



INSTITUTE COLLOQUIUM

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"Quantitative biology in combination with genetics, deterministic and stochastic simulations and new instrumentation."

Quantitative insights into cells at work

Cells are self-autonomous entities that make up all units of life, and their individual well-functioning is critical for the entire organism. Focused and systemic work combined with 'omics approaches have altogether shed light on the huge diversity of the constituents present inside cells and we now start to appreciate that the challenges that are associated with understanding their interplay and complex functions can only be addressed in combination with detailed investigations of the individual constituents while they are at work, and that this analysis has to be quantitative and to occur in a physiologically relevant scenario.

The central goal of cell biology is always to integrate such information into models that provide causal descriptions of cellular processes and functions. In my laboratory we conduct cell biology research at the interface to new technologies and where we apply these to address important biological questions, from cell signalling and cell differentiation to cellular homeostasis and quality control. In this presentation I will discuss different microscopic methods that have been developed in my lab the recent years such as specialized light sheet microscopes and techniques for ultrafast imaging of fluorescence, which can be used to image the diffusion and interactions of molecules in vivo.

Progress on microscopy is always tightly linked with the development of new reporters and labeling strategies that can be used to observe individual molecules and molecular assemblies inside cells and that allow us to read out biophysical parameters. In this talk I will furthermore address basic reporter systems, from fluorescent proteins to chemically crosslinked dye-systems and how development of new probes and reporters provides opportunities for novel insights into cellular functions. Both – microscopy and reporter systems simultaneously benefit from progress in genome engineering methodology such as CRISPR/Cas, which enables efficient delivery of new probe into nearly every biological model or cell type under investigation for imaging with new microscopes. While our laboratory is working at the interface of these technologies, we always try to visualize processes that have never been seen before, through which we hope to uncover new fundamental principles. During the presentation I will discuss different examples, bridging the gap between cell-cell communication in yeast to tissue patterning in animal models.

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Seminar Hall, Chemical Sciences Block
Indian Institute of Science Education and Research
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