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Endocrine System

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

Nervous	Endocrine
Effects lasting for a very short time	- Effects last for years
	- Comprises of glands and hormones.
	└ chemical messenger, secreted by endocrine glands and transported via blood.

- Exocrine - glands with ducts
- Trophic hormones are those which regulate the release of other.
- Functⁿ of Endocrine System :-
1. maintain Internal Homeostasis [metabolism, Osmoregulation]
2. facilitate Behavioural & social interactions
3. Coordinate Reproduction.
4. Coordinate Development
5. Regulate growth and morphological change.

4 Chemical classes of hormone

1. Steroids
2. Amines (derivative of aminoacid i.e tyrosine & tryptophan)
3. Proteins
4. Polypeptides.

→
- Tyrosine derivative : Dopamine, Epinephrine
- Tryptophan " : melatonin, Serotnin

Proteins : } Hypothalamus hormone, Pituitary & Pancreas all belong to proteins
Polypeptide : } 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 & Proteins
  (1) Act Hypothalamic releasing and inhibiting hormones
  (2) Act Anterior lobe hormone
  (3) Antidiuretic hormone
  (4) oxytocin
  (5) Calcitonin (6) Parathyroid hormone.
  (7) Digestive hormone.

Endocrine gland.

- In the brain
  1. Hypothalamus 2. Pituitary

- In the rest of the body
  3. Adrenal gland 4. Gonads (Testes & ovaries)
  5. Pancreas 6. Thyroid

Oxytocin — motherly feeling or behaviour.

- Adrenal — Kidney [above the kidney
close proximity

- 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 releasing factors like gonadotrophin releasing hormone. [tropic hormone] · There are two hormones — oxytocin & (Peptide) Antidiuretic hormone (ADH) [They are synthesized here] (Peptide)	• oxytocin → stimulates contraction of uterus & mammary glands. • ADH → Promotes retention of water by kidneys
Posterior pituitary		
Anterior pituitary gland	(Pro) Growth hormone (GH)	Stimulates growth
	• Prolactin (Pro.) (PRL)	Stimulates milk production & secretion
	gonado-tropin { • FSH (Gly.)	• Stimulates production of ova & sperm
	• LH (Gly.)	• Stimulates ovaries (ovulation) & testes (testosterone)
	• Thyroid stimulating hormone (TSH) (Glycoprotein)	• Stimulates thyroid gland
	• Adrenocorticotropic (ACTH) (Peptide)	• 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

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		Triiodothyronine	
(2) Thyroid gland	T_3 ↓	Amine	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
	Glycagon (Protein)		↑ses " " " "
(5) Adrenal ~~gland~~ ~~medulla~~ Cortex	Glucocorticoids	(Steroid)	(during stress) • ↑ses blood glucose level • Promotes reabsorptn of Na^+ & excretion of K^+ in Kidneys
	Mineralocorticoids		
	Androgens ↓		• Support sperm formatn provide development & maintainance of male 2° sex characters
Adrenal	[induce in competitive feeling in females [facial hair, thickning of voice, muscular features]		
(6) Adrenal medulla	• Epinephrine • Norepinephrine		• Raise blood glucose level & rate metabolic activity
(7) ovaries	• Estrogen		• Stimulate uterine lining growth provide development and maintenance of female 2° sex characters.
	• Progesteron		• Promote uterine lining growth.
(8) Pineal gland	melatonin (secretes at night) (sleepy)		• Involves in biological rhythms • sleep induce & calmness
(chocolates, curd contain lots of serotonin)	Serotonin (Secretes at day)		

Anterior pituitary

- Growth hormone

- Hypersecretion 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 and causes contract^n of the uterus during parturition.

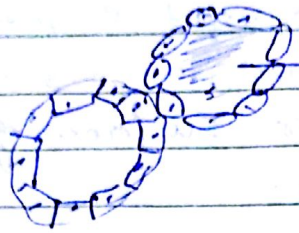
ADH :

- 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 :

- T3 and T4 both stimulate cellular metabolism — Cellular metabolism — chemical processes that result in growth, generat^n of energy, elimination of



active
- cuboidal & squamous cells
↓
not so active.

Deficiency : Goiter, Simple; Nontoxic
- Hyperplasia 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, Exopthalmia (bulging of eyes)

Hypothyroidism
- cond^n in which there is a shortage of thyroid hormone & carry on extremly low bo

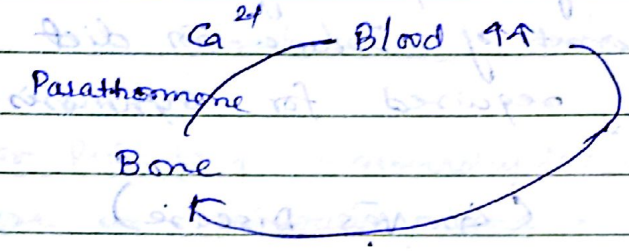
~~Thyroid~~ Thyroiditis (Hashimoto's)

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

[Body cannot recognise the own thyroid cells]
- Chronic disease

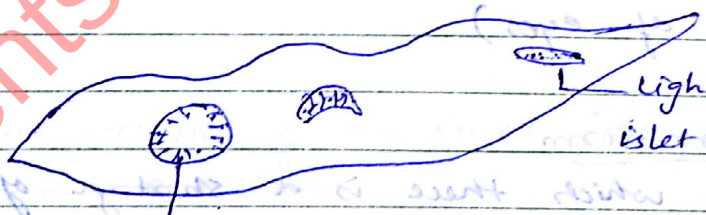
Parathyroid gland

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



Pancreas

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



Two types of cells K and β

K – secretes glucagon

β – Insulin

Hyperglycaemia – High glucose level

- Islets contain 2 types of cells
  - Alpha secrete a hormone cld glucagon
  - Beta " " " " Insulin

- Blood sugar
  - Normal 80 – 120 mg/dl
  - Hypoglycemia – low level of glucose
  - Hyperglycemia – high level of glucose

Diabetes mellitus

- Type I Diabetes
- Formerly known as insulin Dependent diabetes mellitus (IDDM)
- usually occurs before age of 30
- Individuals are prone to developing ketosis
- Sudden onset
- Symptoms – Polyuria → Used urination
  Polyphagia → ↑ hunger
  wt loss
  Polydipsia → ↑ed thirst

Type II Diabetes

- Formerly known as Non-insulin-Dependent Diabetes mellitus: (NIDDM)
- usually controlled through diet and exercise
- majority of these individuals are obese
- Usually appears in adults after age of 40.

Adrenal gland

- Sit on the superior surface of the kidneys; actually two glands in one
- Adrenal cortex — outer part, Contains three zone
  - (A) Zona glomerulosa → secretes aldosterone (Mineralocorticoids) [irregularly arranged cells]
  - (B) Zona Fasciculata → secretes glucocorticoids (Stress hormone) → arrange in the form of cord
  - (C) Zona reticularis → secretes androgen
- Medullary cells also c/d chromaffin cells; deeply stained cells.

Addison's Disease:

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

Conn's Disease: (Primary Aldosteronism)

- Excessive amt of aldosterone
- Causes body to retain extra sodium & excrete extra potassium
- Leads to ↑ed volume of blood and hypertension as large amt of Na is reabsorbed.

Cushing's Syndrome

- ~~cluster of s~~
- 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.

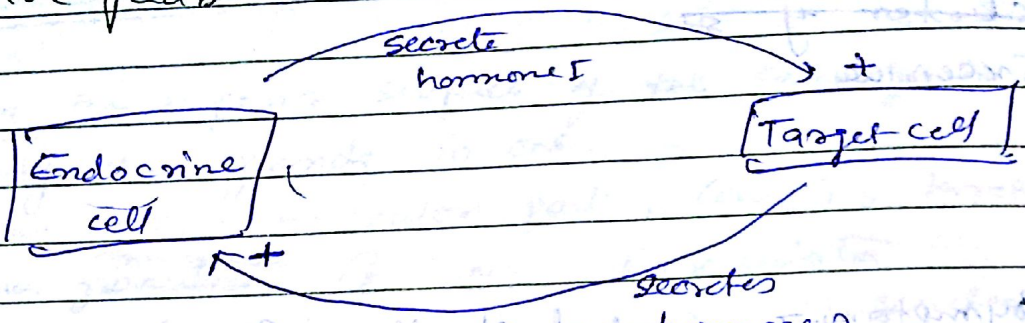
Virilism

- Development of male 2° sex characteristics in the female due to the excessive secretion of adrenocortical androgens 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.

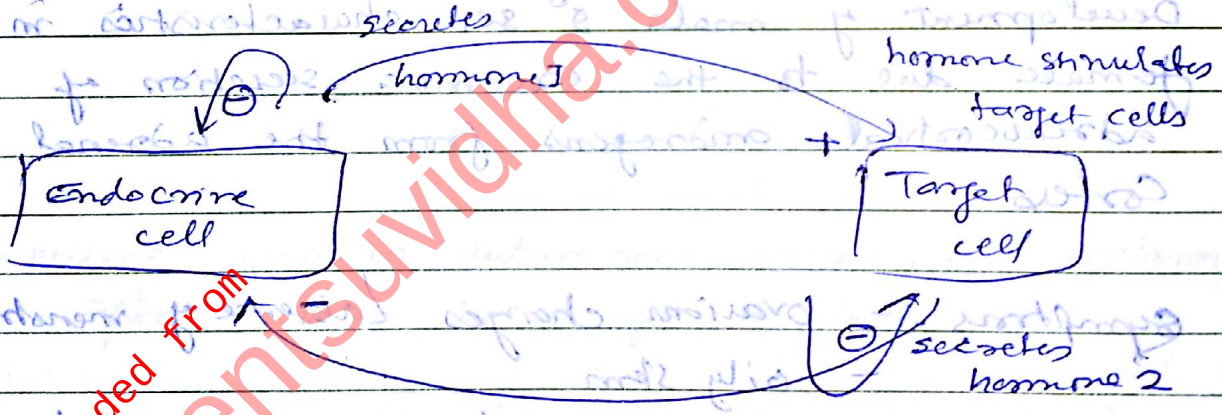
- Ans: Adrenal medulla secretes catecholamines
  - Epinephrine =,

+ve feedback



Hormones stimulates each other, the product of target cells is the production of initial hormone which causes even more secretion of the target cell product.
- This is rare and short lived bcoz they quickly get out of control.

-ve feedback



- -ve feedback have short and long - loops.
- Product of inhibits further production 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.

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E.g -ve feedback : ~~Pro~~

+ve feedback : Prolactin