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Living Cells Show Promise as Key to Making Nano-sensor Devices

Scientists in New Mexico have learned that living cells can adapt for survival in manmade silica habitats of nanoscale dimensions. This discovery increases hope that the remarkable cellular capacity for sensitive detection of biomolecules may at last be harnessed for applications in industry and national security.

Living cells are able to perform a number of relatively sophisticated functions in an extremely small package. In engineering terms they might be described as miniaturized environmental or physiological sensors. The idea of incorporating them into actual devices has been around for a while; however, this has proven problematic. Cells need a hospitable environment, and lacking it they will die.

A team led by C. Jeffrey Brinker, Helen Baca, and coworkers at Sandia National Laboratories, the University of New Mexico, and Los Alamos National Laboratory encapsulated a sample of *Saccharomyces cerevisiae*, a yeast used in baking and brewing, in a silica nanostructure. Amphiphilic phospholipids used in making the nanostructure formed a multilayered interface around the cells, and the cells then modified the acidity/alkalinity balance around themselves, changing the nanostructure in a way that sealed in water and kept them alive without added buffer. More than half the yeast cells were still alive a month after they were encapsulated.

Long-lived cells could serve as the sensor "brain" of tiny airborne surveillance devices. Groups of them may serve as models to investigate how tuberculosis bacteria survive long periods of dormancy within human bodies. They could generate signals to repel harmful bacteria from the surfaces of surgical tools. The method employed by Brinker's team may also offer a simple method to genetically modify cells. "This is not the end of the story, but the beginning," Brinker says. "No one else has created these symbiotic materials and observed these effects. It's a totally new area."

Brinker, a Sandia fellow and University of New Mexico professor of chemical engineering, molecular genetics and microbiology, has with co-workers achieved a number of significant accomplishments in the formation of nanostructures by self-assembly techniques over the past two decades. These controlled porosity materials have found a wide range of applications including antireflective coatings, sensors, gas separation membranes, inertial confinement fusion targets, lasers, radioluminescent lights and thermal and acoustic insulation. Brinker's most recent research has implications in a diverse range of technologies, including drug delivery, cosmetics, catalysis, chromatography and custom designed pigments.

Comprehensive information on Brinker's research activities is posted at: http://www.unm.edu/~solgel/. Yeast cell research with work was originally published in: Helen Baca *et al*, "Cell-Directed Assembly of Lipid-Silica Nanostructures Providing Extended Cell Viability." *Science* 313:337-341 (July 21, 2006).

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