Title:

From Structure to Function: Cell Adhesion, Mechanotransduction, and Metabolic Pathways in Pancreatic Islet Formation

Abstract:

Pancreatic islet development depends on intricate molecular interactions between cell adhesion molecules, mechanosensitive pathways, and metabolic regulators that collectively establish functional tissue architecture. Our recent study shows that α-catenin (*Ctnna1*) functions as a critical integrator that shapes islet architecture while governing β-cell differentiation. Ctnna1 facilitates islet clustering and regulates cholesterol metabolism through Sterol Regulatory Element Binding Transcription Factor 2 (*Srebf2*) expression, which is essential for both structural organization and metabolic maturation. Complementarily, integrin β1 (*Itgb1*) mediates extracellular matrix (ECM) interactions that maintain architectural integrity and cell communication. These structural components form a mechanotransduction system where adhesion molecules influence gene expression and chromatin organization, effectively translating mechanical forces into metabolic and developmental responses needed for functional islet formation. These insights could advance our understanding of diabetes pathophysiology and establish principles for developing stem cell-based therapies.