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How a bacterial pathogen swims in the storm stirred up by its coral host DOUGLAS BRUMLEY, MELISSA GARREN, VICENTE FERNANDEZ, ROMAN STOCKER, Massachusetts Institute of Technology — One important cause of the worldwide demise of coral reefs is the infection of corals by pathogenic bacteria. These bacteria are always motile, yet how they land on the coral surface remains unclear. In particular, the recently discovered vortical flows produced by the coral with its epidermal cilia create a hostile hydrodynamic environment for motility and the pursuit of chemical cues. We used high-speed imaging coupled with dual-wavelength epifluorescent microscopy to track individual Vibrio coralliilyticus bacteria - known for causing coral disease - in the immediate vicinity of its host, the coral Pocillopora damicornis. By simultaneously determining the fluid velocity and bacterial trajectories, we quantified the ability of the bacteria to target the coral surface. We show that the cilia-driven flows considerably but not entirely disrupt bacterial navigation towards the coral, as a result of (i) the stirring of the chemical cues guiding the cells and (ii) the shear-induced alignment of bacteria within the flow. By enabling the direct visualization of microbial motility in ciliary flows, this system can not only provide insights into coral disease, but also serve as a model system for bacterial disease in other ciliated environments, including the human respiratory system.

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