

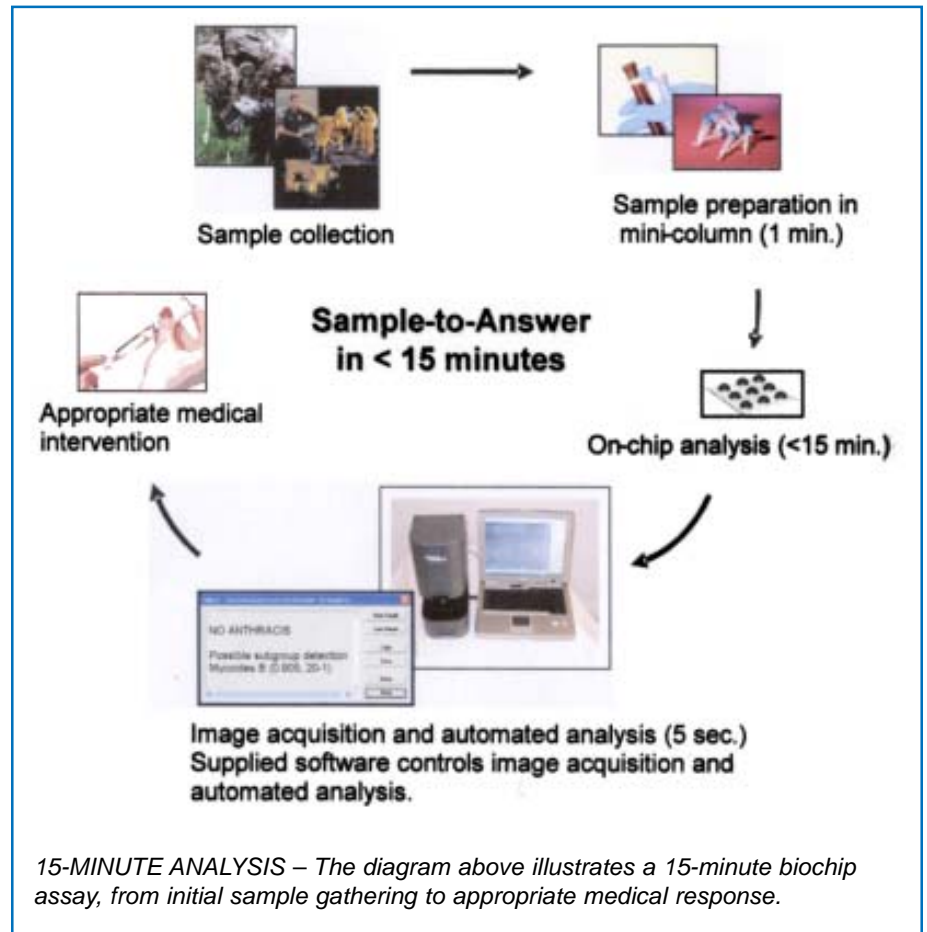
Biochip technology could become standard diagnostic tool for human, veterinary medicine

Researchers at Argonne National Laboratory have developed a biochip technology system that may one day become a standard diagnostic tool for identifying human and veterinary infectious diseases.

“In the last two years we’ve transitioned from basic research to mainly development of assays,” said Dan Schabacker, team leader of the biochip group in Argonne’s Energy Systems Division. “We know the technology works. Now it’s time to refine its applications.”

The biochip system can identify infectious disease strains in less than 15 minutes when testing protein arrays and in less than two hours when testing nucleic acid arrays. The system can be used in hospitals and other laboratories as well as in the field. The technology provides a point-of-care diagnostic system that would save time and money compared to current systems, which require sending samples to a centralized lab for confirmatory diagnosis.

Each biochip has hundreds to thousands of gel drops, each about 100 microns in diameter — 100 microns is about the width of an average human hair. A segment of a DNA strand, protein, peptide or antibody is inserted into each drop, tailoring it to recognize a specific biological agent or biochemical signature. These drops are in known positions so when a sample reacts, the reaction position can be detected, identifying the sample.



“The array of gel drops can be tailored to detect specific strains of infectious diseases or other biological organisms,” said Schabacker. “Each drop can detect trace quantities of the agents for which they are specific.”

The biochip can also be used to identify biological warfare agents. Easy sample preparation, standard operating protocols and a portable biochip reader that is smaller than a lunchbox make the system suitable

for use in the field by first responders, military personnel and medical technicians.

The system makes use of the polymerase chain reaction (PCR), a universal method for replicating billions of copies from one piece of genetic material. PCR allows trace quantities of DNA to be replicated to a level where they can be detected in the biochip system.

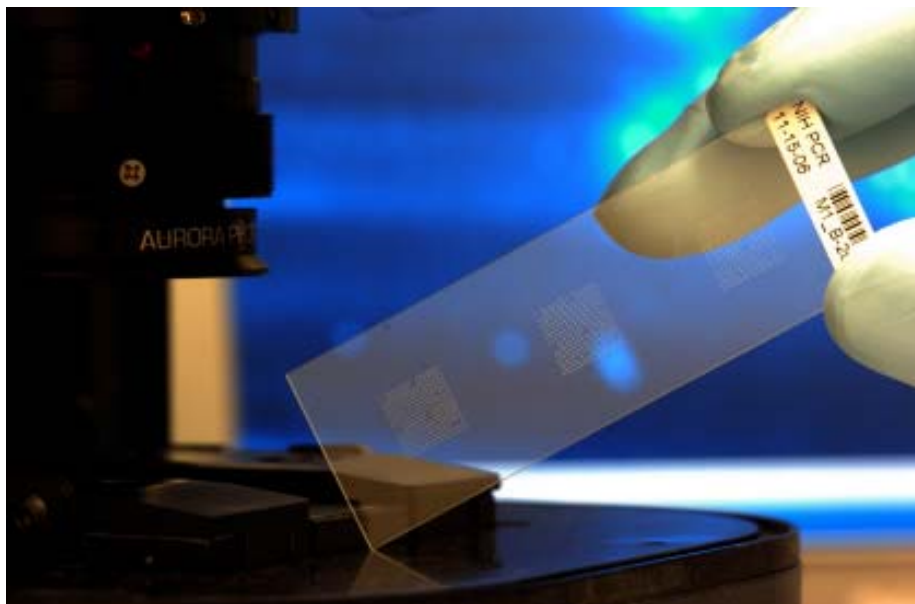
A sample to be tested is applied to a biochip, which is then put in a reader and scanned using patented side illumination laser technology to detect reaction sites. Automated algorithms determine the agents present in the sample.

Working through Argonne's Office of Technology Transfer, three start-up companies currently hold licenses related to the system — Safeguard Biosystems Inc., Akonni Biosystems Inc., and Aurora Photonics Inc.

Schabacker believes the technology holds great promise for rapid diagnostic testing since the biochip allows technicians to test for so many different agents at once. Under current development is a respiratory syndrome chip that tests for strep throat, influenza A, and influenza B. This chip would allow doctors to make a faster and more precise diagnosis when patients display symptoms common to several different ailments.

The biochip system also has great potential as a discovery tool. Current research aimed at the development of proteome chips has shown great promise. Proteome chips, which are biochips displaying all the proteins expressed by an organism at a specific time, provide the ability to screen for new cancer biomarkers, vaccine targets and therapeutic targets, as well as provide a means of characterizing disease states.

In the near future, Schabacker hopes to bring the licensees together in a cooperative program to assist them in a near-term commercial deployment strategy of the technologies for each licensee's initial target markets.



BIOCHIP SLIDE – Each biochip has hundreds to thousands of gel drops on a glass, plastic or membrane support. The biochip system can identify infectious disease strains in less than 15 minutes when testing protein arrays and in less than two hours when testing nucleic acid arrays.

“These are start up companies built largely on the biochip technology, and as a result, they are sources of jobs and growth in the economy, but they don't have the R&D infrastructure that is available at Argonne,” he said. “However, they can collaborate with us to develop their technologies. We are committed to adding value to the investment of each of our partners in their efforts to bridge the gap from research to commercial use and to introduce this technology to the market.”

Research is underway to shorten sample preparation time to about 10 minutes and increase system sensitivity, allowing full analysis to be done in less than one hour for nucleic acid arrays.

These companies all want to get a competitive product to market as soon as possible, Schabacker added. “They will all face many of the same challenges, so our respective objectives can be achieved a lot more quickly if we pool our resources. We need to get the technology out there and used so it can be accepted as a tool.”

For more information, please contact:

Dan Schabacker, PhD

Phone: 630-252-5191

E-mail: DSchabacker@anl.gov

November 2006



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