

Anatomy (7)

PANCREAS

- Mixed gland.
- Its exocrine activity is much more than the endocrine.
- Exocrine activities → secreting digestive enzymes.
- It locates in the abdomen, anterior to the diaphragm and ~~is~~ behind the stomach.
- Has a head, body and tail.
 - ↳ ^{is} wrapped by the duodenum.

The cells of islets are polygonal or rounded, smaller and more lightly stained than the acinar cells.

- Most cells are acidophilic or basophilic with fine cytoplasmic granules.
- Active polypeptide secreting cells.
- Its secretory granules vary in size morphology and electron density from cell to cell.
- **Embryology** → it has the same embryonic origin as the acinar tissue → in epithelial outgrowths from the endoderm of the developed gut.

ISLETS OF ~~ISLET~~ LANGERHANS

THE PANCREATIC ISLETS

- compact spherical or ovoid masses of endocrine cells embedded within the acinar exocrine tissue of the pancreas.
- The pancreas has more than 1 million islets, most of them are 100-200 μm in diameter and contain several hundred cells but some have only a few cells.
- They only constitute 1%-2% of the organ's total volume.
- Most of them are in the tail.
- A thin capsule surrounds each islet.
 1. ~~is~~ separating it from the acinar tissue.
 2. Important for allowing the islet to be supplied with blood vessels.

HISTOLOGY OF THE ISLETS

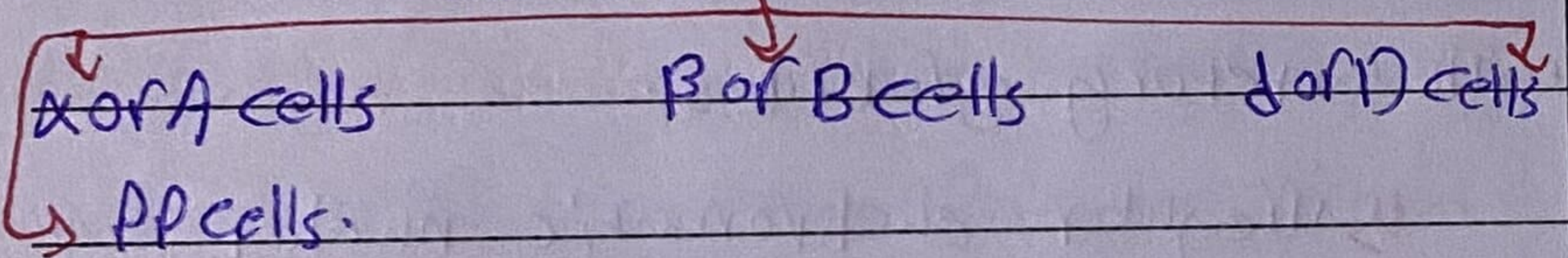
- The exocrine tissue is darker than the endocrine.
- There is a reticular connective tissue for support.
- Several arterioles enter each islet → branch into fenestrated capillaries among the peripheral islet cells → then ^{flow} converge centrally → leave the islet as efferent capillaries carrying blood to the acini.
 - ↳ This local vascular system allows specific islet hormones to help control the secretion of other islet cells and the neighboring cells.
- Stains → H&E and special stain Modified aldehyde Fuchsin stain. ↙

- special stain ↘
- 1. granules in the peripheral α-cells ↘ Deep brownish purple.
- 2. The center β-cells granules ↘ Brownish oranges.
- 3. Reticular connective tissue of the islet capsule and along the capillaries ↘ green.
- Immunohistochemistry with antibodies against the various islet polypeptide hormones allows definitive identification of each islet cell type.

CELLS

- we use immunohistochemistry.

3 types of cells



- 1. A cells 20% ↘ the starvation hormone.
 - ↳ secrete glucagone. ↳ located peripherally
 - ↳ Activates glycogenolysis, gluconeogenesis...

- 2. B cells 70%
 - ↳ produce insulin. ↳ Most numerous.
 - ↳ small. ↳ located centrally.

- Type 1 diabetes or insulin-dependent diabetes mellitus (IDDM) 1g
 - ↳ Autoimmune disease.
 - ↳ loss of β-cells from autoimmune destruction.
 - ↳ treated by regular injections of insulin.
 - ↳ causes may be genetic or viral.
 - ↳ recorded earlier ages. ↳ more in

- Type 2 diabetes or non-insulin-dependent diabetes mellitus (NIDDM) 2g
 - ↳ β-cells are present but fail to produce adequate (90) levels of insulin, and the target cells no longer respond to the hormone.

↳ commonly occurs with obesity, changes in biological clock, and multifactorial genetic components.

- ↳ more recording in adults.
- 3. D cells 5-10%
 - ↳ secrete somatostatin ↘ inhibits secretion of GH, insulin and glucagon.
 - ↳ scattered (1%) and much less abundant.

- 4. PP cells. Rare.
 - ↳ secrete a pancreatic polypeptide.
 - ↳ more common in the head.
 - ↳ stimulates activity of gastric chief cells, inhibits bile secretion, pancreatic enzyme and bicarbonate secretion, and intestinal motility.

- Function of insulin ↘ entry glucose into cells and promotes decrease of blood glucose content.

- Function of glucagon ↘ make energy stored in glycogen and fat available through glycogenolysis and lipolysis to increase blood glucose content.

- Function of Somatostatin ↘ inhibits release of other islet cell hormones, GH and TSH from the anterior pituitary and HCL from gastric parietal cells.

PINEAL GLAND

- Pure gland.
- Located ~~in~~ between the 2 cerebral hemispheres between the 2 thalamic bodies in the opposite pole of the pituitary.
- originates from the neural crest of the ectoderm \rightarrow it is nervous tissue in origin but endocrine in function.

- small, cone-shaped (5-8 mm by 3-5 mm) and weights 0.1 g.

- Known as the epiphysis cerebri.
- Has a rich blood supply.
- innervated by postganglionic sympathetic nerve fibers.

- covered by connective tissue of the pia mater and divided inside by CT septa.

CSF

- \rightarrow fills the subarachnoid space.
- \rightarrow surrounds the brain and the spinal cord.

\rightarrow produced by specialized ependymal cells in the choroid plexus of the ventricles of the brain.

\rightarrow important for reflexing the internal environment of the brain.

\rightarrow A sample can be collected from the spinal cord.

\rightarrow Epidural anesthesia is distributed in the CSF.

- There are 3 ventricles:-

1. The lateral ventricle \rightarrow the biggest one, connects with all cerebral lobes and then it continues.

2. The third ventricle \rightarrow the pineal gland originates from its posterior end forming its roof.

3. the central canal of the spinal cord.

HISTOLOGY

- Pinealocyte:-

\rightarrow prominent and abundant secretory cells.

\rightarrow cytoplasm \rightarrow slightly basophilic (pale) with secretory granules.

\rightarrow irregular euchromatic nuclei.

Active cell, lightly packed \rightarrow genetic material \rightarrow so it is lighter in staining.

\rightarrow secretory vesicles and many mitochondria.

\rightarrow long cytoplasmic processes.

Because it is a modified nervous tissue.

\rightarrow produce melatonin \rightarrow low-molecular weight. - tryptophan derivative.

\rightarrow Unmyelinated sympathetic nerve fibers enter the pineal gland and end among pinealocytes (some from synapses).

MELATONIN

↳ Melatonin release is promoted by darkness and inhibited by daylight: Diurnal Fluctuation in blood melatonin levels.

↳ it may be helpful for jet lag if take a few days before and after travel.

↳ it helps with our circadian rhythm.

↳ The ganglionic cells ^{in the retina} (1-2% of the retina) is only function in sensing the light, they called the intrinsically photosensitive retinal ganglion cells (ipRC) ↳ it contains the photopigment melanopsin.

↳ its axons belonging to the retinohypothalamic tract project directly **monosynaptically**, to the suprachiasmatic nuclei (SCN) via the optic nerve and the optic chiasm.

↳ The SCN receive and interpret ^{and} information on environmental light, dark and day length.

↳ the SCN ^{direct the pineal gland} ~~transmits the signal~~ to secrete the Melatonin.

↳ ↑ Melatonin → Feeling of tiredness and sleeping.

↳ Other functions ↳ inhibiting ACTH which is responsible for awakeness.

↳ People who are staying up late are the most predisposed for diabetes and hypertension.

↳ rhythmic (cyclic) changes in the activity of the hypothalamus, pituitary and other endocrine tissues.

↳ the cycle of light and darkness is transmitted to the pineal via the

1. retinohypothalamic tract, 2. SCN 3. the tracts of sympathetic fibers entering the pineal G.

→ The pineal gland is a neuroendocrine transducer (J&S) (Facilitator) covering sensory input into variations in many hormonal functions.

→ **corpus arenaceum** ↳ Extracellular mineral deposit, a marker for the pineal.

→ Has interstitial glial cells

↳ Modified astrocytes. ↳ smaller.

↳ 5% of the cells.

↳ Elongated nuclei, more heavily stained

↳ Found in perivascular ^{area} ~~area~~ area.

→ The corpus arenaceum of brain sand is formed by mineralization of extracellular protein deposits.

↳ concentrations of calcium and Mg salts.

↳ it may appear and gradually increase in number and size with age with **NO** apparent effect on the gland's function.

ORGANOGENESIS

- 7th and 8th week.
 - Develops from neuroectoderm.
 - Neuroepithelium that lines the roof of the third ventricle in the prenatal brain and its maturation continues postnatally.
- The gland will increase in size \cup from birth to ~~at~~ about 2 years in age.

PINEAL GLAND FUNCTIONS

- Influences the activities of:
 1. the pituitary gland.
 2. the islets of Langerhans.
 3. the parathyroids.
 4. the adrenals.
 5. the gonads.
- its secretions reach their target organs via blood stream of CSF.
- Their actions are mainly inhibitory. Directly or indirectly by \cup inhibiting the secretion of releasing factors by the hypothalamus.