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Limiting Speed of the Bacterial Flagellar Motor JASMINE NIRODY, University of California, Berkeley, RICHARD BERRY, University of Oxford, GEORGE OSTER, University of California, Berkeley — The bacterial flagellar motor (BFM) drives swimming in a wide variety of bacterial species, making it crucial for several fundamental biological processes including chemotaxis and community formation. Recent experiments have shown that the structure of this nanomachine is more dynamic than previously believed. Specifically, the number of active torque-generating units (stators) was shown to vary across applied loads. This finding invalidates the experimental evidence reporting that limiting (zero-torque) speed is independent of the number of active stators. Here, we put forward a model for the torque generation mechanism of this motor and propose that the maximum speed of the motor increases as additional torque-generators are recruited. This is contrary to the current widely-held belief that there is a universal upper limit to the speed of the BFM. Our result arises from the assumption that stators disengage from the motor for a significant portion of their mechanochemical cycles at low loads. We show that this assumption is consistent with current experimental evidence and consolidate our predictions with arguments that a processive motor must have a high duty ratio at high loads.

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