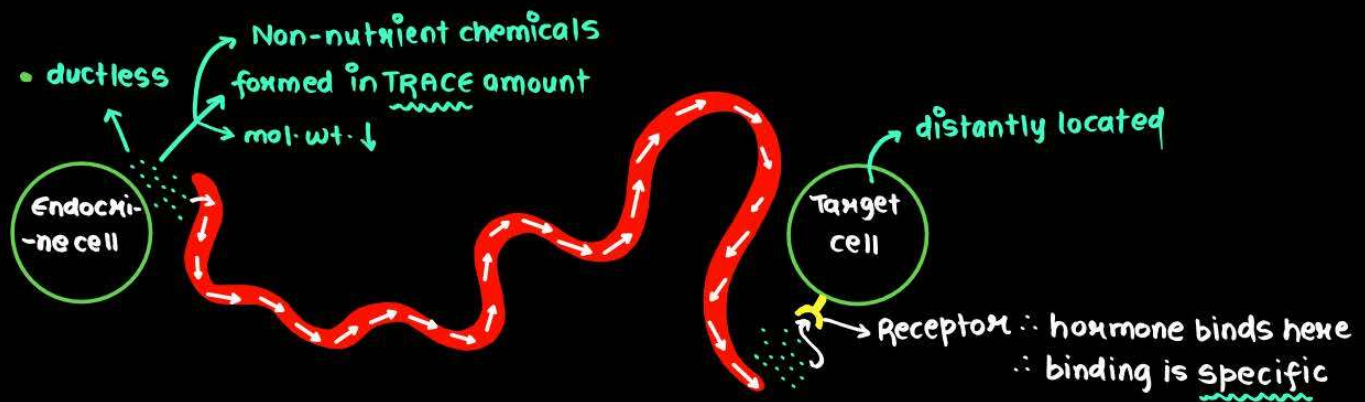
Neuro-Endocrine System

- point to point
- fast
- short lived
- the nerves donot innervate all cells of the body

- not point to point
- Slow
- Long lived
- Hormones can reach all cells through vascular supply



Endocrine Glands and Hormones

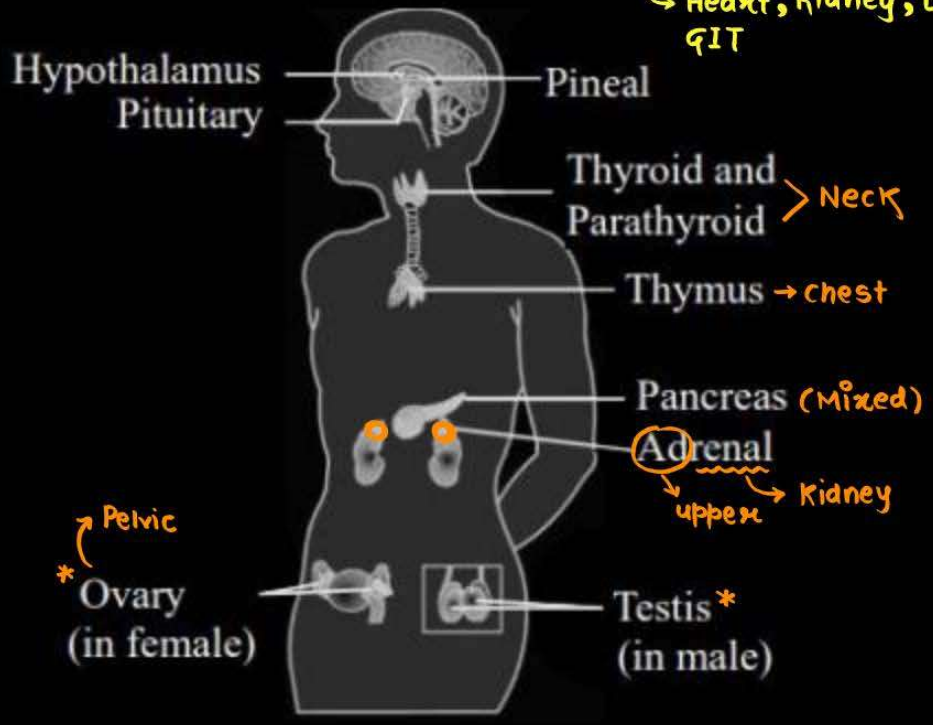
- **Classical definition of hormone:** They are chemicals produced by endocrine glands and released into the blood and transported to a distantly located target organ.

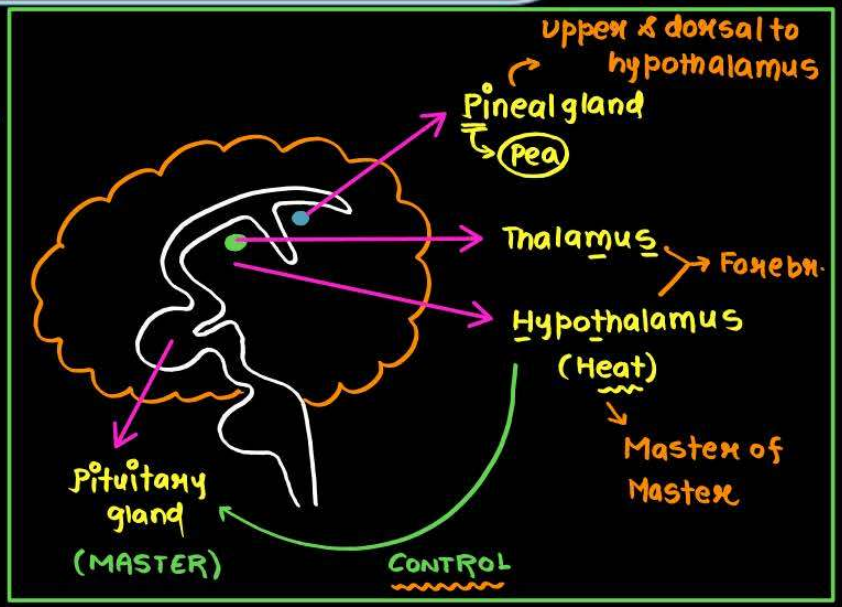
- **Current/ scientific definition:** Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.
  (signal)
  (specific) → do not get wasted
  (in b/w 2 cells) → Endocrine cell to Target cell

- Invertebrate: simple endocrine system
  Hormones ↓
  Vertebrates: complex endocrine system
  Hormones ↑

Human Endocrine System

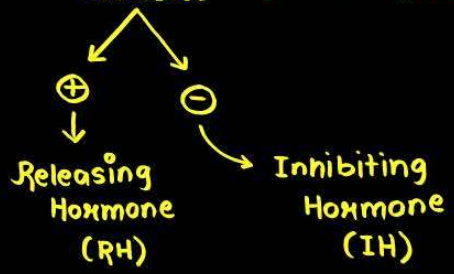
Endocrine glands, endocrine tissues
↳ Heart, Kidney, Liver, GIT





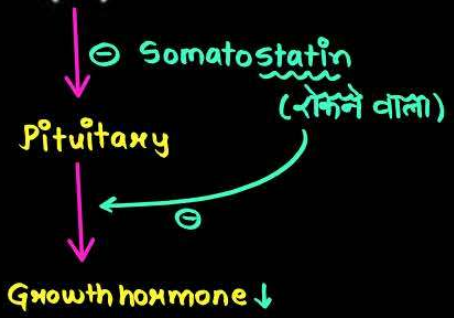
① Hypothalamus

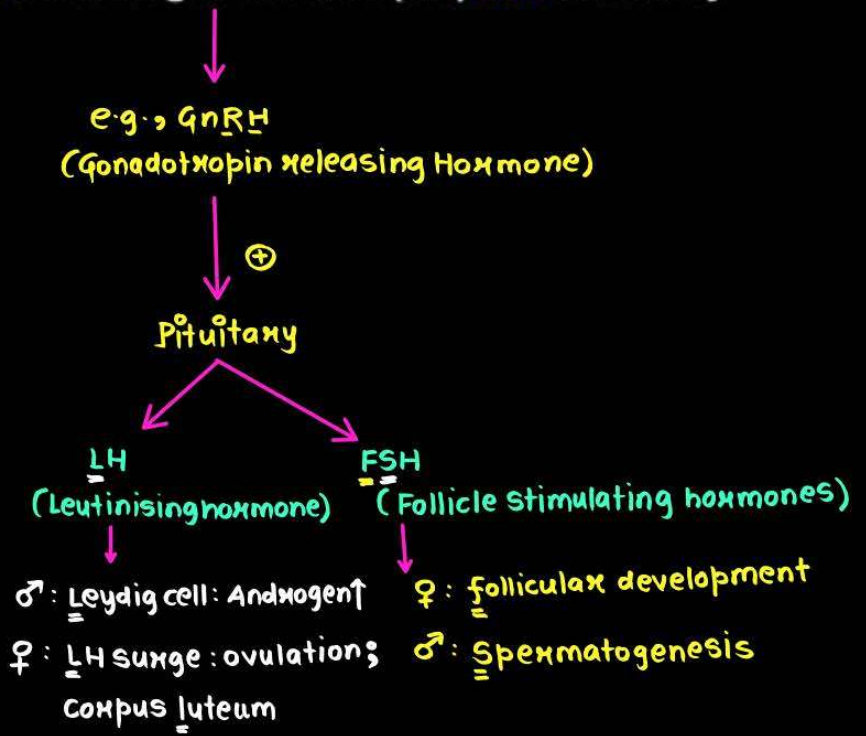
- **Location:** below thalamus in diencephalon of forebrain
- It contains neurosecretory cells called: NUCLEI
- Nuclei controls: pituitary gland ∴ hypothalamus is called master of master gland



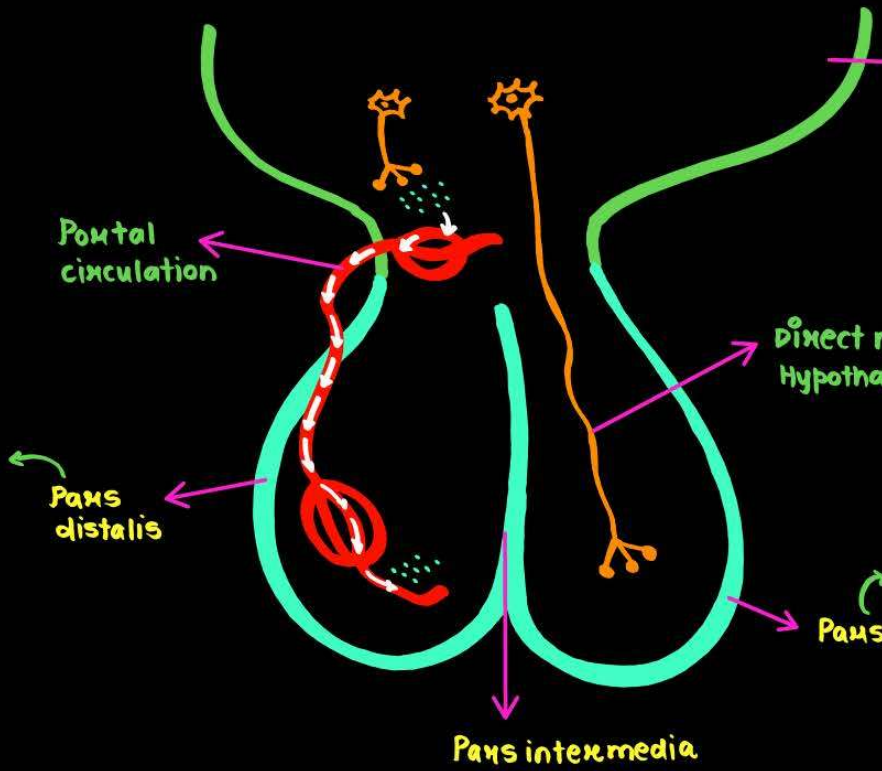
Hypothalamus

- **Hypothalamus produces 2 types of hormones namely** Releasing Hormones (RH) **and** Inhibitory Hormones (IH)





Connection between Hypothalamus and Pituitary



Hypothalamus
↓
Makes 2 hormones
1. oxytocin
2. Vasopressin

* NOTE: Pars distalis & intermedia are fused in Humans

Stored in post. pit. & released from post. pit.

① oxytocin: contracts smooth muscle
e.g., uterine muscles
Milk ejection

② Vasopressin / Anti-diuretic hormone
Na^+ & H_2O reabs. from DCT
BP ↑; BV ↑
• Def. : Diabetes insipidus

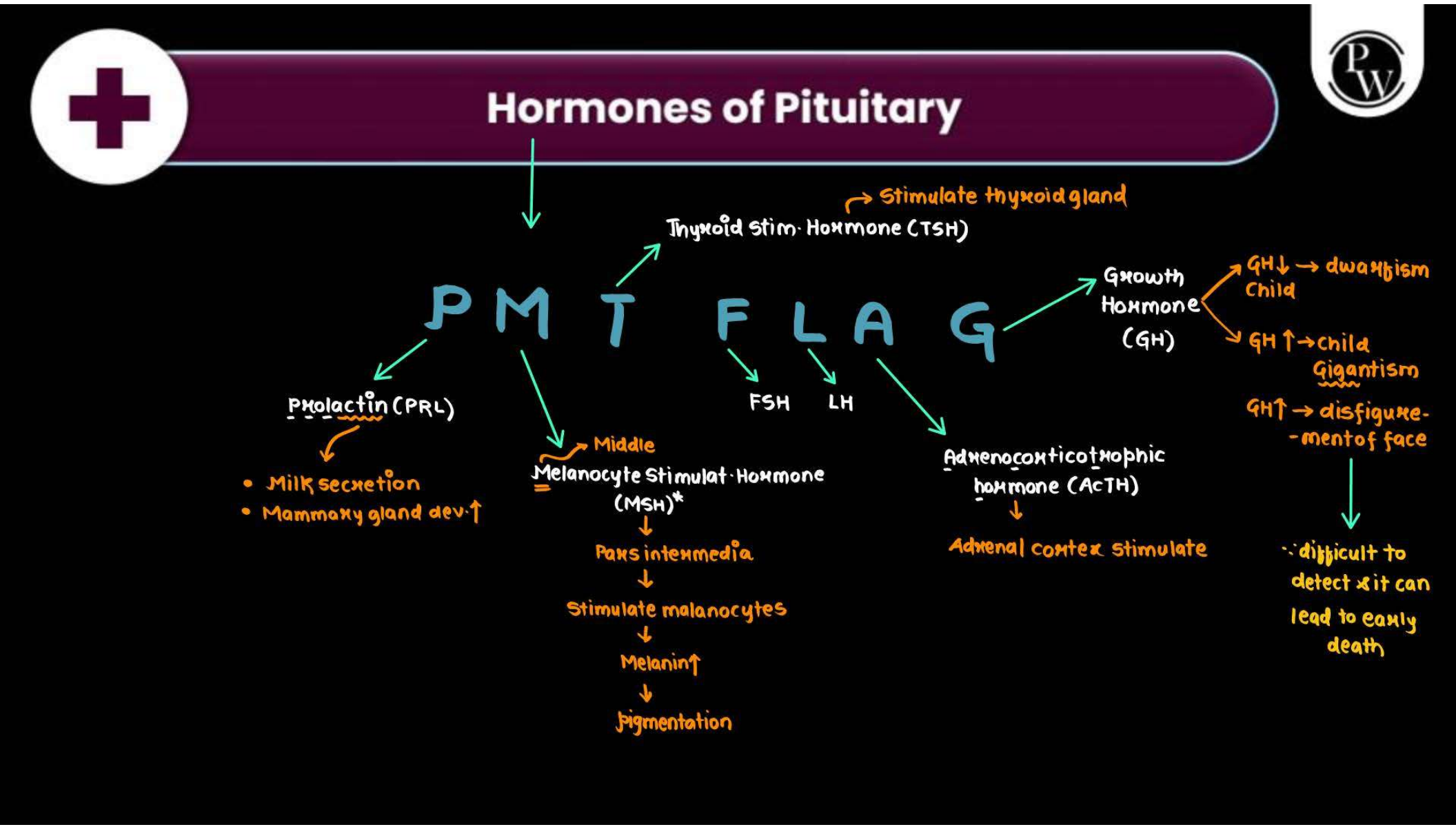
Pituitary Gland

- **Location:** in cavity of sphenoid bone called sella tursica

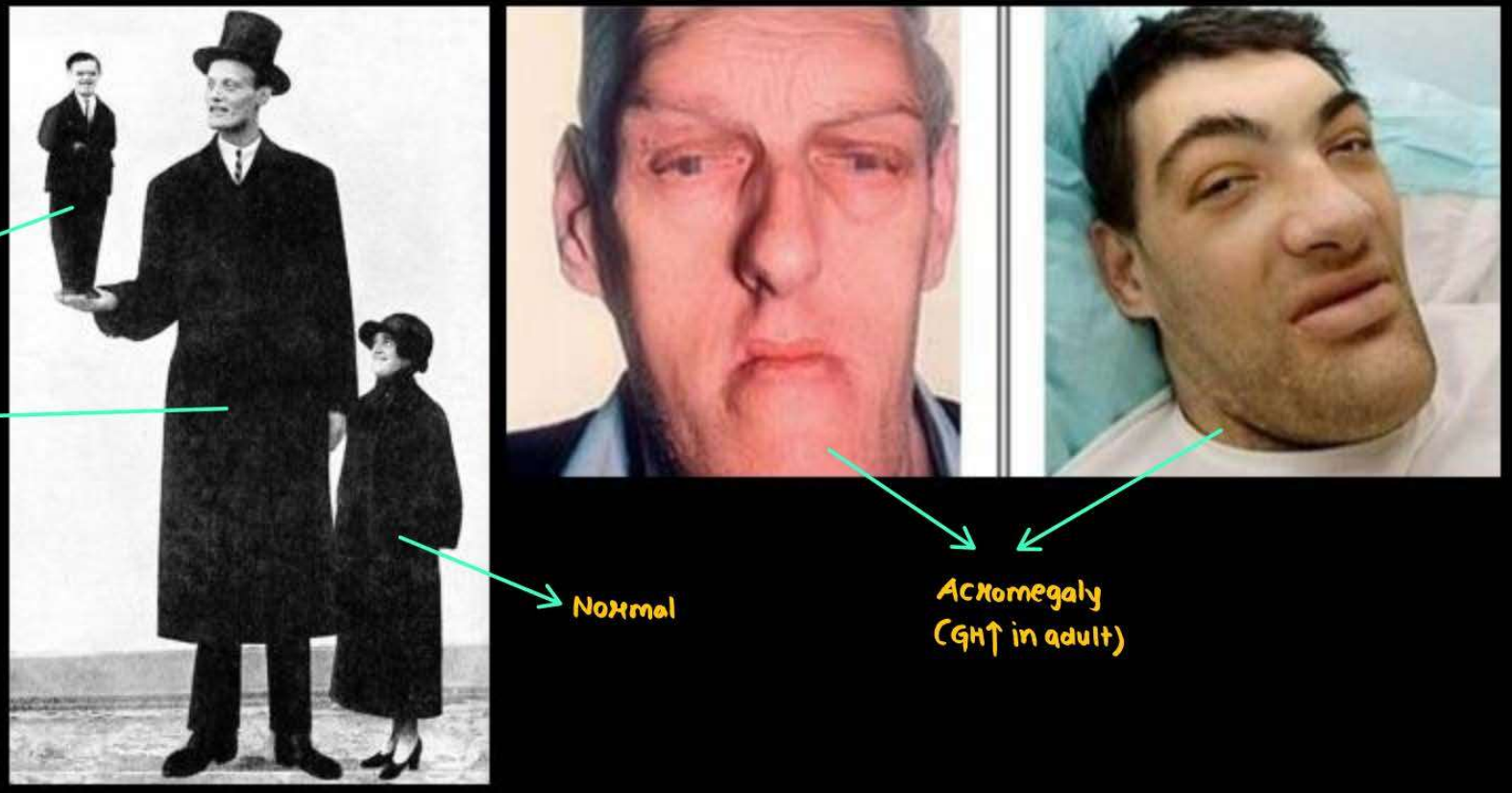
Pituitary

- Adenohypophysis
  - Pars distalis (Ant. pituitary)
  - Pars intermedia
  - Merged in human
- Neurohypophysis
  - Pars nervosa (Post. pituitary)
    - Stores & release oxytocin & vasopressin

Hormones of Pituitary



Hypo and Hyper-Secretion of GH

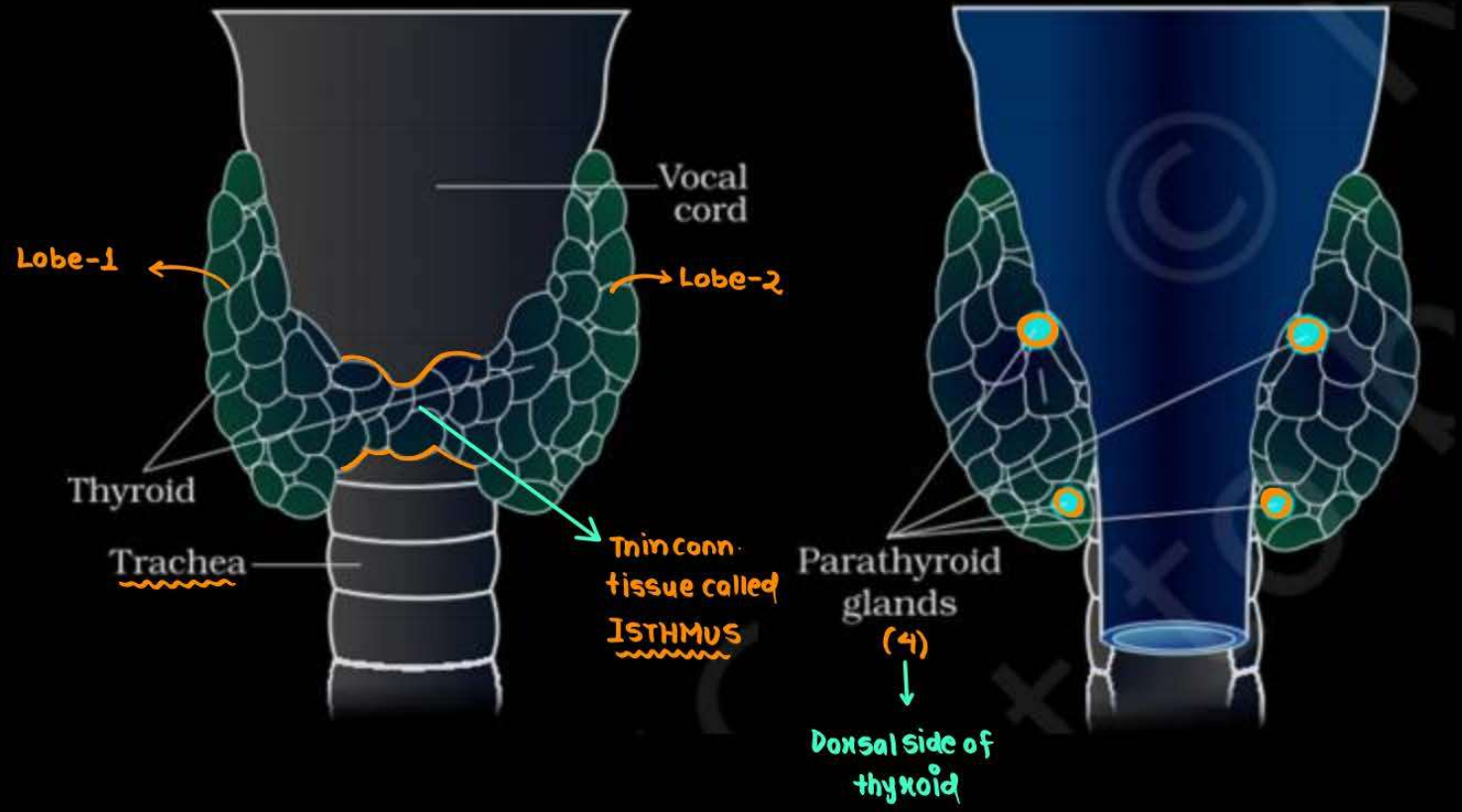


Pineal Gland (Helper)

- **Location:** Dorsal & upper to hypothalamus in brain
- **Size:** Pea-seed
- **Secrete which hormone:** Melatonin
- **Functions:** **Main Function:** Regulate our 24hr cycle / diurnal rhythm / BIOLOGICAL CLOCK
  - ↳ Periods: control
  - **Regulate Temperature:** Main: Hypothalamus
  - **Defense:** Main: Thymus
  - **Pigmentation:** Main: Melanin
  - **Metabolism:** Main: Thyroid

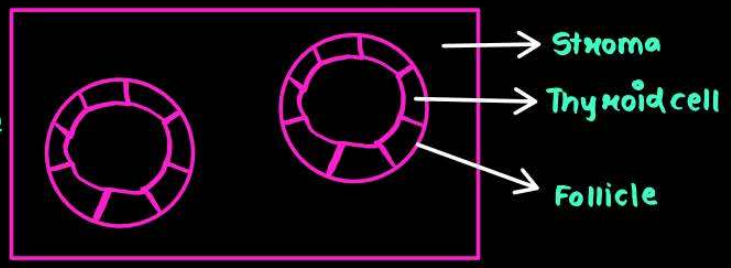
  → Pineal: helper

Position of Thyroid and Parathyroid Gland



Thyroid

- **Location:** In the neck region (on trachea)
- **Largest Endocrine Gland** → It has 2 lobes which are connected to each other by thin ISTHMUS
- **Hormones:**
  - Iodothyronines
    - T_3 : Tri-iodothyronine
    - T_4 : Tetra-iodo-thyronine (Thyroxine)
  - Thyrocalcitonin (TCT)
    - ↳ Ca^{2+}↓↓ (Hypocalcemic)



- **Functions of Thyroxine:** Carbs, proteins and fat metabolism; water-electrolyte balance (salt/ion); Formation of RBC
  - ↳ controls BMR (Basal metabolic rate)

Thyroid

- Hyperthyroidism: Grave's Disease/ Exophthalmic Goitre:
- BMR increase and thus weight loss happens

Thyroid

- Hypothyroidism: 1. Cretinism: Pregnant women → Thyroid ↓
  → Child impact: deaf mutism
  mentally retard
  pigmentation

2. In Adult Women (hypo): menstrual cycle will be impacted

3. Simple Goitre: I_2 deficiency : T_3 & T_4 ↓
   Thyroid enlarges

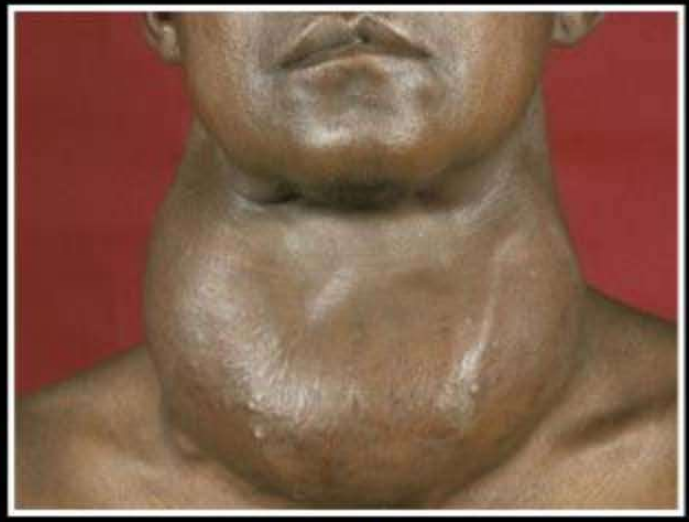
Thyroid

Cretin Baby

Myxoedema (Hypo)

(Swell)

↳ Adipose & Soft tissue - Swell

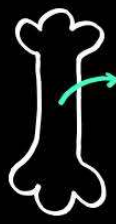


Simple Goitre

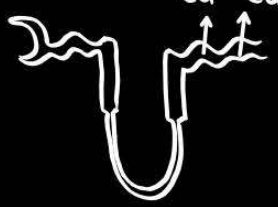
Parathyroid: Functions

- Dorsal to thyroid : 4 swellings
- Hormone : PARATHormone (PTH)
  - Blood : Ca^{2+} ↑ (Hypercalcemic)
  - Antagonist to TCT

- Take Ca^{2+} from bones



- Diet
  ↓
  Ca^{2+} ↑↑ in blood

- 

reabsorbed through renal tubules

Thymus: Location and Functions

- Found in chest region b/w the lungs
- found dorsal to sternum & ventral to aorta
- It regresses with age

↓

Small in aged people

∴ defense↓

Immunity↓

- Differentiation & maturation of T-cells

↳ Cell mediated immunity

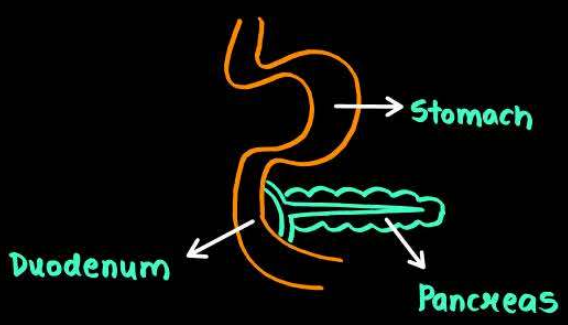
- Help in formation of antibodies

↓

Humoral immunity

- Hormone : THYMOSIN

Pancreas: Location, Nature and Structure

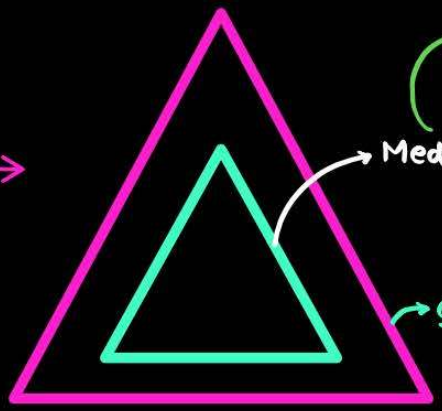


- Heterocrine/composite/mixed
  - ⇓
  - Exocrine + Endocrine (panc. juice)
  - Hormones (Islets of langerhans) → 1-2% of pancreas (1-2 million)

* low insulin can cause diabetes mellitus
  - → Glycosuria
  - Ketonuria
  - Treatment : Insulin therapy

- Alpha-cell → Glucagon → Blood glucose ↑ → Hyperglycemic
  - Hepatocyte
    - glycogenolysis
    - gluconeogenesis
  - uptake & utilise glucose ↓
- Beta-cells → Insulin → hypoglycemic → Blood glucose ↓
  - uptake & utilise glucose ↑
  - acts on hepatocytes & adipocytes
    - hepatocytes → glycogenesis (glucose ↓)
    - adipocytes → Fat
- Delta-cells → Somatostatin → ⊖ signal to α & β cell

Adrenal Gland: Location and Structure



AMAN

Adrenal medulla

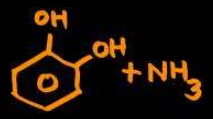
Adrenaline / epinephrine

Noradrenaline / Non-epinephrine

(derived from Tyrosine)

(Amino acid-derv.)

Catecholamine



Hormones are called Corticoids (steroids)

GFR के MUGS

outer inner

G: Zona Glomerulosa → Mineralocorticoids

F: Zona Fasciculata → Glucocorticoid

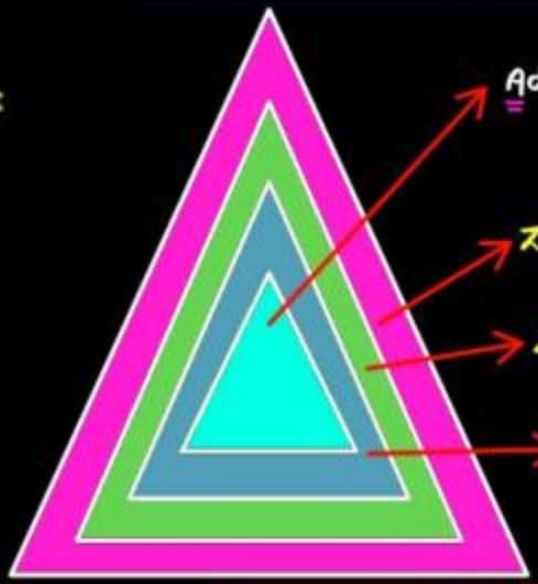
R: Zona Reticularis → Sex corticoids (Androgenic)

⇓

बाल कलाकार

Adrenal Gland: Functions

- **Structure:**



Adrenal medulla → Adrenaline & Noradrenaline — AMAN

Zona Glomerulosa (outer) → Mineralocorticoids → regulate the balance of H_2O & ions/salts/electrolytes in your blood

Zona fasciculata (middle) → Glucocorticoids → Glucose/carbohydrate metabolism

Zona reticularis (inner) → Sex corticoids

*AMAN: Adrenal medulla
Adrenaline
Nor-adrenaline

GFR के MuGS

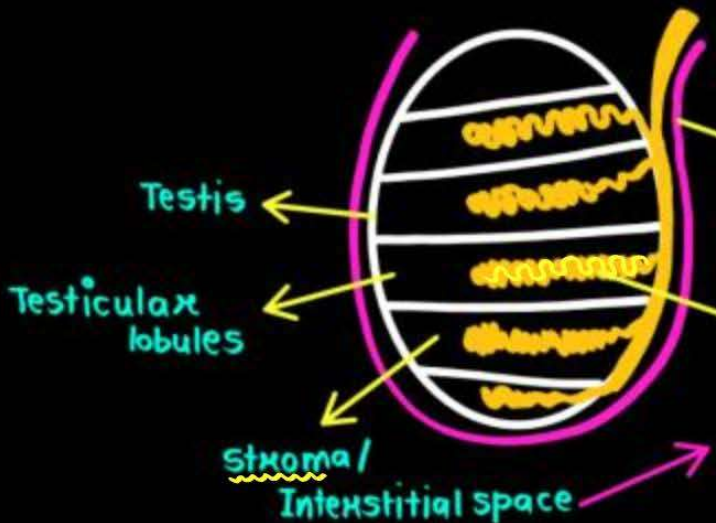
1. Glomerulosa → 1. Mineralocorticoid (Aldosterone)
2. Fasciculata → 2. Glucocorticoid (Cortisol)
3. Reticul. → 3. Sex corticoid (Androgenic steroids)

Adrenal Gland: Disorders

- **DISORDERS** → Addison's disease: Hyposecretion of hormones of adrenal cortex
  - Glucocorticoid ↓: carb. metabolism disturbs
    - Blood glucose ↓
      - weakness
      - Fatigue
  - Cushing disease (Hypersecretion of corticoids)
    - Moon face
    - Blood glucose ↑
    - Na^+ & H_2O reabs. ↑
    - Blood volume & pressure ↑

Testis

- **Location:** → Scrotal sac; Testis
  - Testis → Extra-abdominally (outside abdomen)
    - For sperm production - optimum temp. should be provided which is 2-2.5°C ↓ than normal body temperature
- **Called primary sex organ:** *
  - Spermatogenesis occur here
  - Sex hormones made here
- **Structure:**



Testis

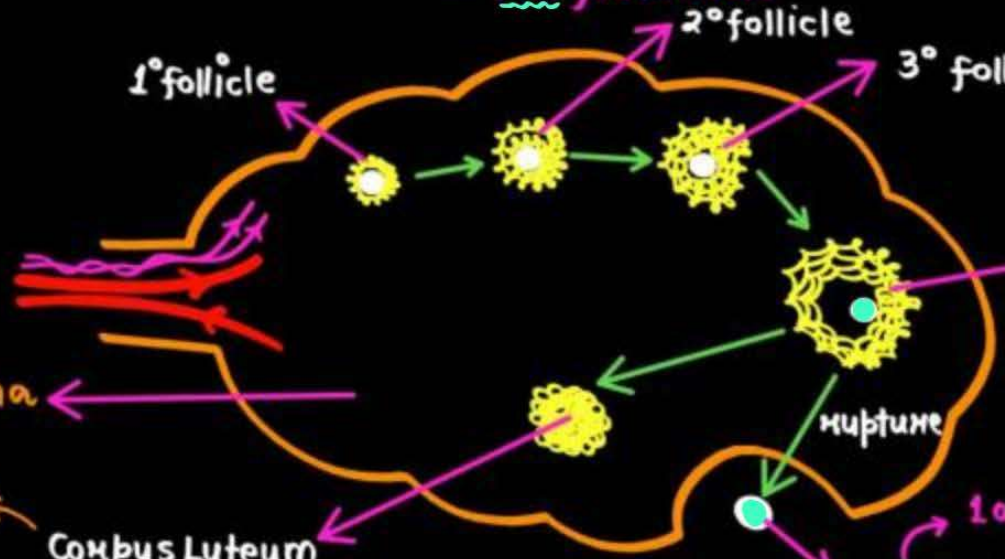
- Hormones and their Functions

Androgens
e.g., Testosterone

1. Low pitched voice
2. Development of facial, axial & Pubic hairs
3. More muscular: Anabolism of protein & Carbohydrates
4. Development of accessory reproductive organs: epididymis, vas deferens, vasa efferentia, urethra.....
5. Regulates ♂-sexual behavior: LIBIDO
6. RBC production↑
7. Aggressiveness↑

Ovaries

- **Location:** in abdominal cavity (in Pelvic region)
- **Called primary sex organ:**
  - Ova* produced
  - ♀ sex* hormones
    - Estrogen → produced by developing follicles
    - Progesterone → produced by corpus Luteum
- **Structure:**



Ovaries

- **Hormones and their Functions**

Estrogen

- made by growing follicles
- helps in development of follicles alongwith FSH
- Growth & maturation of accessory sex organs
- High pitched voice
- ♀-hair pattern
- Hips & mammary gland development (size↑)
- ♀-sex behavior : LIBIDO

Progesterone : made by Corpus Luteum

Pregnancy maintaining hormone

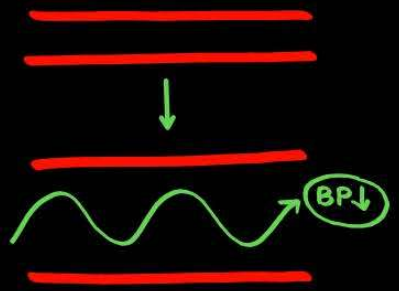
- Mammary gland develope (alveoli)*
- Milk secretion alongwith PRL (prolactin)

Hormones of Liver, Kidney and Heart

- Insulin like growth factor
- Angiotensinogen
- Hepaticin

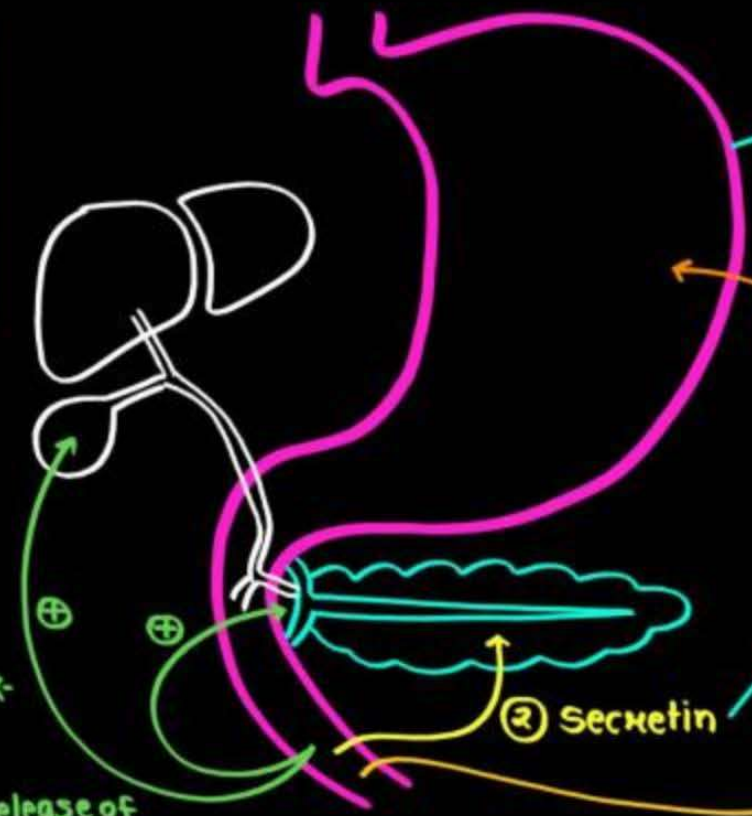
JG cells/Juxta-glome-
-rular cells
↓
make erythropiotin
↓
RBC↑

Atrial wall makes
Atrial Natriuretic factor (ANF)
↓
Vasodilation



Hormones of GIT

* In our body many cells/ Tissues makes growth Factors which are imp. for our body growth. repair



Stomach wall has 'G'-cells

Secretes HCl & pepsinogen from stomach via making Hormone GASTIN ①

② Secretin

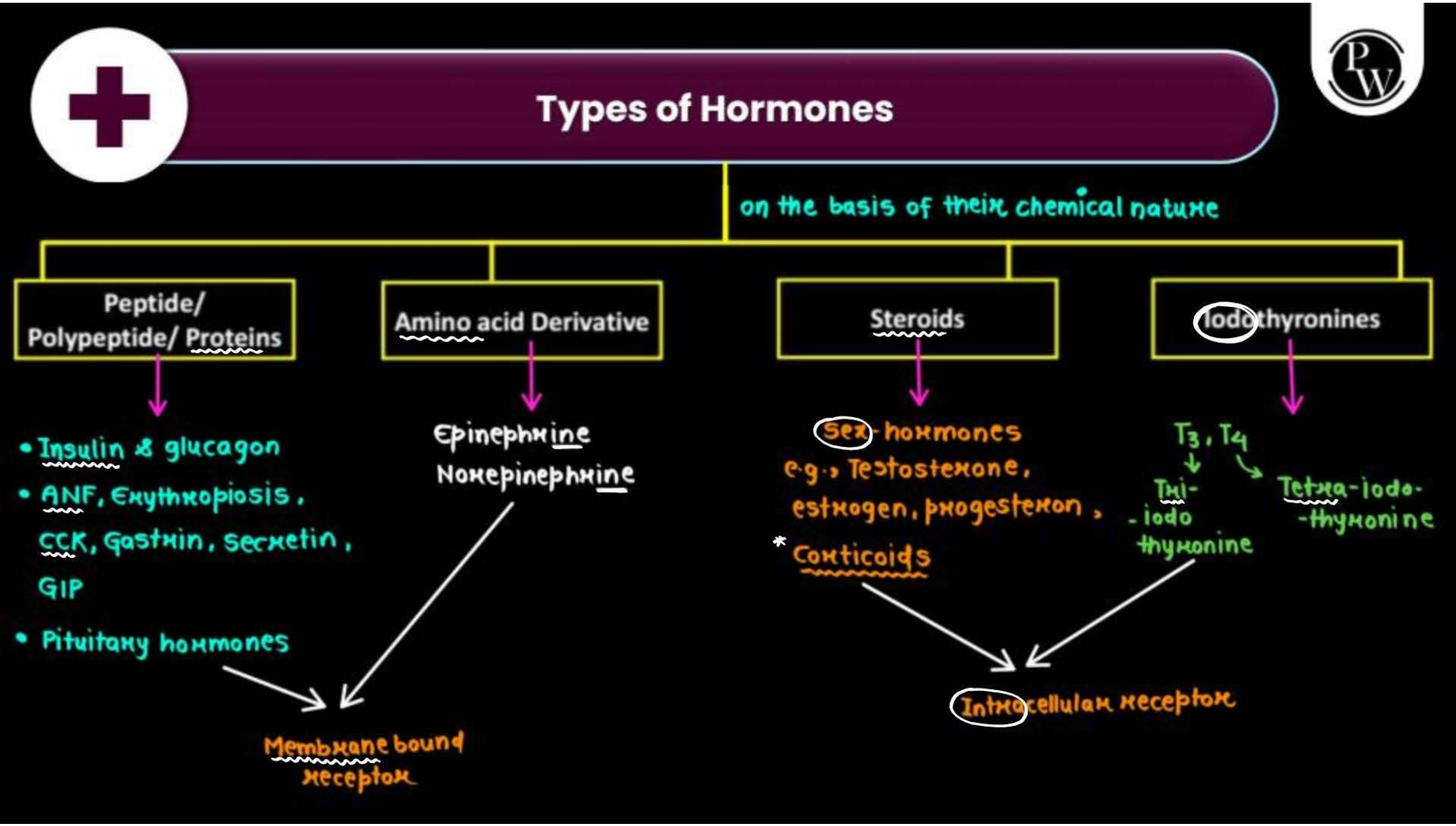
gets bicarbonates & H_2O secreted from pancreas

③ Gastric inhibitory Peptide (GIP)

④ CCK (Cholecystok-inin)

↓

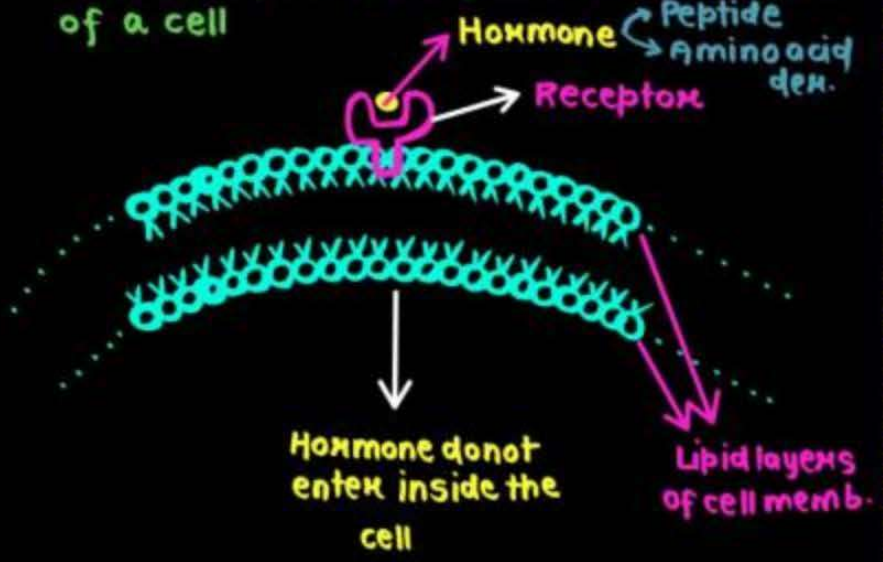
Stimulates release of Bile & Pancreatic juice


Types of Hormones
on the basis of their chemical nature
Peptide/ Polypeptide/ Proteins
Amino acid Derivative
Steroids
Iodothyronines
• Insulin & glucagon
• ANF, Erythropoiesis, CCK, Gastrin, Secretin, GIP
• Pituitary hormones
Epinephrine
Norepinephrine
Sex hormones
e.g., Testosterone, estrogen, progesterone,
* Corticoids
T3, T4
Tri-iodothyronine
Tetra-iodothyronine
Membrane bound receptor
Intracellular receptor

Mechanism of Hormone Action

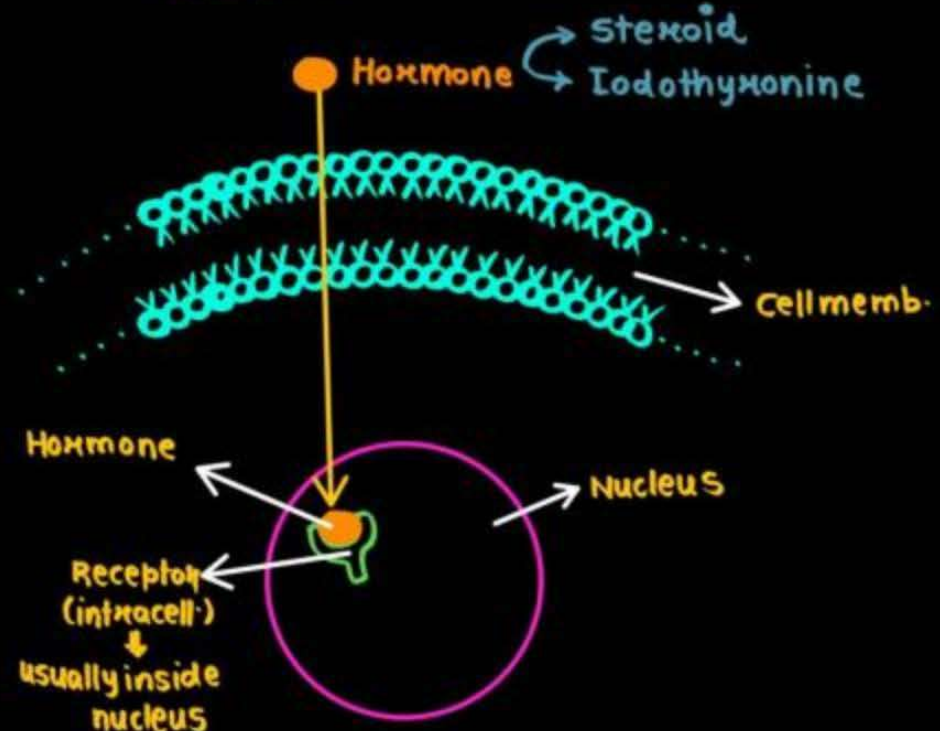
Membrane Bound Receptors

These receptors are found on membrane of a cell

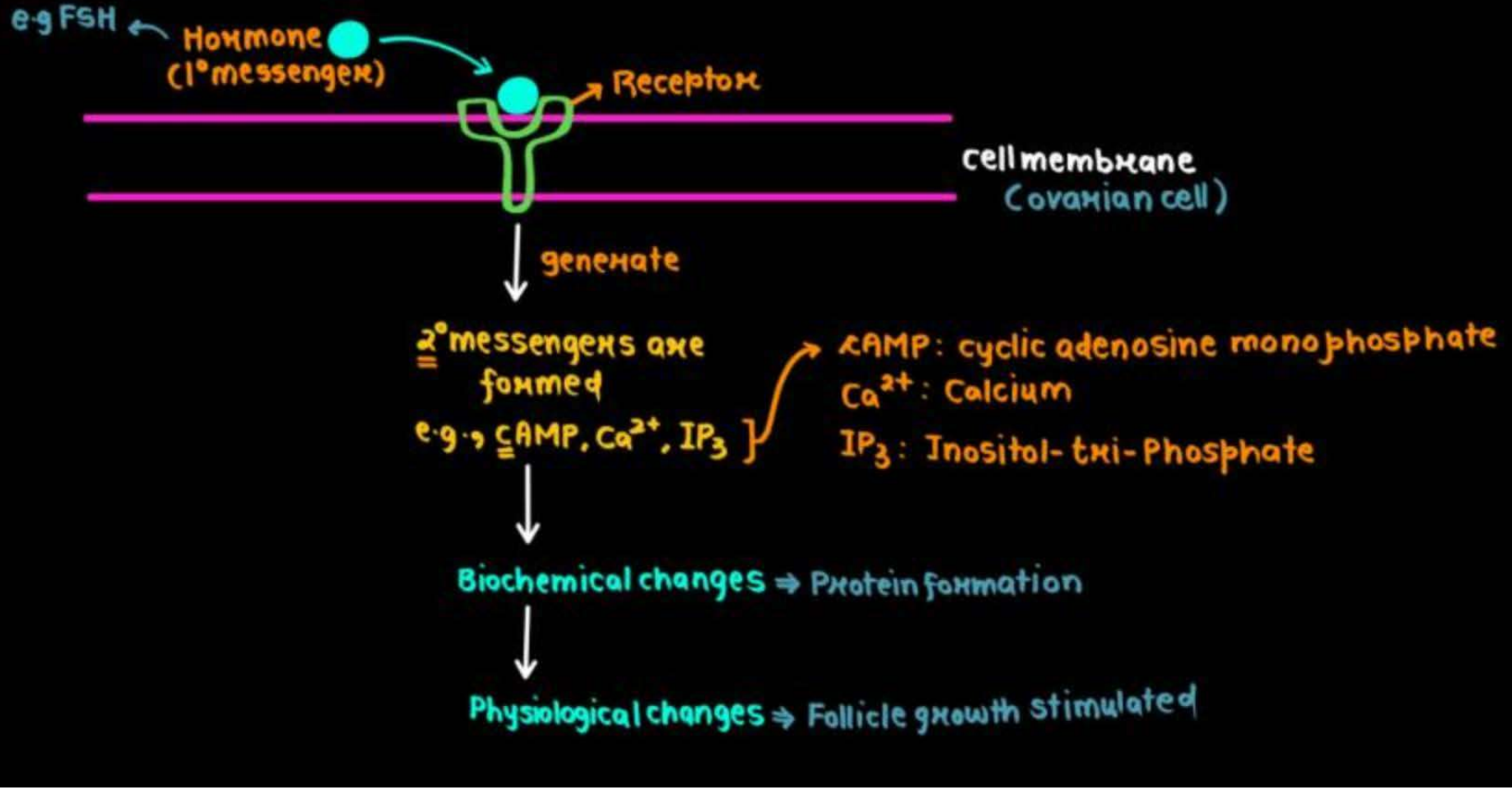


Intracellular Receptors

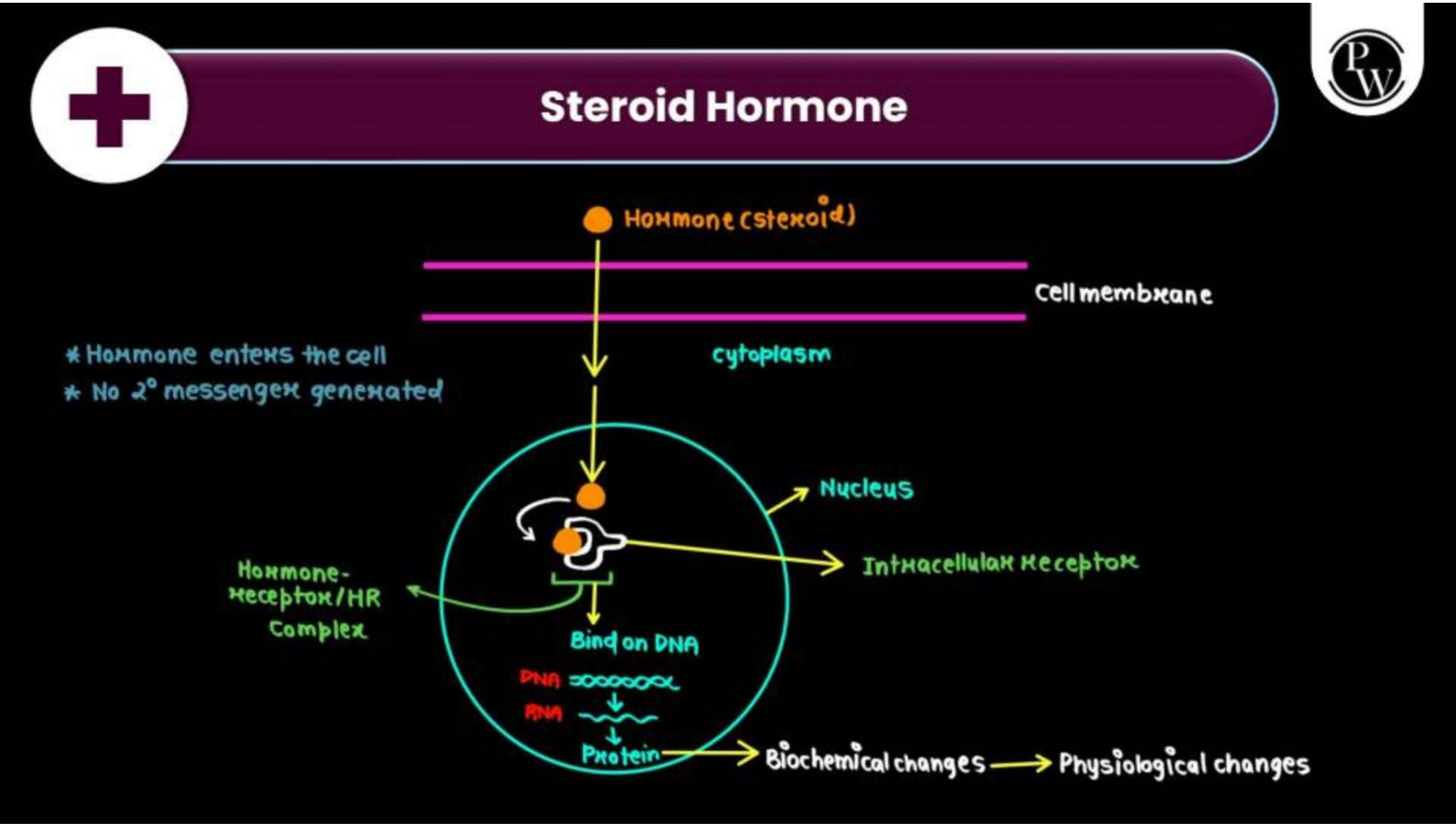
Within cell



Protein Hormone



Steroid Hormone



QUESTION (NEET PYQ EXAM 2024)

Which of the following is not a steroid hormone?

(1) Cortisol

(2) Testosterone

(3) Progesterone

(4) Glucagon

FOR NOTES & DPP CHECK DESCRIPTION

QUESTION (NEET PYQ EXAM 2024)

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : FSH acts upon ovarian follicles in female and Leydig cells in male.

Reason R : Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and R are true but R is NOT the correct explanation of A

(3) A is true but R is false

(4) A is false but R is true

QUESTION (NEET PYQ EXAM 2024)

Match **List-I** with **List-II**.

	List-I		List-II
A.	Epinephrine	I.	Hyperglycemia
B.	Thyroxine	II.	Smooth muscle contraction
C.	Oxytocin	III.	Basal metabolic rate
D.	Glucagon	IV.	Emergency hormone

Choose the correct answer from the options given below :

(1) A-II, B-I, C-IV, D-III

(2) A-III, B-II, C-I, D-IV

(3) A-IV, B-III, C-II, D-I

(4) A-I, B-IV, C-III, D-II

QUESTION (NEET PYQ EXAM 2023)

Which of the following statements are **correct** with respect to the hormone and its function? **(Manipur 2023)**

(A) Thyrocalcitonin (TCT) regulates the blood calcium level.

(B) In males, FSH and androgens regulate spermatogenesis.

(C) Hyperthyroidism can lead to goitre.

(D) Glucocorticoids are secreted in adrenal medulla.

(E) Parathyroid hormone is regulated by circulating levels of sodium ions.

Choose the **most appropriate** answer from the options given below.

(1) (C) and (E) only

(2) (A) and (B) only

(3) (B) and (C) only

(4) (A) and (D) only

QUESTION (NEET PYQ EXAM 2023)

Given below are two statements. **(Manipur 2023)**

Statement-I: Parathyroid hormone acts on bones and stimulates the process of bone resorption.

Statement-II: Parathyroid hormone along with thyrocalcitonin plays a significant role in carbohydrate metabolism.

In the light of the above statements, choose the **correct** answer from the options given below.

(1) **Statement-I** is correct but **Statement-II** is false.

(2) **Statement I** is incorrect but **Statement-II** is true.

(3) Both **Statement I** and **Statement II** are true.

(4) Both **Statement I** and **Statement II** are false.

QUESTION (NEET PYQ EXAM 2023)

Match **list-I** with **list-II**. **(NEET 2023)**

List-I		List-II	
A.	CCK	P.	Kidney
B.	GIP	Q.	Heart
C.	ANF	R.	Gastric gland
D.	ADH	S.	Pancreas

Choose the **correct** answer from the options given below.

(1) A-(S); B-(Q); C-(R); D-(P)

(2) A-(S); B-(R); C-(Q); D-(P)

(3) A-(R); B-(Q); C-(S); D-(P)

(4) A-(Q); B-(S); C-(P); D-(R)

QUESTION (NEET PYQ EXAM 2023)

Which of the following are **not** under the control of thyroid hormone? **(NEET 2023)**

A. Maintenance of water and electrolyte balance
B. Regulation of basal metabolic rate
C. Normal rhythm of sleep-wake cycle
D. Development of immune system
E. Support the process of RBCs formation.

Choose the **correct** answer from the options given below.

(1) D and E only
(2) A and D only
(3) B and C only
(4) C and D only

QUESTION (NEET PYQ EXAM 2022)

Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**. **(2022 II)**

Assertion (A): FSH which interacts with membrane bound receptors does not enter the target cell.

Reason (R): Binding of FSH to its receptors generates second messenger (cyclic AMP) for its biochemical and physiological responses.

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) **Assertion (A)** is not correct but **Reason (R)** is correct.

(2) Both **Assertion (A)** and **Reason (R)** are correct and **Reason (R)** is the correct explanation of **Assertion (A)**.

(3) Both **Assertion (A)** and **Reason (R)** are correct but **Reason (R)** is not the correct explanation of **Assertion (A)**.

(4) Assertion (A) is correct but Reason (R) is not correct.

QUESTION (NEET PYQ EXAM 2022)

Match **list-I** with **list-II**. (2022)

List-I (Biological Molecules)		List-II (Biological functions)	
A.	Glycogen	P.	Hormone
B.	Globulin	Q.	Biocatalyst
C.	Steroids	R.	Antibody
D.	Thrombin	S.	Storage product

(1) A - (Q); B - (S); C - (R); D - (P)

(2) A - (S); B - (R); C - (P); D - (Q)

(3) A - (R); B - (Q); C- (S); D - (P)

(4) A - (S); B - (Q); C - (P); D - (R)

QUESTION (NEET PYQ EXAM 2022)

Given below are two statements.

Assertion (A): Osteoporosis is characterised by decreased bone mass and increased chances of fractures.

Reason (R): Common cause of osteoporosis is increased levels of estrogen. **(2022)**

Mark the **correct** choice as;

(1) Both **Assertion (A)** and **Reason (R)** are true and the **Reason (R)** is a correct explanation of the **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not a correct explanation of the **Assertion (A)**.

(3) **Assertion (A)** is true but the **Reason (R)** is false.

(4) **Assertion (A)** is false but the **Reason (R)** is true.

QUESTION (NEET PYQ EXAM 2022)

Which of the following are **not** the effects of Parathyroid hormone? **(2022)**

A. Stimulates the process of bone resorption
B. Decreases Ca^{2+} level in blood
C. Reabsorption of Ca^{2+} by renal tubules
D. Decreases the absorption of Ca^{2+} from digested food
E. Increases metabolism of carbohydrates

Choose the **most appropriate** answer from the options given below.

(1) A and C only
(2) A and C only
(3) B, D and E only
(4) A and E only

QUESTION (NEET PYQ EXAM 2021)

Erythropoietin hormone which stimulates RBC formation is produced by; **(2021)**

(1) cells of rostral adenohypophysis

(2) cells of bone marrow

(3) juxtaglomerular cells of the kidney

(4) alpha cells of pancreas

QUESTION (NEET PYQ EXAM 2020)

Presence of which of the following conditions in urine are indicative of diabetes mellitus? **(2020)**

(1) Uremia and Renal Calculi

(2) Ketonuria and glycosuria

(3) Renal calculi and hyperglycemia

(4) Uremia and ketonuria

QUESTION (NEET PYQ EXAM 2020)

Match the **list-I** and **list-II** and select the **correct** option.

(2020)

List-I		List-II	
A.	Pituitary gland	P.	Grave's disease
B.	Thyroid gland	Q.	Diabetes mellitus
C.	Adrenal gland	R.	Diabetes insipidus
D.	Pancreas	S.	Addison's disease

(1) A-(R); B-(Q); C-(P); D-(S)

(2) A-(R); B-(P); C-(S); D-(Q)

(3) A-(Q); B-(P); C-(S); D-(R)

(4) A-(S); B-(R); C-(P); D-(Q)

QUESTION (NEET PYQ EXAM 2020)

Which one of the following is **correct** statement? **(2020)**

(1) Glucagon is associated with hypoglycemia

(2) Insulin acts on pancreatic cells and adipocytes

(3) Insulin is associated with hypoglycemia

(4) Glucocorticoids do not stimulate gluconeogenesis

QUESTION (NEET PYQ EXAM 2020)

Select the **correct** statement. (2020)

(1) Glucocorticoids stimulate gluconeogenesis

(2) Glucagon is associated with hypoglycemia

(3) Insulin acts on pancreatic cells and adipocytes

(4) Insulin is associated with hyperglycemia

QUESTION (NEET PYQ EXAM 2020)

Match the **list-I** and **list-II** and select the **correct** option.

(2020 COVID)

List-I		List-II	
A.	Pituitary hormone	P.	Steroid
B.	Epinephrine	Q.	Neuropeptides
C.	Endorphins (pain reliever)	R.	Peptides, proteins
D.	Cortisol	S.	Biogenic amines

(1) A-(R); B-(S); C-(P); D-(Q)

(2) A-(S); B-(P); C-(Q); D-(R)

(3) A-(R); B-(S); C-(Q); D-(P)

(4) A-(S); B-(R); C-(P); D-(Q)

QUESTION (NEET PYQ EXAM 2020)

Hormones stored and released from neurohypophysis are;
(2020 Covid)

(1) oxytocin and vasopressin (ADH)
(2) follicle stimulating hormone and luteinizing hormone
(3) prolactin and vasopressin
(4) thyroid stimulating hormone and oxytocin