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Power at the Nanoscale: Speed, Strength and Efficiency in Biological Motors

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The cell is no longer view as a small bag that contains a concentrated solution of proteins and nucleic acids undergoing second-order reactions. Instead, our current view is that the cell has a modular architecture, wherein all of the central processes are performed in factories made up of specialized molecular machines. Some of these machines have evolved to operate in a cyclical manner, and function as molecular motors capable of converting chemical energy into mechanical work. I will present a review of how we study these molecular motors using single molecule approaches and what we are learning about them, by describing one motor in particular: a ring motor that packages DNA inside a viral capsid. I will discuss the large efficiencies that these motors display and speculate about the possible origin of these efficiencies. I will finish with a description of the full mechanochemical cycle of this viral motor.