

Physics of dynamic living matter

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Living cells and their environments are examples of highly dynamic matter. For example, intracellular transport is based on diffusion, but also on active transport by molecular motors. Furthermore, the structure of a cell, its chemical content and also its mechanical properties can adapt at the timescale of seconds to minutes to external stimuli. Living cells also dynamically shape their extracellular surroundings. Hence, cells can be regarded as perfect examples of active, dynamic matter and can provide inspiration for shaping novel materials. For example, materials that mimic the dynamic properties of cellular environments provide essential information on the physical properties of cells and multicellular systems, but can also highly valuable in microtechnological applications. Dynamic cellular microenvironments can be shaped by reversibly controlling the mechanical properties and the shape of hydrogels, e.g. also by manipulating (multi)cellular structures *in situ* by two-photon lithography. A variety of examples for such a dynamic control of cellular systems and their physical properties will be discussed.