Applied Physics Seminar

The Bacterial Flagellar Motor: Step, Jump, and Spin

Professor Ned Wingreen

Department of Molecular Biology, Princeton

Abstract:

The flagellar motor is a highly efficient rotary machine used by bacteria like *E. coli* for propulsion. Recently, it was discovered that at low motor speeds rotation proceeds in steps. I will present a simple physical model for this stepping behavior as a random walk in a corrugated potential arising from a combination of torque and contact forces. One implication of this model is that the angular position of the rotor is crucial for the stepping properties. This hypothesis is consistent with the available data, in particular the observation that backward steps are smaller on average than forward steps. The model also makes novel predictions, including a sublinear torque-speed relationship at low torque, and a peak in rotor diffusion with increasing torque. Finally, I will discuss open questions including the molecular mechanism of torque generation.

Biography:

Ned Wingreen received his Ph. D. in theoretical condensed matter physics from Cornell University in 1989. He did his postdoc in mesoscopic physics at MIT before moving, in 1991, to the newly founded NEC Research Institute in Princeton. At NEC, he continued to work in mesoscopic physics, but also started research on the statistical mechanics of protein folding. Thinking about proteins led him inexorably down the path into biology. During a sabbatical at UC Berkeley in 1999, his primary focus shifted to systems biology of bacteria. Wingreen joined Princeton University as a Professor of Molecular Biology in 2004.

Tuesday January 20st
4:00pm-5:00pm.
Watson 104

Refreshments will be available in the Watson Lobby at 3:45pm