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Mechanical Signal Filtering by Viscoelastic Properties of Cuticle in a Wandering Spider MICHAEL E. MCCONNEY, Georgia Institute of Technology, CLEMENS SCHABER, University of Vienna, MICHAEL JULIAN, California State University Stanislaus, JOSEPH A.C. HUMPHREY, University of Virginia, FRIEDRICH BARTH, University of Vienna, VLADIMIR V. TSUKRUK, Georgia Institute of Technology — As recently found, in mechano-sensors of wandering spiders (Cupiennius salei) viscoelastic materials are important in signal filtering. We used atomic force microscopy to probe the time dependent mechanical behavior of these materials in live animals. We measured Young's modulus of a rubbery material located between a vibration receptor and the stimulus source. Earlier electrophysiological studies had demonstrated that the strain needed to elicit a sensory response (action potential) increased drastically as stimulus frequencies went below 10 Hz. Our surface force spectroscopy data similarly indicated a significant decrease in stiffness of the cuticular material and therefore less efficient energy transmission due to viscoelastic effects, as the frequency dropped to around 10 Hz. The stimulus transmitting cuticular material is acting as a high-pass filter for the mechanical stimulus on its way to the strain receptors. Again our results indicate that viscoelastic mechanical signal filtering is an important tool for arthropods to specifically respond to biologically relevant stimulus patterns.

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