Handheld nanoLAB detects disease proteins in minutes

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In 2009, Stanford University faculty member Shan Wang and doctoral students Richard Gaster and Drew Hall demonstrated that they could use the same ultrasensitive magnetic sensors that form the basis of today's compact, high-capacity disk drives in combination with mass-produced magnetic nanotags to detect small amounts of cancer-associated proteins (click here for earlier story).

Now, in a paper published in the journal Lab on a Chip, the three scientists show how they shrunk this technology to create a handheld disease-detection device that any individual should be able to use at home to detect illness and even monitor the effectiveness of anticancer therapy. Dr. Wang is the co-principal investigator of the Center for Cancer Nanotechnology Excellence and Translation, one of nine such centers funded by the National Cancer Institute.

The device, which the researchers have named the nanoLAB, consists of a disposable "stick" that resembles a home pregnancy test, and a handheld magnetic reader that analyzes a patient's urine, blood, or saliva for the presence of specific disease-associated proteins. In its current design, the nanoLAB can provide simultaneous yes-no answers for up to eight different disease-associated proteins. The handheld sensor unit costs less than $200 to produce, while the sticks capable of making eight measurements cost less than $3.50 each, and could drop to under $1 apiece with improvements already in the works. When Dr. Wang's students built the first version of this device, it occupied an entire room. One component, the electromagnet, weighed over 200 pounds by itself

and had to be plugged into a wall outlet. Batteries power the device in its new form.

To conduct a test using the nanoLab, a person would add a drop of biological sample - urine or blood, for example - on the stick. They would then add the contents of two premeasured vials to the stick and then wait 15 minutes for results to appear in the form of a lit LED light on the sensor unit. A pre-programmed microprocessor handles all data analysis and generates the yes-no signal visible as either a green or red light.

This work, which is detailed in a paper titled, "nanoLAB: An ultraportable, handheld diagnostic laboratory for global health," was supported in part by the NCI Alliance for Nanotechnology in Cancer, a comprehensive initiative designed to accelerate the application of nanotechnology to the prevention, diagnosis, and treatment of cancer. An abstract of this paper is available at the journal's website.

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