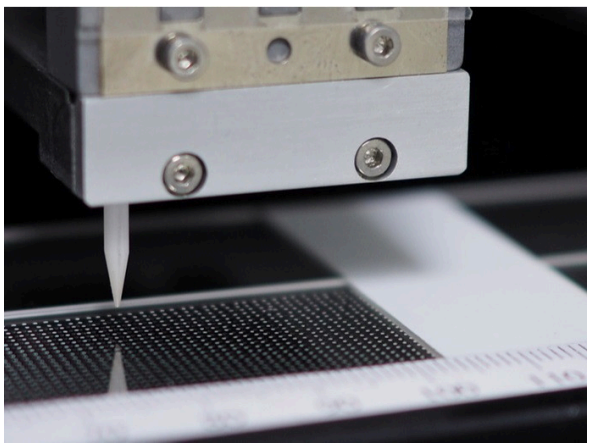
CellPrintArray – on-demand nano-scale printing of live cells and compounds for miniaturized cell screening applications

Results in Brief

A cell-based microarray platform for drug screening

Drug discovery is a time-consuming process that takes on average 15-22 years. Through a miniaturised platform, European scientists hope to speed up the drug screening process and reduce overall cost.

HEALTH



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Drug discovery includes synthesis and characterisation of individual drug candidates, followed by biological screening. Pharmaceutical companies employ combinatorial chemistry and high-throughput approaches to screen chemical libraries. However, this requires large quantities of reagents and cells as well as the need to use robotics to transfer libraries of chemicals into microtiter plates.

Cell printing onto microarrays

Contrary to traditional drug discovery systems, the EU-funded CellPrintArray project proposed to develop a miniaturised array format for high-throughput screening in live cells. The concept relies on the Droplet Microarray platform synthesised during the DROPCELLARRAY project.

“Existing array technologies are limited to the screening of nucleic acids. Our goal was to develop a system that enables the screening of soluble drugs with live cells in the microarray format,” explains project coordinator Dr Pavel Levkin. Project partners designed an integrated approach that allows the addition of entire libraries of drugs, other molecules and cells into individual 100 nanolitre droplets of the Droplet Microarray platform.

The CellPrintArray system utilises microarray slides with porous hydrophilic spots separated from each other by superhydrophobic liquid-repellent barriers. Using a nanolitre dispenser system compatible with printings of defined volumes, scientists filled the microarray spots with droplets of controlled volumes (3-500 nL per experiment) of drug solutions or cells (1-100 cells per experiment).

Alongside the liquid dispensing system, scientists (in collaboration with the manufacturer of the dispenser) developed a humidity control system for minimising evaporation effects during processing. This allowed them to control atmosphere conditions such as humidity, carbon dioxide levels and temperature, and culture cells for up to three days in screening assays.

CellPrintArray merits

The CellPrintArray platform for printing cells and cells screenings was successfully tested in house for a diverse set of biological screenings but also externally evaluated by pharmaceutical companies and clinical partners for personalised medicine applications. As Dr Levkin emphasises “the screening results obtained from miniaturised experiments proved comparable to the state-of-the-art screening technologies.”

The main advantage of the platform is that it miniaturises cell screening assays up to 1 000 times, enabling the use of physiologically more relevant cell models such as primary cells, stem cells, biopsy-derived cells and other scarce cell types. Simultaneously, it saves on the consumption of expensive reagents, significantly reducing overall assay costs and time required for screening.

The next goal for the CellPrintArray team are to generate a user-friendly all-in-one platform for miniaturised cell screenings that combines the functions of nanolitre dispensing, plate handling, cell cultivation and readout. This integrated system will offer pharmaceutical companies and hospitals the opportunity to perform high throughput screenings using a single piece of equipment.

Partners hope to provide larger array formats that are compatible with most laboratory infrastructure to widen the applicability of the CellPrintArray platform. With

a view to the future, Dr Levkin envisages “the platform that will allow the use of patient-derived cells, opening new possibilities in personalised medicine.”

Keywords

CellPrintArray | cell | microarray | humidity | chemical synthesis | drug screening | hydrophilic | culture | liquid dispensing system | humidity control system

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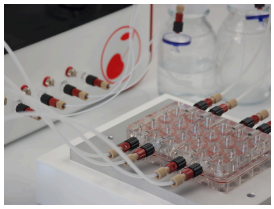

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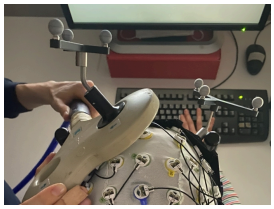

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