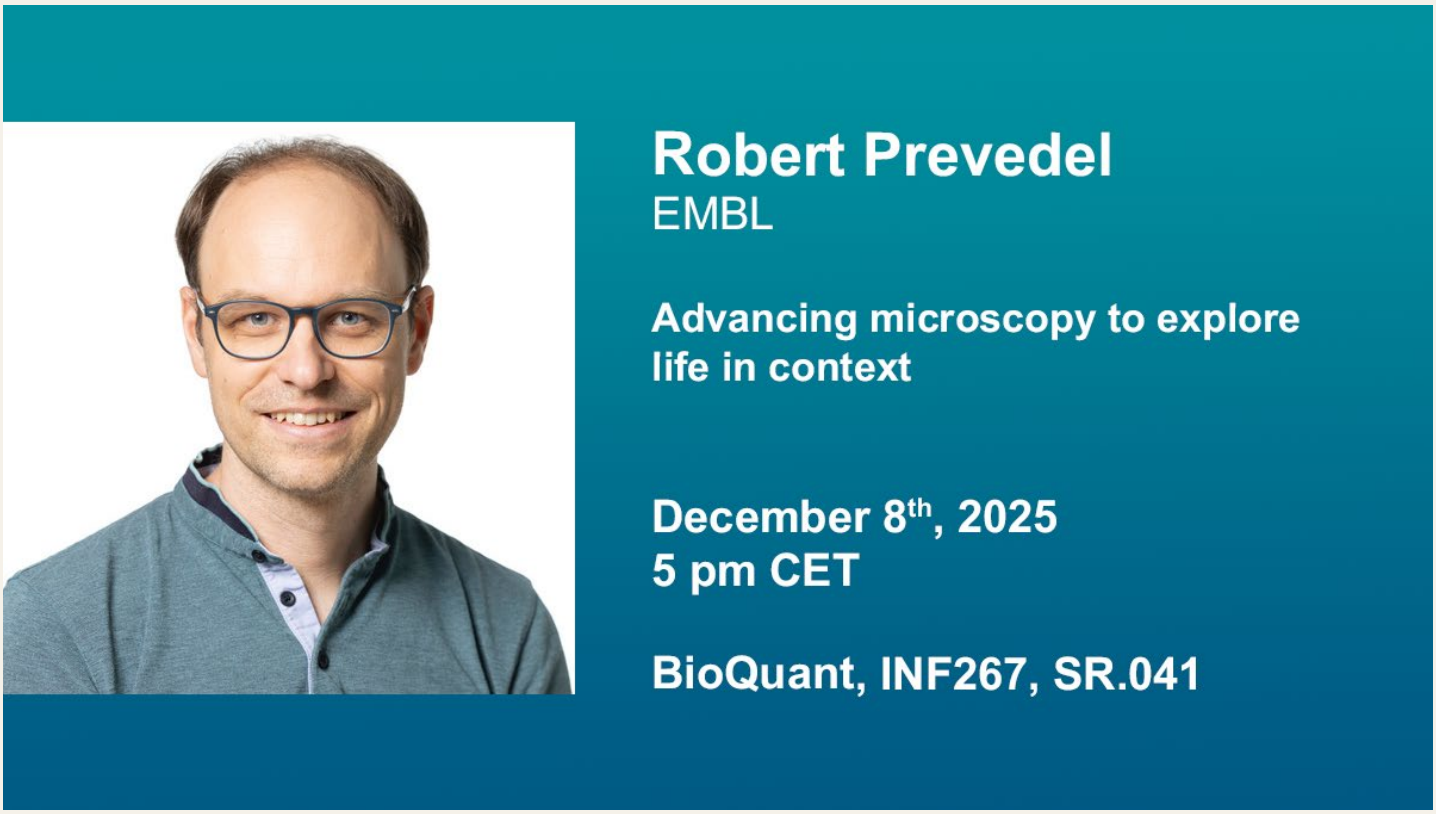
FLAGSHIP INITIATIVE
ENGINEERING
MOLECULAR SYSTEMS

UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386

COLLOQUIUM
ENGINEERING MOLECULAR SYSTEMS

ROBERT PREVEDEL will talk about **ADVANCING MICROSCOPY TO EXPLORE LIFE IN CONTEXT** in the “Engineering Molecular Systems” colloquium on **December 8th, 2025** at **5 p.m.** (CET) hosted by the Flagship Initiative Engineering Molecular Systems of Heidelberg University. The colloquium will take place at the BioQuant (Im Neuenheimer Feld 267, room SR041).



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ABSTRACT

Understanding biological processes in their native environment requires imaging approaches that combine depth, resolution, and minimal perturbation. Our group develops advanced optical technologies that extend the reach of light microscopy into intact and highly scattering tissues. A major focus is on deep brain imaging using three-photon excitation in combination with adaptive optics. This strategy mitigates both tissue scattering and sample-induced aberrations, enabling near diffraction-limited resolution at depths exceeding one millimeter in the living mouse brain. These advances allow us to visualize fine subcellular structures, such as dendritic spines, and to follow their dynamics in healthy and diseased states, including tumor progression in vivo. Complementing this structural and functional imaging, we are also pioneering Brillouin microscopy, an emerging, label-free technique that maps mechanical properties of cells and tissues in three dimensions. By exploiting the interaction of light with spontaneous acoustic waves, Brillouin microscopy enables non-invasive quantification of viscoelasticity with subcellular resolution and minimal photodamage. Together, these approaches offer a powerful window into both the structural and mechanical aspects of life in context. In this talk, I will present our latest results and discuss how our approaches open new opportunities across neuroscience, development, and disease biology.

BRIEF BIO

Robert Prevedel is a group leader and senior scientist at EMBL Heidelberg. His work focuses on new optical techniques for investigating dynamic cellular processes deep inside tissue in vivo. He graduated from the University of Vienna with a Master's in Quantum Physics and earned his PhD, also at the University of Vienna, in Quantum Optics. For a postdoctoral fellowship he moved to the University of Waterloo (Canada) to work on quantum information experiments with single and entangled photons and the development of quantum-inspired imaging tools. After moving back to Vienna in 2011, Robert worked as a senior postdoctoral researcher at the Max F. Perutz Laboratories (MFPL) and the Institute for Molecular Pathology (IMP), developing high-speed imaging methods for neuroscience applications.

Robert has been awarded several prestigious fellowships and awards, including an ERC Consolidator grant. He is a member of the Optical Society of America, SPIE (Society of Photo-Optical Instrumentation Engineers) and the International BioBrillouin Society. He was also a member of the Management Committees of COST Action Networks 'BioBillouin' (2017-2022) and 'Comulis' (2018-2023).