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**Bacteria foraging in turbulent waters** JOHN TAYLOR, MIT, WENBO TANG, ASU, ROMAN STOCKER, MIT — Marine bacteria are the Ocean's recyclers, contributing to as much as 50% of the productivity of the marine food web. Bacteria forage on patches of dissolved nutrients using chemotaxis, the ability to swim up chemical gradients. As turbulence is ubiquitous in the Ocean, it is important to understand how turbulent flow conditions affect bacterial foraging. We used three-dimensional, isotropic direct numerical simulations coupled with a bacterial transport equation to address this problem. After the flow is continuously forced until it reaches a steady state, microscale nutrient patches are injected into the turbulent flow, and stirring produces thin nutrient filaments. Two populations of bacteria compete against each other: one population is motile and chemotactic ('active'), the other is non-motile ('passive'). The distribution of both populations is initially uniform. Chemotaxis allows active bacteria to cluster near the center of the nutrient filaments, increasing their nutrient uptake relative to passive bacteria. Increasing the turbulence intensity increases the short-term chemotactic advantage by quickly producing large gradients in the nutrient concentration, but also leads to rapid mixing of the nutrient field, which makes the chemotactic advantage short-lived. The results suggest that the evolutionary advantage of chemotaxis, based on the increase in nutrient uptake relative to the energetic cost of swimming, strongly depends on the turbulence level.

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