Project #7

Title: Role of Mitochondria in the maturation and functionality of human pluripotent stem cell-derived pancreatic beta-cells

Description: Diabetes mellitus (DM) is a chronic disease characterized by impaired glucose metabolism. According to the 2021 statistics from the International Diabetes Federation, 39.5% of adults in Qatar have DM. The two major types of DM are type 1 diabetes (T1DM) and type 2 diabetes (T2DM). Current pharmacological treatments for T1DM mostly rely on exogenous insulin injections. Both whole pancreas and isolated islet transplantation have shown to be effective, however the shortage of organs limit this option. An alternative to cadaveric islet shortage and a future goal is to generate pancreatic ß-cells from human pluripotent stem cells, such as embryonic stem cells (hESC) and induced pluripotent stem cells (hiPSC). However, sometimes hPSC-derived insulin-positive pancreatic ß-cells fail to respond to glucose-stimulated insulin secretion (GSIS) properly. As mitochondria plays an important role in ß-cells functionality, in this project, the overall objective is to investigate the role of mitochondria in the maturation and functionality of hPSC-derived pancreatic ß-cells. More specifically, we will study mitochondria morphology, dynamics and function across all stages of the pancreatic beta-cell differentiation using human pluripotent stem cells and a six-step scalable 3D directed differentiation protocol.

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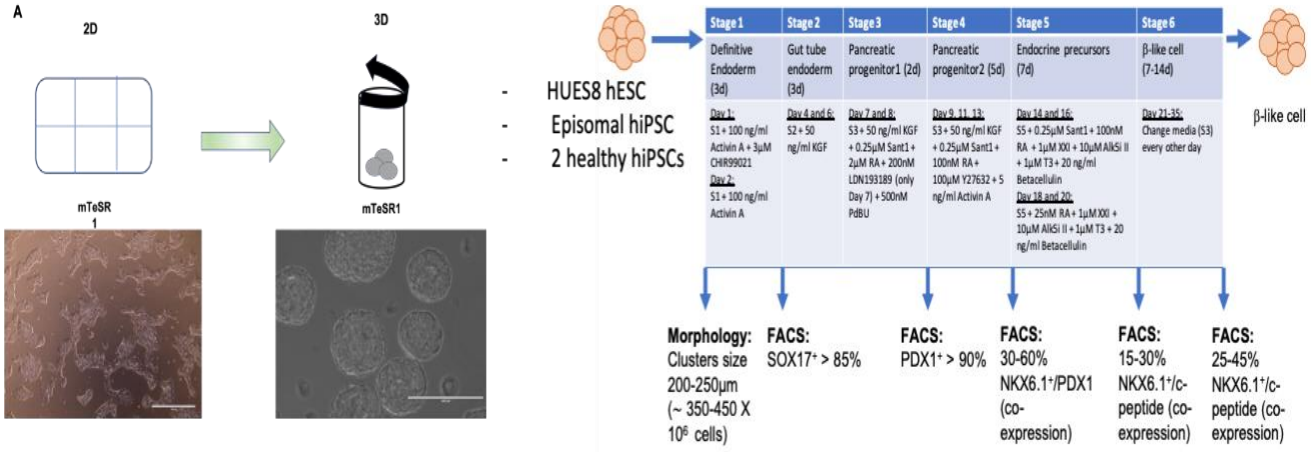

Figure 1. Adaptation of hPSCs from 2D cultures into 3D cell cultures and outline of the in vitro 3D directed differentiation of hPSCs into pancreatic ß-cells.