The World's Smallest Rotary Motors: They Propel Bacteria in Your Gut

Howard C. Berg

Herchel Smith Professor of Physics and Professor of Molecular and Cellular Biology

CURRENT RESEARCH

Fundamental research uncovers the secrets of bacterial motility

Imagine microscopic things swimming around in your gut, propelled by reversible rotary motors driving propellers of variable pitch, containing rotors, stators, drive shafts, bushings, and universal joints! All quite remarkable and happening at each moment in each of us. It doesn't take long after contemplating the complexities beneath our exteriors to understand that cells and cell behaviors are complex and in many ways not understood. Despite the centuries of work aimed at investigating such basic science, many questions remain unanswered. Dr. Howard Berg, Herchel Smith Professor of Physics and Professor of Molecular and Cellular Biology at Harvard University, is trying to understand the molecular biology of behavior in the smallest free-living organisms, bacteria; notably in E. coli, a bacterium that lives in your gut. This behavior, known as chemotaxis, enables cells to taste chemicals in their environment and to move toward regions that they deem more favorable. The output device for the sensory system of the cell that monitors the concentrations of chemicals in the external environment is a rotary motor that spins, now clockwise (CW), now counterclockwise (CCW), that enables a cell to opt for new directions of travel, or to swim smoothly toward regions that it deems more favorable. A recent discovery is that the motor can remodel itself to match its operating point, the fraction of time that it spins CW, to the signals generated by the sensory transduction network.

Given the fact that all cells sense and respond to changes in their environment, Dr. Berg's research is of broad interest. Using easy to study bacteria, he and his team can manipulate cells genetically and determine biochemical mechanisms...

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AFFILIATION

Harvard University

EDUCATION

- B.S., in Chemistry, 1956 , California Institute of Technology
- Preclinical Study, 1959 , Harvard Medical School
- Ph.D., in Chemical Physics, 1964 , Harvard University

AWARDS

- Fulbright Fellow, 1956-1957
- National Scholar, Harvard Medical School, 1957-1959
- NIH Predoctoral Fellow, 1959-1963
- Guggenheim Fellow, 2000-2001
- U.S. Genomics Award for Outstanding Investigator in the Field of Single Molecule Biology, awarded by the Biophysical Society, 2007
- and 1 more...

RESEARCH AREAS

Life Science, Infectious, Neurological / Cognitive

FUNDING REQUEST

Your contributions will support the continued research of Dr. Howard Berg, of Harvard University, as he tries to understand the molecular biology of motile behavior. Donations will pay for personnel, for the construction of specialized instruments, and for unexpected expenditures. An unrestricted gift account is particularly valuable, because the uses that can be made of funds from federal grants are narrowly defined. In choosing to donate, you will play a role in expanding our fundamental knowledge of molecular biological processes. Additionally, Dr. Berg's research may well provide important targets for dealing with infectious diseases.