BaDx

Portable Diagnostic Device for *Bacillus anthracis* Detection in Ultra-Low Resource Environments

Sandia National Laboratories

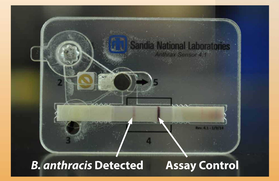
Sandia National Laboratories developed a stand-alone credit card-sized cartridge used in resource-limited environments to sense extremely low concentrations of *Bacillus anthracis*. The device will be commercialized by Sandia's industry partner, Aquila, a small woman-owned business.

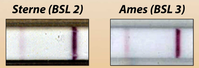
Worldwide Prevalence of Anthrax and Risk of Theft

Anthrax poses a significant threat to National Security as demonstrated by the 2001 terrorist attacks targeting the US Postal Service and Hart Building. The causative agent, *Bacillus anthracis (B. anthracis)*, is ubiquitous worldwide. More importantly, it is found in countries harboring terrorists.

Anthrax outbreaks commonly occur in livestock. Consequently, the agent is routinely isolated, propagated, and maintained in laboratories (often with no security) by indigenous populations to diagnose the disease. This practice drastically increases laboratories' repositories of *B. anthracis* and escalates the risk that the agent can be stolen for nefarious purposes. Moreover, it enhances the capabilities of laboratory personnel to produce pure *B. anthracis* isolates.

Detection from 100 Spores *B. anthracis* (Ames & Sterne Strains)





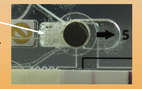
100 spore inoculum, 37 °C, no agitation
24 hr. culture + 15-60 min. development
Tetracore Red-Line LFA strip

- This is a 4-5 order of magnitude improvement in detection limit over LFA alone
- Brings the device detection limit within a practical range for real-world samples

Post-Assay Self-Sterilization

- Minimizes the potential for malicious use of the bacterial sample
- Reduces the need for experienced technicians to isolate the organism in the laboratory, reducing laboratory stores

Chemical decontamination: sodium dichloro-s-trazinetrione (dichlor)



Development of a Sustainable Anthrax Diagnostic Assay

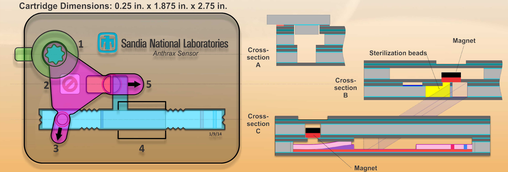
Objective: Develop a portable diagnostic device for *B. anthracis* for use in developing countries where biological threat proliferation is a serious concern.

Device Requirements:

- Field-deployable
- Target cost <10 USD
- Self-sterilizing upon completion of assay
- Detection limit ~100 spores
- No power to operate
- No instrumentation or equipment required to operate/read
- Operable by individuals with little or no technical training

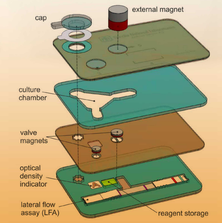
Anthracis Detection Cartridge

Cartridge Dimensions: 0.25 in. x 1.875 in. x 2.75 in.



Microfluidic platform for bacterial detection prepared from laser ablated plastic laminates

Anthrax Detector Modules and Functional Components



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