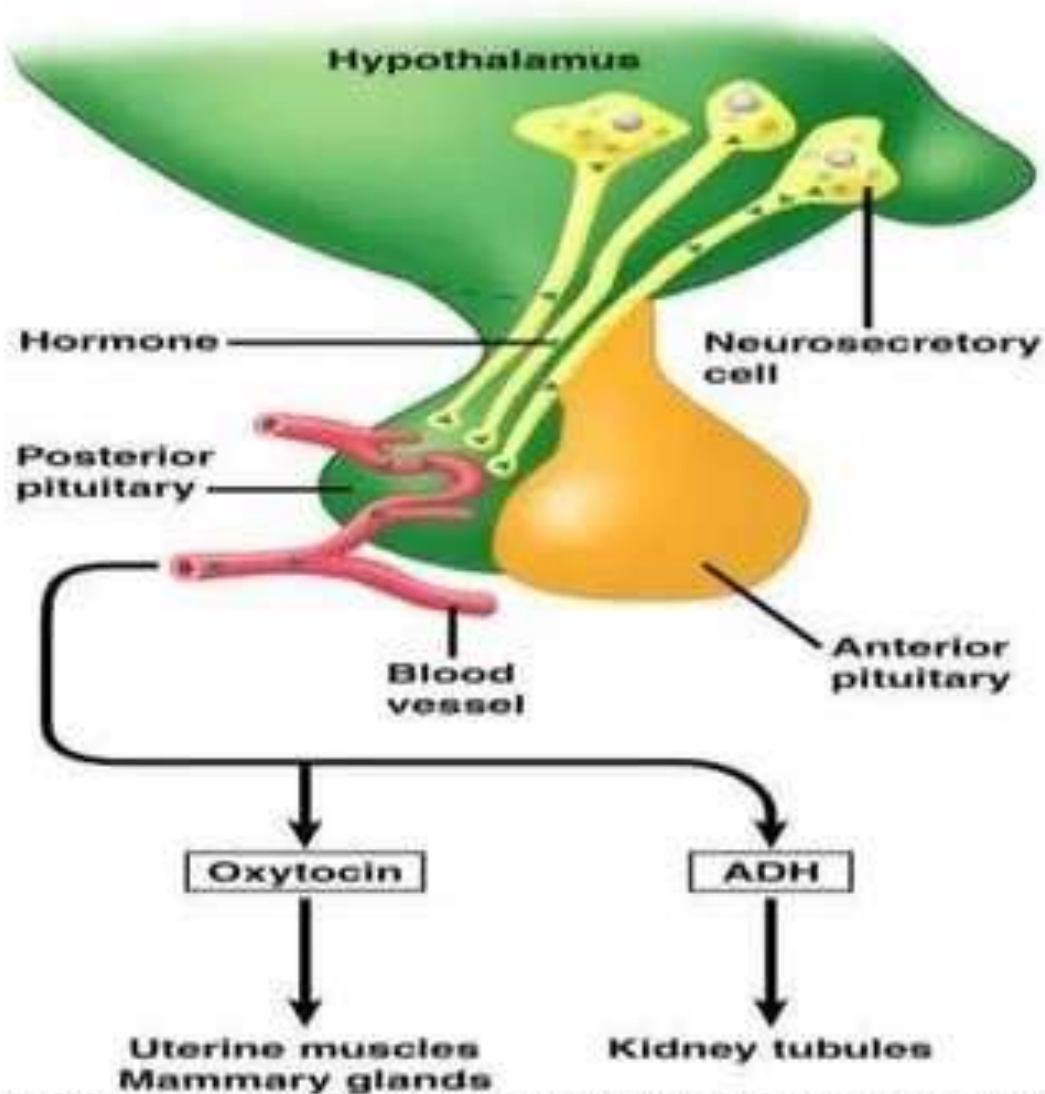
- α melanocyte stimulating hormone
- β melanocyte stimulating hormone

Function:

- They stimulate the production of melanin by melanocytes in skin and hair
- MSH signals to the brain have effects on **appetite** and **sexual arousal**.



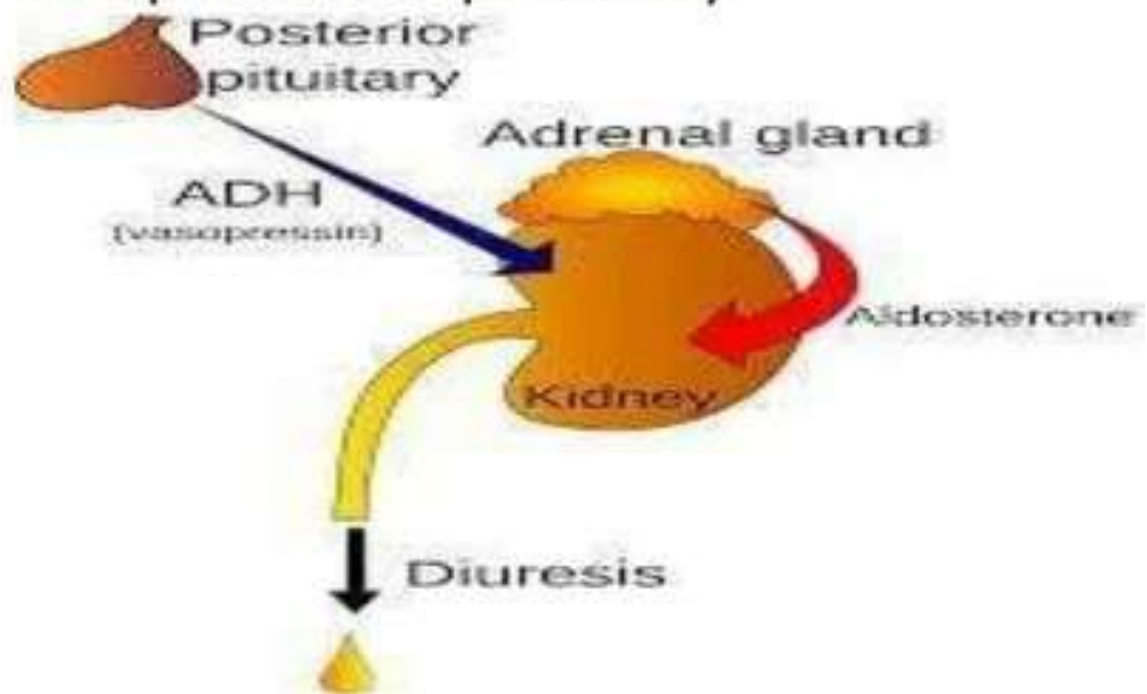
POSTERIOR PITUITARY:



HORMONES OF POSTERIOR PITUITARY:

A. Anti-diuretic hormone (ADH) / vasopressin:

- It is a hypothalamic hormone synthesized in the cells of the *supra optic nucleus*
- ADH is stored in the posterior pituitary

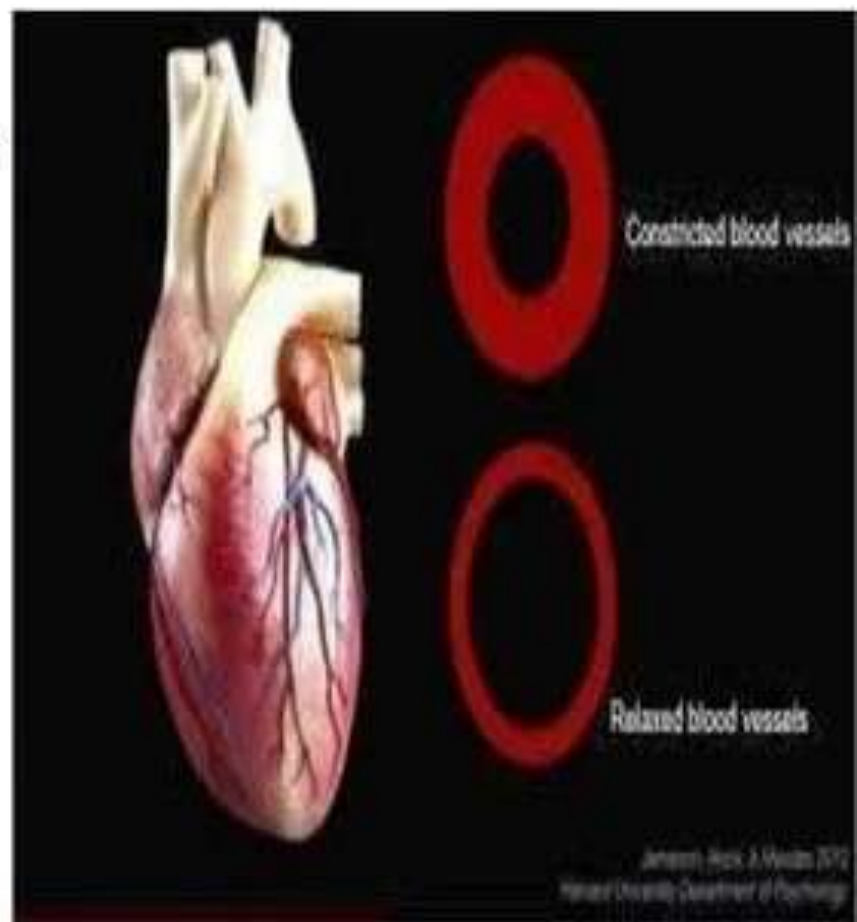


ADH continue...

Functions of ADH:

Its two primary functions-

- To retain water in the body
- To constrict blood vessel.



DISEASES RELATED TO ADH:

➤ **Diabetes Insipidus:**

It is a condition characterized by-

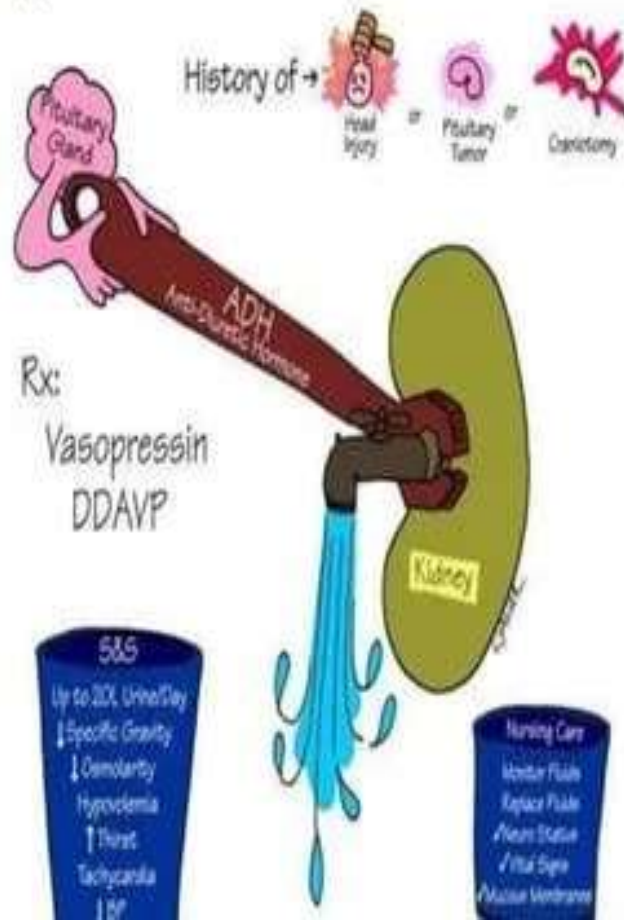
- Excessive thirst
- Excretion of large amounts of severely diluted urine



diseases continue...

➤ Polyuria:

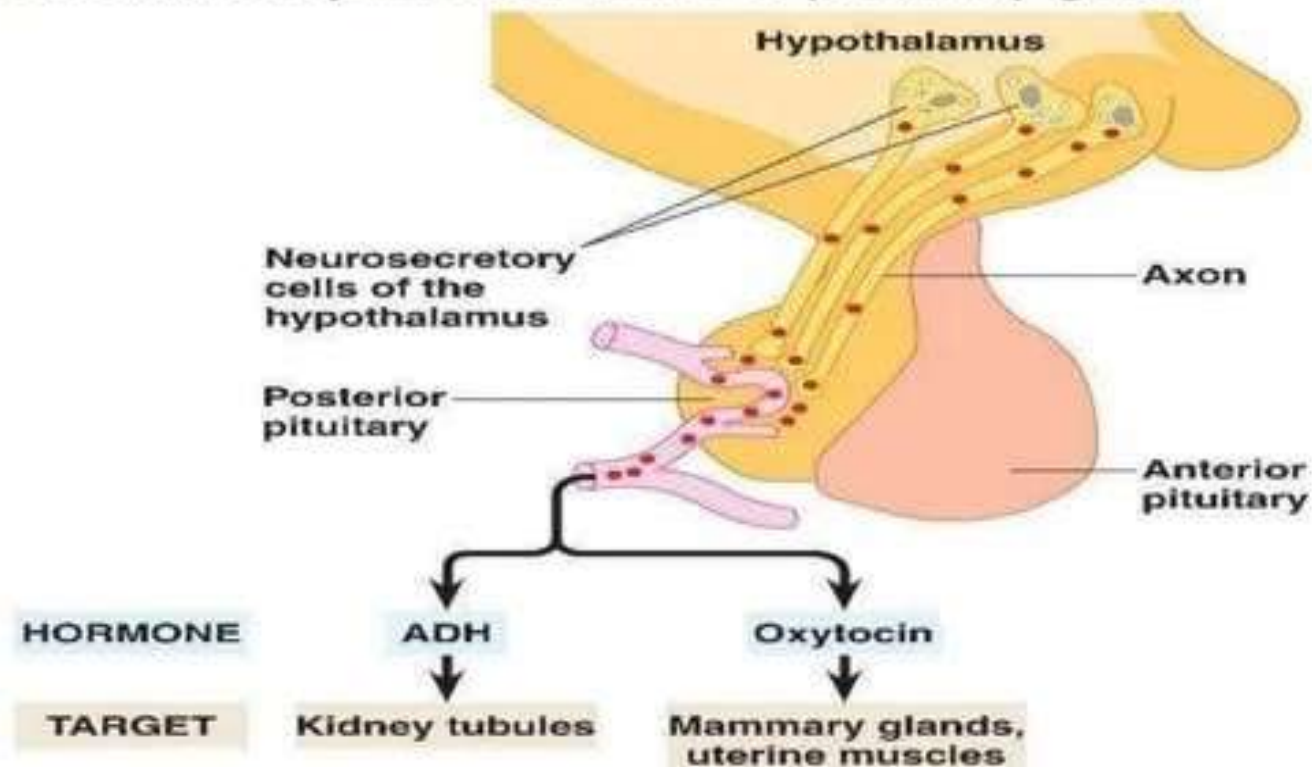
It is the excessive or abnormally large production of urine (at least 2.5 or 3L /in adults)



Hormones of posterior pituitary continue...

B. OXYTOCIN: -

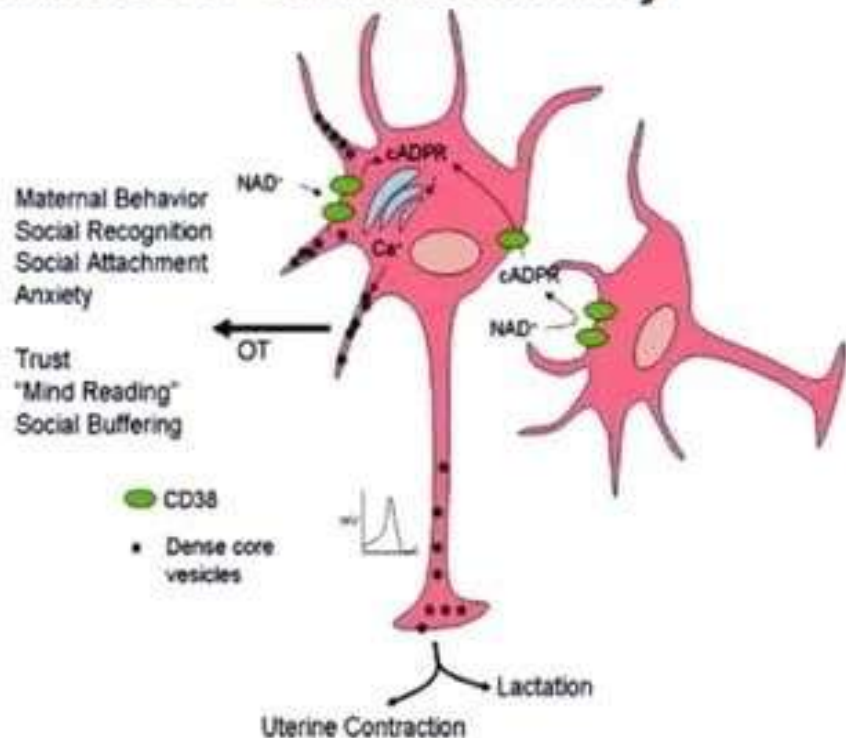
- Oxytocin is synthesized in the *hypothalamus*
- Stored in the *posterior lobe* of pituitary gland



oxytocin continue...

Action of oxytocin:

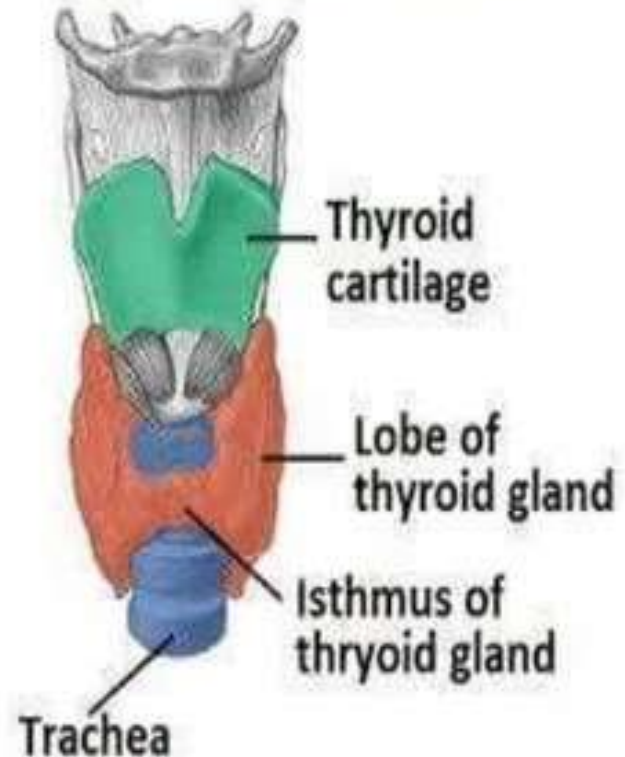
- Oxytocin stimulates **contraction** of **mammary gland** to produce milk.
- Stimulate **contraction** of the smooth muscles of the **uterus**



Thyroid gland continue...

ANATOMY OF THE THYROID GLAND: -

- The thyroid gland is situated in the **neck** in front of the **larynx** and **trachea**
- It weighs about **25g**
- It looks like butterfly in shape
- Consisting of **two lobes**
- The lobes are joined by a narrow **isthmus**



THYROID HORMONES

➤ Triiodothyronine (T₃):

It affects almost every physiological process in the body:

- Growth and development,
- Metabolism,
- Body temperature, and
- Heart rate

➤ Thyroxin (T₄):

- Controls *development* and *maturation*
- Excess thyroxin results rapid development
- Deficiency of thyroxin results in delayed development



hormones continue...

- **Calcitonin:** It is a hormone secreted by the C cells of the thyroid gland

Its main actions are :

- to increase bone calcium
- to decrease blood calcium levels



DrapeArt.com

Calcitonin opposes the effects of parathyroid hormone, which acts to increase the blood level of calcium.

Thyroid gland continue...

Thyroid is not absolutely essential for life,

but its removal **in adults** leads to :

- Poor resistance to cold
- Mental and physical slowing.

and in children's:

- Mental retardation
- Dwarfism

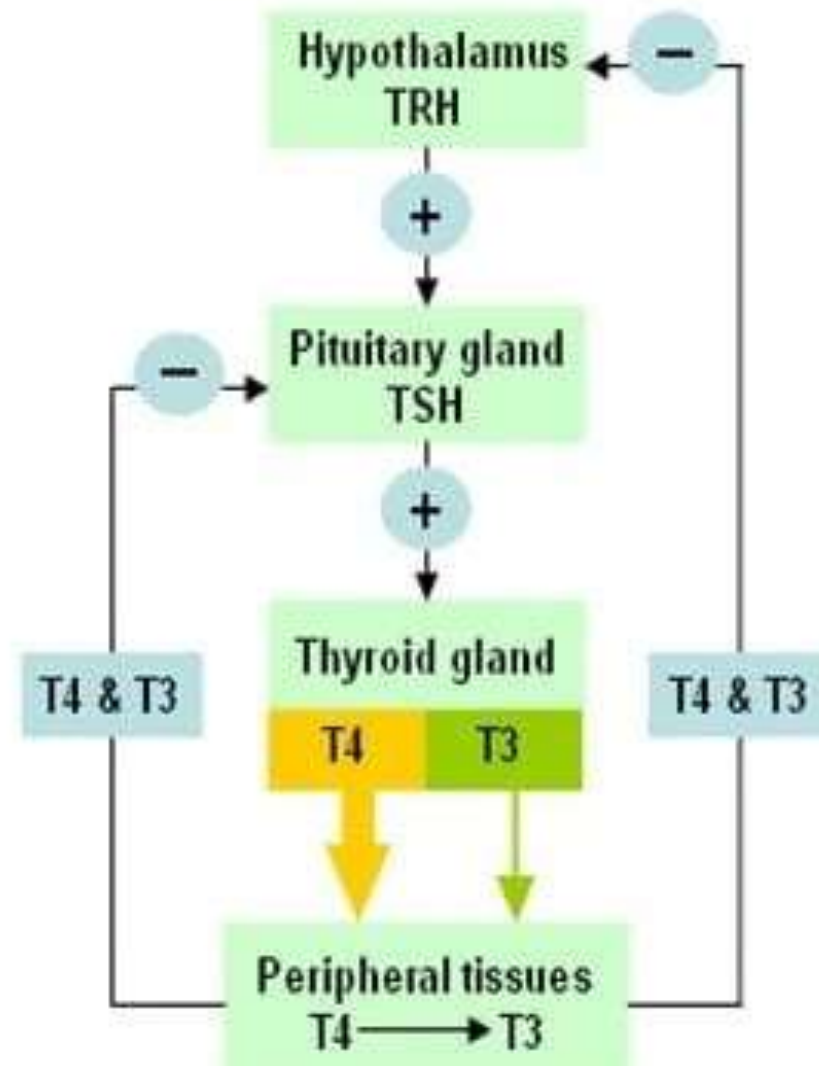


REGULATION OF THYROID SECRETION

Thyroid stimulating hormone (TSH) controls the regulation of thyroid hormones.

✓ The release of **TSH** by the anterior lobe of the pituitary, is regulated by the hypothalamus via *negative feedback mechanism*.

It is a reaction that causes a decrease in function. It occurs in response to some kind of stimulus.



DISEASES RELATED TO THYROID GLAND

1. GOITER: -

Any enlargement of the thyroid gland is called goiter
Caused by *iodine deficiency*.

Characteristic features: -

- ✘ Swelling in the neck
- ✘ Breathing difficulties
- ✘ Cough
- ✘ Hoarseness
- ✘ Swallowing difficulties



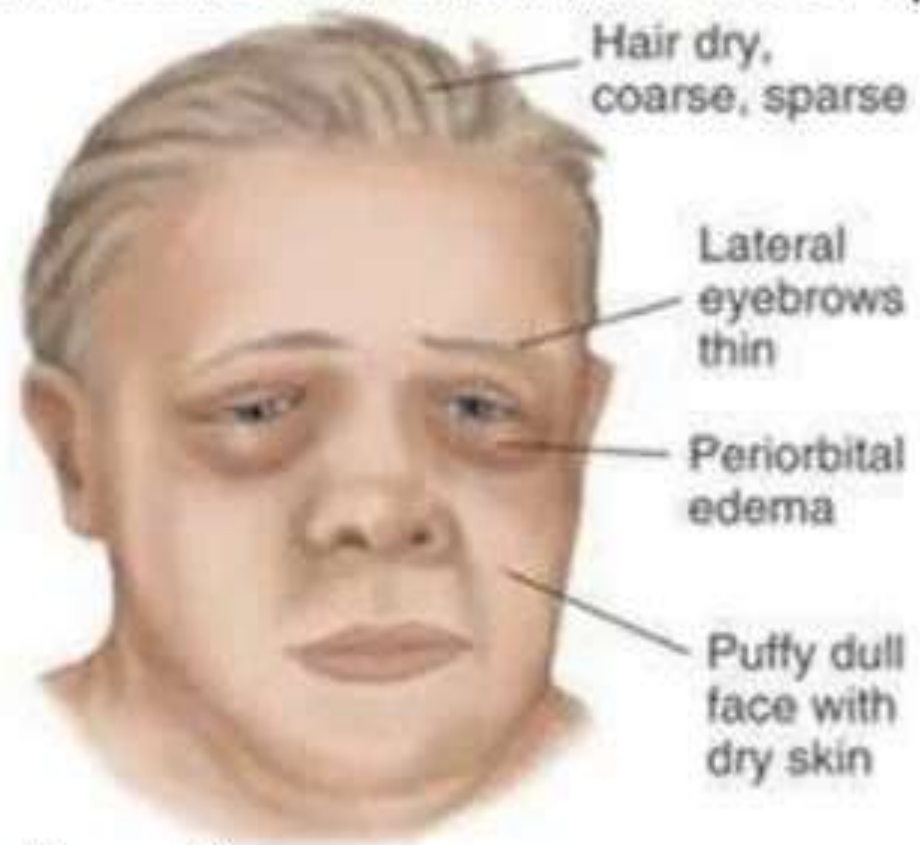
diseases continue...

2. HYPOTHYROIDISM: -

It is the condition resulting from reduced circulating levels of T_3 and T_4 .

Characteristic features: -

- ✗ Goiter
- ✗ Puffiness of face with
- ✗ Periorbital swelling
- ✗ Loss of scalp hairs
- ✗ Ptosis, i.e., drooping of upper eyelid.
- ✗ Dry, thickened, rough and yellow skin



diseases continue...

3. HYPERTHYROIDISM/GRAVES DISEASE: -

It is the condition resulting from increased circulating level of T_3 and T_4

Characteristic features: -

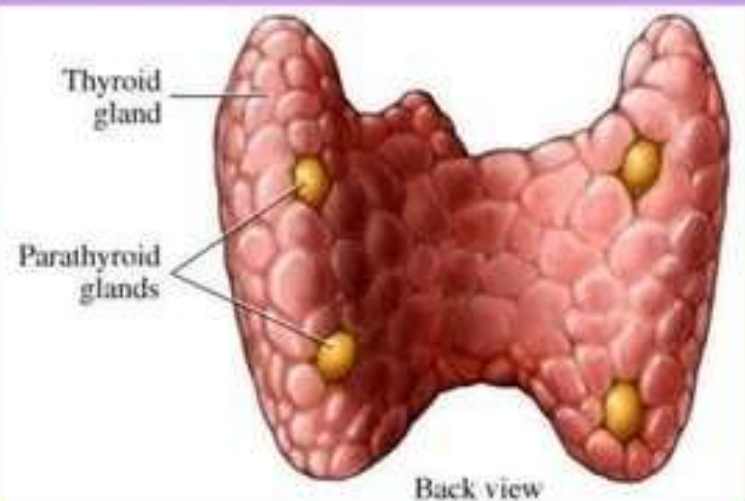
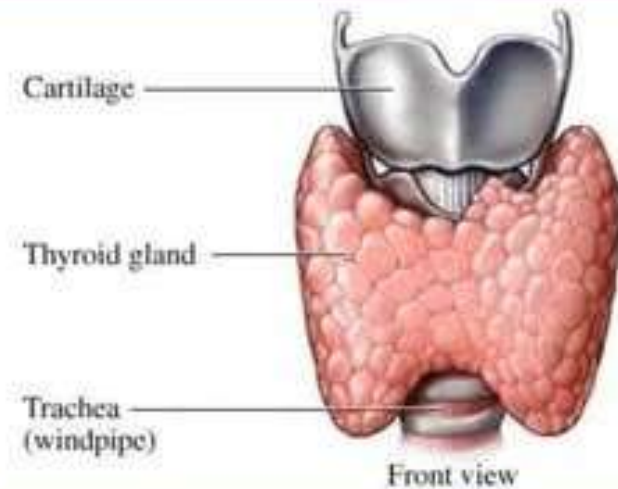
- ✘ Moderate enlargement of thyroid gland
- ✘ Exophthalmos (Lid retraction)



D. Parathyroid Gland

Secretions of the parathyroid gland...

The two pairs of parathyroid glands are located on the dorsal or back side of the thyroid gland. They secrete parathyroid (PTH) which plays a role in the metabolism of phosphorus. Too little results in cramping; too much results in osteoporosis or kidney stones.



Function

The parathyroid glands secrete parathyroid hormone (PTH, parathormone). Secretion is regulated by blood calcium levels. When they fall, secretion of PTH is increased and vice versa.

The main function of PTH is to increase the blood calcium level when it is low.

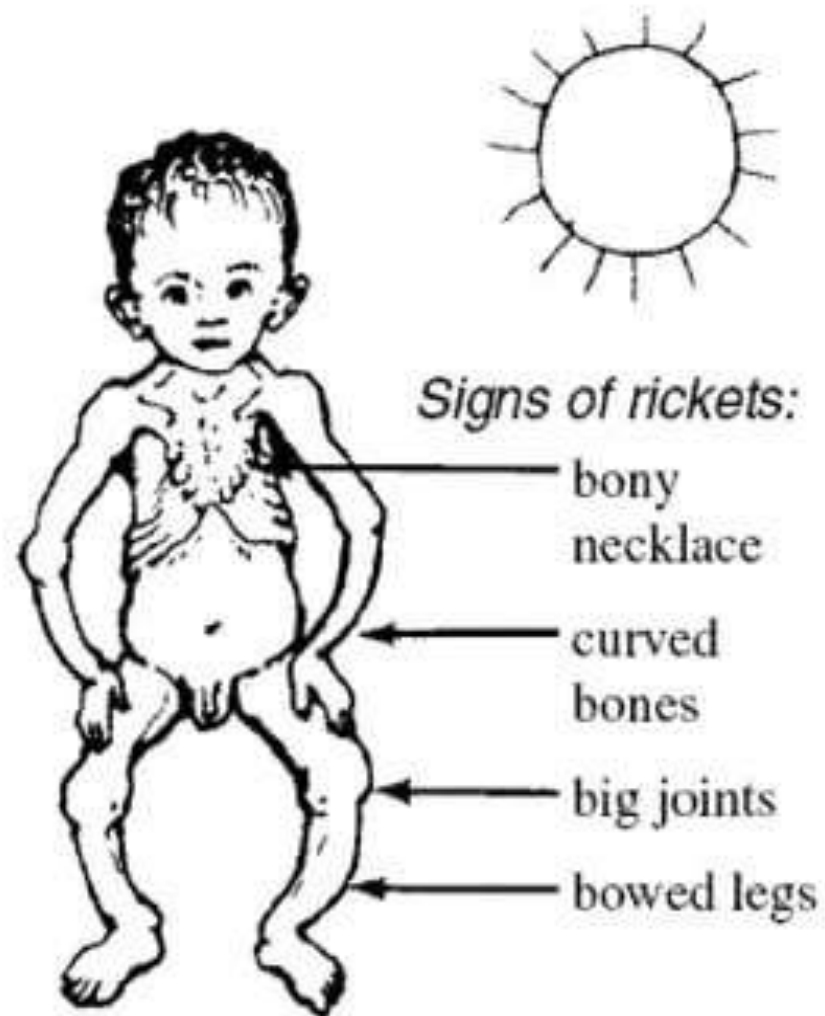
DISEASES RELATED TO PARATHYROID GLAND

1. RICKETS:

- It is a disease characterized mainly by bone deformities in young children's
- The disease of children sets in about 6th month of life

Characteristic features: -

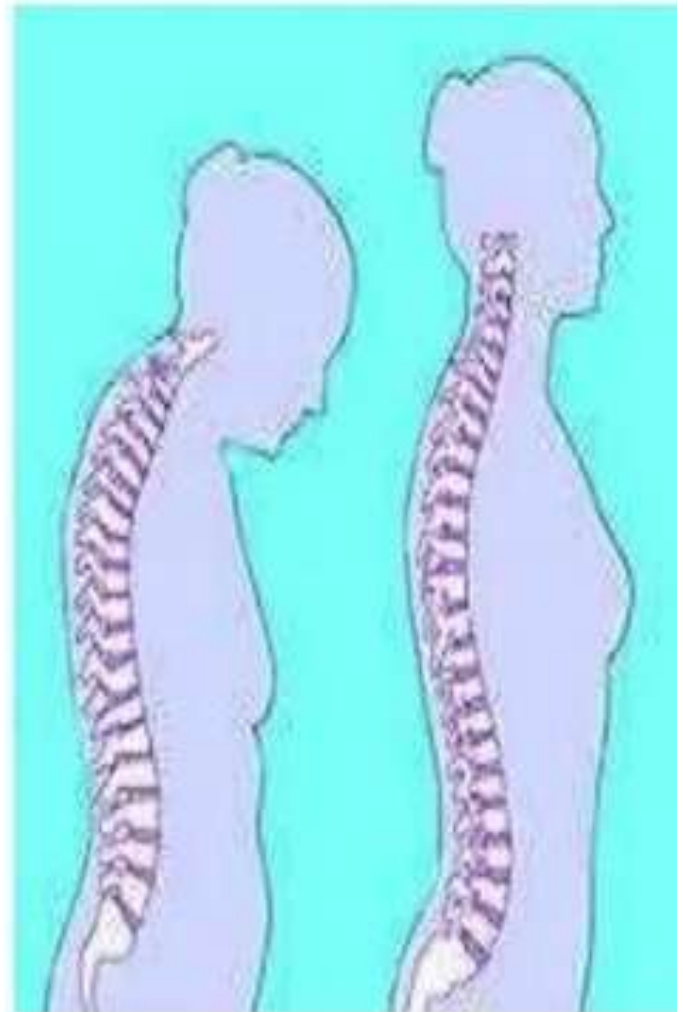
- ✓ Deformed bones
- ✓ Thick wrist and ankles
- ✓ Retarded growth



diseases continue...

2. OSTEOMALACIA: -

- This is due to *inadequate absorption of calcium* due to deficiency of *Vitamin D and Calcium* in the diet
- The disease is limited to females, usually appears *after multiple pregnancies and lactation*.



diseases continue...

3. HYPOPARATHYROIDISM:

It is an abnormally *low level of calcium* in the blood

- **Characteristic features:** -
- Psychiatric disturbance
- Par aesthesia
- Development of cataract



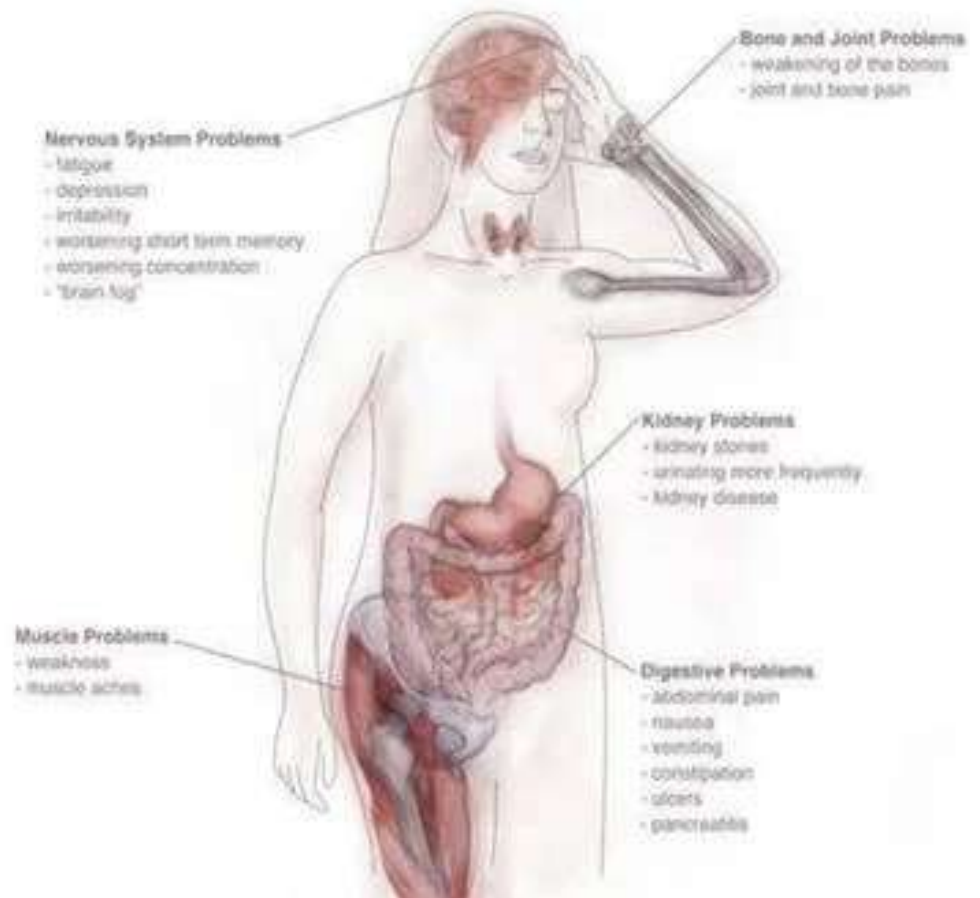
diseases continue...

4. HYPERPARATHYROIDISM: -

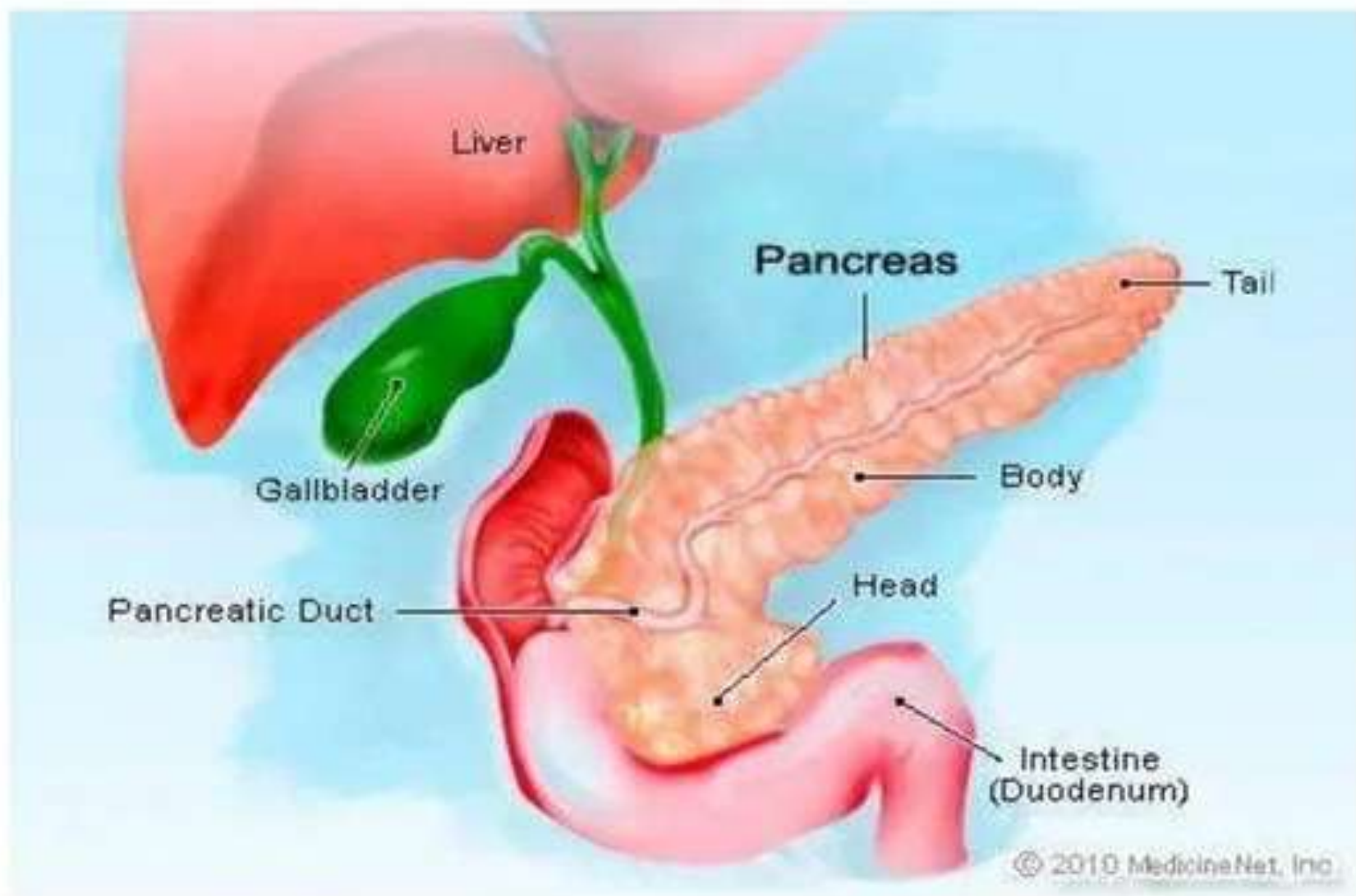
Excessive secretion of parathyroid hormone.

Characteristic features: -

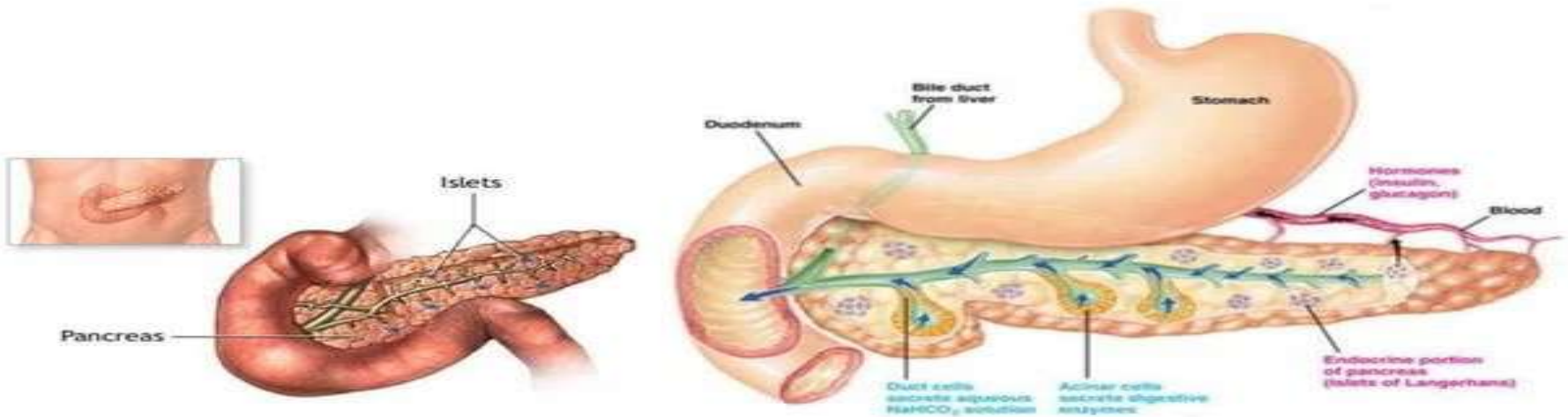
- Formation of renal calculi
- Polyuria
- Polydipsia
- Anorexia
- Muscle weakness
- General fatigue
- Calcification of soft tissue



PANCREAS



The islets of Langerhans...



The islets of Langerhans are small clusters of cells located in the pancreas.

throughout the body.

There are three main types of cells in the pancreatic islets:

α (alpha) cells, which secrete glucagon

β (beta) cells, which are the most numerous, secrete insulin

δ (delta) cells, which secrete somatostatin (GHRH)

Secretions from the islets of Langerhans...

Alpha cells facilitate the breakdown of glycogen to glucose. This elevates the blood sugar.

Delta cells suppress the release of glucagon and insulin.

Beta cells secrete the hormone insulin, which is essential for the maintenance of normal blood sugar levels. Inadequate levels result in diabetes mellitus.

Your goal is to maintain normal blood glucose levels



PANCREATIC HORMONES

1. INSULIN:

Actions:

➤ On carbohydrate metabolism:

- Insulin increases the glucose entry into most of body cells
- Insulin produce *hypoglycemia*

➤ On protein metabolism:

- Insulin promotes amino-acid uptake
- It decrease protein breakdown
- It promotes protein synthesis especially in muscles

Actions of Insulin



Modified from Clinical Biochemistry, A. Gow et al., Churchill Livingstone, Edinburgh, 1995.





DISEASES RELATED TO INSULIN: -

DIABETES MELLITUS

✘ It is a group of metabolic diseases in which there are *high blood sugar* over a prolonged period.

✘ This high blood sugar produces the symptoms of

- ✓ frequent urination,
- ✓ increased thirst, and
- ✓ increased hunger.

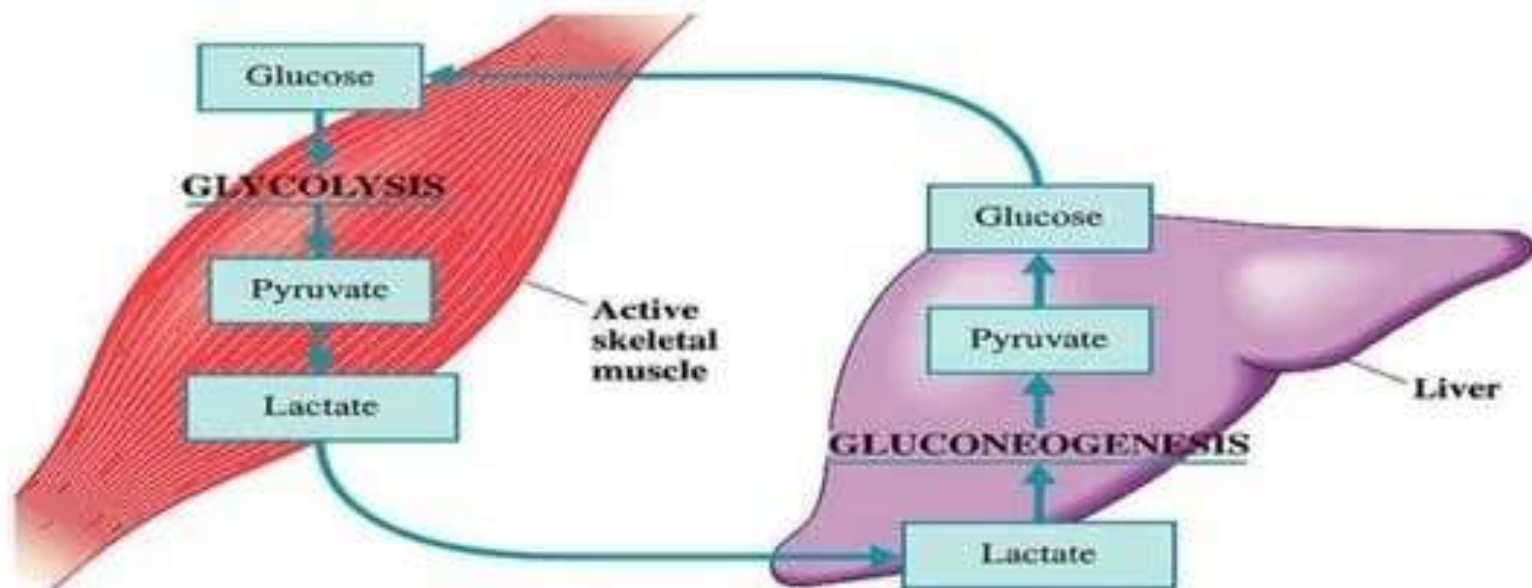
<p>Polyuria (Frequent Urination)</p> 	<p>Polydipsia (Excessive Thirst)</p> 
<p>Polyphagia (Excessive Hunger/Increased Appetite)</p> 	<p>Involuntary Weight Loss</p> 

hormones continue...

2. GLUCAGON: -

Glucagon act mostly on the *liver and adipose tissues* where it antagonizes the actions of insulin

- ✓ Stimulate glycogenolysis
- ✓ Promotes gluconeogenesis



- The normal blood glucose level is between 3.5 & 8 mmol/litre (63 to 144 mg/100 mL).
- Blood glucose levels are controlled mainly by the opposing actions of insulin & glucagon:

- **glucagon increases blood glucose levels**



- **insulin reduces blood glucose levels.**



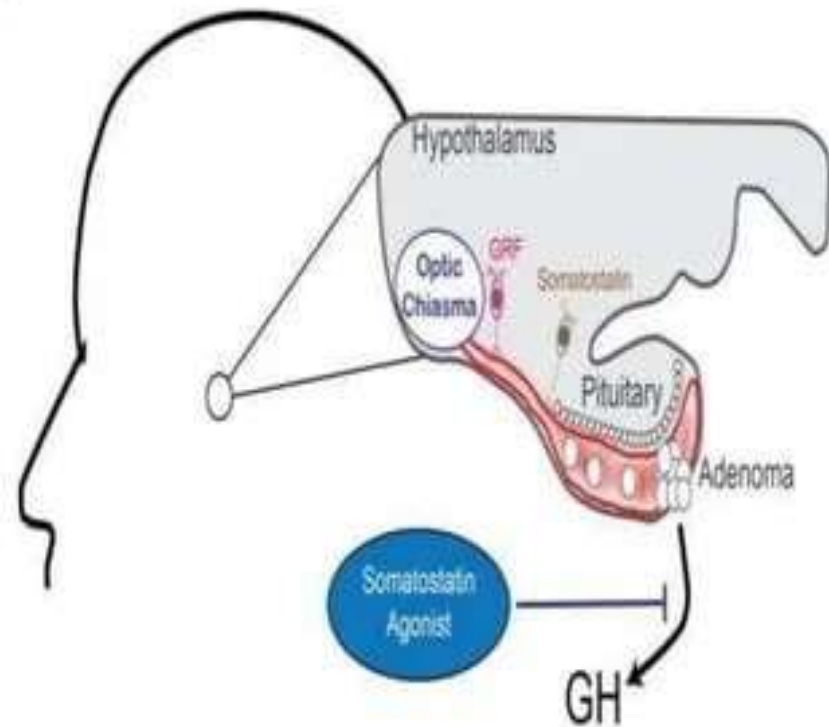
hormones continue...

3. SOMATOSTATIN:

A hormone that is widely distributed throughout the body, especially in the *hypothalamus and pancreas*

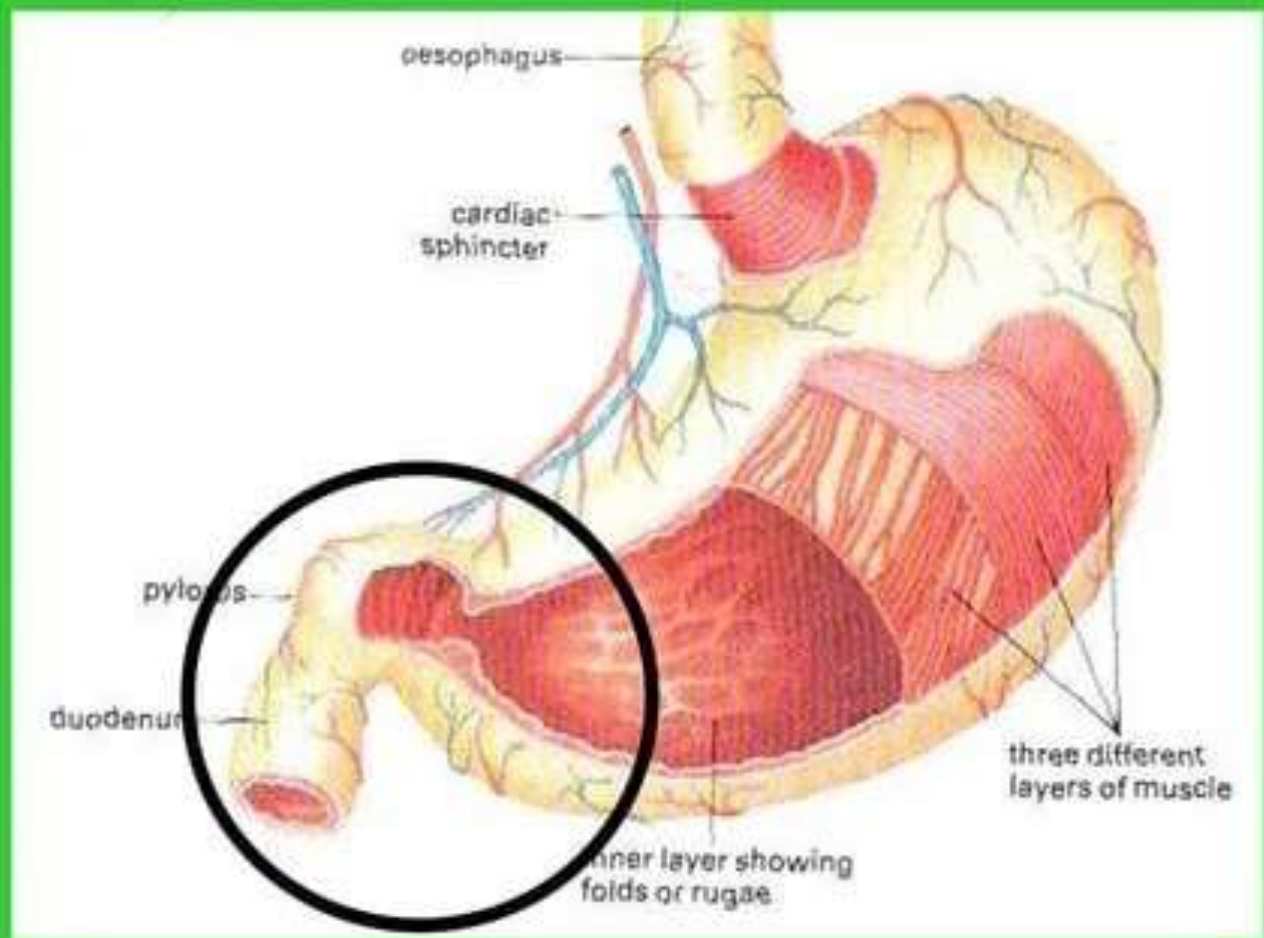
Action:

- It regulates the *endocrine and Nervous system functions*



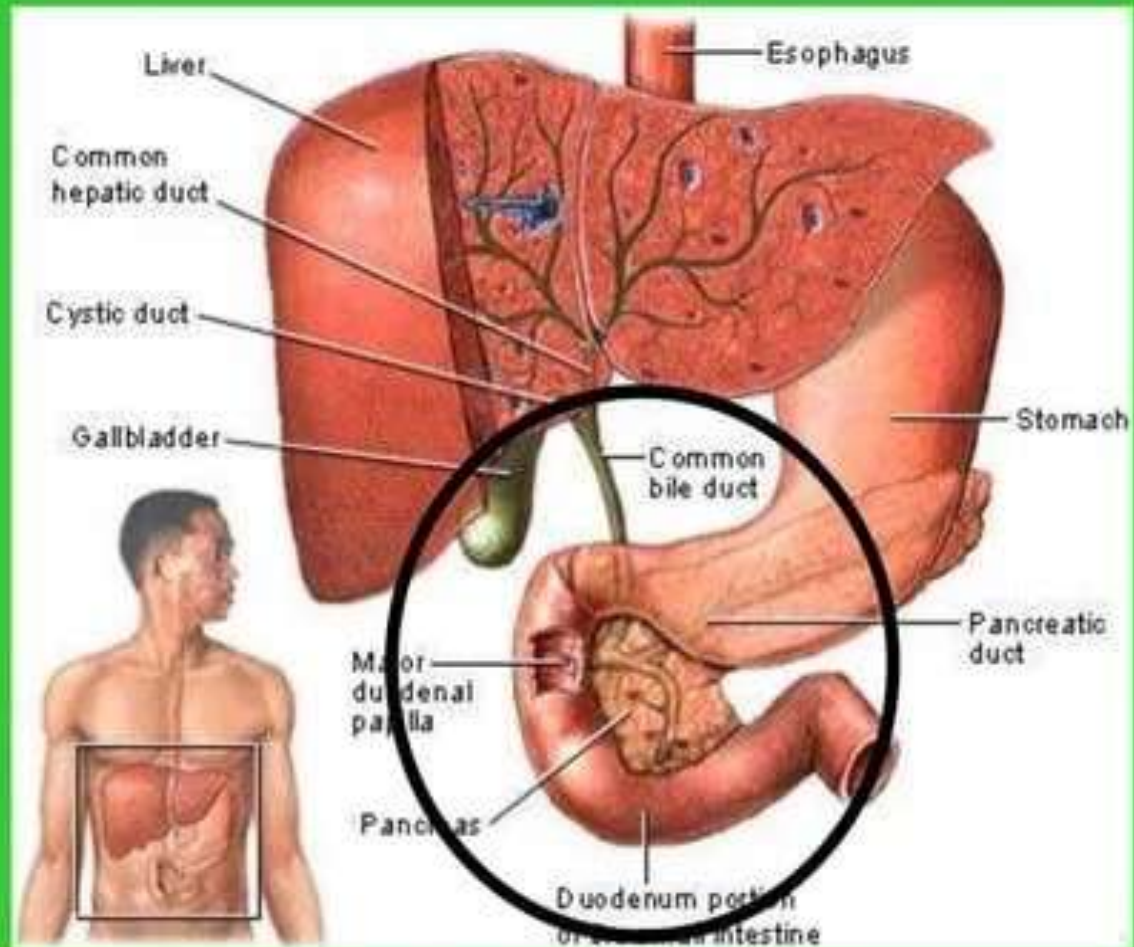
Secretions of the gastrointestinal mucosa...

The mucosa of the pyloric area of the stomach secretes the hormone gastrin, which stimulates the production of gastric acid for digestion.



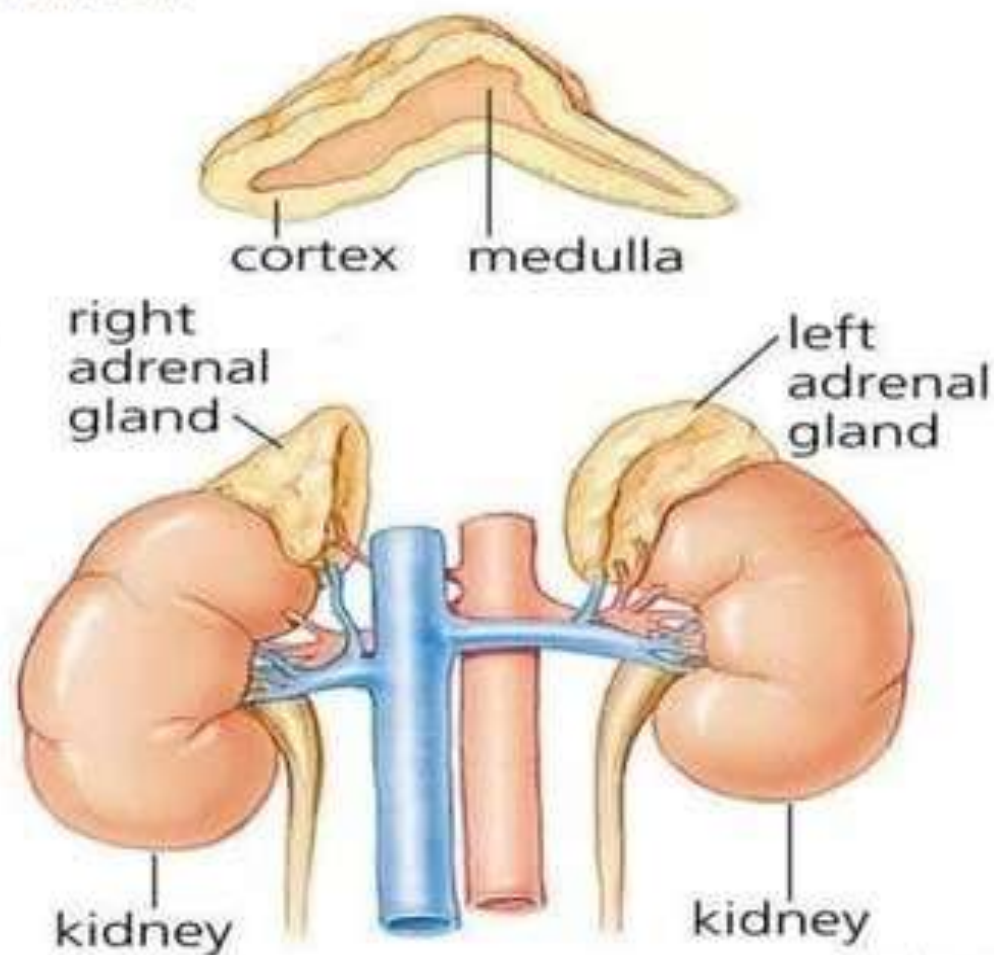
Secretions of the gastrointestinal mucosa...

The mucosa of the duodenum and jejunum secretes the hormone secretin, which stimulates pancreatic juice, bile, and intestinal secretion.



ADRENAL GLANDS

- There are two adrenal glands,
- About 4 cm long and 3 cm thick
- It has two parts:
 - outer part is **cortex** and
 - the inner part is **medulla**.



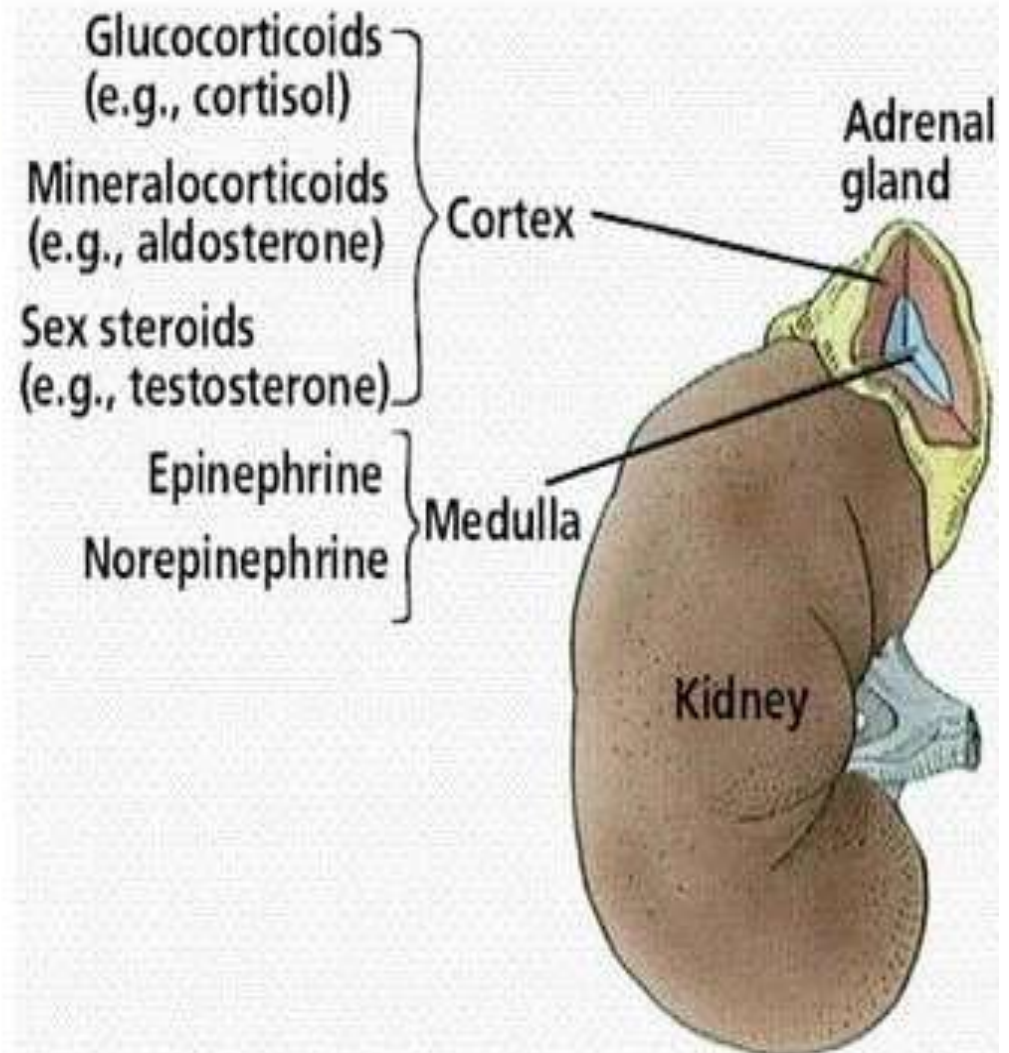
adrenal glands continue...

1. ADRENAL CORTEX: -

✦ It produces three hormones:

- Glucocorticoids
- Mineralocorticoids
- Sex hormones (androgens)

These are collectively called as *adrenocorticoids*

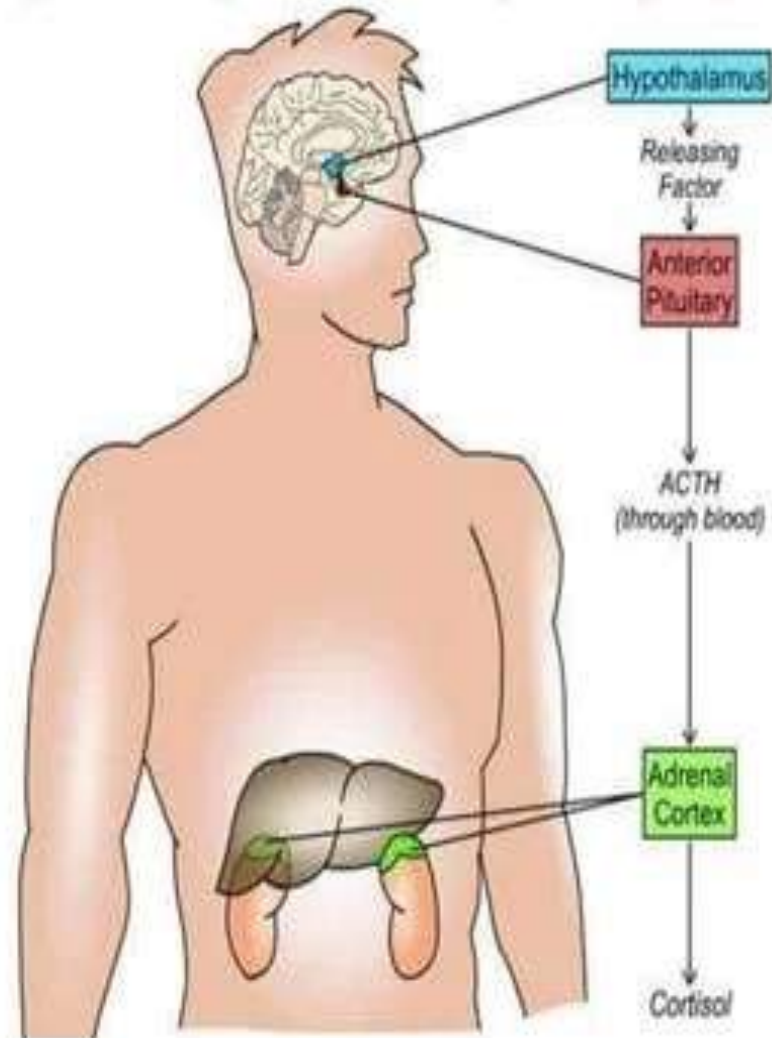


adrenal cortex continue...

A. Glucocorticoids: -

- *Cortisol*, *corticosterone* and *cortisone* are the main Glucocorticoids
- They are essential for life, regulating metabolism and stress
- They are high in between 4 to 8 am
- Lowest between midnight and 3 am

Figure AN-1: Hypothalamic-Pituitary-Adrenal (HPA) Axis



glucocorticoids continue...

Effects:

- *Gluconeogenesis* (formation of new sugar)
- *Lipolysis* (breakdown of triglycerides into fatty acids and glycerol for energy production).

In pathology and pharmacology:

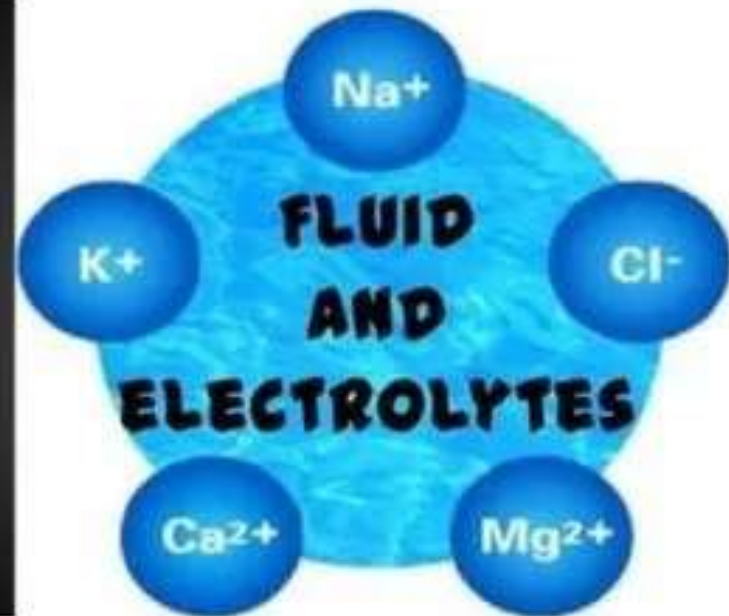
- ✘ Have an anti-inflammatory action.
- ✘ Suppress the immune response.
- ✘ Suppress the response of tissue to injury.
- ✘ Delay wound healing.



adrenal glands continue...

B. Mineralocorticoids (aldosterone): -

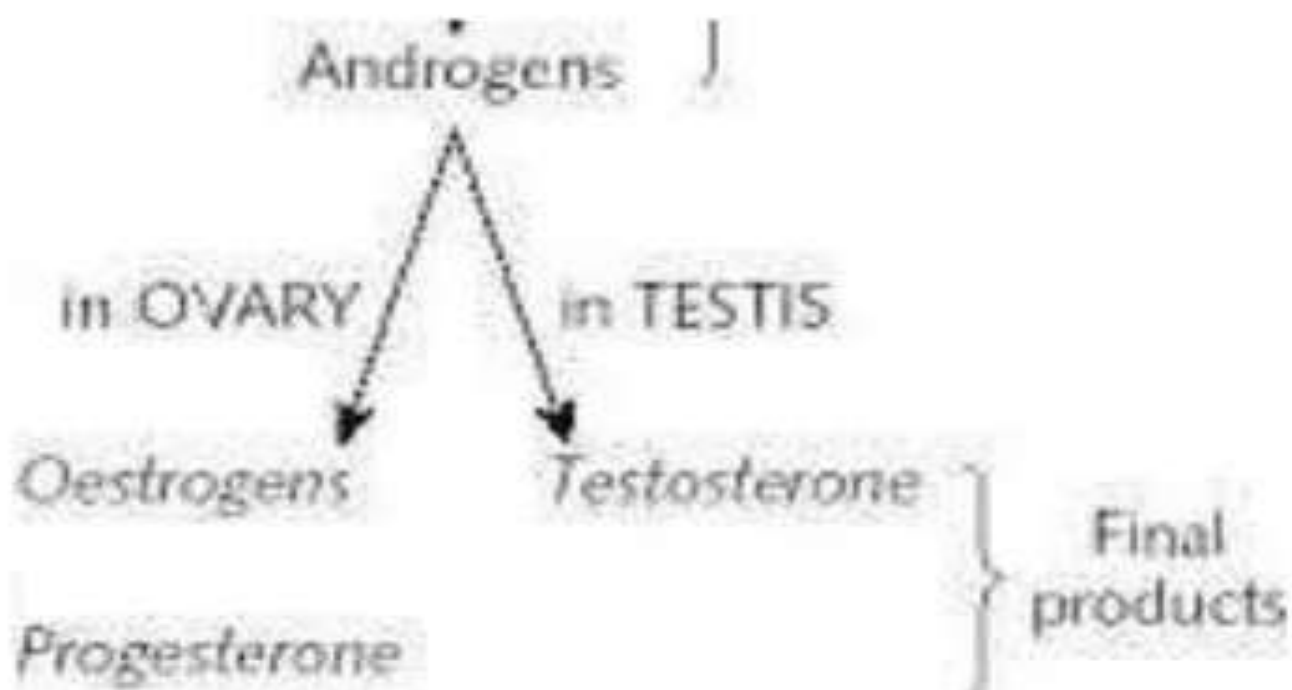
- *Aldosterone* is the main mineralocorticoids
- It maintains Water and electrolyte balance



adrenal glands continue...

C. Sex hormones: -

- *Androgens* are the main sex hormones
- They contribute to the onset of puberty



DISORDERS OF ADRENAL CORTEX

1. Cushing's syndrome: -

It is caused due to hyper secretion of glucocorticoids

Characteristic features:

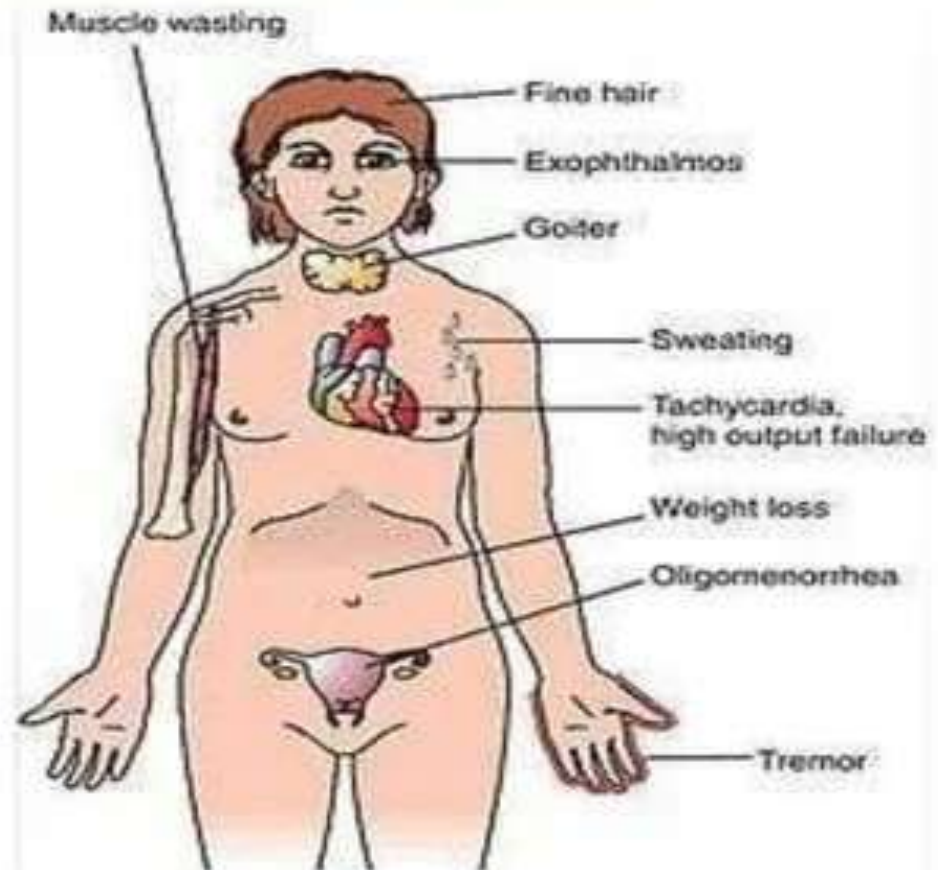
- Pain in face, neck and abdomen
- Pathological fractures
- Diminished protein synthesis
- Suppression of growth
- Hypertension
- Menstrual disturbance
- Peptic ulcers



disorders of adrenal cortex

2. Conn's syndrome: -

- ✘ This is due to excessive secretion of mineralocorticoids.
- ✘ It is usually caused by tumor affecting only one adrenal gland



disorders of adrenal cortex

3. Addison's disease:

- It is due to hypo secretion of *glucocorticoids and mineralocorticoids*
- Caused by autoimmune disease

Effects:

- ✗ Muscle weakness.
- ✗ Vomiting and diarrhea.
- ✗ Tiredness.
- ✗ Mental confusion.
- ✗ Low blood volume.
- ✗ Hypotension.
- ✗ Loss of body hairs in women.

ADDISON'S DISEASE

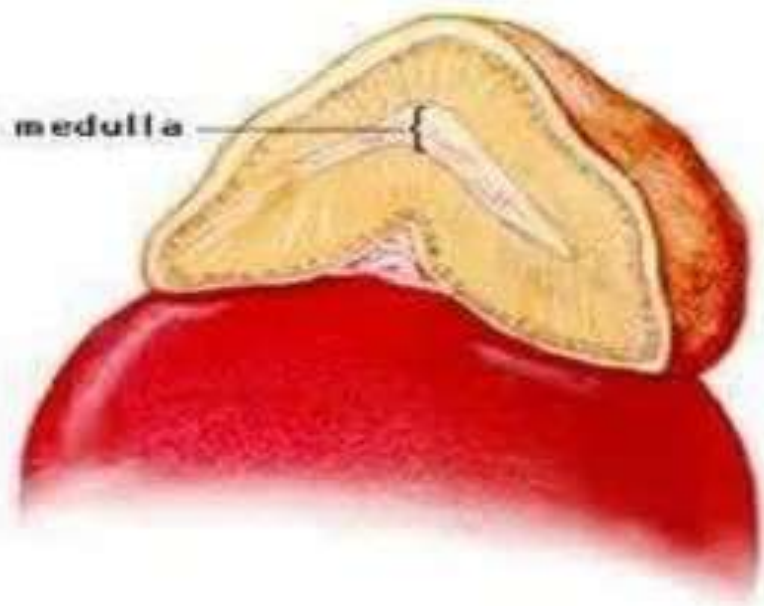


adrenal glands continue...

2. ADRENAL MEDULLA: -

- ✖ It is surrounded by the cortex
- ✖ It produces two hormones
 - ☐ *adrenaline* and
 - ☐ *noradrenaline*.

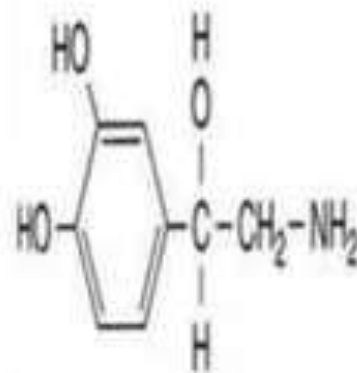
The Adrenal Gland



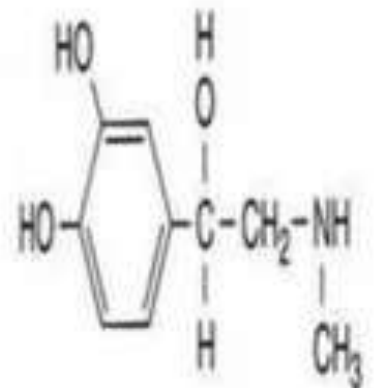
adrenal medulla continue...

Adrenaline and noradrenaline:

- **Noradrenaline** and **adrenaline** are released into the blood
- They are structurally very similar and have similar effects
- Together they potentiate by:
 - Increasing heart rate
 - Increasing blood pressure
 - Increasing metabolic rate
 - Dilating the pupils



Norepinephrine



Epinephrine

DISORDERS OF ADRENAL MEDULLA: -

The effects of excess adrenaline and noradrenaline are: -

- Hypertension
- Hyperglycemia
- Raised metabolic rate
- Nervousness
- Headache



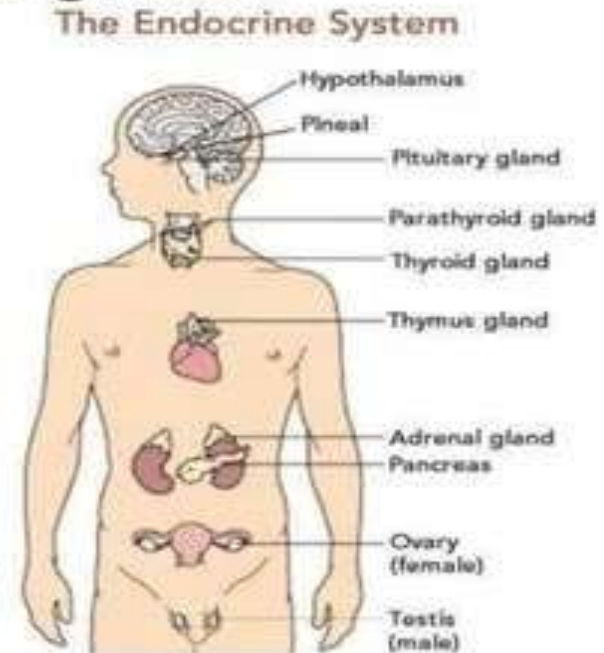
SUMMARY

So we discussed about the endocrine system and why it is important to us

In which we also studied about various gland:

- **Pituitary gland**
- **Thyroid gland**
- **Parathyroid**
- **Adrenal glands**
- **Pancreas**
- **Thymus gland**

Their location, function and disorders



THANK YOU
FOR
LISTENING

