

SUMMER SEMESTER 2026

RTG 2756 CYTAC SEMINAR SERIES

TUESDAY, APRIL 21
17:00 IN HS5

CYTAC

RTG 2756

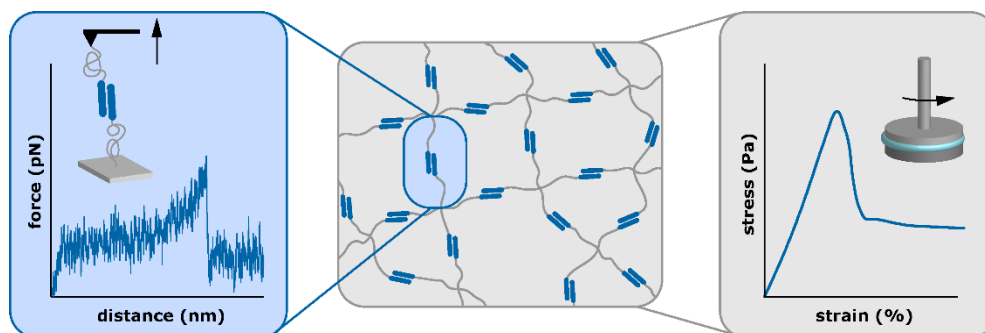
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COILED COILS AS MECHANORESPONSIVE MATERIAL BUILDING BLOCKS

Coiled coils (CCs) are ubiquitous structural motifs in biological materials, e.g., forming load-bearing elements of cytoskeleton and extracellular matrix proteins. CCs consists of two (or more) α -helices wound around each other in a superhelical fashion. This well-defined geometry, combined with sequence modularity, makes CCs attractive building blocks for bioinspired materials, where engineered CCs can serve as reversible crosslinks. Our key goal is to understand the molecular determinants of CC mechanics and to exploit this knowledge for the design of materials with molecularly encoded dynamic mechanical properties.

Using atomic force microscope (AFM)-based single-molecule force spectroscopy, we have shown that the molecular rupture forces of CCs depend on length, helix



propensity, hydrophobic core packing and pulling geometry [1-5]. Based on this knowledge, we have developed a library of CCs with tuneable thermodynamic, kinetic and mechanical properties and synthesized a series of CC-crosslinked poly(ethylene glycol)-based hydrogels [2,6,7]. We show that equilibrium thermodynamic and kinetic parameters (as well as network architecture) determine bulk viscoelastic properties in the linear viscoelastic range while molecular rupture forces correlate with bulk material failure. Our modular hydrogel platform thus provides a molecularly controlled extracellular matrix mimic for dissecting how local and global mechanical properties govern cellular mechanosensing.

[1] Goktas et al. (2018) *Chem. Sci.* 9:4610; [2] Tunn et al. (2018) *Nanoscale* 10:22725; [3] López-García et al. (2019) *Phys. Chem. Chem. Phys.* 21:9145; [4] López-García et al. (2021) *Angew. Chem. Int. Ed.* 60:232; [5] Tsirigoni et al. (2023) *Macromol. Biosci.* 23:2200563; [6] Tunn et al. (2019) *Biomimetics* 4:25; [7] Grad et al. (2020) *Front. Chem.* 8:536.