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Self-rheology of cell monolayers ROMARIC VINCENT, XAVIER SERRA-PICAMAL, VITO CONTE, ESTER ANON, XAVIER TREPAT, Institute for Bioengineering of Catalonia, University of Barcelona — Collective migration of cell sheets is a central feature of fundamental biological processes including morphogenesis, tissue regeneration, and cancer invasion. The dynamics of such processes are heavily determined by the rheology of the sheet and of the constituent cells. Such material properties have been extensively measured using a broad variety of rheological techniques, but none of these techniques has probed the ultraslow time scales that are central to collective cell migration, and exceed thousands of seconds. Here we present a novel approach we call 'Self rheology' that probes cell rheology using the pulses of strain rate that cells spontaneously generate. Using this approach, we show that stress and strain rate are in quadrature, thus indicating that the dominant stresses that govern collective cell migration are elastic. The monolayer's Young modulus is found to be an order of magnitude lower than the stiffness of single cells determined through active micro-rheology techniques at shorter time scales. This elastic behavior is followed by a fluidization regime at higher strains, which we interpret in terms of cell rearrangements. "Self-rheology" provides a new approach to study the dynamics of collective cellular processes at ultraslow time scales.

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