BioCDs could hit No. 1 on doctors' charts

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WEST LAFAYETTE, Ind. – While-you-wait medical tests that screen patients for thousands of disease markers could be possible with compact-disk technology patented by Purdue University scientists.

A team led by physicist David D. Nolte has pioneered a method of creating **analog CDs that can function as inexpensive diagnostic tools for protein detection**.

Because the concentration of certain proteins in the bloodstream can indicate the onset of many diseases, a cheap and fast method of detecting these biological molecules would be a welcome addition to any doctor's office. But with current technology, blood samples are sent to laboratories for analysis – a procedure that only screens for a few of the thousands of proteins in the blood and also is costly and time-consuming.

"This technology could revolutionize medical testing," said Nolte, who is a professor of physics in Purdue's School of Science. "We have patented the concept of a 'bio-optical CD,' which could be a sensitive and high-speed analog sensor of biomolecules. Technology based on this concept could provide hospitals with a fast, easy way to monitor patient health."

Nolte and some members of his team will be available on Tuesday (May 18) to speak to the media about their work during the Conference on Lasers and Electro Optics (CLEO). Team members include chemistry professor Fred E. Regnier and physics graduate students Manoj Varma and Leilei Peng, all of Purdue.

CDs ordinarily store digital information – such as computer data or music – as billions of tiny "pits" in their surface. These microscopic pits, which represent binary ones or zeroes depending on their size, are etched in concentric tracks circling the midpoint from the inner to the outer edge of a CD.

"It is these pits which we transform into miniature test tubes," Nolte said. "Each pit can hold a trace quantity of a chemical that reacts to a certain protein found in the blood."

Blood contains more than 10,000 proteins that physicians would like to monitor, and Nolte said up to 10,000 tracks on a CD could be paired up with a different protein.

"Each ring of pits, or 'track,' on the CD could be coated with a different protein," he said. "Once the surface of a BioCD has been exposed to a blood serum sample – which would not need to be larger than a single drop – you could read the disk with laser technology similar to what is found in conventional CD players. Instead of seeing digital data, the laser reader would see how concentrated a given protein had become on each track."

Each pit is only a few micrometers – millionths of a meter – in diameter, but is nevertheless large enough to hold many thousands of individual detector molecules, each of which could pair up with and bond to a single protein molecule. The pits' capacity, Nolte said, would make the Bio-CDs an analog, rather than merely digital, screening tool.

"Physicians need a device that measures the concentration of proteins, not merely their presence or absence," he said. "Because many detector molecules can theoretically be deposited on the surface of each pit, the CDs should measure concentrations with high sensitivity. If the concentration of a given protein is high, many detector molecules will

snag a partner from a sample; if it's low, only a few will pair up."

The team's most recent experiments demonstrate a sensitivity of 10 nanograms per milliliter with a selectivity greater than 10,000. These numbers, to be reported for the first time at CLEO, are sufficient to make a working prototype BioCD seeking biologically relevant molecules.

Nolte said the advantages to using BioCDs rather than other nascent detection technology, such as biochips, would be in the number of molecules the disks could screen for, as well as simplicity and price.

"There are many detectors out there, but the most sophisticated systems can cost upwards of $50,000 and do not screen for many proteins comprehensively," he said. "BioCDs, if developed, would make use of existing technology, by and large. CDs and CD drives are very cheap to manufacture, and the changes that would need to be made to transform them into bio-assays are not unreasonable."

Those changes would include exposing the pitted surface of the CD, ordinarily protected by an acrylic coating, and depositing the plethora of detector molecules onto the CD track by track. Despite the promise of BioCDs, however, Nolte said they would not be available on the market anytime soon.

"While in principle they can be developed, significant work will need to be done to refine these techniques sufficiently," he said. "It will be at least 10 years before doctors have Bio-CDs at their disposal, and that assumes everything goes smoothly in the interim."

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Please, find the original news release in Purdue News Digest.