

Endocrine Glands

“The Producers of Chemical Messengers”

Multicellular organisms communicate with and control their various activities by means of two major systems—the nervous system and the endocrine system.

Hormonal Control	Nervous Control
• Affects bodily activities by releasing chemical messengers called hormones into the blood stream.	• Controls and maintains the internal environment of the body by sending impulses to neurons.
• Action is slow.	• Action is immediate.
• Effects can be short-term or long lasting.	• Effects are brief.
• Can affect growth.	• Does not affect growth.
• Brings about specific chemical changes, thus regulating metabolism.	• Does not influence chemical changes and hence cannot regulate metabolism.

Hormones

A hormone is a secretion from some glandular part of the body, which is poured into the blood and which acts on the target organs or cells of the same individual.

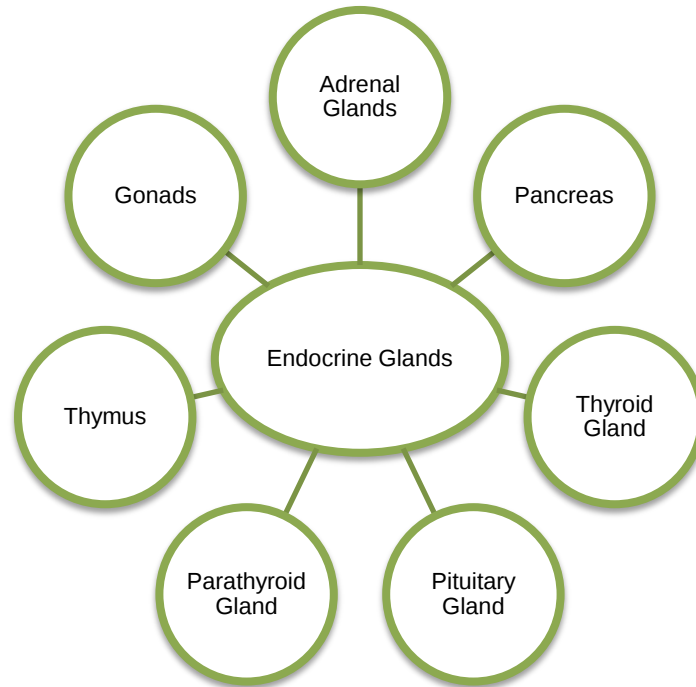
Most hormones are secreted by special glands called endocrine glands.

General Properties of Hormones

1. Hormones are secreted by the endocrine glands directly into the blood.
2. Produced in very small quantities.
3. Biologically very active.
4. Act on target organs or cells usually away from the source.

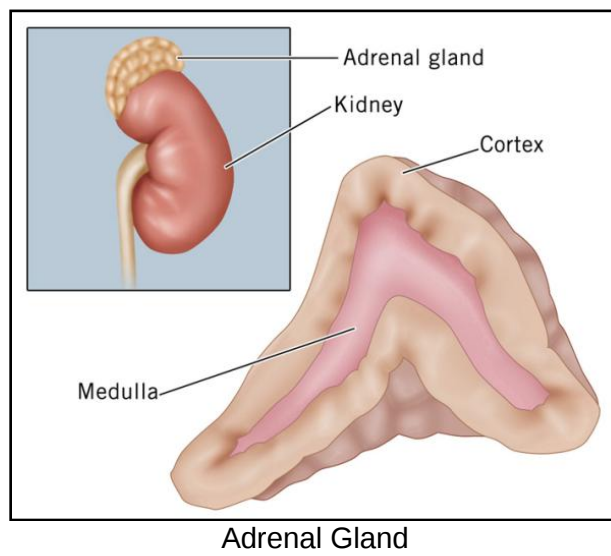
Endocrine System

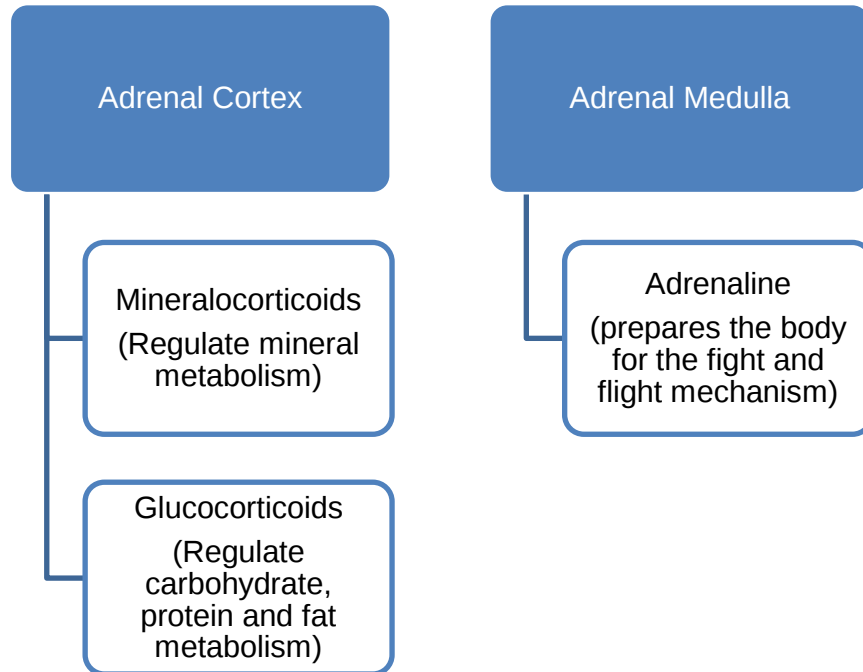
The endocrine system is made of endocrine glands and tissues.



Adrenal Glands

The human body has two adrenal glands located on top of the kidneys; hence, they are also known as suprarenal glands.





Response to Adrenaline			
Body Part	Effects of Adrenaline	Biological Advantage	Effect or Sensation
Heart	Beats faster and blood pressure increases	Sends more glucose and oxygen to the muscles	Thumping heart
Muscles of body	Tenses muscles	Ready for immediate action	Tense feeling, shivering
Liver	Conversion of glycogen to glucose	Glucose available in blood for energy production	No sensation

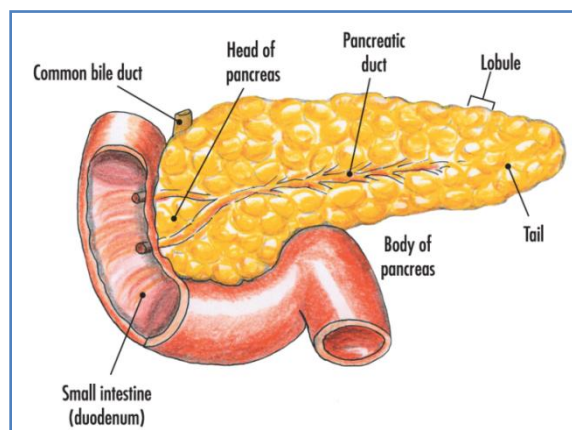
Adrenaline also causes dilation of the pupil of the eyes, stimulates uterine contraction during child delivery and increases the clotting capacity of blood.

Abnormal Secretions of Adrenal Glands

Hyposecretion of the adrenal cortex causes Addison's Disease.

Hypersecretion of the adrenal cortex causes Cushing Syndrome.

Pancreas



Pancreas

The pancreas is exocrine as well as an endocrine gland.

The exocrine part pours its secretion—pancreatic juice—into the duodenum through the pancreatic duct. The endocrine part is made up of a special group of cells known as **islets of Langerhans**.

Three kinds of cells found in the islets of Langerhans and their secretions are

Alpha Cells	Beta Cells	Delta Cells
• Secrete glucagon • Glucagon stimulates the breakdown of glycogen into glucose in the liver	• Secrete insulin • Insulin maintains the rise of the blood sugar level	• Secrete somatostatin • Somatostatin controls the secretion of glucagon and insulin

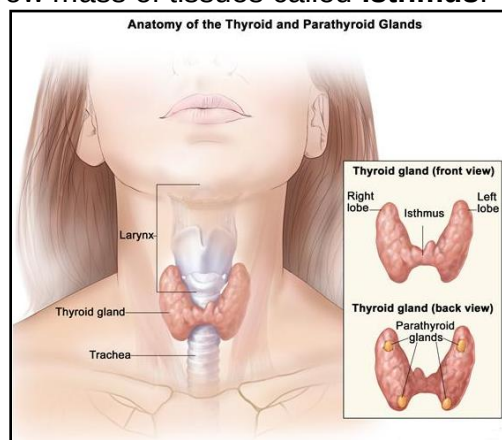
Abnormal Secretions of Insulin

Insufficient Secretion of Insulin	• Causes diabetes mellitus • <u>Symptoms:</u> • High concentration of sugar in blood (hyperglycemia). • Excretes a large amount of urine containing more concentration of sugar. • <u>Treatment:</u> It cannot be cured, but sugar levels can be maintained by the administration of insulin.
Oversecretion of Insulin	• The sugar level in the blood is lowered, i.e. hypoglycemia. • If the level becomes too low, then the brain may enter a state of coma for a few minutes. A patient may become unconscious due to an overdose of insulin. This is called insulin shock.

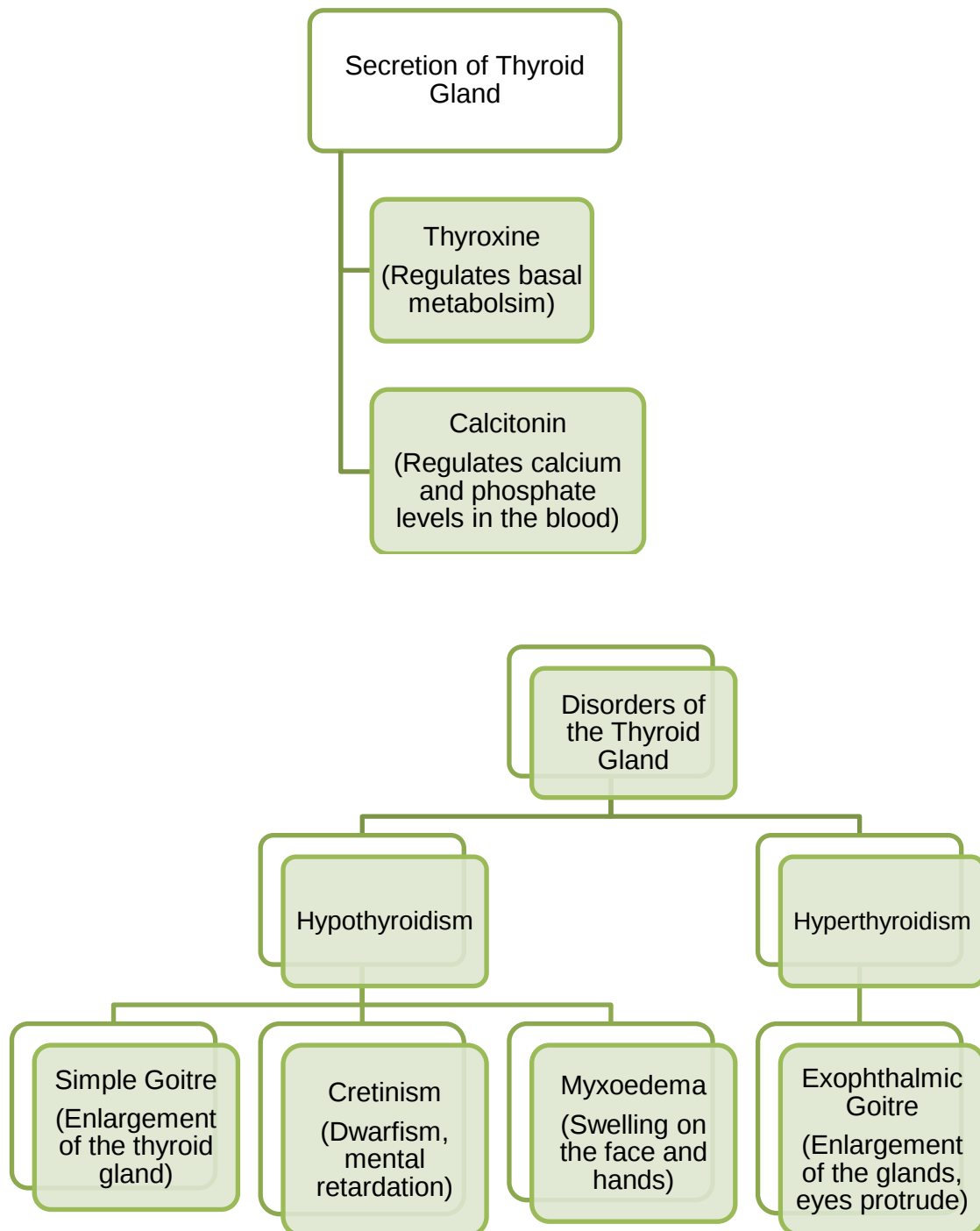
Thyroid Gland

The thyroid gland is a bilobed, butterfly-shaped gland.

The two lobes are joined by a narrow mass of tissues called **isthmus**.



Thyroid Gland - Front View and Back View

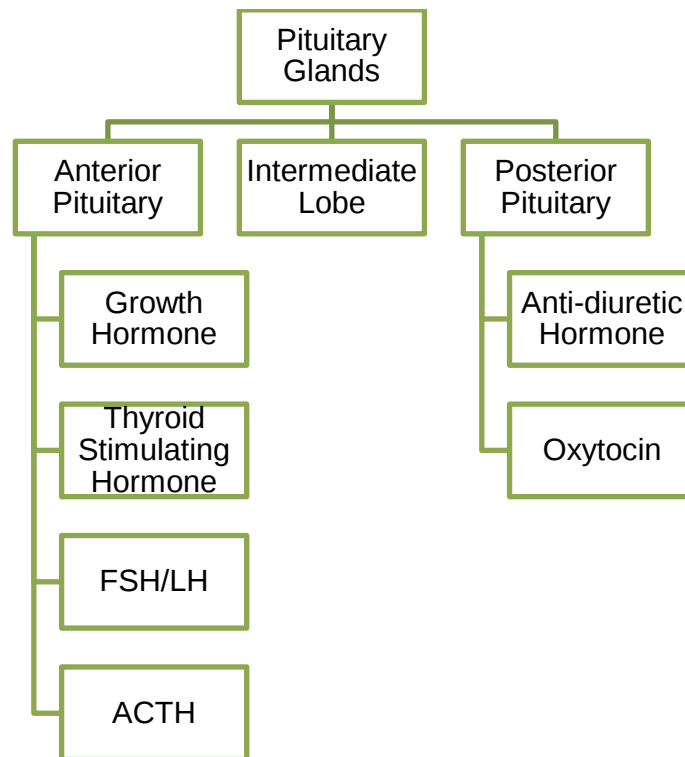


Pituitary Gland

It is a small gland about the size of a pea.

The pituitary controls the secretions of all the other endocrine glands; therefore, it is also called the **master gland**.

The pituitary gland is divided into three lobes. The secretions from these lobes are as follows:



Anterior Pituitary

- Growth Hormone:
 - Essential for normal growth.
 - Deficiency of growth hormone causes dwarfism.
 - Oversecretion causes gigantism and acromegaly.
- Thyroid Stimulating Hormone (TSH):
 - Controls the activities of the thyroid gland.
- Gonadotropins (FSH/LH):
 - Regulate the activities of testes and ovaries.
- Adrenocorticotrophic Hormone (ACTH):
 - Regulates the activity of the adrenal cortex.

Intermediate Lobe of the Pituitary Gland: Regulates the activity of the adrenal cortex.

Posterior Pituitary

- Anti-diuretic Hormone (Vasopressin):
 - Regulates the amount of water excreted in the urine.
 - Deficiency of ADH causes diabetes insipidus.
- Oxytocin:
 - Stimulates contraction of uterine muscles during childbirth.

Feedback Mechanism

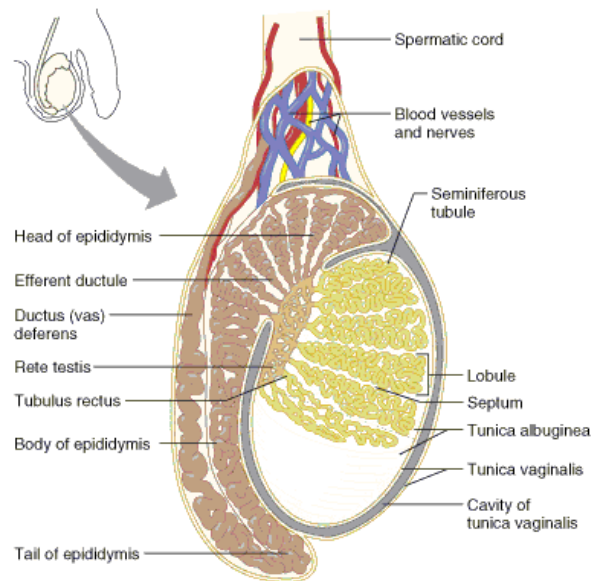
Negative Feedback Mechanism

- The body has mechanisms to maintain a normal state.
- Whenever there is a change in the normal state, the messages are sent to 'increase' secretions if there is a fall below normal or to 'decrease' secretions if there is a rise above normal to restore the normal body state. Such a mechanism is called a **Negative Feedback Mechanism**.



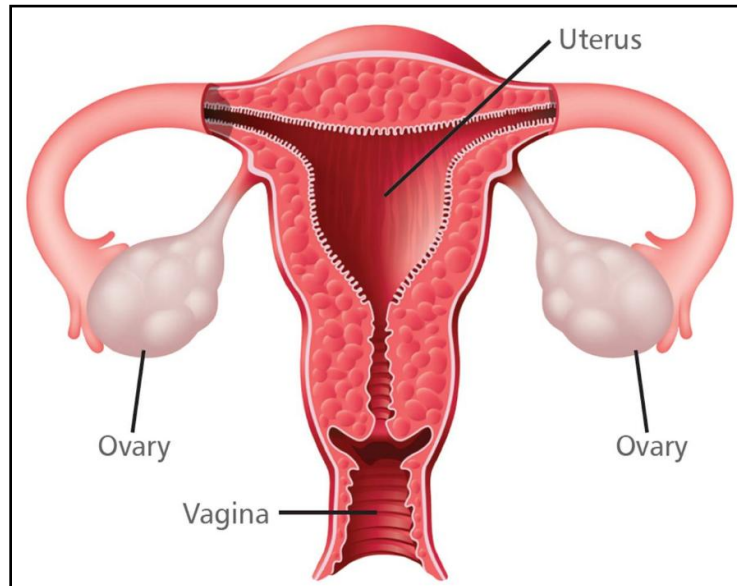
Gonads

1. Testes



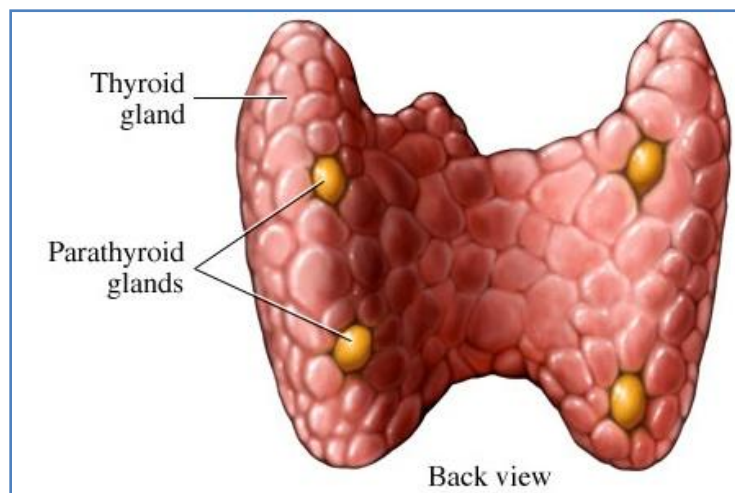
- Found in males.
- Lie in scrotum.
- Interstitial cells of testes secrete testosterone.
- Testosterone is responsible for the maturation of sperms.
- Stimulates the growth and development of the male reproductive system.

2. Ovaries



- They are the female gonads.
- Found in females.
- They secrete oestrogen, progesterone and relaxin.
- Oestrogen is responsible for the development of ovarian follicles.
- Progesterone is responsible for the development of corpus luteum and placenta.
- Relaxin dilates the cervix towards the end of pregnancy.

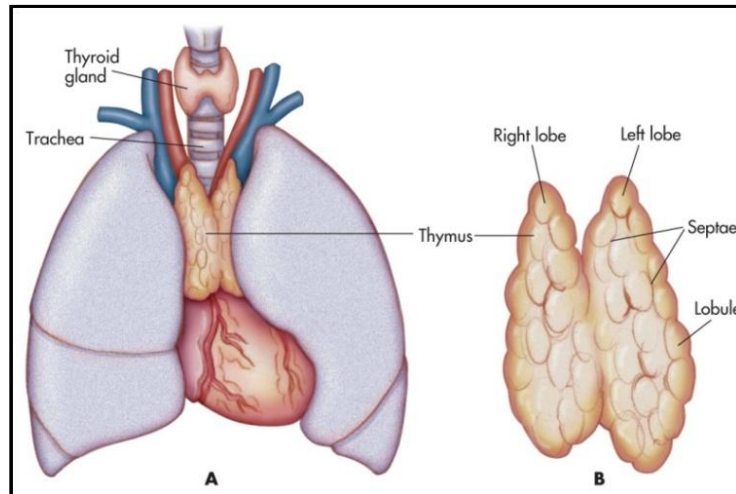
Parathyroid Glands



Parathyroid Glands

- Two pairs of parathyroid glands are located on the posterior surface of the thyroid gland.
- These glands secrete parathormone (PTH).
- PTH controls calcium metabolism and maintains blood calcium at a constant level.
- Its hyposecretion causes tetany, while its hypersecretion results in demineralisation of bones.

Thymus Gland



- It is a bilobed gland which is present between the lungs.
- This gland produces different hormones such as thymic protein, thymosin etc.
- **Functions:**
 - Controls the maturation and distribution of lymphocytes.
 - Stimulates antibody production.