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Spontaneous and induced gait-switching in microswimmers KIRSTY Y. WAN, RAYMOND E. GOLDSTEIN, University of Cambridge — Self-propulsion by slender structures known as cilia and flagella can present a significant selective advantage. Great variability exists in the number of flagella, their beating modes, and greater still in the basal architecture whence the flagella emanate. In species of enteric bacteria, flagella bundle coherently behind a rod-shaped cell to push the organism forward, while the model alga C. reinhardtii uses two near-identical flagella to pull itself through the fluid, executing a breaststroke. In reality, neither gait is stereotypical. For free-living unicellular eukaryotes with fewflagella the question of their actuation and coordination has been receiving growing attention from theorists and experimentalists alike. Performing a comparative study across select flagellates, we demonstrate an unprecedented diversity in swimming gaits and reveal the extent to which control of flagellar motility is driven intracellularly. Stochastic bifurcations between different modes of swimming are visualised at high spatiotemporal resolution, and dynamic changes in flagellar beating shown to elicit in trajectory reorientation and responsive navigation. These insights suggest that fast transduction of signal to peripheral appendages may have evolved far earlier than previously thought.

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