Balanced charged immune-evasive hydrogel for type 1 diabetes treatment

With the support by the Excellent Young Scientists Fund and Tianjin University, the research team led by Prof. Zhang Lei (张雷) at the Department of Biochemical Engineering, School of Chemical Engineering and Technology, Tianjin University, developed a new balanced charged immune-evasive hydrogel for rapid and long-term glycemic control, which was published in *Advanced Function Materials* (2019, 29: 1900140).

Type 1 diabetes mellitus (T1DM) is a chronic epidemic afflicting over 30 million people worldwide. Multiple daily exogenous insulin injections are the common treatment for patients with T1DM, but inevitably bring a lot of pain to patients. In addition, this method cannot dynamically respond to the changes in blood glucose concentrations and even cause serious complications. Transplantation of encapsulated islets is a very promising strategy since it can help to achieve dynamical blood glucose control. However, its long-term clinical therapeutic efficacy is still seriously hindered by the host immune rejection to the implanted materials. Currently, very limited biomaterials can completely avoid the foreign body reaction (FBR). Thus, the development of encapsulation biomaterial that can evade *in vivo* immune recognition and FBR is still a great challenge.

To address this issue, Zhang's group developed an anti-biofouling hydrogel based on a balanced charge strategy. This balanced charged hydrogel not only possessed excellent antifouling properties *in vitro* but also could effectively mitigate the FBR and inhibit capsule formation for at least 3 months in a mice model. This finding was published in *ACS Applied Materials & Interfaces* (2018, 10: 6879—6886).

More excitingly, they found that this balanced charged hydrogel also enabled highly efficient islet encapsulation, *in vivo* immune evasion, and rapid and long-term blood glucose control. After intraperitoneal transplantation of islets encapsulated by this hydrogel, 100% of the recipient mice could rapidly recover to normal blood glucose level within 2 days and remain stable for at least 150 days without any immunosuppression treatment. In contrast, the pristine alginate hydrogel sample required 5 to 7 days to achieve blood glucose control, and could just maintain for ~20 days. This new balanced charged anti-biofouling hydrogel is also low-cost and has a great potential to be widely used in the biomedical and healthy field, including cell therapy and tissue engineering.

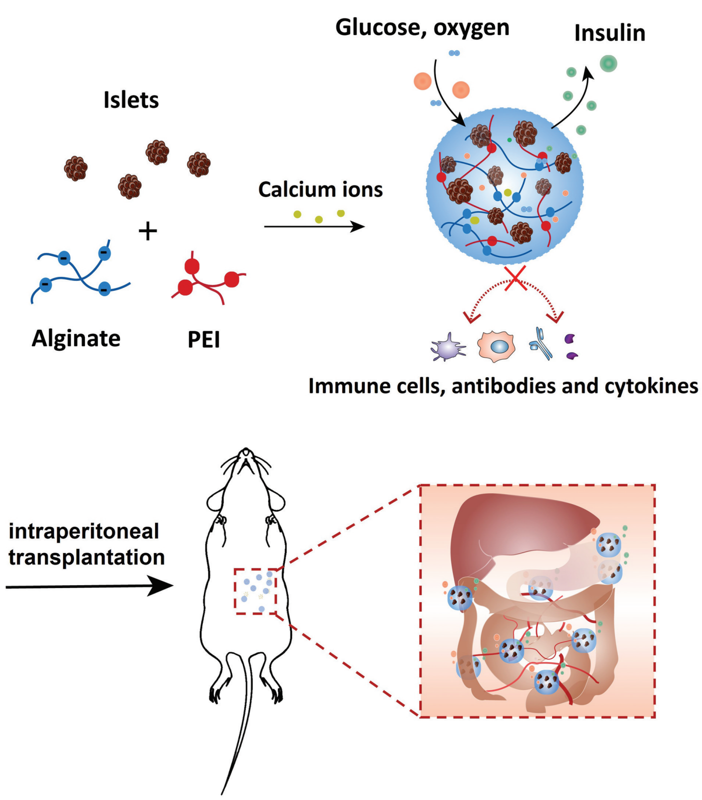

Figure Scheme demonstrating the encapsulation of islets using a balanced charged hydrogel for immunoprotection and glucose-responsive insulin secretion after intraperitoneal transplantation in diabetic mice.