

# PRESS INFORMATION

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## Small, smaller, smallest – Leipzig researchers develop new process for surface nanostructuring

Whether in medical engineering, biotechnology or microelectronics, new approaches are needed in the trend towards miniaturization in order to fabricate even smaller, more sensitive and more precise forms and structures. Together with colleagues from the Leibniz Institute of Surface Modification, researchers at the Fraunhofer Institute for Cell Therapy and Immunology have managed to lower this limit even further. Using a new printing method, the scientists demonstrated that surface modifications with a resolution of less than 10nm are now also possible.

The *Single Molecule Contact Printing* method sees DNA molecules, rather than expensive and elaborate lithography processes, being used as a nanometer-scale stamps, similar to the typeset on the classic printing press. In order to produce these stamps, the scientists harness the natural molecular binding and self-assembly properties of the DNA in order to arrange specific patterns.

By using the printing method, these molecular patterns are then able to be transferred to different materials. The process was first demonstrated on gold surfaces. Beyond this, it could be shown that even functional coatings, created by first depositing a monolayer of small molecules on the surface, are able to be imprinted. This research paves the way to structuring further materials such as ceramics, silicates, metals and plastics at the nano scale. Moreover, the process has also been used to arrange nanoparticles and biomolecules such as DNA and proteins into complex patterns.

The scientists envisage applications above all in the field of life sciences, where the demand for precise arrangements of individual or a small number of molecules in order to analyze and detect biomolecules is constantly on the rise. Fields of application present themselves here in various areas of biomedicine, medical engineering, biotechnology and even in microelectronics.

Link to original publication: [Sajfutdinow M, Uhlig K, Prager A, Schneider C, Abel B and Smith DM | Nanoscale patterning of self-assembled monolayer \(SAM\)-functionalised substrates with single molecule contact printing | Nanoscale Issue 39, 2017](#)

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**Editor**

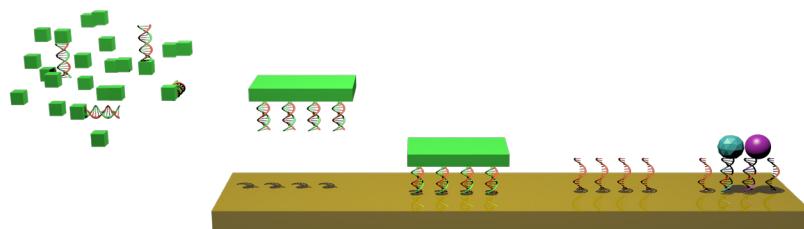
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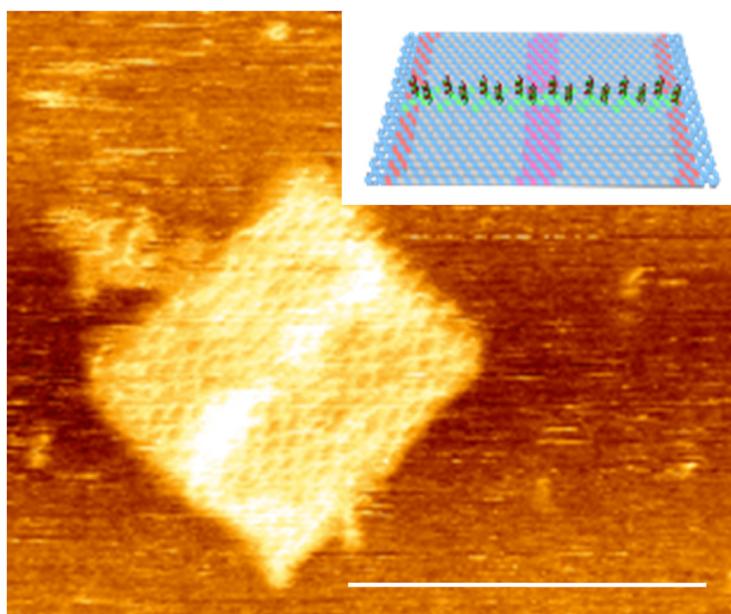
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**Figure 1:** Schematic diagram of the *Single Molecule Contact Printing* process. From left to right: the DNA stamp assembles itself from individual components (green) and the target molecules (red). The target molecules (red) are printed onto a surface, enabling e.g. nanoparticles (blue and violet) to be arranged in a precise, targeted manner.



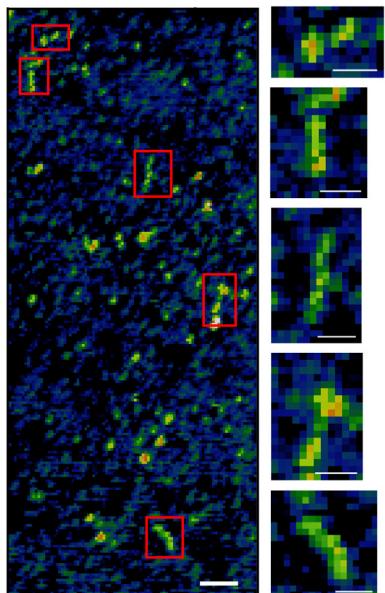
**Figure 2:** Diagram and image of a Single Molecule Contact Printing stamp taken with atomic force microscopy.

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**Figure 3:** Striped patterns were imprinted on a coated gold surface in order to arrange streptavidin molecules. Atomic force microscopy image.

**FRAUNHOFER INSTITUTE FOR CELL THERAPY AND IMMUNOLOGY IZI**

The Fraunhofer Institute for Cell Therapy and Immunology IZI



**LEIPZIG**



**POTSDAM-GOLM**



**ROSTOCK**



**HALLE (SAALE)**

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The Fraunhofer Institute for Cell Therapy and Immunology IZI investigates and develops solutions to specific problems at the interfaces of medicine, life sciences and engineering. One of the institute's main tasks is to conduct contract research for companies, hospitals, diagnostic laboratories and research institutes operating in the field of biotechnology, pharmaceuticals and medical engineering. The Fraunhofer IZI develops, optimizes and validates methods, materials and products for the business units Cell and Gene Therapy, Drugs, Diagnostics and Biosystems Technology. Its areas of competence lie in cell biology, immunology, drug biochemistry, biomarker, bioanalytics and bioproduction as well as process development and automation. In these areas, research specifically focusses on the indications oncology, neuropathology, autoimmune and inflammatory diseases as well as infectious diseases and regenerative medicine.

The **Fraunhofer-Gesellschaft** is the leading organization for applied research in Europe. Its research activities are conducted by 69 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of 24,500, who work with an annual research budget totaling 2.1 billion euros. Of this sum, 1.9 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.

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