Nanoparticles create biocompatible capsules

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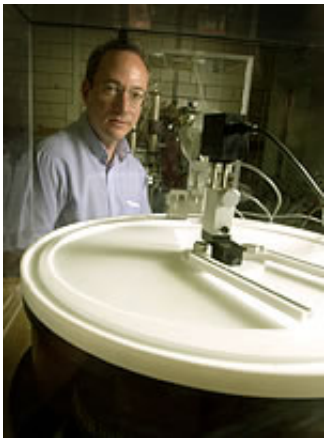

Steve Granick, a professor of materials science, engineering, chemistry and physics, has developed an innovative strategy of mixing lipids and nanoparticles to produce new drug and agricultural materials and delivery vehicles. (University of Illinois Photo)

An innovative strategy of mixing lipids and nanoparticles to produce new drug and agricultural materials and delivery vehicles has been developed by researchers at the University of Illinois at Urbana-Champaign.

“This is a new way to make nano-size capsules of a biologically friendly material,” said Steve Granick, a professor of materials science and engineering, chemistry and physics. “The hollow, deformable and biofunctional capsules could be used in drug delivery, colloidal-based biosensors and enzyme-catalyzed reactions.”

Lipids are the building blocks of cell membranes. The construction of useful artificial lipid vesicles was previously not possible, because the vesicles were too delicate. Granick and graduate student Liangfang Zhang found a way to stabilize lipids and stop their destruction. The researchers describe their technique in a paper accepted for publication in the journal *Nano Letters*, and posted on its Web site.

To stabilize lipids, the researchers begin by preparing a dilute solution of lipid capsules of a particular size. After encapsulating chemicals in the capsules or adsorbing molecules on their surfaces, they add charged nanoparticles to the solution. The nanoparticles adhere to the capsules and prevent further growth, freezing them at the desired size. The lipid concentration can then be increased without limits.

“We form an ‘army’ of uniform capsules, and then we can use them in a military fashion,” said Granick, who also is a researcher at the Frederick Seitz Materials Research Laboratory and at the Beckman Institute for Advanced Science and Technology. “That is, the capsules are well behaved, and follow orders without wandering off and propagating.”

As proof of concept, Granick and Zhang encapsulated fluorescent dyes within lipid capsules. No leakage occurred, and the lipids proved stable against further fusion.

“This opens the door to using biologically friendly capsule delivery vehicles in exciting new health and agricultural applications,” Granick said. “Chemical reactions can be performed within individual isolated capsules, or on groups of capsules linked together like boxcars in a train.”

The biocompatible containers could carry cargo such as enzymes, DNA, proteins and drug molecules throughout living organisms. They could also serve as surrogate factories where enzyme-catalyzed reactions are

performed. By attaching biomolecules to the capsule's surface, novel colloidal-size sensors could be produced.

An additional use for stabilized lipid capsules is the study of drug behavior. "A drug contained in this nano environment is like a fish swimming inside a bowl," Granick said. "We can study the 'fish' in detail, and it won't swim away."

Source: University of Illinois at Urbana-Champaign