Title:

Next-Generation in vivo Imaging in the Short-Wave Infrared (SWIR)

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Biosketch

Dr. Oliver Bruns was the first independent group leader (PI) to be recruited to the Helmholtz Pioneer Campus. Since January 2019, he is also the head of an Emmy Noether Reserach Group. Prior to this, he was a research scientist at the Massachusetts Institute of Technology (MIT) in the group of Prof. Moungi Bawendi and was a postdoctoral fellow with a long-term fellowship from the European Molecular Biology Organisation (EMBO). In Germany, his last position was as research associate at the Heinrich-Pette-Institute, Leibniz Institute for Experimental Virology, in Hamburg. He completed his doctoral thesis under Prof. Ulrike Beisiegel (meanwhile President of the Georg-August University Göttingen) at the University Medical Center Hamburg-Eppendorf with a scholarship from the German National Academic Foundation. He studied biochemistry and molecular biology at the University of Hamburg.

Vision

Short-wave infrared region (SWIR) is the future of optical imaging.

My vision is that in 10 years, SWIR imaging is going to be the gold standard for preclinical and clinical imaging. Every research center and every major clinic will have SWIR detection systems and use novel contrast agents like the ones which I plan to develop with my team and collaborators. This new generation of optical imaging techniques will enable preclinical contact-free imaging in awake and behaving mice and in the future clinical imaging with single cell sensitivity and penetration depth up to centimeters.

Research

The research of our group is dedicated to the development of excellent techniques for biomedical imaging. The advancement of new targeted contrast agents and novel imaging modalities will pave the way for personalized therapy and high precision treatments in the near future. Imaging in the short-wave infrared region (SWIR) is a new technology for biomedical applications. It provides several advantages over the visible and near-infrared regions: general lack of autofluorescence, low light absorption

by blood and tissue, and reduced scattering. In this wavelength range tissues become translucent. Recent progress in detection technology and the development of probes demonstrated that, in principal, SWIR imaging enables applications which were previously not feasible with any other technique. These advantages will enable new capabilities in preclinical imaging. Most SWIR imaging setups so far are used for proof of principal demonstrations only.

Our aims

To utilize the full potential, the first goal is developing novel SWIR imaging setups, which enable high-speed intravital imaging, ultra-sensitive whole animal imaging and clinical SWIR imaging.

The second goal is to develop novel bright and targeted SWIR probes for preclinical research and subsequent clinical translation for treatment and diagnosis in diabetes and oncology.