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Steps, shot noise and diffusion in the bacterial flagellar motor

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Many bacteria like *E. coli* swim by virtue of small rotary motors that drive rotation of helical flagella. Each motor is powered by a transmembrane proton flux passing through the motor. This flux is converted into torque with near-perfect efficiency by a mechanism whose details remain largely unknown. First I will describe the important biophysical properties of the motor, as measured in experiments, including the recent observation of a stepping behaviour at low speeds. I will then present a simple physical model that allows us to explain most of these data, but also to make new predictions. In particular, I will show how steps can be interpreted as barrier-crossing events in a corrugated energy landscape. Then I will show how to use our model to calculate the effect of shot noise (due to the discrete nature of the energy source–the protons) on motor diffusivity, and thus propose experiments to measure the proton cooperativity in the torque generation process.