TECHNISCHE UNIVERSITÄT CHEMNITZ

Sächsische Forschergruppe FOR 877
From Local Constraints to Macroscopic Transport

Symposium der Sächsischen Forschergruppe FOR 877

Donnerstag, den 24.02.2011, um 13:30 Uhr
Ort: Reichenhainer Str. 70; Neues Physikgebäude, Raum: 2/P032

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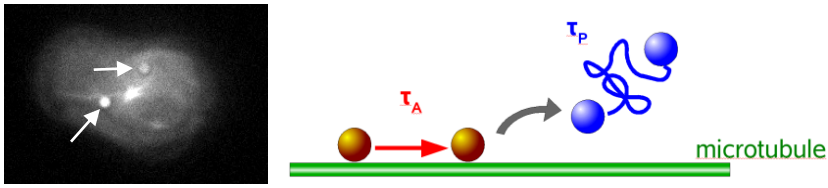
Invited Talk:

Motion Analysis Applied to Living Cells –
from intracellular transport to cellular migration strategies

Living cells exhibit exceptional dynamic properties, caused by the presence of ATP-driven motion. In particular, intracellular transport of cargos proceeds by successive phases of diffusion and active movement along microtubules via dynein and kinesin motors. While passive Brownian motion allows for intracellular transport of molecules on the nanoscale, it becomes inefficient for transport of large proteins, vesicles and organelles on the scale of a whole cell.
We developed a time-resolved identification method for motility state signatures of cytoplasmic tracers in living cells. Such an approach is both experimentally challenging and of fundamental importance for our understanding of intracellular transport processes. Our rolling-average algorithm [1] is based on the analysis of the local mean-square displacement (MSD) and the directional persistence of the tracer path, to reliably separate the active and passive motion of particles in cells. This two-state motility model yields distributions for active and passive state durations, velocities during active phases and the diffusion coefficients for passive motion. We are able to extend this analysis to sub-diffusive intracellular transport states [2] and further to motion states of the entire cell during migration. By further applying spatially and temporally defined external boundary conditions to these cells, like precisely monitored chemotactic gradients or by cell motility assays on pre-ordered 3D topologies, we induce changes in cellular function and therefore control cell migration [3].

[1] D. Arcizet, B. Meier, E. Sackmann, J. Rädler and D. Heinrich, *Phys. Rev. Lett.* **101**:248103 (2008)
[2] C. Pelzl, D. Arcizet, G. Piontek, J. Schlegel, and D. Heinrich, *ChemPhysChem* **10**:2884 (2009)
[3] E. Sackmann, F. Keber and D. Heinrich, *Annu. Rev. Condens. Matter Phys.* **1**:257 (2010)



Tracer beads (arrows) attached to microtubules in a living Dictyostelium discoideum cell (left), active microtubule-bound tracer motion of duration τ_A preceding a passive intracellular diffusion phenomenon of duration τ_P (right).

Informationen zum Vortrag erteilt Prof. Dr. Günter Radons, Tel. 0371/531-33205