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Microrheology of Type I Collagen with Holographic Optical Tweezers MATTHEW CIBULA, CHRISTOPHER JONES, BO SUN, Oregon State University — Collagen proteins are the main component of the extracellular matrix which is abundant throughout the human body and integral in wound healing. These proteins form an inhomogeneous elastic material with polarized domains which respond to cellular activity. Most previous studies have considered collagen as a homogeneous elastic material and used bulk rheology to characterize its mechanical properties. However, examination with confocal microscopy reveals that the collagen fibers form an anisotropic porous material. In order to examine the structure-property consequences, we use holographic optical tweezers (HOT) to measure the local rigidity tensor with piconewton forces – the same range of forces exerted by single molecular motors. HOT enables us to position the trap in three dimensions around micron-sized beads embedded in the gel. We place a trap adjacent to a bead's equilibrium position and measure the relative displacement, using radial position tracking to record the bead's position in 2D. Rayleigh-Somerfield back propagation is implemented to measure vertical bead displacements in the gel. We use these techniques to calculate the rigidity tensor for many particles to measure the size and polarization of collagen domains.

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