Researchers use 'nanopore channels' to precisely detect DNA

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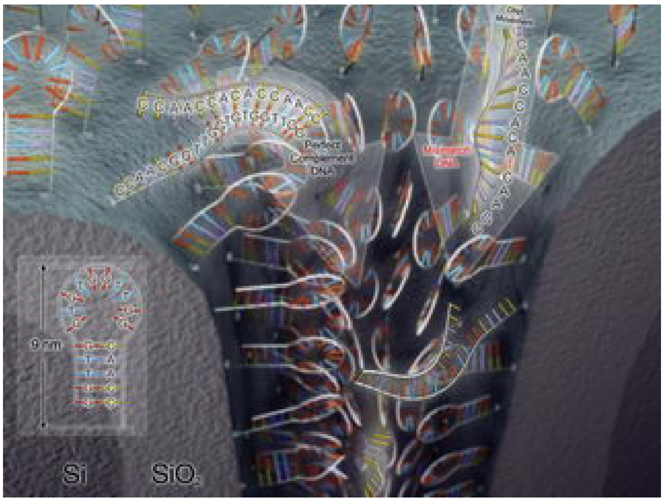

This artist&acutes rendition depicts how "nanopore channels" can be used to rapidly and precisely detect specific sequences of DNA, a potential tool for future sensors with possible genomic applications in medicine and biology. The tiny channels, which are 10 to 20 nanometers in diameter and a few hundred nanometers long, were created by researchers from Purdue&acutes Birck Nanotechnology Center. The Purdue researchers "functionalized" the channels so that single strands of DNA were attached inside each one. (Image courtesy of Seyet LLC)

Researchers at Purdue's Birck Nanotechnology Center have shown how "nanopore channels" can be used to rapidly and precisely detect specific sequences of DNA as a potential tool for genomic applications in medicine, environmental monitoring and homeland security.

The tiny channels, which are 10 to 20 nanometers in diameter and a few hundred nanometers long, were created in silicon and then a single strand of DNA was attached inside each channel.

Other researchers have created such channels in the past, but the Purdue group is the first to attach specific strands of DNA inside these silicon-based channels and then use the channels to detect specific DNA molecules contained in a liquid bath, said Rashid Bashir, a professor in the School of Electrical and Computer Engineering and the Weldon School of Biomedical Engineering.

Findings are detailed in a research paper appearing online this week in the journal *Nature Nanotechnology*. The paper was authored by former graduate student and now postdoctoral research associate Samir Iqbal, research assistant professor Demir Akin and Bashir.

Each channel was fabricated in a thin silicon membrane and bathed in the fluids containing DNA. Because DNA is negatively charged, applying a voltage across the membrane causes the genetic material in the bath to flow through the channel. The DNA is said to "translocate" through the nanopore.

The researchers discovered that single strands of perfectly complementary DNA - strands matching those attached to the inside of each channel - flowed faster and were transported in higher numbers across the pores compared to strands that did not match, Bashir said.

"We can detect the translocation of specific types of DNA strands by measuring the electrical current across the channel," he said. "Essentially, we can measure specific signature pulses that happen as a result of the specific DNA movement."

DNA is made of four different kinds of "nucleotides" identified by a specific "base." The bases are paired together to form the double-stranded helical structure.

"When the DNA molecules in the bath are perfectly complementary to those in the channels, then this current pulse is shorter compared to when there is even a single base mismatch," Iqbal said.

Being able to detect specific DNA molecules quickly and from small numbers of starting molecules without the need to attach "labels" represents a potential mechanism for a wide variety of DNA detection applications.

Source: Purdue University