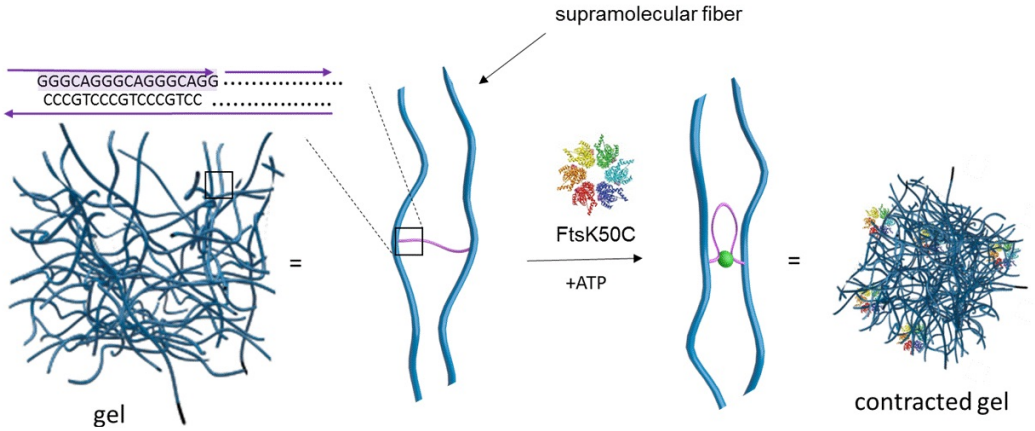
Designing artificial soft materials exhibiting mechanochemical activity

M. Vybornyi[1], E. W. Meijer[1]*

[1]Eindhoven University of Technology, The Netherlands

Herein, we explore the possibility to transfer mechanochemical activity exerted by motor proteins to a synthetic hydrogel. Water-soluble supramolecular polymers are excellent candidates for this purpose, since they possess numerous properties intrinsic to extra- and intracellular matrices – biocompatibility, tunable rheological properties, dynamic behavior of components, and adaptability to stimuli.[1] The model material in this study is a hybrid DNA hydrogel assembled from one-dimensional supramolecular polymers (structural scaffold), in which the filaments are held together by complementary DNA strands (crosslinking motifs). The supramolecular polymers consist of two kinds of co-assembled benzene-1,3,5-tricarboxamides, one of which is conjugated to a short DNA handle. The self-assembly exhibits two regimes of the supramolecular polymerization. Moreover, the usage of two components allows to adjust the dynamics and crosslinking density of the material. Based on the previous results, we foresee that such hydrogels can be rendered active, i.e. change their stiffness and exhibit spontaneous mechanical fluctuations in the presence of the DNA translocase motor protein and ATP.[2] We believe that our system can provide a convenient tool to establish design principles for the preparation of adaptive and responsible artificial soft matter. The project offers opportunities for studying the diverse properties of active materials which are difficult – if not impossible – to modulate in entirely natural objects.



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[2] O. Bertrand, D. K. Fygenson, O. A. Saleh, *Proc. Natl. Acad. Sci.* **2012**, 109, 17342-17347.