

A Universal Bio-Sensing Platform

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MITRE Sponsored Research



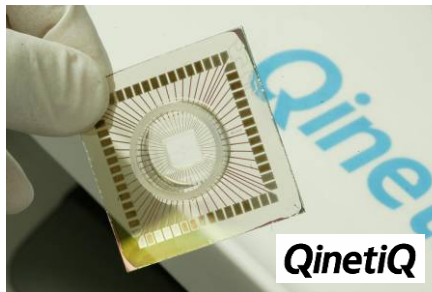
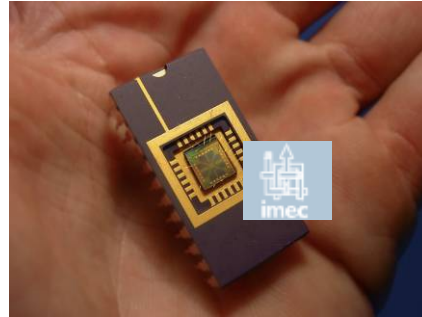
Problem

- **Current bio-sensing technology is extremely limited**
 - Need to know what you're looking for
 - Only a few agents can be sensed at once on a platform
 - Sensing a new agent requires a new sensor
 - Low accuracy: 70-85%, almost entirely Type I (false positives)
 - Tested only in the lab environment, not the field
- **Conventional methods are extremely time consuming –24 h to 1 month when performed by a well-trained clinical technician; limited number of personnel**
- **Researchers are not interested in commercializing their product**
- **Commercial products are not focused on pathogen and biothreat agent detection**

Background



 Idaho Technology Inc.

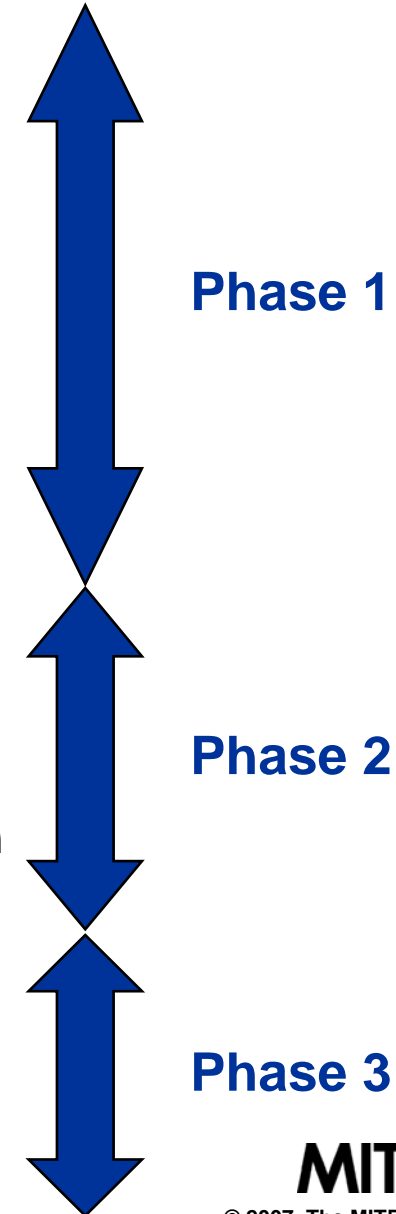


Objective

- **Develop a more generalized sensing platform to identify a larger (unlimited?) number of pathogens/organisms, leveraging microarray technology and automated processing**
 - **Identify genetic sequences that will broadly attach to genetic material of various organisms at differing levels simultaneously**
 - **Design microarray probes for the sequences, taking into account secondary structure folding, consistent hybridization temperature, etc.**
 - **Design classification algorithms that will take in the levels of attachment of each probe and classify the organism in the environment**

Activities

- **Develop a probe library**
 - Identification of sequences
 - Common to organisms of interest
 - Differential between organisms of interest
 - Secondary structure modeling, restriction of T_m
- **Identify image scanning software**
- **Identify and create classification algorithms**
 - Image classification
 - Image digitization and numerical classification
- **Train and test on agent surrogates**
 - In the MITRE lab AND in the field
 - Collaborators at Edgewood Chemical and Biological Center



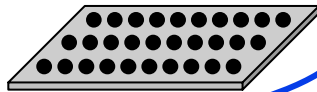
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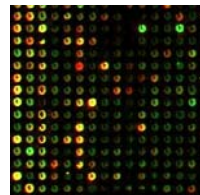
Highlight

Sample Processing: Nucleic acid (RNA/DNA) – many copies

Custom Designed Microarray

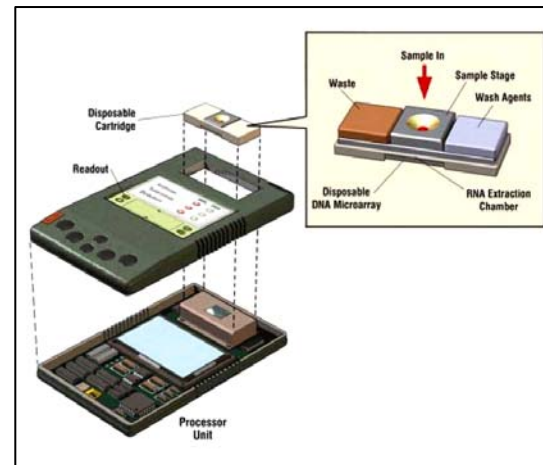


Microarray Data



Pattern Classification

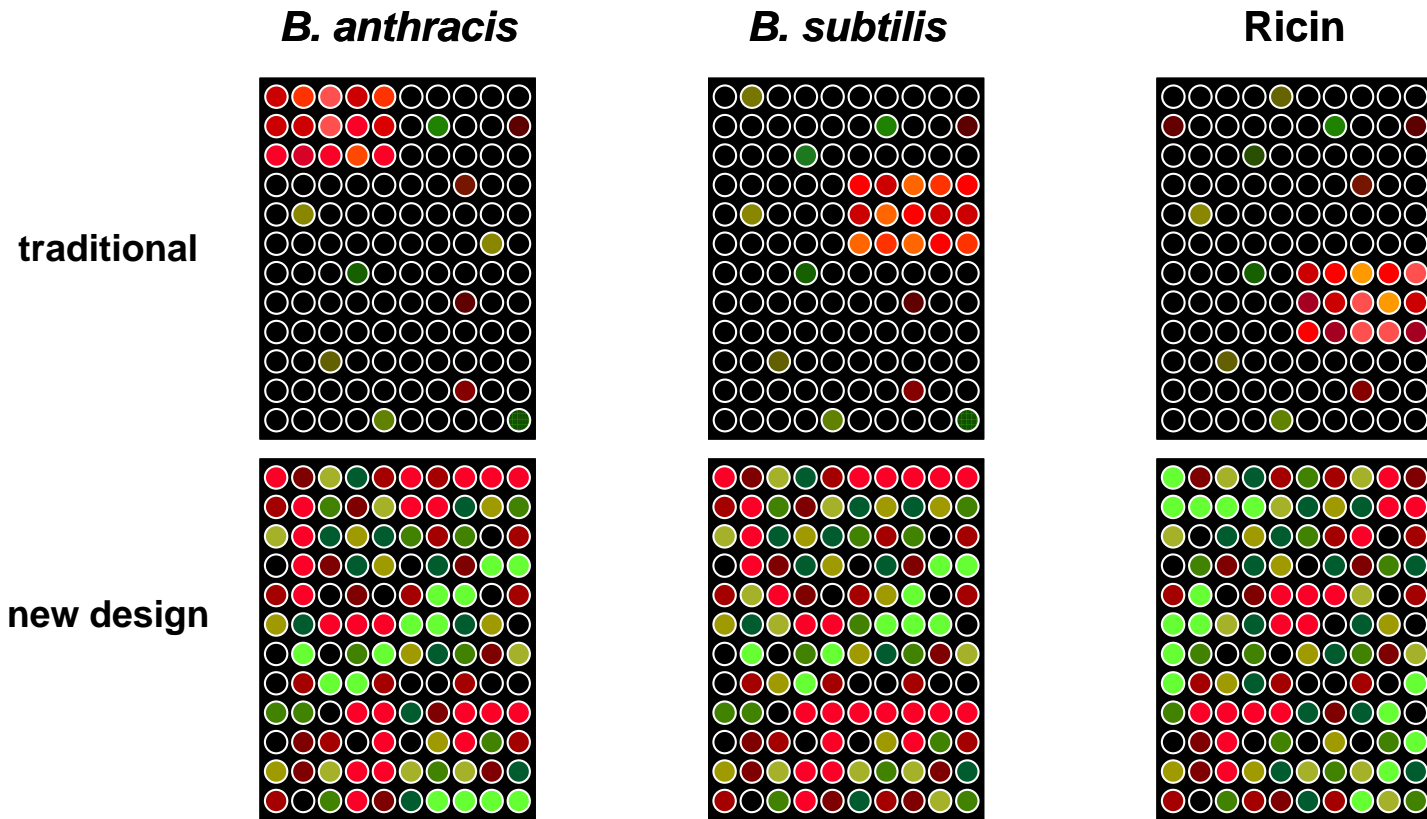
Identification of agent/pathogen



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Highlight



Impacts

- **New sensor prototype that can be used to identify pathogens/organisms by DNA**
- **Identification of sequences informative for distinguishing between organisms**
 - **Insight into how various organisms operate**
 - **Potential to establish a metric to indicate how similar organisms are (i.e. if a new organism is found)**
 - **Motivate potential therapeutics across many agents**
- **Potential expansion to protein biothreat agents (toxins and bioregulators) by designing protein arrays to bind to common/unique structures**

Future Plans

