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Opinion

Mechanism of Islets of Langerhans in Pancreas

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DESCRIPTION

The adult pancreas is composed of endocrine cells organized in the islets of Langerhans and gastrointestinal acinar cells. Endocrine cells make up less than 2% of the total pancreatic mass of the adult pancreas. The adult pancreas has approximately 1 million islets, each containing approximately 3000 cells, ranging in diameter from 40 μm to 1 mm. The islets have a complex structure and are composed of four types of cells: A (alpha), B (beta), D, and F cells. The four cell types are not evenly distributed within the islets or throughout the pancreas. Peripheral A cells secrete glucagon and make up about 10% of the islet cell mass. The islets are mainly composed of B cells that secrete the hormone insulin (up to 70%) and are located in the centre of the islets. By comparison, F cells make up about 15% of the islet cell mass and secrete the hormone pancreatic polypeptide. D cells are evenly distributed throughout the islets and account for about 5% of the islet cell mass. D cells secrete somatostatin and D2 cells secrete vasoactive intestinal peptide. In the original pancreas, B cells and D cells are concentrated in the body and tail of the pancreas; A cells are evenly distributed throughout the gland. The microcirculation of the islets enables signal transduction from endocrine to endocrine cells required for hormonal regulation. In the surrounding area, afferent arterioles invade the centre of the islets of B cells. The order of perfusion and interaction of islet cells is from this B cell nucleus towards the mantle, first towards the A cells and then towards the peripheral D cells. This allows B cells to block the secretion of A cells, which can stimulate the secretion of D cells. Endocrine pancreatic secretion regulates exocrine pancreatic secretion. Although the islets occupy less than 2% of the volume of the pancreas, most of the arterial blood supply to the pancreas first flows to the islets and then across the islets to the exocrine parts of the glands. The distribution of blood flow is associated with potential physiological interactions. B-cell insulin stimulates pancreatic exocrine secretion, amino acid transport, and protein and enzyme synthesis. Glucagon on Island A, on the other hand, has an accommodative effect and inhibits the same process. The islets of Langerhans are three-dimensional clusters of about 1000 cells that make up the endocrine part of the pancreas, each with a diameter of about 50-500 μm. The most abundant islet cell type in all species is insulin-secreting β-cells, but there is some variation in the proportion of β-cells between species, and mouse islets are estimated to contain 80-90% β-cells. However, in human islets, β-cells make up 60-70% of the mass of the islets. Islet isolation from all species by collagenase digestion of the exocrine pancreas and purification by hand picking or density gradient is time consuming. In addition, some primary cells, such as those derived from smooth muscle, proliferate in culture to produce additional experimental cells, but islet cells do not proliferate easily. Therefore, since the 1970s, considerable effort has been devoted to producing insulin-secreting cells that proliferate in culture and exhibit the functional properties of primary β-cells. The islets of Langerhans are distributed throughout the organs of adults and are supported by a mass of bifurcated exocrine tissue. The size of the islets varies considerably, but typical islets have a diameter of about 50-200 μM. In mouse islets, β-cells are found to be clustered in the nucleus of each islet surrounded by peripheral hormone-secreting cells, most commonly α-cells. In contrast, the endocrine cell type of the human pancreas does not show such diverse structures, but appears to be mixed throughout the islets. It was suggested that the major homozygous β-β cell interactions in mice compared to the predominantly atypical β-non-β cell interactions in humans may be the reason for the observed species-specific differences. However, in both species, delta cells have a long process of penetrating the islets and contacting multiple α and β cells.

The islets of Langerhans make up only an estimated 1-2% of the total pancreas, but receive up to 20% of the blood supply. The abundant vascular blood supply to the pancreas derives from the splenic artery, allowing islets to be easily exposed to systemic blood glucose levels. Interestingly, recent studies suggest that islet local blood flow is tightly regulated by percentage. It dynamically controls the diameter of the islet microvasculature. Under diabetic conditions, pericytes are significantly lost, impairing the fine-tuning of islet function by this mechanism, suggesting a contribution to the pathology of the disease. Adult mice and the human pancreas also differ in innervation. Although the islets of mice have an extensive network of bifurcated nerves that are in direct contact with endocrine cells, the islets of humans are sparsely nerved compared to nerves that are in contact with smooth muscle cells of blood vessels rather than endocrine cells. It is dominated. This supports a new hypothesis that in human's regulation of islet function depends on dynamic control of blood flow rather than direct signals from the autonomic nervous system.

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