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Purdue Team Develops RNA Nanotech Delivery System

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Purdue University scientists created a drug delivery nanotech system for bringing anticancer therapeutics directly to infected cells. The nanoparticles, which are assembled from three short pieces of ribonucleic acid, resemble miniature triangles.

The microscopic particles possess both the right size to gain entry into cells and the right structure to carry other therapeutic strands of RNA inside with them, where they are able to halt viral growth or cancer's progress, according to the scientists.

The team reportedly has tested the nanoparticles successfully against cancer growth in mice and lab-grown human cells.

"Until now, we have not had an efficient system to bring multiple therapeutic agents directly into specific cancer cells where they can perform different tasks," explains research team leader Peixuan Guo, D.V.M., Ph.D., who is a professor of molecular virology.

"Physicians have hoped that nanotechnology might provide a solution to the problem, and it's possible that the application of these tiny triangles could lead to the solution."

"With these devices, Dr. Guo was able to deliver three different therapeutic agents into a cell at the same time," says Jean Chin, a scientist at the National Institute of General Medical Sciences.

The research appears in two related papers being published in *Nano Letters* and *Human Gene Therapy*. Members of Dr. Guo's research team are from Purdue, the University of Central Florida and the University of California, Riverside.

Several years after building a tiny "motor" from several strands of RNA that mimic those in the phi29 bacteria-killing virus, the team learned how to manipulate these stringy molecules into different shapes, including rods, triangles and arrays.

"We speculated at that time that these shapes would be useful purely as physical scaffolding on which more sophisticated nanodevices could be constructed," says Dr. Guo.

"But RNA also has many therapeutic functions. We realized that if we built different kinds of therapeutic RNA onto the RNA scaffolding and created a single structure, we might be able to respond to several challenges that have confronted the medical field.

"We looked around for RNA strands that would behave in certain ways when they encounter a cancer cell because each of them needs to perform one step of the therapy. An effective agent against cancer needs to accomplish several tasks. It needs to recognize the cancer cell and gain access to its interior, and then it needs to destroy it.

"But we'd also like the agent to leave a trail for us, to mark the path the molecule has taken somehow.

That way, we can pinpoint the location of the cancer and trace the outcome after the treatment."

The team found that the nanoparticles block cancer development in living mice. A group of mice that were in the process of developing cancer were tested with the nanoparticles, and they did not develop the disease. A second group that was tested with mutated inactive RNA all developed tumors.