

Master assignment:

Injectable hydrogels for chondrogenesis of nasal chondrocytes

Supervisor: Prof. Dr. Marcel Karperien

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Project description:

Osteoarthritis is a degenerative joint disease that affects millions of people worldwide, and vast efforts have been made to intensively study this disorder to develop effective treatments. One of the promising regenerative therapies is intra-articular injection with *in situ*-forming hydrogels as fillers of focal cartilage defects which can emulate the cartilage environment and promote cell proliferation, and extracellular matrix formation. Human nasal chondrocytes (NCs) have recently been considered as an alternative to articular chondrocytes (ACs) since they have fast proliferation and produce typical collagen types in the articular cartilage. In the previous work, a hybrid hydrogel including dextran (Dex) hyaluronic acid (HA) and chondroitin sulfate (CS) was shown to improve chondrogenesis of NCs in the free-swelling scaffold compared to ACs offering the potential to employ this cell type for cartilage regeneration. However, the results were only representative of one donor, thus testing on various NC donors is required to accurately validate those data and draw a conclusion.

Assignment objectives:

This master assignment will focus on investigating and comparing the chondrogenic activities of different NC donors encapsulated in injectable hydrogels. Particularly, the student will prepare the cell-laden hydrogel scaffolds and culture them in a differentiation medium. Then, the culture media and scaffolds are collected at specific time points for analysis. The student will have at least 3 donors to test.

Laboratory technique involved:

- Cell culture techniques (particularly for primary chondrocytes)
- Hydrogel preparation
- Physical characterization of hydrogel using a rheometer
- RNA isolation and RT-qPCR from encapsulated cells
- Fixing and cryosectioning scaffold for histology and immuno-staining (fluorescence/histochemistry)
- Imaging using a fluorescence/confocal microscope, slide scanner
- Biochemical assays to quantify protein deposition, cell viability

The assignment should start in (from) September 2025.

If you are interested in the project, please contact n.x.t.le@utwente.nl for more information!