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Hindered bacterial mobility in porous media flow enhances dispersion[1] AMIN DEHKHARGHANI, NICOLAS WAISBORD, Tufts University, JÖRN DUNKEL, MIT, JEFFREY GUASTO, Tufts University — Swimming bacteria live in porous environments characterized by dynamic fluid flows, where they play a crucial role in processes ranging from the bioremediation to the spread of infections. We study bacterial transport in a quasi-two-dimensional porous microfluidic device, which is complemented by Langevin simulations. The cell trajectories reveal filamentous patterns of high cell concentration, which result from the accumulation of bacteria in the high-shear regions of the flow and their subsequent advection. Moreover, the effective diffusion coefficient of the motile bacteria is severely hindered in the transverse direction to the flow due to decorrelation of the cells persistent random walk by shear-induced rotation. The hindered lateral diffusion has the surprising consequence of strongly enhancing the longitudinal bacterial transport through a dispersion effect. These results demonstrate the significant role of the flow and geometry in bacterial transport through porous media with potential implications for understanding ecosystem dynamics and engineering bioreactors.

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