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**Directional swimming in bacteria: active and passive gradient responses**

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The ability to swim directionally is paramount for bacteria, in their quest for nutrients and favorable microhabitats. This ability depends on both active and passive responses to gradients. Here we bring an example from each case, based on novel microfluidic experiments that quantify the swimming behavior of bacteria. First, we describe their active response to oxygen gradients - or aerotaxis - and show the unexpected consequences of competing oxygen gradients with nutrient gradients. Then, we present the first observations of directional swimming by bacteria in response to fluid velocity gradients - or rheotaxis. Combining experiments with mathematical modeling we demonstrate that, unlike in larger organisms such as fish, rheotaxis in bacteria is passive, resulting from a previously undetected torque that originates from the chirality of the bacterial flagellum.

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