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Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: **G. Ertl**
Organizers: **M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, H. Stark**

Friday, 11th February 2011, 16:00 s.t.

Prof. Dr. Thomas Pfohl

Departement of Chemistry, Universität Basel

Dead or alive at low Reynolds numbers: from single filaments to unicellular parasites

Abstract

The behavior of soft biological objects under low Reynolds numbers microflow conditions may have apart from its fundamental relevance in biology a great impact on biotechnological and chemical applications. For example, single polymeric filaments in symmetric channels with Poiseuille velocity profiles show owing to the interplay of stochastic properties of the filaments and the deterministic behavior of the flow fields interesting and surprising phenomena such as cross-streamline migration and tumbling. These effects may be used to analyze and sort individual molecules or organisms based on their mechanical properties. Motility at low Reynolds numbers is of paramount importance to cell survival and hence pathogenicity of African trypanosomes, a parasites responsible for devastating diseases in sub-Saharan Africa. Trypanosomes are found in the mammalian bloodstream and penetrate the central nervous system during late stages of African Sleeping Sickness. Our studies show that despite relatively high blood flow cell motility plays a strong role in the swimming-behaviour, induces hydrodynamic drag forces to protect trypanosomes against complement-mediated immune destruction and may influence their ability to penetrate membrane barriers. Using optical tweezing methods in microfluidic cell culture environments, we are able to analyze cellular motility in great detail and measure the forces they generate. We find that trypanosome propagation depends on cell cycle and growth of the flagellum. Moreover, the motility pattern shows a broad spectrum not only over the whole population but also on single cell level.

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