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Bacterial trapping in shear ROBERTO RUSCONI, JEFFREY S. GUASTO, ROMAN STOCKER, MIT — Bacteria are ubiquitously exposed to flow, both in natural environments and artificial devices (e.g., catheters), where confining surfaces create non-uniform shear. While the effects of shear on passive particles are well understood, little is known about the consequences of shear on motile bacteria. We exposed bacteria having different motility strategies (e.g., run-and-tumble, run-and-reverse) to microfluidic Poiseuille flows and quantified the swimming kinematics and cell distribution in the channel using video-microscopy. We discovered that the coupling of motility and a spatially varying shear results in a dramatic trapping of motile cells in high-shear regions, and conversely a strong depletion in the low-shear portion of the channel. We demonstrate experimentally that this trapping process is robust across species such as *Bacillus subtilis* and *Pseudomonas aeruginosa*, and can have far-reaching consequences on bacterial transport, by (i) counteracting bacterial chemotactic responses; and (ii) enhancing surface attachment and thus biofilm formation by trapping cells near walls. More generally, this work shows that–despite the low Reynolds number–the coupling of flow and self-propulsion can be nonlinear and not simply a superposition of the two effects.

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