Scientists closer to new cancer detection method

November 29 2005

University of Florida researchers say they are a step closer to a technique to easily detect a wide variety of cancers before symptoms become apparent. The findings, currently online in the *Proceedings of the National Academy of Sciences*, involve introducing molecularly engineered strands of DNA into cell cultures and observing whether they unleash a fluorescent burst after they adhere to cancer proteins.

The technique could enable doctors to search within extremely complex fluid or tissue samples to pinpoint biomarkers - proteins that signal that something is amiss.

"Even when the cancer biomarkers are in extremely low concentration we have been able to detect them," said Weihong Tan, Ph.D., a UF Research Foundation professor of chemistry in the College of Liberal Arts and Sciences and a member of the UF Genetics Institute, the UF Shands Cancer Center and the McKnight Brain Institute. "This approach could help for early diagnosis of cancer, as well as for detecting residual cancer in patients after treatment."

It works by capitalizing on fluorescent molecules engineered into tiny strands of DNA or RNA. Known as aptamers, the strands act as molecular beacons, corresponding and readily binding to a sought-after substance such as cancer protein.

In this case, the target was platelet derived growth factor, or PDGF, a protein that regulates cell growth and division. Elevated PDGF levels

have been linked to different forms of cancer, and have been found in patients with malignancies of the ovaries, kidneys, lung, pancreas and brain.

After the probe physically conforms to the PDGF, the molecule can be snapped on like a light switch to flash a fluorescent signal.

Tan, the associate director of UF's Center for Research at the Bio/Nano Interface, is seeking to patent the technology in conjunction with UF. He has been issued four U.S. patents for his work in the past two years.

"In your body, if you want to detect a molecule that coexists with many other molecules, you have to sort through the signals from the other molecules," Tan said. "This technique solves the problem caused by background signals from both the probe and the biological fluids where the proteins reside. We have engineered a molecular switch that turns on the fluorescence."

The probe's green fluorescent burst lasts little more than a billionth of a second - a nanosecond - but just long enough to separate it from surrounding signals, according to co-author Nicholas Turro, Ph.D., the William P. Schweitzer professor of chemistry at Columbia University. He also holds professorships in the department of chemical engineering and the department of earth and environmental engineering.

"A cell contains a lot of material that absorbs and emits light when it's excited," Turro said. "That's been the problem. However, if you wait 10 nanoseconds, the signals from the native fluorescence go away. What's left is the signal from the probe, which is engineered to be more long-lived at about 50 nanoseconds."

The result is a clear indication of the presence of PDGF.

"The problem of background signals is a major obstacle in many of these biodetection methods," said Paras N. Prasad, Ph.D., a distinguished professor of chemistry and executive director of the Institute for Lasers, Photonics and Biophotonics at the University of Buffalo. "Dr. Tan and his colleagues were able to address that with their light-switching method. This is a significant advancement in minimizing a frequent problem."

Much work remains to be done, but the technique potentially could be a diagnostic tool for cancer and other diseases. It could also be used to detect illicit drugs, such as cocaine, in the body, researchers say.

"Eventually we would like to see this assay become as convenient as a pregnancy test," said Chaoyong James Yang, a chemistry doctoral student in the Tan group and the first author of the paper. "Put the probe inside a few drops of body fluid or blood and a color change would be an indication of the existence of a cancer biomarker in the body. In that event, the person could seek a more thorough examination."

Source: University of Florida

Citation: Scientists closer to new cancer detection method (2005, November 29) retrieved 10 April 2024 from https://phys.org/news/2005-11-scientists-closer-cancer-method.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.