

News

[Annual Reports](#)[College Magazine](#)[PharmImpact](#)

RUBBERY PROPERTIES HELP RNA NANOPARTICLES TARGET TUMORS EFFICIENTLY, LEAVE BODY QUICKLY, STUDY SHOWS



September 15, 2020



A new study by researchers at The Ohio State University College of Pharmacy and The Ohio State University Comprehensive Cancer Center - Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC - James) shows that RNA nanoparticles have elastic and rubbery properties that help explain why these particles target tumors so efficiently and why they possess lower toxicity in animal studies.

RNA nanoparticles show great promise for the targeted delivery of anticancer drugs. Understanding their structure and behavior is essential for their possible future use.

This study, published in the journal *ACS Nano*, reveals that RNA nanoparticles have elastic and rubbery properties that enable the molecules to stretch and return to their normal shape. Researchers say that these properties could help the particles target tumors by enabling them to slip through the poorly formed walls of tumor blood vessels and enter a tumor mass.

The researchers further proved that the same rubbery properties enable the RNA nanoparticle to slip through the kidney filters to excrete into the urine half hour after systemic injection, thereby eliminating them from the body relatively quickly. That, in turn, could reduce retention of the anticancer agent in vital organs, lowering an agent's toxicity.

"We show that RNA nanoparticles have a flexibility that allows for the assembly of molecular structures that have stretchable angles," says study leader and corresponding author Peixuan Guo, PhD, professor in the College of Pharmacy and the Sylvan G. Frank Endowed Chair in Pharmaceutics and Drug Delivery. Guo also is in the OSUCCC - James Translational Therapeutics Research Program.

"These findings demonstrate the rubbery properties of RNA nanoparticles and why these molecules hold great promise for industrial and biomedical applications, especially as carriers for targeted delivery of anticancer drugs," says Guo, who directs Ohio State's Center for RNA Nanobiotechnology and Nanomedicine.

For this study, Guo and his colleagues tested the elasticity of nucleic acid polymers by stretching and relaxing individual RNA nanoparticle, while subjecting RNA nanoparticles to elasticity studies using dual-beam optical tweezers built in Guo lab. Finally, they used animal models to study the biodistribution, excretion and retention of RNA nanoparticles. This included measuring excretion of the particles in urine, along with the study on the effect of their shape and size.

Key findings include:

- RNA nanoparticles are stretchable and shrinkable, like rubber, even after repeated extension and relaxation with multiple repeats by optical tweezers.
- In animal models, RNA nanoparticles show stronger cancer targeting and lower accumulation in healthy organs when compared to gold and iron nanoparticles of similar size.
- Also in animal models, within half hour after systemic injection, RNA nanoparticles that were 5, 10 and 20 nm in size were filtered by the kidneys and retained their original structure in urine, even though the upper limit of kidney pore size for filtration is generally 5.5 nm. This suggests that the larger RNA nanoparticles slipped like rubber and amoeba through filtration pores, then returned to their original size and shape in urine.

"Overall," Guo says, "we believe these findings further support the development of RNA nanoparticles for targeted delivery of anticancer drugs or therapeutic RNA."

Grants from the National Institutes of Health (EB019036, CA151648 and CA207946) supported this research.

Other researchers involved in this study were Chiran Ghimire, Hongzhi Wang, Hui Li, Mario Vieweger and Congcong Xu, The Ohio State University.

About the OSUCCC - James

The Ohio State University Comprehensive Cancer Center - Arthur G. James Cancer Hospital and Richard J. Solove Research Institute strives to create a cancer-free world by integrating scientific research with excellence in education and patient-centered care, a strategy that leads to better methods of prevention, detection and treatment. Ohio State is one of only 51 National Cancer Institute (NCI)-designated Comprehensive Cancer Centers and one of only a few centers funded by the NCI to conduct both phase I and phase II clinical trials on novel anticancer drugs sponsored by the NCI. As the cancer program's 356-bed adult patient-care component, The James is one of the top cancer hospitals in the nation as ranked by U.S. News & World Report and has achieved Magnet® designation, the highest honor an organization can receive for quality patient care and professional nursing practice. With 21 floors and more than 1.1 million square feet, The James is a transformational facility that fosters collaboration and integration of cancer research and clinical cancer care.

Sign up for our newsletter and never miss a beat.

Email Address	First Name	Last Name
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> I'm not a robot reCAPTCHA Privacy - Terms		
<input type="button" value="Subscribe"/>		

217 Lloyd M. Parks Hall
500 West 12th Ave.
Columbus, OH 43210

Phone: [614-292-2266](tel:614-292-2266)

Fax: [614-292-2588](tel:614-292-2588)



If you have trouble accessing this page and need to request an alternate format, please contact: webmaster@pharmacy.ohio-state.edu.

[Log In](#)