

# Artificial Cells: Creating Life From Scratch?

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With eight ingredients, twenty years of work, and one billion euros, scientists have tested the boundaries of existence, paving the way to creating life from scratch. Dr. Petra Schwille of Germany's Max Planck Institute led a [team with a mission](#) to assemble biomolecules under specific conditions to simulate aspects of life.

Their work produced rudimentary cells, [described](#) by Schwille as "pulsating blobs...with some of the machinery necessary to divide on their own." These "blobs" could be the first step in creating a wholly synthetic cell without building from a living scaffold.

The success relied on recent progressions in microfluidic technology, which allowed for the control of fluids within a cell. These advances give scientists unprecedented control over various elements of a cell.

## Starting from square one

The team used two proteins, three buffering agents, two types of fat molecules, and chemical energy to create their "cell." They initially focused on designing the plasma membranes both within the cell and surrounding it. One of the membranes' key roles is organization of internal structures; organelles within the cell must be organized adequately into regions, allowing the proteins produced by each organelle to work together to drive the overall function of the cell.

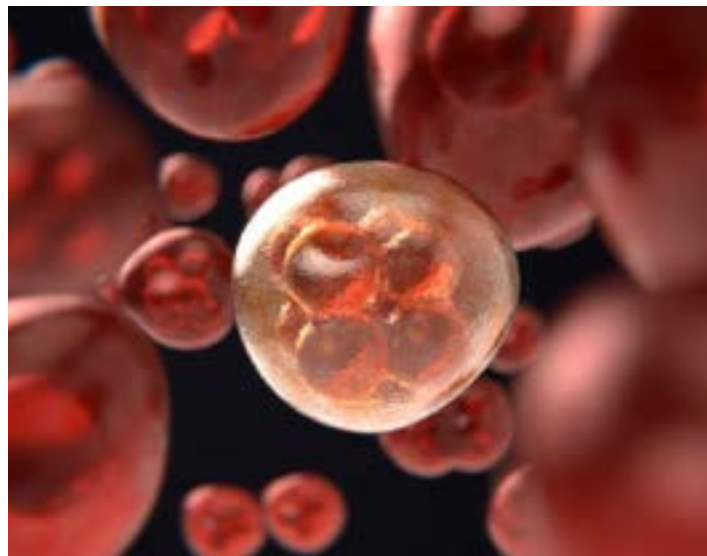
## Cell division in synthetic molecules

When creating the artificial cell membranes, the very first step was to incorporate the Min protein into a synthetic membrane made of lipids. The Min protein is involved in bacterial cell division and has been studied extensively in the world of biophysics, making it exceptionally useful in experimentation.

So far, the team has discovered a method that allows only for the mechanical division of cells. This mechanical division involves using a chip that splits lipid bubbles in two by pushing them against a sharp point. In the long run, however, the researchers are striving to develop a process that mimics natural division more accurately. Current studies toward this goal involve the manipulation of the membranes of *E. coli*. Schwille and her team want to better understand the level of alteration a cell can take while still maintaining efficient function.

## Giving the cell energy

All living things require energy. In cells, this energy comes in the form of the molecule known as ATP. The ultimate goal in a synthetic cell is for it to have its own 'power plant'; that is, for it to produce sufficient ATP for its own survival. In a living cell, this role is performed by the mitochondria. A separate group at the Max Planck Institute has created a primitive synthetic mitochondrion, which contains molecules that help synthesize ATP within its



membranes. This synthetic mitochondrion may be able to power artificial cells.

## What's next?

Scientists are working towards creating synthetic components to mimic the action of chloroplasts, which are organelles found in plant cells and other organisms that produce energy by converting carbon dioxide using sunlight. Naturally occurring chloroplasts convert 0.03%-0.1% of carbon dioxide to usable chemical energy. Conversely, synthetic chloroplasts are projected to be 10 times more efficient.

Creation of storage compartments for genes will arguably be the step that truly differentiates a synthetic cell from the real thing. Genes are the internal codes that create proteins and an efficient cell can be created using only essential genes. Synthetic biologists from La Jolla, California, distributed genes from the smallest known genome to identify which genes were essential to the organism. This allowed them to chemically stitch these genes together to create an efficient genome that functioned optimally with 473 genes. This was nearly half the number of genes found in that of the original organism.

The morals and ethics of creating life from scratch have been debated for centuries, but until now, the idea has lain solely in fiction. The emergence of this research, however, may challenge what was once a purely theoretical concept.