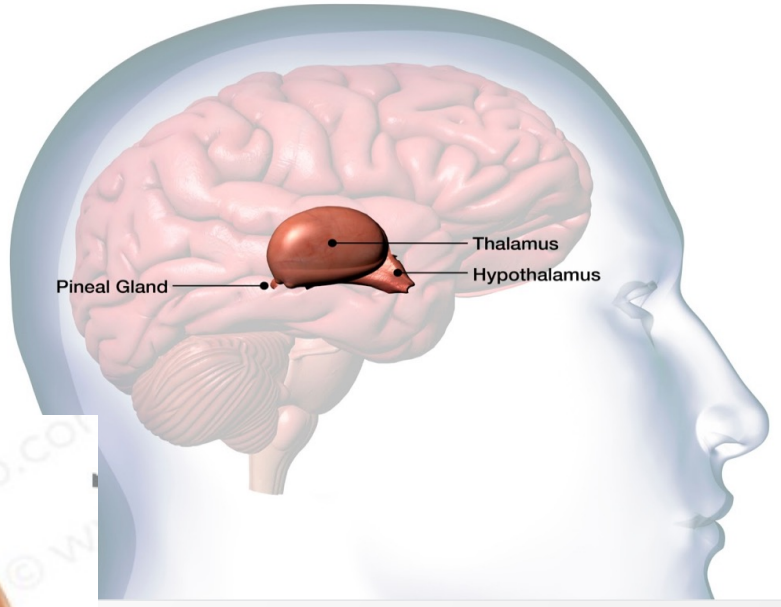
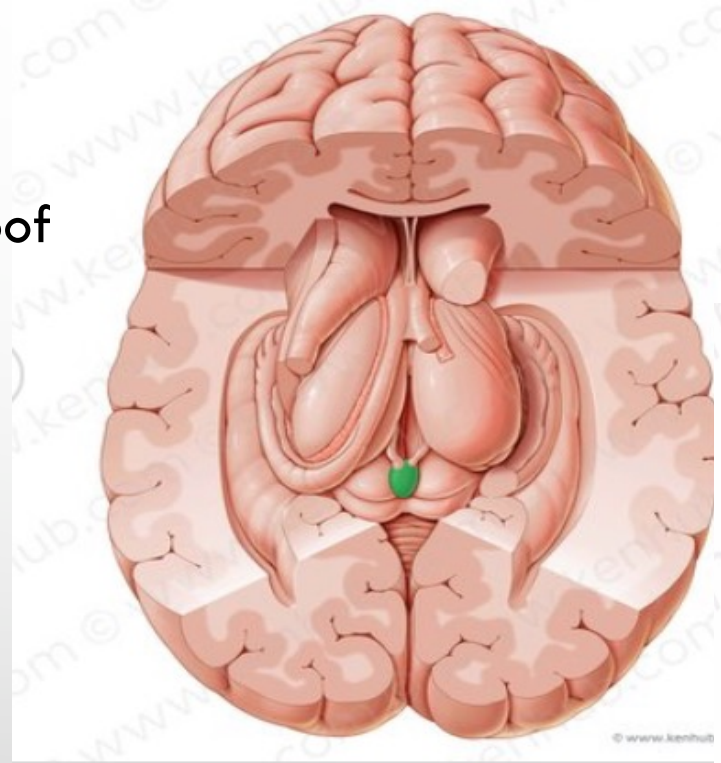
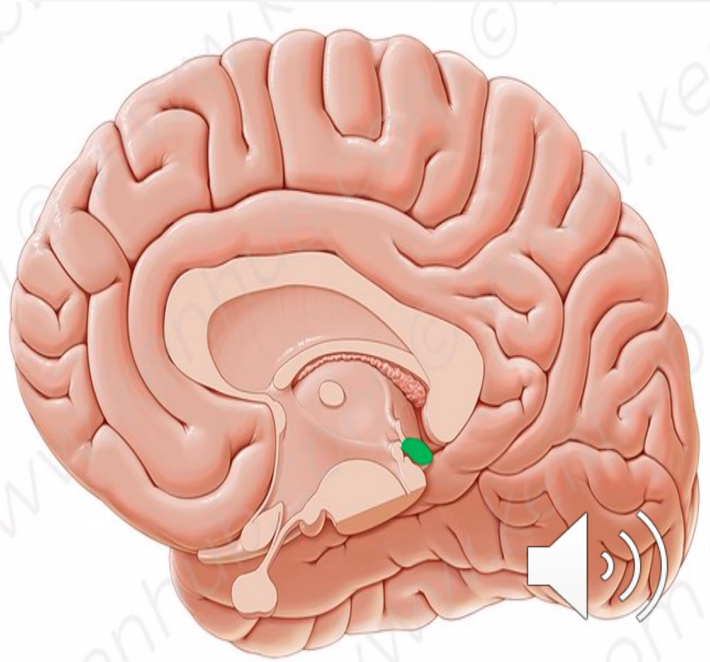
Pineal Gland

Pineal Gland

- A small, pine cone-shaped organ (5-8 mm by 3-5 mm)
- Also known as the epiphysis cerebri
- Posteriorly from the posterior end of the roof of the third ventricle of the brain.
- Resides between the thalamic bodies.
- Has a rich blood supply
- Innervated by postganglionic sympathetic nerve fibers (SCG).
- Covered by connective tissue of the pia mater (septa).





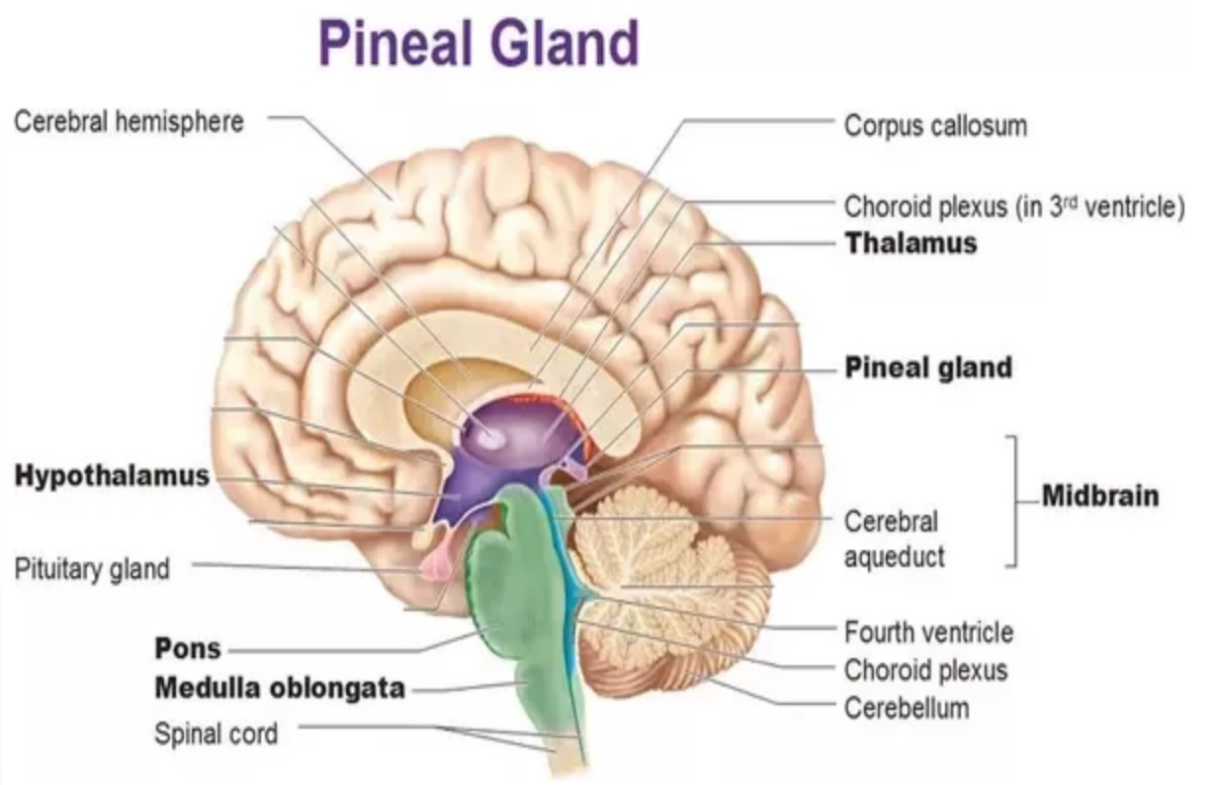


LOCATION/BLOOD SUPPLY

Location

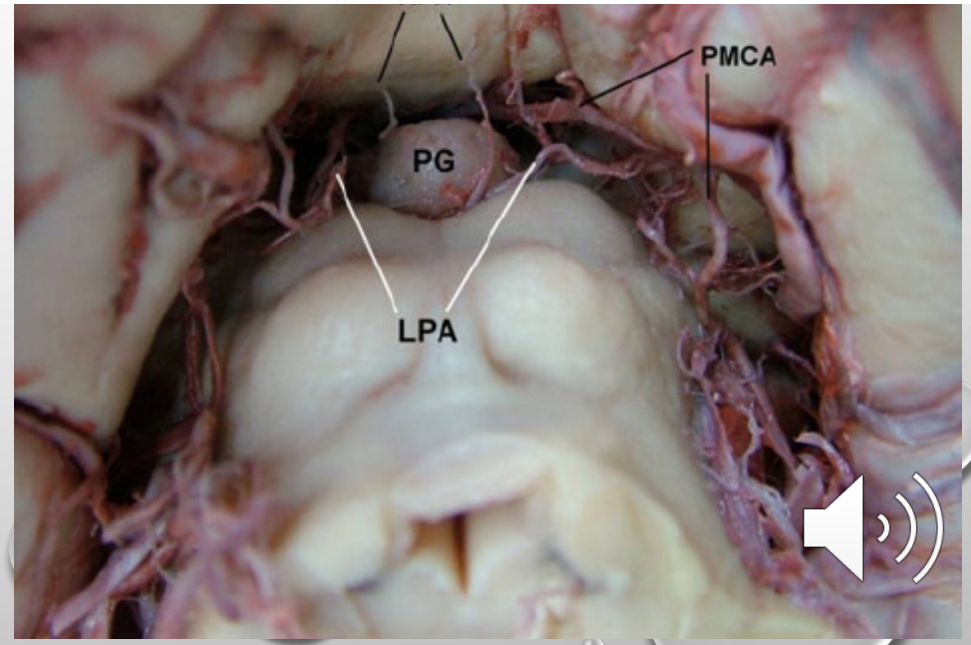
Is a midline structure, located between the two cerebral hemispheres.

It is attached by a stalk to the posterior wall of third ventricle.



Blood supply

- Lateral and medial pineal artery branches of the posterior choroidal artiers (posterior cerebral artery (terminal branch of basiliar artery)

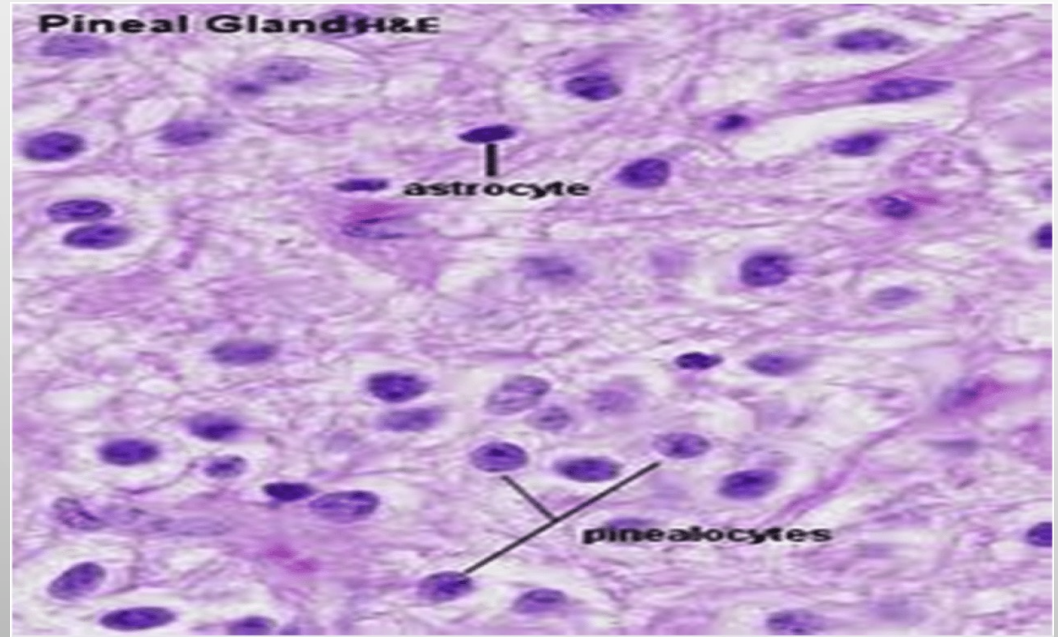


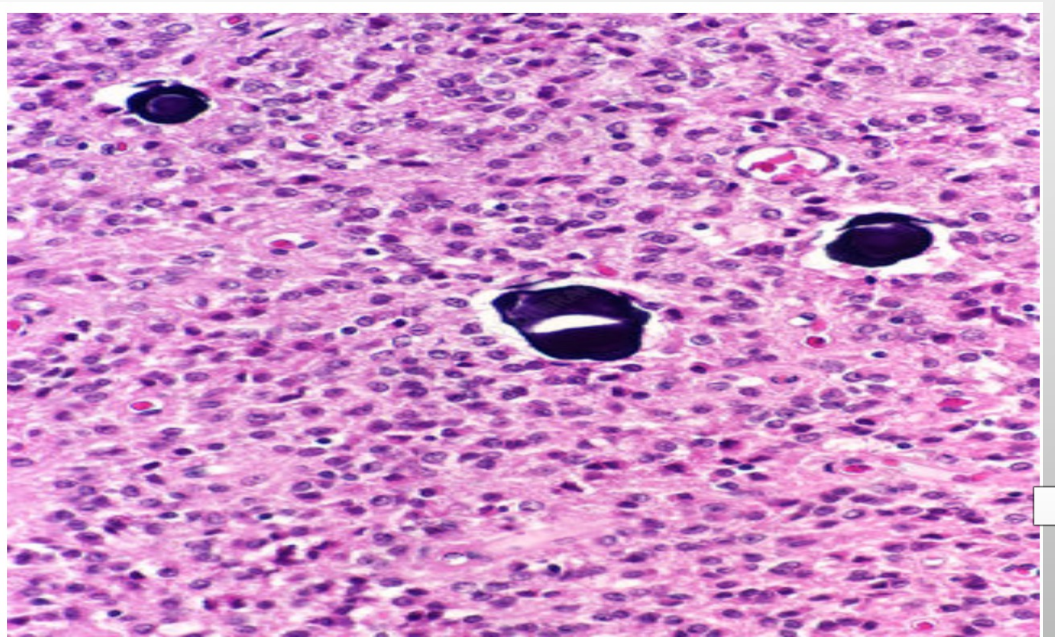
Organogenesis

- 7th-8th week.
- Develops from neuroectoderm (posterior wall of the third ventricle).
- Neuroepithelium that lines the roof of the third ventricle thickens, then the gland is formed as a small cavity that is connected to the third ventricle. Gradually, the parenchymal cells forms the secretory cells and the innervation also takes place.
- The development of the mature gland is seen in the first decade of life; the pineal gland will increase in size from birth to about 2 years in age.

Histology

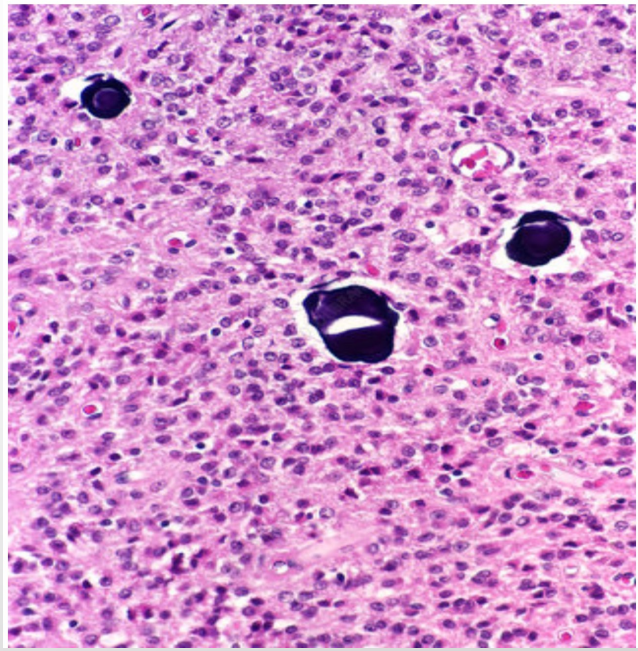
- Prominent and abundant secretory cells-**pinealocytes.**
- Slightly **basophilic** cytoplasm and irregular euchromatic nuclei
- Secretory vesicles, many mitochondria, and long cytoplasmic processes.
- Produce **melatonin:** a low-molecular-weight, a tryptophan derivative.
- Unmyelinated **sympathetic** nerve fibers enter the pineal gland and end among pinealocytes (some form synapses)

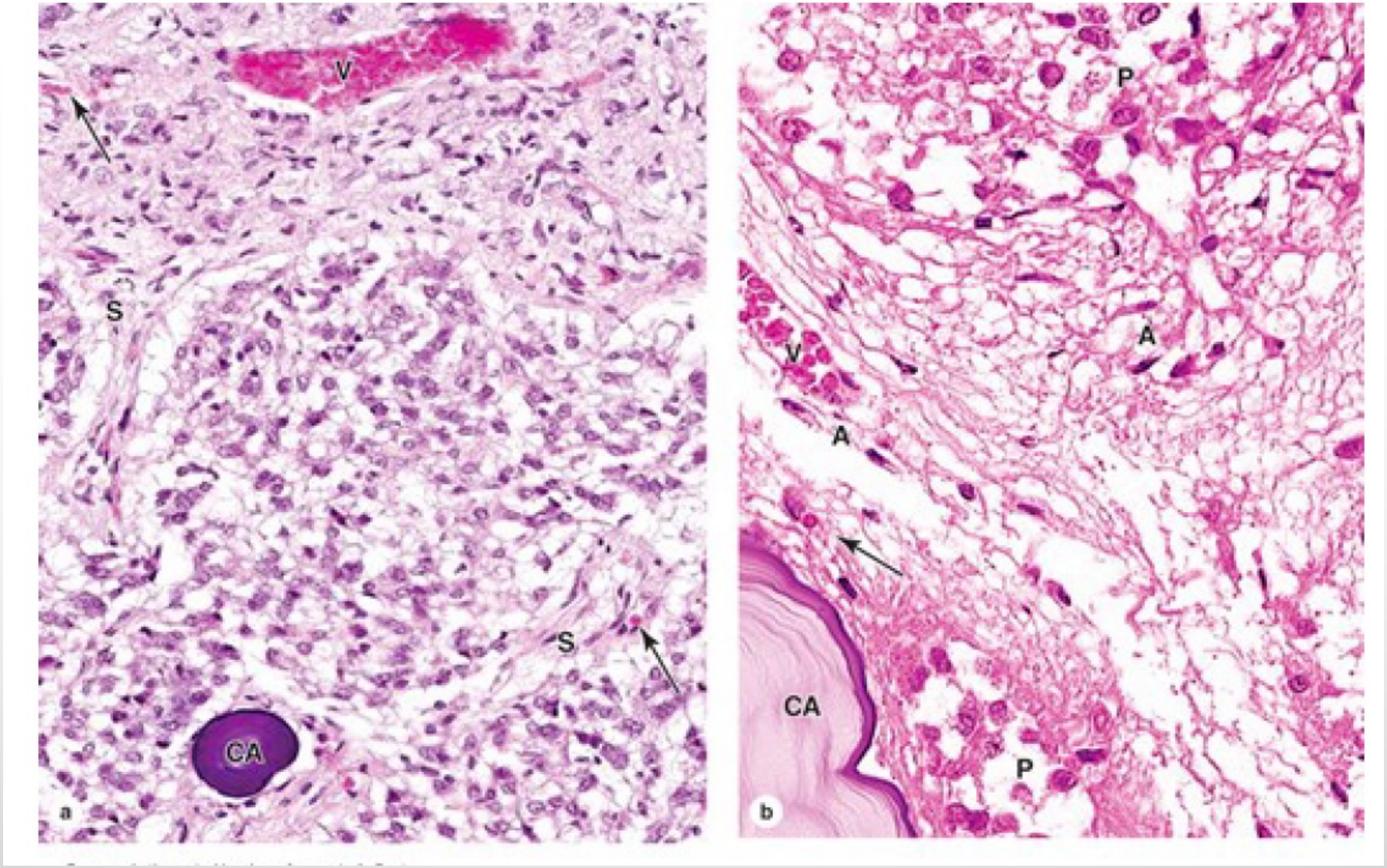




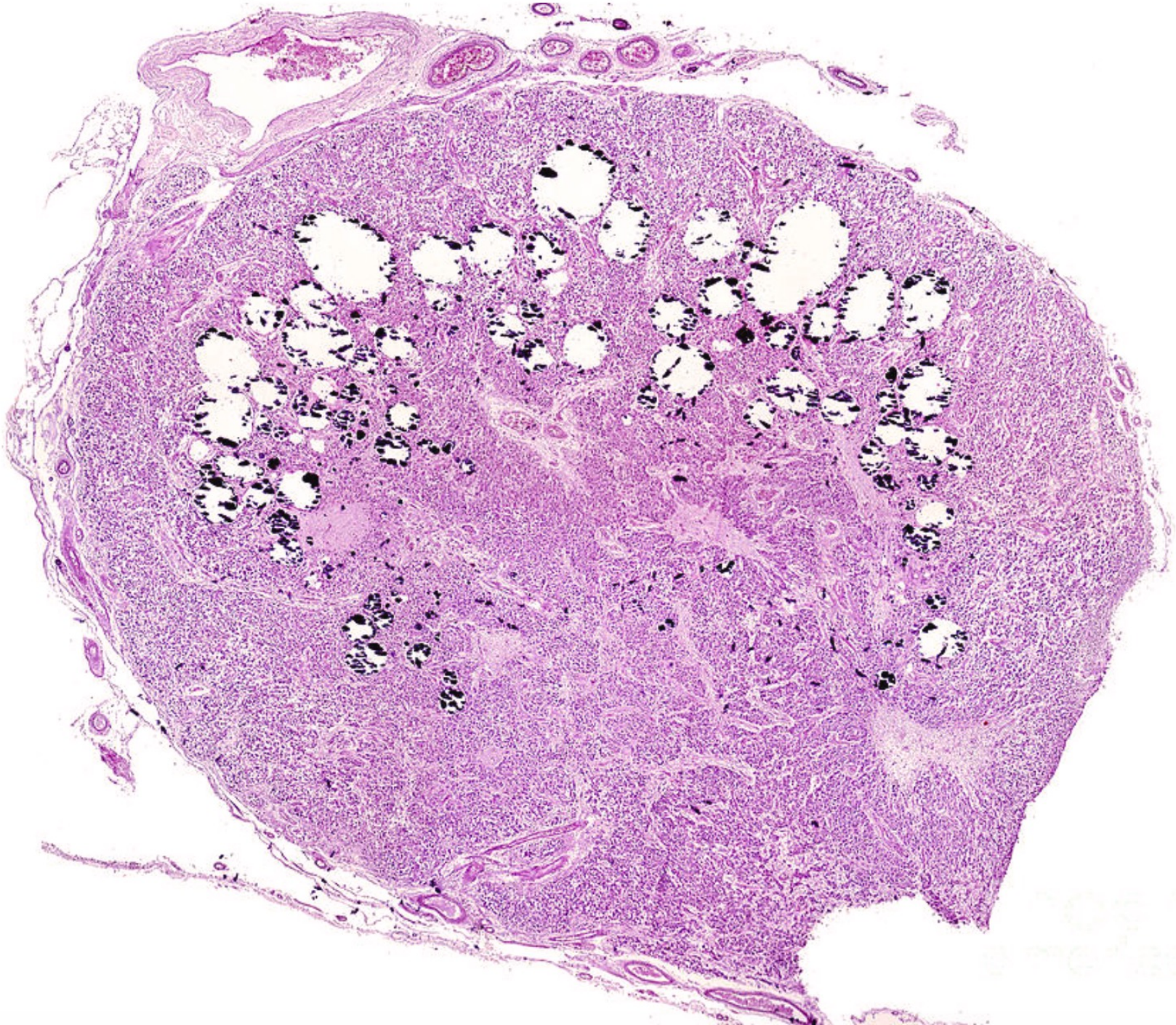
Histology

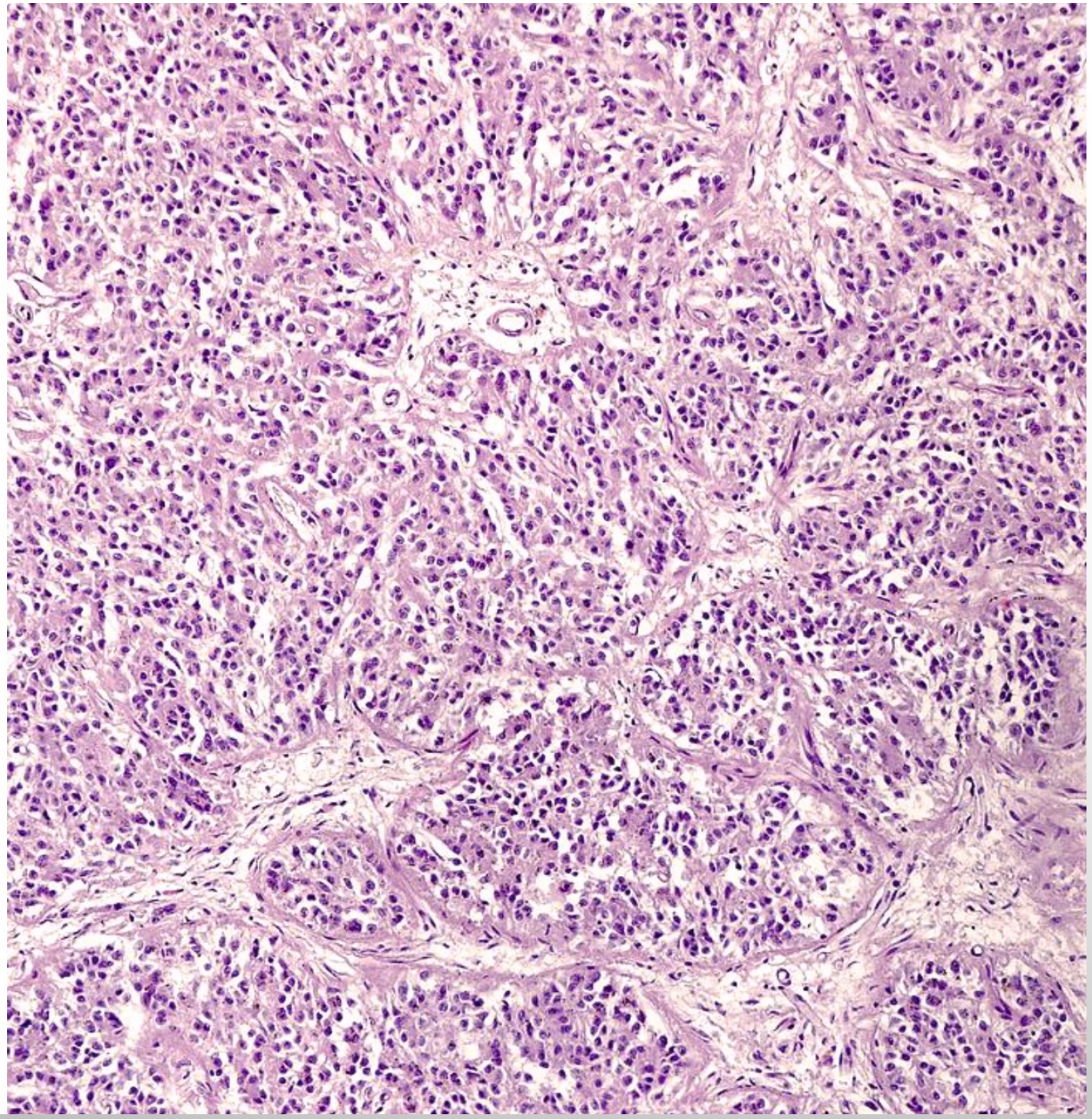
- Has interstitial glial cells (modified astrocytes) which represent 5% of the cells---- elongated nuclei more heavily stained than those of pinealocytes and found in perivascular areas.
- Microglial cells are present too.
- **Corpora arenacea, or brain sand** (concretions of calcium and magnesium salts), formed by mineralization of extracellular protein deposits---glands accumulate calcium from blood.
- May appear during childhood and gradually increase in number and size with age.
- **No apparent effect** on the gland's function.





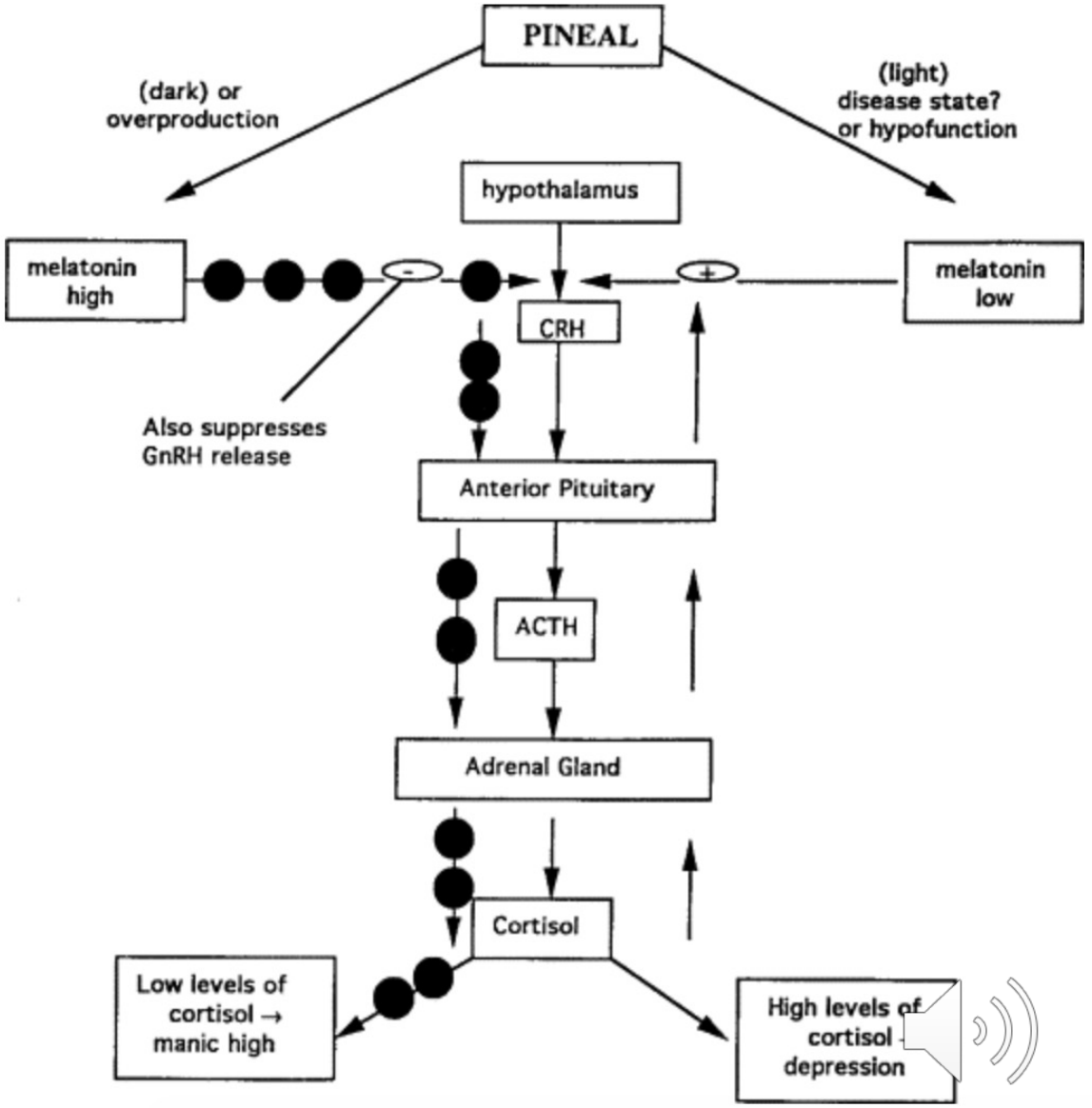
- (A) pinealocytes surrounded by septa (S) venules (V) and capillaries (arrows). Extracellular mineral deposit: corpus arenaceum (C A) (marker for the pineal).
- (B) pinealocytes (p) fewer astrocytes (a)





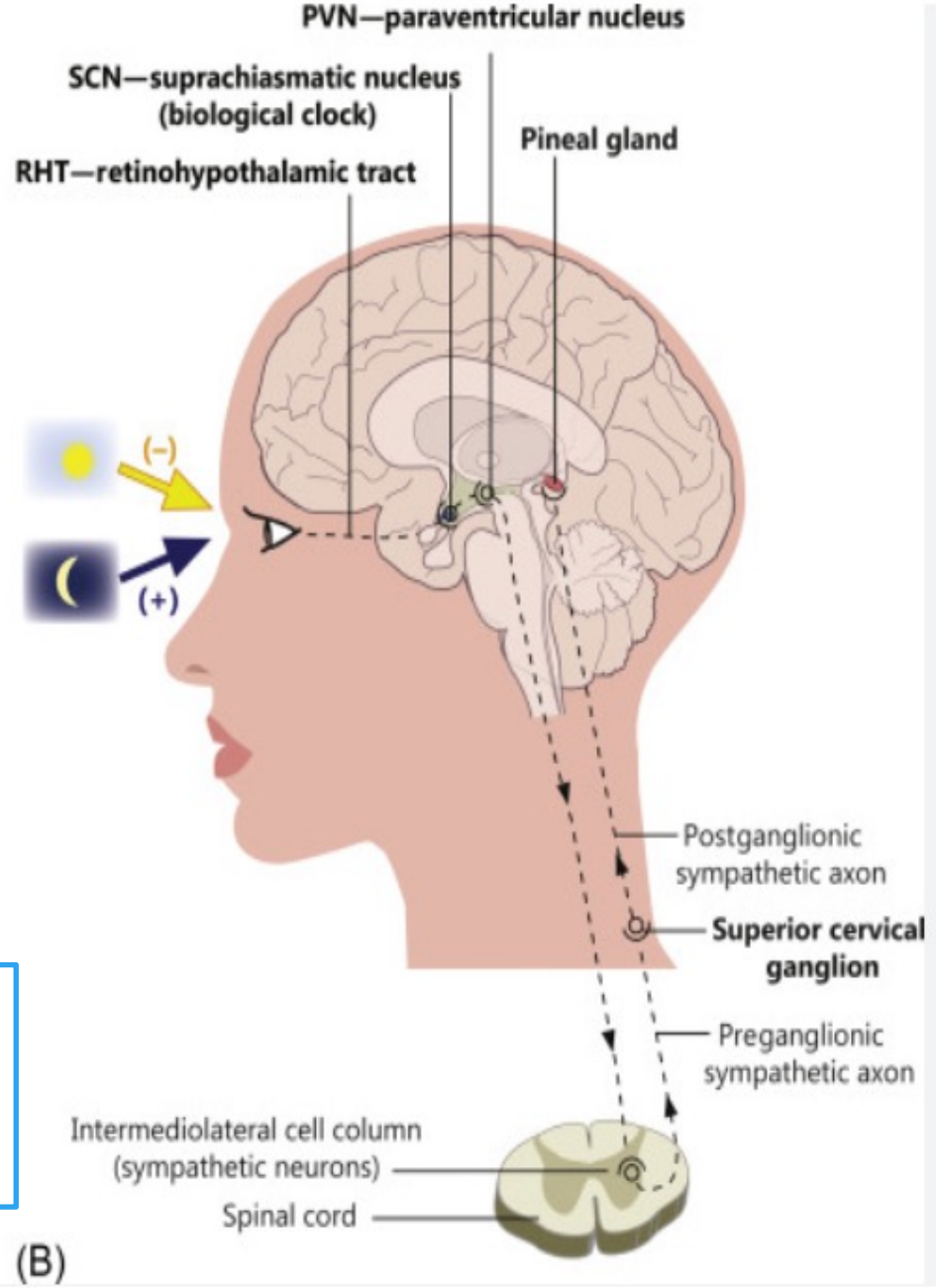
Pineal Gland Functions

- Influences the activities of the **pituitary** gland, the Islets of Langerhans of the pancreas, the parathyroids, the adrenals, and the gonads.
- The pineal secretions, reach their target organs via bloodstream or cerebrospinal fluid.
- Their actions are mainly inhibitory.
- Directly inhibit the production of hormones or indirectly inhibit the secretion of releasing factors by the hypothalamus.



Melatonin release is **promoted** by darkness and **inhibited** by daylight.

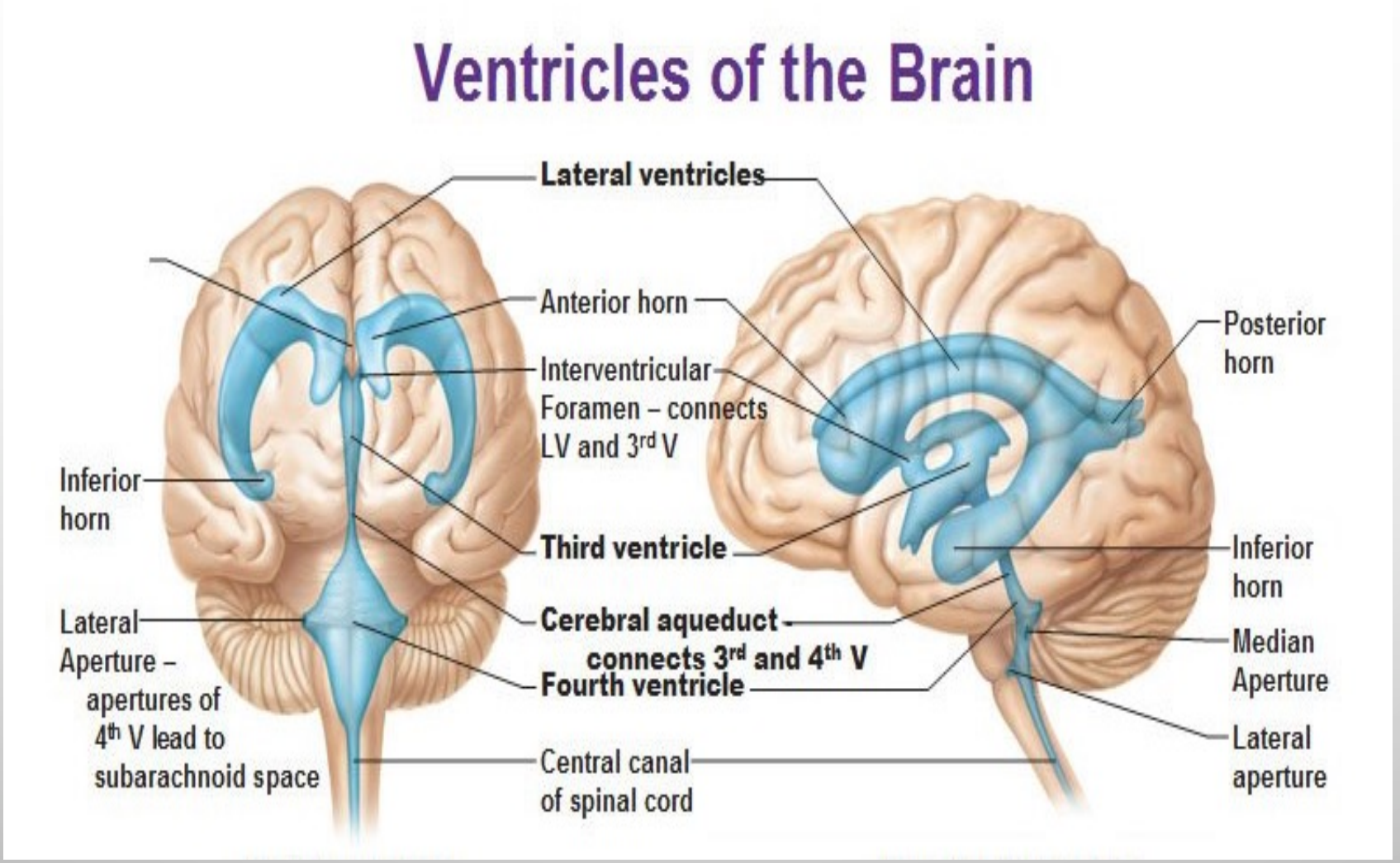
Diurnal fluctuation in blood melatonin levels---rhythmic changes in the activity of the hypothalamus, PG, and other endocrine tissues.



The cycle of light and darkness is detected within the retinas and transmitted to the pineal via the **retinohypothalamic tract,** the suprachiasmatic nucleus, and the tracts of sympathetic fibers entering the pineal G.

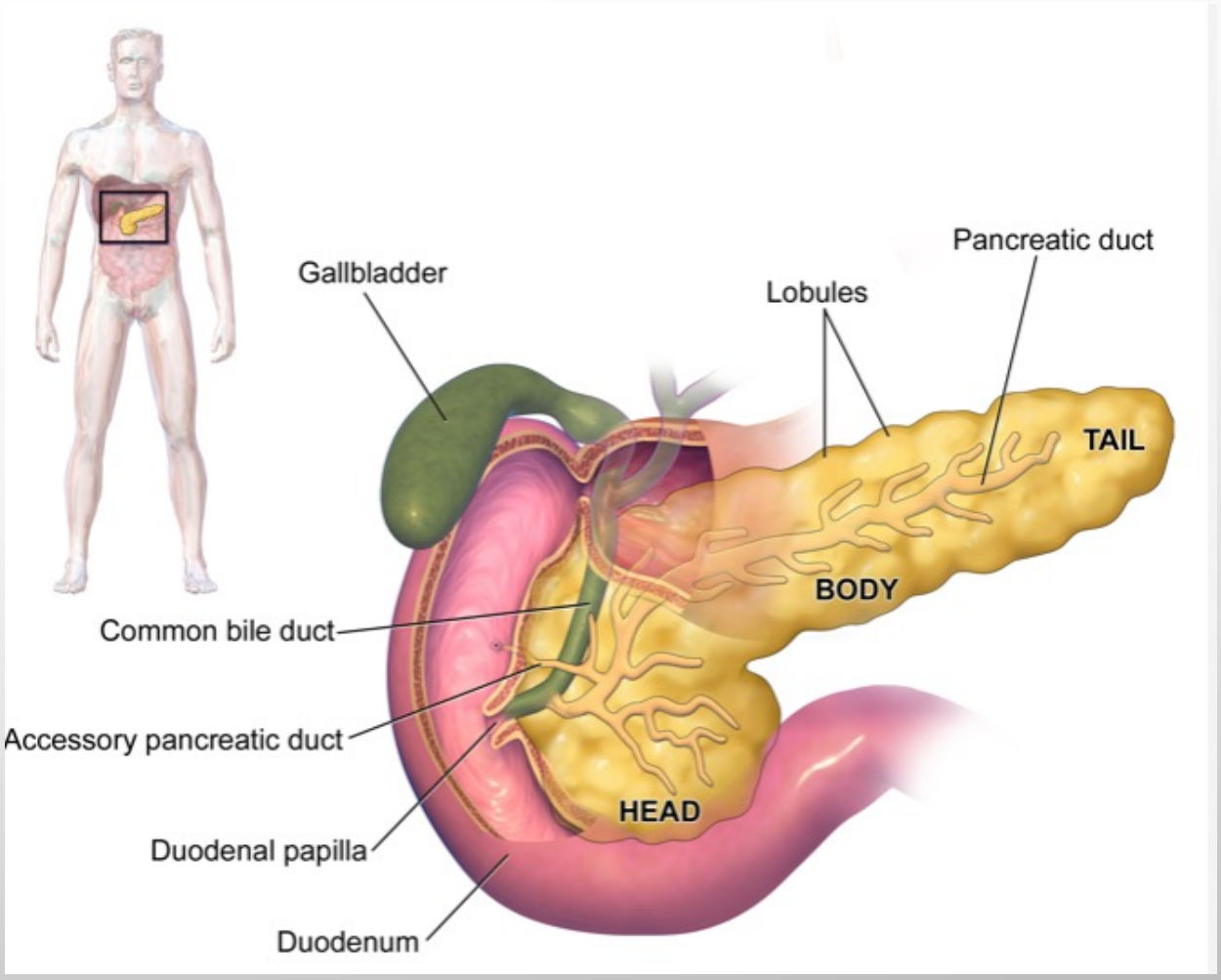
The pineal gland---a neuroendocrine transducer, converting sensory input into variations in many hormonal functions.

Pineal Glands



The pancreatic islets (Islets of Langerhans)

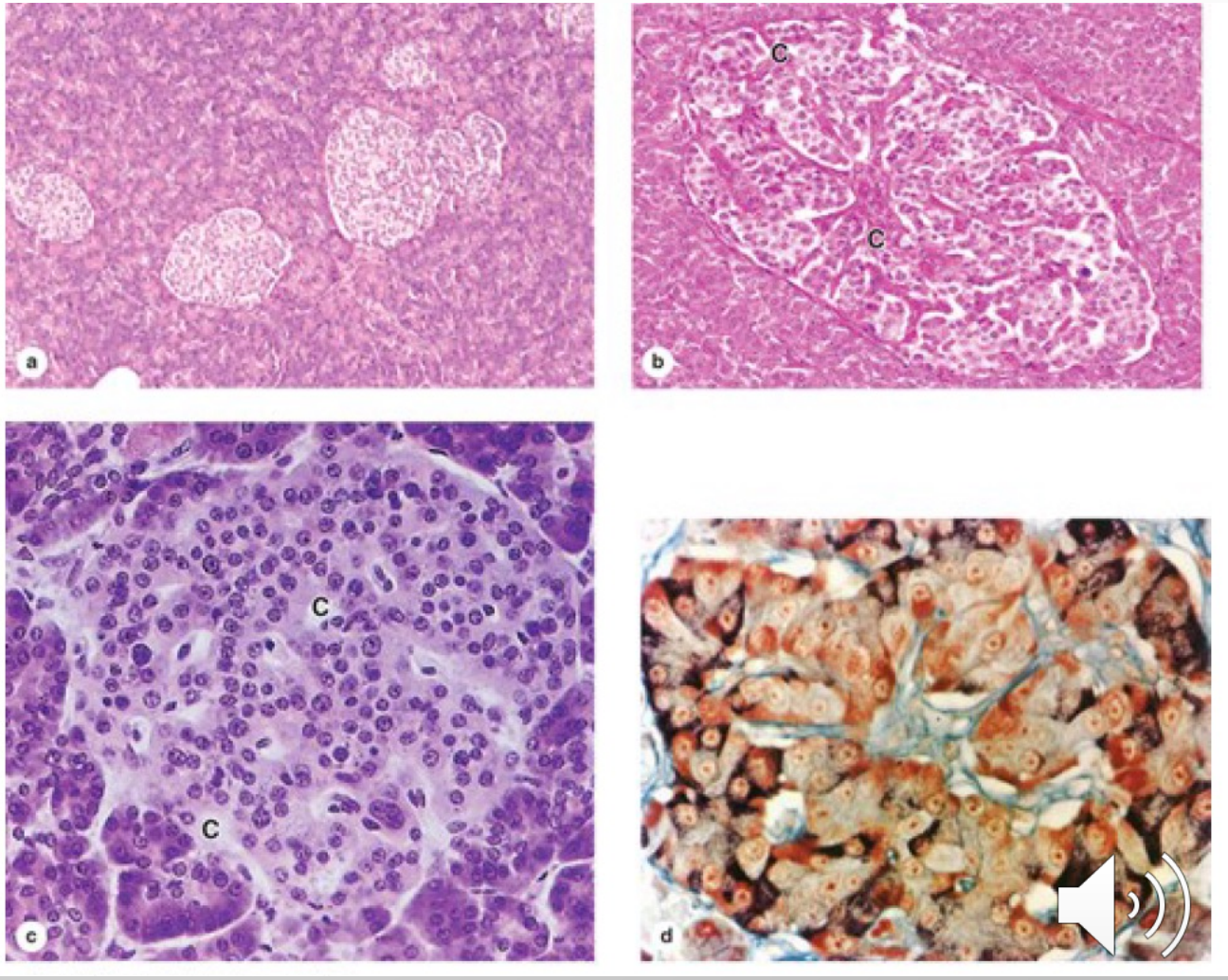
- Are compact spherical or ovoid masses of endocrine cells embedded within the acinar exocrine tissue of the pancreas.
- Most islets are 100-200 µm in diameter and contain several hundred cells, but some have only a few cells.
- The pancreas has more than 1 million islets (mostly in tail region).



ISLETS OF LANGERHANS PANCREAS

The Pancreatic Islets (Islets of Langerhans)

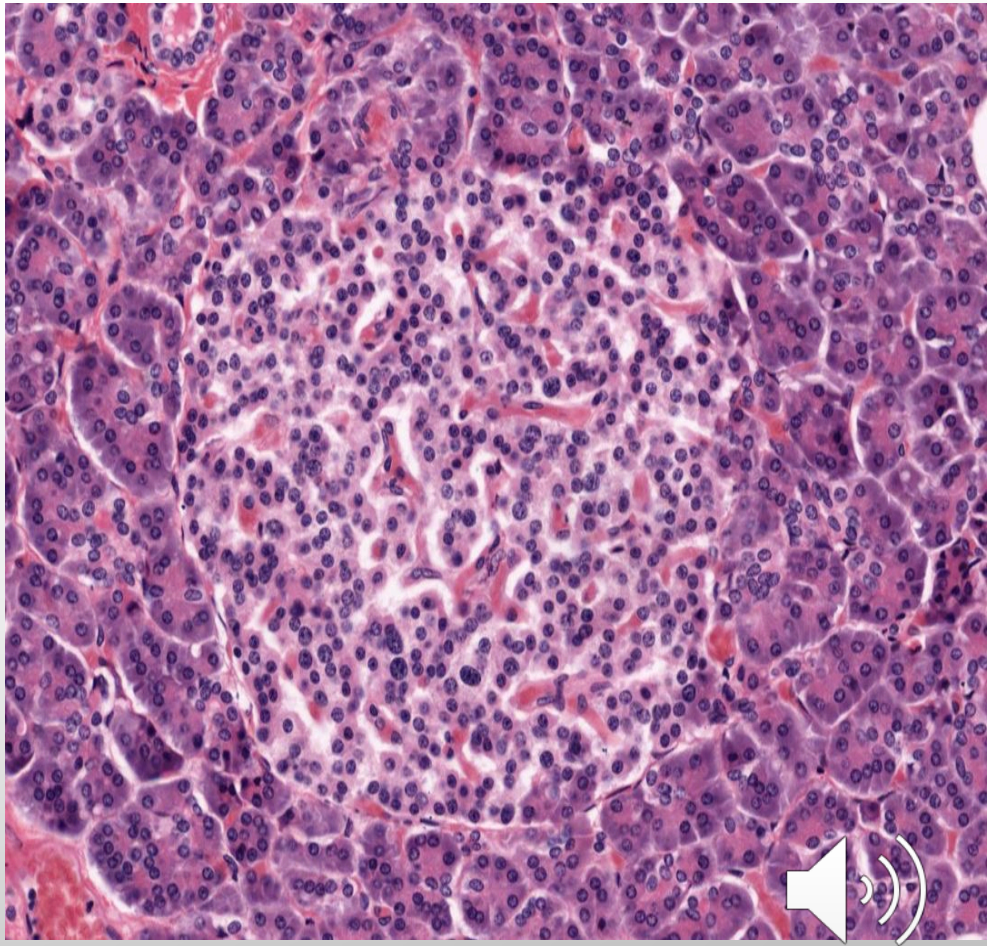
- They only constitute 1-2% of the organ's total volume.
- A thin reticular capsule surrounds each islet, separating it from the adjacent acinar tissue.
- Have the same embryonic origin as the pancreatic acinar tissue: in epithelial outgrowths from **endoderm** of the developing gut.



(a-c) H&E staining at different magnifications.
(d) An islet prepared with a modified aldehyde fuchsin stain shows that granules in the peripheral **α cells** are a deep brownish purple and the central **β cells** granules are brownish orange. Reticulin connective tissue of the islet capsule and along the capillaries stains green in this preparation.

The Pancreatic Islets (Islets of Langerhans)

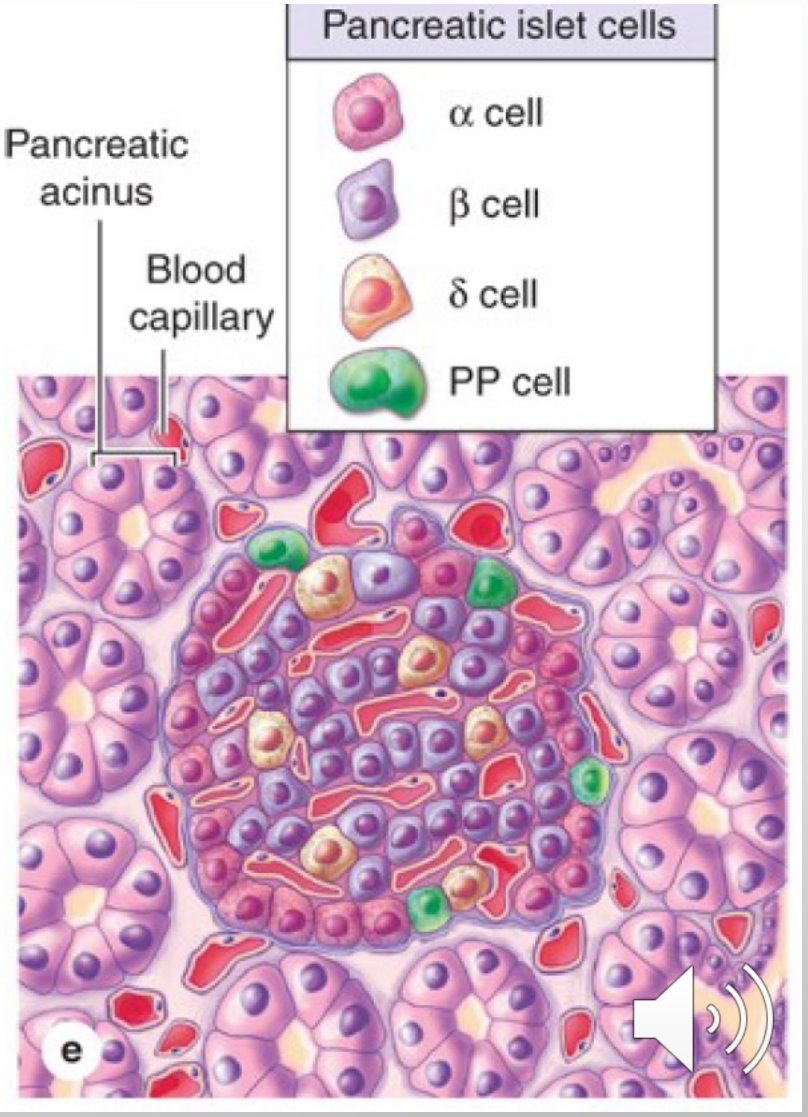
- The cells of islets are polygonal or rounded, smaller, and more lightly stained than the surrounding acinar cells,
- Arranged in cords separated by fenestrated capillaries.
- Most islet cells are acidophilic or basophilic with fine cytoplasmic granules.
- Active polypeptide-secreting cells, with secretory granules that vary in size, morphology, and electron density from cell to cell.

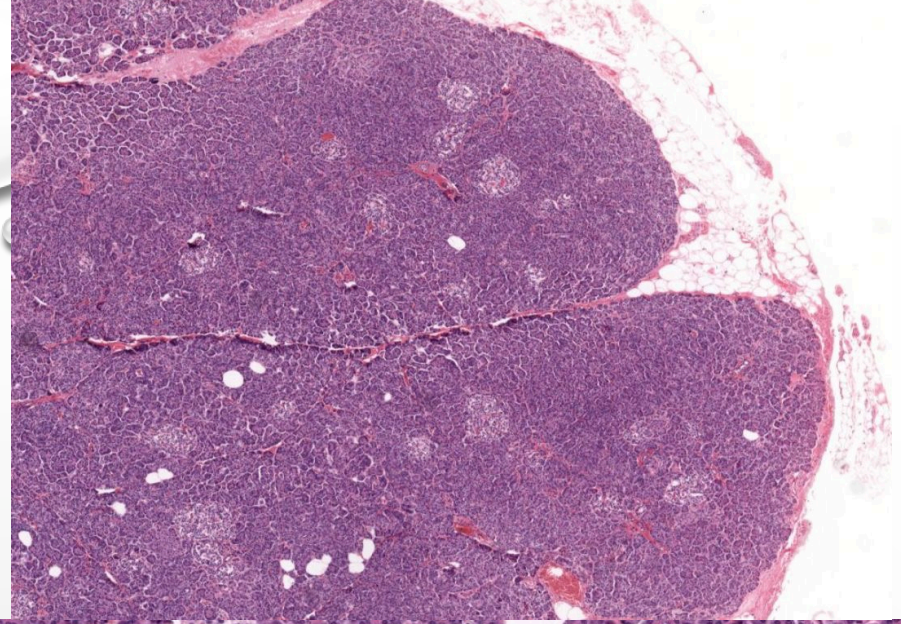


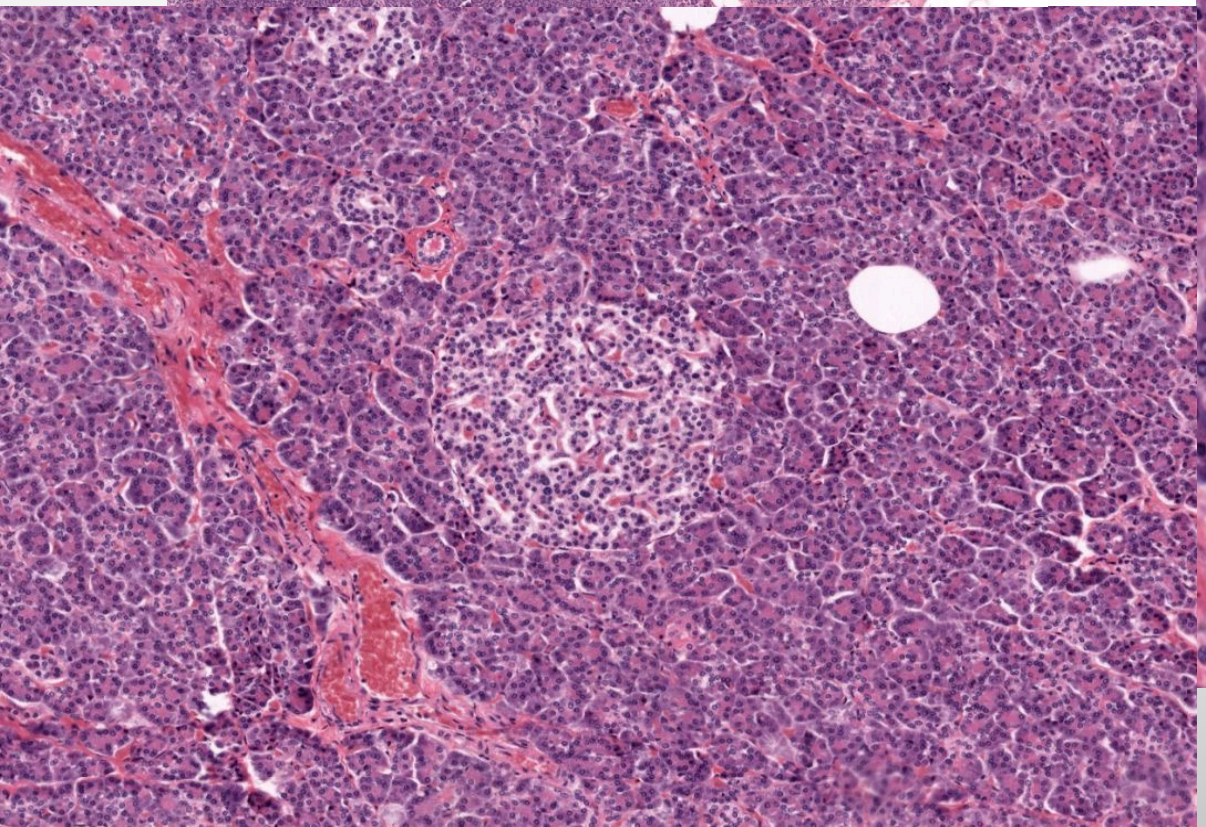
Cells

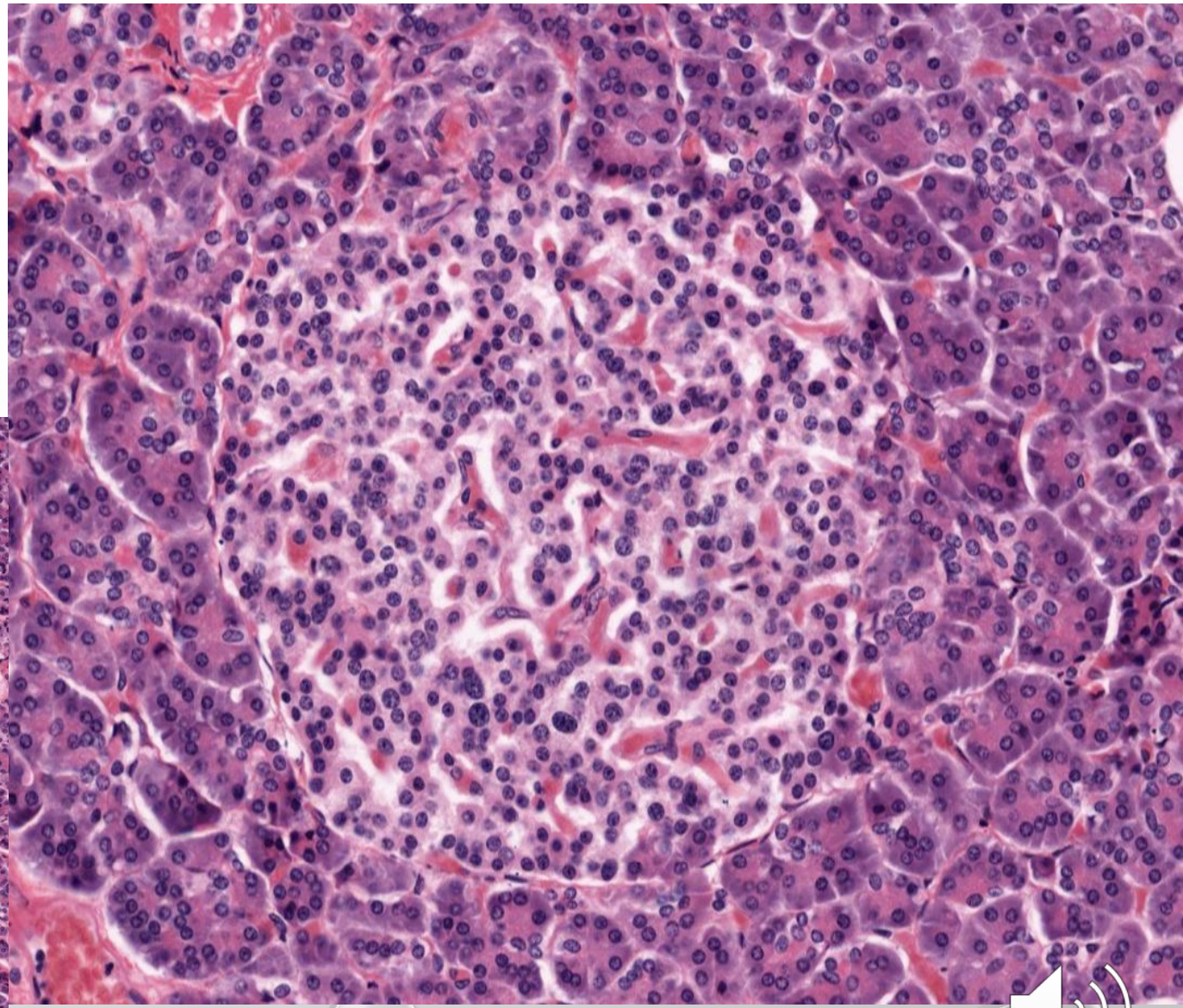
The Major islet cells:

1. α or A cells secrete primarily **glucagon** and located <u>peripherally</u>.
2. β or B cells produce **insulin** (l. Insula, island), most numerous, and located <u>centrally</u>.
3. δ or D cells, secreting **somatostatin**, are <u>scattered</u> and much less abundant.
4. **PP** cells secrete **pancreatic polypeptide**, more common in islets located within the <u>head.</u>

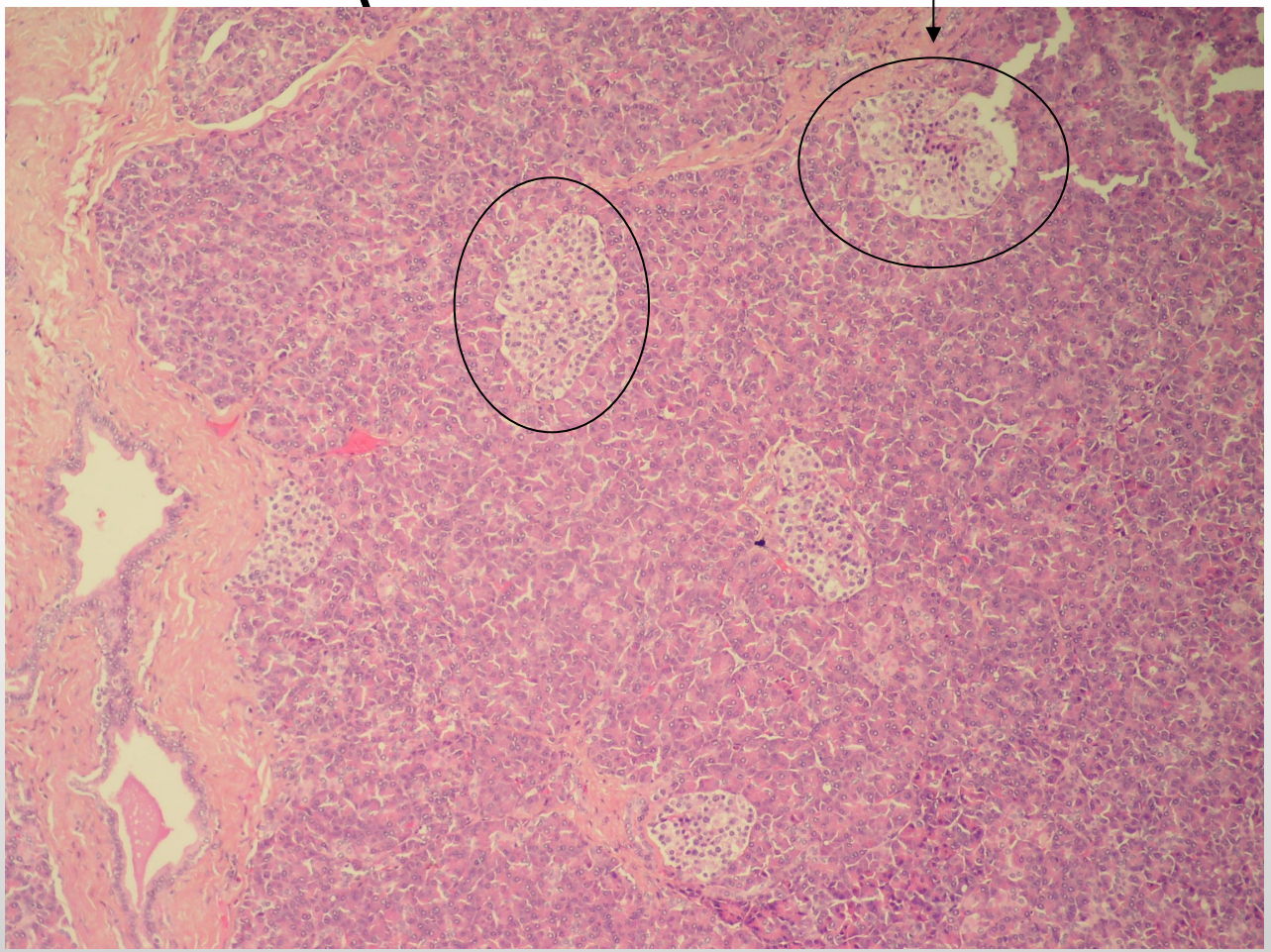




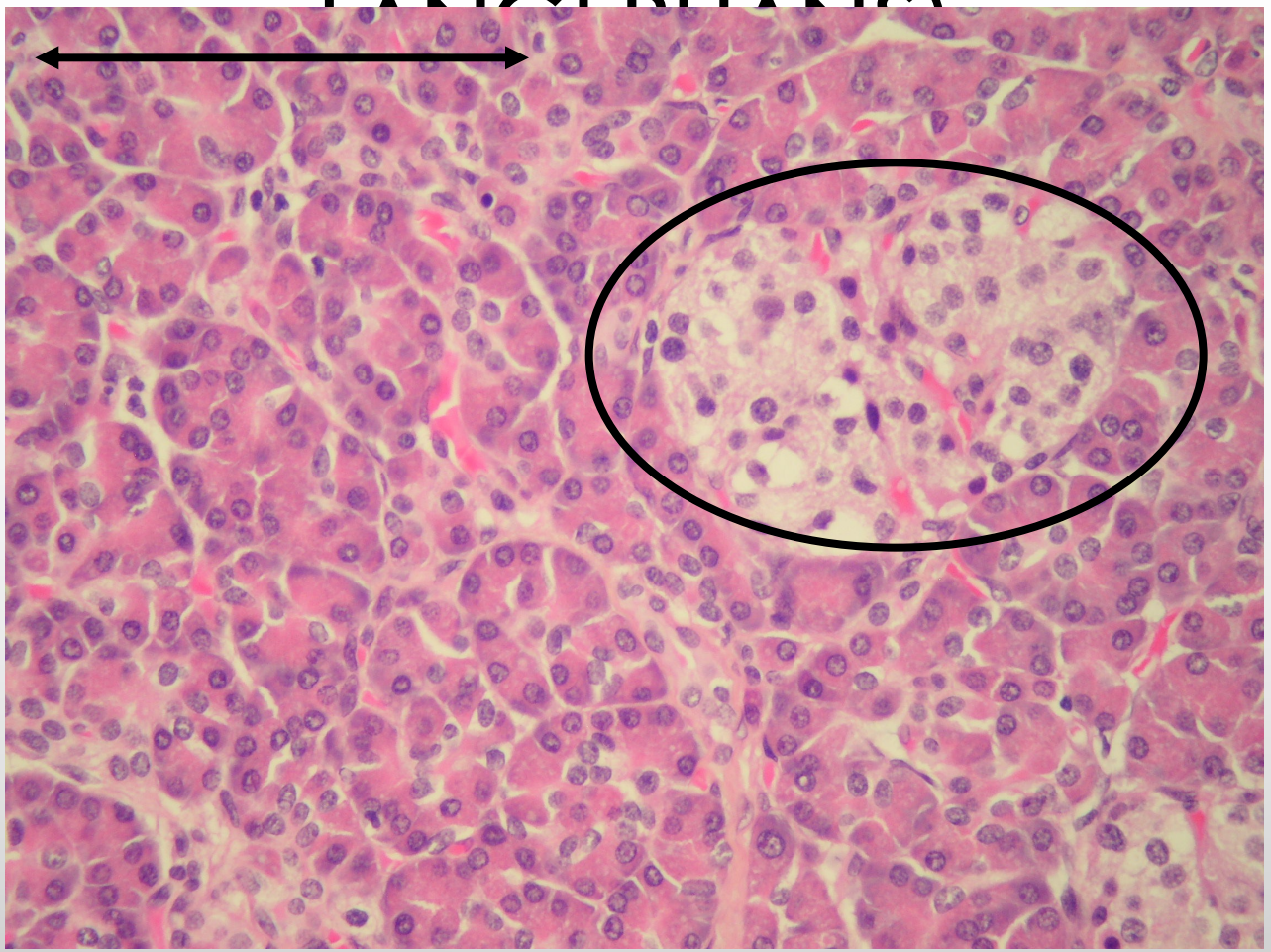




PANCREAS (EXOCRINE &ENDOCRINE)

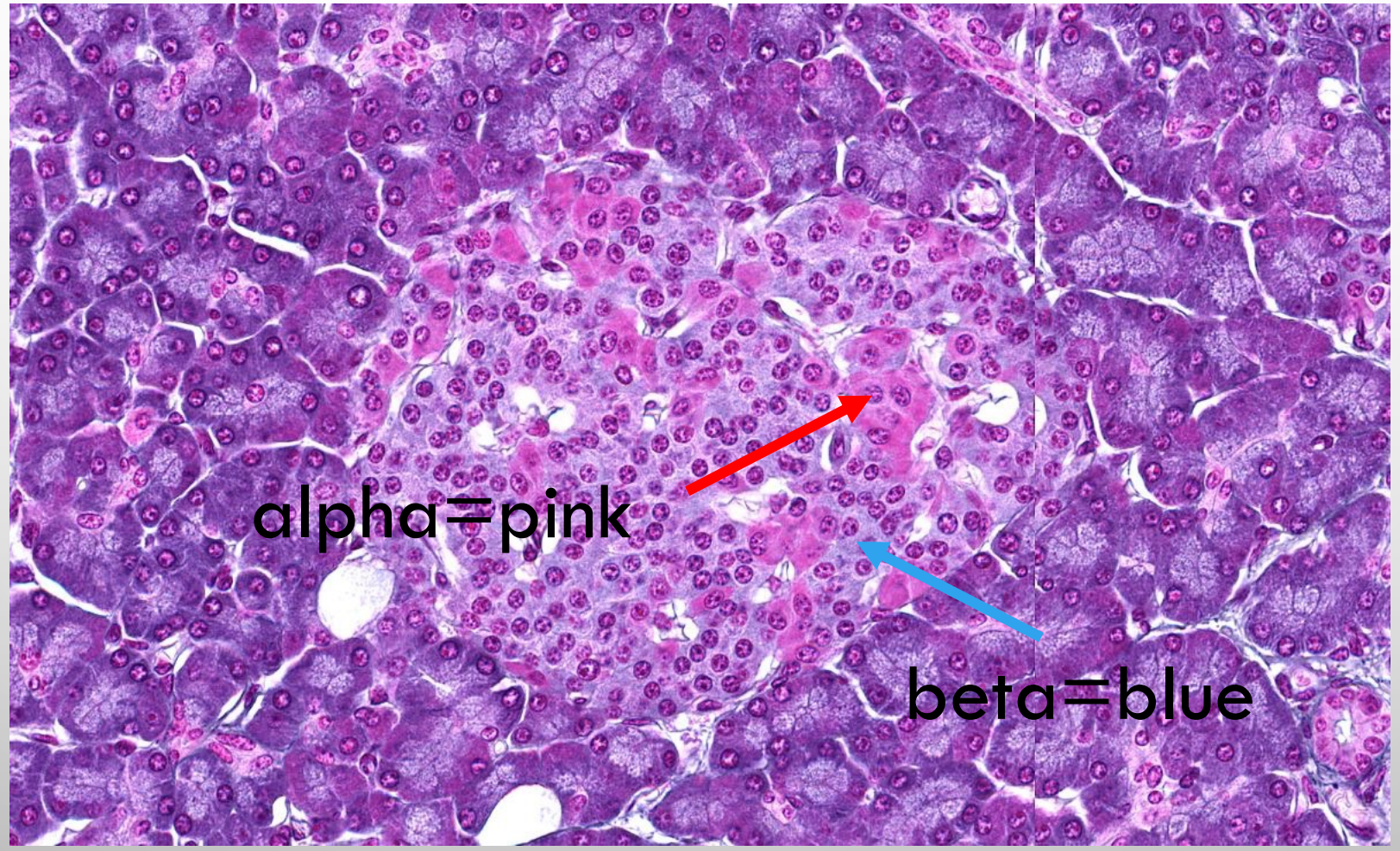


EXOCRINE PART &ENDOCRINE (ISLET OF LANGERHANS)



TYPES OF ENDOCRINE CELLS

Islets of langerhans-Gomri's stain
alpha Cs=pink, beta Cs=blue



Cell Type	Quantity (%)	Hormone Produced	Hormone Structure and Size	Hormone Function
α	~20	Glucagon	Polypeptide; 3500 Da	Acts on several tissues to make energy stored in glycogen and fat available through glycogenolysis and lipolysis; increases blood glucose content
β	~70	Insulin	Dimer of α and β chains with S-S bridges; 5700-6000 Da	Acts on several tissues to cause entry of glucose into cells and promotes decrease of blood glucose content
δ or D	5-10	Somatostatin	Polypeptide; 1650 Da	Inhibits release of other islet cell hormones through local paracrine action; inhibits release of GH and TSH in anterior pituitary and HCl secretion by gastric parietal cells
PP	Rare	Pancreatic polypeptide	Polypeptide; 4200 Da	Stimulates activity of gastric chief cells; inhibits bile secretion, pancreatic enzyme and bicarbonate secretion, and intestinal motility