Innovative Approaches to CB Defense

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ECBC Mission/Vision

MISSION: The nation’s premier provider of innovative chemical and biological solutions.

VISION: Provider of world class solutions
Innovation at ECBC

- Creating an adaptive and innovative culture
- Internal investments to fill gaps and find solutions
- Open call to the workforce to pitch their ideas
- Putting a premium on collaboration, both internally and externally
Smaller
- MiniION technology puts sequencing in the palm of your hand

Better
- Super-antibodies to improve performance in austere environments

Cheaper
- Colorimetric paper assays provide low-cost solutions to CB detection

Faster
- Innovative scarf represents the changing face of respiratory protection
SMALLER:
Genomic analysis in the palm of your hand
MinION™ from Oxford Nanopore Technologies

- MinION™ utilizes a protein nanopore, powered and controlled from a laptop
- ECBC is a MinION Access Program (MAP) participant, receiving materials for method and application development during alpha-test phase

Current MinION™ projects:
- Viral whole genome sequencing (Ebola)
- Fieldable method development for far-forward deployment (universal sample prep, limited library prep, no cold chain, etc.)
BETTER: Building a Better Antibody
Imagine an antibody that is so stable that you can make a test kit that sits in a sauna for three days and it still works!!!!

Now imagine you can make a specific super-stable antibody to a new threat in 3-4 weeks with no animals.
**Molecular Display Technology**

**Warfare Agents**

**New Specific Antibodies**

- No animals are required!
- Fast generation of specific antibodies.
  - In as little as 3-4 weeks
- Thermostable antibodies that do not require cold chain.
  - No refrigeration ever required
  - Shelf-life >20 years
- Cheap and portable assays for use in the field.
  - Rain or shine, hot or cold

**Targets completed:**

- Ebola
- Ricin
- SEB
- Vaccinia
- B. anthracis

….and the list goes on
CHEAPER:
Low-cost Detection Solutions
Paper Assays are multiplexed chemical assays that cost 12¢.
Numerous printed dots on a small (≈1 in$^2$) piece of paper.
Each dot a unique indicator dye, responds to a different chemical moiety or property.
Pattern of dots gives unique fingerprint to identify agent.
Paper Assays can detect both chemical and biological agents.
Accurate Detection of Chemicals

30 minute exposures

In this experiment the arrays were exposed to headspace above agent, not directly ‘dipped’ in liquid.

- Paper arrays distinguish VX, GF, HD, GB, from precursors
- Agent patterns are stored in a database for rapid identification
- Not spoofed by interferrants
- Can work on vapor but also by direct contact with liquids
- Being integrated into sampling kits and other remote devices
- Can communicate results to Smartphone or to the cloud
Building a library of colorimetric sensor color changes to identify signatures of pests found in grain crops

- What are the unique signatures of insects?
- Can we distinguish between insect types?
- Do signatures vary based on food source?
Problem: Opening agricultural commodity crates infested with microorganisms and pests risks exposing unspoiled produce handled within the same shipping or processing facilities.

Solution: Construct a Volatile Organic Compound (VOC) signature library using existing colorimetric sensing arrays to create a wireless “contamination indicator system” for agricultural imports.

- Inexpensive, disposable “VOC Reader”
- Placed within a crate prior to shipment
- Queried by a smart phone from up to 25 feet away
- Allows inspectors to assess food security and quality without having to open the container
FASTER: The face of innovation in respiratory protection
Integrated Respiratory and Eye Protective Scarf (IREPS)

Summary: Mission essential head borne components do not integrate well with traditional full-facepiece air-purifying respirators that can fit on all types of faces. Create a traditional mask that could be donned quickly and without helmet removal.

Innovation: Development of an easily deployed Integrated Respiratory and Eye Protective Scarf that offers bearded user protection against particulates and RCA vapors, maintains head-borne equipment compatibility and maximize user input.
ECBC prides itself in its ability to make CB Defense equipment that is *smaller, better, cheaper, and faster* than current products used by our warfighters, allies and first responders.