



Title: Engineering a new islet transplantation site to improve access to cellular therapy as a treatment option for diabetes

Researchers:

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Dr. Steven Paraskevas, Co-Applicant: McGill University Health Centre

Research area: Type 1 diabetes

Award: End Diabetes 100 Award, 2021-2024

Summary:

Purpose: Islet transplantation allows most people with type 1 diabetes to live without insulin for at least 1 year. Because of the side effects of the immune suppressive drugs needed to avoid transplant rejection, only patients that struggle to control their blood glucose are eligible for islet transplants. Instead of immune suppression, islets could be shielded from immune cells via a physical barrier using encapsulation. While encapsulated islets can reverse diabetes in rodents, this has not yet been shown in humans. This is likely due to insufficient blood supply to larger devices. The objective of this project is to engineer vascularized islet transplantation devices that also protect the islets from immune rejection.

Methods: When designing encapsulation devices, there is a trade-off between islet vascularization and immune protection. Blood vessels carry oxygen and insulin to and from the graft, but on the other hand they also carry immune cells which attack the graft. To find this “sweet spot”, we will test device performance in vitro and in rats. We will also predict performance of human scale devices using mathematical models and in vitro studies.

Outcome: At the end of this project we will have sufficient data to test our device in larger animals like pigs.

Relevance to people affected by diabetes: Because our devices would avoid transplanted cell escape, stem cells could be used safely instead of human islets which are in limited supply. This project could make islet transplantation broadly available as an alternative to insulin injections or pumps.

Engagement: Steven Paraskevas, co-applicant on the team, leads the clinical islet transplantation program in Québec. His laboratory is in a unique position to set up future clinical studies and transplants. Three partners with lived experience with type 1 diabetes are engaged in the project. They will provide input on research directions and reach out to the broader community to share our results.