

Injectable Hydrogels for VHH Antibodies Delivery in Osteoarthritis Treatment

MASTER THESIS PROPOSAL

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PROJECT DESCRIPTION

Osteoarthritis (OA) is a debilitating joint disorder characterized by cartilage degradation and inflammation. Single-domain antibodies, known as VHHs, have shown promise in OA therapy due to their high specificity and affinity towards targets associated with cartilage degradation. This research proposes the development of injectable hydrogels based on hyaluronic acid (HA) and dextran (Dex) polymers as a delivery platform for VHH antibodies to promote joint homeostasis. The study will primarily focus on *in vitro* assessments to evaluate the efficacy, stability, and compatibility of the developed hydrogels for VHH delivery.

PROJECT OBJECTIVES

The master student will focus on:

- 1. Synthesis and Characterization of the Injectable Hydrogels:** Prepare the hydrogels using established protocols and characterize the physical properties of the hydrogels, including mechanical strength, swelling behavior, and degradation kinetics.
- 2. VHH Antibody Conjugation:** Conjugate VHH antibodies to polymers using established protocols and evaluate the conjugation efficiency and target binding affinity.
- 3. Release Kinetics:** Establish *in vitro* release profiles of VHH antibodies from the hydrogels and evaluate factors influencing release kinetics, such as hydrogel composition, crosslinking density, and VHH loading.
- 4. *in vitro* disease model assesment:** Conduct rigorous *in vitro* assays using relevant cell lines and organ-on-chip models to evaluate the VHH-conjugated hydrogels. Assess the efficacy of released VHHs in an *in vitro* disease model.

Laboratory Techniques that the Master's student will acquire:

VHH-polymer coupling, SDS-PAGE, ELISA, SPR, hydrogel synthesis, cell culture, and imaging techniques.

Competences/Skills:

Problem-solving, experimental design, planning and execution of experiments, data recording, data analysis, presentation to expert and non-expert audiences, scientific writing, and teamwork.

If you are interested of being part of the Developmental Bioengineering Group please contact a.c.serranolarrea@utwente.nl

