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Probing interactions between collagen proteins via microrheology MARJAN SHAYEGAN, Department of Chemistry, Simon Fraser University, NANCY R. FORDE, Department of Physics, Simon Fraser University — Collagen is the major structural protein of our connective tissues. It provides integrity and mechanical strength through its hierarchical organization. Defects in collagen can lead to serious connective tissue diseases. Collagen is also widely used as a biomaterial. Given that mechanical properties are related to the structure of materials, the main goal of our research is to understand how molecular structure correlates with microscale mechanical properties of collagen solutions and networks. We use optical tweezers to trap and monitor thermal fluctuations of an embedded probe particle, from which viscoelastic properties of the solution are extracted. We find that elasticity becomes comparable to viscous behavior at collagen concentrations of 5mg/ml. Furthermore, by simultaneously neutralizing pH and adding salt, we observe changes in viscosity and elasticity of the solution over time. We attribute this to the self-assembly process of collagen molecules into fibrils with different mechanical properties. Self-assembly of collagen under these conditions is verified by turbidity measurements as well as electron microscopy. By comparing results from these local studies of viscoelasticity, we can detect spatial heterogeneity of fibril formation throughout the solution.

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