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Guo Lab Discovers New Class of Revolution Biomotor and Solves Mystery in Viral DNA Packaging

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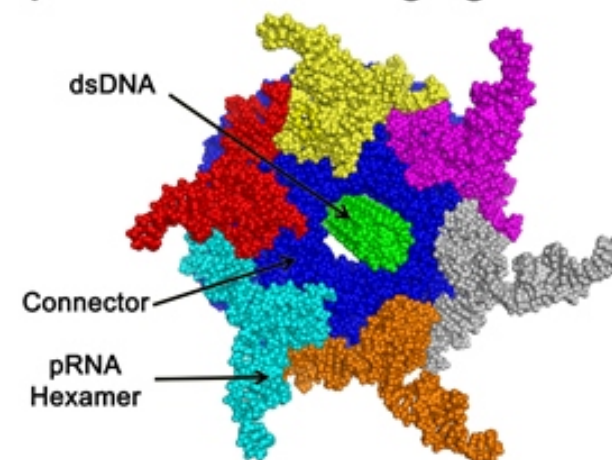
Scientists at the University of Kentucky have cracked a 35-year-old mystery about the workings of natural "biomotors." These molecular machines are serving as models for development of synthetic nanomotors that will someday pump therapeutic DNA, RNA or drugs into individual diseased cells.

The report, revealing the innermost mechanisms of these motors in a bacteria-killing virus and a "new way to move DNA through cells," is being published online today in the journal ACS Nano.

The article, "Mechanism of One-Way Traffic of Hexameric Phi29 DNA Packaging Motor with Four Electropositive Relaying Layers Facilitating Anti-Parallel Revolution," can be downloaded with free, open access from <http://pubs.acs.org/doi/abs/10.1021/nn4002775>.

Peixuan Guo, director of the UK Nanobiotechnology Center, and his colleagues explain that two

phi29 DNA Packaging Motor



motors have been found in nature: A linear motor and a rotating motor. Now they report discovery of a third type, a revolving molecular motor.

Guo points out that nanomotors will open the door to practical machines and other nanotechnology devices so small that 100,000 would fit across the width of a human hair. One major natural prototype for those development efforts has been the motor that packages DNA into the shell of bacteriophage phi29, a virus that infects and kills bacteria.

Guo's own research team wants to embed a synthetic version of that motor into nanomedical devices that are injected into the body, travel to diseased cells and pump in medication. A major barrier in doing so has been uncertainty and controversy about exactly how the phi29 motor moves. Scientists thought that it worked by rotating or spinning in the same motion as the Earth turning once every 24 hours upon its own axis.

In their ACS Nano paper, Guo — with his team, Zhengyi Zhao, Emil Khisamutdinov, and Chad Schwartz — challenge that idea. Indeed, they discovered that the phi29 motor moves DNA without any rotational motion. The motor moves DNA with a revolving in the same motion as the Earth revolving around the sun in one orbit ever 365 days. The "revolution without rotation" model could resolve a big conundrum troubling the past 35 years of painstaking investigation of the mechanism of these viral DNA packaging motors, the report states.

Guo is professor in the UK College of Pharmacy's Department of Pharmaceutical Sciences and holds the William S. Farish Fund Endowed Chair in Nanobiotechnology for the Markey Cancer Center.

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Illustrated videos of the mechanism can be found at <http://nanobio.uky.edu/movie2013.html>

