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Thermoresponsive Peptide Cross-Linkers for Injectable Hydrogels

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Computationally designed tetrameric coiled coils, ranging from 8-29 amino acids, revealed a minimum of three heptads (21 amino acids) is necessary for stable coiled coil formation, establishing a minimum sequence for the creation of building blocks to construct nanostructured material.

The designed 22-residue sequence (BNDL22) formed coiled-coil building blocks with a melting temperature of 58°C and stability across various pH values (4-11) and types and concentrations of salt, all of which are useful for applications and provide handles for designing responsiveness into a range of materials.

BNDL22 was incorporated within hydrogels as a thermoresponsive and shear-thinning cross-linker for reversibly cycling properties and enabling material processing for 3D printing and injectable applications.

Overall, through computational and experimental interdisciplinary collaboration, design rules for dimeric coiled coils were established, with a balance between design simplicity and dynamic functionality. These building blocks and the resulting responsive nanostructured materials are relevant for future use in the design and construction of molecular and nano machines.

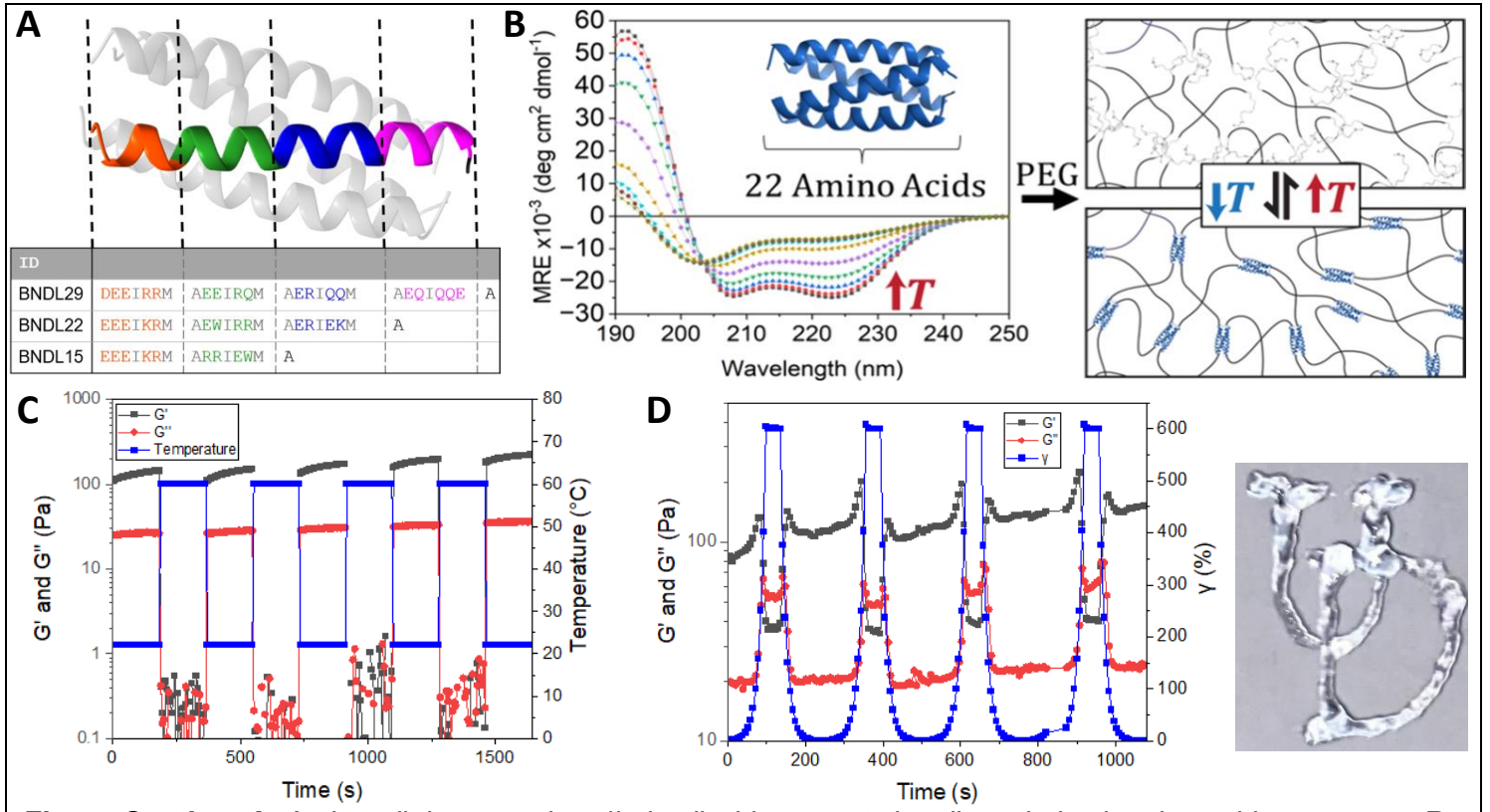

Figure Caption: A: Antiparallel tetrameric coiled coil with computationally optimized amino acid sequences. **B:** CD spectra for BNDL22 peptides demonstrating thermally responsive coiled coil formation that can be used as responsive cross-links within hydrogels. **C, D:** Hydrogel rheometry shows reversible recovery after deformation of BNDL22 cross-linked PEG hydrogels as a function of changes in temperature (C) and strain (D). Here, in (D), the materials were extruded through a syringe needle for proof-of-concept printing of 'UD'.