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Mechanical properties of dynamic microtubule networks[1] MEGAN VALENTINE, CHARLOTTA LORENZ, BUGRA KAYTANLI, University of California, Santa Barbara — The mechanical properties of cytoskeletal networks have been studied extensively with in vitro microrheology methods to assess the effect of the composition and architecture of a network on its linear viscoelasticity, nonlinear rheology, and strength. Motor proteins have been shown to modulate mechanical response, introducing sources of athermal noise and network fluidization through driven filament sliding, while dynamic crosslinkers provide toughening and routes to self-repair. By contrast, the role of dynamic changes in filament length, which are common in cellular networks, has been largely unexplored. In this study, we demonstrate our ability to create three dimensional networks of microtubules without use of chemical stabilizers. This results in a space-spanning network of filaments that grow and shrink dynamically as a function of time. We use this platform to investigate the role of length fluctuations in determining the linear viscoelastic properties of entangled microtubule networks, as well as the ability of such networks to bear and transmit load. Using a combination of confocal microscopy and microrheology techniques, we find that the interplay between dynamic structure and mechanics plays an important role in determining the load-bearing performance of the network.

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