# Detection of DNA on nanotubes offers new sensing, sequencing technologies

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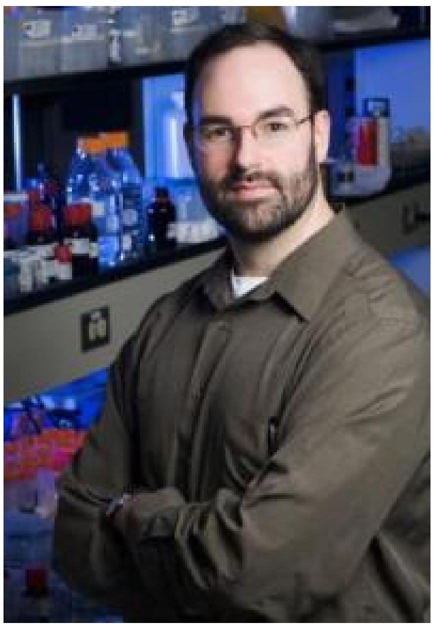

Michael Strano, professor of chemical and biomolecular engineering, and his students have found that DNA-wrapped nanotubes can be used to target specific DNA sequences. Photo by L. Brian Stauffer

Researchers at the University of Illinois at Urbana-Champaign who recently reported that DNA-wrapped carbon nanotubes could serve as sensors in living cells now say the tiny tubes can be used to target specific DNA sequences. Potential applications for the new sensors range from rapid detection of hazardous biological agents to simpler and more efficient forensic identification.

In the Jan. 27 issue of the journal *Science*, chemical and biomolecular engineering professor Michael Strano and his students reported that single-walled carbon nanotubes coated with DNA could be placed in living cells and detect trace amounts of harmful contaminants. In a paper accepted for publication in the journal Nano Letters, and posted on its Web site, the researchers report they have taken the technique a significant step further.

“We have successfully demonstrated the optical detection of selective DNA hybridization on the surface of a nanotube,” said Strano, who is also a researcher at the Beckman Institute for Advanced Science and Technology and at the university’s Micro and Nanotechnology Laboratory. “This work opens possibilities for new types of nanotube-based sensing and sequencing technologies.”

In its natural state, DNA is in the double stranded form, consisting of two complementary strands, each resembling the side of a ladder and having a specific sequence of nucleotide bases as rungs. Hybridization refers to the spontaneous binding of two complementary strands through base pair matching.

By wrapping one strand of DNA around the surface of a carbon nanotube, the researchers can create a sensor that is targeted for a particular piece of complementary DNA. When the complementary DNA then binds to the DNA probe, the nanotube’s natural near-infrared fluorescence is shifted slightly, and can readily be detected.

“The optical detection of specific DNA sequences through hybridization with a complementary DNA probe has many potential applications in medicine, microbiology and environmental science,” said Esther Jeng, a graduate student at Illinois and the paper’s lead author. “For example, this system could be used in genomic screening to detect sequences that encode for genetic disorders, and that are precursors to diseases such as breast cancer."

"Optical detection allows for passive sensing of hybridization, meaning there is no need to pass voltage or current through the system," Jeng said. "Furthermore, optics yield high-resolution signals and require a relatively simple setup. And, because our detection setup is in solution, we can sense in a natural biological environment."

Co-authors of the paper with Strano and Jeng are undergraduate students Joseph Gastala, Anthonie Moll and Amanda Roy. The work was funded by the National Science Foundation.

Source: University of Illinois at Urbana-Champaign

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