Researchers develop high throughput paper-based arrays of 3-D tumor models

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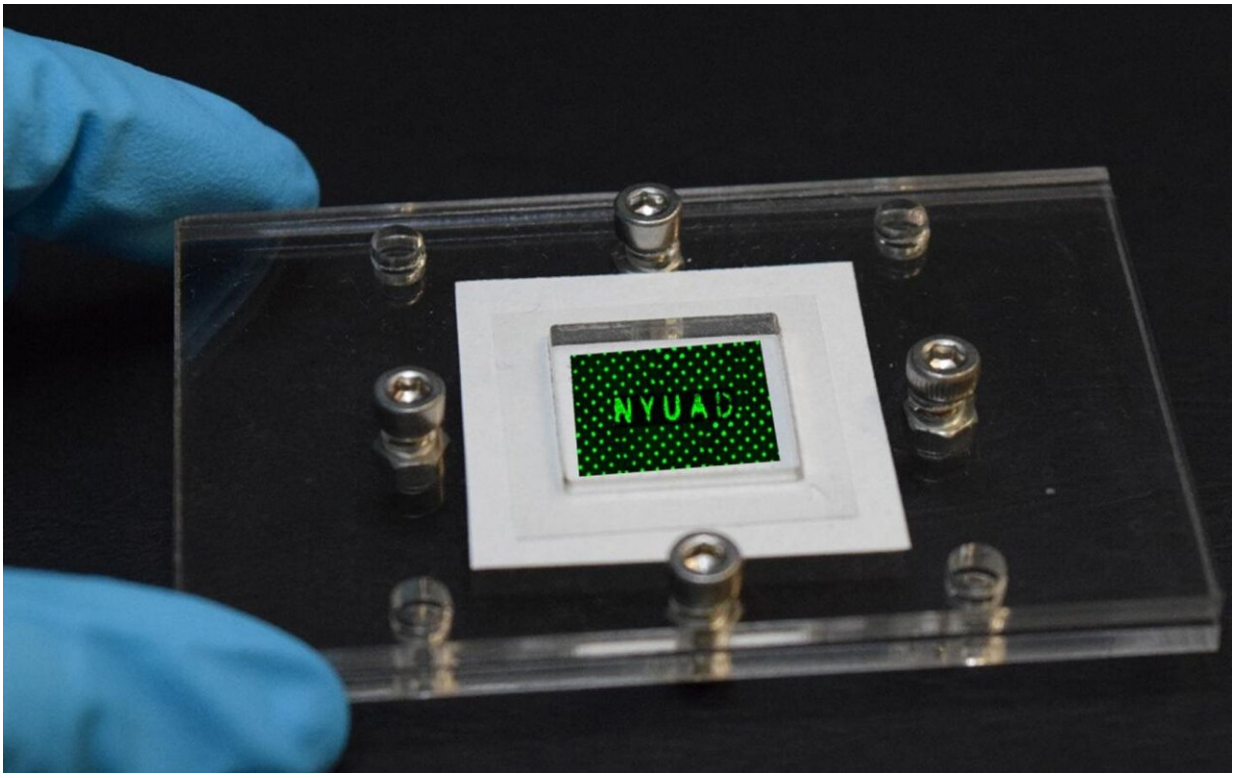


Credit: NYU Abu Dhabi

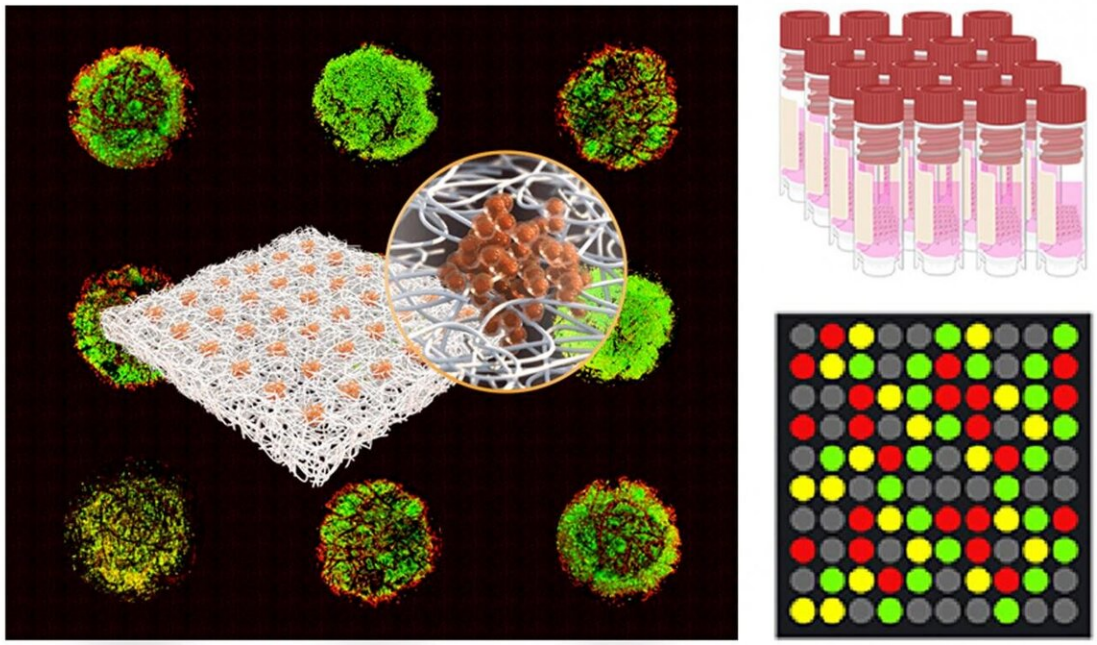
By engineering common filter papers, similar to coffee filters, a team of NYU Abu Dhabi researchers have created high throughput arrays of miniaturized 3-D tumor models to replicate key aspects of tumor physiology, which are absent in traditional drug testing platforms. With

the new paper-based technology, the formed tumor models can be safely cryopreserved and stored for prolonged periods for on-demand drug testing use. These cryopreservable tumor models could provide the pharmaceutical industry with an easy and low cost method for investigating the outcomes of drug efficacy, potentially bolstering personalized medicine. The developed technology can be transferred to other trending therapeutic applications such as measuring tumor response to drug concentration gradients, studying cancer cell signaling pathways, and investigations of invasive tumors.

The findings were published in the paper "Cryopreservable Arrays of Paper-Based 3-D Tumor Models for High Throughput Drug Screening", in the flagship journal, *Lab on a Chip*. The findings build on the team's earlier research engineering the paper platforms.

Led by Assistant Professor of Mechanical and Biomedical Engineering at NYUAD Mohammad A. Qasaimeh, the researchers sought to develop 3-D tumor models because they offer great potential for understanding the fundamental mechanisms governing tumor responses to drug treatments, and provide opportunities to develop a number of emerging therapeutic applications. Currently, most pre-clinical drug screening is conducted on simplified two-dimensional (2-D) monolayers of cell culture which do not fully represent the complexity of human tissues and organs.

Existing methods for developing 3-D cell cultures and tumor models are laborious, technically challenging, time consuming, and do not allow cryopreservation for future use. This contributes to high attrition rates in the drug development process, and can cause significant delays to market and major financial losses to companies.



Credit: NYU Abu Dhabi

"Our work presents a paper patterning method for high throughput cell culture, cryopreservation, and drug testing of 3-D tumor models. This technology is very promising to provide unparalleled advantages to the fields of drug discovery, tissue engineering, and personalized medicine," said Qasaimeh, the Principal Investigator of the Laboratory and the study leader.

By testing cisplatin (a typical chemotherapeutic drug) on breast cancer 3-D models generated within the developed platform, they were able to prove that their technology is capable of predicting the outcomes of drug

efficacy. Breast cancer is considered the most frequently diagnosed cancer in more than 80 percent worldwide. In the USA more than 10 percent of women are reported to develop invasive breast cancer over the course of their lives, and in the UAE, breast cancer is considered the most common malignancy based on incidence and mortality.

"Our reliable, easy-to-prepare, and inexpensive method is for creating high throughput paper-based arrays of 3-D tumor models that will bring us one step closer to biomimetic drug screening in the pre-clinical stages," said Bisan Samara, the first author and a former research assistant in Qasaimeh's lab.

This research is an advancement of the team's earlier work, "Paper-based Cell Cryopreservation," published last year in the journal *Advanced Biosystems*, in which they established their new technique utilizing filter paper to cryopreserve human cells, offering scientists an efficient alternative to conventional, long-term cryopreservation methods.

More information: Bisan Samara et al. Cryopreservable arrays of paper-based 3D tumor models for high throughput drug screening, *Lab on a Chip* (2021). DOI: 10.1039/d0lc01300e

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