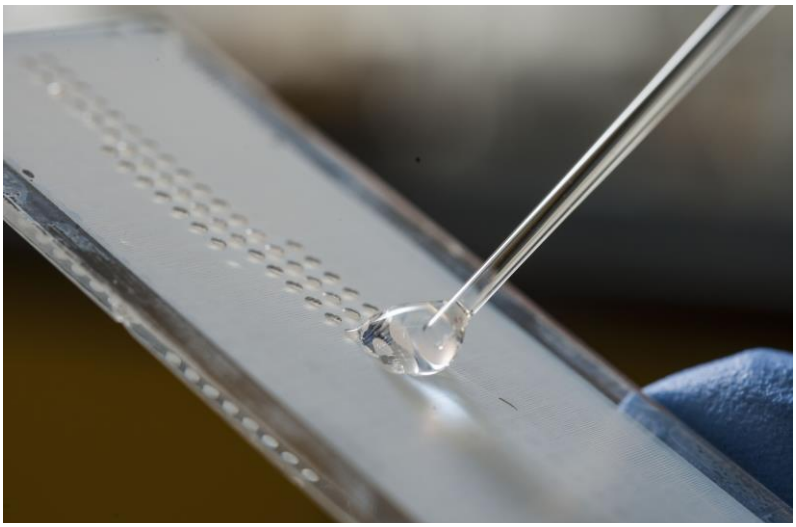
Water Droplets as Miniaturized Test Tubes

New Laboratory Technology Makes Search for Active Substances Less Expensive – Water Droplets Self-arrange and Pipetting Robots Are No Longer Required



Fluids self-arrange in smallest droplets on a DMA. (Photo: KIT)

Monika Landgraf
Chief Press Officer

Kaiserstraße 12
76131 Karlsruhe, Germany
Phone: +49 721 608-47414
Fax: +49 721 608-43658
Email: presse@kit.edu

For further information, please contact:

Dr. Felix Mescoli
Press Officer
Phone: +49 721 608-48120
Fax: +49 721 608-43658
Email: felix.mescoli@kit.edu

Modern laboratory technology cannot only help develop new medicine, but also make quicker diagnoses of higher precision. Scientists of Karlsruhe Institute of Technology (KIT) have now developed laboratory equipment that facilitates the search for active substances and the examination of cell samples. Thus, costs are reduced by a factor of up to one hundred.

Treatment methods can be adapted better to the individual needs of patients. The scientists of KIT have found a way to execute so-called high-throughput screenings with thousands of samples being tested in parallel without any expensive and complex robot systems that have been necessary so far.

Chemist Pavel Levkin of KIT's Institute of Toxicology and Genetics (ITG) and his multidisciplinary team have developed a surface on which aqueous solutions self-arrange in thousands of separate droplets. "On a droplet microarray (DMA), biological samples, such as tissue from a biopsy, can be subjected to substance screening," Levkin's team member Simon Widmaier, ITG, says. Every individual

droplet is used as a type of test tube for biological experiments. Pipetting robots and pipette tips that have been indispensable so far are no longer required. “An individual laboratory employee can execute thousands of substance screening experiments within a few seconds.” The cost reduction potential of this new technology is enormous according to Widmaier. “A pipetting robot costs several 10,000 Euros and has to be operated by an expert.” Each pipetting step alone costs five to seven cents for a pipette tip.

By means of a highly precise UV exposure method, highly water-attracting and highly water-repellent areas are produced on the array surface. As a result, the size of the droplets to be investigated can be varied between three and 250 nanoliters (one nanoliter corresponds to one billionth of a liter). When using conventional microtiter plates with lines and rows of depressions, 40 microliters (one microliter corresponds to one millionth of a liter) of reactants at least are required. “Estimated roughly, a DMA consumes a thousand times less reactants. As these substances often are very expensive - some are more expensive than gold - this is a big advantage for users,” Widmaier says.

Moreover, classical pipetting technology does not allow for portioning fluids with finely dispersed solids, e.g. cells, in nanoliter amounts. On the novel biologically compatible polymer, by contrast, experiments can also be performed with a few living cells. The technology has big advantages when screening stem and primary cells for the effect of substances on human organs. Widmaier expects that screening results will be more reliable and development of medicine will be much cheaper in the future.

To commercialize their findings, the researchers plan to establish the company Aquarray. In this way, they want to enable biological research laboratories with small funds to perform high-throughput screenings. They also want to make it easier for diagnostic laboratories to perform personalized substance screenings for e.g. cancer treatment. Last, but not least, costs of large pharmaceutical companies will be reduced. “The DMA technology solves the central problem of miniaturization of cell experiments and allows for screenings of medical substances and smallest cell volumes, an example being biopsy tissues of patients. We want to develop, produce, and commercialize droplet microarrays, product platforms, and screening kits and offer them to research institutes, screening centers, and pharmaceutical companies for cell-based substance screening in the context of personalized medicine,” Widmayer says. First prototypes are being tested on the market.

Karlsruhe Institute of Technology (KIT) pools its three core tasks of research, higher education, and innovation in a mission. With about 9,300 employees and 25,000 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

KIT – The Research University in the Helmholtz Association

Since 2010, the KIT has been certified as a family-friendly university.

This press release is available on the internet at www.kit.edu.

The photo of printing quality may be downloaded under www.kit.edu or requested by mail to presse@kit.edu or phone +49 721 608-4 7414. The photo may be used in the context given above exclusively.