Institute for Bioprocessing and Analytical Measurement Techniques
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- Master thesis for 6 months -

Characterization and modulation of modified magnetic nanoparticles: Improvement of platelet labeling

During the clinical treatment of patients with thrombocytopenia or platelet function defects, platelet concentrates (PC) are transfused to prevent bleeding or to treat bacterial infection.[1] To distinguish transfused platelets from the patient's own after PC transfusions, platelets are labeled with magnetic nanoparticles (MN) because these magnetically labeled platelets can be visualized *in vitro* by magnetic resonance imaging. Platelet labeling efficiency is further enhanced when particles are conjugated with proteins like human serum albumin (HSA)[2] and binding pathways of particles during platelet labeling[3] has been determined. However, the large variety of binding forces between particle and platelet was observed while the aggregation of particles seems to occur which may impair platelets. This limitation may be due to the original character of magnetic nanoparticles such as their shape/size, morphology and also the type of proteins conjugated on the surface of the particles.

Aim of the master thesis:

To further improve platelet labeling, Dr. Jörg Schemberg synthesizes magnetic nanoparticles with different shapes/morphology and narrows size distribution of the nanoparticles. However, characteristic of these particles when interacting with human blood platelets is unknown. The main topic of the thesis is to characterize and modulate these protein-conjugated magnetic nanoparticles when they interact with human blood platelets.

Work packages of the master thesis:

The master student will

- Coat these particles with different proteins like human serum albumin (HSA) or fibronectin.
- Determine concentration of MN that human blood platelets can uptake by atomic absorption spectroscopy (AAS) and critical concentration of protein required to coated MN by single-particle force spectroscopy based atomic force microscopy (AFM).
- Clarify the uptake pathway and binding targets between particles and platelets by AFM and 2-photon manipulation.
- Quantify if blood platelet activated after uptaking particles by FACS (in cooperation with the University of Greifswald).

Profile of qualification and further requirements

Student of chemistry, biology, biochemistry or biotechnology with a strong tendency to work with biology and technical platforms. Deadline for the application is 20.10.2019. It is possible to be financially supported by iba.

Contacts

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[1] F. Gärtner et al. *Cell* **2017**, 171, 1368−1382.
[2] K. Aurich, et al. *Nanomedicine-Nanotechnology Biology and Medicine* **2012,** *8*, 537-544.
[3] T-H. Nguyen, N. Schuster, A. Greinacher, K. Aurich *Appl. Mater. Interfaces* **2018**, 10, 34, 28314-28321.