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Strain-weakening rheology of marine sponges and its evolutionary implication EMILY KRAUS, PAUL JANMEY, ALISON SWEENEY, ANNE VAN OOSTEN, Univ of Pennsylvania — Animal cells respond to mechanical stimuli as sensitively as they do to chemical stimuli. Further, cell proliferation is dependent on the viscoelasticity of the polymeric extracellular matrix (ECM) in which they are embedded. Biophysicists are therefore motivated to understand the biomechanics of the ECM itself. To date, this work has focused on the more familiar Bilateria, animals, including humans, with bilateral symmetry. The ECM of this group of animals is now understood to exhibit non-linear rheology that is typically strain- and compression-stiffening, and shear moduli that are frequency-dependent. These complex properties have been attributed to the semi-flexible nature of the underlying polymers. In contrast, we show that marine sponges are markedly strain-weakening under physiologically relevant conditions. Since sponges are a much earlier evolutionary branch than Bilateria, we interrogate the evolutionary potential and biochemical underpinnings of this novel complex rheology in filamentous networks, and cells ability to respond. Further, their life history strategy is uniquely dependent on flow and correlated shear stress, making them a model organism to study self-assembly algorithms organized around flow.

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