

**TATRC Highlighted Research News Article:
“Field Portable Biological Identification and Diagnostic System”**

New Portable Device Uses Nanotechnology to Identify Biological Threats in Minutes



A new “laboratory on a chip” portable, automated system will enable extremely rapid identification of infectious disease and biological warfare agents during operations in the field. View a product animation at www.integratednano.com/system_animation.



Paramagnetic nanoparticles attaching to DNA in the Palladium system

Images courtesy of Integrated Nano-Technologies, LLC

Integrated Nano-Technologies (INT) has developed a field-portable device that can easily and accurately identify targeted infectious diseases and other biological threats within minutes. The Palladium employs nanotechnology to obtain DNA analysis results that until now were not possible without lengthy sample preparation and expensive equipment. Samples today generally have to be taken to a laboratory for this level of analysis.

Early research for the project was funded through the Defense Threat Reduction Agency, and continued prototype and engineering refinements have been funded by the U.S. Army Medical Research and Materiel Command's Telemedicine and Advanced Technology Research Center (TATRC). The device could be in the field in a year.

TATRC Disaster Preparedness Portfolio Manager Dr. Kevin Montgomery explains, "There's a real need for a sensitive, easy-to-use device such as this that will help us detect and treat biological threats sooner. Just as importantly, INT has developed a universal automated sample preparation process that can more easily produce samples for gene sequencing and other lab uses."

INT President Michael Connolly notes that their new process is the first fully automated DNA sample preparation method. "For viable field use, we had to develop a robust process for extracting DNA from all kinds of samples, including very dirty ones. Anyone can use this device—just grab a mosquito, throw it in the test cartridge, and the device will tell you whether it's carrying malaria."

Connolly is also excited about the electronic sensor method INT's team has developed for identifying types of DNA. "Today's polymerase chain reaction (PCR) techniques require a large number of molecules to look for DNA optically with a dye. Our device obtains PCR-level results from just one DNA molecule because the DNA becomes part of the wiring in the microchip sensor, turning on an electrical circuit."

With the handheld Palladium device, the user puts blood, tissue or another type of sample in a disposable test cartridge, locks the cartridge into the reader and presses the start button. The device releases the DNA from the cells or viruses in the sample by bombarding them with small glass beads that are vibrated ultrasonically. Paramagnetic nanoparticles attach to the released DNA, which is drawn via electromagnets to a computer chip with sensors on its surface.

A DNA molecule that matches two capture probes in a sensor binds to the probes and creates a bridge. A metal coating is deposited along the bridge between these electrodes, forming a wire that shorts the sensor for that particular virus, bacteria or strain. The device reads which sensors are activated and reports results to the user.

The analysis takes less than 10 minutes. Time, location and results can be reported wirelessly to a central site so disease outbreaks can be readily identified and monitored.

Says Montgomery, “In the face of a new disease strain, possible epidemic or biological weapon, it is critical to know exactly what you are dealing with as soon as possible. This device holds great promise for that.”

TATRC manages more than 700 research projects. For more on TATRC efforts related to biosurveillance and disaster preparedness, visit www.tatrc.org.