# Pancreatic islets of Langerhans

In addition to the digestive function, Pancreas also has certain specialised glandular cells, that seem to be developed as specialized outgrowths of the gut-endoderm and differed from the rest of the Pancreas tissue. These cells are endocrine in function and these were discovered by Langerhans (an scientist) and therefore they have been known as islets of Langerhans (1869)
These are tiny clusters of cells scattered throughout the Pancreas and in islets form. (= an endocrine constituent of the Pancreas)

## Histology

(1) Upto 2 millions islets in human Pancreas; form only 1% of Pancreatic mass
(2) Fine, fine connective tissue fibres in the islets.
(3) Cytoplasm of cells contains Golgi complex, mitochondria, endoplasmic reticulum with ribosomes and characteristic secretary granules
(4) Islets are composed of 3 types of cells.
alpha cells (α cells), Beta cells (B-cells) and delta cells (δ-cells)

(1) Alpha cells - form 20% of islets cells
(a) ovoid, deeply intended; lobulated nucleus
(b) Contain alcohol soluble blue staining granules
(c) oxyphilic and secrete a hormon known as glycogen
uniform in size and embedded in a membrane are distributed throughout the cytoplasm
(d) Small Golgi complex; free ribosomes and filamentous mitochondria

(2) B-cells - form 70-75% of the islets cells.
(a) Smaller in size; and more numerous
(b) have a granular protoplasm
(c) Granules are insoluble in alcohol and secrete the hormone insulin
(d) round/ovoid nucleus
(e) Prominent Golgi complex; heavy amount of RER & free ribosomes. typical mitochondria with transverse cristae.

(b) Mostly scattered towards plasma membrane

(5) Delta (Gamma cell . δ cells) form about 5% of a cells.
(a) Cells of unknown function
(b) Considered to be the precursors of both types of cells.
(c) Contain numerous homogenous granules of low density.
(d) believed to secrete gastrin, according to Williams 1968.

. Some cells of islets, devoid of granules and called C-cells are believed to be progenitors of alpha and beta cells.

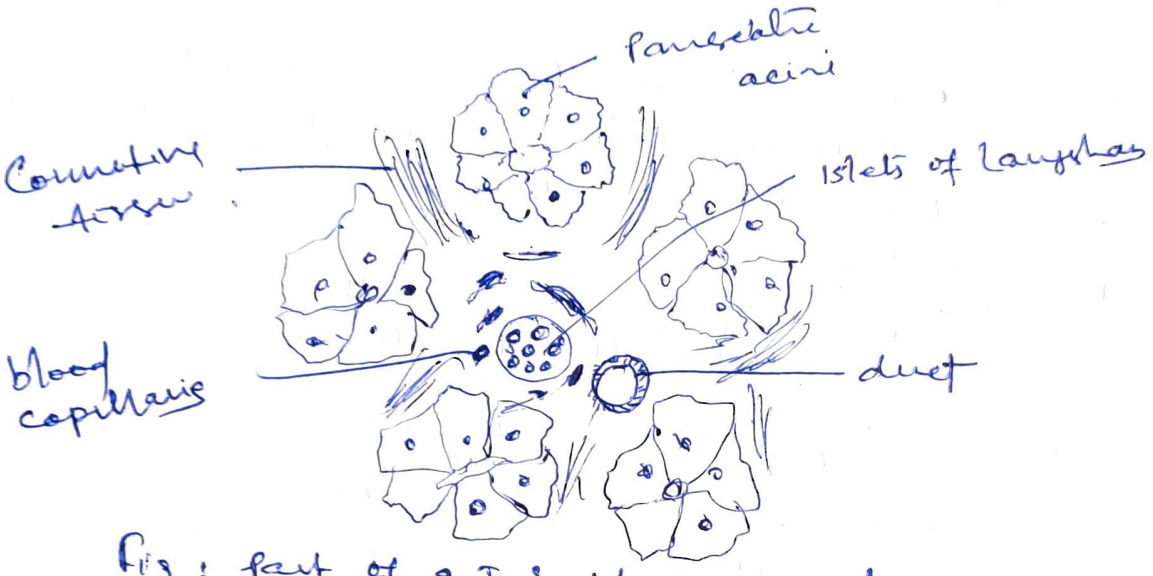


Fig: Part of a T.S of Mammalian pancreas

## Hormons Secreted by islets of Langerhans

Role of Glucagon

(1) Secreted by alpha cells

Role of Glucagon

(1) Glucagon

(2) It is a polypeptide chain of 29 amino acids residues
(3) antagonistic to insulin, secreted by B cells.
(4) It induces glycogenolysis (= hydrolysis of glycogen into glucose molecule which causes a rise in blood sugar level.
(5) Gluconeogenesis also — i.e Synthesis of glucose from materials other than carbohydrate i.e Protein and fat
(6) no action of muscle glycogen or on peripheral utilization of glucose
(7) promotes lipolysis in adipose tissue and liver and enhances ketogenesis.

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## Role of Insulin (first obtained in pure crystalline form by Abel (1926); Synthesized in the B-cells

(1) It increases membrane permeability to certain nutrients
(2) Lowers blood glucose levels by stimulating the deposition of glycogen granules
(3) It induces protein Synthesis
(4) It inhibits adenyl cyclase. It, therefore reduces the level of cyclic AMP that would ordinarily be attained in cells.
(5) It induces the synthesis of enzymes involved in converting glucose to glycogen.
(6) It together with other endocrines, including secretion from the adrenal glands, permits cellular differentiation in tissue cultures.

## Effects of Insulin

Effect of insulin on Carbohydrate Metabolism
i) Increased rate of Carbohydrate metabolism
ii) decreased blood glucose concentration
iii) increased glycogen stores in tissues

The ability of insulin to increase the rate of glucose metabolism in the tissues is very important to the Body. Its complete lack in the body may results in diabetes mellitus, a disease characterised by the following symptoms.

1) Hyperglycemia (= high blood sugar level) and glycosauria (= Sugar in urine) are common.
2) Diuresis (= increased flow of urine) is common.
3) In liver glycogen levels may be below normal but muscle glycogen in general may be about normal or heart-muscle glycogen level is much above normal.
(4) the conversion of carbohydrate into fat is reduced
(5) the formation of glucose from non-Carbohydrate sources (mostly protein) is increased to a great extent.

(2) Effect of insulin on blood glucose concentration
In the deficiency of insulin, very little of the glucose absorbed from the gastro-intestinal tract is transported into the tissues and the result- the blood sugar

or glucose concentration is raised from a normal value of 90 mg per 100 ml to as high as 300 to 1200 mg per 100 ml.

On the other hand in the over production of insulin glucose is transported into the tissues so rapidly that its concentration in the blood falls to a low as 20 to 30 mg per 100 ml.

(3) Effect of protein Metabolism. The total quantity of protein stored in the tissues of the body is increased by insulin and greatly decreased by insulin deficiency, thus insulin promote protein metabolism.

(4) Effect of insulin on growth - Insulin is essential for growth of animal. In the absence of insulin growth hormone (eg. alone) - no effect - in promoting growth of an animal.

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Interaction between insulin and other hormones

Normal blood sugar level is the result of balance between insulin action and action of several other hormones which are chiefly insulin antagonists.

These are: (a) diabetogenic and growth hormone of pituitary,

(b) adrenocortical hormone

(c) Thyroxine

(d) glucagon

(e) adrenalin and sex hormone.

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