FREE NOTES · NCERT + NEET LEVEL

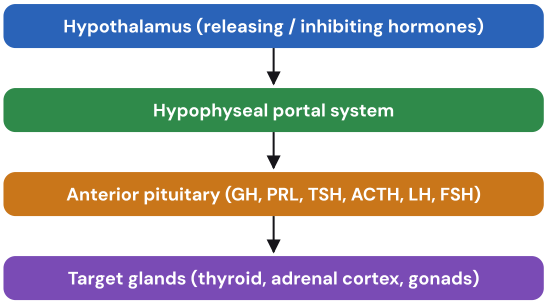
Chemical Coordination & Integration

Endocrine glands and hormones: hypothalamus, pituitary, pineal, thyroid, parathyroid, thymus, adrenal, pancreas, gonads, hormones of heart, kidney and GI tract, and mechanism of hormone action.

01 Endocrine system and hypothalamus
02 Pituitary and pineal
03 Thyroid, parathyroid, thymus
04 Adrenal and pancreas
05 Gonads and other hormones
06 Mechanism of hormone action
07 Extra + tricks
08 Important Q&A
09 Common mistakes
10 Practice (NEET style)
11 Quick revision

01 Endocrine system and hypothalamus

- Endocrine glands are ductless; secretions = **hormones**: non-nutrient chemicals acting as intercellular messengers, produced in trace amounts.
- Hypothalamus: basal part of diencephalon; neurosecretory cells (nuclei) make **releasing** hormones (e.g. GnRH stimulates pituitary gonadotrophins) and **inhibiting** hormones (e.g. somatostatin inhibits GH).
- These reach anterior pituitary via portal circulation; posterior pituitary is under direct neural regulation of hypothalamus.



Hypothalamus–pituitary axis

02 Pituitary and pineal

Part	Hormone	Action / disorder
Adenohypophysis (pars distalis)	GH	Growth; excess in child: **gigantism**; low: **pituitary dwarfism**; excess in adult: **acromegaly**
	Prolactin	Mammary gland growth, milk formation
	TSH, ACTH	Thyroid hormones; glucocorticoids from adrenal cortex
	LH, FSH (gonadotrophins)	Males: LH → androgens from testis, FSH + androgens → spermatogenesis. Females: LH → ovulation, corpus luteum; FSH → follicle growth
Pars intermedia	MSH	Melanocytes, skin pigmentation (almost merged with pars distalis in humans)
Neurohypophysis (stores, released from hypothalamus)	Oxytocin	Smooth muscle contraction: uterus at childbirth, milk ejection
	Vasopressin (ADH)	Water reabsorption in DCT; deficiency: **diabetes insipidus**
Pineal (dorsal forebrain)	Melatonin	24-h (diurnal) rhythm: sleep-wake, body temperature; also pigmentation, menstrual cycle, defence

03 Thyroid, parathyroid, thymus

- **Thyroid**: two lobes joined by isthmus; follicles make **T_4 (thyroxine)** and **T_3**; iodine needed. Iodine deficiency ⇒ hypothyroidism and enlarged gland: **goitre**. Hypothyroidism in pregnancy ⇒ **cretinism** in baby (stunted growth, mental retardation, deaf-mutism). Adult hypothyroidism: irregular menstrual cycle. **Hyperthyroidism** (cancer, nodules) and **exophthalmic goitre** (Graves' disease: enlarged thyroid, protruding eyeballs, high BMR, weight loss).
- T_3/T_4: regulate BMR, RBC formation, metabolism, water and electrolyte balance. **Thyrocalcitonin (TCT)**: lowers blood Ca^{2+}.
- **Parathyroid** (4, on back of thyroid): **PTH** raises blood Ca^{2+} (hypercalcaemic): bone resorption, Ca^{2+} reabsorption in kidney, absorption from food. PTH and TCT together regulate Ca^{2+}.
- **Thymus** (between lungs, on dorsal side of sternum): **thymosins** help T-lymphocyte differentiation (cell-mediated immunity) and antibody production (humoral immunity). Degenerates in old age ⇒ weaker immunity.

04 Adrenal and pancreas

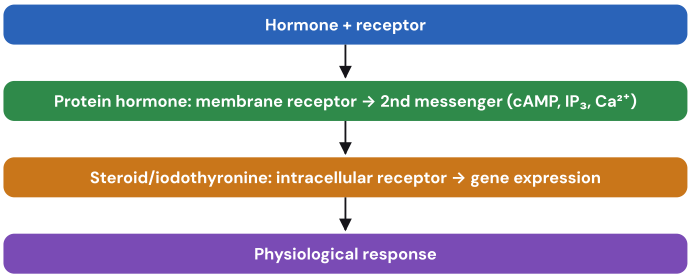
Gland	Hormone	Action
Adrenal medulla	Adrenaline, noradrenaline (catecholamines): "emergency" / fight-or-flight hormones	Alertness, pupil dilation, piloerection, sweating, increased heart rate and breathing, glycogenolysis, lipolysis, proteolysis
Adrenal cortex (zona reticularis, fasciculata, glomerulosa)	Glucocorticoids (cortisol)	Gluconeogenesis, lipolysis, proteolysis; anti-inflammatory; suppress immune response; RBC production; cardiovascular and kidney function
	Mineralocorticoids (aldosterone)	Na^+ and water reabsorption, K^+ and phosphate excretion: electrolytes, BP
	Androgenic steroids	Axial, pubic, facial hair at puberty
Pancreas (islets of Langerhans; 1–2 million)	Glucagon (α-cells)	Hyperglycaemic: glycogenolysis, gluconeogenesis in liver
	Insulin (β-cells)	Hypoglycaemic: glucose uptake by liver and adipocytes, glycogenesis. Prolonged high blood sugar ⇒ **diabetes mellitus** (glucose in urine, ketone bodies)

Deficiency of adrenal cortex hormones ⇒ **Addison's disease**.

05 Gonads and other hormones

- **Testis**: Leydig (interstitial) cells make **androgens** (mainly testosterone): male accessory organs, secondary sexual characters (muscular growth, facial hair, low voice), spermatogenesis, male sexual behaviour (libido), anabolic effects on protein and carbohydrate metabolism.
- **Ovary**: **oestrogen** (growing follicles: female secondary sex organs, mammary glands, female sexual behaviour) and **progesterone** (corpus luteum: supports pregnancy, milk storing alveoli).
- Heart atria: **ANF** lowers BP. Kidney JG cells: **erythropoietin** stimulates RBC formation.
- GI tract: **gastrin** (HCl, pepsinogen), **secretin** (water, bicarbonate from pancreas), **CCK** (pancreatic enzymes, bile), **GIP** (inhibits gastric secretion and motility). Growth factors from non-endocrine tissues help repair.

06 Mechanism of hormone action

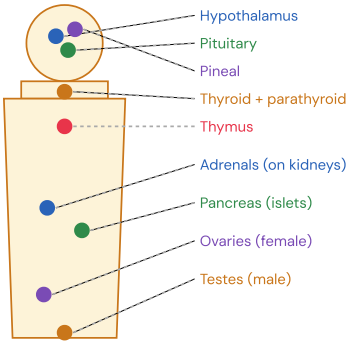


How hormones act on target cells

Chemical nature	Examples	Receptor
Peptide, polypeptide, protein	Insulin, glucagon, pituitary and hypothalamic hormones	Membrane-bound; second messenger
Steroids	Cortisol, testosterone, oestradiol, progesterone	Intracellular (nuclear)
Iodothyronines	Thyroid hormones	Intracellular
Amino-acid derivatives	Adrenaline, noradrenaline	Membrane-bound

07 Extra + tricks

Disorder	Cause
Myxoedema	Hypothyroidism in adults (puffy face, low BMR)
Hashimoto's disease	Autoimmune destruction of thyroid
Conn's syndrome	Excess aldosterone (high BP, low K^+)
Cushing's syndrome	Excess cortisol (moon face, high sugar, obesity of trunk)
Adrenal virilism	Excess adrenal androgens in females (facial hair)
Tetany	Low PTH ⇒ low blood Ca^{2+}



Location of major endocrine glands

- Islets of Langerhans: α (glucagon), β (insulin), **δ (somatostatin**: inhibits both), PP cells (pancreatic polypeptide).
- Thyroid = largest endocrine gland; pituitary = "master gland" but controlled by hypothalamus.

08 Important Q&A

Q1. Distinguish diabetes mellitus and diabetes insipidus.

Mellitus: insulin deficiency/resistance, high blood glucose, glucose in urine. Insipidus: ADH deficiency, excess dilute urine, thirst.

Q2. Why is adrenaline called an emergency hormone?

It is released rapidly in stress/danger and prepares body for fight or flight.

Q3. How do PTH and TCT work together?

PTH raises blood Ca^{2+}, TCT lowers it; together they maintain Ca^{2+} balance.

09 Common mistakes

- Saying posterior pituitary makes oxytocin (it only stores; hypothalamus makes).
- Mixing gigantism (child) and acromegaly (adult).
- Writing insulin from α-cells (β-cells).
- Saying steroid hormones use cAMP.

10 Practice (NEET style)

1. Hormone deficient in diabetes insipidus?
2. Hormone regulating diurnal rhythm?
3. Disease from adrenal cortex deficiency?
4. Hormone stimulating RBC formation?
5. Exophthalmic goitre is also called?

ANSWERS

1) ADH (vasopressin) · 2) Melatonin · 3) Addison's disease · 4) Erythropoietin · 5) Graves' disease

11 Quick revision: 5 minutes before the exam

PITUITARY

- GH: gigantism / acromegaly
- LH, FSH, TSH, ACTH, PRL
- Posterior: oxytocin, ADH

THYROID GROUP

- T_3, T_4 need iodine
- Cretinism, goitre, Graves
- PTH up, TCT down Ca^{2+}

ADRENAL/PANCREAS

- Adrenaline: fight/flight
- Cortisol, aldosterone
- Insulin β, glucagon α

MECHANISM

- Protein: membrane, cAMP
- Steroid: nuclear receptor

Have a doubt? Ask the AI Doubt Solver at padhaiadda.netlify.app, or take the mock test on this chapter.