Advances in cancer detection research by Virginia Tech engineer featured in British magazine

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Blacksburg, Va. ?? New advances for the detection of cancer led by Rafael V. Davalos of the Virginia Tech-Wake Forest School of Biomedical Engineering and Science (SBES) are featured as the cover story in the January 19, 2010 Royal Society of Chemistry's magazine, "*Lab on a Chip*," the premier journal for researchers in microfluidics. http://www.rsc.org/Publishing/Journals/lc/index.asp [2]

Microfluidics is the behavior of fluids at the microscale level. A relatively new technology, it had already shown promise in revolutionizing certain procedures in molecular biology and in proteomics, among other fields.

Building upon novel technology developed while working on Homeland Security projects at Sandia National Laboratories (SNL) as well as from his biomedical graduate student days at the University of California, Berkeley, Davalos, an assistant professor of biomedical engineering at Virginia Tech, is now creating unique microsystems that are showing considerable promise for the detection of cancer and for the study of the progression of this disease. http://www.sbes.vt.edu/people/faculty/primary/davalos.html [3]

Specifically, Davalos helped engineer microsystems for the detection of water-borne pathogens using a technique called dielectrophoresis (DEP) in the early part of this decade. DEP separates and identifies cells and microparticles suspended in a medium based on their size and electrical properties.

Using the technology that can detect bacteria in water, Davalos continues to work with his colleague at Sandia, Blake A. Simmons, vice president, Deconstruction of the Joint BioEnergy Institute and manager of the Energy Systems Department at SNL. Together, they hypothesized that the technology could be reconfigured to detect cancer cells by injecting a blood or saliva sample into their microfluidic chip to screen for cancer, based on the cancer cells electrical signatures.

"Unfortunately, the direct translation was not possible due to applying high electric fields in conductive physiological solutions such as blood as compared to tap water," Davalos said. However, the lessons learned and engineering that went into developing robust and reliable microsystems at SNL was instrumental in motivating his team to come up with a viable solution ? called contactless dielectrophoresis (cDEP).

Today, Davalos, an award-winning assistant professor of biomedical engineering at Virginia Tech, along with his graduate students and co-authors of the paper, Hadi

Shafiee, John Caldwell, Erin A. Henslee, and Michael Sano, all of Blacksburg, have found a way to provide "the non-uniform electric field required for DEP that does not require electrodes to contact the sample fluid."

They named their variation cDEP since it does not require electrodes to contact the sample fluid; instead electrodes are capacitively coupled to a fluidic channel in his device through barriers that act as insulators. High-frequency electric fields are then applied to these electrodes, inducing an electric field in a channel in the device. Their initial studies illustrate the potential of this technique to identify cells through their unique electrical responses without fear of contamination from electrodes or significant joule heating.

The significance of this work is it "enables a robust method to screen for targeted cells based on the dielectrophoretic properties from an entire blood sample rather than a few microliters," Davalos, the director of Virginia Tech's Bioelectromechanical Systems Laboratory, explained.

The paper accepted by the publication "*Lab on a Chip*" is titled "Selective isolation of live/dead cells using contactless dielectrophoresis (cDEP)." http://www.rsc.org/delivery/_ArticleLinking/DisplayHTMLArticleforfree.cfm?JournalCode=LC&Year=2010&ManuscriptID=b920590j&Iss=Advance_Article [4]

"With the microfluidic devices, the researchers are able to selectively isolate a targeted cell type and let the others float by," Davalos, the 2006 recipient of the Hispanic Engineer National Achievement Award for Most Promising Engineer or Scientist, said. The behavior of living cancer cells was observed to be significantly different from those of their dead counterparts within the device.

"I'm really proud of my students. Our vision would not have been realized without their ability to engineer some crazy ideas," he said.

SOURCE [5]

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