New technique could dramatically lower costs of DNA sequencing

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(*Nanowerk News*) Using computer simulations, researchers at the University of Illinois have demonstrated a strategy for sequencing DNA by driving the molecule back and forth through a nanopore capacitor in a semiconductor chip. The technique could lead to a device that would read human genomes quickly and affordably.

The ability to sequence a human genome for $1,000 or less (the price most insurance companies are willing to pay) could open a new era in personal medicine, making it possible to precisely diagnose the cause of many diseases and tailor drugs and treatment procedures to the genetic makeup of an individual. “Despite the tremendous interest in using nanopores for sequencing DNA, it was unclear how, exactly, nanopores could be used to read the DNA sequence,” said Aleksei Aksimentiev, Ph.D., who led this research effort. “We now describe one such method.” Aksimentiev and his collaborators describe the method in a paper published in the journal *Nano Letters* ("Detection of DNA Sequences Using an Alternating Electric Field in a Nanopore Capacitor").

“Through molecular dynamics simulations, we demonstrate that back-and-forth motion of a DNA molecule in a nanopore capacitor 1 nanometer in diameter produces an electrostatic fingerprint that can be used to read the genetic sequence,” said Aksimentiev.

In the researchers’ simulations, the nanopore capacitor consists of two conducting layers of doped silicon separated by an insulating layer of silicon dioxide. As DNA passes through the nanopore, the molecule’s electric field induces sequence-specific electrostatic potentials that can be detected at the top and bottom layers of the capacitor membrane. A semiconductor device capable of reading the electrostatic potentials and decoding the genetic sequence is within the grasp of current technology, Aksimentiev said.

“Nanometer pores in electronic membranes have been manufactured, and the voltage signals resulting from DNA movement through such pores have been recorded.” The next big challenge is to minimize noise in the system and reduce the speed of DNA molecules moving through the pore.

Source: *National Cancer Institute*