Microwell Arrays for Studying Many Individual Cells

Lyndon B. Johnson Space Center, Houston, Texas

“Laboratory-on-a-chip” devices that enable the simultaneous culturing and interrogation of many individual living cells have been invented. Each such device includes a silicon nitride-coated silicon chip containing an array of micro-machined wells sized so that each well can contain one cell in contact or proximity with a patch clamp or other suitable single-cell-interrogating device. At the bottom of each well is a hole, typically ≈ 0.5 μm wide, that connects the well with one of many channels in a microfluidic network formed in a layer of poly(dimethylsiloxane) on the underside of the chip. The microfluidic network makes it possible to address wells (and, thus, cells) individually to supply them with selected biochemicals. The microfluidic channels also provide electrical contact to the bottoms of the wells.

This work was done by Albert Folch and Turgut Fettah Kosar of the University of Washington for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

ROI Coordinator
Office of Technology Licensing
University of Washington
1107 NE 45th Street, Suite 200
Seattle, WA 98105

Refer to MSC-24046-1, volume and number of this NASA Tech Briefs issue, and the page number.

Droplet-Based Production of Liposomes

Lyndon B. Johnson Space Center, Houston, Texas

A process for making monodisperse liposomes having lipid bilayer membranes involves fewer, simpler process steps than do related prior methods. First, a microfluidic, cross-junction droplet generator is used to produce vesicles comprising aqueous-solution droplets contained in single-layer lipid membranes. The vesicles are collected in a lipid-solvent mix that is at most partially soluble in water and is less dense than is water. A layer of water is dispensed on top of the solvent. By virtue of the difference in densities, the water sinks to the bottom and the solvent floats to the top. The vesicles, which have almost the same density as that of water, become exchanged into the water instead of floating to the top. As there are excess lipids in the solvent solution, in order for the vesicles to remain in the water, the addition of a second lipid layer to each vesicle is energetically favored.

The resulting lipid bilayers present the hydrophilic ends of the lipid molecules to both the inner and outer membrane surfaces. If lipids of a second kind are dissolved in the solvent in sufficient excess before use, then asymmetric liposomes may be formed.

This work was done by Donald E. Ackley and Anita Forster of Nanotrope, Inc. for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Nanotrope Inc.
3030 Bunker Hill St
San Diego, CA 92109
Phone No.: (858) 270-7992

Refer to MSC-24302-1, volume and number of this NASA Tech Briefs issue, and the page number.

Identifying and Inactivating Bacterial Spores

NASA’s Jet Propulsion Laboratory, Pasadena, California

Problems associated with, and new strategies for, inactivating resistant organisms like Bacillus canaveralius (found at Kennedy Space Center during a survey of three NASA clean-rooms) have been defined. Identifying the particular component of the spore that allows its heightened resistance can guide the development of sterilization procedures that are targeted to the specific molecules responsible for resistance, while avoiding using unduly harsh methods that jeopardize equipment.

The key element of spore resistance is a multilayered protein shell that encases the spore called the spore coat. The coat of the best-studied spore-forming mi-