

## Master Students Research Project

### Peptide-based dual probes for targeted molecular imaging of tumor angiogenesis

Noninvasive imaging of the expression of endothelial cell surface markers or adhesion-promoting molecules *in vivo* represents an opportunity for identifying early signs of tumor angiogenesis, arthritis and inflammation as well as atherosclerosis. We are particularly interested in E-selectin, a cell adhesion molecule which is induced on the surface of endothelial cells in response to inflammatory cytokines. E-selectin is upregulated in proliferating endothelial cells and its overexpression was colocalized with dividing microvascular endothelial cells in tissues with active angiogenesis. Therefore, imaging of the E-selectin expression *in vivo* can be an attractive approach to detect tumor angiogenesis and inflammation-mediated diseases.

In collaboration with the group of Dr. Jessica Gätjens we intend to develop peptidic bimodal probes that will allow *in vivo* mapping of E-selectin expression by combined Ultrasound (US)/Magnetic Resonance (MR) and Near-Infrared (NIR)-fluorescence imaging and allow for translation in between these different complementing imaging modalities.

The proposed Master research project will involve:

- The solid-phase synthesis (using an automatic peptide synthesizer), the purification (by reverse-phase HPLC) and the characterization (by mass spectroscopy: ESI-MS or MALDI-MS) of the peptide conjugates containing a NIR fluorophore and a reactive group for subsequent coupling to both imaging media (US and MR). This work will be carried out in ITQB.
- The coupling of the pure peptide conjugates to both imaging media, superparamagnetic iron oxide nanoparticles (USPIOs) for MR and gas-filled microbubbles for US, and posterior characterization of the new particles with different analytical methods tailored to the specific contrast agent (i.e. light microscopy, transmission electron microscopy, fluorescence spectrometry, powder XRD, ICP OES and ICP-MS measurements). This work will be carried out in the Medical Faculty of the RWTH-Aachen University (Germany).
- Preliminary “*in vitro*” studies of their binding affinities and their specific targeting properties. This task will also be developed in Germany.

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