A synthetic cell that produces anti-cancer drugs within a tumor

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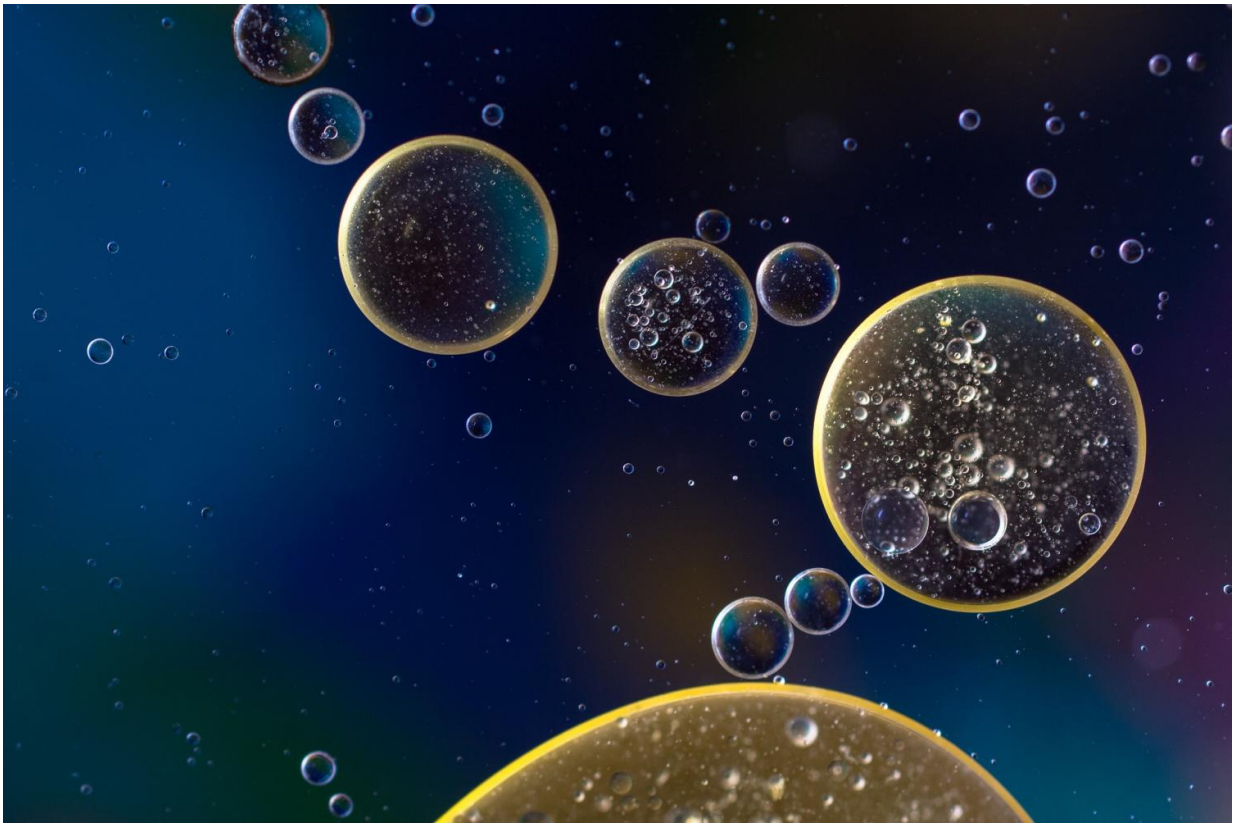

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Technion-Israel Institute of Technology researchers have successfully treated a cancerous tumor using a "nano-factory" – a synthetic cell that produces anti-cancer proteins within the tumor tissue. The research,

which was published in *Advanced Healthcare Materials*, combines synthetic biology, to artificially produce proteins, and targeted drug delivery, to direct the synthetic cell to abnormal tissues.

The synthetic cells are artificial systems with capacities similar to, and, at times, superior to those of natural cells. Just as human cells can generate a variety of biological molecules, the synthetic cell can produce a wide range of proteins. Such systems bear vast potential in the tissue engineering discipline, in production of artificial organs and in studying the origins of life.

Design of artificial cells is a considerably complex engineering challenge being pursued by many research groups across the globe. The present research, in which an artificial cell serves as a nanofactory for generating proteins within abnormal tissue, was led by the doctoral student Nitzan Krinsky and Assistant Professor Avi Schroeder, at the Wolfson Faculty of Chemical Engineering at the Technion.

The researchers integrated molecular machines within lipid-based particles resembling the natural membrane of biological cells. They engineered the particles such that when they "sense" the biological tissue, they are activated and produce therapeutic proteins, dictated by an integrated synthetic DNA template. The particles recruit the energy sources and building blocks necessary for their continued activity, from the external microenvironment (e.g., the tumor tissue).

After experiments in cell cultures in the lab, the novel technology was also tested in mice. When the engineered particles reached the tumor, they produced a protein that eradicated the cancer cells. The particles and their activity were monitored using a green fluorescent protein (GFP), generated by the particles. This protein can be viewed in real-time, using a fluorescence microscope.

"By coding the integrated DNA template, the particles we developed can produce a variety of protein medicines," said Professor Schroeder. "They are modular, meaning they allow for activation of protein production in accordance with the environmental conditions. Therefore, the artificial cells we've developed at the Technion may take an important part in the personalized medicine trend – adjustment of treatment to the genetic and medical profile of a specific patient."

More information: Nitzan Krinsky et al. Synthetic Cells Synthesize Therapeutic Proteins inside Tumors, *Advanced Healthcare Materials* (2017). DOI: 10.1002/adhm.201701163

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