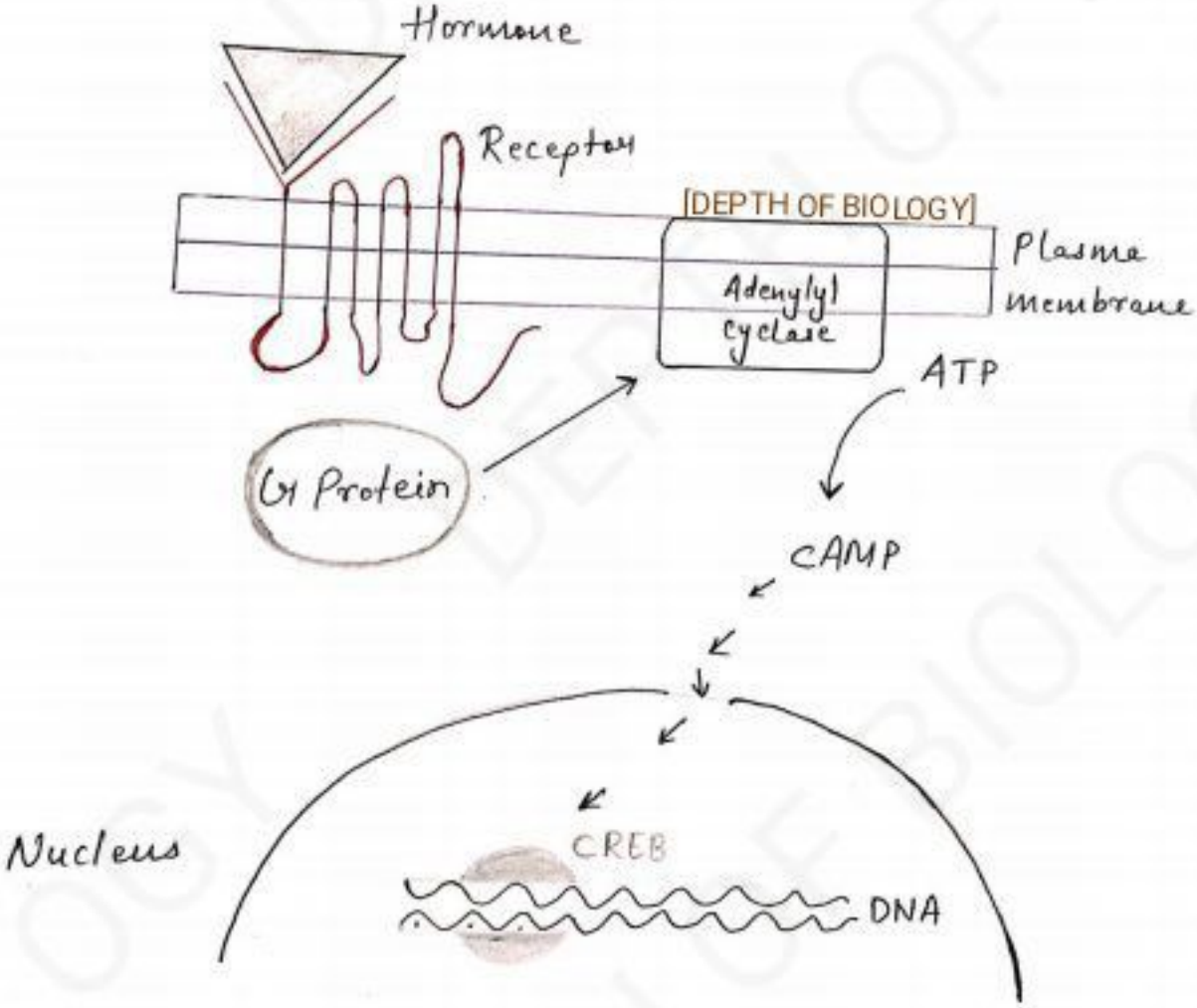
Classification of Hormones

- Steroids
  - Adrenal Cortical hormones (Corticoids)
  - Sex hormones
    - Female Sex hormones
      - Estrogen (estrone esteradial)
      - Progesterone
    - Male Sex hormones Androgens eg:- Testosterone
- Peptide hormones (Insulin glucagon)
- Amino Acid derivative (Thyrodial hormones)
- Miscellaneous (Prostaglandins cytokinins)

Mechanism of Hormone Action :—

Each hormone has receptors that are found on the cell membrane of the target organ. Once the hormone bind to its designated receptor, a series of actions are initiated to release secondary messengers inside the cell. These secondary messengers are responsible for relaying information to the nucleus or other organelles.



cAMP Response Element

Pituitary Gland

Adenohypophysis

- Pars distalis (Anterior Pituitary)
- Pars intermedia

Neurohypophysis

- Infundibulum
- Pars nervosa (Posterior Pituitary)

↳ Pars distalis (anterior pituitary) :—

(A) Somatotrophs ⇒ Secrete GH / STH

↳ Stimulates growth of bone, cartilage and soft tissues (Muscles & liver).

↳ Stimulates metabolism of proteins fat and carbohydrates. [DEPTH OF BIOLOGY]

(B) Lactotrophs ⇒ Secrete PRL / LTH

↳ Regulates growth of mammary glands and formation of milk in them.

↳ Responsible for lactation after delivery.

↳ Hormone of maternity. [DEPTH OF BIOLOGY]

(C) Corticotrophs ⇒ Secrete ACTH

↳ Stimulates the Synthesis and Secretion of Steroid hormones from adrenal cortex.

[DEPTH OF BIOLOGY]

(glucocorticoids & Steroid hormones)

(D) Thyrotrophs ⇒ Secrete TSH

↳ Stimulates thyroid gland for Synthesis and Secretion of thyroid hormone (thyroxine).

[DEPTH OF BIOLOGY]

(E) Gonadotrophs ⇒ Secrete LH & FSH

Stimulates gonadial activity and hence called gonadotropins

↳ FSH ⟶ In male FSH & Androgen (Secreted from testes) both regulates Spermatogenesis and normal functioning of Seminiferous tubules. [DEPTH OF BIOLOGY]

- In female, FSH Stimulates growth & development of ovarian follicles.

↳ LH ⟶ - In males, LH Stimulates the Synthesis & Secretion of hormones Called Androgens from testes.

[DEPTH OF BIOLOGY]

- In females, LH induces ovulation of fully mature follicles (graffian follicles) and maintains the corpus luteum.

↳ Pars intermedia (middle pituitary) :-
↳ Melanocyte Stimulating hormone (MSH)

↳ Pars nervosa (Posterior pituitary) :-

(A) Oxytocin / Birth hormone [DEPTH OF BIOLOGY]

- Stimulates uterine contraction during the time of child birth.
- Stimulates milk ejection from the mammary gland.
- Helps in egg laying in birds.
- Artificial injected in cattles (cow & buffaloes) for instant milk ejection.

(B) ADH / Vasopressin [DEPTH OF BIOLOGY]

- Mainly acts on kidney & Stimulates reabsorption of water by distal tubules and thereby reduces loss of H_2O through urine (Diuresis)

So called as antidiuretic hormone.
[DEPTH OF BIOLOGY]

Pituitary hormone disorder :-

① Hyposecretion :- [DEPTH OF BIOLOGY]

↳ Childhood - Dwarfism (STH)

↳ Diabetes insipidus (ADH)

② Hypersecretion :-

↳ Childhood - Gigantism (STH)

↳ Adulthood - Acromegaly (STH)

Pineal Gland (Dorsal side of Forebrain) :-

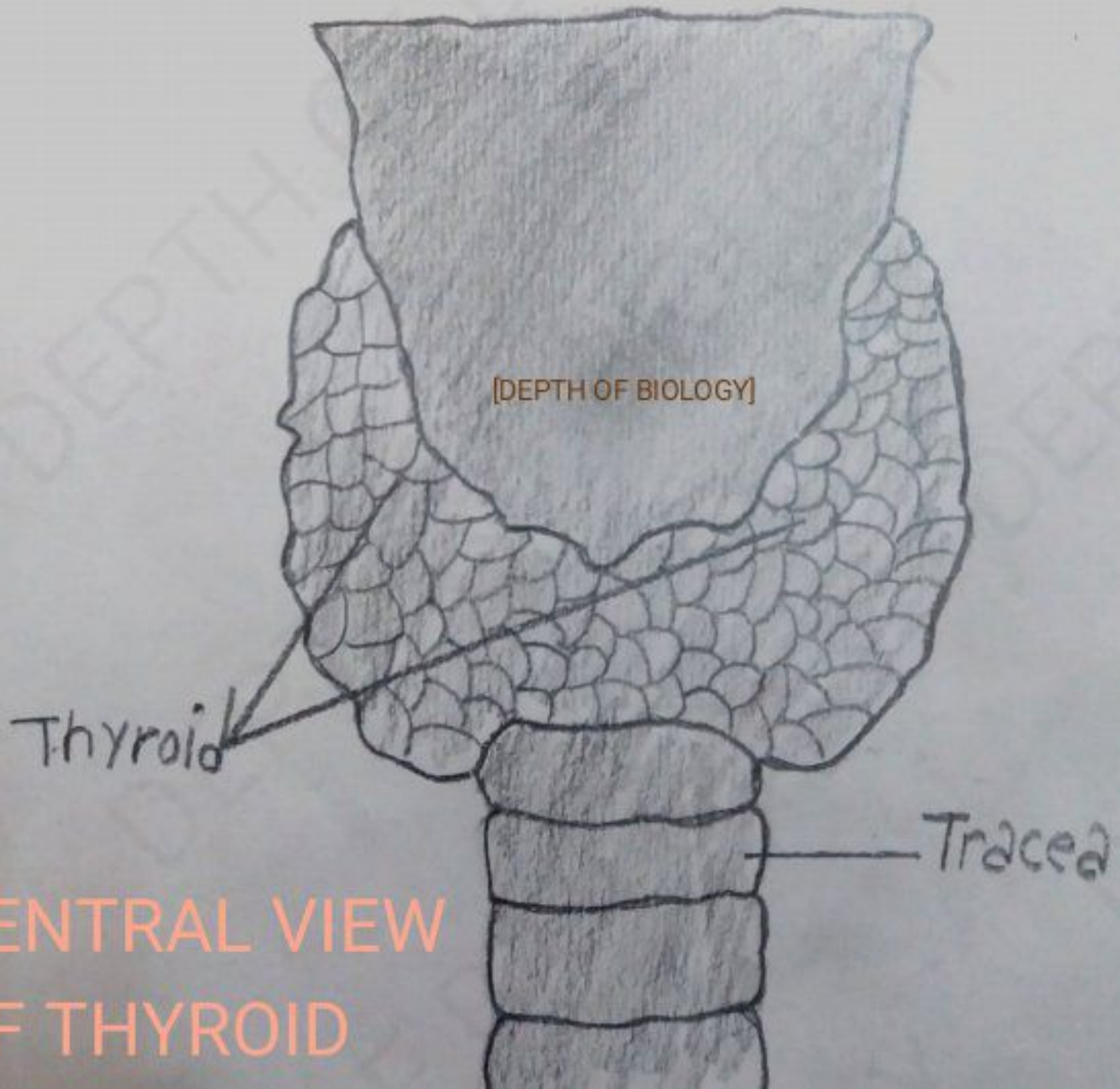
[DEPTH OF BIOLOGY]

- Hormone = Melatonin
- Melatonin regulate 24 hours diurnal rhythms of body.
- Melatonin maintain rhythms of body like - Sleep wake cycle, body temperature
- Melatonine also influence metabolism, Pigmentation, menstrual cycle and defense capability.
- After 7 years of birth pineal gland undergo involution & crystal of $CaCO_3$ and Ca_3PO_4 are deposited in it called "Brain Sand." [DEPTH OF BIOLOGY]

NOTE:- Melatonin provide light colour to skin. It play role in metachrosis (Change in colour) of amphibia.

Thyroid Gland

- Largest endocrine gland of body.
- Located at both side of trachea (or at junction of trachea and larynx).
- Bilobed gland (Lobes are interconnected) by a thin flap of connective tissue called Asthmus.
- Each lobe composed of follicles and stromal tissue.
- Follicular cells of follicle synthesize T_3 & T_4 (thyroxine) hormones.
- Thyroid is only gland in the body which stores its hormone in inactive stage.



VENTRAL VIEW OF THYROID

▶ Function of Thyroid hormone :-

→ Regulation of basic metabolic rate.
→ Support the process of RBC formation.
→ Control the metabolism of carbohydrate, Proteins & fats.
→ Maintenance of water and electrolyte balance. [DEPTH OF BIOLOGY]

Thyroid hormone disorder :-

① Hyposecretion :-

↳ Childhood

• Cretinism = In pregnancy defective development and maturation of growing baby. [DEPTH OF BIOLOGY]

Children are called Cretin. Mentally retard, low intelligence quotient, abnormal skin, deaf-mutism.

↳ Adulthood

(1) Myxoedema (Gull's disease):

- Falling of hair, loose and swollen skin, deposition of adipose fat. [DEPTH OF BIOLOGY]

(2) Simple goitre / Endemic goitre
(3) Hashimoto's disease / Suicide of thyroid / Autoimmune thyroiditis.

(2) Hypersecretion :—

(1) Exophthalmic Goitre / Grave's disease / Basedow's disease

↳ Protrusion of eye balls, increased BMR & weight loss.

(2) Plummer's disease / Toxic adenoma

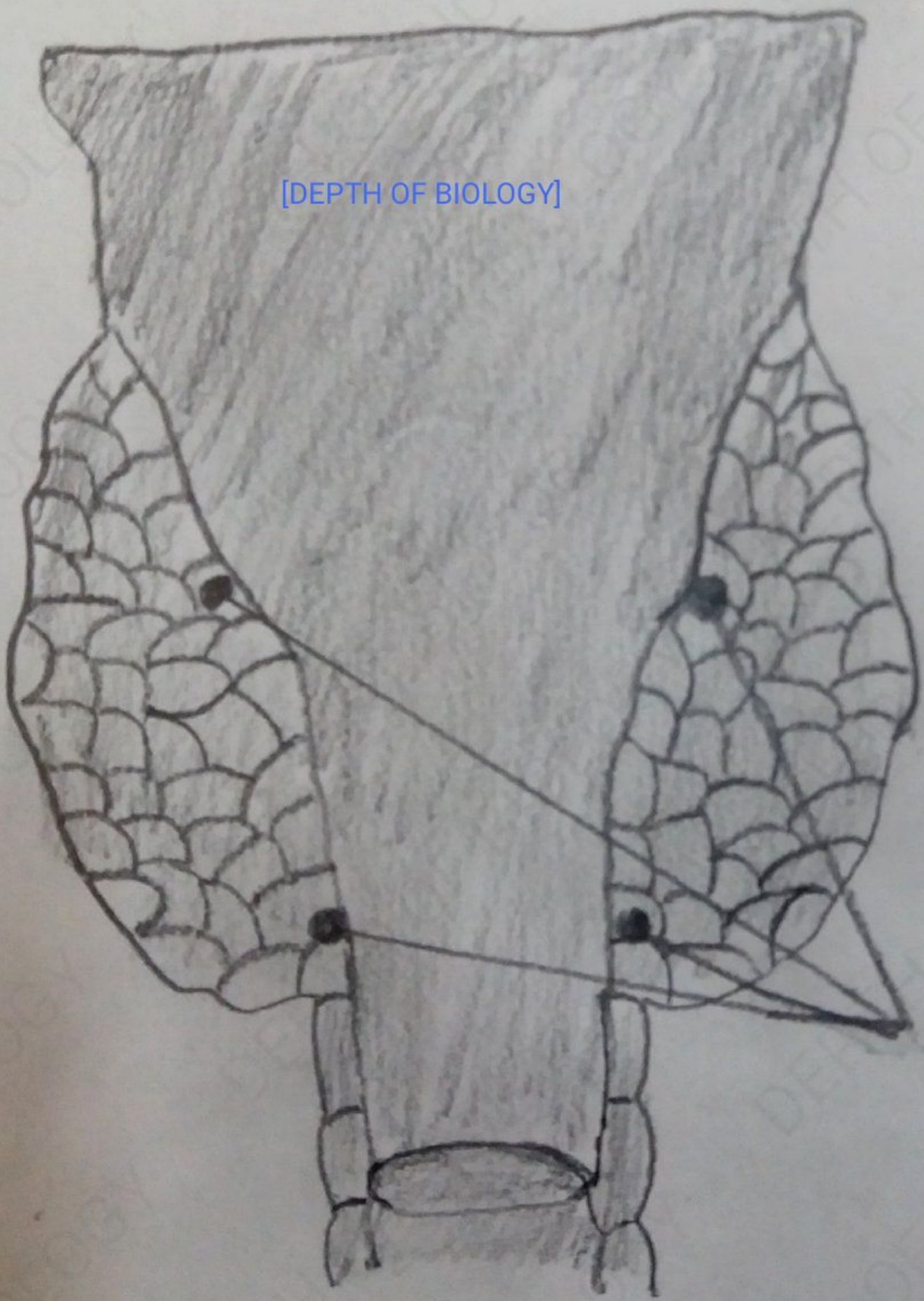
Thyrocalcitonin :— TCT regulate blood Ca^{+2} level ($\downarrow Ca^{+2}$ level in blood) by excretion of Ca^{+2} in urine and enhance deposition of Ca^{+2} in bones.

Parathyroid Gland

↳ Four Parathyroid glands are present on back side of thyroid gland.

↳ Hormone = Peptide hormone

↳ Also called as collip's hormone.



Parathyroid

Dorsal
View

Function :—

↳ PTH increases the Ca^{+2} levels in blood.

↳ PTH acts on bones and stimulates the process of bone reabsorption (dissolution / demineralisation) [DEPTH OF BIOLOGY]

↳ PTH also increase reabsorption of Ca^{+2} from renal tubules & from digested food.

↳ PTH & PCT play significant role in Ca^{+2} balance in the body (Antagonistic Hormones). [DEPTH OF BIOLOGY]

↳ Required for proper functioning of muscular activities, nerve impulse conduction, heart beat, blood coagulation, bone formation & fertilization of ova.

Parathyroid hormone disorder :—

① Hyposecretion — [DEPTH OF BIOLOGY]

▲ Hypocalcemia (Decreased amount of Ca^{+2} in ECF)

- Hyperphosphatemia (PO_4^{-3} increased)

② Tetany :- Convulsion and cramping (in voluntary muscle) Asphyxia (leads to death (in involuntary muscle like diaphragm).

② Hypersecretion —

- Hypercalcemia (Increased amount of Ca^{+2} in ECF) and Hypophosphatemia (PO_4^{-3} decreased).
- Osteoporosis due to activation of osteoclast cells in bone.

Thymus Gland

↳ Lobular structure located on dorsal side of the heart & the aorta.

↳ Secretion = Peptide hormone = Thymosin

- Function :-
  ↳ Play major role in development of immune system.

↳ Play major role in differentiation of T lymphocytes. (T- lymphocytes provide cell mediated immunity).

↳ Also promote production of antibodies to provide humoral immunity. [DEPTH OF BIOLOGY]

- Thymus is degenerated in old individuals resulting in a decreased production of thymosin by which immune responses of old person become weak [DEPTH OF BIOLOGY]

- Hypersecretion of thymosin may be associated with myasthenia gravis.

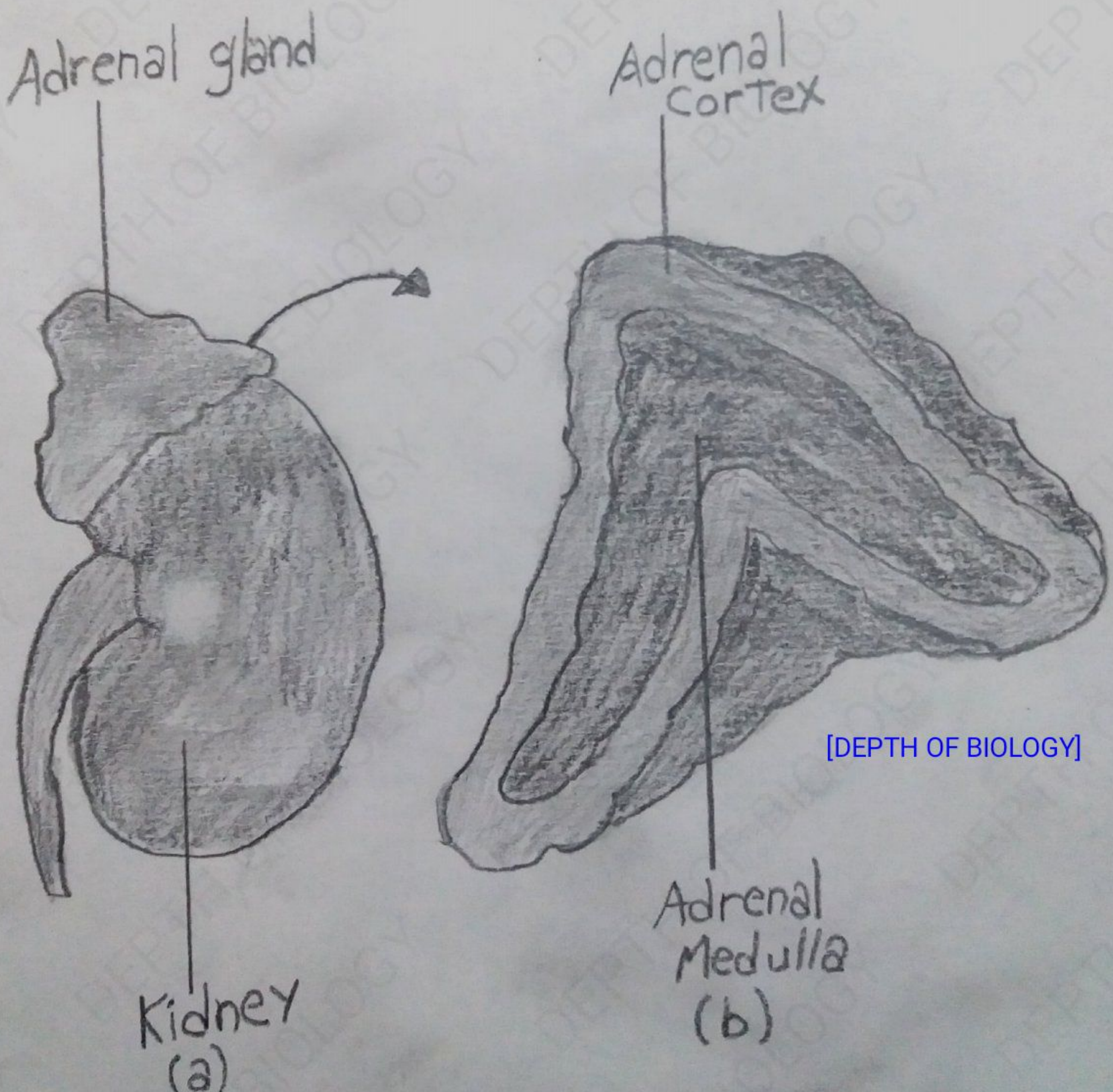
Adrenal gland

Consists of two regions

[DEPTH OF BIOLOGY] [DEPTH OF BIOLOGY]

Cortex (outer) Medulla (inner)

Adrenal Gland



① Cortex :—

↳ Mesodermal in origin.

↳ Subdivided in 3 zones —

▸ Zona glomerulosa ⟶ Secretes mineralo-corticoids

↳ Aldosterone

(1) Acts on renal tubules & helps in reabsorption of Na^+ & Cl^- ions and controls the excretion of K^+ ions.

(2) Also known as salt retaining hormone.

(3) Maintain osmotic pressure & blood pressure.

▶ Zona fasciculata ⟶ Secretes glucocorticoids

↓

Cortisol

(1) Increase glaconeogenesis, lipolysis and Proteolysis. [DEPTH OF BIOLOGY]

(2) Anti inflammatory hormone and Supress immune System.

(3) Stimulate RBC production.

(4) Maintain Cardiovascular System & Kidney functions.

▶ Zona reticulata ⟶ Secretes Sexcorticoids

[DEPTH OF BIOLOGY]

↓

Androgens & oestrogens

(1) Promote growth of axial hair, Pubic hair and facial hair during Puberty. [DEPTH OF BIOLOGY]

(2) Promote Secondary Sexual Characters.

② Medulla :—

↳ Ectodermal in origin.

↳ Consist of chromaffin cells.

↳ Secretes two hormones commonly called as Catecholemines or emergency hormones or hormones of flight and fight.

Adrenaline

Noradrenaline

↑ Pupilary dilation.

↑ Heart beat.

↑ B.P [DEPTH OF BIOLOGY]

↑ Alertness

↑ Piloerection

↑ Stimulates breakdown of glycogen in glucose.

↑ Stimulates breakdown of lipids & Proteins. [DEPTH OF BIOLOGY]

↓ Salivation
↓ Peristalsis of alimentary canal etc.

▶ Adrenal gland is called 'triple F gland' (FFF). It is also called 4S (Stress, Sugar metabolism, Salt retention & Sex corticoids). [DEPTH OF BIOLOGY]

Adrenal hormone disorder :—

① Hyposecretion —

(1) Addison's disease (Hypoadrenalism)
- Dehydration in the body, blood Pressure, BMR and body temperature are reduced, excretion of water and Na increase. [DEPTH OF BIOLOGY]

② Hypersecretion —

(1) Cushing's Syndrome
- Excess deposition of fat under skin. Moon face, fish mouth, buffalo hump.

Protein catabolism ↑

Hyperglycemia [DEPTH OF BIOLOGY]

(2) Sex Steroids
- Adrenal Virilism

Pancreas

- Composite gland which acts as both exocrine (pancreatic acini) and endocrine (islets of Langerhans).
- The two main types of cells α & β cells found in islets of Langerhans secrete glucagon & insulin hormone respectively.

Glucagon :-
- It is a peptide hormone.
- Glucagon acts mainly on hepatocytes and stimulates glycogenolysis resulting in an increased blood glucose (Hyperglycemia) level.
- Glucagon stimulates the process of gluconeogenesis

Insulin :- [DEPTH OF BIOLOGY]

- It is also a peptide hormone.
- Insulin acts mainly on hepatocytes and adipocytes and enhances cellular glucose uptake and utilisation.

Decrease blood glucose level = Hypoglycemia

- Insulin stimulates glycogenesis.

[DEPTH OF BIOLOGY]

NOTE :- Prolonged hyperglycemia leads to a complex disorder called Diabetes mellitus (Loss of glucose through urine and formation of ketone bodies).

Treatment = Insulin therapy

Gonads [DEPTH OF BIOLOGY]

① Male ⟶ Testis ⟶ Leydig cell / Interstitial cell

↓

Testosterone / Androgen

↓

(1) Stimulate Spermatogeneris. [DEPTH OF BIOLOGY]
(2) Development, maturation & functions of accessory of male sex organs.
(3) Stimulate muscles growth, growth of facial and axillary hair, aggressiveness, low pitch voice.
(4) Influence the male sexual behaviour (libido) [DEPTH OF BIOLOGY]
(5) Anabolic effect on protein and Carbohydrate metabolism.

(2) Female

↓

Ovary [DEPTH OF BIOLOGY]

↓

Corpus luteum ⟶ Oestrogen

↓

Progesteron

↓

(1) Supports pregnancy.
(2) Acts on the mammary glands and stimulates the formation of alveoli.

Oestrogen

↓

(1) Development of mammary gland.

(2) Development of growing ovarian follicles.

(3) Regulates female sexual behaviour.

(4) Stimulates the development of secondary sex organs.

(5) Develop the high pitch of voice (feminine voice).