C&EN CHEMICAL & ENGINEERING NEWS
Serving The Chemical, Life Sciences & Laboratory Worlds

Volume 92 Issue 27 | p. 29 | Concentrates
Issue Date: July 7, 2014

Some Repulsion Helps Package Viral DNA

Completely eliminating ionic repulsive effects gums up protein machinery

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News Channels: **Biological SCENE**
Keywords: **DNA folding**, **virus**, **packaging**

As part of their replication, viruses must pack newly made DNA to near-crystalline density in a small protein shell. But DNA is negatively charged, and repulsion of these charges creates a strong barrier to packing. Positively charged polyamines naturally available in cells help screen those interactions and accelerate packing, but there can be too much of a good thing: At higher concentrations, polyamines slow and stall packing, reports a team led by **Douglas E. Smith** of the University of California, San Diego (*Phys. Rev. Lett.* 2014, DOI: **10.1103/physrevlett.112.248101**). Smith and colleagues used optical tweezers to study the effects of the polyamine spermidine^{3+}, $NH_3(CH_2)_3NH_2(CH_2)_4NH_3^{3+}$, on DNA packaging in a virus that infects bacteria. The virus uses a motor protein to reel DNA into a new virus shell. They found that 0.8 mM spermidine^{3+} reduced the packing forces, increasing the motor's velocity and filling rate. At 5 mM spermidine^{3+}, motor velocity sometimes increased further still, but more often the motor slowed and stalled, decreasing the packaging rate overall. The researchers suggest that higher concentrations of spermidine^{3+} induce attractive DNA conformations that could impede the motor.

Chemical & Engineering News
ISSN 0009-2347