

# Physikalisches Kolloquium

Daniel J. Müller, ETH Zürich

»Imaging, sensing and manipulating biological nanomachines«

Einführung: Th. Schimmel

---

Every process of the biological cell relies on molecular forces that are a complex interplay of chemical, biological and physical interactions. Elucidating when and where certain interactions guide the nanoscopic machinery of the cell and how these hundreds of thousands nanomachines contribute to cell biological processes resembles deciphering a basic molecular language. Understanding this language includes describing how a nanomachine finds its ligand, how and where the ligand binds and by which mechanism the ligand switches the functional state of the nanomachine. It also includes taking parts of such nanomachines apart and to assemble them into new nanomachines to program them with novel functions. It also includes understanding how the biological cell establishes interactions that dynamically guide the assembly many different nanomachines into functionally, timely, and spatially flexible molecular factories. Here I review how modern biophysical approaches allow imaging the molecular machinery of the cell at molecular resolution, to watch these machines at work, to sense the interactions of the cellular machinery, and to direct the cellular machinery. These possibilities provide unique insight into how cells control and modulate their highly sophisticated molecular machineries and challenges physicists to tackle complex dynamic systems.

'Five challenges to bringing single-molecule force spectroscopy into the living cell' Y.F. Dufrene, E. Evans, A. Engel, J. Helenius, H.E. Gaub & D.J. Muller *Nature Methods* (2011) 8, 123-127.

'Combined activities of hydrostatic pressure and the actomyosin cortex drive mitotic cell rounding' M.P. Stewart, J. Helenius, Y. Toyoda, S.P. Ramanathan, D.J. Muller & A.A. Hyman *Nature* (2011) 469, 226-230.

'Force probing surfaces of living cells to molecular resolution' D.J. Muller, J. Helenius, D. Alsteens & Y.F. Dufrene *Nature Chemical Biology* (2009) 5, 383-390.

'Quantifying adhesive and tensile cell properties determining germ layer organization during gastrulation' M. Krieg, Y. Arboleda, P.-H. Puech, J. Kaefer, F. Graener, D.J. Muller & C.P. Heisenberg *Nature Cell Biology* (2008) 10, 429-436.

'AFM: A nanotool in membrane biology' D.J. Muller *Biochemistry* (2008) 47, 7986-7998.

---

Freitag, 11.11.2011, 17 Uhr c.t.,

KIT, Campus Süd,

Otto-Lehmann-Hörsaal, Physik-Flachbau (Geb. 30.22).

Anschließend Nachsitzung im Gastdozentenhaus „Heinrich Hertz“