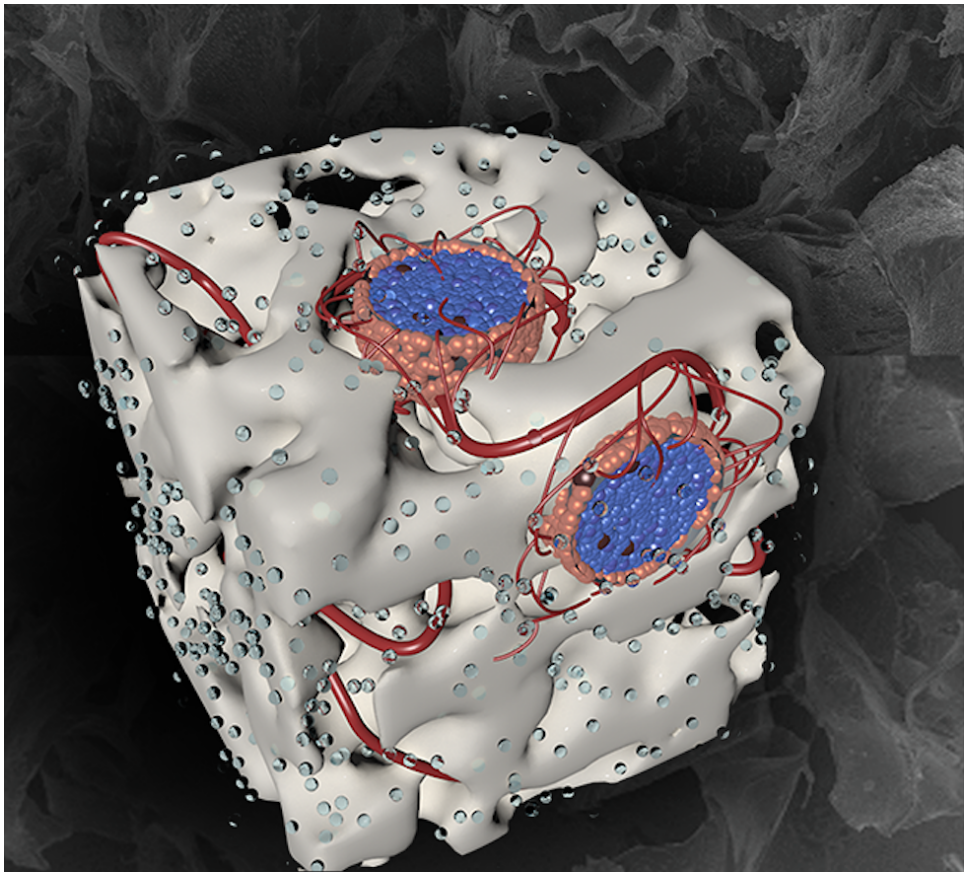
Docket #: S18-259

AN OXYGEN-GENERATING COLLAGEN-BASED CRYOGEL BIOSCAFFOLD FOR PANCREATIC ISLET TRANSPLANTATION

Researchers at Stanford have developed an oxygen-generating, collagen-based cryogel bioscaffold to improve islet cell transplantation for the treatment of diabetes. Type 1 diabetes, which affects millions of people, is currently treated by daily injection of insulin. This treatment is effective, but it can only keep blood glucose levels within a broad range and does not allow dynamic response to changes in glucose levels. Tight control of glucose levels significantly reduces the occurrence of secondary complications such as renal failure, heart disease and blindness. Thus, it would be highly beneficial to develop a diabetes treatment that restores glucose control in an automated and self-regulating manner. One such attempt is pancreatic islet cell transplantation. This approach, however, is not yet clinically useful as 50-70% of the transplanted islet cells die during the first week due to lack of oxygen. (It takes 2-3 weeks for transplanted islets to establish their own blood supply.) To help overcome this challenge the inventors developed this oxygen-generating, collagen-based cryogel bioscaffold. The bioscaffold generates oxygen and thus serves as a bridge for islet survival until they can generate their own microcirculation for long term oxygen delivery. This bioscaffold has the potential to improve islet cell transplantation and diabetes treatment as it provides a suitable 3D microenvironment for islets and can generate oxygen to facilitate islet survival following transplantation, and can serve as a "platform technology" for any cellular therapy that can be added as cargo.



Bioscaffold (Image credit: Thakor Lab)

Stage of development – In vivo testing
Using a diabetic mouse model, the inventors have shown that their new bioscaffold promotes islet viability and function.

Applications

- Islet cell transplantation for treatment of diabetes
- Cellular therapy – suitable for any cellular therapy that can be added as cargo to the bioscaffold

Advantages

- First time oxygen generating bioscaffold based on a natural polymer has been generated for islet transplantation
- High degree of porosity-

    - Good for nutrient and oxygen transfer
    - Prevents islet aggregation
    - Big pores to facilitate retention of islets and smaller pores to promote blood vessel ingrowth
- Bioscaffold is soft and pliable- can be compressed to a fraction of its original shape before returning to its original shape
- Biocompatible
- Improves chance of islet transplantation success

Publications

- M. Razavi, R. Primavera, B.D. Kevadiya, J. Wang, P. Buchwald, A.S. Thakor A Collagen Based Cryogel Bioscaffold that Generates Oxygen for Islet Transplantation *Advanced Functional Materials* 20 February 2020.

Patents

- Published Application: WO2020232008
- Published Application: 20220218875
- Issued: 12,390,557 (USA)

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