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Guo Lab Reshaping RNA Containers for Transporting Drug Therapies

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One of the major challenges in treating disease at the cellular level is constructing vessels with defined shape and size to load and protect medicine for release in the human body. But Ohio State's College of Pharmacy researcher and nanotechnology innovator Peixuan Guo, PhD is finding ways to reshape RNA so that it may transport any number of therapies, a discovery that may have implications for treatment of numerous cancers and other diseases. His findings can be found in two recent editions of *Advanced Materials*.

RNA nanotechnology is an emerging field that involves the design, construction and functionalization of nanometer-scale particles—composed mainly of RNA—for applications in bio-medical and material sciences. RNA, or ribonucleic acid, is an important molecule that, like DNA, is vital for living beings. Although RNA nanotechnology resembles DNA nanotechnology in many ways, rules for constructing RNA nanoparticles are different. The large variety of secondary structures found in RNA allows it to fold into numerous primary structures. The stability of RNA at high heat also allows the production of countless nanostructures with defined shapes that can link substances in chemical reactions.

Nanoscale machines can be found in nature, providing many examples that scientists may emulate. Researchers like Guo, who pioneered the field of nanotechnology in 1998, are developing artificial nanomachines to affect the way medicine is delivered. Guo's lab is currently focused on using RNA nanotechnology for the construction of 3D RNA containers. The core scaffold for these containers is based on an ultra-stable 3WJ (3-Way Junction) *motif*, or stretches of a protein sequence.

Guo's first *Advanced Materials* paper focuses on the construction of a tetrahedron, or 3D triangle-shaped RNA structure. Studies reveal that these structures, made functional with epidermal growth factor receptor molecules, could specifically target breast tumors without affecting healthy vital organs. The second *Advanced Materials* paper found that 3D RNA nanocontainers are adaptable enough to be created in different sizes, increasing specificity and efficacy in the treatment of disease.

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These novel RNA nanocontainers are envisioned to have a broad impact in the nanotechnology arena. They can be used for organizing nanoscale materials with high precision, encapsulating functional materials within its hollow cavity, targeting therapy to diseased cells, and creating image-guided delivery vectors.

Apart from Guo lab members, the work was a collaborative effort with Luda Shlyakhtenko, who performed the AFM imaging at University of Nebraska Medical Center, and Wah Chiu, a world-renowned expert in Cryo-EM at Baylor College of Medicine.

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