Biomedical imaging beyond the visible

Department of Functional Imaging in Surgical Oncology – NCT Dresden

Prof. Oliver Bruns

Are you ready to lead the next generation of biological imaging innovation? Join us at the FBOO, we are pushing the boundaries of optical imaging in biomedical applications. Utilizing shortwave infrared (SWIR) imaging, we have the bold vision of revolutionizing surgical procedures and empowering groundbreaking research.

Our focus

SWIR imaging (950 to 1700 nm) offers unique advantages over traditional optical imaging modalities, such as deeper tissue penetration, minimal autofluorescence, and enhanced contrast. We explore both label-free and fluorescence-based approaches to design novel imaging systems in biomedicine.

Our Offer

Be part of the future of optical imaging for clinical and research settings. Our projects provide a great opportunity for students to explore the cutting-edge field of SWIR imaging and its diverse biological applications. Additionally, you will have the chance to interact with network of international collaborators to foster knowledge exchange.

Exciting Projects Await

As part of our multidisciplinary team, you will tackle thrilling projects such as:

- Building imaging setups for label-free visualization of structures like lymph nodes and fatty tissue in clinical settings.
- Developing and testing novel SWIR contrast agents for precise tumor targeting, nerve visualization, and other essential structures.
- Designing and refining the next generation of SWIR fluorescence imaging systems to visualize these novel contrast agents.
- Applying contrast agents and SWIR imaging techniques to study physiological processes and disease progression in biological models like mice and pigs.

Are You the Perfect Fit?

We are seeking enthusiastic students with a passion for technology development and its application to biological systems. Prior exposure to coursework or practical experience in physics, chemistry, engineering, or biology is desired. Strong collaborative skills, effective communication in multidisciplinary teams, and a proactive attitude towards learning and applying new techniques are essential qualities we are looking for.

Don't miss out on this opportunity to be at the forefront of biomedical imaging innovation!

Selected publications

1. In vivo NIR-II fluorescence imaging for biology and medicine. Feifei Wang, Yeteng Zhong, Oliver T. Bruns, Yongye Liang, Hongjie Dai. **Nature Photonics.** 2024 DOI: 10.1038/s41566-024-01391-5

2. Targeted multicolor in vivo imaging over 1,000 nm enabled by nonamethine cyanines. Bandi VG*, Luciano MP*, Saccomano M*, Patel NL, Bischof TS, Lingg JGP, Tsrunchev PT, Nix MN, Ruehle B, Sanders C, Riffle L, Robinson CM, Difilippantonio S, Kalen JD, Resch-Genger U, Ivanic J, Bruns OT*, Schnermann MJ*. **Nat Methods**. 2022. PMID: 35228725 DOI: 10.1038/s41592-022-01394-6

3. Shortwave infrared polymethine fluorophores matched to excitation lasers enable non-invasive, multicolour in vivo imaging in real time. Cosco ED, Spearman AL, Ramakrishnan S, Lingg JGP, Saccomano M, Pengshung M, Arús BA, Wong KCY, Glasl S, Ntziachristos V, Warmer M, McLaughlin RR, Bruns OT*, Sletten EM*. **Nat Chem**. 2020. PMID: 33077925 DOI: 10.1038/s41557-020-00554-5

4. Next-generation in vivo optical imaging with short-wave infrared quantum dots. Bruns OT*, Bischof TS*, Harris DK, Franke D, Shi Y, Riedemann L, Bartelt A, Jaworski FB, Carr JA, Rowlands CJ, Wilson MWB, Chen O, Wei H, Hwang GW, Montana DM, Coropceanu I, Achorn OB, Kloepper J, Heeren J, So PTC, Fukumura D, Jensen KF, Jain RK, Bawendi MG. **Nat Biomed Eng**. 2017.
PMID: 29119058 DOI: 10.1038/s41551-017-0056

5. Bright Chromenylium Polymethine Dyes Enable Fast, Four-Color In Vivo Imaging with Shortwave Infrared Detection. Cosco ED, Arús BA, Spearman AL, Atallah TL, Lim I, Leland OS, Caram JR, Bischof TS, Bruns OT*, Sletten EM*. **J Am Chem Soc**. 2021. PMID: 33939921 DOI: 10.1021/jacs.0c11599

6. Absorption by water increases fluorescence image contrast of biological tissue in the shortwave infrared. Carr JA, Aellen M, Franke D, So PTC, Bruns OT*, Bawendi MG*. **Proc Natl Acad Sci U S A**. 2018. PMID: 30150372 DOI: 10.1073/pnas.1803210115

7. Shortwave infrared fluorescence imaging with the clinically approved near-infrared dye indocyanine green. Carr JA, Franke D, Caram JR, Perkinson CF, Saif M, Askoxylakis V, Datta M, Fukumura D, Jain RK, Bawendi MG*, Bruns OT*. **Proc Natl Acad Sci U S A**. 2018. PMID: 29626132 DOI: 10.1073/pnas.1718917115

8. Shortwave-Infrared Line-Scan Confocal Microscope for Deep Tissue Imaging in Intact Organs. Jakob G. P. Lingg, Thomas S. Bischof, Bernardo A. Arús, Emily D. Cosco, Ellen M. Sletten, Christopher J. Rowlands, Oliver T. Bruns, Andriy Chmyrov. **Laser & Photonics Reviews**. DOI: 10.1002/lpor.202300292

9. Development of a shortwave infrared sinuscope for the detection of cerebrospinal fluid leaks. Klein TW, Yang S, Tusty MA, Nayak JV, Chang MT, Bruns OT*, Bischof TS*, Valdez TA*. **J Biomed Opt**. 2023. PMID: 37188003 DOI: 10.1117/1.JBO.28.9.094803

10. Shortwave infrared fluorescence imaging of peripheral organs in awake and freely moving mice. Arús BA, Cosco ED, Yiu J, Balba I, Bischof TS, Sletten EM, Bruns OT. **Front Neurosci**. PMID: 37274204 DOI: 10.3389/fnins.2023.1135494