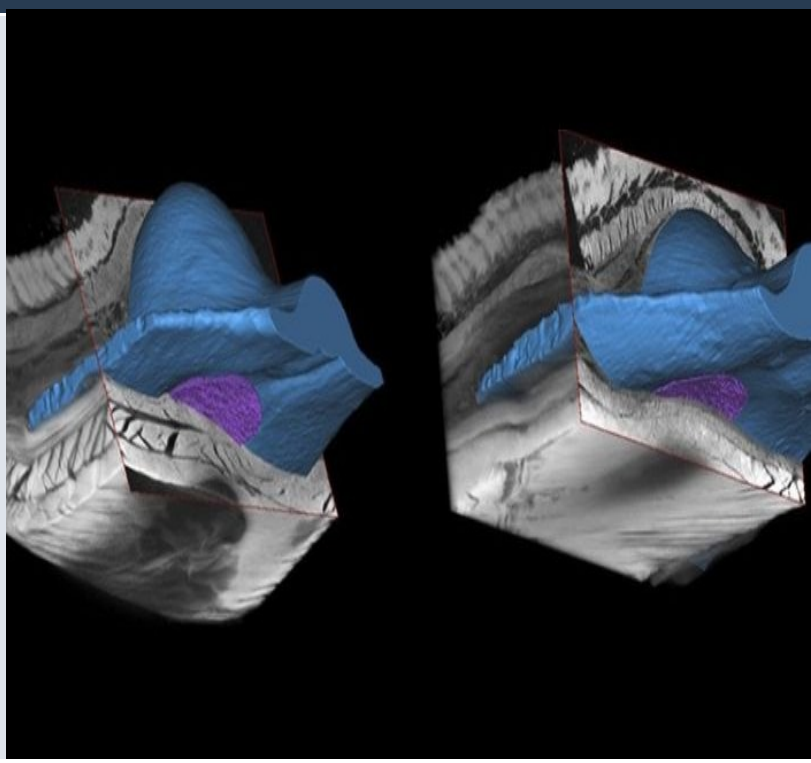
An Actuatable Soft Reservoir to Prevent Host Foreign Body Response

Biod A milliscale dynamic soft reservoir (DSR) for implantable medical devices egradab



Objective

Seeking Licensing Opportunities
or Development Partner

Research and IP Status

Patent application submitted

Patents

US patent no. US 62/867,927

European patent application no. EP19187842.0

Background

The long-term performance of implantable medical devices is drastically limited by complex and unpredictable foreign body responses (FBRs). Medical devices that depend on an interface with native tissue such as neural probes, indwelling catheters, mammary implants, drug and cell delivery devices etc, - are particularly vulnerable.

Once a device is implanted, a complex series of events is initiated to protect the host from the foreign body. This dense fibrous capsule can impair the function of implanted devices by obstructing diffusion (drug/cell delivery devices and biosensors) or causing capsular contracture (breast implants). Soft robotic technologies are highly suited to medical applications involving human interaction because of their inherent conformability and ability to achieve biomimetic motion.

Tech Overview

Here, NUI Galway present a milliscale dynamic soft reservoir (DSR) that uses mechanical oscillation to modulate the biomechanics of the biotic-abiotic interface by perturbing fluid flow and cellular activity.

The researchers performed cyclical actuation of the DSR in a preclinical rodent model. Evaluation of the resulting host response showed a significant reduction in fibrous capsule thickness ($P = 0.0005$) in the actuated DSR compared with non-actuated controls, whereas the collagen density and orientation were not changed. The researchers also show a significant reduction in myofibroblasts ($P = 0.0036$) in the actuated group and propose that actuation-mediated strain reduces differentiation and proliferation of myofibroblasts and therefore extracellular matrix production.

Figure 1

Figure 2

An actuatable soft reservoir modulates host foreign body response. Dolan et al. Science Robotics 28 Aug 2019:Vol. 4, Issue 33, eaax7043

Applications

Applicable to any implanted device in the areas of:

- Modulation of foreign body response
- Therapeutic delivery
- Diabetes

Benefits

- FDA-approved materials
- Low-cost
- Actuation can be modulated
- Minimally-invasive delivery
- Drug-free approach to overcome fibrosis
- Highly versatile design

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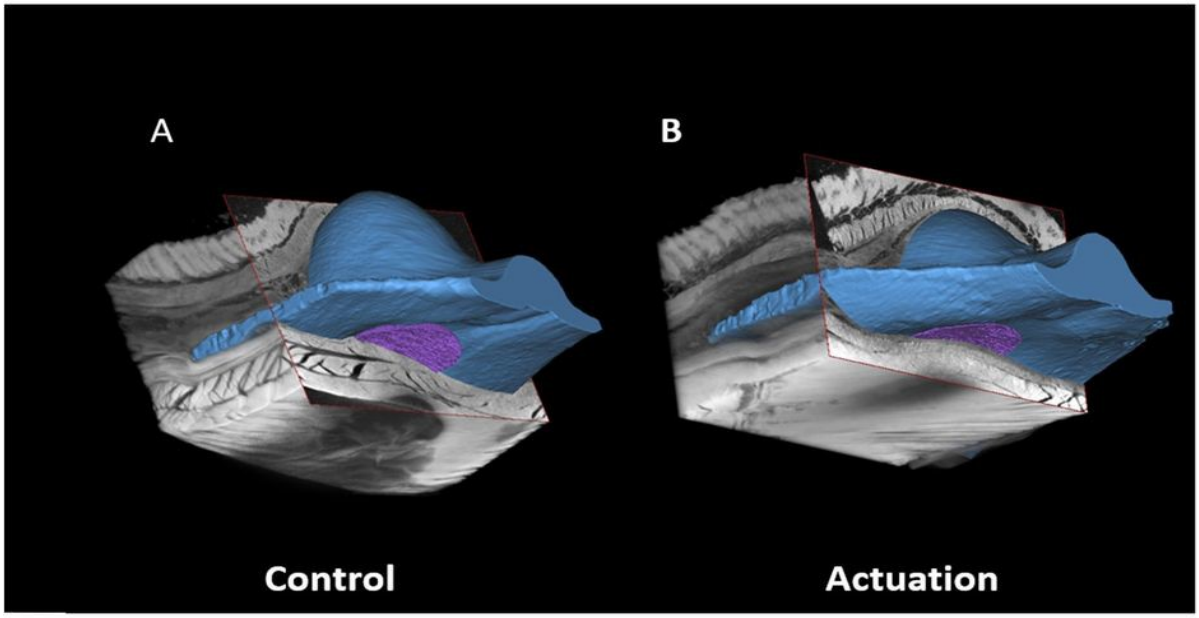
Appendix 1

Figure 1

DSR reduces the fibrous capsule thickness in vivo. Mimics reconstruction of soft tissue stained with PMA and imaged with microCT, where the DSR is shown in blue and the quantified segment of the fibrotic capsule is shown in purple.



Appendix 2

Figure 2

Nonporous configuration of the DSR for foreign body modulation for implantable devices.