Cytoskeletal Intermediate Filaments –from Self-Assembly to Cell Mechanics

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The cytoskeleton consists of three filamentous systems, actin filaments, microtubules and intermediate filaments (IFs) and has been identified as a main player in cell mechanics. Among the three filamentous systems, IFs self-assemble in a highly hierarchical process giving rise to a very particular molecular architecture. IFs are expressed in a cell type specific manner and are thus being discussed as strong candidates for the precise definition of the different mechanical properties of different cell types. Our research focuses on the relation between molecular structure and mechanical properties of filaments and cells. I will present state-of-the art experiments and recent results on the self-assembly of the proteins into filaments and networks and their intriguing mechanical properties. The relevant length scales for these processes range between few nanometers and many micrometers. Therefore, we employ small angle x-ray scattering (SAXS), x-ray nano-diffraction, static and dynamic light scattering (SLS/DLS), fluorescence correlation spectroscopy (FCS), optical tweezers, and fluorescence microscopy. As some of these methods are inherently slow and thus provide only a low time resolution, we combine the observation techniques with microfluidics to obtain in situ data.

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[2] S. Köster, D. Weitz, R. Goldmann, U. Aebi, H. Herrmann, Curr Opin Cell Biol, 32, 82 (2015)