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Anomalous Brownian motion and viscoelasticity of the ear's mechanoelectrical transducer[1] DANIEL ANDOR-ARDÓ, ANDREI KOZLOV, A.J. HUDSPETH, The Rockefeller University — The Brownian motion of a particle in a complex environment is known to display anomalous power-law scaling in which the mean squared displacement is proportional to a fractional power of time. Using laser interferometry and analytical methods of microrheology, we examine nanometer-scale thermal motions of hair bundles in the internal ear and show that these cellular organelles undergo fractional Brownian motion. This anomalous scaling is caused by viscoelasticity of the gating springs, elements that transmit energy in a sound to the mechanosensitive ion channels. These results demonstrate a connection between rheology and auditory physiology, and indicate that statistical properties of the thermal noise in the ear can be determined by dynamics of a small number of key molecules.

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