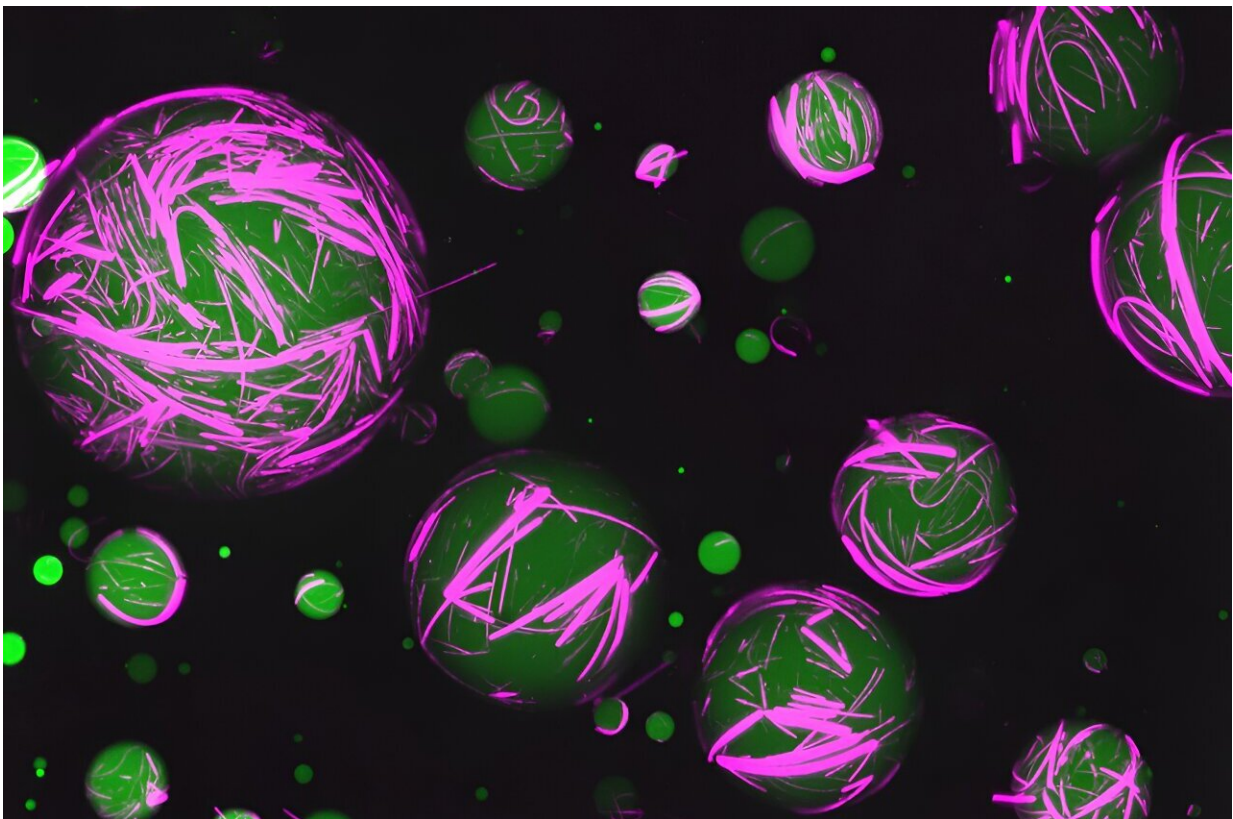


Researchers create artificial cells that act like living cells

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Synthetic cells created with programmable peptide-DNA technology that directs peptides, the building blocks of proteins, and repurposed genetic material to work together to form a cytoskeleton, shown in fuchsia. Credit: UNC-Chapel Hill

In a [new study published](#) in *Nature Chemistry*, UNC-Chapel Hill researcher Ronit Freeman and her colleagues describe the steps they took to manipulate DNA and proteins—essential building blocks of life—to create cells that look and act like cells from the body. This accomplishment, a first in the field, has implications for efforts in regenerative medicine, drug delivery systems, and diagnostic tools.

"With this discovery, we can think of engineering fabrics or tissues that can be sensitive to changes in their environment and behave in dynamic ways," says Freeman, whose lab is in the Applied Physical Sciences Department of the UNC College of Arts and Sciences.

Cells and tissues are made of proteins that come together to perform tasks and make structures. Proteins are essential for forming the framework of a cell, called the cytoskeleton. Without it, cells wouldn't be able to function. The cytoskeleton allows cells to be flexible, both in shape and in response to their environment.

Without using natural proteins, the Freeman Lab built cells with functional cytoskeletons that can change shape and react to their surroundings. To do this, they used a new programmable peptide-DNA technology that directs peptides, the building blocks of proteins, and repurposed [genetic material](#) to work together to form a cytoskeleton.

"DNA does not normally appear in a [cytoskeleton](#)," Freeman says. "We reprogrammed sequences of DNA so that it acts as an architectural material, binding the peptides together. Once this programmed material was placed in a droplet of water, the structures took shape."

The ability to program DNA in this way means scientists can create cells to serve specific functions and even fine-tune a cell's response to

external stressors. While living cells are more complex than the synthetic ones created by the Freeman Lab, they are also more unpredictable and more susceptible to hostile environments, like severe temperatures.

"The [synthetic cells](#) were stable even at 122 degrees Fahrenheit, opening up the possibility of manufacturing cells with extraordinary capabilities in environments normally unsuitable to human life," Freeman says.

Instead of creating materials that are made to last, Freeman says their materials are made to task—perform a specific function and then modify themselves to serve a new function. Their application can be customized by adding different peptide or DNA designs to program cells in materials like fabrics or tissues. These new materials can integrate with other synthetic cell technologies, all with potential applications that could revolutionize fields like biotechnology and medicine.

"This research helps us understand what makes life," Freeman says.

"This synthetic cell technology will not just enable us to reproduce what nature does, but also make materials that surpass biology."

More information: Margaret L. Daly et al, Designer peptide–DNA cytoskeletons regulate the function of synthetic cells, *Nature Chemistry* (2024). [DOI: 10.1038/s41557-024-01509-w](https://doi.org/10.1038/s41557-024-01509-w)

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