Brain Builders Coaching Center

Class-X CBSE

Chemical Coordination in Animals

- In animals, body functions are regulated and coordinated by two main systems:
  (i) Nervous system – works via **electrical impulses**, fast, short-term control.
  (ii) Endocrine system – works via **chemical messengers** (hormones), slower but long-lasting effects.
- **Hormones** are chemical messengers secreted in small quantities by **endocrine glands** directly into the blood (ductless glands).
- Endocrine system + Nervous system = **Neuroendocrine system**.

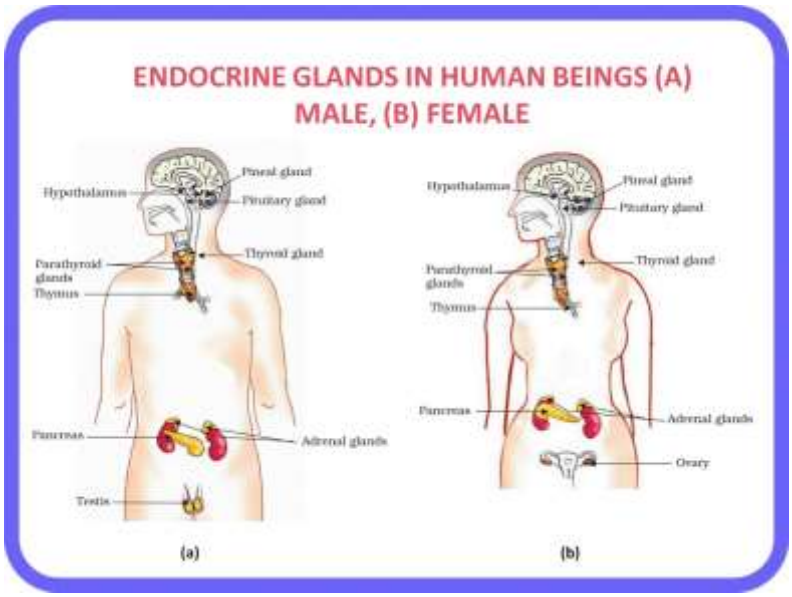
2. Characteristics of Hormones

- Secreted by **endocrine glands** (ductless).
- Transported via **blood** to target organs/tissues.
- Act in **very small amounts**.
- Each hormone has **specific effects** on specific organs (**target organs**).
- Do not act on the site of production (usually act far away).
- Regulate growth, metabolism, reproduction, and homeostasis.

3. Human Endocrine Glands

Main glands:

1. **Pituitary gland**
2. **Hypothalamus**
3. **Pineal gland**
4. **Thyroid gland**
5. **Parathyroid glands**

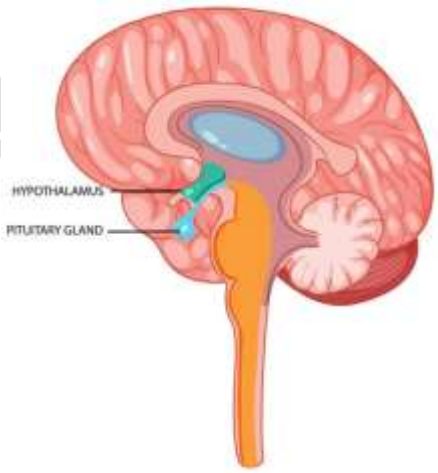


6. **Adrenal glands**
7. **Pancreas (Islets of Langerhans)**
8. **Gonads** (Testes in males, Ovaries in females)

4. Major Endocrine Glands – Location, Hormones, Functions, Disorders

A. Hypothalamus

- Location: Base of the brain, below the thalamus.
- Controls **pituitary gland** through **releasing** and **inhibiting hormones**.
- Maintains **link between nervous and endocrine system**.
- Important hormones:
    - **Releasing hormones** – e.g., TRH (thyrotropin-releasing hormone), GnRH (gonadotropin-releasing hormone).
    - **Inhibiting hormones** – e.g., GHIH (growth hormone-inhibiting hormone).
- Function: Regulates hunger, thirst, temperature, emotions, circadian rhythms.



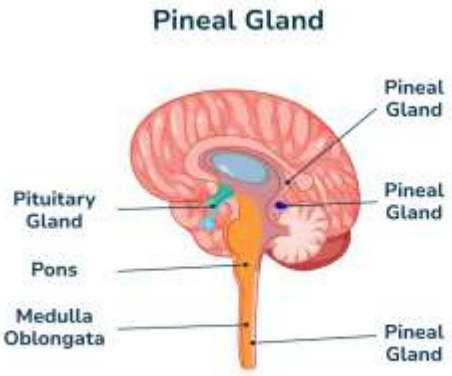
B. Pituitary Gland – *"Master gland"*

- Location: Base of brain, in a bony cavity called **sella turcica**.
- Divisions:

1. **Anterior pituitary** – produces:
    - Growth hormone (GH) – stimulates growth of bones, muscles; excess → gigantism, deficiency → dwarfism.
    - Thyroid stimulating hormone (TSH) – stimulates thyroid gland.
    - Adrenocorticotropic hormone (ACTH) – stimulates adrenal cortex.
    - Follicle stimulating hormone (FSH) – stimulates production of gametes.
    - Luteinizing hormone (LH) – stimulates ovulation/testosterone secretion.
    - Prolactin – stimulates milk production.
2. **Posterior pituitary** – stores & releases:
    - Antidiuretic hormone (ADH/vasopressin) – increases water reabsorption in kidneys; deficiency → diabetes insipidus.
    - Oxytocin – stimulates uterine contraction during childbirth, milk ejection.

C. Pineal Gland

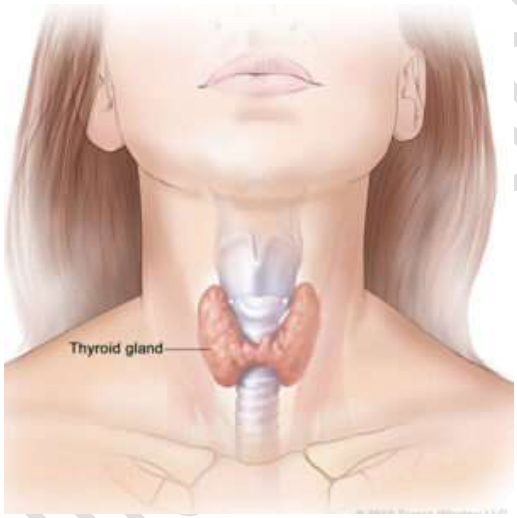
- Location: Between two hemispheres of brain.
- Hormone: **Melatonin** – regulates sleep-wake cycle (biological clock), seasonal reproduction in some animals.



D. Thyroid Gland

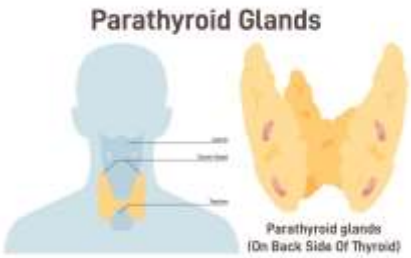
- Location: In neck, in front of trachea.
- Hormones:

  - **Thyroxine (T4)** & **Triiodothyronine (T3)** – regulate metabolism, growth, development.
  - **Calcitonin** – lowers blood calcium level.
- Requires **iodine** for synthesis.
- Disorders:
  - Hypothyroidism (low thyroxine) – causes goitre, cretinism in children, myxedema in adults.
  - Hyperthyroidism (excess thyroxine) – causes exophthalmic goitre.



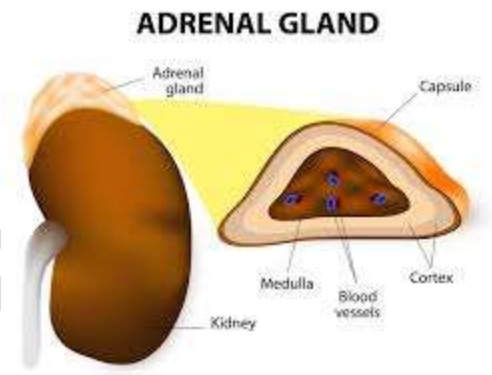
E. Parathyroid Glands

- Four small glands embedded in thyroid.
- Hormone: **Parathyroid hormone (PTH)** – increases blood calcium level by stimulating bone breakdown, increasing calcium absorption in intestines and kidneys.
- Works antagonistically to calcitonin.



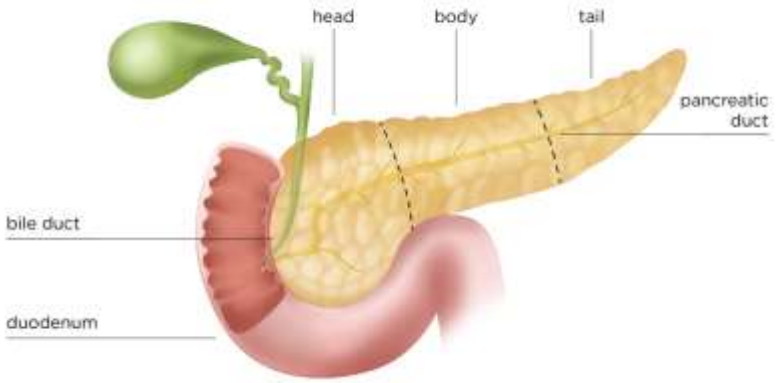
F. Adrenal Glands

- Location: On top of each kidney.
- Structure:
    - **Adrenal cortex** – secretes:
        - Glucocorticoids (e.g., cortisol) – regulate carbohydrate, protein, fat metabolism; anti-inflammatory.
        - Mineralocorticoids (e.g., aldosterone) – regulate sodium & potassium balance, water retention.
        - Small amounts of sex hormones.
    - **Adrenal medulla** – secretes:
        - Adrenaline (epinephrine) & noradrenaline – prepare body for emergency (fight-or-flight response): increases heart rate, blood pressure, blood glucose.



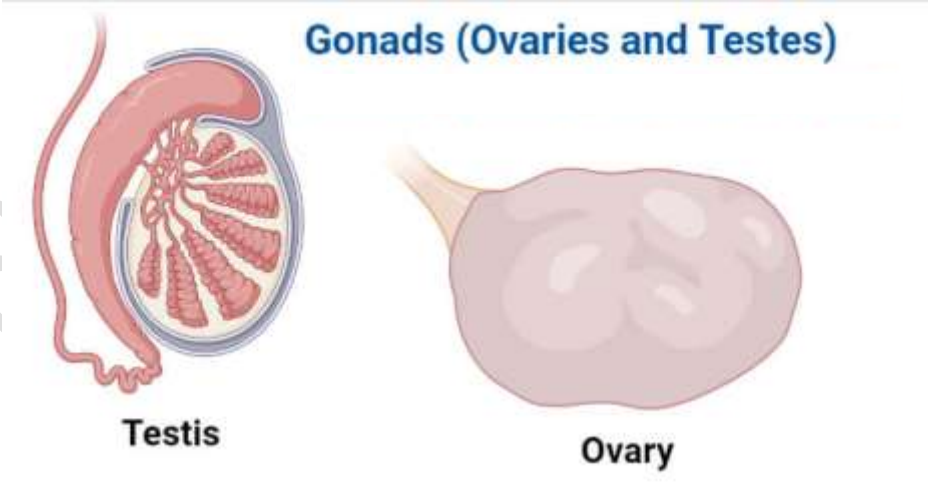
G. Pancreas (Islets of Langerhans)

- Mixed gland: exocrine (digestive enzymes) + endocrine (hormones).
- Endocrine part secretes:
    - **Insulin** – lowers blood glucose by promoting glucose uptake & glycogen storage; deficiency → diabetes mellitus.
    - **Glucagon** – raises blood glucose by stimulating glycogen breakdown.



H. Gonads

1. **Testes**:
    - Hormone: Testosterone – controls development of male secondary sexual characters, spermatogenesis.
2. **Ovaries**:
    - Hormones:
        - Estrogen – development of female secondary sexual characters, menstrual cycle regulation.
        - Progesterone – prepares uterus for implantation, maintains pregnancy.



5. Feedback Mechanism in Hormonal Control

- **Negative feedback**: Hormone secretion regulated by the level of the substance it controls.
    - Example: If thyroxine level ↑, it inhibits TSH secretion from pituitary; if thyroxine level ↓, TSH secretion ↑.
- **Positive feedback**: Hormone secretion stimulates more of its own production.
    - Example: Oxytocin during childbirth – contractions cause more oxytocin release.

6. Differences between Nervous and Endocrine Control

Feature	Nervous System	Endocrine System
Mode of transmission	Electrical impulses	Hormones via blood
Speed	Very fast	Relatively slow
Duration of action	Short-lived	Long-lasting
Target	Specific muscles/glands	Various organs/tissues

7. Common Hormonal Disorders

Hormone/Gland	Excess secretion	Deficiency
GH (Pituitary)	Gigantism, Acromegaly	Dwarfism
Thyroxine (Thyroid)	Hyperthyroidism (exophthalmic)	Hypothyroidism, goitre
Insulin (Pancreas)	Hypoglycemia	Diabetes mellitus
ADH (Posterior pit.)	↑ Water retention	Diabetes insipidus
PTH (Parathyroid)	Osteoporosis	Tetany