Intervascular Capsule for Islet Transplantation in T1D Patients

*Financial Disclosure
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Bioartificial Pancreas Concept
Membrane Characteristics

*Ideal Membrane* (small pore size dimension & tight pore size distribution)

- **Polymer Membrane**
  - Antibody
  - Glucose
  - Insulin

- **Small enough to pass through membrane**
- **Too large to pass through membrane**

*Silicon Nanopore Membranes (SNM)*

- Precise pore size control → Well-defined isolation barrier to host immune system
- High permeability → Implantable form factor & “pump-less operation” under perfusion pressure
- Inert material → Mechanical and chemically stable
- Modifiable surface → Improved biocompatibility
Overall Encapsulation Project Aims

- Establish immune barrier function of SNM and lifetime of encapsulated islets
  - glucose stimulation and insulin secretion kinetics
  - immune barrier characterization
- Optimize blood compatibility of implanted SNM capsule
  - capsule design and attachment
  - in vivo biocompatibility evaluation
- Investigate therapeutic potential of SNM-encapsulated islets
  - islet inoculum for glucose autoregulation
  - chronic autoregulation over 30 days

Capsule for Ultrafiltration
First Study Goals

- Patency of the capsule/SNM
- Viability of the SNM-encapsulated islets
- Functionality of the encapsulated islets

Experimental Plan – 3 days

In vitro: non-circulating (positive control)

In vitro: circulating (stayed)

500 IEQ mouse islets per each side; total 1000 IEQ

Daily glucose challenge:
In vitro – 300 mg/dL
In vivo – 40% glucose sol, 0.5 g/kg administered -> 37.5 mg glucose in total
Sample point (min): 0, 5, 10, 15, 30, 60, 90

Travelled – at the animal facility then brought back
Stayed – always in lab

In vitro: circulating (travelled)

In vivo
Implantation

Angiogram
Inflammatory Response

Surgery results an increase in cytokines

IFN-γ: undetected
IL-2: 35.89 pg/ml on Day 0 post implant only

Explanted Capsule
Post-Explant SNM

Islet Viability

FDA/PI: green live; red dead
Capsule Functionality

Mouse C-Peptide

- Day 1
- Day 2
- Day 3

C-peptide (pM) vs. Time (min)

Team

Thank You, JDRF!