

HUMAN ANATOMY AND PHYSIOLOGY-II

UNIT-IV

Endocrine system

Structure and functions of pancreas, pineal gland, thymus



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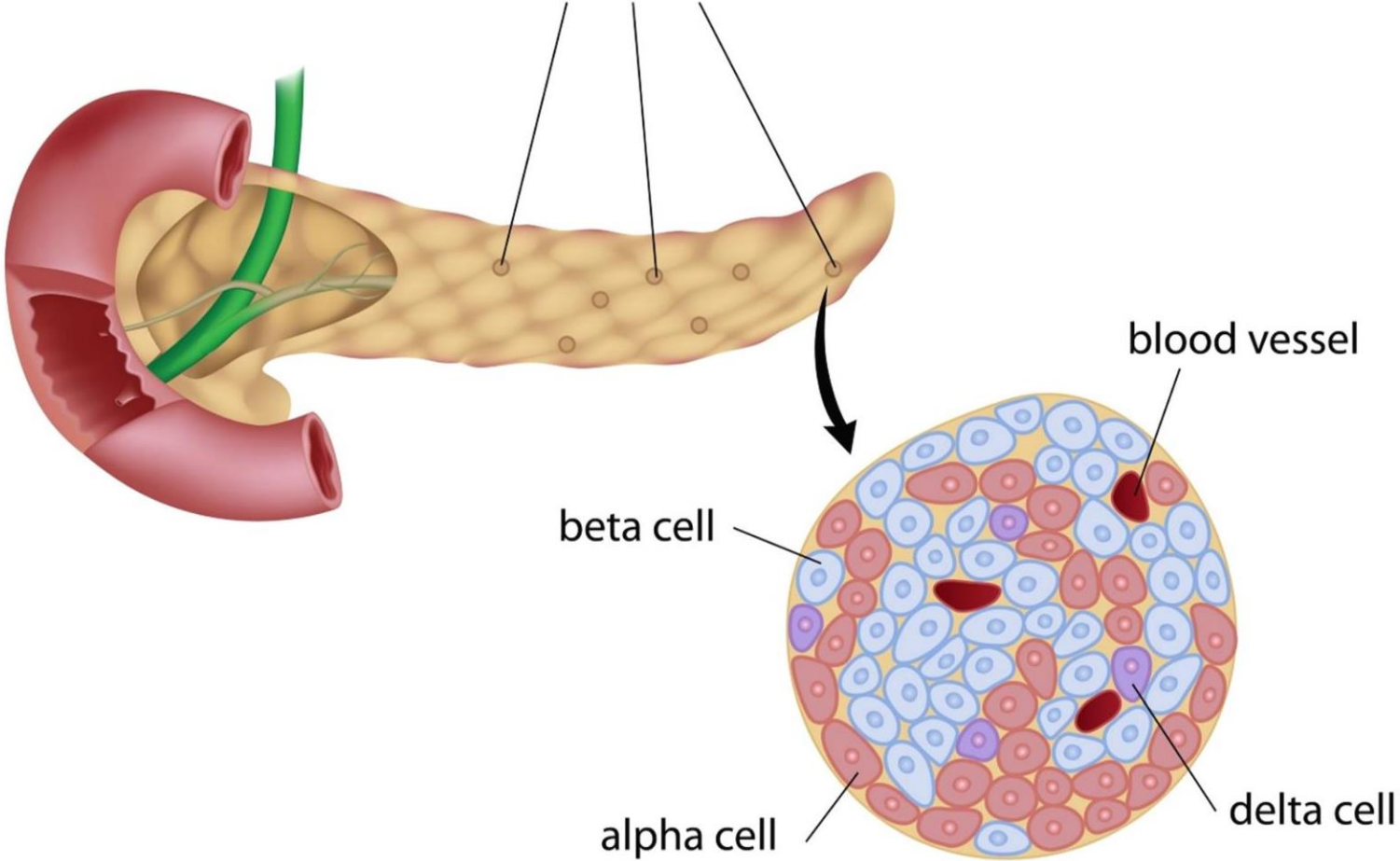
*Shaping Lives...
Empowering Communities...*

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PANCREATIC ISLETS

- **The pancreas is a mixed gland and has both endocrine and exocrine functions**
- The cells which make up the pancreatic islets (islets of Langerhans) are found in clusters irregularly distributed throughout the substance of the pancreas.
- Unlike the exocrine pancreas, which produces pancreatic juice, there are no ducts leading from the clusters of islet cells.
- Pancreatic hormones are secreted directly into the bloodstream and circulate throughout the body.
- There are three main types of cells in the pancreatic islets:
 - α (alpha) cells that secrete glucagon
 - β (beta) cells that secrete insulin
 - δ (delta) cells that secrete somatostatin (GHRH)
- The normal blood glucose level is between 2.5 and 5.3 mmol/litre (45 to 95 mg/100 ml).
- Blood glucose levels are controlled mainly by the opposing actions of insulin and glucagon:
 - Glucagon increases blood glucose levels.
 - Insulin reduces blood glucose levels.

Pancreatic islets



Insulin

- The main function of insulin is to lower blood levels of absorbed nutrients when they rise above normal. When these nutrients, especially glucose, are in excess of immediate needs insulin promotes storage by:
 - ✓ acting on cell membranes and stimulating uptake and use of glucose by muscle and connective tissue cells
 - ✓ increasing conversion of glucose to glycogen (glycogenesis), especially in the liver and skeletal muscles
 - ✓ accelerating uptake of amino acids by cells, and the synthesis of protein
 - ✓ promoting synthesis of fatty acids and storage of fat in adipose tissue (lipogenesis)
 - ✓ decreasing glycogenolysis
 - ✓ preventing the breakdown of protein and fat, and gluconeogenesis (formation of new sugar from, e.g. protein).
- Secretion of insulin is stimulated by increased blood glucose and amino acid levels, and gastrointestinal hormones, e.g. gastrin, secretin and cholecystokinin.
- Secretion is decreased by sympathetic stimulation, glucagon, adrenaline, cortisol and somatostatin (GHRH) secreted by cells of the pancreatic islets.
- Insulin is a polypeptide consisting of about 50 amino acids. Amounts are expressed in international units (IU).

Glucagon

The effects of glucagon increase blood glucose levels by stimulating, e.g.:

- ✓ conversion of glycogen to glucose in the liver and skeletal muscles (glycogenolysis)
- ✓ gluconeogenesis.

Secretion of glucagon is stimulated by a low blood glucose level and exercise and decreased by somatostatin and insulin.

Somatostatin (GHRH)

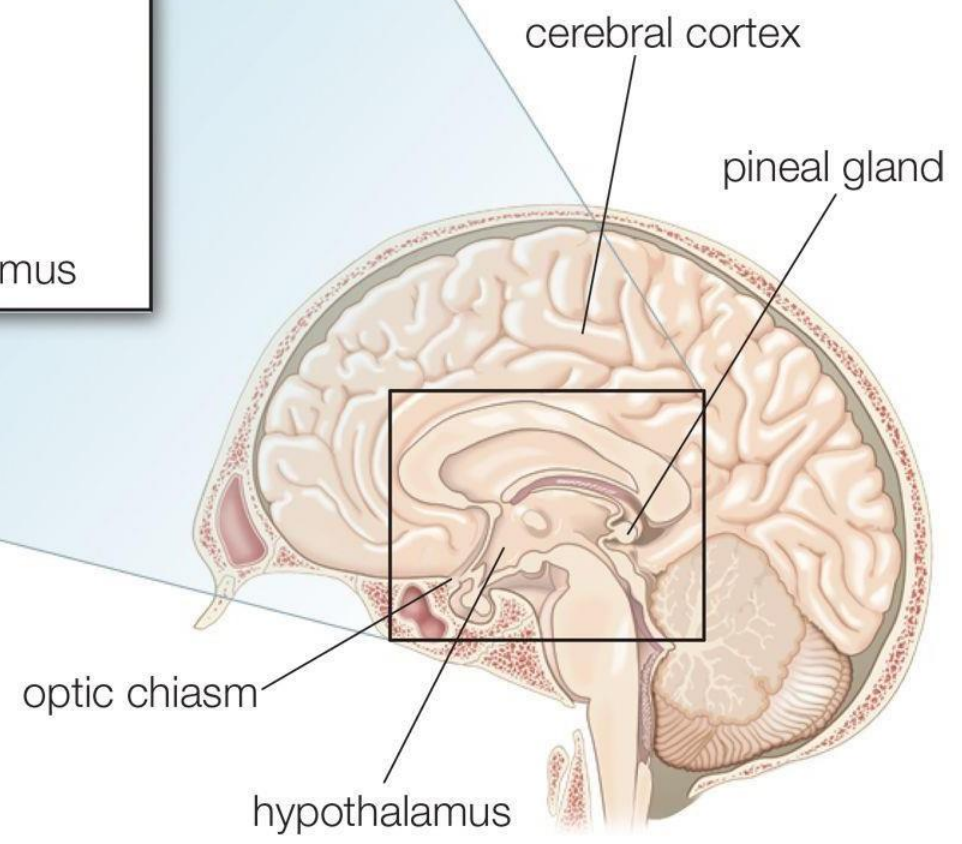
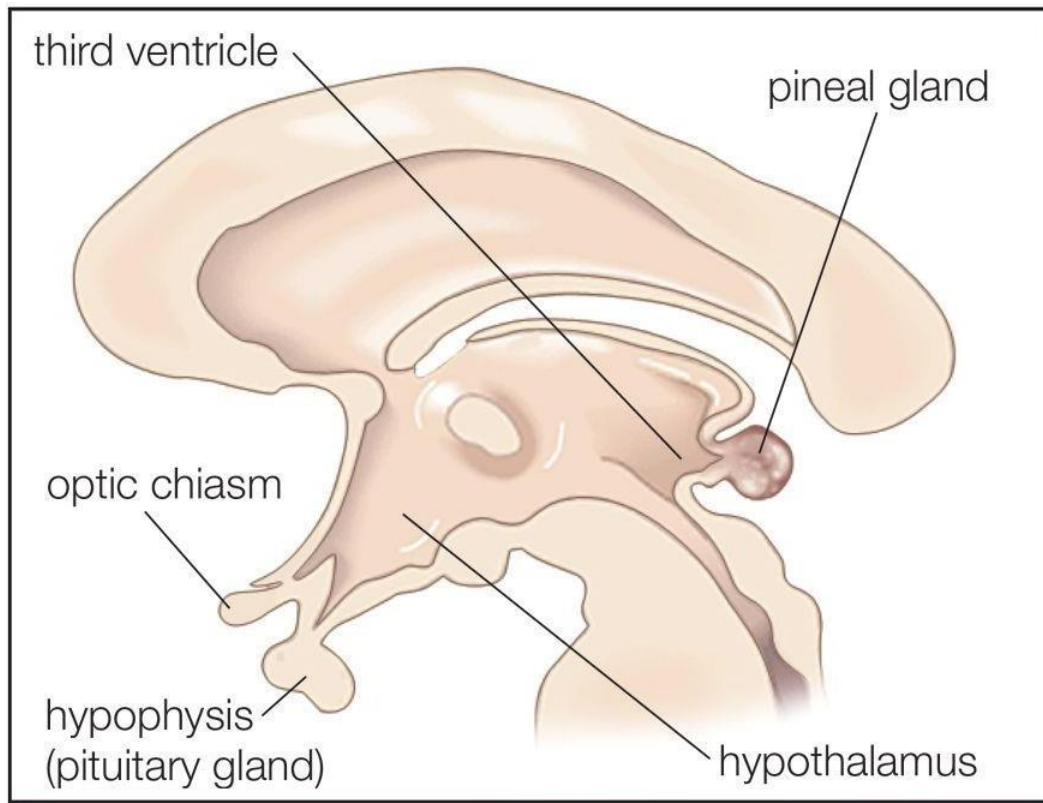
The effect of this hormone, also produced by the hypothalamus, is to inhibit the secretion of both insulin and glucagon.

PINEAL GLAND OR PINEAL BODY

- The pineal gland is a small body attached to the roof of the third ventricle and is connected to it by a short stalk containing nerves, many of which terminate in the hypothalamus.
- The pineal gland is about 10 mm long, is reddish brown in colour and is surrounded by a capsule.

Melatonin

- This is the hormone secreted by the pineal gland.
- Secretion is influenced by the amount of light entering the eye stimulating the optic pathways and levels fluctuate during each 24-hour period, being highest at night and lowest around midday.
- its role in **regulating the circadian system and sleep patterns**, melatonin is involved in cell protection, neuroprotection, and the reproductive system, among other functions.

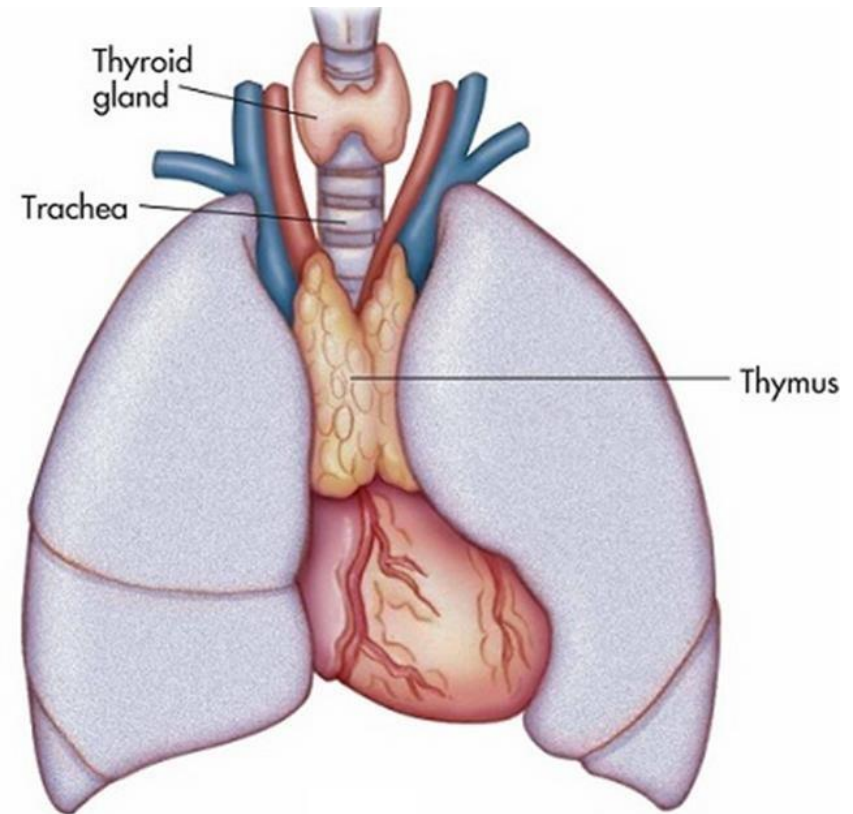


THYMUS GLAND

Thymus is situated in front of trachea, below the thyroid gland. Thymus is small in newborn infants and gradually enlarges till puberty and then decreases in size.

Function

- Thymus has lymphoid function and endocrine function. It plays an important role in development of immunity in the body.
- Thymus has two functions:
 - 1. Processing the T lymphocytes**
 - 2. Endocrine function**



1. Processing the T Lymphocytes

- ✓ Thymus plays an essential role in the development of immunity by processing the T lymphocytes.
- ✓ The lymphocytes which are produced in bone marrow are processed in thymus into T lymphocytes.

2. Endocrine Function of Thymus

Thymus secretes two hormones:

i. **Thymosin** ii. **Thymin**

Thymosin

Thymosin is a peptide. It stimulates the development of T cells. Throughout the childhood years, white blood cells called lymphocytes pass through the thymus, where they are transformed into T cells.

Thymin

Thymin is also called thymopoietin. It suppresses the neuromuscular activity by inhibiting acetylcholine release. Hyperactivity of thymus causes myasthenia gravis.