Nano Printing Technique Produces Model Membranes

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An international team of investigators based in the United States and Germany has modified the nanoscale printing technique known as dip-pen nanolithography to create large numbers of model cell membranes. This method, published in the journal *Small*, could open the door to a better understanding of how the cell membrane functions and could lead to new ways of getting therapeutic drugs into cells.

Cell membranes are incredibly complex structures comprising a mixture of fatty molecules known collectively as phospholipids, proteins, and numerous other molecules, including cholesterol. These components hold each other together in a fluid manner –while the overall structure of the cell membrane is durable, the individual molecules in it are relatively free to move around within the confines of the membrane.

Chad Mirkin, Ph.D., and colleagues at Northwestern University, and Steven Lenhert, Ph.D., and his collaborators at the University of Munster in Germany, worked together on this project. Mirkin, who is the principal investigator of the Nanomaterials for Cancer Diagnostics and Therapeutics Center for Cancer Nanotechnology Excellence, invented dip-pen nanolithography, which uses an atomic force microscope to place individual molecules onto a surface, such as a glass slide or silicon chip.

In this work, the investigators determined the optimal experimental conditions needed to use phospholipids as “ink” that they could print onto glass slides, polystyrene sheets, or silicon wafers. By carefully

controlling the humidity and application rate, the researchers were able to deposit multiple phospholipids in precise patterns. Once deposited onto a substrate, the phospholipids formed a lipid bi-layer characteristic of cell membranes. The investigators note that they should be able to use dip-pen nanolithography to design the type of complex physical and chemical networks of materials that are found in cell membranes.

This work is detailed in a paper titled, “Massively parallel dip-pen nanolithography of heterogeneous supported phospholipid multilayer patterns.” Investigators from Forschungszentrum Karlsruhe in Germany also participated in this study. An abstract of this paper is available at the journal’s website.

Source: National Cancer Institute