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Chemotactic decision making in swimming microorganisms M. MEHDI SALEK, MIT, JEFFREY S. GUASTO, Tufts University, ROMAN STOCKER, MIT — Swimming cells are often guided by chemical gradients ("chemotaxis") to search for nutrients, hosts, and mates, and to avoid predators and noxious substances. It remains unclear, however, how variable the chemotactic abilities of cells are among cells of one species, and whether there are better "decision makers" within a population. Inspired by studies in macro-organism ecology, we fabricated a microfluidic "T-maze" in which marine bacteria are subjected to a chemical attractant gradient at each of a series of consecutive T-junctions. We used video microscopy to capture the motion of thousands of bacteria as they migrate up or down the gradient at each subsequent junction. This approach provides detailed statistics at both the single-cell and population levels, while simultaneously sorting the cells by chemotactic ability. Using a range of bacteria, we demonstrate how the microfluidic T-maze allows us to sort the better decision-making cells in the population, opening the door for improved efficiency of a range of microbial processes in nature and industry.

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