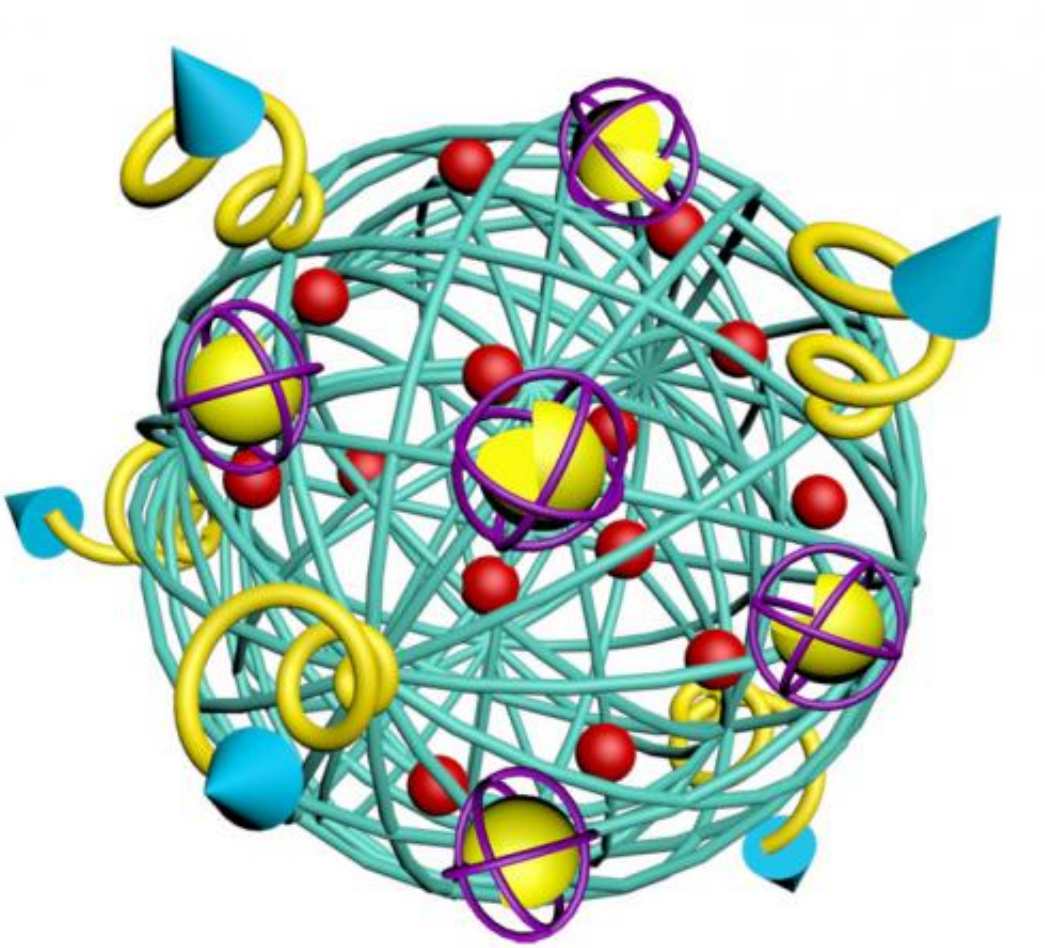
Bio-inspired 'nano-cocoons' offer targeted drug delivery against cancer cells

October 14 2014, by Matt Shipman



The nano-cocoon has ligands on its surface that bind to receptors on the surface of cancer cells. Credit: Zhen Gu

Biomedical engineering researchers have developed a drug delivery system consisting of nanoscale "cocoons" made of DNA that target cancer cells and trick the cells into absorbing the cocoon before unleashing anticancer drugs. The work was done by researchers at North Carolina State University and the University of North Carolina at Chapel Hill.

"This drug delivery system is DNA-based, which means it is biocompatible and less toxic to patients than systems that use synthetic materials," says Dr. Zhen Gu, senior author of a paper on the work and an assistant professor in the joint biomedical engineering program at NC State and UNC Chapel Hill.

"This technique also specifically targets cancer cells, can carry a large drug load and releases the drugs very quickly once inside the cancer cell," Gu says.

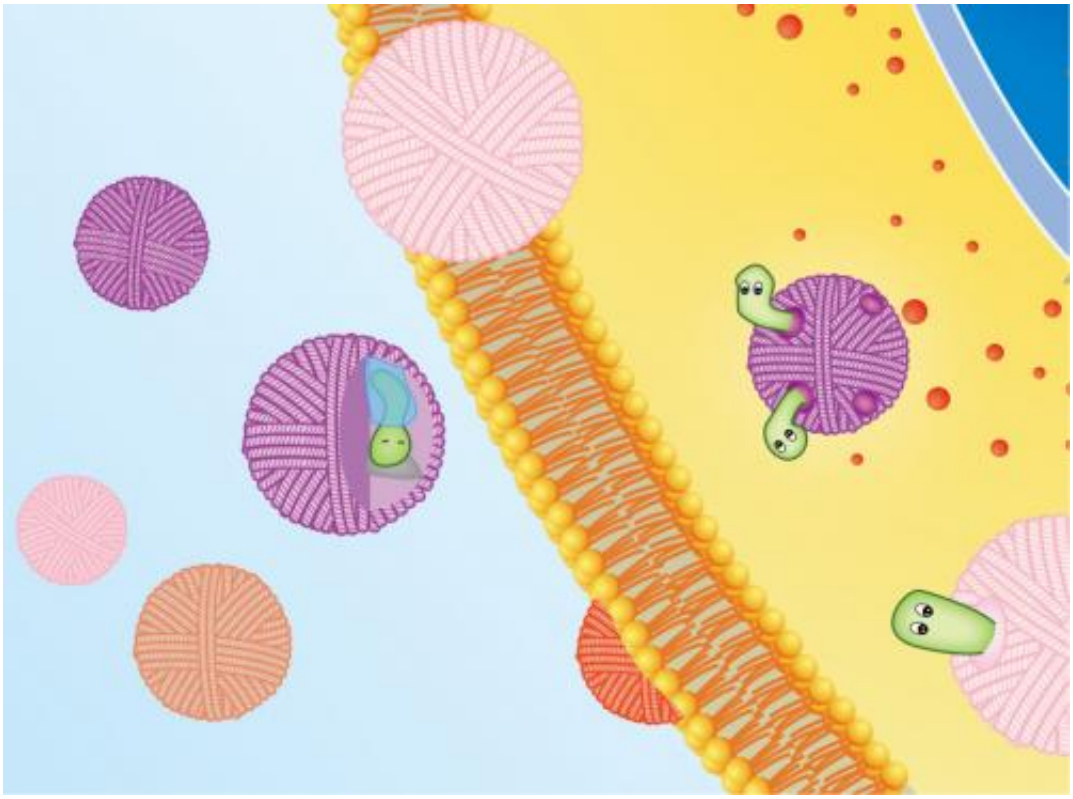
"In addition, because we used self-assembling DNA techniques, it is relatively easy to manufacture," says Wujin Sun, lead author of the paper and a Ph.D. student in Gu's lab.

Each nano-cocoon is made of a single strand of DNA that self-assembles into what looks like a cocoon, or ball of yarn, that measures 150 nanometers across.

The core of the nano-cocoon contains the anticancer drug doxorubicin (DOX) and a protein called DNase. The DNase, an enzyme that would normally cut up the DNA cocoon, is coated in a thin polymer that traps the DNase like a sword in a sheath.

The surface of the nano-cocoon is studded with folic acid ligands. When the nano-cocoon encounters a cancer cell, the ligands bind the nano-cocoon to receptors on the surface of the cell – causing the cell to suck

in the nano-cocoon.



This image illustrates how the nano-cocoon system works. Credit: Zhen Gu

Once inside the cancer cell, the cell's acidic environment destroys the polymer sheath containing the DNase. Freed from its sheath, the DNase rapidly slices through the DNA cocoon, spilling DOX into the cancer cell and killing it.

"We're preparing to launch preclinical testing now," Gu says. "We're very excited about this system and think it holds promise for delivering a variety of drugs targeting cancer and other diseases."

More information: "Cocoon-Like Self-Degradable DNA Nanoclew

for Anticancer Drug Delivery." *J. Am. Chem. Soc.*, Article ASAP Publication Date (Web): October 13, 2014. DOI: 10.1021/ja5088024