



Biocompatible and bioactive hydrogels for biomedical applications

Description

Cells are embedded in extracellular matrix gels whose molecular composition and material properties differ from organ to organ. These gels not only accommodate cells to construct functional tissues but also provide physiochemical and physiological biological cues to the cells to ensure their activity and optimal function¹.

Synthetic bioactive hydrogels that could reconstruct such microenvironments *in vitro* or *in situ* have a wide range of biomedical applications, including tissue regeneration and regenerative medicine. These bioactive hydrogels can be developed by conjugating bioactive motifs to polymers or using bioactive polymers to construct hydrogels. The conjugation chemistry and assembly of the hydrogels are achieved through 'clickable' chemistry and 'bioorthogonal' chemistry, which was awarded the 2022 Nobel Prize in Chemistry², our enzyme-triggered green chemistry.

This master thesis aims to develop such synthetic bioinspired hydrogels and explore the relationship between the material properties and their functions, in Prof. Zhou's lab, at KTH Royal Institute of Technology, together with colleague from KI Karolinska Institutet.

Methods

Conjugation chemistry is carefully designed to achieve selectivity and high yield. The degree of modification is characterized using advanced technologies, including attenuated total reflectance-fourier transform infrared spectroscopy (ATR-FTIR). Nuclear magnetic resonance spectroscopy (NMR). Material properties are characterized by rheometer and electron microscopy. Biocompatibility and bioactivity of gels will be characterized using a human cell line and primary cell model.

Environment

You will be hosted in the division of glycoscience, in the school of biotechnology of KTH (Stockholm, Sweden). Joint supervision between KTH Royal Institute of Technology and KI Karolinska Institutet provides the student with dynamic, international, and multidisciplinary research teams.

Requirements MSc students

We are looking for enthusiastic, motivated students, who enjoy working as part of a team as well as independently. Ideally, candidates have some previous practical lab experience or are interested in learning methods in organic chemistry and hydrogel for biomedical applications.

Please send us a short description of your relevant work experience, your CV, and your motivation if you are interested in doing a research project in this program for your degree. Please also indicate the period during which you are available.

Contact

Prof. Qi Zhou <https://www.kth.se/profile/qi>
E-mail: qi@kth.se

Albanova University Center Stockholm 106 91,
KTH Royal Institute of Technology,
Stockholm, Sweden

1. Blache, U., Stevens, M. M. & Gentleman, E. Harnessing the secreted extracellular matrix to engineer tissues. *Nat Biomed Eng* (2020) doi:10.1038/s41551-019-0500-6.
2. Kaushal, J., Singh, S., Nautiyal, D., Rao, G. K. & Singh, A. K. Themed collection Bioorthogonal and click chemistry: Celebrating the 2022 Nobel Prize in Chemistry. *New J. Chem.* (2022).