MedicalXpress

Dual-purpose liposome offers intelligent diagnosis, drug delivery

August 6 2010, by Neil Thomas

Key objectives of modern health care are early and accurate diagnosis of a disease and quick remediation with minimal side effects.

So imagine a tiny bubble, or liposome, that can be inserted into the human body and delivered to a specific target to provide both precise diagnosis of a cancerous tumor and intelligent drug delivery to combat that tumor.

The dual-purpose liposome is at the heart of joint research being conducted by teams from the University of Delaware and North Dakota State University in a collaborative project funded by a three-year, $586,715 grant from the National Science Foundation to be shared equally between the two universities.

“This proposal addresses all of the important elements of health care, with concurrent imaging and targeted and controlled drug release,” said Kausik Sarkar, associate professor in the University of Delaware Department of Mechanical Engineering.

Sarkar is conducting the research in cooperation with Sanku Mallik, professor in the Department of Pharmaceutical Sciences at North Dakota State.

Sarkar said the goal of the project is to develop lipid bilayer encapsulated liposomes, a field in which Mallik is a noted expert.

“The liposomes are excellent agents for medical purposes because of their close structural resemblance with animal cells, and can be loaded with drugs and genes to be delivered to target tissues,” Sarkar said.

They can also be designed to be diagnostic for better use in ultrasound imaging, which is Sarkar's field of expertise. Ultrasound uses a pulsing high frequency sound beyond the upper limit of human hearing to peer into the body and provide images, and is an important tool in modern health care.

Mallik will devise liposomes that are echogenic, containing gases that would reflect ultrasound and show up in ultrasound images.

He also will make the encapsulation of the liposomes with specially designed molecules that would attach to target enzymes expressed in plaques or cancerous tumors, Sarkar said.

That would enable accurate ultrasound diagnosis of the disease while, at the same time, reaction with the enzymes would uncork the liposomes and release the contained drug to only the target tissue.

Targeting an enzyme with liposomes and regulating drug delivery by releasing an inhibitor is an improvement over the usual practice of passive slow drug release from encapsulates, Sarkar said, adding that the ability to concurrently image the extent of expression using the same encapsulates signifies an important step forward in the goal of quick diagnosis and intelligent therapy.

This is the second NSF grant Sarkar has received in 2010. The earlier award will fund research to better understand ultrasound echoes of encapsulated microbubbles used for noninvasive blood pressure monitoring.

Sarkar joined the UD faculty in 2001. He received a bachelor's degree from the Indian Institute of Technology, and a master's and doctorate from the Johns Hopkins University.

Mallik received a bachelor's degree from the Indian Institute of Technology and a doctorate from Case Western Reserve University.

Provided by University of Delaware