

ENCAPSULATION BIOPROCESSES FOR DIABETES CELLULAR THERAPY

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The number of cell and gene therapy products approved in North America now exceeds 15, creating a need for bioprocesses tailored to this type of biologics. The Stem Cell Bioprocessing Laboratory at McGill, led by Dr. Hoesli, Canada Research Chair in Cellular Therapy Bioprocess Engineering, is developing new materials and methods to produce and deliver promising cell-based products – in particular for the treatment of diabetes and cardiovascular disease. Type 1 diabetes is an autoimmune disease leading to the loss of the insulin-producing beta cells of the pancreas. Islet transplantation aims to replace these insulin producing cells rather than replacing the missing insulin hormone. Over 85% of islet transplant recipients can live without insulin injections for at least 1 year [1], with some patients remaining insulin-independent for over 5 years. Access to this promising long-term treatment to diabetes is limited by donor islet supply as well as the risks associated with lifelong immunosuppression following this intervention. We and others are developing scalable bioprocesses to generate pancreatic cells from pluripotent stem cells, to purify the cells of interest, and to transplant them while circumventing the need for immunosuppression. This presentation will review upstream processing, downstream processing and formulation/delivery methods related to this challenging cell-based product. Examples of novel bioprocesses for pluripotent stem cell differentiation and pancreatic cell encapsulation in immunoprotective devices will be presented [2-4]. Avenues for future research and development include engineering devices that maximize cell oxygenation and survival while also allowing graft retrieval or replacement. One of these approaches is the engineering of vascularized tissue constructs using 3D printing [5]. As the cell therapy field continues to evolve and mature, complex combination products including therapeutic cells, biomaterials as well as drugs are expected to emerge on the market.

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