Super-mini vehicles carry therapeutics and imaging agents into body with mega results

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Measured in billionths of a meter, self-assembling nano-sized devices designed to carry drugs and imaging agents into the body are revolutionizing medicine by improving drug solubility and bio-distribution, providing a platform for combining targeting and imaging agents, and enabling membrane barriers to be crossed as well as making drug and imaging agent combination therapies possible.

Self-assembling nano devices are now enlisted in the nanomedicine revolution, a story as told by researchers from Duke University and the University of Southern California in an article in the current *TECHNOLOGY & INNOVATION*, Proceedings of the National Academy of Inventors.

Their report covers two classes of self-assembled, nanoscale medical delivery devices currently used to transport drugs and also imaging materials across physiological barriers that they, acting by themselves, would be unable to cross.

"Nanoscale self-assembly devices are complex structures organized from simpler subcomponents - either naturally occurring or engineered - which assume complex structures difficult to attain by chemical synthesis," said the paper's corresponding author Dr. Ashutosh Chilkoti, professor of biomedical engineering at Duke University. "Their disassociation can be triggered by external stimuli, which serve as mechanisms to release therapeutic payloads."

According to Dr. Chilkoti and his co-authors, Dr. Mingan Chen and Jonathan R. McDaniel of the Duke University Department of Biomedical Engineering, as well as Dr. J. Andrew MacKay of the University of Southern California Department of Pharmacology and Pharmaceutical Sciences, many biological events rely on structures that self-assemble or disassemble based on environmental changes or physiological needs. Such natural self-assemblies used in nanomedicine rely on multiple weak forces, such as those associated with viral capsids and proteins.

Engineered self-assemblies used in nanomedicine come in over five groups of structural shapes, including the micellar nanostructure.

"We have recently developed a novel strategy that utilizes micelles self-assembled from recombinant polypeptides after attaching doxorubicin, a cancer drug, to deliver the drug," explained Dr. Chilkoti, who is also the director of the Duke University Center for Biologically Inspired Materials and Material Systems.

According to Dr. MacKay, a co-corresponding author of the report, the stability of micelles is important to their success or failure as drug delivery systems.

"The stability of micelles has thermodynamic and kinetic components," he said. "All factors that influence micellar stability can be tuned at the genetic level. Thus, we believe that genetically encoded polypeptide micelles are likely to play an increasing role in the design of next generation nanoscale carriers of drug and imaging agents."

In their report, the authors evaluate the structural and physiochemical properties, as well as the potential applications, of each type of structure.

More information:

http://www.ingentaconnect.com/content/cog/ti/2011/00000013/00000001

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