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Towards a comprehensive picture of temperature-responsive elastin-like peptides

Elastin-like peptides (ELPs) are biomolecules mimicking the hydrophobic repeat units of elastin, a protein providing elasticity to biological tissues such as lung, ligaments and blood vessels. ELPs undergo a hydrophobic collapse upon crossing a lower critical solution temperature (LCST). Due to their stimulus-responsive properties, ELPs are of interest for a broad range of applications including advanced biomaterials, protein purification and drug delivery. While the hydrophobic collapse is believed to be key for the elastic properties of elastin, a comprehensive mechanistic characterisation of the static and dynamic aspects of the collapse has not yet been obtained. In particular, the dynamical state within the collapsed hydrophobic domains of elastin is debated (fluid-like structure vs. a more specific stacking). By combining SANS, QENS, molecular dynamics simulations and selective deuteration, we investigate the temperature response of selectively deuterated ELPs. Neutron data indicate differences in the behaviour of short and long ELPs, and, in agreement with simulations, a shift towards more compact ELP structures with increasing temperature is observed. Using our results, we aim at establishing a framework for the investigation of stimulus-responsive molecules and materials.

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