INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Immune Isolating Device With Improved Diffusion

TECHNOLOGY NUMBER: 2024-096

Technology ID
2024-096

Category
Medical Devices
Research Tools and Reagents
Therapeutics and Vaccines
Life Sciences

Inventor
Ariella Shikanov
Margaret Brunette
Delaney Sinko

Further information
Aparna Bubna
abubna@umich.edu

Innovation Partnerships Tech Marketing Team
IPInventions@umich.edu

View online

OVERVIEW

Dual-layer hydrogel capsule for immune-isolated ovarian grafts

- Enhances nutrient diffusion and mechanical resilience
- Useful for ovarian graft health, fertility preservation, transplantation medicine

MODALITY

Implantable hydrogel capsule

INDICATION

Ovarian tissue grafting for fertility preservation and transplantation

PUBLICATIONS

- "Encapsulated Allografts Preclude Host Sensitization and Promote Ovarian Endocrine Function in Ovariectomized Young Rhesus Monkeys and Sensitized Mice"
- "Encapsulation of ovarian allograft precludes immune rejection and promotes restoration of endocrine function in immune-competent ovariectomized mice"

INTELLECTUAL PROPERTY

- US10918673 "Immunoisolation device"
- US11786560 "Immunoisolation device"

BACKGROUND

The need for effective ovarian tissue grafting is critical for fertility preservation, especially for cancer patients and those undergoing treatments that affect ovarian function. Traditional approaches have faced challenges, such as immune rejection and insufficient nutrient diffusion, compromising graft viability. Previously, single-layer hydrogel capsules have been used, but their utility was limited by poor nutrient diffusion and mechanical stability under physiological conditions. These shortcomings necessitate an improved method to ensure the long-term health and functionality of ovarian grafts. Innovations in biomaterials and tissue engineering offer new opportunities to address these challenges by enhancing both the mechanical resilience and biological functionality of the encapsulating materials.

INNOVATION

Researchers have developed a dual-layer hydrogel capsule incorporates thermosensitive gelatin microgels to enhance the immune isolation and nutrient diffusion for ovarian graft tissue. These microgels are embedded into the outer shell during crosslinking and melt upon implantation, forming micron-scale pores that improve nutrient flow. In vitro tests have demonstrated increased small molecule diffusion and enhanced mechanical resilience to strain with this new design. Ongoing mouse studies aim to evaluate the biocompatibility and functionality of the capsules over both short and long-term periods. Real-world applications include improved methods for ovarian tissue grafting, offering better outcomes in fertility preservation and transplantation medicine, with potential to expand to other types of tissue grafts needing immune isolation and enhanced nutrient access.