

Endocrine System

Communication { Endocrine System - relatively slow
Nervous System - Fast (ms)

Nervous

Effects lasting for a very short time

Endocrine

- Effects last for years

- Comprises of glands and hormones

↳ chemical messengers, secreted by endocrine glands and transported via blood.

- Exocrine - glands with ducts
- Tropic hormones are those which regulate the release of other.
- Functⁿ of Endocrine System :-

 - ① maintain internal homeostasis [metabolism, osmoregulation]
 - ② facilitate behaviour & social interactions
 - ③ coordinate reproduction.
 - ④ coordinate development
 - ⑤ regulate growth and morphological change.

4 Chemical classes of hormone

- ① Steroids
- ② Amino acids
- ③ Proteins
- ④ Polypeptides.

(derivative of amino acid
i.e. tyrosine or tryptophan)

- Tyrosine derivative : Dopamine, epinephrine
- Tryptophan " : melatonin, serotonin

Proteinis : } Hypothalamus hormone, Pituitary
Polypeptide : } hormones all belong to proteinis
and polypeptide group.

• Steroid hormones [secreted by gonads, adrenal & placenta]

1. Aldosterone
2. Testosterone
3. Estrogens & progesterone

• Amines (derivative of tyrosine)

1. Epinephrine
2. Norepinephrine
3. Dopamine
4. Thyroxine

• Peptides & Proteinis

- ① All Hypothalamic releasing and inhibitory hormones
- ② All Anterior lobe hormone
- ③ Antidiuretic hormone
- ④ oxytocin
- ⑤ Cortisol
- ⑥ Parathyroid hormone
- ⑦ Growth hormone

Endocrine gland

• In the brain

1. Hypothalamus 2. Pituitary



Rest of the rest of the body

3. Adrenal gland
4. Gonads (Testes & ovaries)
5. Pancreas
6. Thyroid

Oxytocin - motherly feeding or behaviour.

- Adrenal - Kidney [above the kidney]
close group.
- Pancreas - leaf like gland [Exocrine as well as endocrine gland]
↓
Insulin & glucagon
- Islet of Langerhans - special cells which secrete hormones (insulin & glucagon)
[in folds of duodenum]

Gland	Hormone	Actions
-------	---------	---------

- | | | |
|---------------------------------|---|--|
| 1. Hypothalamus | Hormones regulating factors like gonadotrophin releasing hormone, thyroid hormone, etc. These are hypothalamic hormones - oxytocin & antidiuretic hormone (ADH) [They are secreted here] (peptide) | <ul style="list-style-type: none"> • oxytocin → stimulates contractⁿ of uterus & mammary glands. • ADH → Promotes retention of water by kidneys |
| • <u>Posterior pituitary</u> | | |
| <u>Anterior pituitary gland</u> | <ul style="list-style-type: none"> • Growth hormone (GH) stimulates growth • Prolactin (Prl) (PRC) stimulates milk prodⁿ & secretⁿ • FSH (Gly.) stimulates prodⁿ of ova & sperm • LH (Gly.) stimulates ovaries & testes (ovulation) • Thyroid stimulating hormone (TSH) (glycoprotein) stimulates thyroid gland • Adrenocorticotropic (ACTH) stimulates adrenal cortex to secrete glucocorticoids. • MSH (melanocyte stimulating hormone) (in amphibians, reptiles) | |

- Secretion of milk is due to prolactin hormone.
- oxytocin helps in ejection of milk
- Estrogen helps in maintenance & size of breast

Thyroid hormones

- (2) Thyroid gland
- | | |
|-------------------|---|
| T_3 | } stimulate & maintain metabolic processes. |
| T_4 - Thyroxine | |
| Calcitonin | |
- lowers the blood Ca^{2+} level

- (3) Parathyroid gland
- | | | |
|---------------------------|-----------|--------------------------------|
| Parathyroid hormone (PTH) | (peptide) | Releases blood Ca^{2+} level |
|---------------------------|-----------|--------------------------------|

- (4) Pancreas
- | | |
|--------------------|----------------------------|
| Insulin (Protein) | lowers blood glucose level |
| Glycogen (Protein) | stores " " " " |

- (5) Adrenal gland
- | | |
|--------------------|---|
| Glucocorticoids | } (during stress)
• raises blood glucose level
• Promotes reabsorption of Na^+ & secretion of K^+ in kidneys
• Support sperm formation |
| Mineralocorticoids | |
| Androgens | |
- Androgens provide development & maintenance of male 2^o sex characters
- [involve in competitive fighting in females (facial hair, thickening of voice, masculine features)]

- (6) Adrenal medulla
- | | |
|----------------|---|
| Epinephrine | • raises blood glucose level & the metabolic activity |
| Norepinephrine | |

- (7) Ovaries
- | | |
|--------------|---|
| Estrogen | • stimulate uterine lining growth, provide development and maintenance of female 2 ^o sex characters. |
| Progesterone | • promote uterine lining growth |

- (8) Pineal gland
- | | |
|-------------------------------|----------------------------------|
| Melatonin (secreted at night) | • involved in biological rhythms |
|-------------------------------|----------------------------------|

- (9) Pituitary gland
- | | |
|-----------------------------|---------------------------|
| Serotonin (secreted at day) | • sleep inducer, calmness |
|-----------------------------|---------------------------|

Anterior pituitary

Growth hormone

- Hyposecretion in early yrs → dwarfism
- Hypersecretion in early yrs → gigantism
- Hypersecretion in adults → acromegaly

Endocrine Glands - Pituitary

Posterior Pituitary [neurohypophysis]

Structure is nervous tissue. Stores & secretes 2 hormones produced in hypothalamus.

- Oxytocin: acts on mammary glands for milk ejection & causes contraction of the uterus during parturition.

- Deficiency in secretion of antidiuretic hormone (ADH) by posterior pituitary

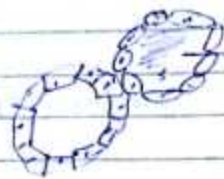
→ large amts of water & sodium is excreted

Thyroid

- Located in the neck just below the larynx, secretes 3 hormones: triiodothyronine (T₃), thyroxine (T₄) & calcitonin.

- T₃ and T₄ both stimulate cellular metabolism

Cellular metabolism - chemical processes that result in growth, generation of energy, elimination of



- active
- cuboidal & squamous cells
- not so active.

Deficiency : Goiter, simple; Nontoxic

- Hypertrophy of thyroid gland
- deficient amt of Iodine in diet
- Iodine is required for synthesis of T_3 & T_4

Hyperthyroidism (Graves Disease)

- hypertrophy of thyroid gland resulting in excessive secretion of thyroid hormone (T_3 & T_4)
- Three distinguishing characteristics :

- ① Hyperthyroidism
- ② Thyroid gland enlargement (goiter)
- ③ Exophthalmia

- Palpitation, over active, Thin, Exophthalmia (bulging of eyes)

Hypothyroidism

- Condⁿ in which there is a shortage of thyroid hormone carrying an extremely low b

Thyroid Thyroiditis (Hashimoto's)

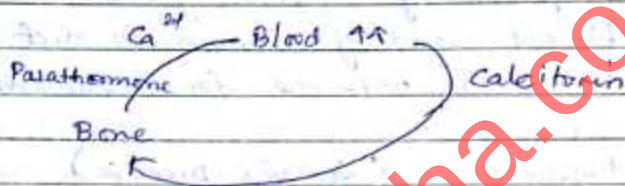
- Chronic inflammation of thyroid gland leading to enlargement of the thyroid gland.

[Body cannot recognise the own thyroid cells]

- Chronic disease

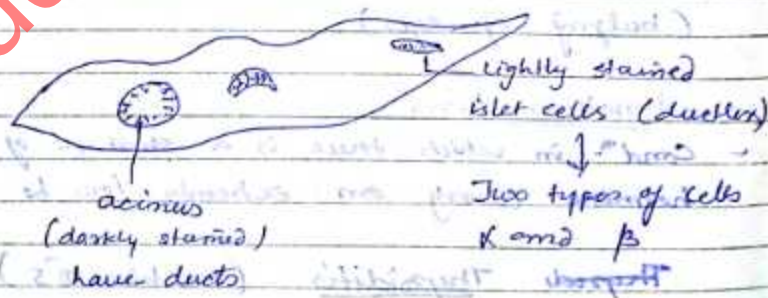
Parathyroid gland

- Located on the posterior surface of the thyroid, usually 4 in number.
- Hormone is parathyroid hormone which prevents hypocalcemia



Pancreas

- Extends from the duodenum to the spleen
- Has exocrine and endocrine functions
- Endocrine part consists of clumps of cells called islets of Langerhans or pancreatic islets



α - secretes glucagon
 β - secretes insulin

Adrenal gland

- sit on the superior surface of the kidneys; actually two glands in one
- Adrenal cortex — outer part, contains three zone
 - (A) ^{Glomerular} zona ~~granulosa~~ (B) Zona Fasciculata
 - (C) Zona reticularis
- ↓
- secretes androgen
- [Irregularly arranged cells]
- ↳ secretes glucocorticoids (stress hormone)
- arrange in the form of (cords)
- Medullary cells also c/d chromaffin cells; deeply stained cells.

Addison's Disease:

- Resulting from an autoimmune process, a neoplasm, or infection, or a hemorrhage in the gland.

Conn's Disease: (Primary Aldosteronism)

- Excessive prod of aldosterone
- causes body to retain extra sodium & ~~water~~ excrete extra potassium
- leads to ↑ vol of blood and hypertension as large amt of Na is reabsorbed.

Cushing's Syndrome

- cluster of
- Excessive

Symptoms:- central obesity, round moon face, Edema, hypertension, poor wound healing.

Pheochromocytoma

- Leads to persistent or intermittent hypertension and heart palpitations
- Produces extra epinephrine and norepinephrine
- Vascular tumor of adrenal medulla.

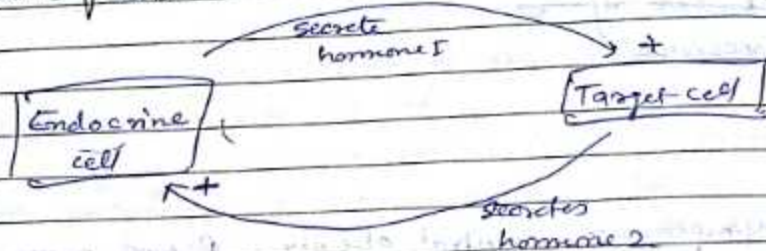
Virilism

- Development of male sex characteristics in the female due to the excessive secretion of androgenic hormones from the adrenal cortex.

- Symptoms:-
- ovarian changes (absence of menstruation)
 - oily skin
 - Atrophy of the breasts and uterus
 - Deepening of the voice
 - Excessive hair on the body & face (hirsutism)
 - muscular hypertrophy.

Adrenal medulla secretes catecholamines
- Epinephrine =

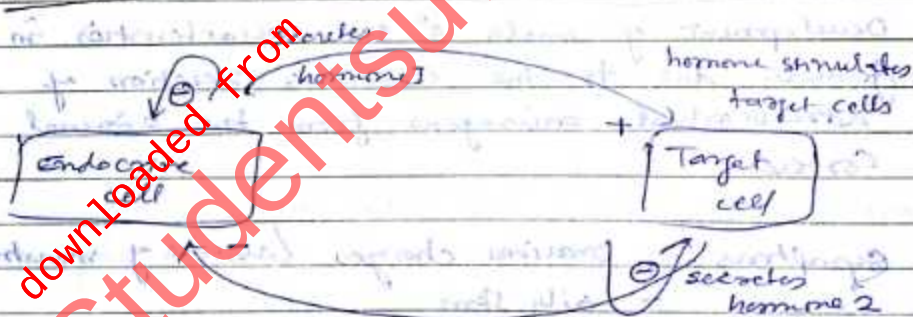
the feedback



Hormones stimulates each other, the product of target cells the the productⁿ of initial cell hormone which causes even more secretion of the target cell product.

— This is rare and short lived becoz they quickly get out of contact.

-ve feedback



- -ve feedback have short and long loops.
- Product of inhibits further productⁿ of self and of stimulating hormone.

short loop: hormone inhibits it own synthesis

long loop: Product of target cell will inhibit hormone from endocrine cell.

Eg -ve feedback : Progesterone

+ve feedback : Prolactin

