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New Study Shows Promise in Using RNA Nanotechnology to Treat Cancers and Viral Infections

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LEXINGTON, Ky. (Sept. 4, 2012) — A new study by University of Kentucky researchers shows promise for developing ultrastable RNA nanoparticles that may help treat cancer and viral infections by regulating cell function and binding to cancers without harming surrounding tissue.

The study, published in *Nano Today*, was carried out in the laboratory of Peixuan Guo, the William S. Farish Endowed Chair in Nanobiotechnology in the UK College of Pharmacy and the UK Markey Cancer Center, in collaboration with Dr. Mark Evers, director of the UK Markey Cancer Center.

The study uses RNA (ribonucleic acid) as a building block for the bottom-up fabrication of nanostructures. Using the RNA nanotechnology pioneered by Guo, the researchers constructed ultrastable X-shaped RNA nanoparticles using re-engineered RNA fragments to carry up to four therapeutic and diagnostic modules. Their RNA nanoparticles can include small interfering RNA for silencing genes, micro-RNA for regulating gene expression, aptamer for targeting cancer cells, or a ribozyme that can catalyze chemical reactions.

The study demonstrated that regulation of cellular functions progressively increased with the increasing number of functional modules in the nanoparticle.

"RNA nanotechnology is an emerging field, but the instability and degradation of RNA nanoparticles have made many scientists flinch away from the research in RNA nanotechnology," Guo said. "We have addressed these issues, and now it is possible to produce RNA nanoparticles that are highly stable both chemically and thermodynamically in the test tube or in the body with great potential as therapeutic reagents."

The RNA nanoparticles displayed several favorable attributes: polyvalent nature, which allows simultaneous delivery of multiple functional molecules for achieving synergistic effects; modular design, which enables controlled self-assembly with defined structure; thermodynamically stable, which keeps the RNA nanoparticles intact in animal and human circulation systems, where they exist at very low concentrations; and chemically stable, which makes the nanoparticles resistant to RNase (an enzyme, which cleaves RNA) digestion in the blood serum.

"A major problem with cancer treatments is the ability to more directly and specifically deliver anti-cancer drugs to cancer metastases," Evers said. "Using the nanotechnology approach that Peixuan Guo and his group have devised may allow us to more effectively treat cancer metastasis with fewer side effects compared to current chemotherapy."

In addition to Evers and Markey team member Dr. Piotr Rychahou, Guo's research team at UK also includes Farzin Haque, first author on the paper; Dan Shu; Yi Shu; and Luda Shlyakhtenko.

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