



Islet of Langerhans

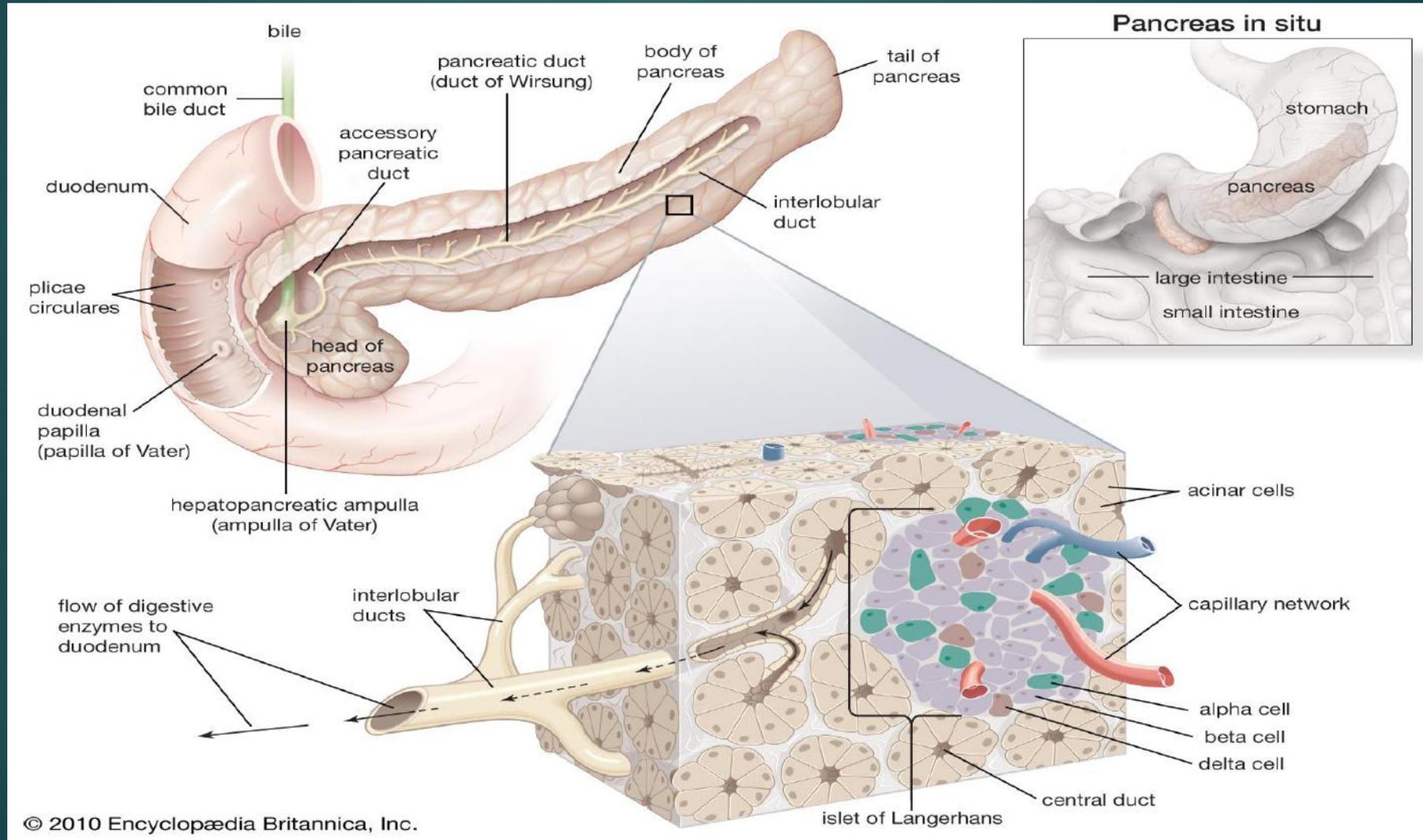
B.SC. PART-II

DR. VANDANA KUMARI, DEPARTMENT OF ZOOLOGY, R.C.S. COLLEGE, MANJHAUL

Introduction

- ▶ **Islets of Langerhans are** irregularly shaped patches of endocrine tissue located within the pancreas of most vertebrates. They are named for the German physician Paul Langerhans, who first described them in 1869. The normal human pancreas contains about 1 million islets. The islets consists distinct cell types, of which three (alpha, beta, and delta cells) produce important hormones.
- ▶ Islet of Langerhans are three dimensional clusters of nearly 1000 cells which constitute the endocrine portion of the pancreas
- ▶ In human islet's most abundant cells are the β cells, and it constitute about 60 to 70% of islet cell mass.

Islet of Langerhans



Structure

- ▶ Islet of Langerhans comprise approximately 1-2% of the weight of pancreas. With scanning electron microscopy the isolated islets appear as round or ovoid structures.
- ▶ It contains mainly three cell types in the human islet which can be identified with electron microscopy.
- ▶ Based upon ultrastructural differences in their secretory granules these are
- ▶ Beta granules-round or rectangular with a crystalline structure.
- ▶ Alpha granules - round with a central dense core.
- ▶ Delta granules - round, less dense than alpha granules and have an amorphous appearance.
- ▶ Different cell types within an islet are not randomly distributed - beta cells occupy the central portion of the islet and are surrounded by alpha and delta cells.

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- ▶ The individual islet cells are surrounded by a continuous plasma membrane with scattered desmosomes attaching them to the plasma membrane of neighboring islet cells.
 - ▶ Although islets comprise only 1-2% of the mass of the pancreas, they receive about 10 to 15% of the pancreatic blood flow.
 - ▶ Additionally, they are innervated by parasympathetic and sympathetic neurons, and nervous signals clearly modulate secretion of insulin and glucagon.
 - ▶ Islets are richly vascularized, allowing their secreted hormones ready access to the circulation.
 - ▶ The islet capillaries are lined with a fenestrated-type of endothelium.

Histology of an Islet of Langerhans of the Pancreas

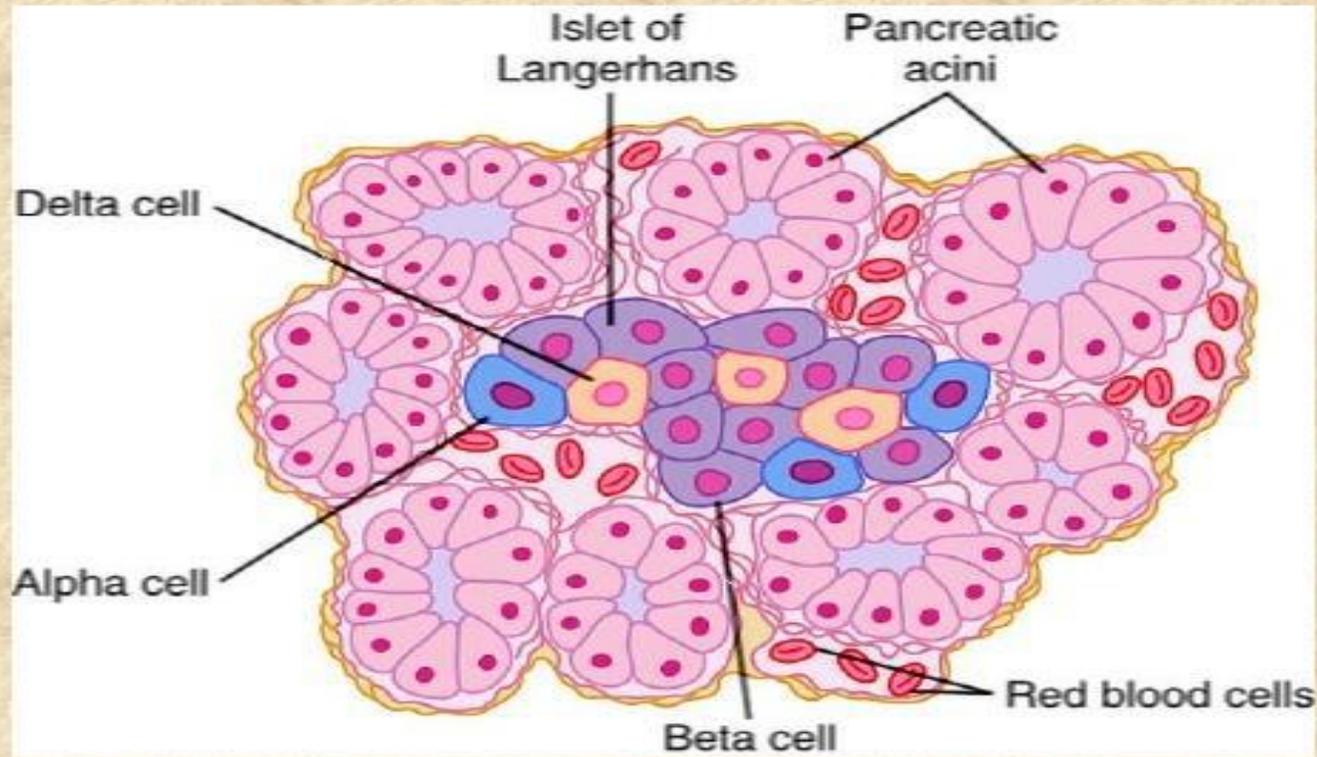
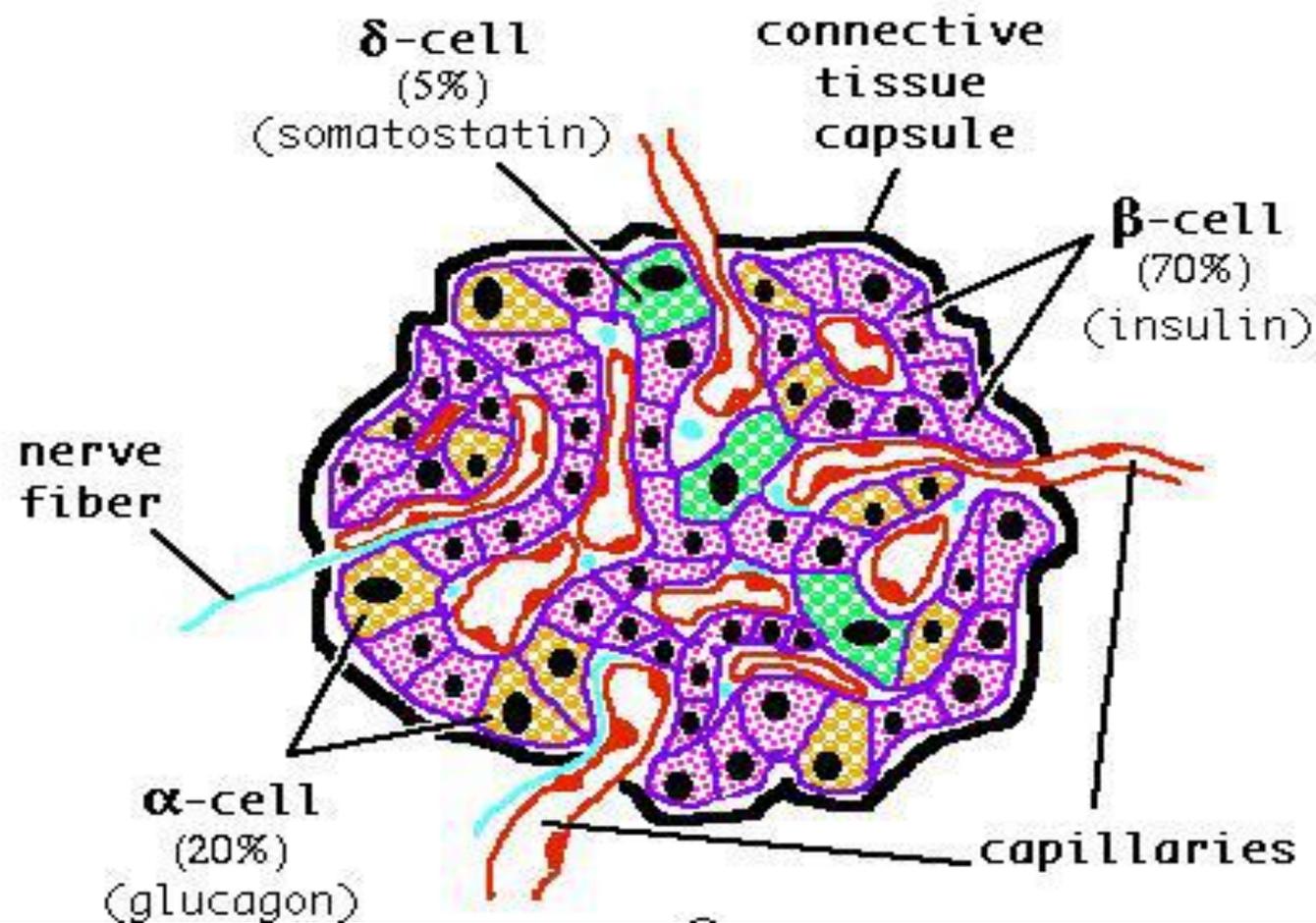


Figure 78-1; Guyton & Hall

Islet of Langerhans



Functions

- ▶ The millions of cells found in the pancreas that have this endocrine capability are collectively called the **islets of Langerhans**.
- ▶ There are three types of cells within this region of islet of Langerhans, and each produce and secrete its own hormone.
- ▶ These cells are the alpha cells, beta cells, delta cells.
- ▶ **Alpha cells-** are responsible for producing and releasing the peptide hormone called glucagon. Glucagon is released during fasting (when the blood glucose level is low) and it stimulates the process of gluconeogenesis and glycogenolysis. This increases the concentration of glucose in the blood.

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- ▶ **Beta cells-** are those cells that produce and release the peptide hormone insulin. Insulin is a protein comprising 51 amino acids, and contains an A and B chain linked together by disulfide bonds. Insulin works antagonistically to glucagon. Insulin is released when the blood glucose level is high and it acts to promote the uptake of glucose from the blood by the cells, as well as the uptake of amino acids and fatty acids. Therefore insulin causes the decrease in blood glucose levels because it promotes glycogen formation in the liver cells, protein formation in the muscle cells and triglyceride formation in the fat cells
 - ▶ **Delta cells-** are those cells that produce and release a peptide hormone called somatostatin. This protein is involved in inhibiting both insulin and glucagon.
 - ▶ Aside from the insulin, glucagon and somatostatin, a number of other "minor" hormones have been identified as products of pancreatic islets cells.

