

CHEMICAL COORDINATION & INTEGRATION

ENDOCRINE GLANDS (DUCTLESS GLANDS)

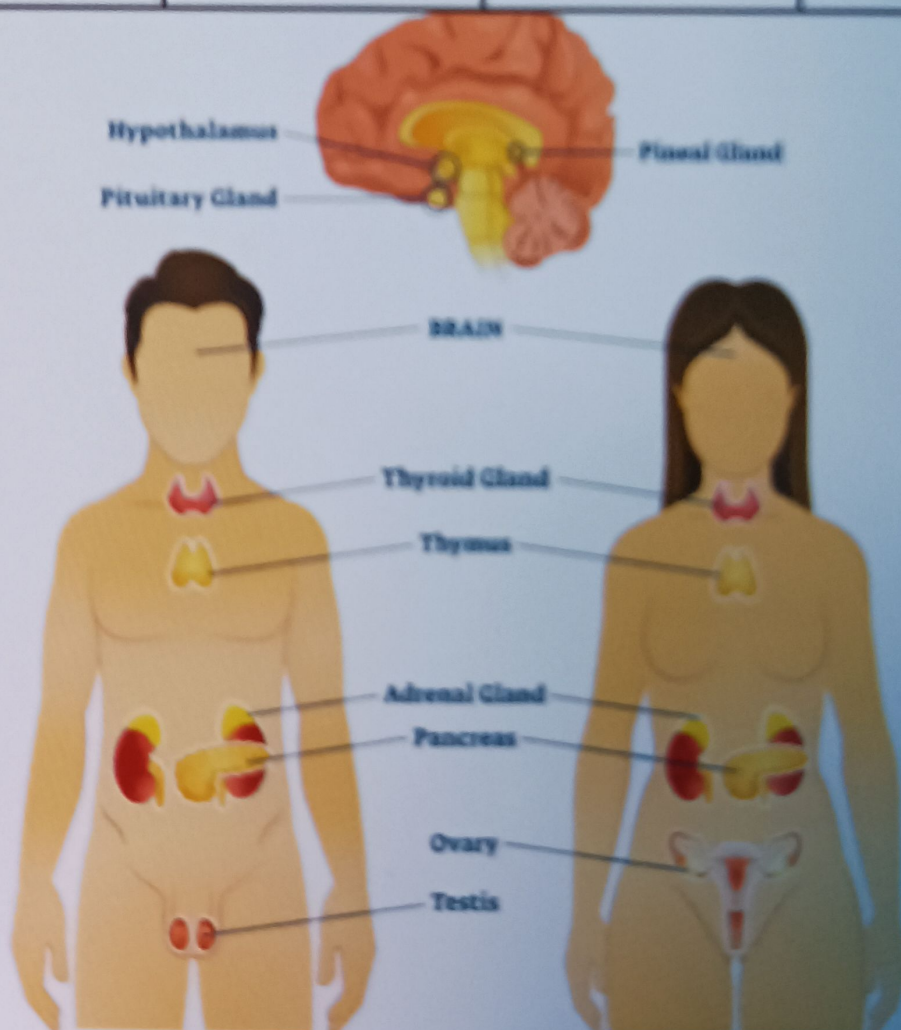
Secrete hormones & release secretions directly into blood.

HORMONES

Non-Nutrient chemicals produced in trace amounts, which act as intercellular messengers.

HUMAN ENDOCRINE SYSTEM

Pituitary	pineal	thyroid	pancreas
adrenal	parathyroid	thymus	gonads



HYPOTHALAMUS

Basal part of Diencephalon

In Anterior & Inferior to Thalamus

It is anatomically & functionally related to pituitary gland and its Hormones regulate the synthesis of secretion of pituitary hormones

Hormones (2 Types)

Releasing hormone

Inhibiting hormone

Stimulates secretion of pituitary hormones
GnRH - Gonadotrophin releasing hormone

Inhibits secretion of pituitary hormones.
eg-Somatostatin

*Note- Portal circulatory system connects to anterior Pituitary
Posterior pituitary is under direct control

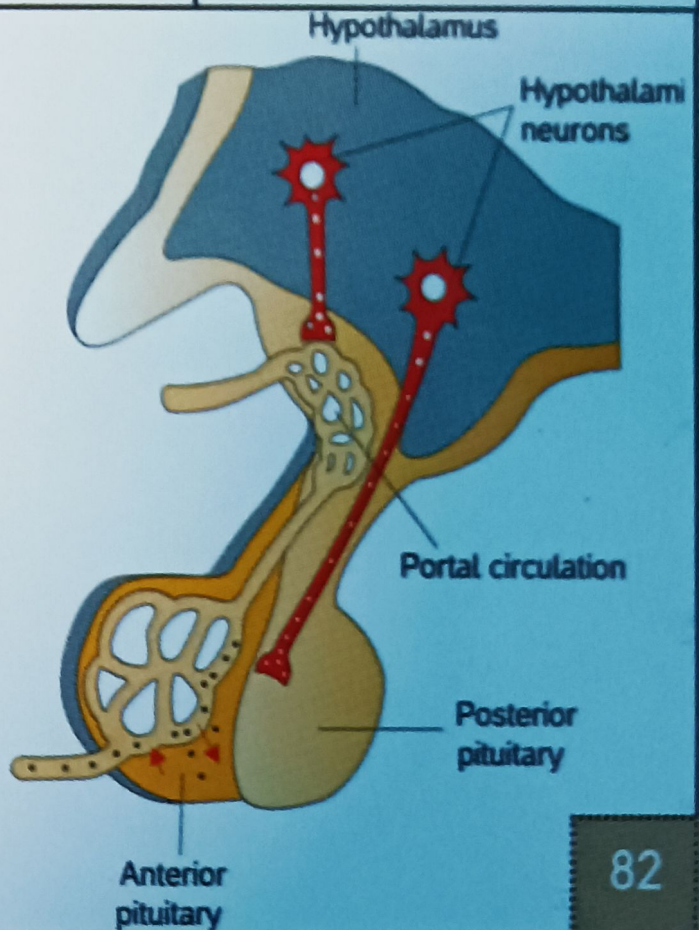
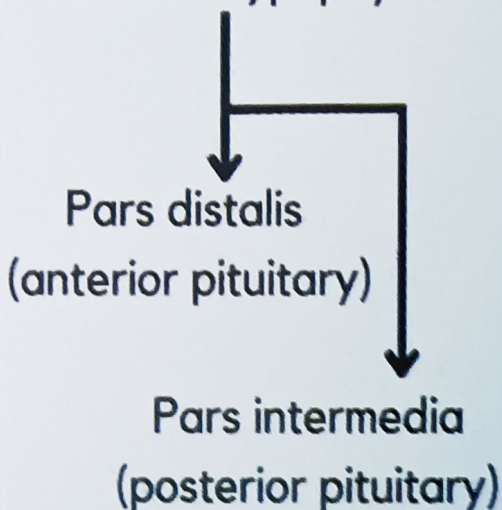
PITUITARY GLAND

Location- Bony cavity (Sella turcica)

smallest endocrine gland

Parts

- Neurohypophysis
- Adenohypophysis



Hormones of Pars Distalis

1. Growth hormone (GH)

Low secretion- dwarfism	High secretion- gigantism	High secretion in adults- Acromegaly (disfigurement)
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2. Prolactin (PRL)

- Regulates growth of mammary glands, milk production

3. Thyroid stimulating hormone (TSH)

- Regulates synthesis & secretion of thyroid hormones.

4. Adenocorticotrophic hormone (ACTH)

- Stimulates synthesis & secretion of steroid hormone (glucocorticoids) from adrenal cortex.

5. Lutenizing hormone (LH)

- stimulates secretion of androgens from testis & induces ovulation of graffian follicle & maintains corpus leutum

6. Follicle stimulating hormone (FSH)

- FSH along with androgens regulates spermatogenesis
- Also stimulates growth of follicles in female (FSH and LH = gonadotrophions.)

7. Melanocyte stimulating hormone (MSH)

Regulate Skin Pigmentation

Pars intermedia - (Transported directly from hypothalamus)

Oxytocin

- Stimulate uterus contractions for child birth, also helps ejection of milk.

Vasopressin (ADH)

- Stimulate reabsorption of water + electrolytes from DCT in kidneys, reducing water loss by urine; hyposecretion of ADH - Diabetes Insipidus

Adrenal Cortex Hormones

Glucocorticoids	Mineralocorticoid
<ul style="list-style-type: none"> carbohydrate metabolism stimulate gluconeogenesis, lypolysis & proteolysis 	<ul style="list-style-type: none"> Regulate water & electrolyte balance helps maintaining blood & osmotic pressure

eg- **Cortisol**- Anti inflammatory, suppress immune system, stimulate RBC production

Aldosterone- Reabsorbs Na^+ & helps excretion of K^+ & phosphate ions in renal tubules

Note

- Cortex part also secretes androgenic steroids (hair growth)
- Addison's disease- under production of corticoids

Adrenal Medulla (Hormones)

Adrenaline/epinephrine

Noradrenaline/norepinephrine

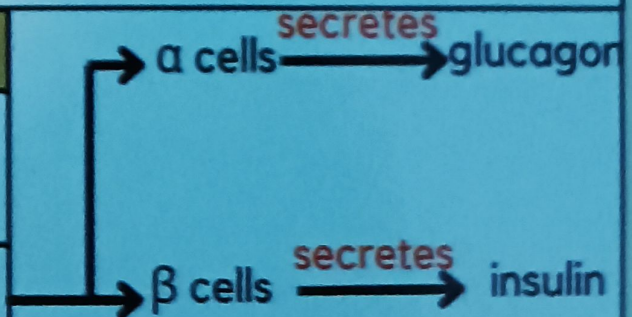
They are also called emergency hormones/hormones of fight & flight

- increases alertness, pupil dilation
- increases heartbeat, respiration rate
- increases glucose conc. in blood.
- helps breakdown of proteins + fats.

PANCREAS

composite in nature = exocrine + endocrine

consists of Islets of Langerhans



PINEAL GLAND

- Location- Dorsal side of forebrain.
- Hormone - Melatonin which Regulate 24-hour (diurnal) rhythm of body
- Also regulates body metabolism, pigmentation, menstrual cycle & defense capability.

THYROID GLAND

- Present on both sides of trachea (2-lobes) which is interconnected by Isthmus
- Thyroid gland is formed by Follicles & Stromal tissue

Hormones secreted by Follicle cells

Tetraiodothyronine (or thyroxine) (T_4) Triiodothyronine (T_3)

Functions of T_4 and T_3

- Regulate metabolic rate
- Support RBC formation
- Regulate metabolism of carbohydrate, fats, proteins.
- Maintain water & electrolyte balance
- Secrete Thyrocalcitonin (TCT)- regulate blood- Ca^{2+} levels

Hypothyroidism (Def. of I_2)

- Enlarged thyroid gland (Goitre)
- Defective development of baby (during pregnancy)
- Stunted growth (Cretinism)
- Mental Retardation
- Irregular Menstrual cycle (in female)

Hyperthyroidism

- Abnormally high levels of thyroid hormones (Causes- cancer/nodules)
- Exophthalmic goitre - enlarged thyroid gland (Grave's Disease)
- Thyroid gland protrusion of eyeballs, weight loss

PARATHYROID GLAND

Location-back of thyroid gland (one pair on each lobe=Total 4)

Parathyroid hormones (PTH)

- peptides in nature ; hypercalcemic hormone
- regulate secretion of Ca^{+2} ions (increases secretion in blood)
- stimulate bone reabsorption.

THYMUS

Location- b/w lungs, on ventral side of sternum

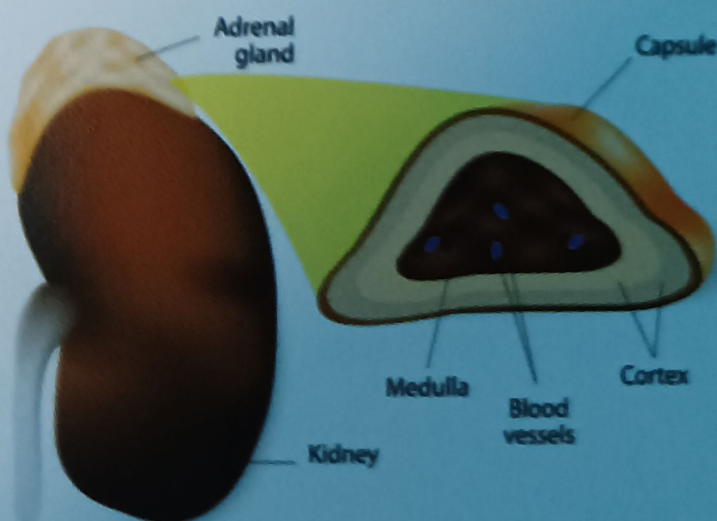
Hormone -Thymosins

- regulate differentiation of T-lymphocytes (cell-mediated immunity)
- promote antibody production (humoral immunity)

Note-Thymus degenerates with age - immune response becomes weak with old age

ADRENAL GLAND

- Location-Anterior to part of kidney.
- 2 types of tissues
 - Adrenal Medulla (inside)- secret Catecholamines
 - Adrenal Cortex (outside)- secrete Corticoids



Adrenal cortex

- Zona reticularis (inner)
- Zona fasciculata
- Zona glomerulosa (outer)



1. Glucagon

- maintains blood-glucose level

acts on liver cells → glycogenolysis ^{causing} → hyperglycemia
(increasing blood sugar)

- reduces cellular glucose uptake & utilisation

2. Insulin (peptide)

- also regulates glucose homeostasis

acts on hepatocytes & adipocytes → increases glucose uptake → hypoglycemia
(decreases blood-glucose level)

Prolonged hyperglycemia → Diabetes mellitus • Glucose loss in urine.
• formation of ketone body

TESTES

- Location : scrotal sac.

Androgens

- regulate development of male sex organs
- stimulate 2° sexual characters in males
- influence male sexual behavior (libido)
- eg- testosterone

OVARY

- Location : abdomen

Estrogen

- stimulates growth of female sex organs & secondary sexual characters
- mammary gland development

Progesterone

- supports pregnancy
- development of mammary glands, secretion



NON ENDOCRINE GLANDS

Atrial Wall of hearts

JG cells of kidney

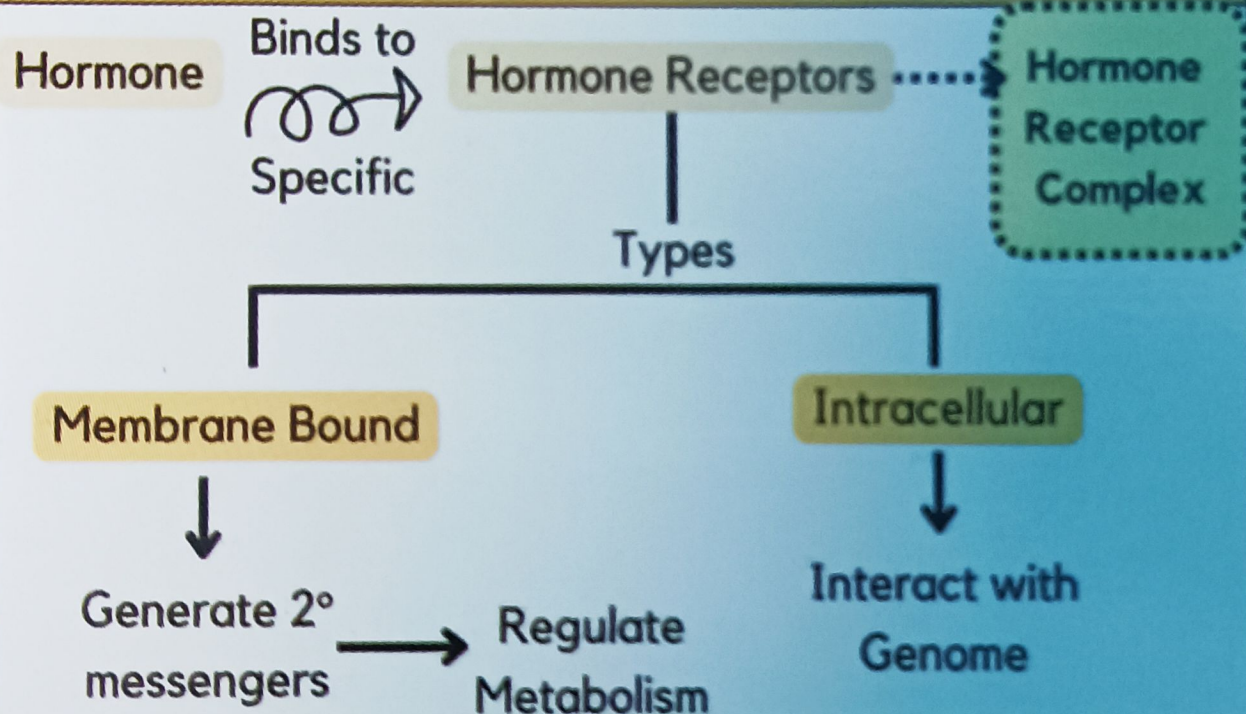
- Atrial natriuretic factor(ANF)
- decreases BP

- Erythropoietin
- stimulates enthropoiesis

Gastro-Intestinal tract

- Gastrin-Stimulats HCl secretion
- Secretin - Stimulates secretion of H₂O & bicarbonate ions.
- Cholecystokinin (CCK) - helps secretion of bile juice & pancreatic enzymes
- Gastric Inhibitory peptide (GIP) -inhibits gastric secretion

HORMONE RESPONSE DIAGRAM



HORMONES

- Proteins (insulin, glucagon etc)
- Steroids (cortisol, testosterone, progesterone)
- iodothyronine (thyroid hormones)
- AA derivatives (eg-epinephrine)

