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Mechanical Evolution of Bacterial Films at Oil-Water Interfaces
DANIEL ALLAN, Johns Hopkins University, LIANA VACCARI, University of Pennsylvania, JIAN SHENG, Texas Tech University, ROBERT LEHENY, Johns Hopkins University, KATHLEEN STEBE, University of Pennsylvania — Bacteria can assemble at the interface between oil and water to form films that strongly affect the mechanical properties of the interface. In comparison with biofilms on solid substrates, such biofilm formation at fluid-fluid interfaces has been the subject of relatively little study. The microstructure of the films, which can include not only packings of bacteria but macromolecular surfactants secreted by the bacteria and the remains of dead bacteria, resembles a quasi-two-dimensional colloidal suspension in a polymer solution. We have characterized the mechanical response of bacterial films at oil-aqueous interfaces during their formation via passive microrheology and pendant drop imaging. With increasing age, the films undergo a transition from a viscous to an elastic interfacial shear rheology and eventually acquire a bending rigidity. These findings will be discussed in terms of viscoelstic models and in the context of the active nature of the bacteria in the films and in the adjoining aqueous suspension.

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