Nano World: Nano helps keep cells alive

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Encasing living cells in networks of silica and fatty layers only nanometers or billionths of a meter in size could help keep them alive longer for use in novel chemical factories or sensors, experts tell UPI's Nano World.

Scientists are tinkering with integrating cells into devices. However, the usual method of doing so involves encapsulating them in silica gel, but when these dry out, stresses are generated that kill cells.

Materials scientist Jeff Brinker at Sandia National Laboratory and the University of New Mexico in Albuquerque and colleagues instead used live cells to direct the formation of scaffolds that would help keep them alive. They gave cells silica dissolved in a solution loaded with fatty compounds known as phospholipids, which are key components of cell membranes.

The cells rapidly organized a shell of water and lipids around themselves roughly two millionths of a meter thick. Surrounding that, the cells formed a casing one to two microns wide made of alternating layers of silica and lipids only nanometers thick.

The water and lipid shell helps keep the cells alive in a nurturing space and helps the cells maintain distance from the silica, the electrical and chemical properties of which can damage cells. At the same time, the silica and lipid shell can resist the drying seen with silica gels, providing cells a stress-free environment.

Bacterial and yeast cells survived in the scaffolds for weeks under dry New Mexico conditions, as opposed to hours as typically seen when encased in regular silica, the researchers found. Brinker, chemical engineer Helen Baca and their colleagues report their findings in the July 21 issue of the journal Science.

These scaffolds around the cells appear readily permeable to small molecules, a fact key to whether or not these scaffolds are useful for cell-based sensors. For instance, Brinker and his colleagues found genetically modified yeast cells in these networks generated a fluorescent protein when given a specific sugar.

The researchers discovered they could plug in components to the scaffolds around the cells fairly readily as well. For instance, they found gold or cadmium selenide nanocrystals coated in lipids concentrated on cell surfaces. These so-called "quantum dots" are extraordinarily fluorescent, and could serve as readout mechanisms in cell sensors "to study the onset of disease or the status of therapies or the response to drugs," Brinker said.

Brinker and his colleagues also discovered they could plug DNA into these scaffolds. This could prove a means to genetically modify cells with nearly 100 percent efficiency, compared with other methods that use electrical fields or heat that can injure cells. Future research could experiment with mammalian cells or microbes that normally live in extreme environments of heat, cold or other factors, he added, thereby extending the operational range of the sensors.

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