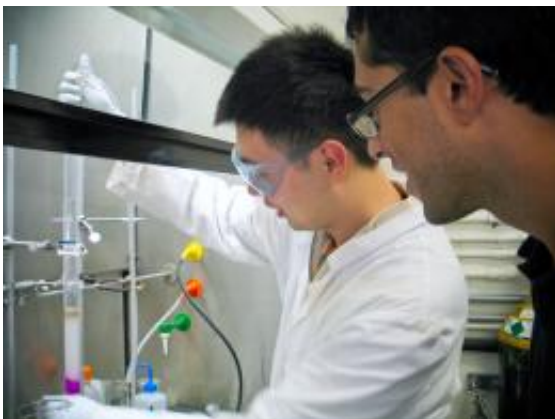


Envelope for an artificial cell

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Neal Davaraj watches as undergraduate student Weilong Li works on a next step in their quest to create an entirely artificial cell.

(PhysOrg.com) -- Chemists have taken an important step in making artificial life forms from scratch. Using a novel chemical reaction, they have created self-assembling cell membranes, the structural envelopes that contain and support the reactions required for life.

Neal Devaraj, assistant professor of [chemistry](#) at the University of California, San Diego, and Itay Budin, a graduate student at Harvard University, report their success in the [Journal of the American Chemical Society](#).

“One of our long term, very ambitious goals is to try to make an artificial cell, a synthetic living unit from the bottom up – to make a living

organism from non-living molecules that have never been through or touched a living organism,” Devaraj said. “Presumably this occurred at some point in the past. Otherwise life wouldn’t exist.”

By assembling an essential component of earthly life with no biological precursors, they hope to illuminate life’s origins.

“We don’t understand this really fundamental step in our existence, which is how non-living matter went to living matter,” Devaraj said. “So this is a really ripe area to try to understand what knowledge we lack about how that transition might have occurred. That could teach us a lot – even the basic chemical, biological principles that are necessary for life.”

Molecules that make up cell membranes have heads that mix easily with water and tails that repel it. In water, they form a double layer with heads out and tails in, a barrier that sequesters the contents of the cell.

Devaraj and Budin created similar molecules with a novel reaction that joins two chains of lipids. Nature uses complex enzymes that are themselves embedded in membranes to accomplish this, making it hard to understand how the very first membranes came to be.

“In our system, we use a sort of primitive catalyst, a very simple metal ion,” Devaraj said. “The reaction itself is completely artificial. There’s no biological equivalent of this chemical reaction. This is how you could have a de novo formation of membranes.”

They created the synthetic membranes from a watery emulsion of an oil and a detergent. Alone it’s stable. Add copper ions and sturdy vesicles and tubules begin to bud off the oil droplets. After 24 hours, the oil droplets are gone, “consumed” by the self-assembling membranes.

Although other scientists recently announced the creation of a “synthetic cell,” only its genome was artificial. The rest was a hijacked bacterial cell. Fully [artificial life](#) will require the union of both an information-carrying genome and a three-dimensional structure to house it.

The real value of this discovery might reside in its simplicity. From commercially available precursors, the scientists needed just one preparatory step to create each starting lipid chain.

“It’s trivial and can be done in a day,” Devaraj said. “New people who join the lab can make membranes from day one.”

Provided by University of California - San Diego

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