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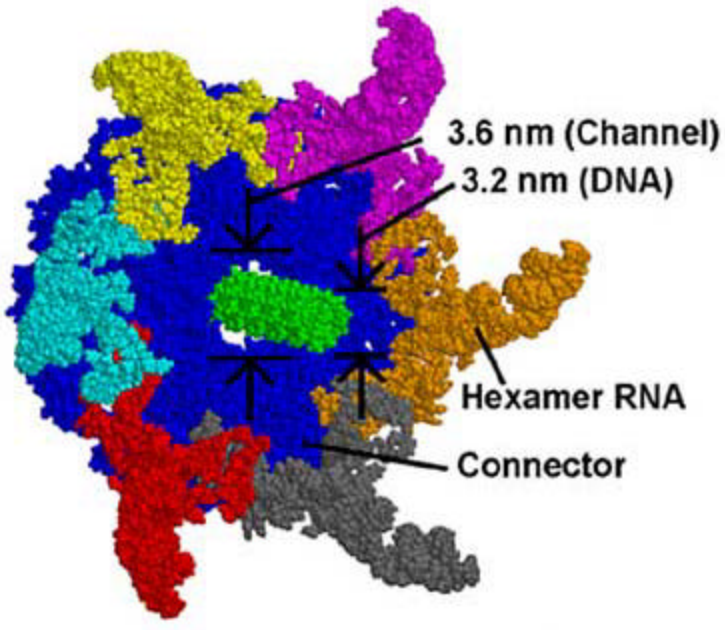
Mighty RNA Powers Viral Assembly

DENVER--Researchers have found that the most powerful molecular motor known can be switched on by ATP. Because the motor is made of RNA, the results suggest that cells could have functioned long before the evolution of DNA. They also offer nanotechnologists controllable motors to propel tiny molecular-scale machines.



Tiny but powerful. This minuscule motor, composed of RNA and a protein connector, drives DNA through a slightly wider channel to help assemble a virus.
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The motor, called pRNA and composed of six identical RNA molecules arranged in a ring, helps viruses assemble themselves. Many viruses must stuff their DNA genome into a shell of protein called a capsid. Several years ago, molecular biologist Peixuan Guo's team at Purdue University in West Lafayette, Indiana,

discovered that, for one virus called phi29, the stuffing job falls to pRNA. As the virus pulls itself together inside bacterial cells, pRNA forces DNA into the capsid. Further experimentation showed that the motor, which is one-third the width of a human hair, can generate between 50 to 60 piconewtons of force, more than any other known molecular motor. But the researchers were puzzled how such a tiny machine turns on and off.

Now Guo's group may have the answer. On 14 February at the meeting of the American Association for the Advancement of Science, the team reported that the motor binds to ATP or magnesium to switch on. When the researchers prevented the motor from grabbing those chemicals, it switched itself off. In separate research, the group also found that pRNA alone could bind ATP, a task that usually falls to proteins. Changing just one letter in its sequence abolished that ability, proving that pRNA is the first natural RNA known to bind ATP, according to results in press in the *Journal of Biological Chemistry*. That builds on existing evidence for an early world in which RNA, rather than protein, carried out the work of the cell, Guo says.

The results represent the first insights into how this motor works, and the experiments are "very difficult" to do, says bioengineer Carlo Montemagno of the University of California, Los Angeles. "I think it's a great achievement."

--DAN FERBER

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