Triggered Bioaerosol Sampling onto Dry Electret Filters; Wanted: Dead or Alive

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Detect-Collect-Identify for Tactical Use and Building Environments Infection Control
LIF Detection with Threat Signatures and Network
Dry Filter Collection with Wet Foam Elution
Direct Concentration for Identification
Current Efforts
Bioaerosol Transmission of Pathogens

Unintentional releases
Releases despite attempts at control
Intentional releases

Detect to Warn scenario is key

- Nat. Academies report, 2005

Aerobiology, AAAS 1942; Terrorismfiles.org, 2011
Detect-Collect-Identify Solution

**DETECTOR:** Areté’s LIF detector engine

**COLLECTION:** InnovaPrep’s dry-collection/wet-elution system

**SAMPLE PREP:** InnovaPrep’s HSC-40 Hydrosol Concentration System

**IDENTIFICATION:** Immunoassays, PCR, RMMs
Areté TRAP Detection System

Key Threat Reduction Advancement Processor (Detector) Subsystems:
- Laser Induced Fluorescence Detector
- Laser Source
- Receiver
- Integrated Flow Module
- Aerosol Inlet with an Optional Scalping Module
- System Electronics/Programming
- Battery

The system is a point detection sensor that provides single particle detection and analysis.

*Patents Pending*
InnovaPrep Bobcat (ACD-200)

Lightweight
No liquids
Eluting captured particles is quick & easy
Sample is ready for analysis in less than one minute
Operator can wear gloves
Single electrical port allows for remote triggering, data acquisition, and external power

*Patents Pending*
Integrated Detect-Collect System

By integrating and repackaging the TRAP and Bobcat collector, a networkable detect-collect module has been developed.

The two systems were integrated within an envelope the approximate size of the current Areté system.

The power supply is shared, allowing the use of single power/battery sourcing for the two systems.

Single user interface

Patents Pending
Networked Detection

Areté Threat Reduction Advancement Network (TRAN) connects all sensors to central node for processing and analysis.

Network signal processed in real time; triggers samplers to collect sample for identification.
Hand Held Extraction (HHE) System

InnovaPrep Developed
HHE
Cartridge Holds
Carbonated Elution Fluids
Elutor Cap
Fits Directly on Filter
Housing Used in Collector
Directs the Wet Foam Evenly
Through the Filter
Filter Housing

*Patents Pending*
Fast
Losses are minimal
Process is effective for all particles depending on membrane selection, including small particles like viruses
Quickly Breaks Down into a Liquid
Maintains Sample Viability in buffer or appropriate matrix

Patents Pending
Centrifugation

Time-consuming, exacting procedure
Losses occur in centrifuge tubes
Process is uneven due to physical constraints
Increasingly difficult to centrifuge small particles
Liquid to Liquid Concentration

Dead-end hollow fiber membrane filtration
Automated process
Wet Foam Elution of captured particles routinely into volumes as small as 80 µL (volumes as low as 4 µL have been demonstrated)

Patents Pending
InnovaPrep’s Concentration Process

Physical Size-based Separation technology
Buffer exchange
Final volumes are settable by user
“Particles” as small as 1-10 kD

CPT base station instrument and Concentrating Pipette Tips (CPT, center). Actual prototype tips as tested (right). *Patents Pending*
InnovaPrep’s Concentration Process Is Not:

- Not an affinity-based technology
- Not magnetic or bead based
- Not centrifugal
- Not recirculating

Some but not all analytical interferents can be removed through exchange from sample fluid to extraction fluid (i.e., soluble bivalent metal ions)

Some interferents may be concentrated if they are like the target particles (i.e., some humic acids have properties similar to DNA)
Viable Bg Spores, TRAP-Collect
Sample Viability Maintained

Tomato wash on TSA
Unconcentrated
Concentrated

*E. coli* on Petrifilm®
PhytoPlex

Nannochloropsis oculata

Isochrysis sp.

Tetraselmis suecica
PhytoPlex Concentration Testing (Flat Filter)

Dilute 300 µL of concentrated PhytoPlex to 50 mL with water
~4.5 minutes process to concentrate into 350 µL

Undiluted PhytoPlex  Dilution  Concentrated by HSC-40