materials-driven regeneration

- Wednesday December 8th, 2021 -

- 4:00pm (CET) -

MDR colloquium December 2021

Online – Teams meeting

The Research Center for Materials-Driven Regeneration (MDR) is proud to present a series of lectures (monthly). The MDR Gravitation program is a partnership between Eindhoven University of Technology, Maastricht University and Utrecht University, University Medical Center Utrecht and the Hubrecht Institute. MDR brings together materials scientists, cell biologists, tissue engineers and medical scientists to jointly work on the regeneration of tissue and organ function with intelligent, life-like materials.

1) Uncovering stem cell-based corneal regeneration using nanomaterials and multimodal imaging

2) Targeting mechanosensitive ion channels to guide biomaterial driven stem cell behaviour.

1) Stem cell therapies have shown great promise and currently they are in use in over 3000 active clinical trials. However, only 3 stem cell therapies have received market approval within the EU. One of the major factors hindering development of stem cell therapies is the lack of knowledge of cell biodistribution and survival after delivery. In this project we are developing a nanoparticle system with multimodal imaging capabilities to label and track stem cells in vivo. The cornea will be the system in which we use this approach, due to its accessibility for live imaging and its optical properties. The epithelium of the cornea is constantly being renewed from a stem cell population found at the limbus, on the border between the cornea and the conjunctiva. Loss of these limbal epithelial stem cells (LESCs) results in a disease known as limbal stem cell deficiency (LSCD). In the first approved stem cell-based therapy in Europe (Holoclar®), stem cells are sourced from a limbal graft taken from the healthy eye of the affected individual, and are expanded in vitro before transplantation to the affected eye on a fibrin sheet. Using a model of LSCD we look to demonstrate the capabilities of our nanoparticle system to track stem cell fate over time after delivery.

Dr. Darragh Crosbie

MERLN Institute for Technology-Inspired Regenerative Medicine

2) It is well known that cells 'sense' the mechanical nature of their environment and this can lead to specific cellular responses. It has recently been shown that calcium ion channels effect stem cell differentiation in response to various stimuli including shear stress, hydrostatic pressure and substrate stiffness. These ion channels include the TRP and Piezo families of proteins and are expressed across multiple cell types. In this project we are using a tuneable hydrogel system to investigate the effect of mechanosensitive ion channel inhibitors on stem cell response to substrate stiffness. Further, we hope to use this information to affect stem cell differentiation or proliferation in biomaterial systems.

The Structure/Function of Articular Cartilage: Implications for Regeneration and Restoration.

In developed countries, joint pain is the most common reason for patients to seek medical care. Most often this is because they suffer from osteoarthritis (OA). Although OA, also known as "degenerative joint disease," involves all tissues of the synovial joint, the primary damaged tissue is the articular cartilage (AC). Even after half a century of efforts to restore and regenerate AC, no satisfactory treatments are currently available. This may be due to the unique structure and function of AC tissue. In this talk, this unique quality will be explained, and its development explored. The implications for tissue regeneration will be highlighted and our attempts to mimic this structure/function relationship with synthetic biomaterials presented.

Prof. Keita Ito

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