Immunosuppressive gels for islet cell encapsulation and transplantation using microfluidics, *in vitro* and *in vivo*

Description

Transplantation of islets to individuals with type 1 diabetes is a treatment option for this disease. Recipients must receive long-term immunosuppressive therapies that cause severe side effects. Encapsulating islets with gels can form a barrier through which immune cells cannot diffuse and thus has the potential to circumvent immunosuppressive therapy. Currently, such islet encapsulating approaches only focus on maintaining clear grafts after transplantation by eliminating fibrotic insulation. However, gels trigger immune activation leading to the release of large numbers and types of immune components such as IgG, IgM, or IgA that can diffuse through the barrier and impair islet function. As well as this, the engraftment of islets (revascularization to the host vasculature), which is critical for their optimal function, was also not even considered with this approach. Thus, passive diffusion results in a delay of glucose-stimulated insulin secretion by at least 30 minutes, as shown in recent clinical trials.

Methods

A novel approach with novel immunosuppressive gels may solve the above challenges. The project is based on is based on the solid foundation of my previous research using droplet microfluidics to microencapsulate microtissues. These gels are biocompatible with mammalian cells, can support the glucose-responsive insulin secretory function of encapsulated human pancreatic islets, are insensitive to the immune system, can suppress immune cell recruitment and activation, can evade fibrotic isolation, can suppress human complement system activation, and can promote angiogenesis.

Environment

The state-of-the-art infrastructure across and beyond the MCB, UU ensures that we have access to all the necessary facilities to perform the proposed work.

Requirements MSc students

We are looking for enthusiastic, motivated students, who enjoy working as part of a team as well as independently. Ideally, candidates have some previous practical lab experience or are interested in learning methods in organic chemistry and hydrogel for biomedical applications.

Please send us a short description of your relevant work experience, your CV, and your motivation if you are interested in doing a research project in this program for your degree. Please also indicate the period during which you are available.

Contact

Researcher: Hongji Yan

E-mail: hongji.yan@mcb.uu.se

Key references

S. Chen et al **H. Yan*** (2023) Bioact. Mater. **25:**176
M Kretschmer et al and **H. Yan*** (2022) *Adv. Sci*, 2203898
H. Yan* et al (2021) *Adv. Func. Mater*, **31**:42,2203898
J. Kun, **H. Yan** et al (2021) *Adv. Func. Mater*, **31**:10, 2008428
H. Yan et al (2020) *ACS Appl. Mater. Interfaces.*12:17, 324
H. Yan et al (2019) *Adv. Func. Mater*, **29**:46,1902581