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Impact of Motile Bacterial Suspensions on Viscous Fingering and Mixing JANE CHUI, Massachusetts Institute of Technology, HAROLD AURADOU, Université Paris-Sud, PIETRO DE ANNA, Université de Lausanne, KAREN FAHRNER, HOWARD BERG, Harvard University, RUBEN JUANES, Massachusetts Institute of Technology — Viscous fingering is a hydrodynamic instability that occurs when a less viscous fluid displaces a more viscous one. Instead of progressing as a uniform front, the less viscous fluid forms fingers to create complex patterns. Understanding how these patterns and their associated gradients evolve over time is of critical importance in characterizing the mixing of two fluids, which in turn is important to applications such as enhanced oil recovery, bioremediation, and microfluidics. Here, we investigate the impact of replacing the less viscous fluid with an active suspension of motile bacteria. In this series of experiments, a suspension of motile *Escherichia coli* capable of collective swimming is injected into a microfluidic Hele-Shaw cell under viscous fingering conditions. Through videomicroscopy, we obtain high-resolution concentration fields to determine the evolution of the mixing zone (region with concentration gradients). We quantify the impact that active suspensions have on the formation of viscous fingering patterns and mixing efficiency between the two fluids, and—conversely—report details of the collective swimming behavior in the presence of a viscous-gradient front.

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