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Swimming bacteria power microscopic gears[1] ANDREY SOKOLOV, Princeton University, IGOR ARONSON, Argonne National Laboratory, MARIO APODACA, BARTOSZ GRZYBOWSKI, Northwestern University — While the laws of thermodynamics prohibit extraction of useful work from the Brownian motion of particles in systems at equilibrium, under non-equlibrium conditions their motions can be "rectified", for example, in the presence of asymmetric geometrical obstacles. We describe a class of systems in which aerobic bacteria *Bacillus subtilis* moving randomly in a fluid film power submillimeter gears and primitive systems of gears decorated with asymmetric teeth. The directional rotation is observed only in the regime of collective bacterial swimming and the gears' angular velocities depend on and can be controlled by the amount of oxygen available to the bacteria. The ability to harness and control the power of collective motions appears an important requirement for further development of mechanical systems driven by microorganism.

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