# Scientists develop new process to create artificial cell membranes

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The membranes surrounding and inside cells are involved in every aspect of biological function. They separate the cell's various metabolic functions, compartmentalize the genetic material, and drive evolution by separating a cell's biochemical activities. They are also the largest and most complex structures that cells synthesize.

Understanding the myriad biochemical roles of membranes requires the ability to prepare synthetic versions of these complex multi-layered structures, which has been a long-standing challenge.

In a study published this week by *Nature Chemistry*, scientists at The Scripps Research Institute (TSRI) report a highly programmable and controlled platform for preparing and experimentally probing synthetic cellular structures.

"Layer-by-layer membrane assembly allows us to create synthetic cells with membranes of arbitrary complexity at the molecular and supramolecular scale," said TSRI Assistant Professor Brian Paegel, who authored the study with Research Associate Sandro Matosevic. "We can now control the molecular composition of the inner and outer layers of a bilayer membrane, and even assemble multi-layered membranes that resemble the envelope of the cell nucleus."

Starting with a technique commonly used to deposit molecules on a solid surface, Langmuir-Blodgett deposition, the scientists repurposed the approach to work on liquid objects.

The scientists engineered a microfluidic device containing an array of microscopic cups, each trapping a single droplet of water bathed in oil and lipids, the molecules that make up cellular membranes. The trapped droplets are then ready to serve as a foundation for building up a series of lipid layers like coats of paint.

The lipid-coated water droplets are first bathed in water. As the water/oil interface encounters the trapped droplets, a second lipid layer coats the droplets and transforms them into what are known as unilamellar or single-layer vesicles. Bathing the vesicles in oil/lipid deposits a third lipid layer, and followed by a final layer of lipids that is deposited on the trapped drops to yield double-bilayer vesicles.

"The computer-controlled microfluidic circuits we have constructed will allow us to assemble synthetic cells not only from biologically derived lipids, but from any amphiphile and to measure important chemical and physical parameters, such as permeability and stability," said Paegel.

**More information:** "Layer-by-layer Cell Membrane Assembly," www.nature.com/nchem/journal/v … /abs/nchem.1765.html

Provided by The Scripps Research Institute

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