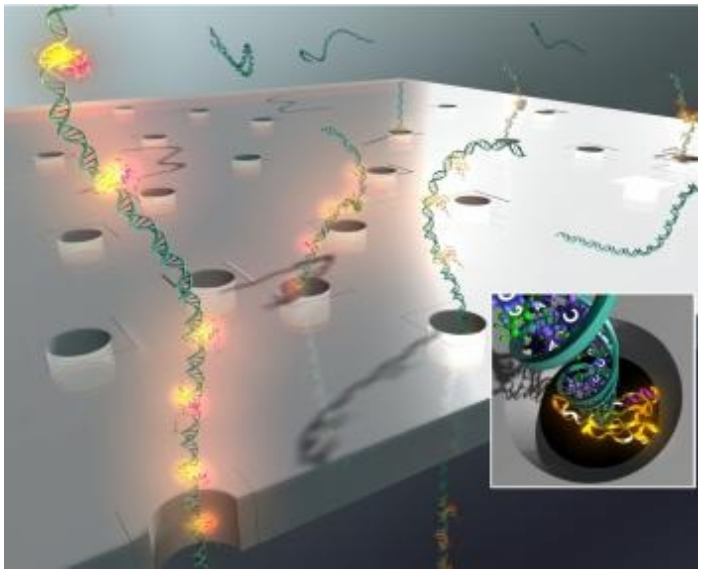
Mayo Clinic and Illinois researchers develop new sensor for methylated DNA

Collaborators from Mayo Illinois Alliance for Technology Based Healthcare have developed a new, single molecule assay for detecting methylated DNA—a naturally occurring process that controls the gene expression. The assay involves using a synthetic solid-state nanopore, and researchers say it has great potential in speeding disease-specific analyses of genetic samples. The findings appear in the current issue of *Scientific Reports* (Nature Publishing Group).

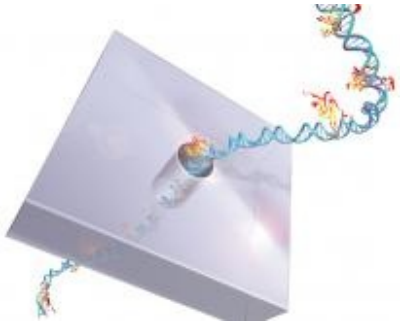


"While nanopores are being pursued for some time for genomic sequencing and screening analysis, this new assay can potentially circumvent the need for some of the current processes in evaluating epigenetics-related diseases," explained George Vasmatzis, co-leader of Mayo's Biomarker Discovery Program in the Center for Individualized Medicine and co-author on the article. He said the assay could eliminate the need for bisulfite conversion of DNA, fluorescent labeling, and PCR.

"Next steps include increasing the spatial resolution by incorporating thinner membranes and by integrating the same preparation steps," said Rashid Bashir, an Abel Bliss Professor of electrical and computer engineering and of bioengineering at Illinois. Bashir, director of the Micro and Nanotechnology Laboratory at Illinois, is co-lead author of the research paper, "Detection and Quantification of Methylation in DNA using Solid-State Nanopores."

A nanopore, in this case, is a very small hole in an artificial membrane that allows only a single molecule to be located and identified. Researchers say this is useful, as methylation in promoter sequences can indicate tumor development in most major types of cancer and may be a better biomarker than many genetic markers.

Scientists now are able to differentiate methylated from non-methylated DNA by attaching a protein on the methylated nucleotides and measuring ionic electrical current via a solid-state nanopore.



In 2010, the Mayo Clinic joined with the University of Illinois at Urbana-Champaign to form the Mayo Illinois Alliance for Technology Based Healthcare to advance research and advance clinical treatment options in health care. These findings are part of that larger formal collaboration, which, in part supported the research. Other support came from the National Institutes of Health (R21 CA155863, NIDDK R01 053884, NCI R25 CA 154015, NIH R21 CA155863, and P41-RR005969). Inaddition to Vasmatzis and Bashir, co-authors include Jiwook Shim, Gwendolyn Humphreys, Bala Murali Venkatesan, Xueqing Zou, Chaitanya Sathe, Klaus Schulten, and Ann Nardulli at the University of Illinois; and Jan Marie Munz and Farhad Kosari, of Mayo Clinic.

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