

# UNIT – IV

# ENDOCRINE SYSTEM

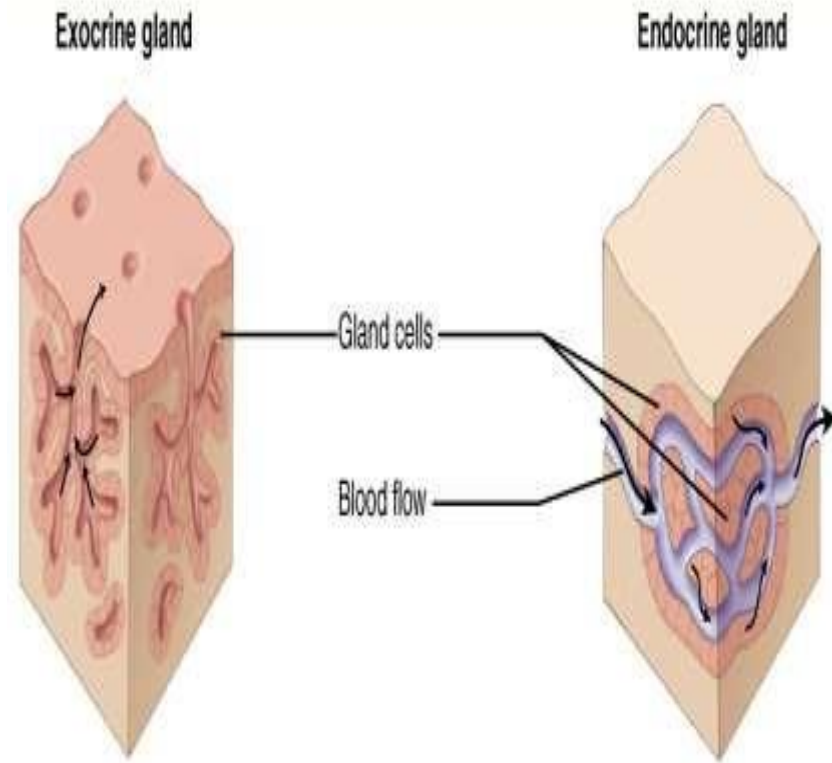


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# GLANDS:

An organ which secretes particular chemical substances for use in the body or for discharge into the surroundings.

- ▣ There are three types of glands in our body:
  - **Endocrine glands**
  - **Exocrine glands**
  - **Heterocrine glands**

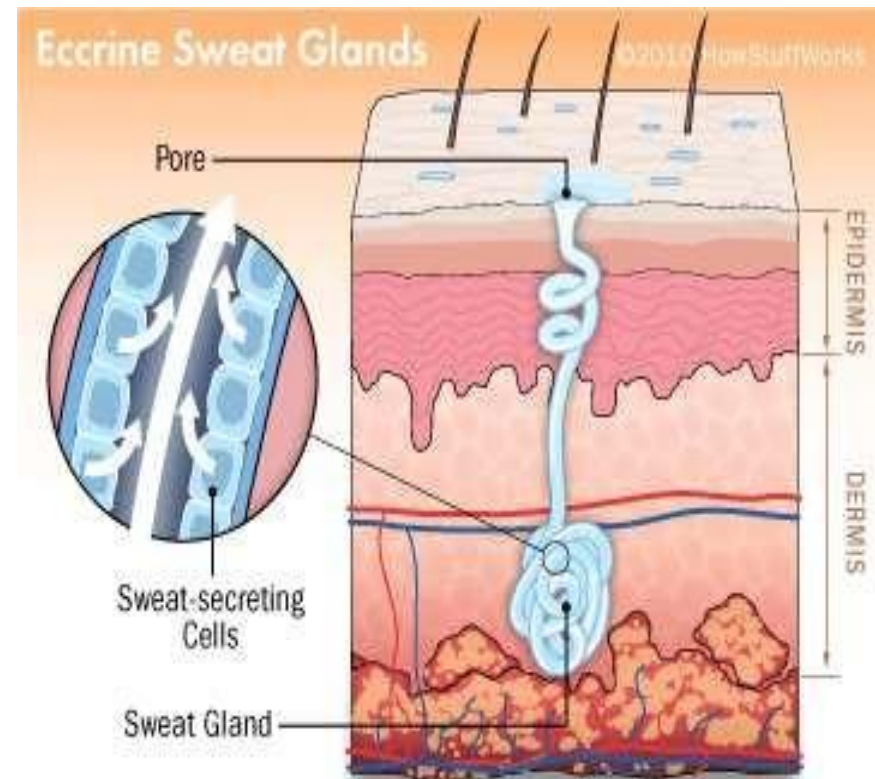


# EXOCRINE GLANDS

Exocrine glands are glands that secrete their products into ducts

## EXAMPLE:

- Sweat glands
- Salivary glands
- Mammary glands
- Stomach
- Liver

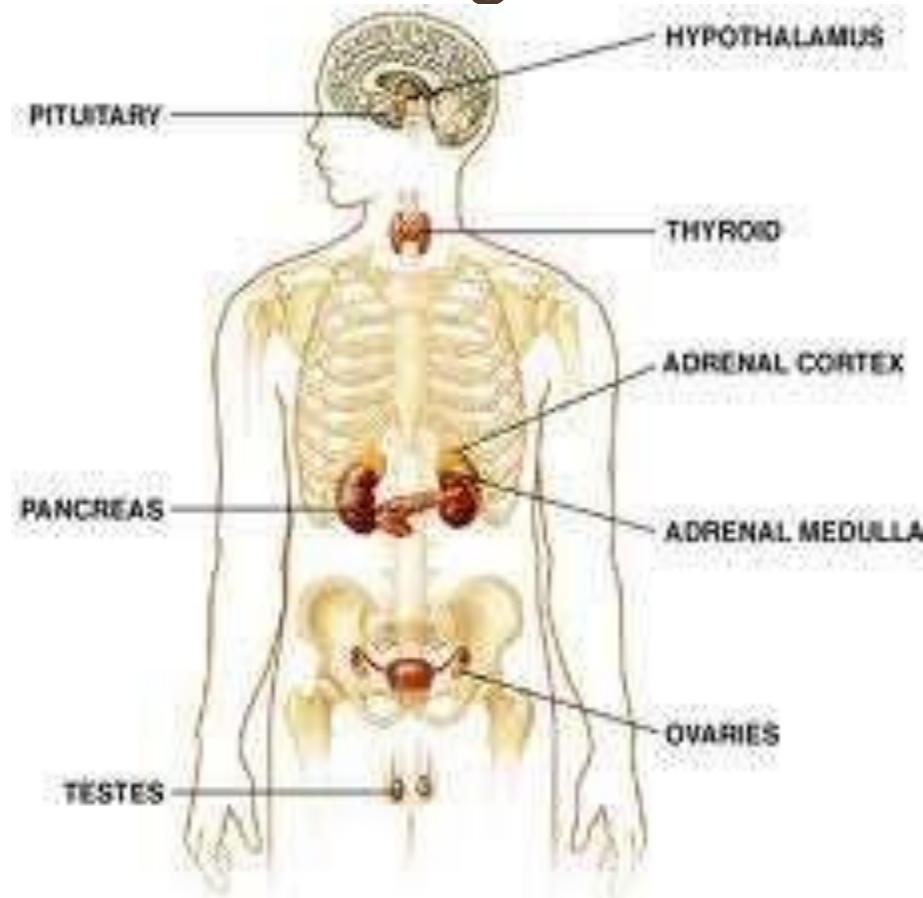


# ENDOCRINE GLANDS

Glands that secrete their product (hormones) directly into the blood rather than through a duct

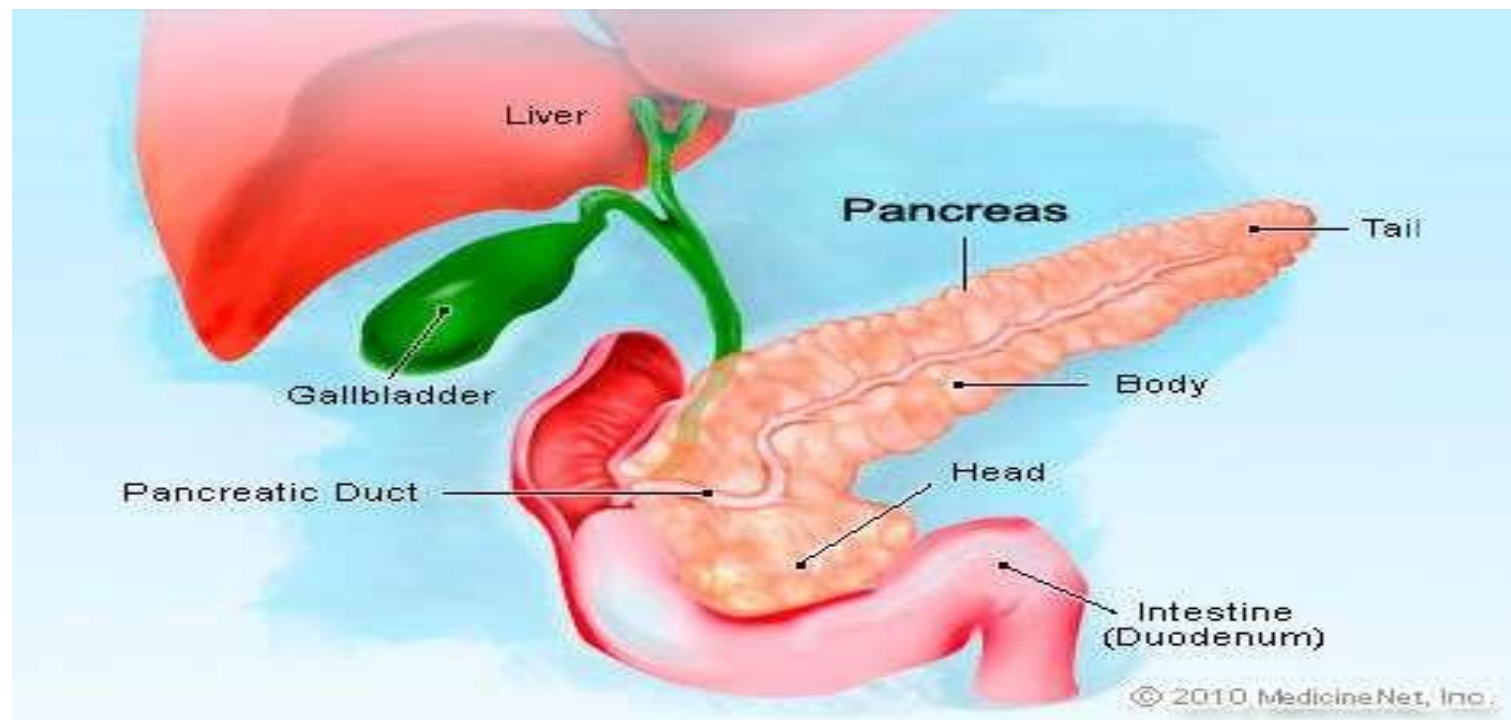
## EXAMPLE:

- Pituitary gland
- Pancreas
- Thyroid gland
- Adrenal glands



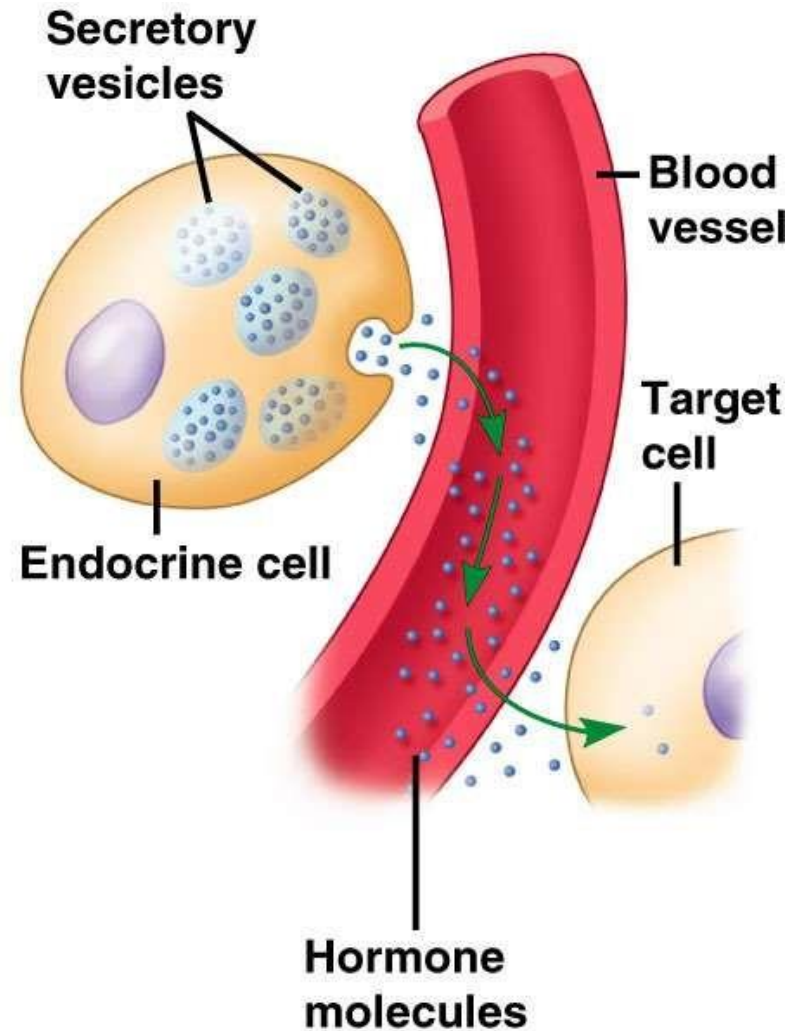
# HETEROCRINE GLANDS

These are glands that perform both exocrine and endocrine functions. For example *pancreas*



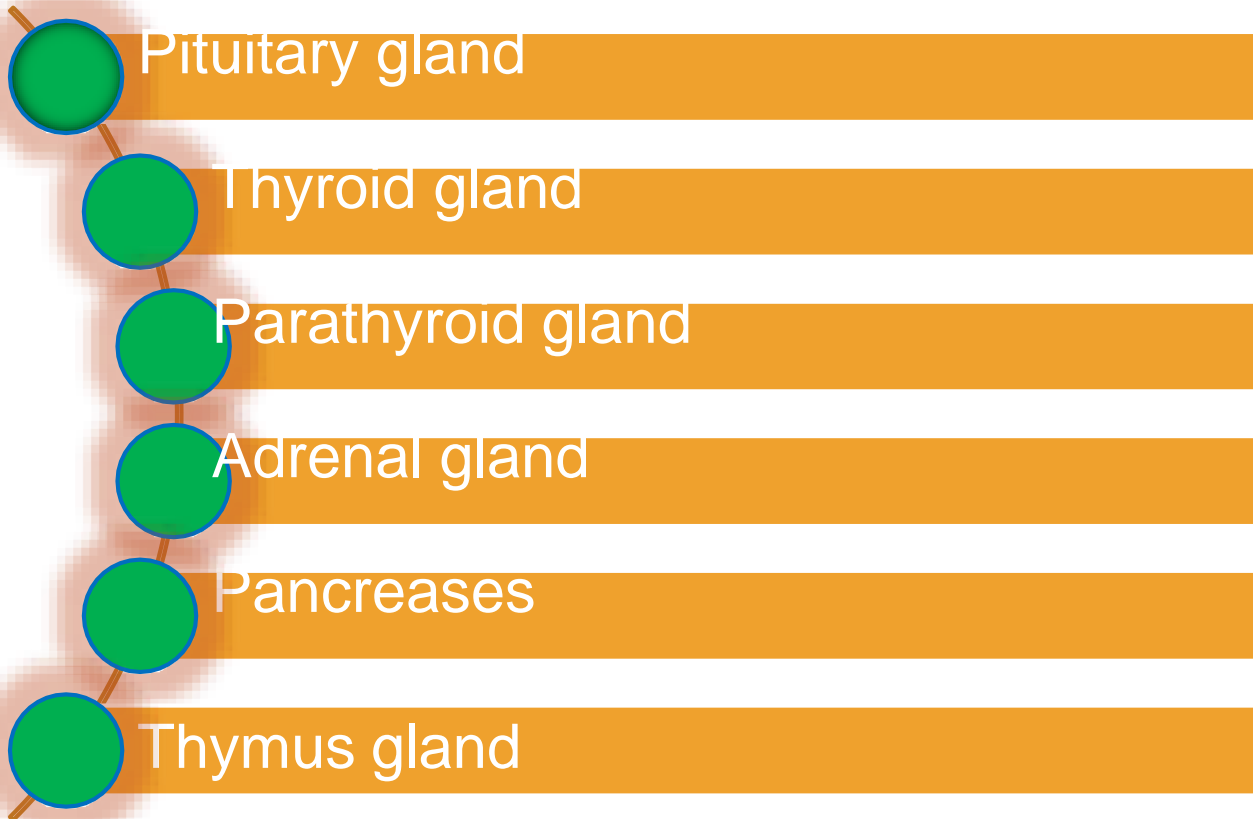
# ENDOCRINE SYSTEM

- Consists of glands and Group of capillaries which Facilitates diffusion of *hormones* to Bloodstream
- They are commonly referred as the *ductless glands*, because the hormones secreted directly into bloodstream



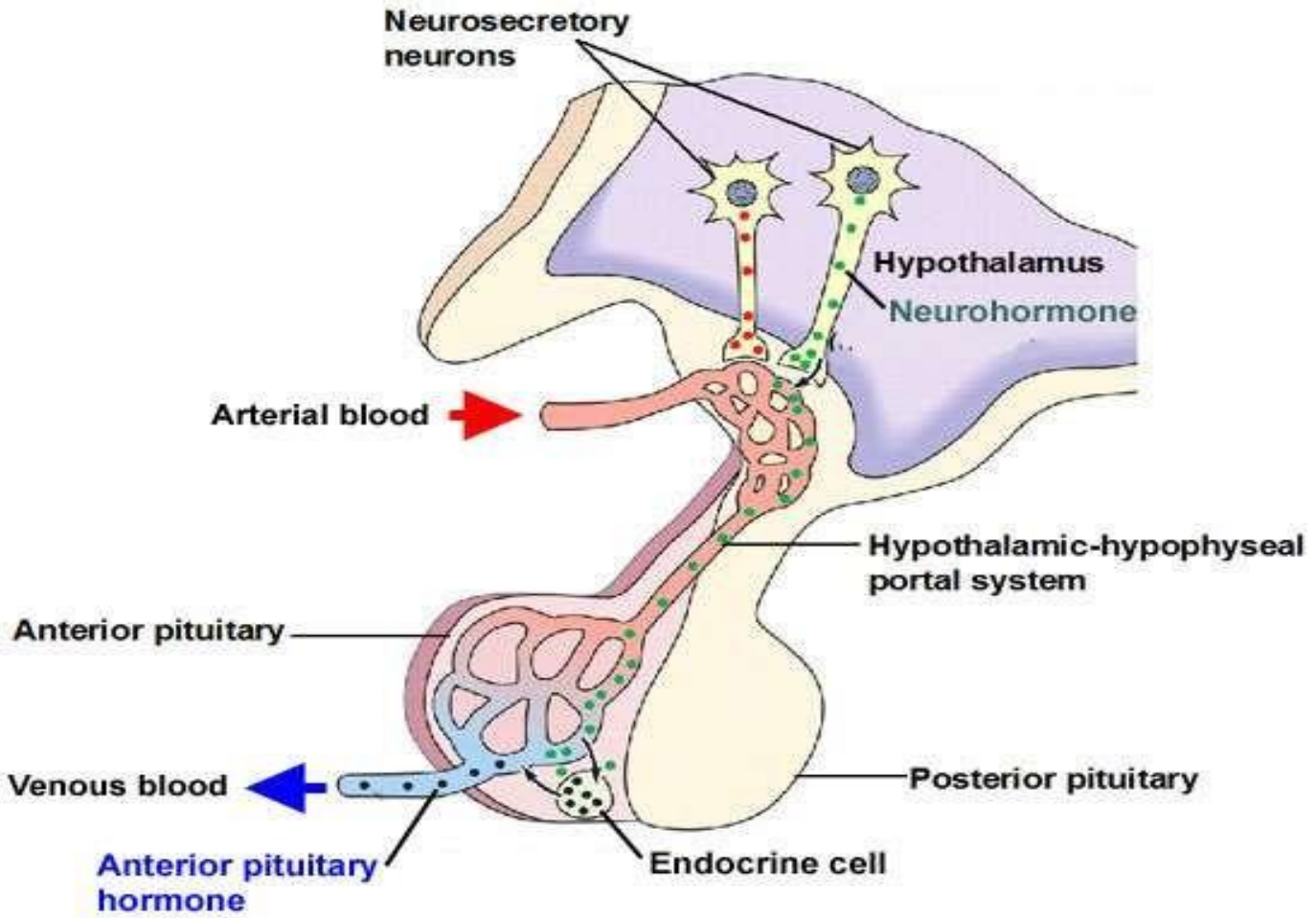
# Endocrine system continue...

It consists of a number of glands:



# PITUITARY GLAND:

PITUITARY GLAND:

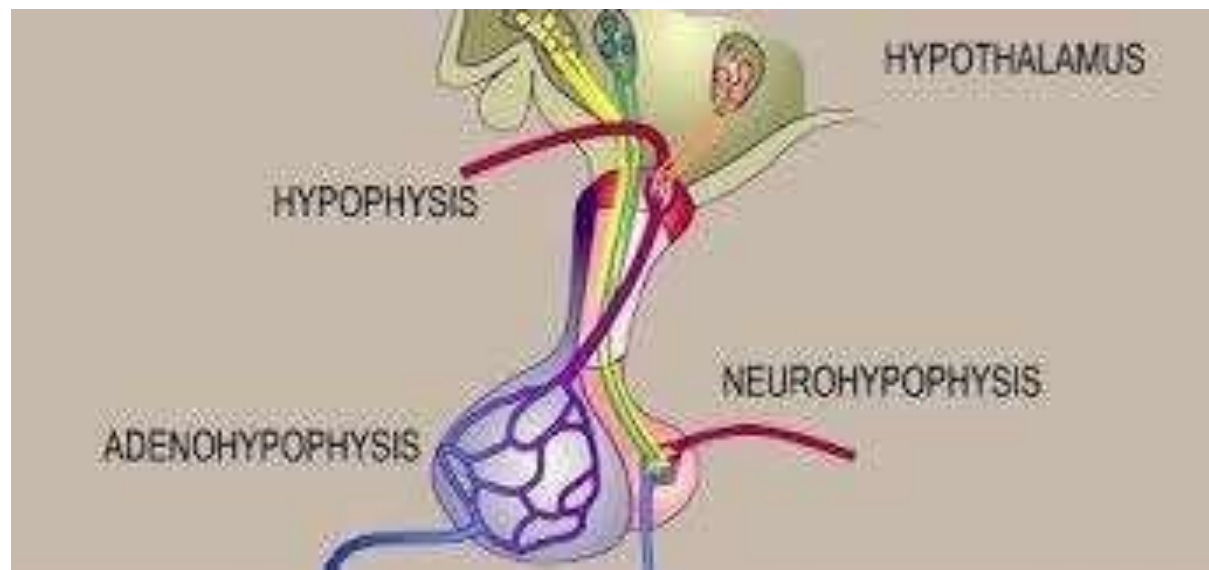




# pituitary gland continue...

□ The pituitary gland consists of:

1. **Adenohypophysis:** - Anterior lobe. It is influenced by hormones which come from the hypothalamus.
2. **Neurohypophysis:** - Posterior lobe. It is influenced by neurons which convey hormones directly from hypothalamic nuclei for storage of posterior lobe



# HORMONES:

## Anterior lobe:

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

## Intermediate lobe:

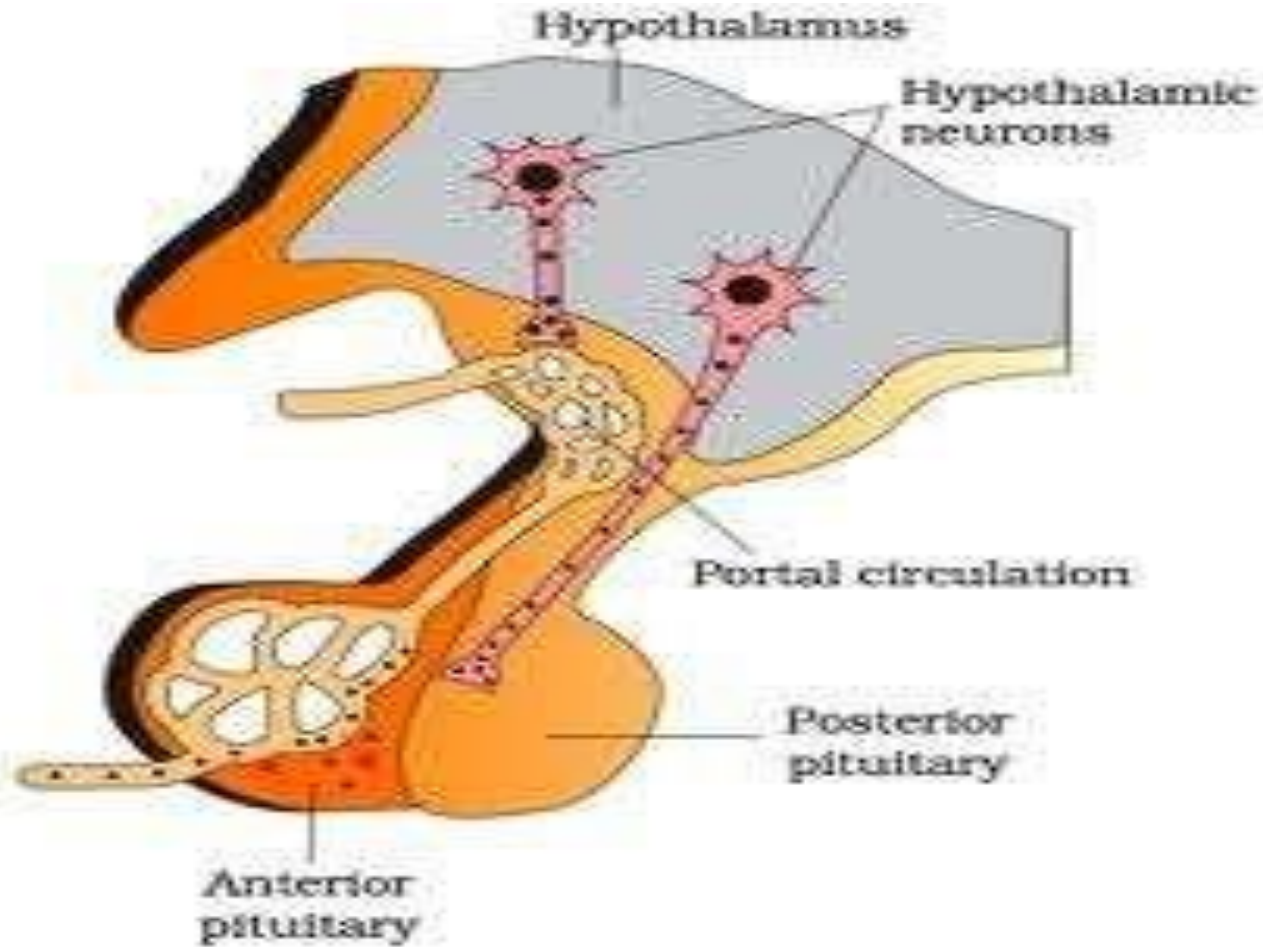
- A and B melanocyte stimulating hormone

## Posterior lobe:

1. Vasopressin (ADH)
2. oxytocin



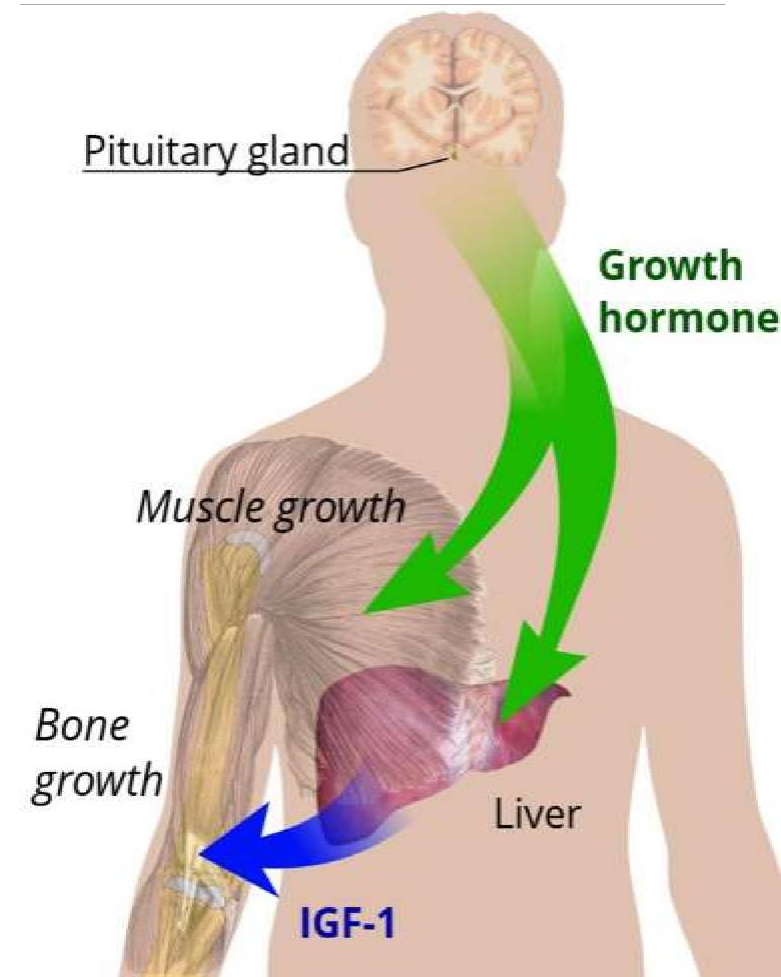
# ANTERIOR PITUITARY



# GROWTH HORMONE (GH):

## Action of growth hormone

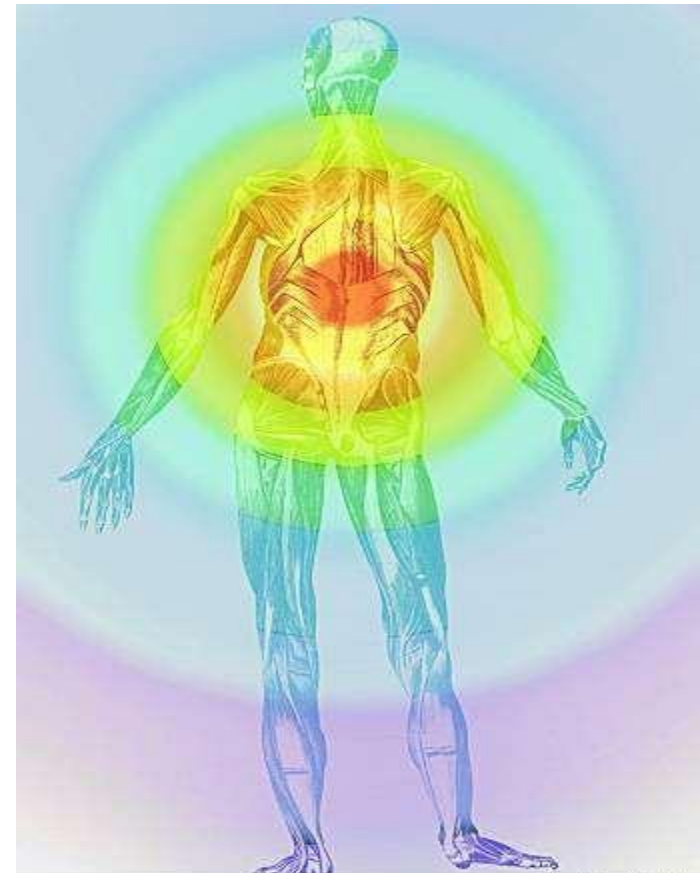
1. Stimulating of growth of bones, cartilage and connective tissue:
  - *Somatomedins* are synthesized in the liver, in response to stimulation by the GH
  - The effects of GH on skeletal growth are mediated by *somatomedins*



# 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...

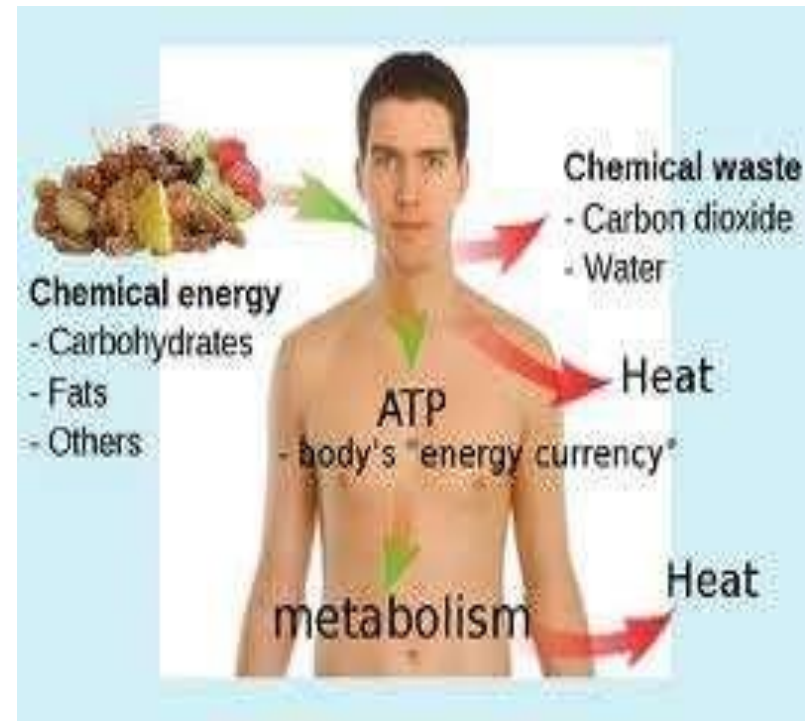
## 3. Effect on carbohydrate and fat metabolism:

### ▮ 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**

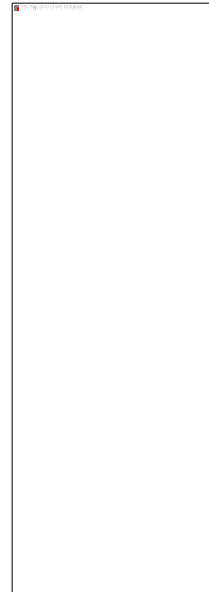


# DISEASES RELATED TO GROWTH HORMONE

**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.

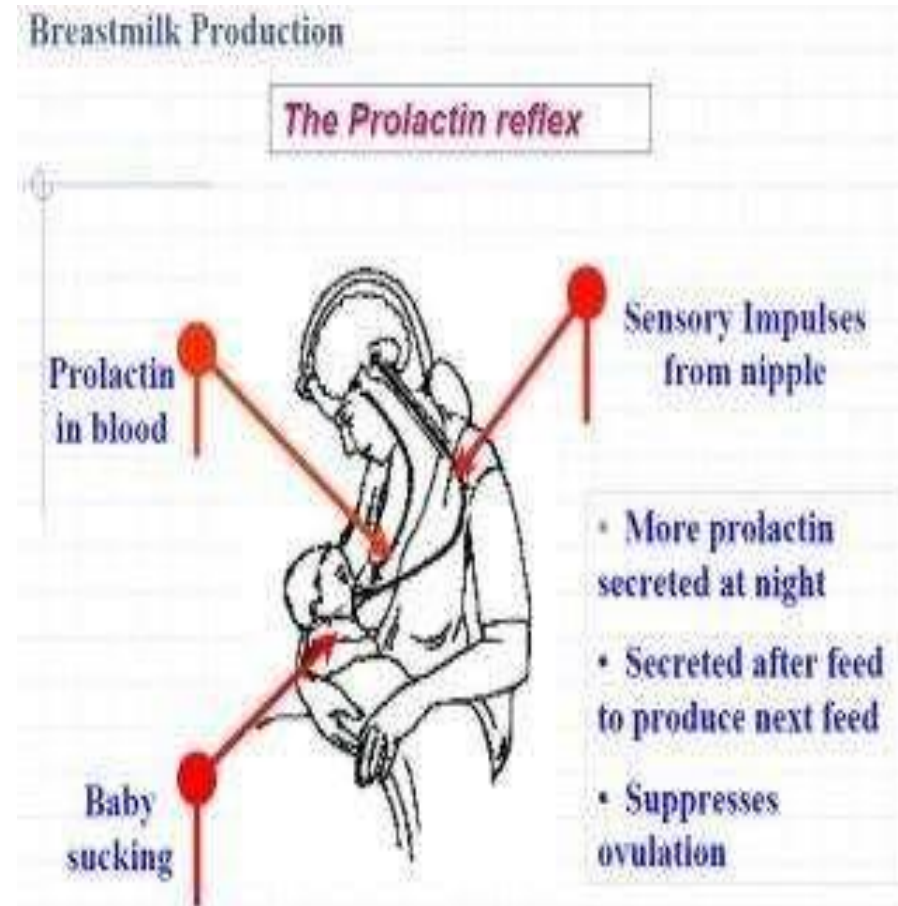


# Hormones of anterior pituitary continue...

## 2. Prolactin:

### Actions of prolactin:

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



# 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.



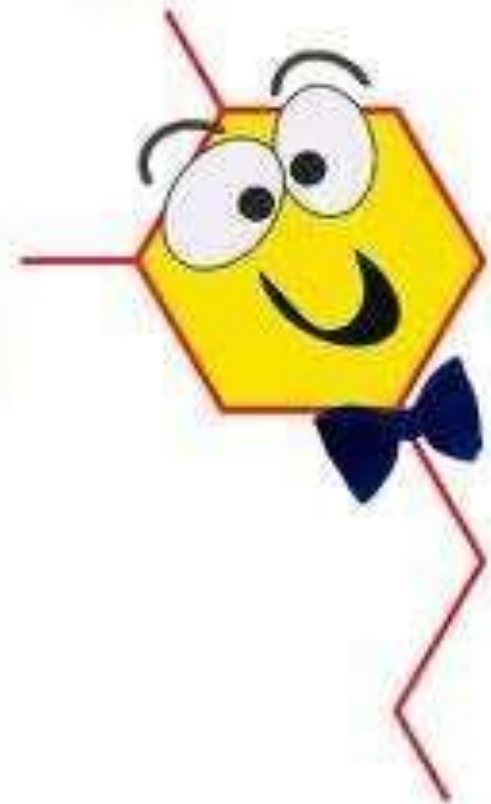
**continue...**

***B. Inhibitory factors:***

which is released by the  
**hypothalamus**

inhibits prolactin secretion  
from the **anterior pituitary**

**Dopamine** may be the main  
prolactin inhibiting factor.



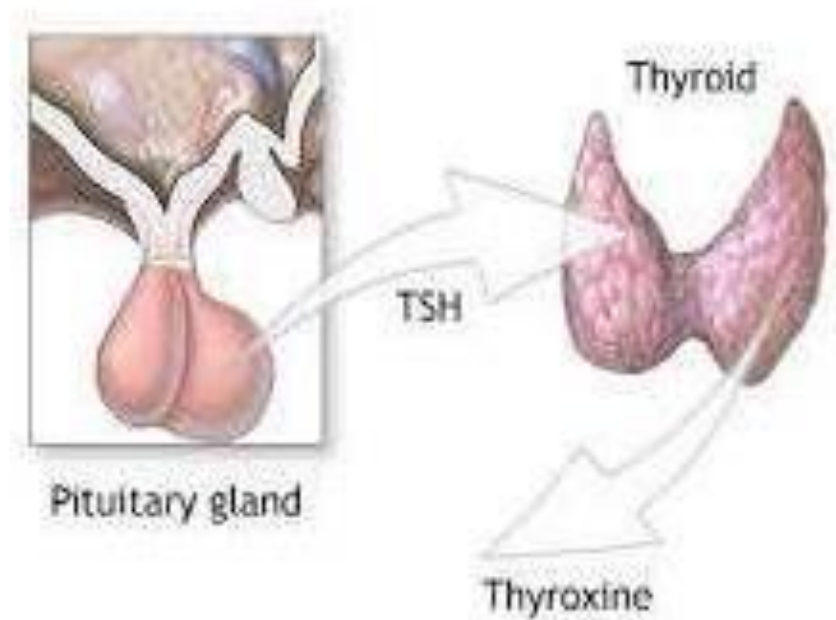
**Dopamine**

# Hormones of anterior pituitary continue...

## 3. Thyroid-stimulating hormone (TSH) :

It stimulates the thyroid gland to produce:

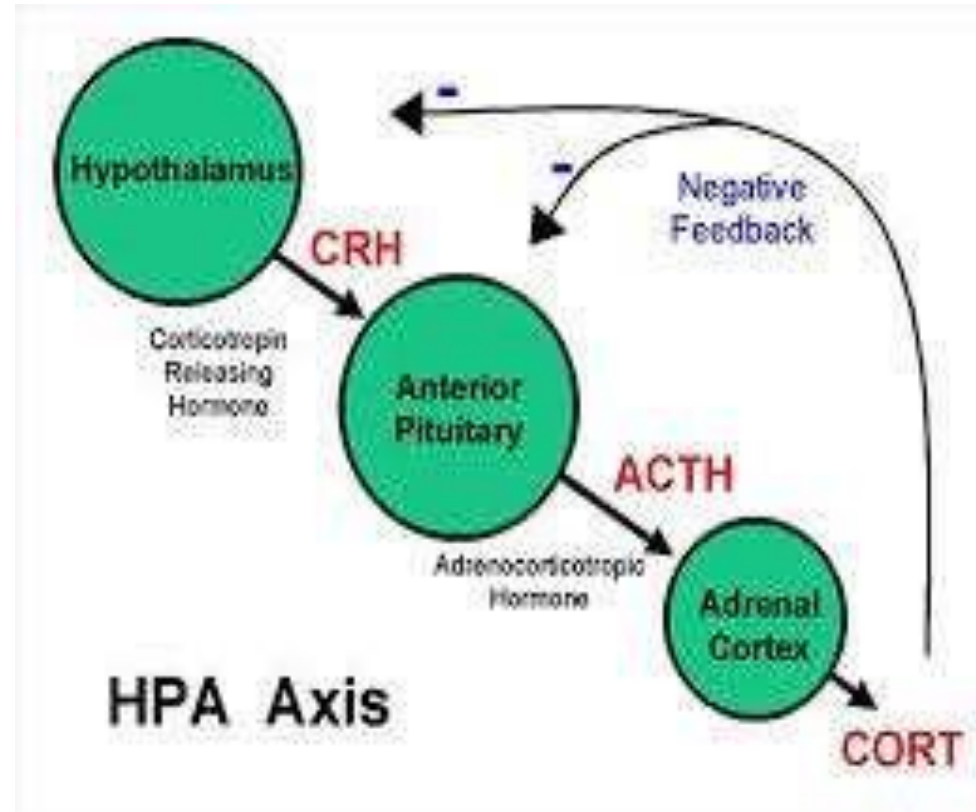
- Thyroxin ( $T_4$ ), and
- Triiodothyronine ( $T_3$ )



# Hormones of anterior pituitary continue...

## 4. ADRENOCORTICOTROPIC HORMONE(ACTH):

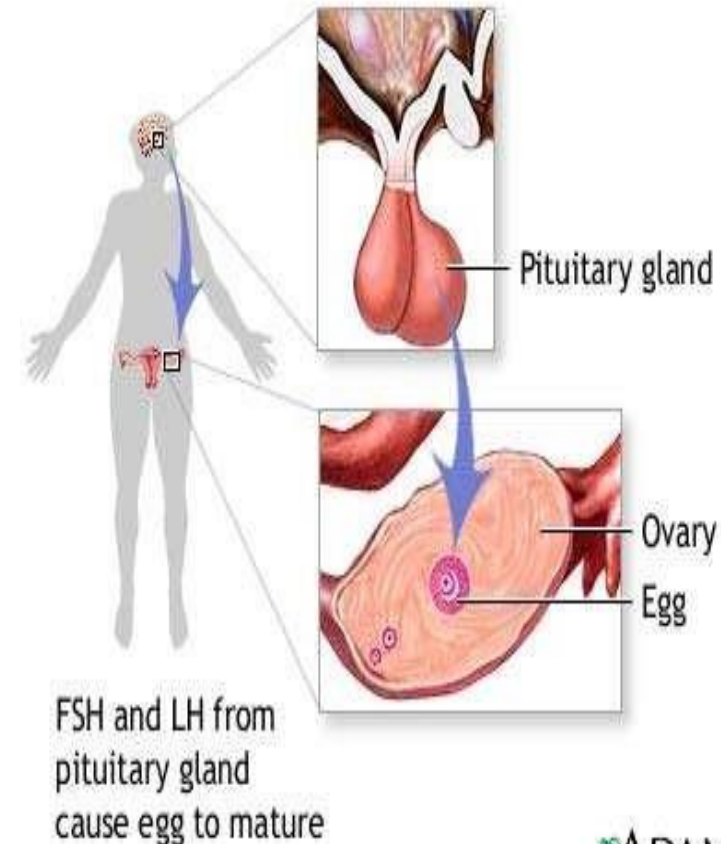
- It is secreted by the anterior pituitary gland.
- It is often produced in response to biological stress.
- Its principal effects are increased production and release of corticosteroids.



# 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

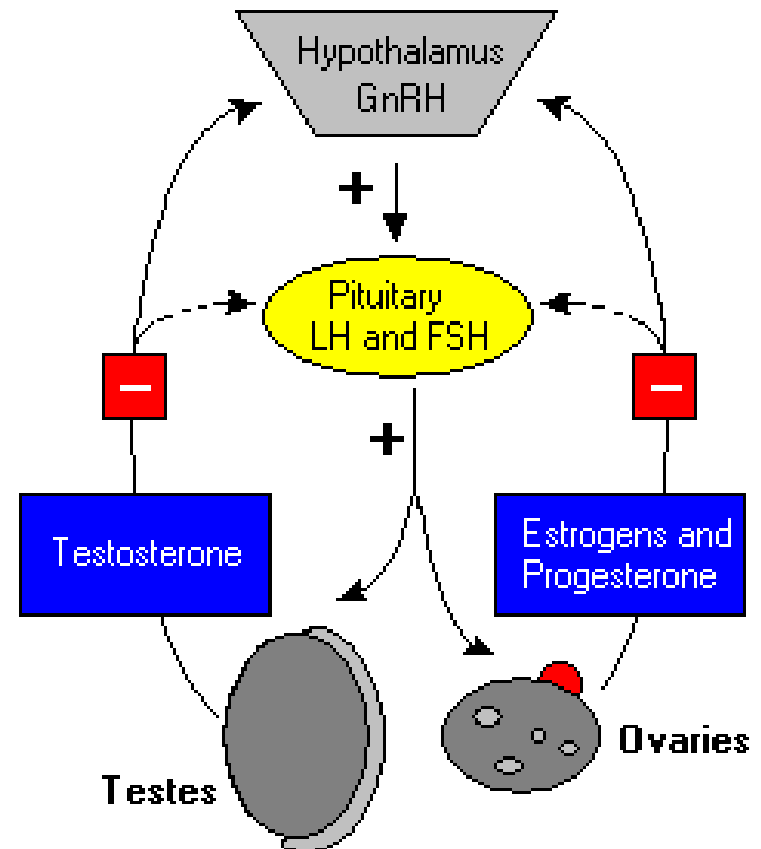




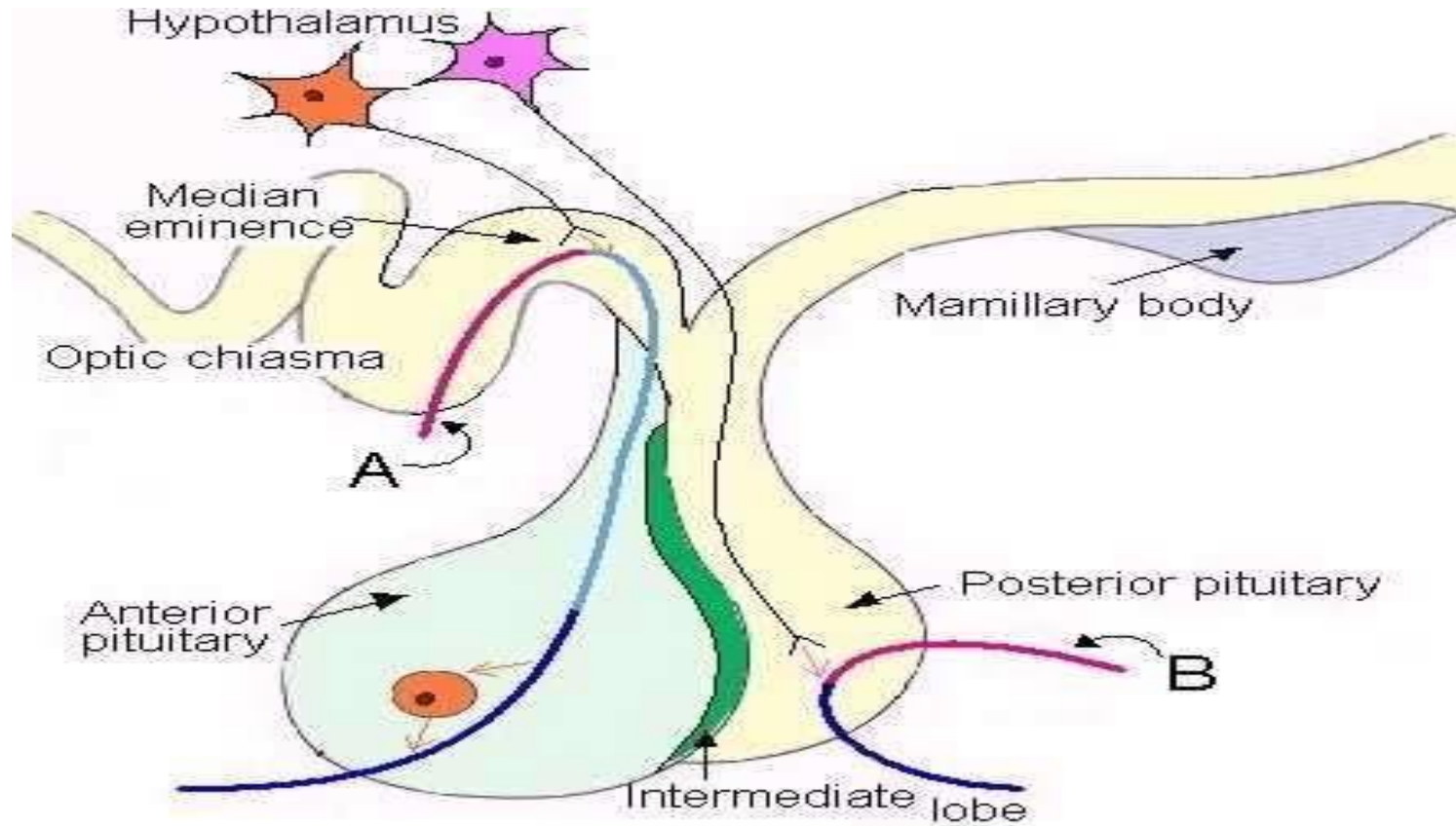
# Hormones of anterior pituitary continue...

## 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...

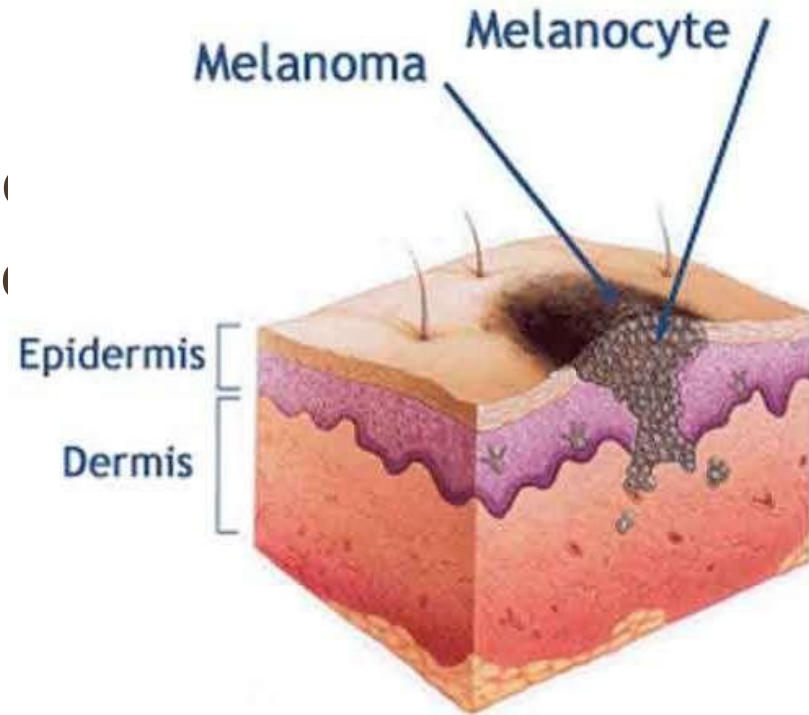
## HORMONES OF INTERMEDIATE LOBE:

It secretes:

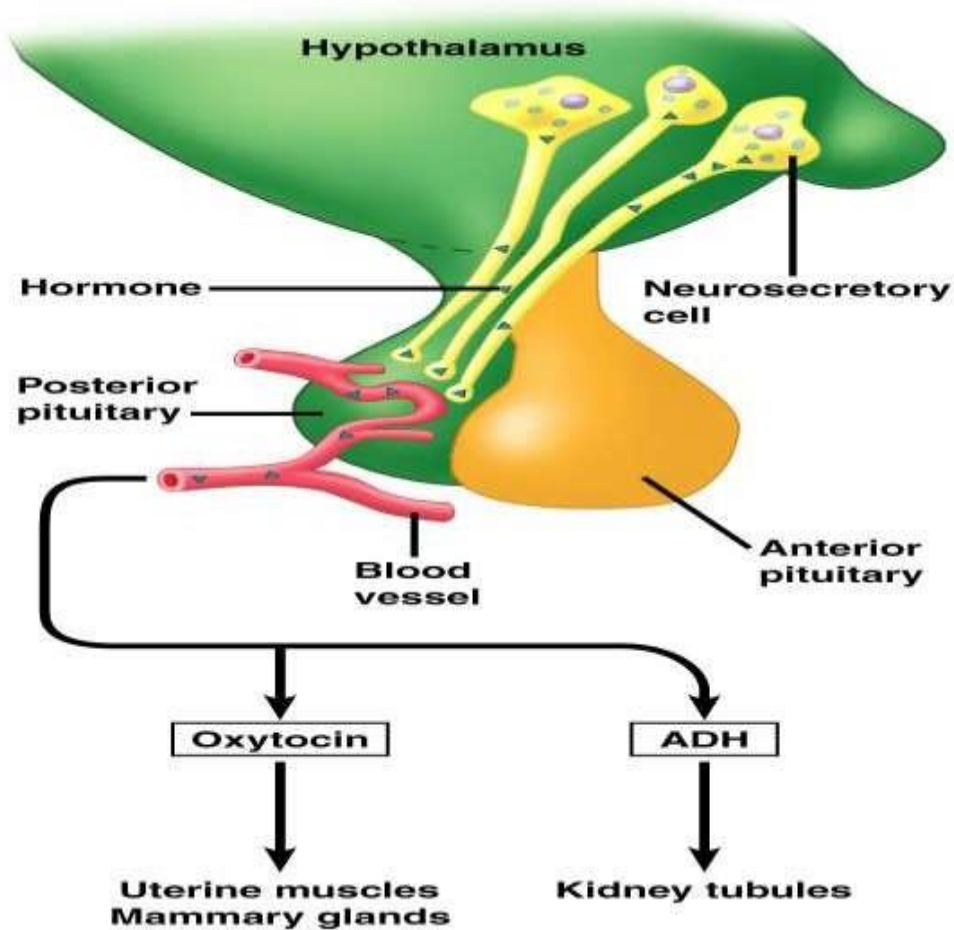
- $\alpha$  melanocyte stimulating hormone
- $\beta$  melanocyte stimulating hormone

### 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

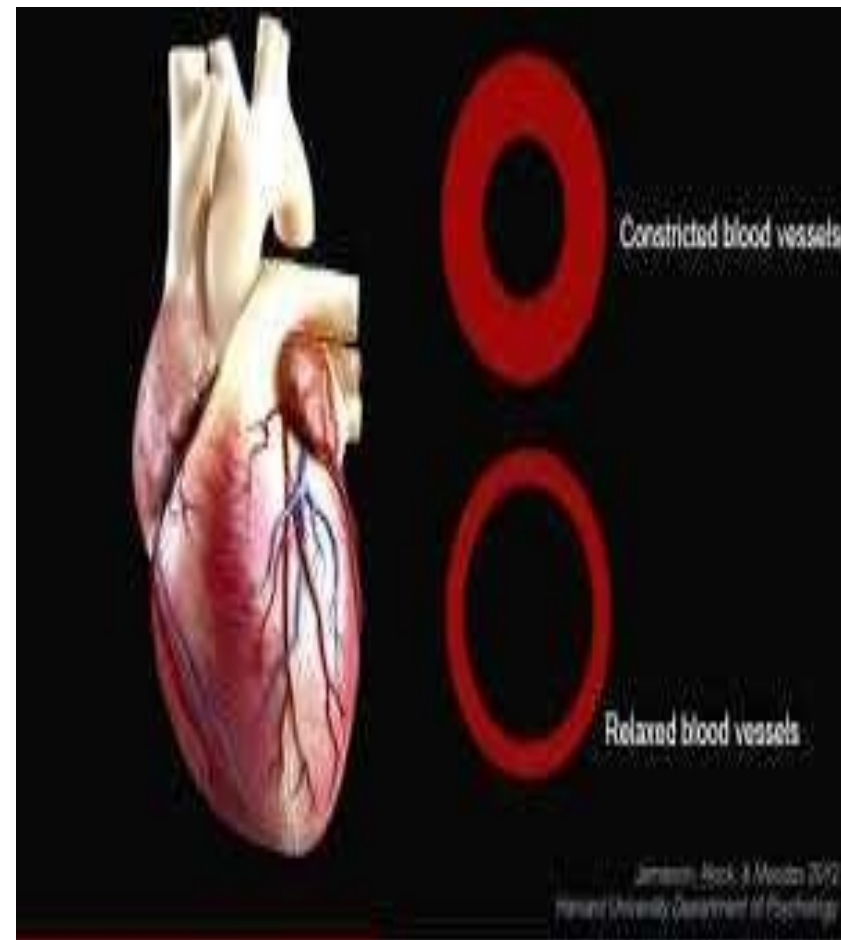


# ADH continue...

## 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-

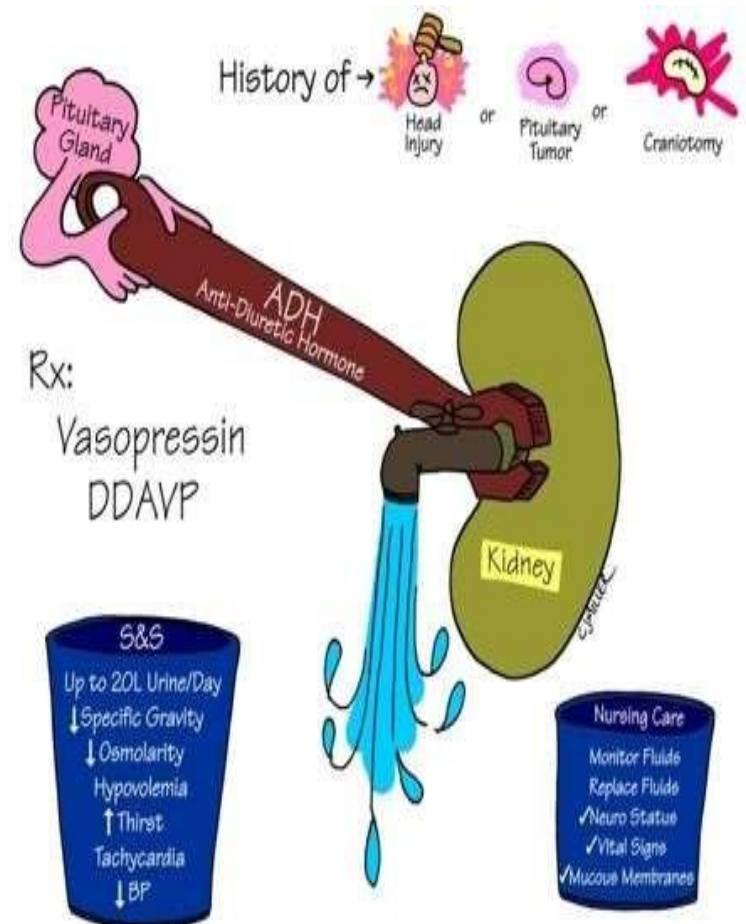
- Excessive thirst
- Excretion of large amounts of severely diluted urine



# diseases continue...

## ➤ Polyuria:

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

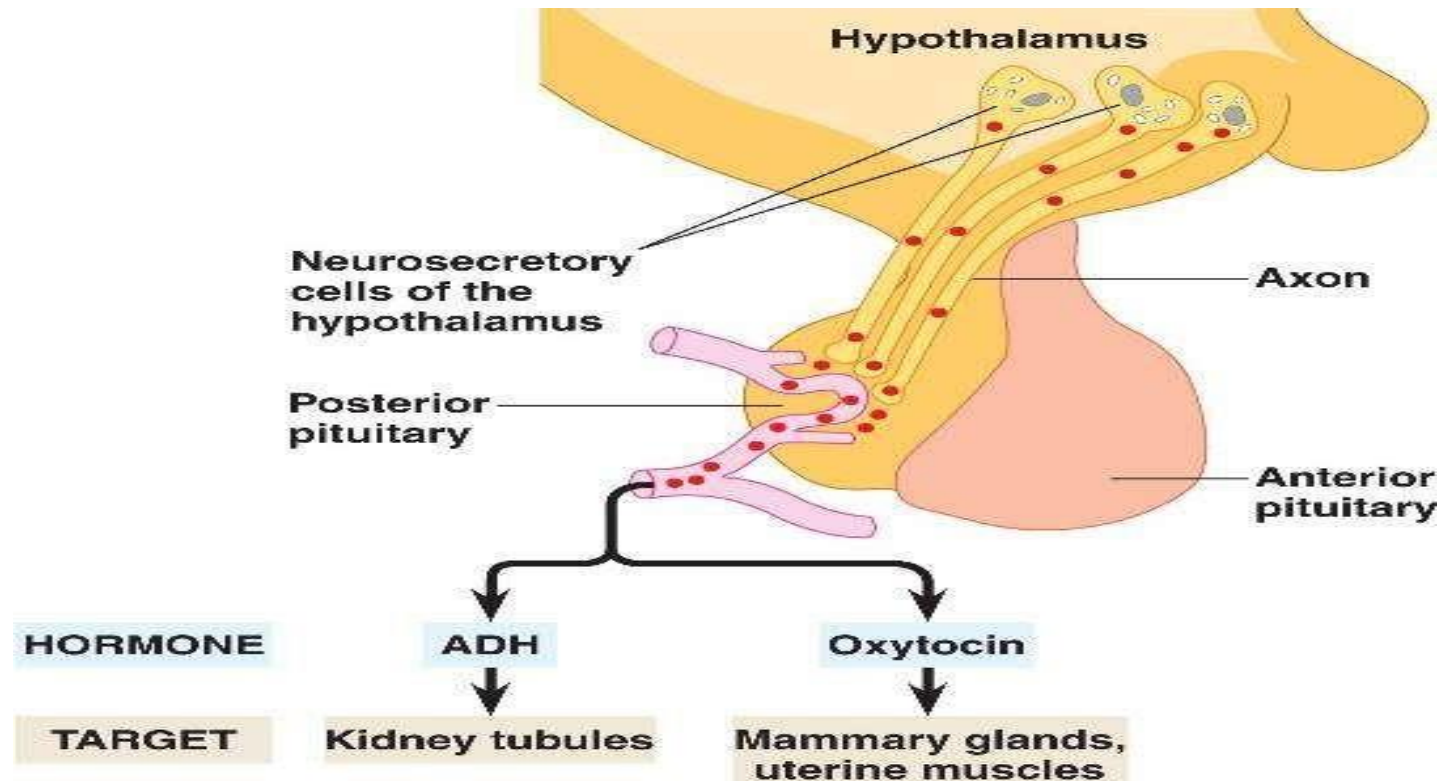




# Hormones of posterior pituitary continue...

## B. OXYTOCIN: -

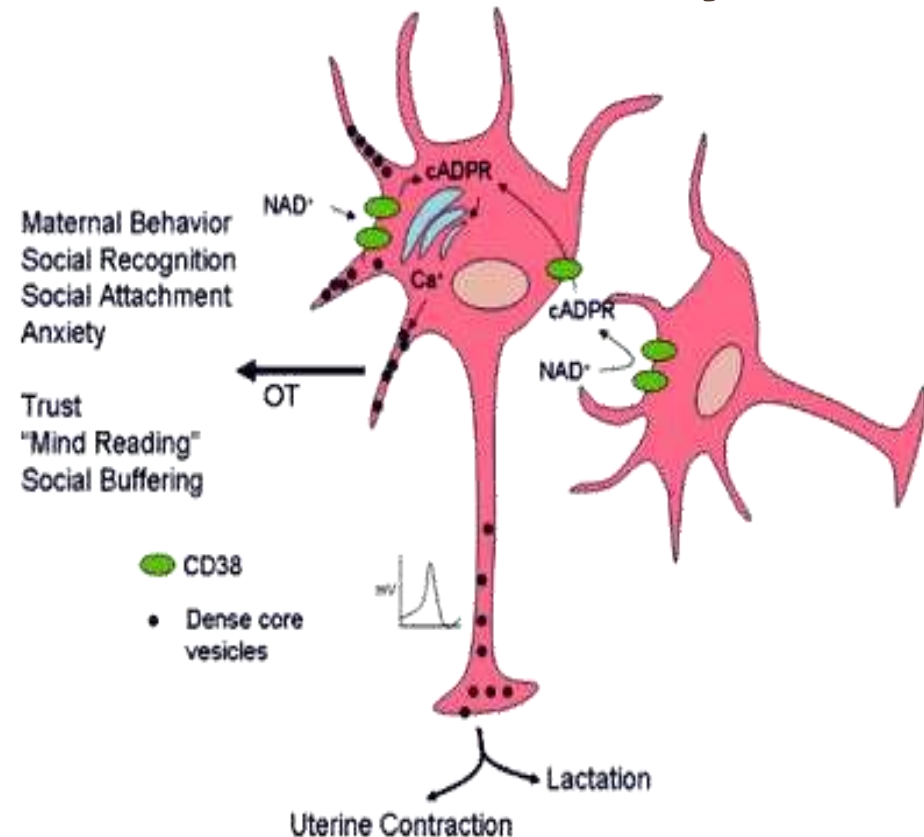
- Oxytocin is synthesized in the *hypothalamus*
- Stored in the *posterior lobe* of pituitary gland



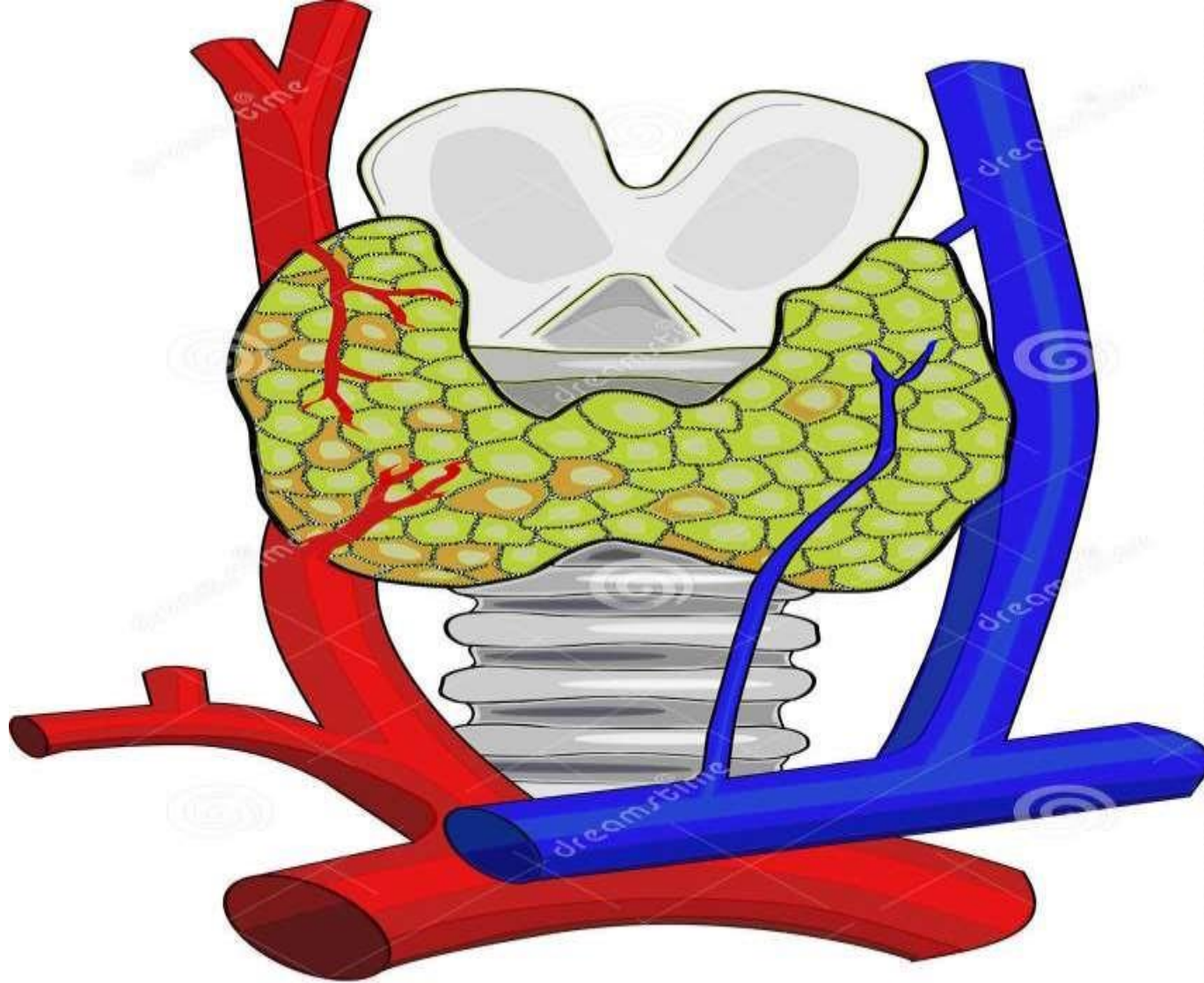
# oxytocin continue...

## Action of oxytocin:

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



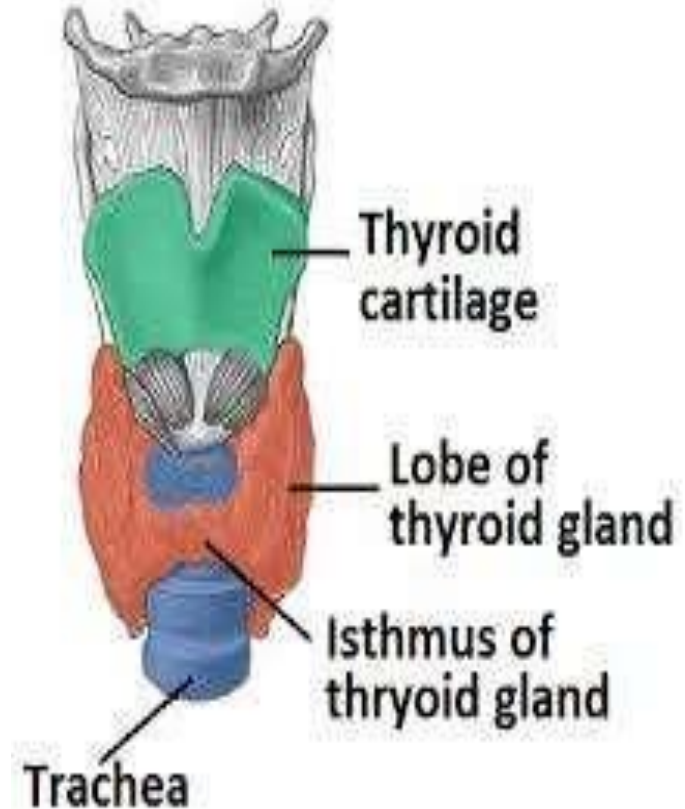
# THYROID GLAND



# 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 (T<sub>3</sub>):

It affects almost every physiological process in the body:

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

## ➤ Thyroxin (T<sub>4</sub>):

- 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



*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

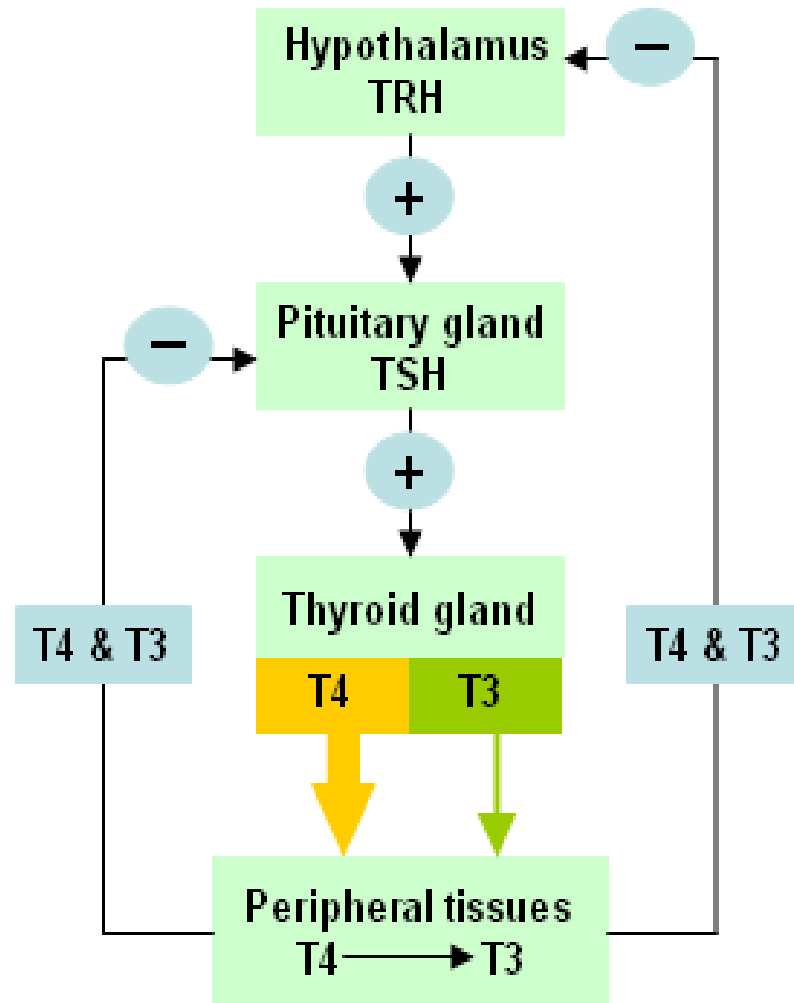


# REGULATION OF THYROID SECRETION

*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



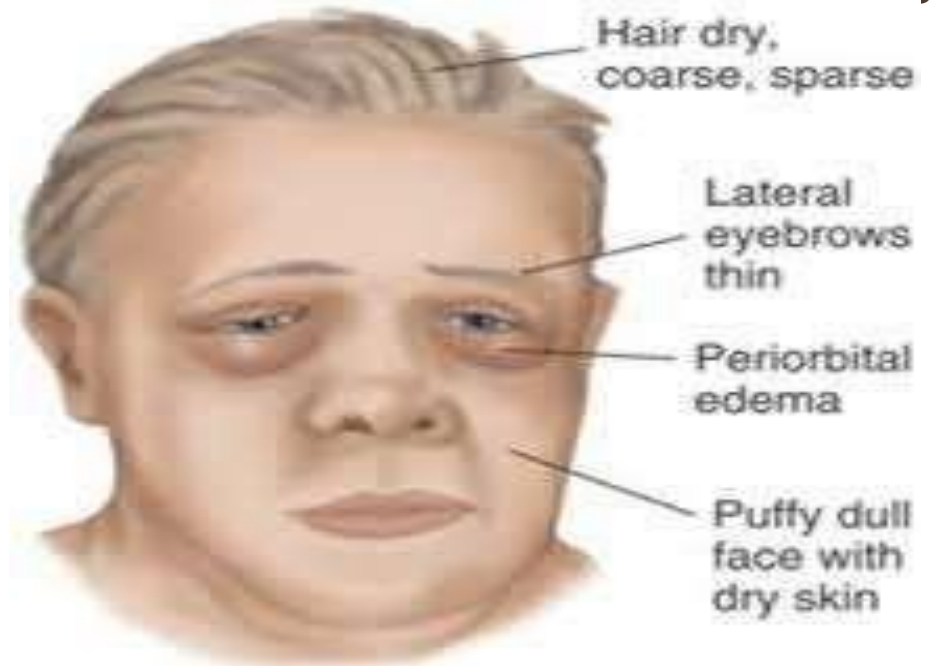
# diseases continue...

## 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



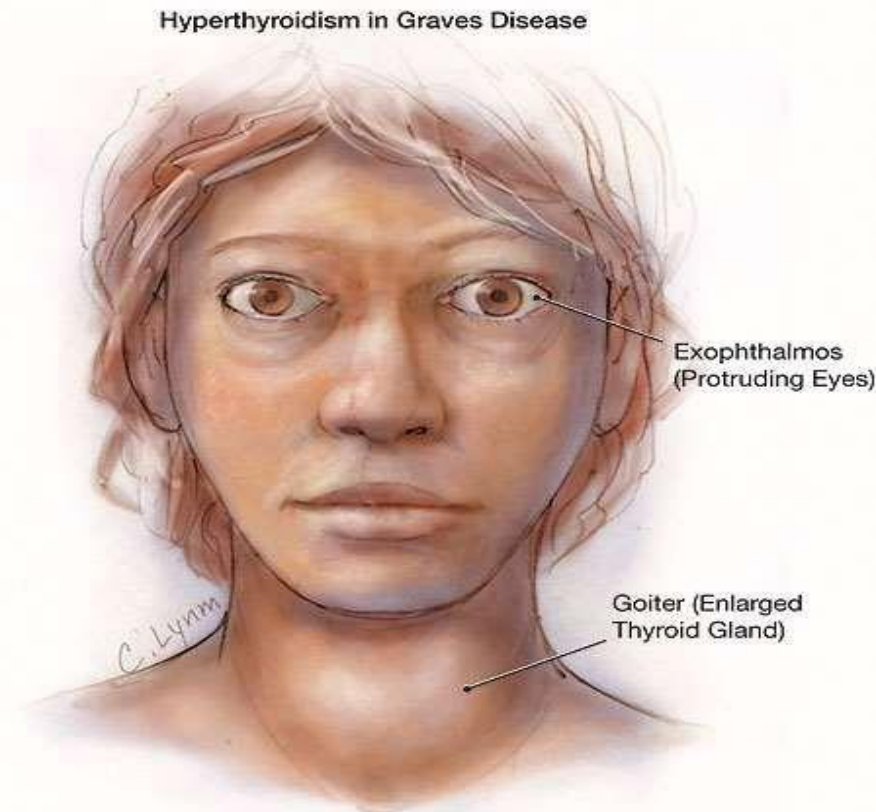
# diseases continue...

## 3. HYPERTHYROIDISM/GRAVES DISEASE: -

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

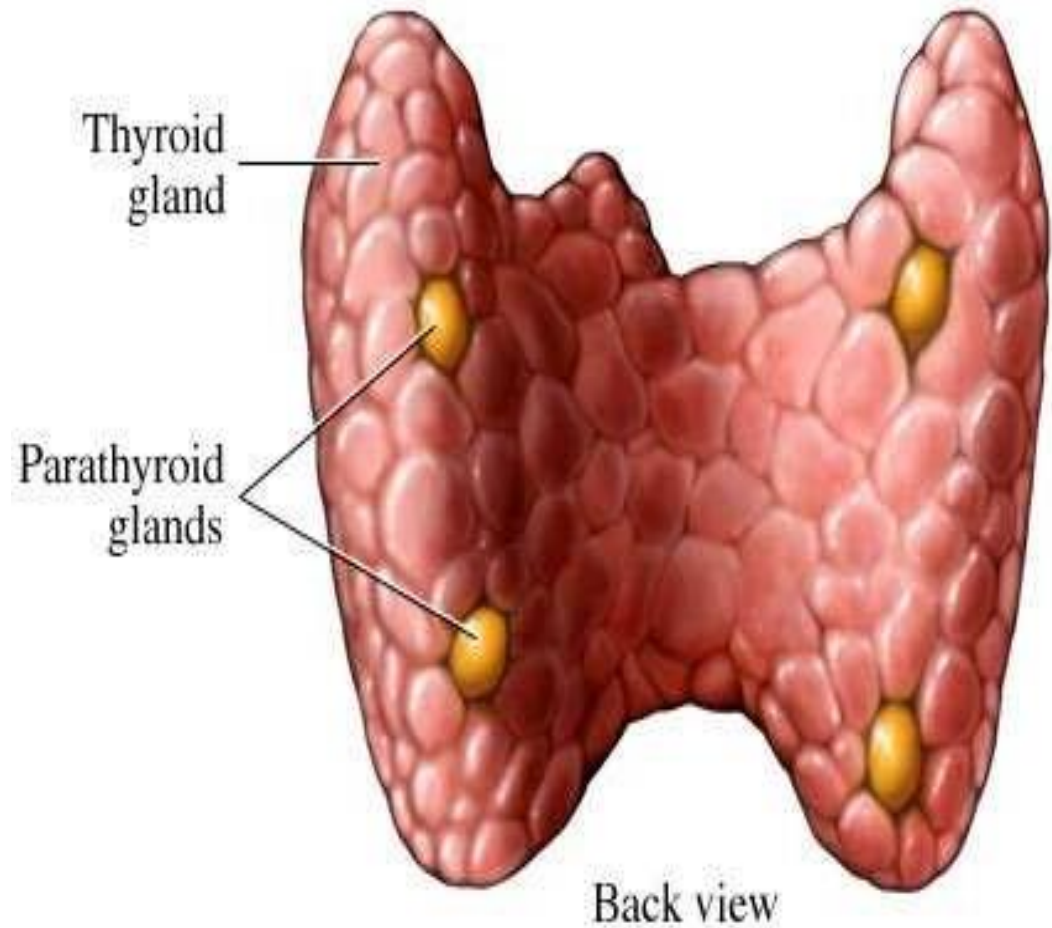
### **Characteristic features: -**

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



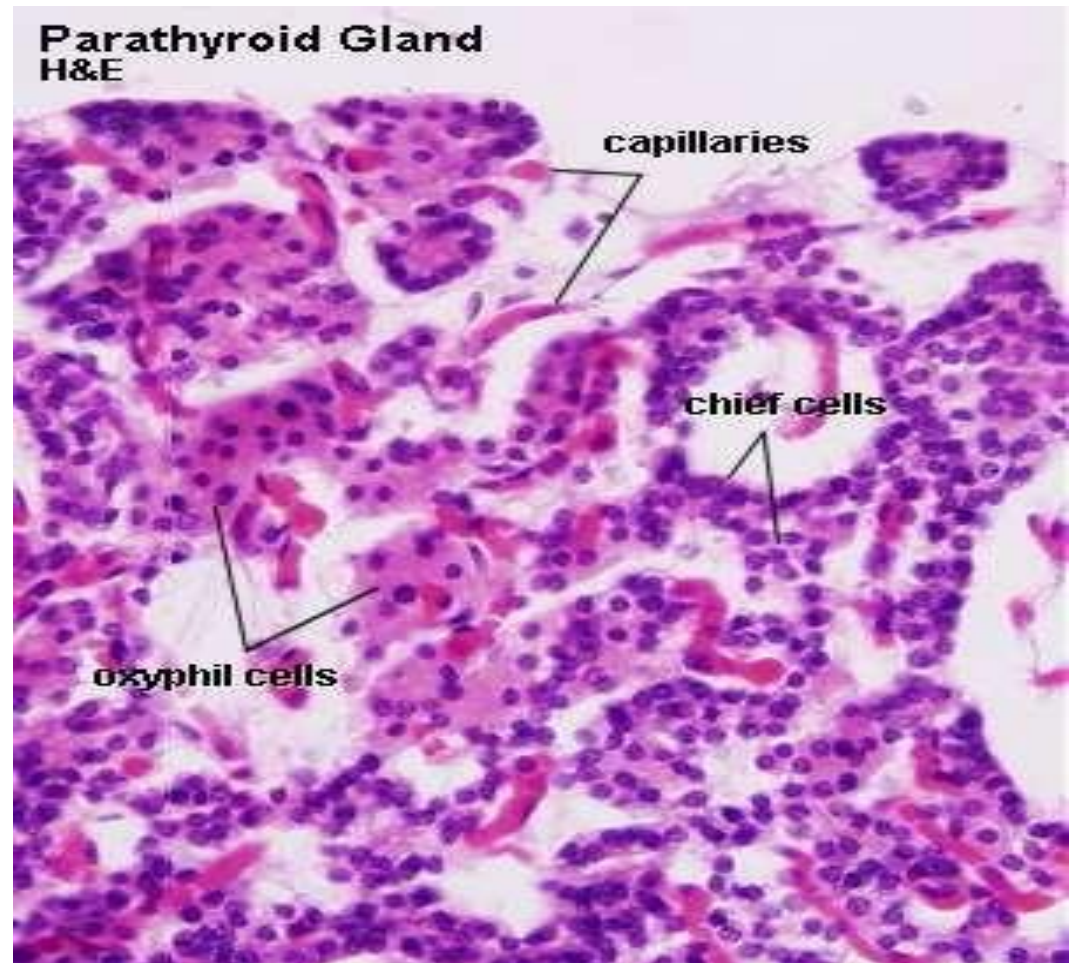
# PARATHYROID GLANDS

- In humans there are **4 *parathyroid glands***
- Parathyroid glands are ***essential for life***, as their removal can cause death from **asphyxia**



# FUNCTION OF PARATHYROID HORMONE

- Parathyroid glands contains *chief cells* which secrete *parathyroid hormone*.
- The main function of *parathyroid hormone* is to increase the blood calcium level



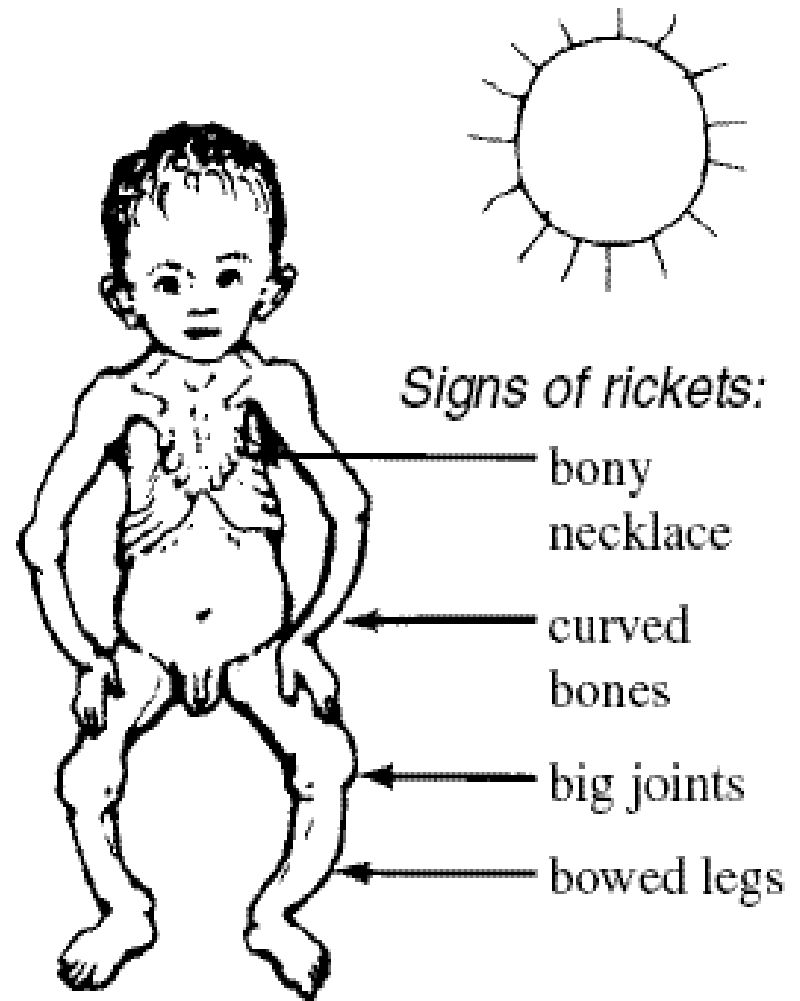
# DISEASES RELATED TO PARATHYROID GLAND

## 1. RICKETS:

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

### Characteristic features: -

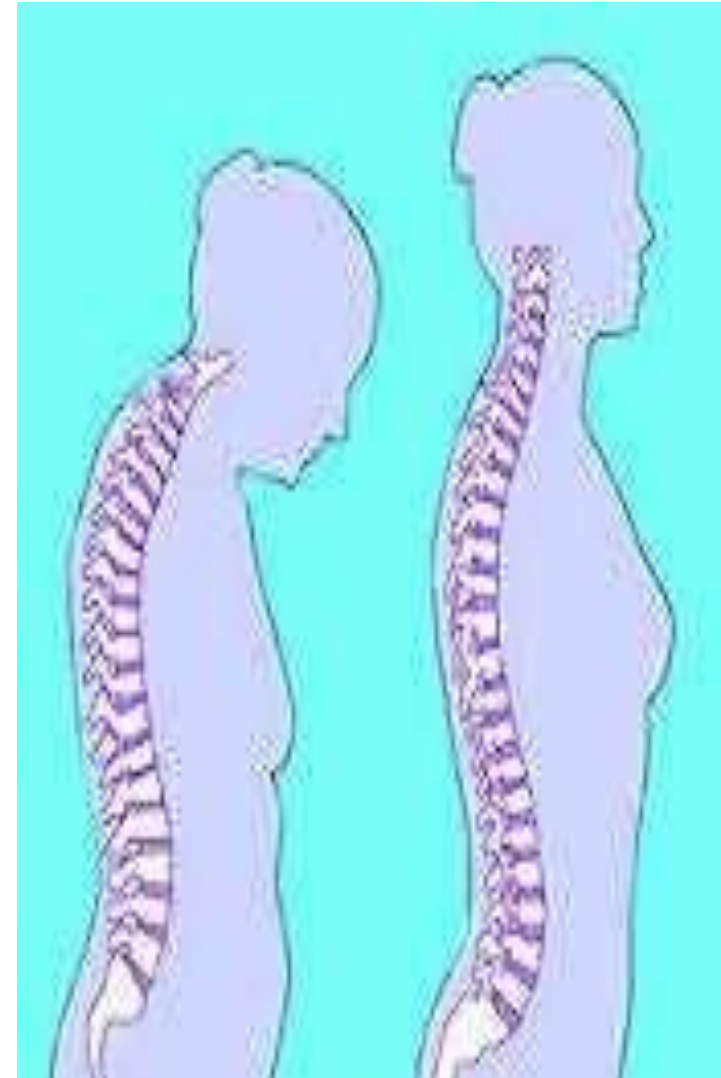
- ✓ Deformed bones
- ✓ Thick wrist and ankles
- ✓ Retarded growth



# 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





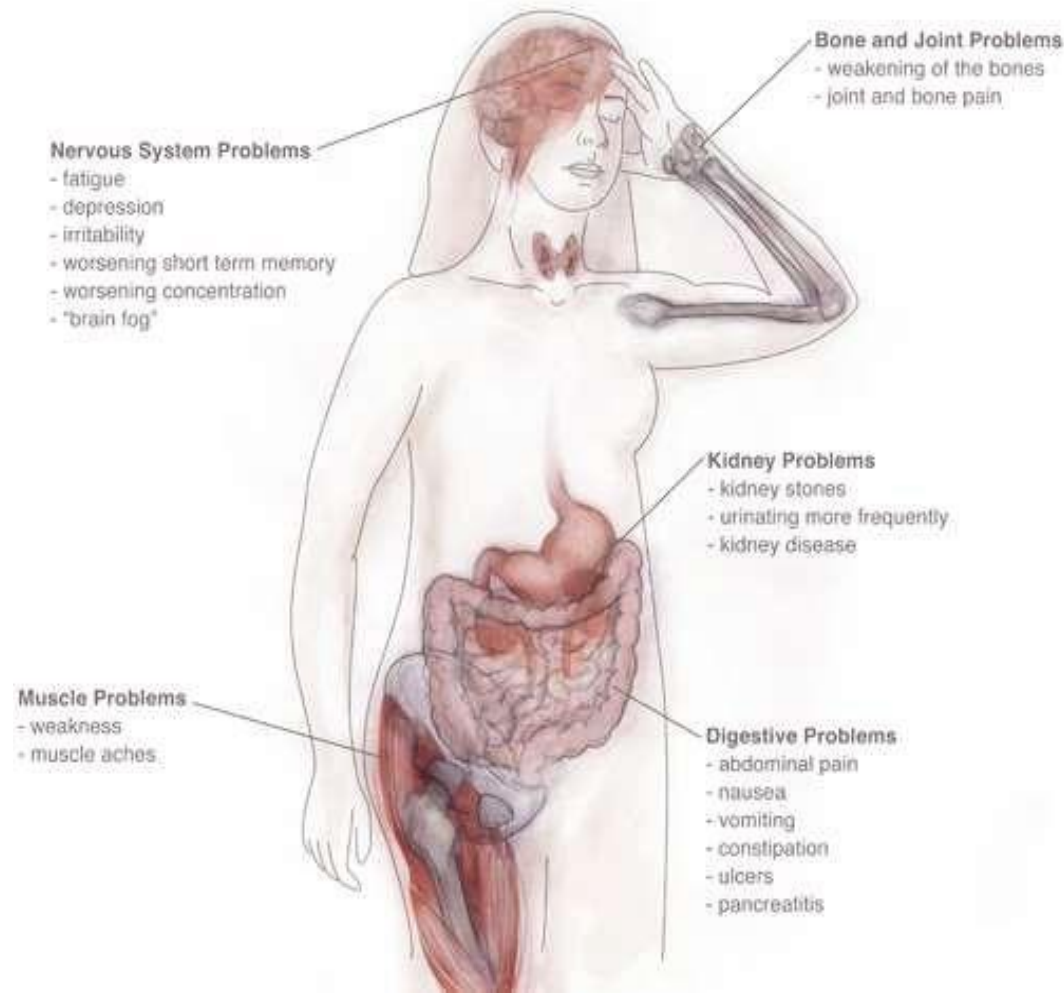
# diseases continue...

## 4. HYPERPARATHYROIDISM: -

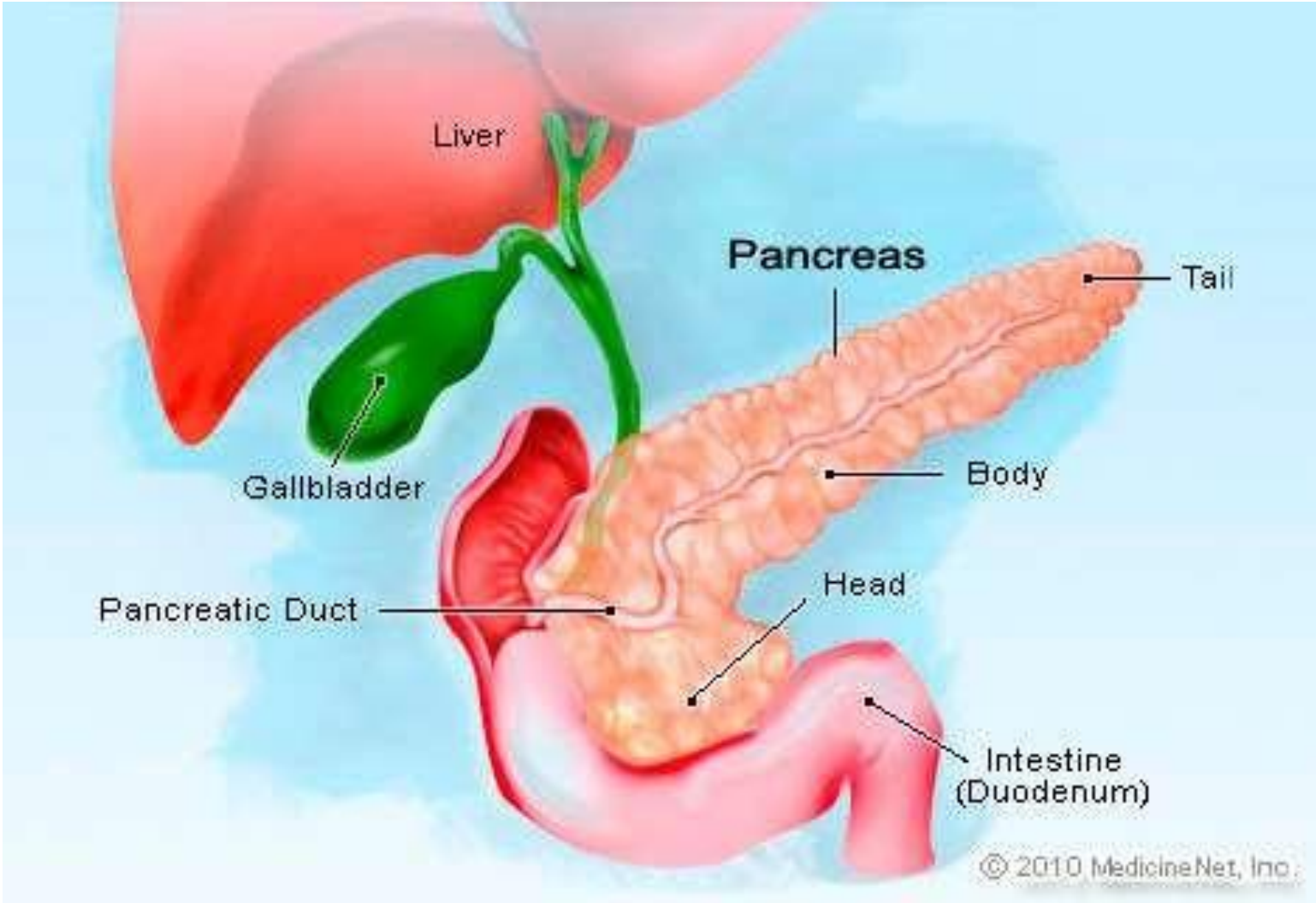
Excessive secretion of parathyroid hormone.

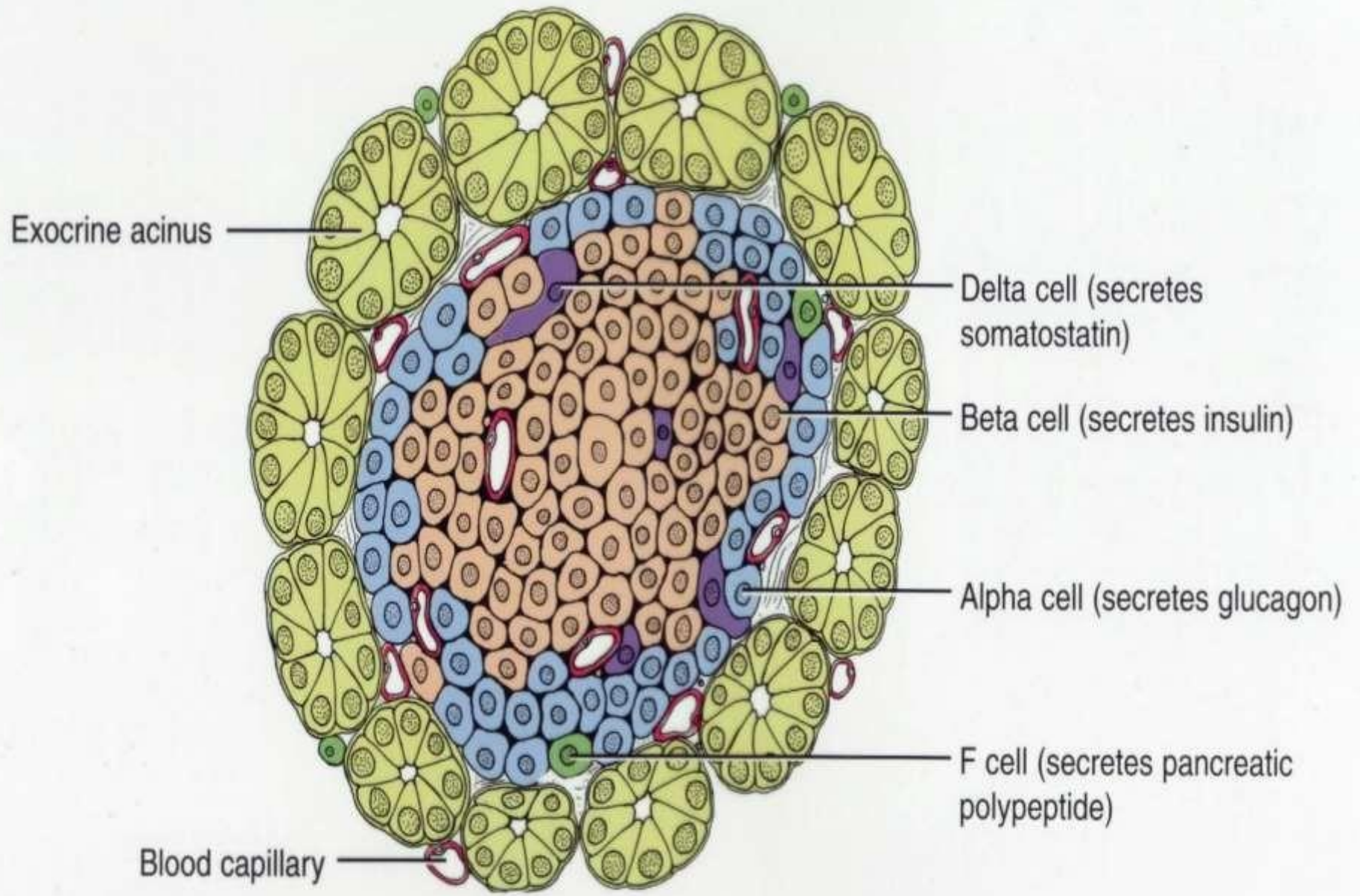
### Characteristic features: -

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



# PANCREAS





# PANCREATIC HORMONES

## 1. INSULIN:

### Actions:

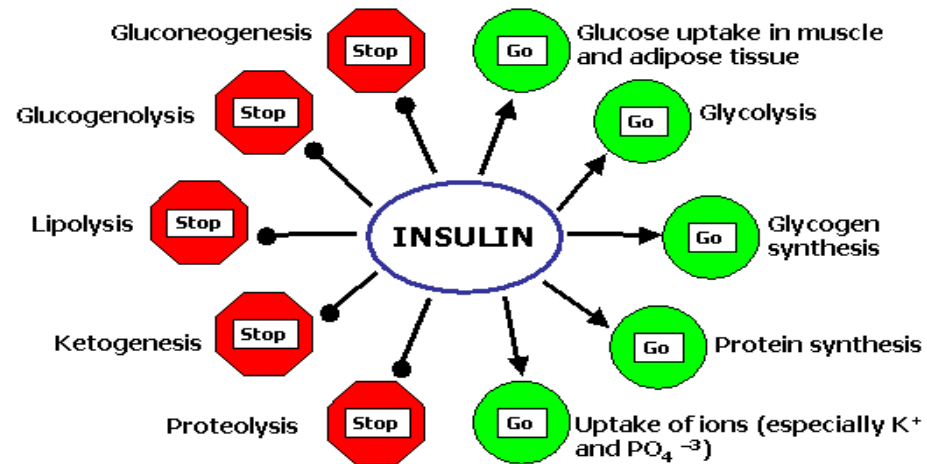
#### ➤ On carbohydrate metabolism:

- 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

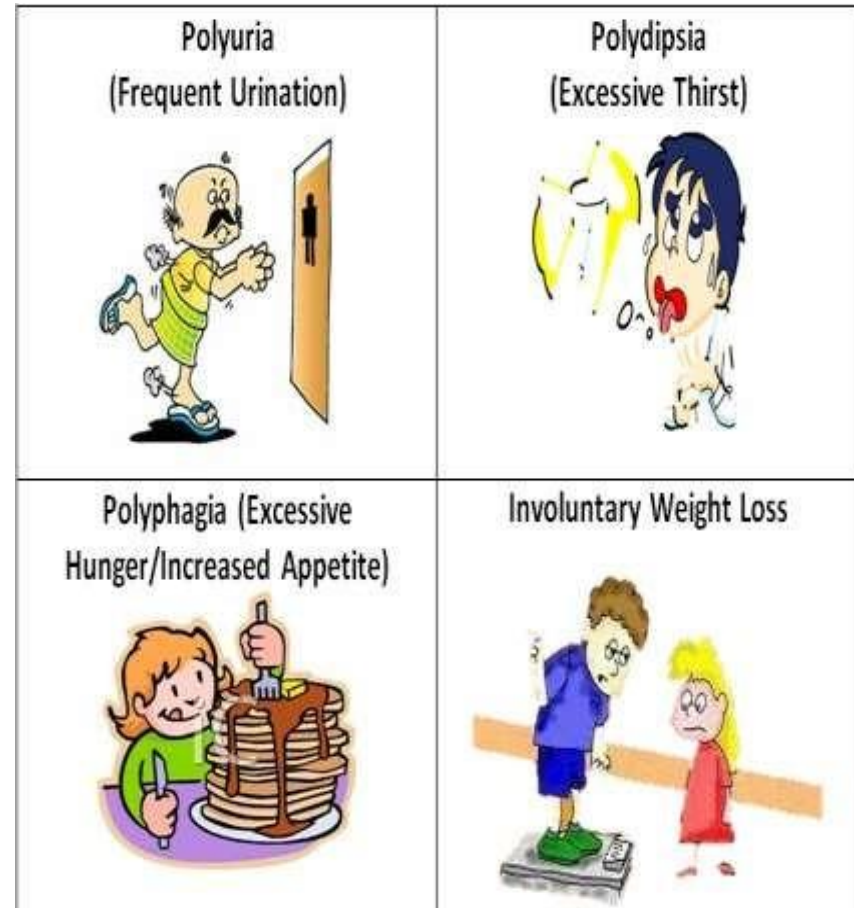


Modified from *Clinical Biochemistry*, A. Gaw et al., Churchill Livingstone, Edinburgh, 1995.

# 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**.

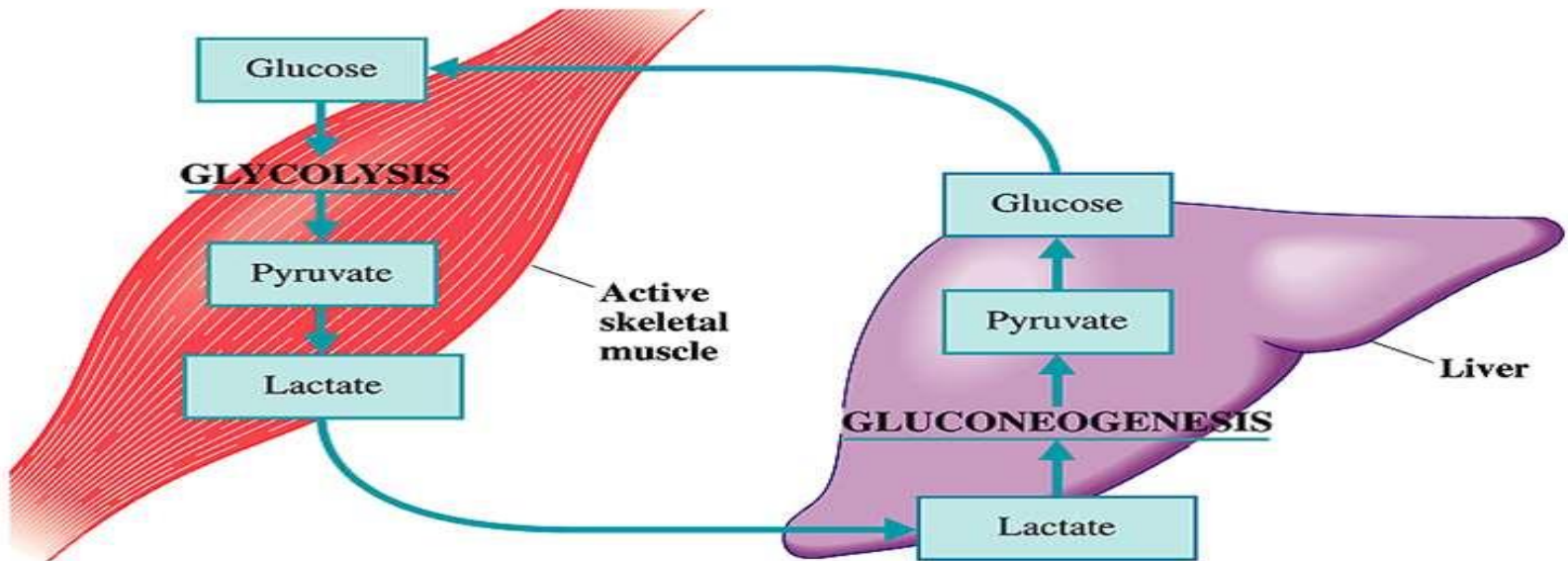


# hormones continue...

## 2. GLUCAGON: -

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

- ✓ Stimulate glycogenolysis
- ✓ Promotes gluconeogenesis



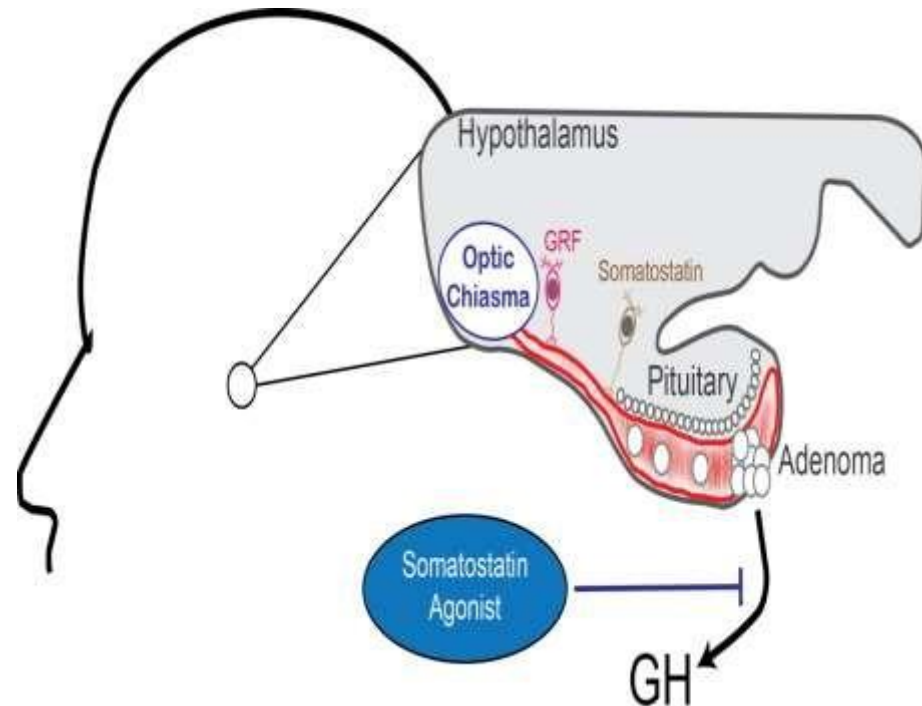
# hormones continue...

## 3. SOMATOSTATIN:

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

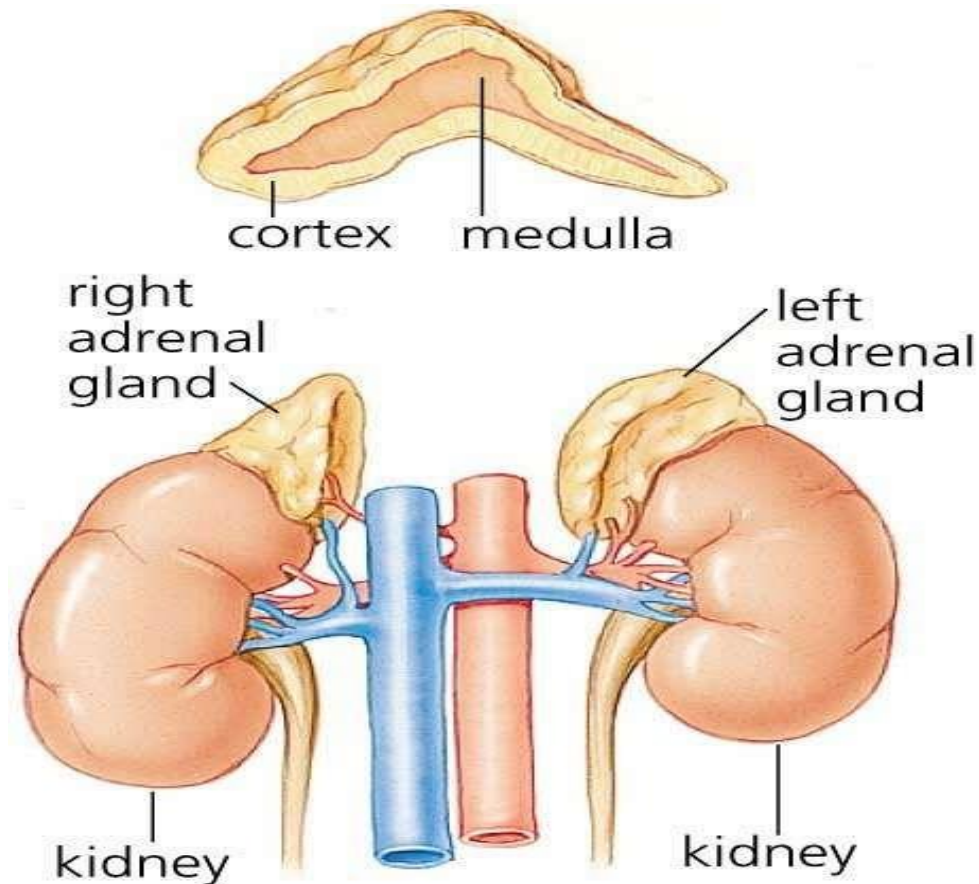
### Action:

- It regulates the *endocrine and Nervous system functions*



# 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***.





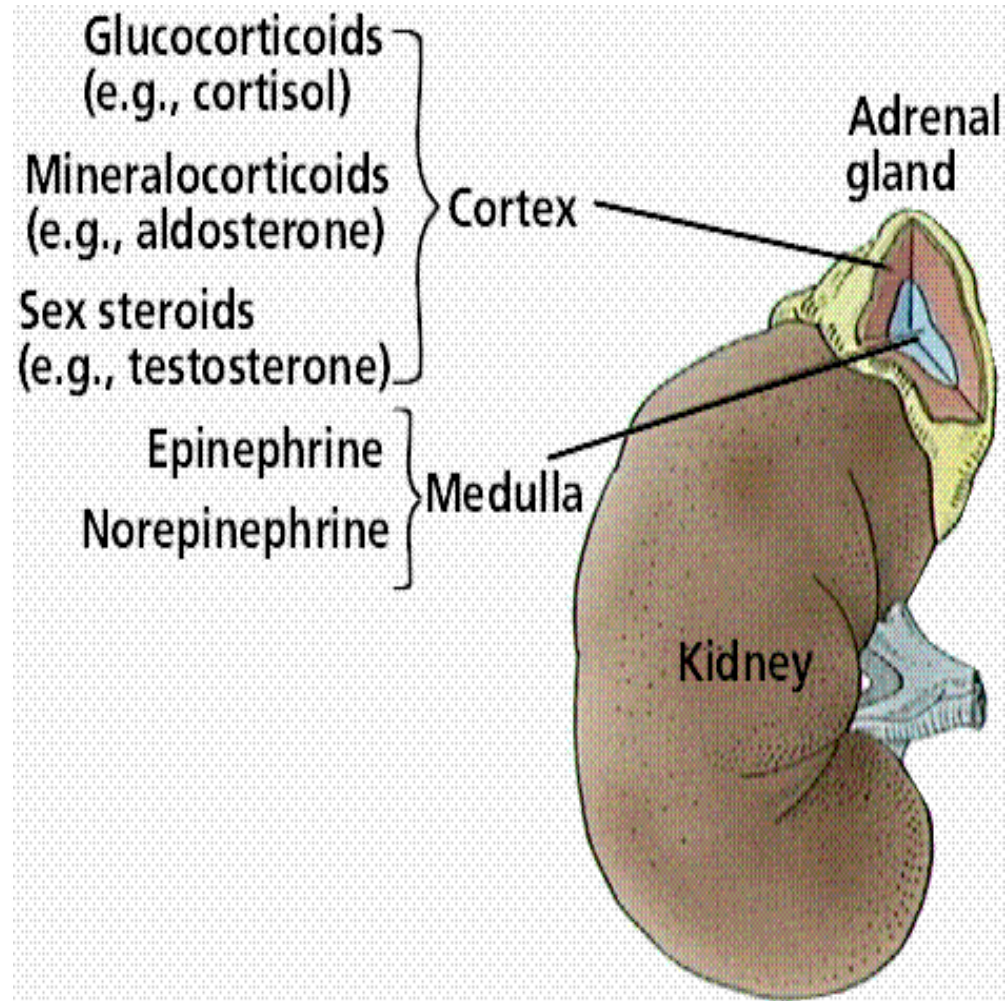
# adrenal glands continue...

## 1. ADRENAL CORTEX: -

It produces three hormones:

- Glucocorticoids
- Mineralocorticoids
- Sex hormones (androgens)

These are collectively called as ***adrenocorticoids***

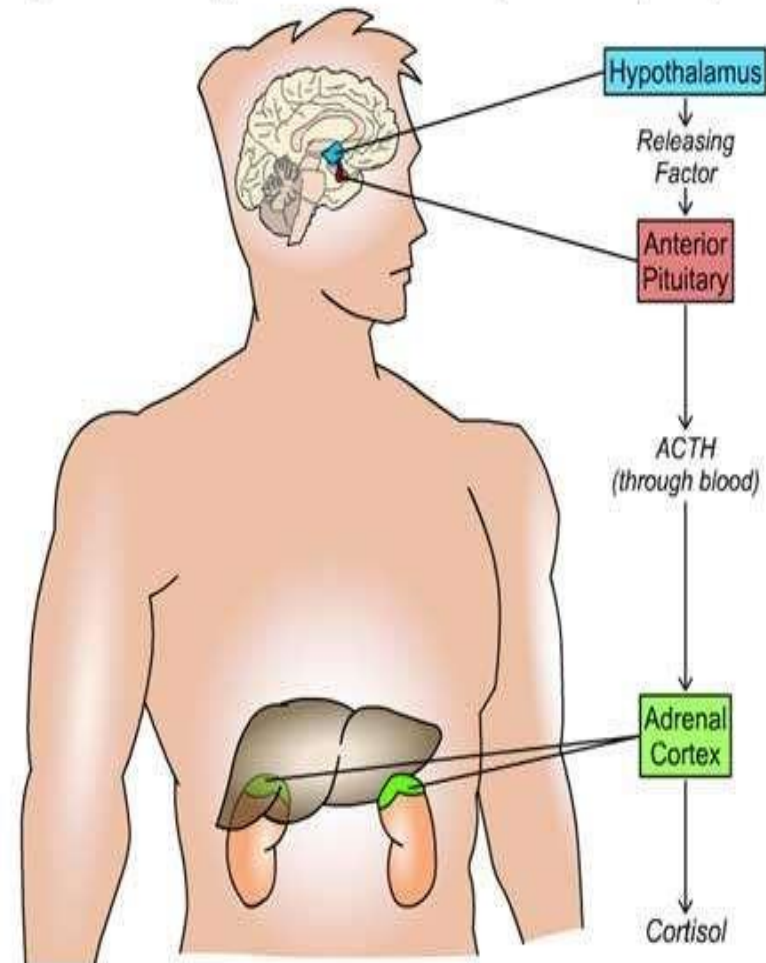


# adrenal cortex continue...

## 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:

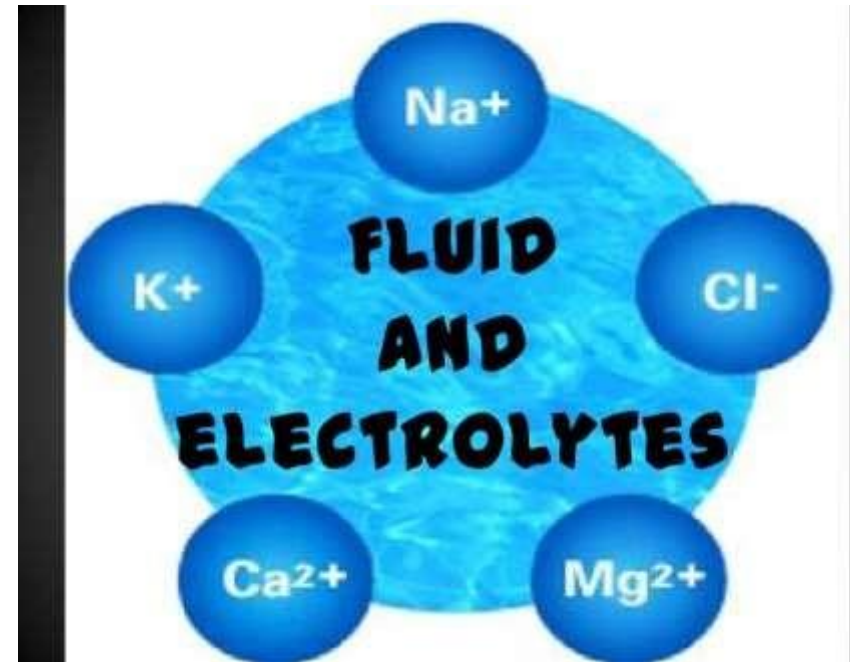
- ▣ Have an anti-inflammatory action.
- ▣ Suppress the immune response.
- ▣ Suppress the response of tissue to injury.
- ▣ Delay wound healing.



# adrenal glands continue...

## B. Mineralocorticoids (aldosterone): -

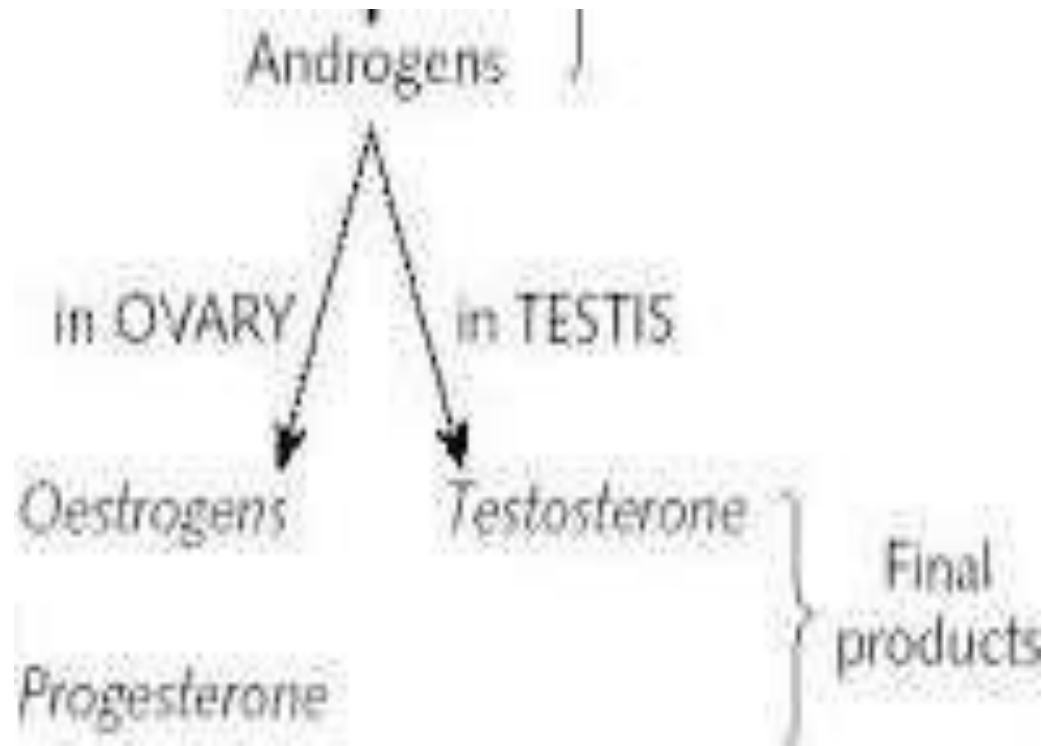
- *Aldosterone* is the main mineralocorticoids
- It maintains Water and electrolyte balance



# 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:

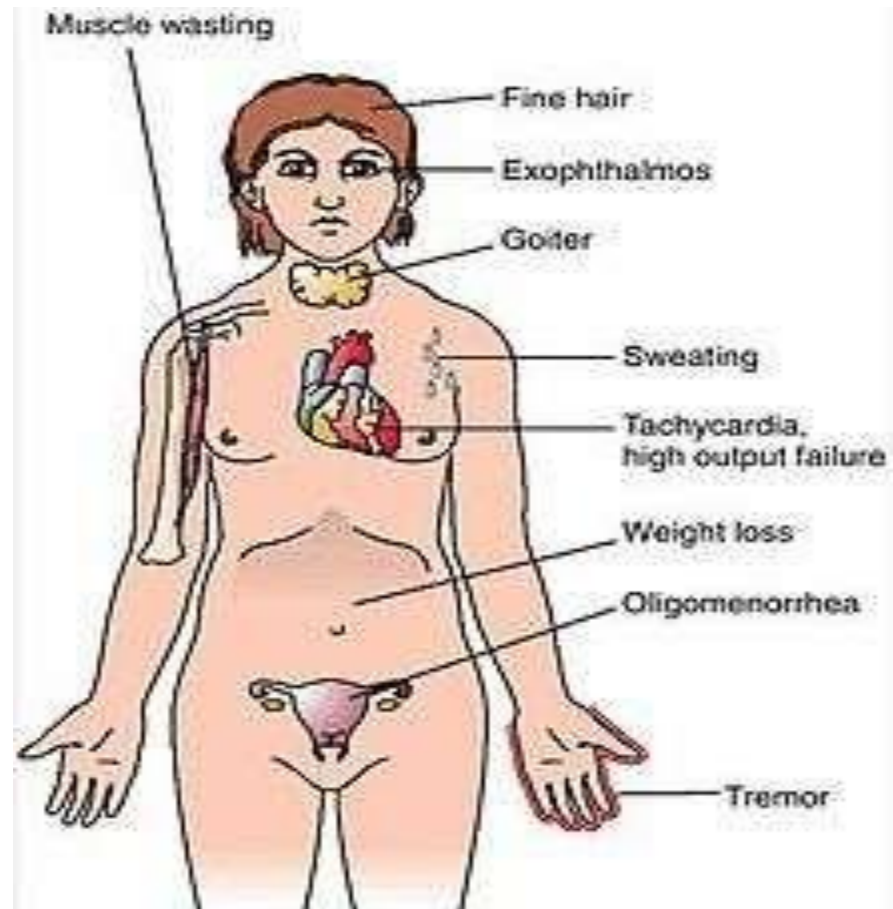
- Pain in face, neck and abdomen
- Pathological fractures
- Diminished protein synthesis
- Suppression of growth
- Hypertension
- Menstrual disturbance
- Peptic ulcers



# 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



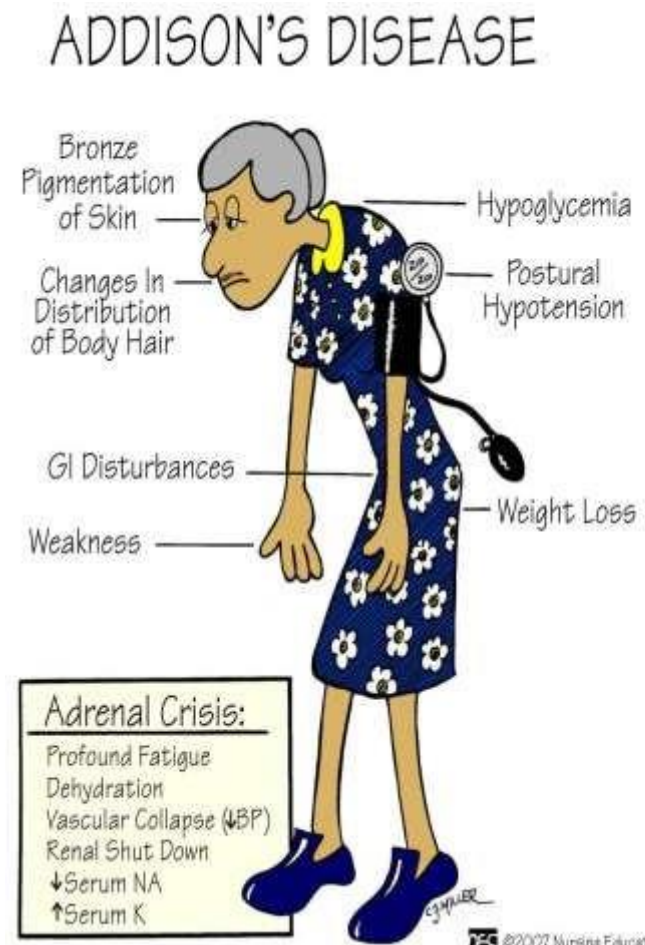
# disorders of adrenal cortex

## 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.

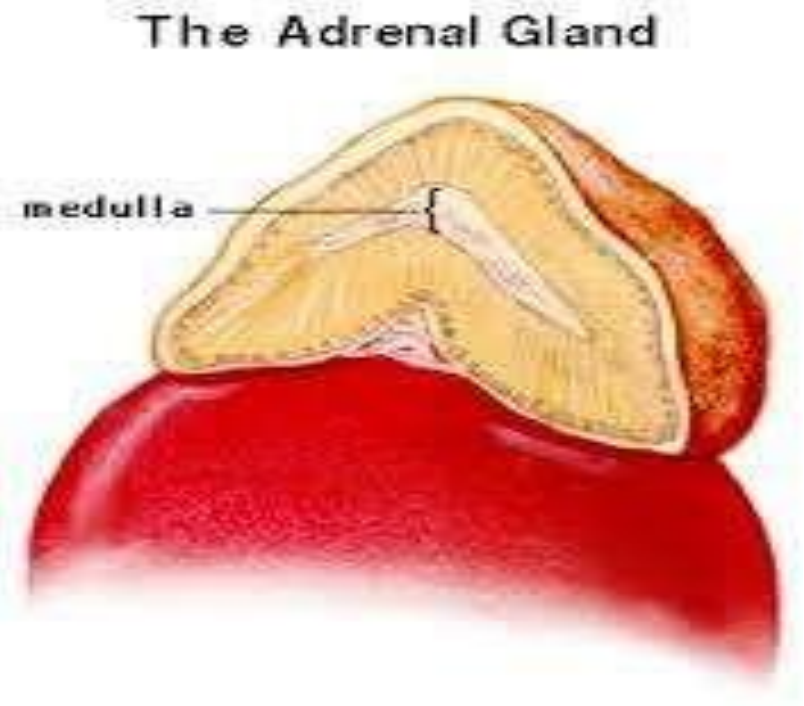




# adrenal glands continue...

## 2. ADRENAL MEDULLA: -

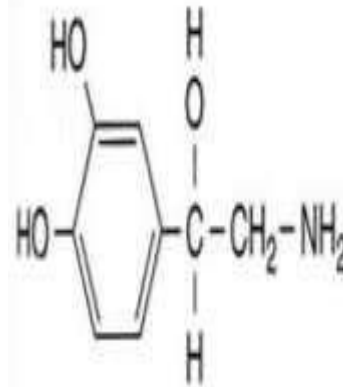
- It is surrounded by the cortex
- It produces two hormones
  - adrenaline* and
  - noradrenaline*.



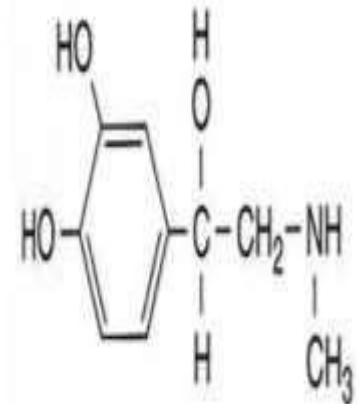
# adrenal medulla continue...

## 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: -

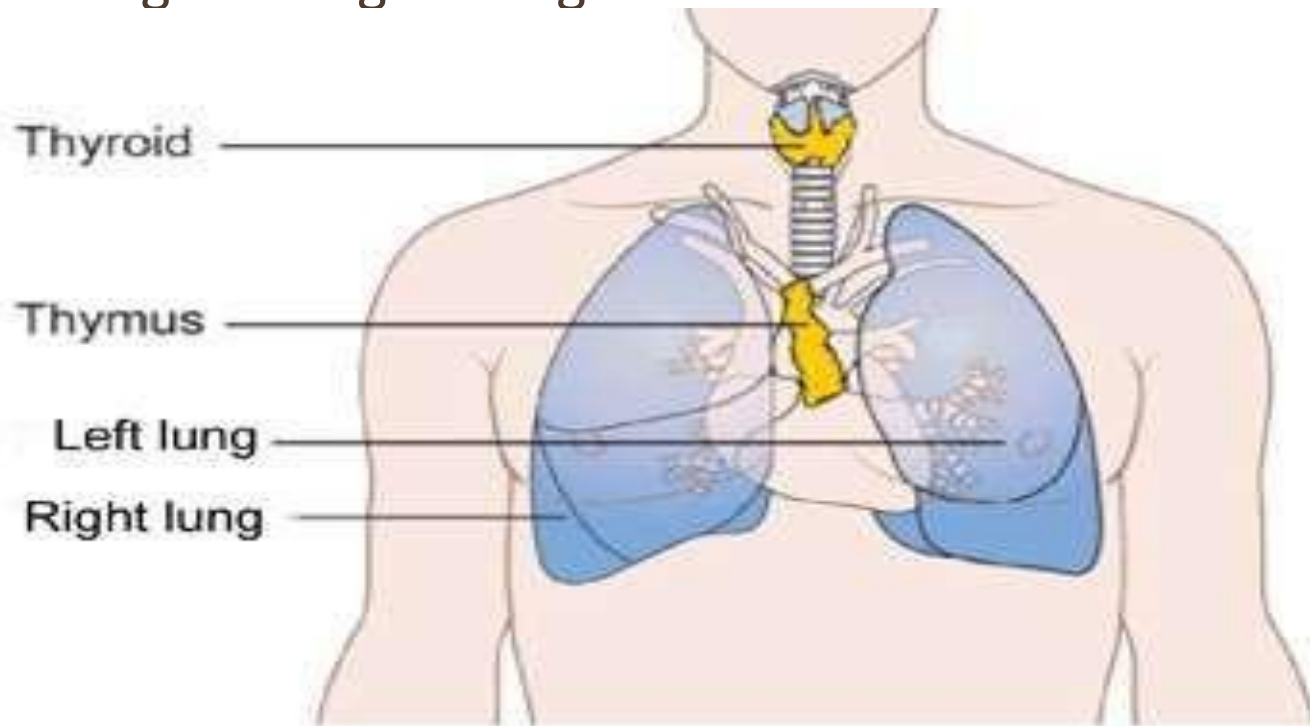
- Hypertension
- Hyperglycemia
- Raised metabolic rate
- Nervousness
- Headache



# THYMUS GLAND

Thymus is located in the anterior part of the upper mediastinum

- At birth it weighs 10-12 gms
- During childhood and adolescence 20-30 gms
- During old age it weighs 3-6 gms



# thymus gland continue...

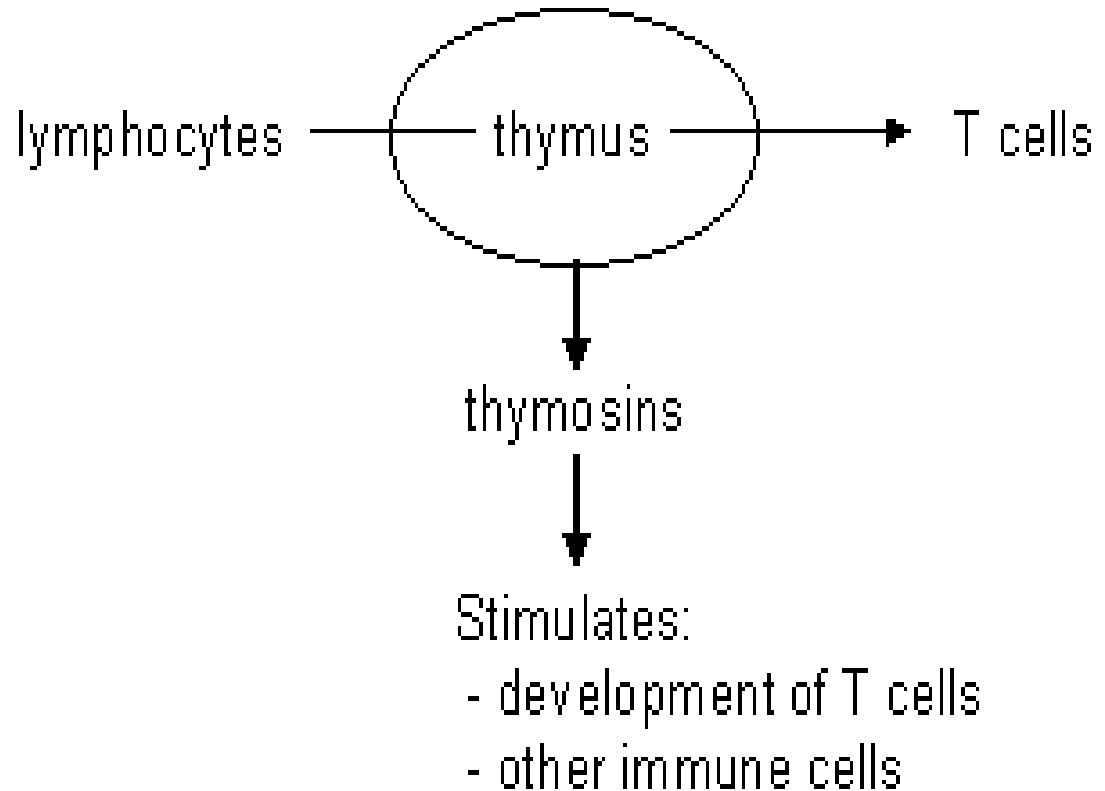
## Functions:-

- It initiates and maintain T- lymphocytes

## HORMONE :-

### Thymosin:-

- It is required for the development of T-lymphocytes for cell mediated immunity



# CONCLUSION

*In endocrine system we use to study and get knowledge about:*

- ✓ various glands of our body
- ✓ Hormones secreted by them
- ✓ Their various functions

*So it is very necessary to study for :*

- ✓ Implementing the gained knowledge *clinical area*
- ✓ For the *better* and *quality nursing care*



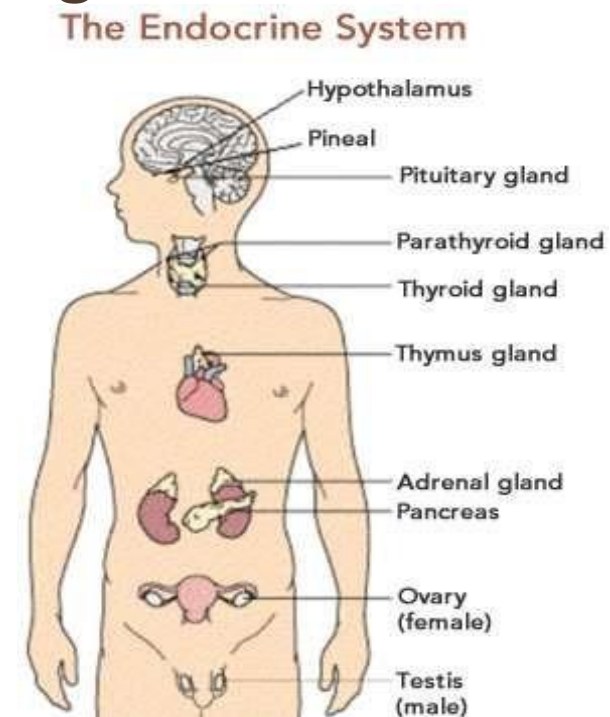
# SUMMARY

*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



# RECAPTUALISATION

- Define glands and their types?
- Enlist the hormones secreted by anterior pituitary?
- What is negative feedback mechanism?
- Define gynacomastia?
- What is gycogenolysis?





THANK YOU  
FOR  
LISTENING

