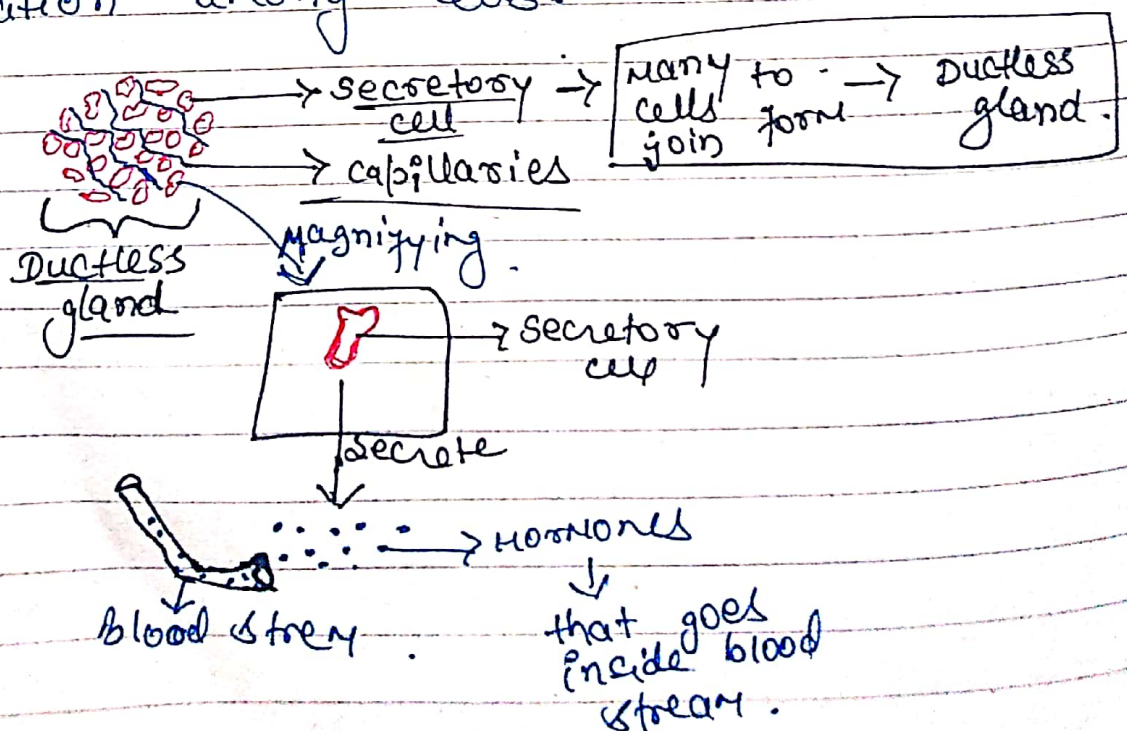


# ENDOCRINE SYSTEM

- Endocrine system is a system of gland & these glands secrete types of hormones into the blood stream to regulate the blood.
- It derives from greek word 'endo' means inside & 'crine' for secretes.
- Endocrine system is an information signal system like the nervous system.
- Endocrine system is ~~an~~ made up of series of ductless gland that produces chemical called hormone.
- Hormones are substance released from endocrine tissue into blood stream that attached to the target tissue and allow communication among cells.



## → Hormones :

- Hormones are the chemical messenger.
- Hormones are synthesised from amino acids and lipids (cholesterol based lipid need).
- Hormones formed in one gland or organ  
↓  
Then it goes to their target organ or tissue  
↓  
Then it produce cellular activity  
(like growth & metabolism)

- In our body homeostasis is maintained by ANS & endocrine system.

## → Pituitary Gland : (1)

- It is located below the hypothalamus.
- It is "master endocrine gland" becoz they control all other endocrine gland.
- They ~~play~~ play role on ~~metabolism~~ on growth, metabolism & regeneration.

→ Pineal gland (1)

- They play major role on sleep & awake cycle.

→ Parathyroid gland (4)

- They play role on absorption of  $Ca^{2+}$

→ Thyroid gland (1)

- It regulate energy & metabolism

→ Thymus gland (1)

- It helps to builds resistance to disease

→ Adrenal gland (2)

- They present on the <sup>(Cupper)</sup> surface of kidney
- They secrete adrenaline or they regulate metabolic process, water balance maintain, B.P regulate.

→ Pancrease (1)

- They play major role in digestion of carbohydrates, proteins, fats.
- They synthesise insulin.

→ Ovary : (2)

- They make Estrogen & progesterone.

→ Testis : (1)

- They secrete Testosterone.

## # Classification of Hormone

→ A/c to chemical Nature :

- Steroids hormones -  
eg ⇒ Testosterone, Estrogen, Progesterone.
- Amino Hormones -  
eg ⇒ Epinephrine, norepinephrine.
- Peptide Hormone -  
eg ⇒ Oxytocin & vasopressin.
- Glycoprotein Hormone -  
eg ⇒ LH & FSH.
- Protein Hormone -  
eg ⇒ Insulin & glycogen.

## A/c to Nature of Action

### • General Hormone -

eg => Thyroid & Insulin hormone they regularly release in our body

### • Specific Hormone -

- The specific hormone is release only on certain condition & they affect the function of specific organ.

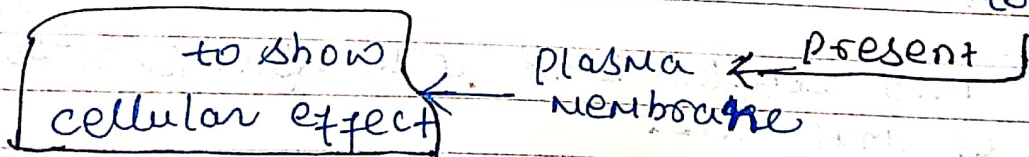
eg => FSH & androgen

### • local hormone -

eg => Prostaglandins, histamine.

## Mechanism of Hormone Action

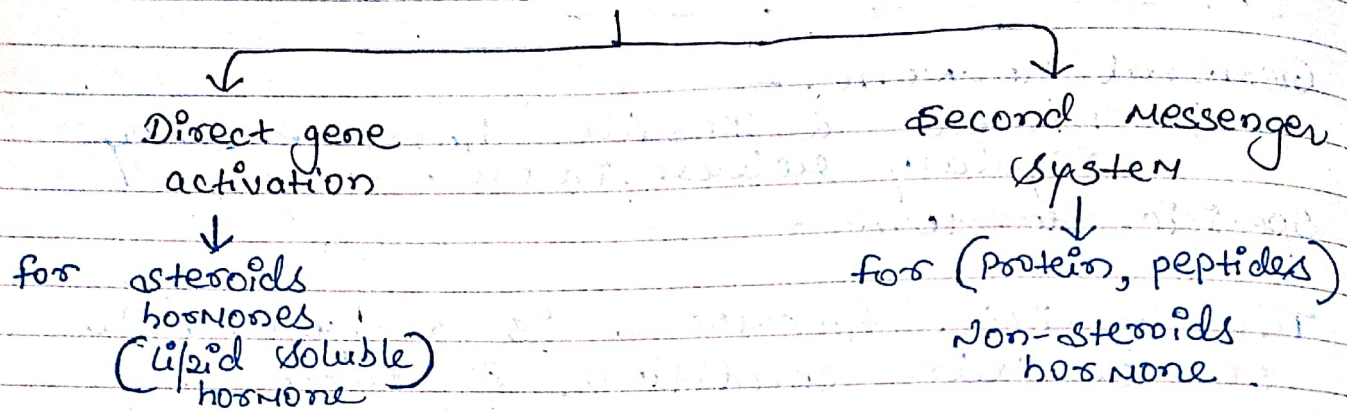
Hormone affect Target cell/organ must have Receptors to bind.



### • cellular effect :

- change in membrane permeability.
- Synthesis of new protein or enzyme.
- Activation or inactivation of enzyme.

## Mechanism of Hormone Action



→ Direct gene Activation → for lipid soluble hormone  
↓  
they cross plasma membrane easily.

Step 1: The steroids hormone enters in cell by diffusion.

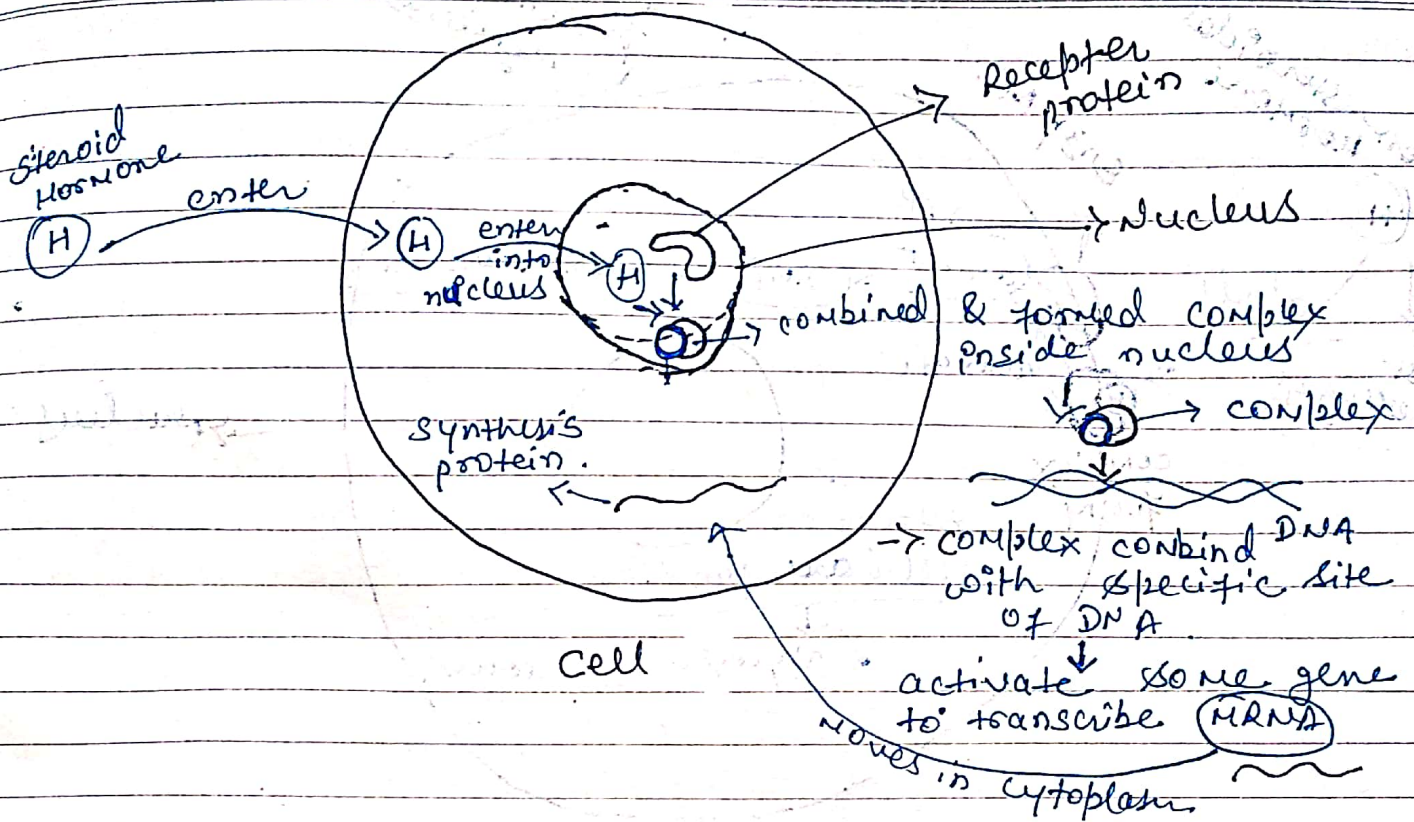
Step 2: This hormone enters into nucleus & In nucleus, they have receptor protein.

Step 3: The hormone combined with receptor protein & form a complex inside nucleus.

Step 4: This complex bind with specific site of DNA at that cell.

Step 5: After bind, the complex activates some genes of that DNA & that genes to transcribe mRNA (messenger RNA).

Step 6: mRNA then translated translocated at cytoplasm & then translated to form new protein in plasma membrane.



→ Second messenger system

↳ only for water soluble hormone

• unable to enter target cell

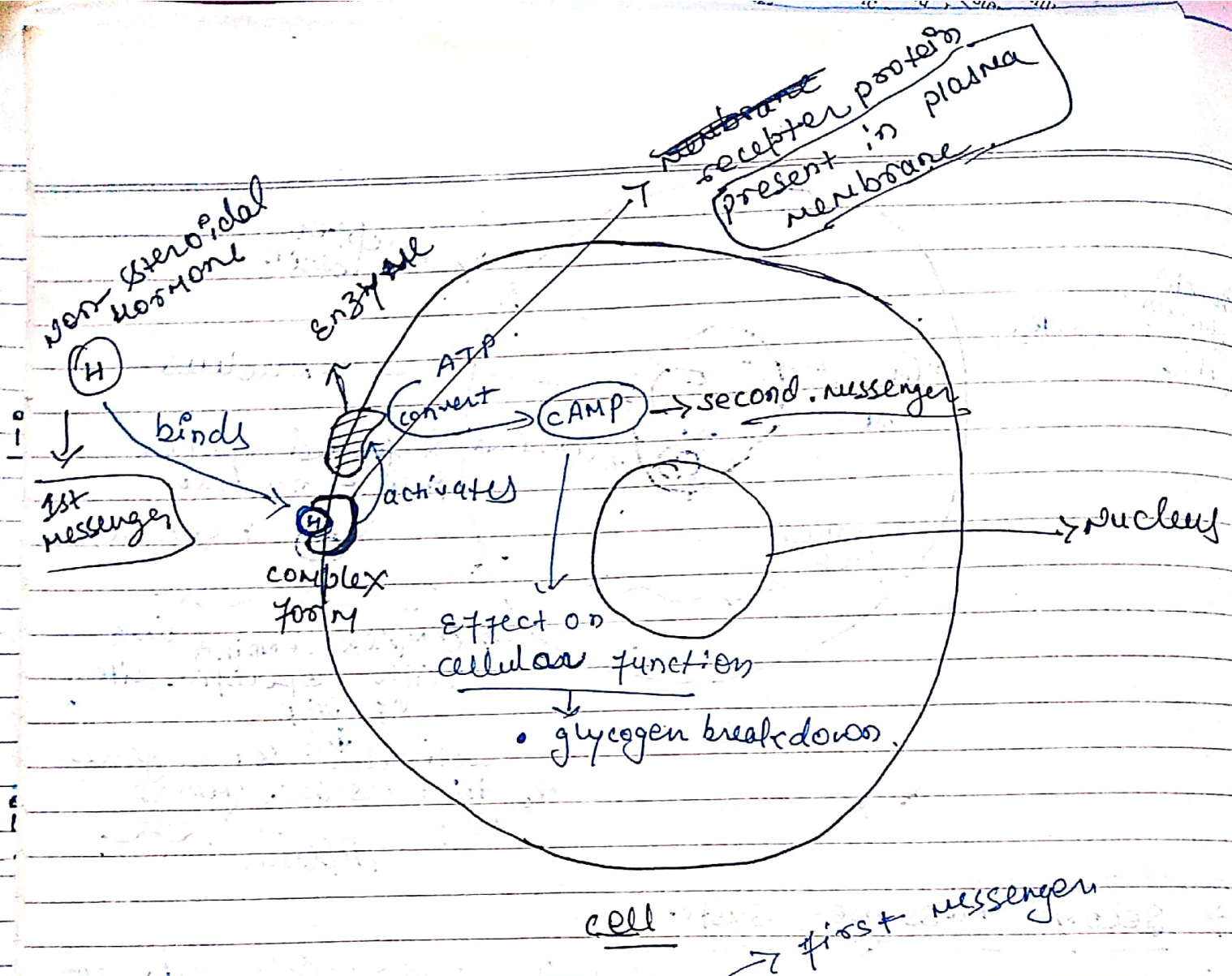
→ Second messenger system

- only for water soluble molecule

• unable to enter target cell

• so, they binds with membrane receptor

• the the complex form & then utilize a second messenger system.



Step 1: The non-steroidal hormone never enter in plasma membrane. so, they combined with receptor protein in plasma membrane & form complex

Step 2: This complex activates enzyme which is present on plasma membrane.

Step 3: Then that enzyme takes all ATP from cell & convert into cAMP.

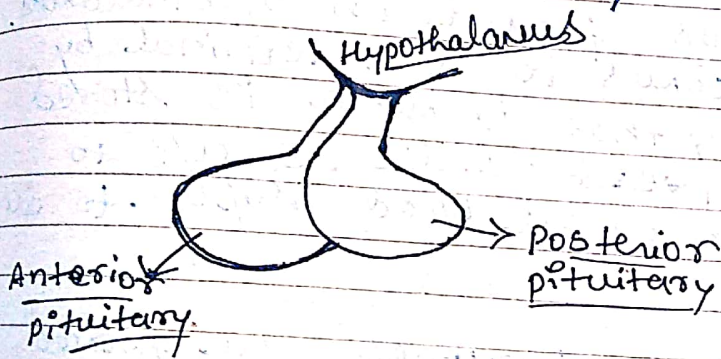
↳ it is second messenger.

Step 4: This cAMP produce cellular function.

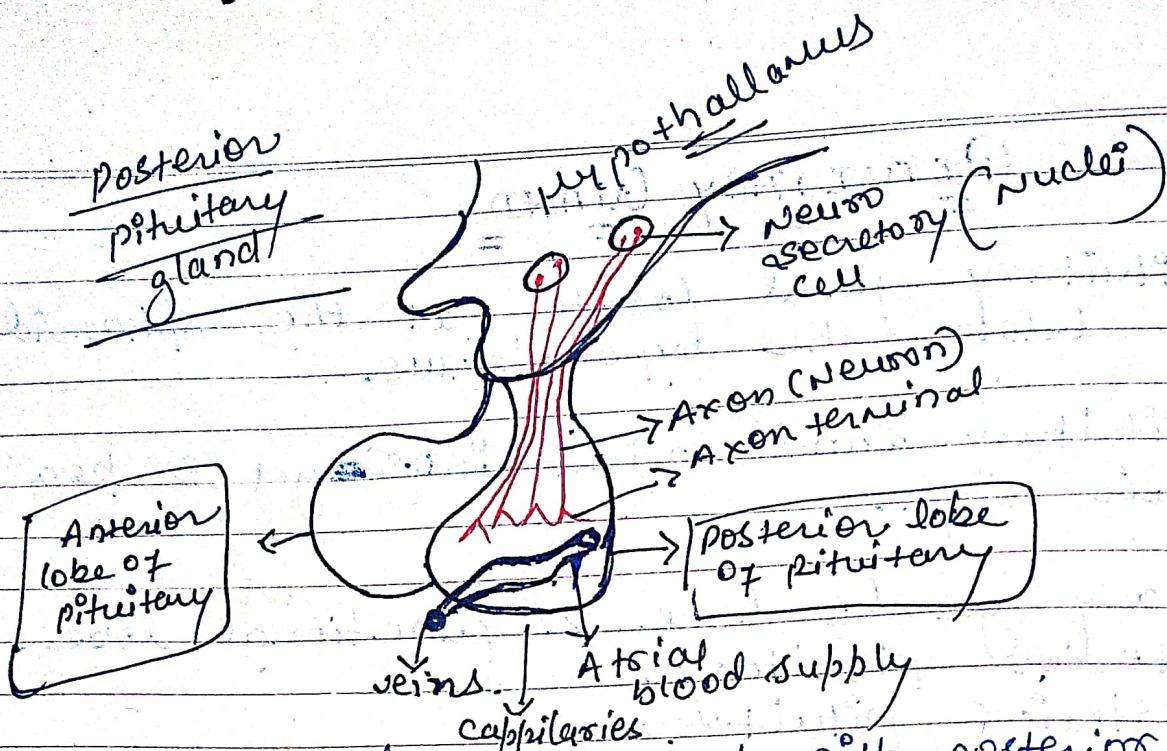


## PITUITARY GLAND

- The pituitary gland locate at the sphenoid bone below the hypothalamus.
- The Pituitary gland weight is 0.5 gm & pea in their size.
- Pituitary glands have 2 functional lobe.
  - i) anterior pituitary.
  - ii) Posterior pituitary.



- Anterior pituitary is made up of glandular tissue.
- Posterior pituitary is made up of nervous tissue.
- Pituitary gland controls activity of other gland, so, that's why ~~the~~ Pit is known as "master endocrine glands".
- Hypothalamus connected with anterior pituitary by ~~nerve tract/fiber~~ blood circulation.
- Hypothalamus connected with posterior pituitary by nerve fiber.



• so, the hypothalamus connect with posterior lobe of pituitary. • The hormones formed in hypothalamus. so, that hormones comes to Axon terminal by passing Axon. & ~~they~~ that hormone is stored in the form of vesicles. & a/c to need they goes in atrial blood supply. to our body.

∴ Hypothalamus general two hormones are formed

i) ADH (Antidiuretic hormone)

↳ ~~acts~~ in kidney tubules target

ii) oxytocin

↳ acts on mammary glands.

## Anterior pituitary gland

- It regulates several physiological processes including stress, growth & reproduction.
- Importance of
  - control chemical & water balance in body.
  - control growth & metabolism

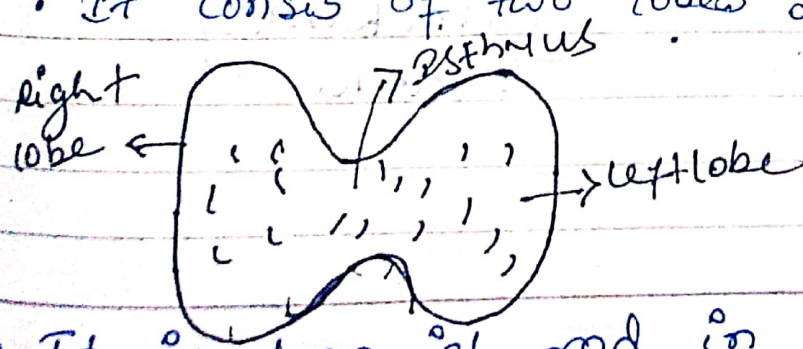
### → Hormones of anterior pituitary gland

	Target tissue
• GH	→ most tissue
• TSH	→ Thyroid gland
• FSH	→ ovaries & testes
• LH	→ ovaries & testes

## THYROID GLAND

- Thyroid gland is the largest gland in endocrine glands.
- It is butterfly in shape.
- It is located at below the larynx
- Their weigh is about 15-20g.

• It consists of two lobes: Right & left lobe. & they both separated by Isthmus.



- It is brownish red in colour & it is rich in blood vessels.

• synthesis of thyroxine

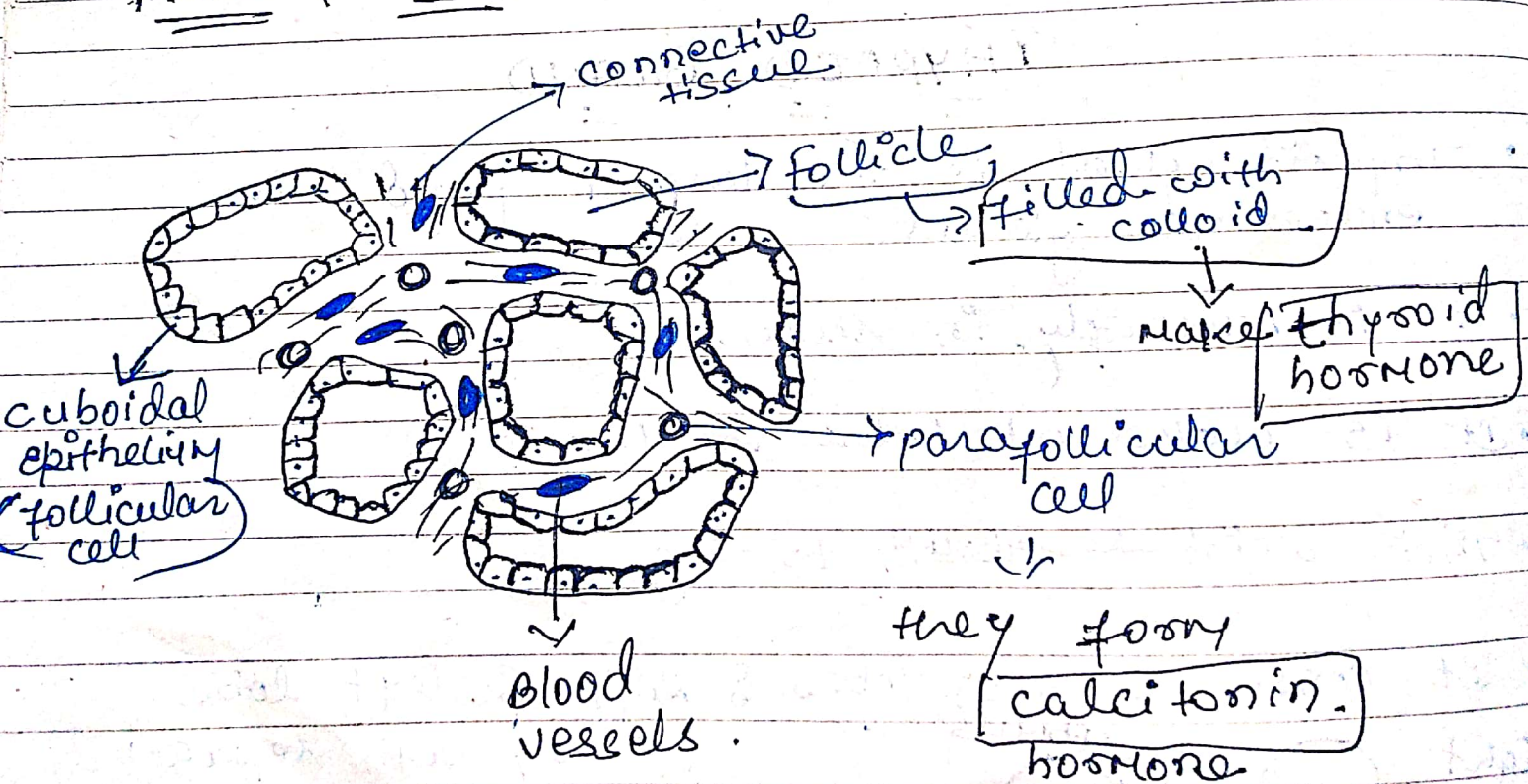
→ Thyroid : composed of hollow structure

↓  
called follicles (cavity)

↓  
they stored sticky colloids

↓  
derived thyroid hormone.

### Microscopic Structure



## → Thyroid hormone :

- metabolic hormone

- present 2 tyrosine molecule

- controls rate at which glucose is burned or oxidised.

↓  
after then glucose convert into body heat. → for body temp.

&  
chemical energy → Need each cell

## → Calcitonin hormone :

- they formed by parafollicular cell

- maintain  $Ca^{2+}$  &  $PO_4$  level

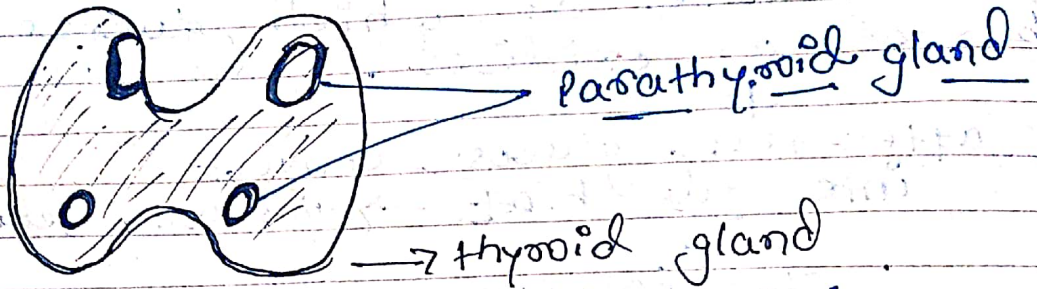
• if  $Ca^{2+}$  level is ↑

↓  
they helps to ↓  $Ca^{2+}$  level by deposit  $Ca^{2+}$  in bones from blood.

- calcitonin is release in blood vessels by parafollicular cell only during  $Ca^{2+}$  level is high.

## Parathyroid Gland

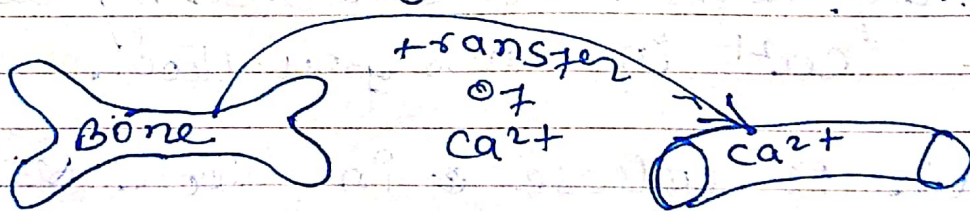
- composed of granular tissue.



— located at back side on the surface of thyroid gland.

— It also stimulate kidney & intestine to absorb more  $Ca^{2+}$ .

— It shows hypercalcaemic effect (they takes  $Ca^{2+}$  from bones & transfer to blood stream. so, in blood the  $Ca^{2+}$  ↑↑ (high) →)



→ Parathyroid Gland

↓ secretes

→ Parathyroid hormone (PTH)

↓

regulate blood  $Ca^{2+}$  level.

When  $\downarrow$   $Ca^{2+}$  level in blood  $\rightarrow$  PTH release  $\rightarrow$  stimulate osteoblast

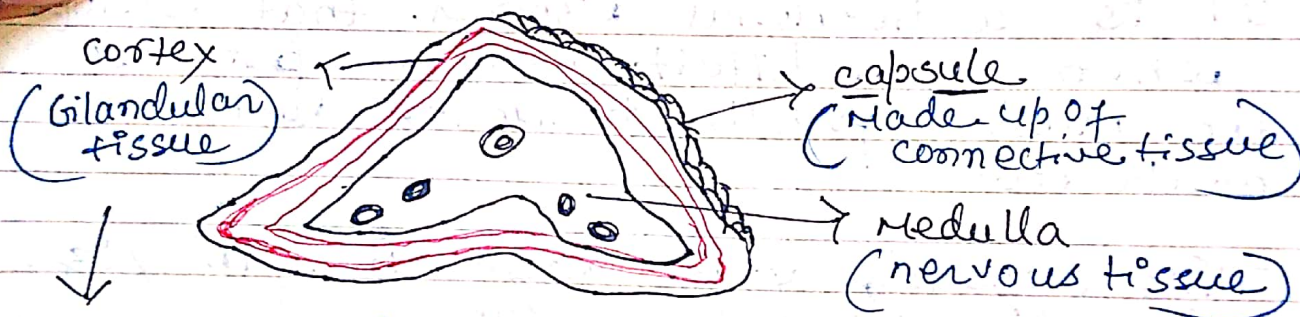
then the  $Ca^{2+}$  in bone to release  $Ca^{2+}$  in blood

breakdown bone matrix

(bone destruction cell)

## Adrenal Gland / medulla / cortex

- It is bean shaped on top of kidney & two in numbers.



$\rightarrow$  Adrenal cortex ~~is~~ have three layers & it is made up of glandular cell.

$\rightarrow$  Adrenal medulla is made up of nervous tissue.

- It gets stimulated by sympathetic nervous system then they release hormone called epinephrine & nor-epinephrine

$\uparrow$  Heart rate  
 $\uparrow$  Blood pressure  $\leftarrow$  helps to prolong the effect of neurotransmitter of SNS.  
 $\uparrow$  Blood glucose level

## Disorder of Pituitary gland

### i) Pituitary Dwarfism

- It is the condition in which the pituitary gland doesn't make enough growth hormone.
- This results in a child's then height is below to normal height, due to deficiency of growth hormone.

### ii) Acromegaly

- It is a hormonal disorder that develops when your pituitary gland produces too much growth hormone during adulthood.
- This results, your bones inc. in size including your hand, face,

## Disorder of Thyroid Gland

### → Hyperthyroidism "Grave disease"



It is an autoimmune disorder is the most common cause of hyperthyroidism. It causes antibodies to stimulate the thyroid to secrete too much hormone.



## Hypothyroidism : 'Goutre'

It is a swelling in the neck resulting from an enlarged thyroid gland. The term is also used to describe an enlarged thyroid.

## Disorder of Parathyroid Gland

### i) Hypoparathyroidism

- It is the condition in which decrease secretion of parathyroid hormone.

- This leads to the decrease blood level of  $Ca^{2+}$  (hypocalcaemia)

### ii) Hyperparathyroidism

- It is the condition in which increase secretion of parathyroid hormone.

- This leads to the inc.  $Ca^{2+}$  level in blood (hypercalcaemia).