14th International Conference

Biodetection Technologies 2009

Technological Responses to Biological Threats

June 25-26, 2009
Baltimore, MD USA

Knowledge Foundation
Technology Commercialization Alliance

participating organizations:

BioTrove
CBRNIAC Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center
DARPA
INT Integrated Nano-Technologies
iZON
JMAR
NXP
OpGen
PHILIPS
smiths detection bringing technology to life DIAGNOSTICS
Tetracore
Veritide

www.knowledgefoundation.com

Technological Responses to Biological Threats

14th International Conference

Biodetection Technologies 2009

Call for Sponsors & Exhibitors

June 25-26, 2009

SPONSORSHIP AND EXHIBIT OPPORTUNITIES

Attendees at this event represent the very top industry, government and academic researchers from around the world and provide an extremely targeted and well-qualified audience for exhibitors and sponsors. Your participation as an exhibitor or sponsor is the most cost effective way to gain high quality, focused exposure to these industry leaders. Among other benefits, sponsorship packages include your logo on marketing materials to promote your participation and expose your company to 10's of thousands of prospects prior to the program - in addition to the highly targeted audience we deliver at the event itself.

CONFERENCE SPONSORSHIPS

A variety of conference sponsorships are available which offer incremental levels of visibility to conference delegates at the event — as well as opportunities for marketing exposure prior to the event. Taking advantage of pre-conference options has the added benefit of getting your organization's name out to a large group of interested decision makers.

register online at
knowledgefoundation.com

NETWORKING EVENT SPONSORSHIPS

These "mini" sponsorships offer representatives of your organization a dedicated opportunity to network with conference delegates — with your organization clearly recognized as the host of the event.

- Cocktail Receptions
- Luncheons
- Dinner Banquets
- Hospitality Suites

WORKSHOP SPONSORSHIPS

Your company may sponsor an instructional workshop (subject to approval) for delegates in conjunction with the conference. Highlight your organization's expertise! Delegate feedback indicates that these scientific/technical vehicles enhance retention of your organization's presence in their minds — increasing the potential for drawing customers long after the conference is over. Call Craig Wohlers at (617) 232-7400 ext. 205 or email cwohlers @ knowledgefoundation.com today for pricing information and customization options.

COMPREHENSIVE DOCUMENTATION AVAILABLE

Nothing can substitute the benefits derived from attending **Biodetection Technologies 2009**. But if your schedule prevents you from attending, this invaluable resource is available to you. Please allow 2-3 weeks after the conference date for delivery. *Note: Documentation is included with conference fee for registered delegates*

Conveniently timed with another special event

Sample Prep 2009

Sample Preparation for Toxin & Pathogen Detection:
Collection • (Pre-) Concentration • Lysis • Extraction

June 24, 2009 • Baltimore, MD USA

register online at **knowledgefoundation.com**

14th International Conference

Biodetection Technologies 2009

June 25-26, 2009

CONFERENCE AGENDA

Thursday, June 25, 2009

8:00 *Registration, Exhibit Viewing/Poster Setup, Coffee and Pastries*

8:50 **Organizer's Welcome and Opening Remarks**

9:00 **KEY NOTE ADDRESS**

Ultra-Rapid, Low-Complexity Bio-Analyzers

Dennis L. Polla, PhD, Program Manager, Defense Advanced Research Projects Agency (DARPA);
John C. Carrano, PhD, President, Carrano Consulting, LLC; and
Susan Barker, PhD, Senior Scientist, System Planning Corporation

The strategic landscape for biological testing is undergoing a truly disruptive transformation spanning a broad and diverse spectrum of applications from testing in the physician's office to screening for diseases in the developing world to environmental sensing of acts of bio-terrorism. The principal drivers for this dramatic paradigm shift are reducing costs, lowering mortality rates, reducing morbidity, and improving national security. Invitrodiagnostics testing is largely done today at major, centralized laboratories owing to the efficiencies associated with high-throughput, semi-automated testing. While the current model affords some pragmatic benefits, the future trends call for a radically new diagnostic solution that is portable, multiplexed, fast, inexpensive, and yet still clinically accurate. We believe the single greatest challenge for realizing pragmatic biological sensors and diagnostic instruments is the development of efficient (in terms of SWAP-C), safe, and simple technologies for the acquisition, preparation, and processing of samples. We refer to this goal as "automation for portability" or as "front-end automation". Up till now, much effort, expense, and research has gone into the development of exciting, novel new detection modalities, but this is only one part of the overall total system solution; largely neglected has been the automation of the front-end. In this talk we will present concepts for automation for portability that DARPA would like to develop in collaboration with industry, academia, and national laboratories.

9:30 **Overview of Biological Simulants Used For Biodetection Trials & Evaluations**

Guilhem Larigauderie, PhD, Technical Expert in Biology, DGA/French Ministry of Defense, France

The comparison of existing and emerging biodefense technologies and systems requires performing trials with calibrated, non-hazardous and easily manipulated simulant bio-agents. Relevant surrogates for bacteria, viruses and toxins have to be used to cover the biological diversity, including the physical properties of biothreat agents. We developed molecular tools to detect and quantify a new harmlessness model, the *Cydia pomonella* granulovirus (baculovirus), simulating large enveloped and double-stranded DNA poxviruses.

10:00 **Single Domain Antibodies for Biothreat Detection**

George Anderson, PhD, Research Chemist, Center for Bio/Molecular Science and Engineering, U.S. Naval Research Laboratory

Single domain antibodies (sdAb) are heavy chain only variable domains cloned from camelids. We have isolated and characterized sdAb towards biothreat agents including *ricin* and *botulinum A* complex. They are able to bind target with both high affinity and specificity. Most are capable of refolding after heat denaturation, recovering their secondary structure and binding activity. They function well as capture and tracer reagents in both ELISA and fluid array immunoassays.

10:30 *Networking Refreshment Break, Exhibit/Poster Viewing*

USE OF NANOTECHNOLOGY

11:00 **Portable Electronic Nucleic Acid Detection**

Michael Connolly, PhD, Integrated Nano-Technologies, LLC

INT is developing a field portable system for rapid and accurate identification of infectious agents. The system is a novel sensor which electronically detects nucleic acid sequences in a sample. No amplification is required. INT's approach utilizes nano-scale metallized DNA wires to provide a sensor that can detect a single molecule. A microfluidic system has been developed to deliver all reagents to the sensor in a small manufacturable disposable cartridge.

11:30 **A Nanofluidic System for Rapid, Quantitative Multi-Pathogen Detection in One or More Samples Simultaneously**

Colin Brenan, PhD, CTO and Senior Vice President, BioTrove Inc.

We have developed a nanofluidic system (OpenArray®) combining the precision and accuracy of real-time quantitative PCR (qPCR) in a high density array format capable of rapid, quantitative detection of multiple pathogens in one or more specimens simultaneously. The functional independence of each assay in the panel simplifies assay design and validation and provides a high degree of flexibility in selecting the assay number that provides optimal information content. System miniaturization and passive nanofluidics simplifies user workflow and makes for a robust, reliable and reproducible detection system. We will report on the system design, its function and its application to bacterial and viral identification and quantification in environmental and clinical specimens.

12:00 **Dynamically Adjustable Nanopores for Nanoparticle Detection: Virology and Biosensing Applications**

Hans van der Voorn, Executive Chairman, Izon Science Ltd, New Zealand

Izon has patented a resizable nanopore technology for rapid

14th International Conference

Biodetection Technologies 2009

CONFERENCE AGENDA

June 25-26, 2009

nanoparticle detection and analysis. The nanopores can be dynamically adjusted in real time enabling optimization of the aperture size for the particle set of interest. A significant application of this technology platform is in the field of virology. Material will be presented showing the application of this technology for detection of a range of nano-sized particles, both biological and synthetic, from 800nm to 12nm. Current developments of the Izon instrumentation will be described including the ability to accurately quantify viruses, and potential characterisation and identification of virus particles through size and shape attributes. Applications utilising antibody conjugated nanoparticles to identify viruses, and other approaches, will also be discussed.

12:30 *Luncheon Sponsored by Knowledge Foundation Technology Commercialization Alliance Membership Program*

POINT-OF-CARE DIAGNOSTICS

2:00 **A Handheld Confocal Fluorescence Scanner for Sensitive Point of Care Diagnostics**

Reinhold Wimberger-Friedl, PhD, Principal Scientist, Dept Molecular Diagnostics, Philips Research, The Netherlands

At Philips Research we have developed a handheld confocal scanner for sensitive fluorescence detection. The system is based on low cost optical components derived from optical storage technology. It has autofocus capabilities and single fluorophore sensitivity. Confocal scanning allows real time detection of the binding of labeled biomolecules due to background suppression. Sub-picomolar sensitivity is demonstrated with several target proteins, such as CRP and TNI under non optimized assay conditions in a few microliters of *serum*. The scanning autofocus system allows flexible multiplexing and does not require alignment. For point of care immunoassays we have developed an all plastic, capillary driven microfluidic cartridge with on-board reagents. In this way we can provide a low cost, versatile and robust platform for the diagnostic market.

2:30 **Development of the BioSeeq-Clinical System, Providing "Sample in, answer out" PCR Testing Capability for Point-of-Care Diagnosis**

John W. Czajka, PhD, MBA, Director Technology Development, Smiths Detection Diagnostics

Smiths Detection Diagnostics is currently developing the BioSeeq-Clinical System for the identification of hospital associated infections. The system utilizes a single-use sample preparation consumable that is driven by the BioSeeq instrument, providing true "Sample in, answer out" capability. A highly multiplexed LATE-PCR assay for MRSA is currently being developed and evaluated for use with the BioSeeq-Clinical System for pre-admission screening in hospitals.

3:00 **Intelligent Wound Management: *In-situ* Sensors to Detect Infection**

Duncan Sharp, PhD, Research Associate, Nottingham Trent University, United Kingdom

The development of a prototype sensor suitable for assessing wound integrity to alert the patient or clinicians to the onset of bacterial colonization by key organisms is described. Based on a multilayer laminate fabrication process, mass production of identical yet inherently disposable sensors suitable for direct incorporation within conventional wound dressings can be readily achieved. The design characteristics and application to the intelligent management of problematic burn wounds are described.

3:30 *Networking Refreshment Break, Exhibit/Poster Viewing*

4:00 **A Novel CMOS Biosensor Technology for Measuring Affinity Reactions**

Filip Frederix, PhD, Program Manager Biosensors, NXP, Belgium

Novel/complex biosensor technologies often lack the ability to be produced at low cost which hampers their commercialization changes. Classical diagnostic technologies (e.g. ELISA) use low cost plastic consumables and reagents. However, such technologies do not give an answer to the needs of the future in-vitro diagnostics with sensitive, multi-parameter point-of-care systems. Therefore, NXP developed a novel electronic biosensor technology, based on copper nanoelectrodes, which can be mass produced by standard CMOS processing at low cost. This biosensor can ultimately lead to massive parallel single molecule detection.

4:30 **Aluminum Oxide Based Sensors for Medical Applications**

Luis Moreno-Hagelsieb, PhD, Researcher, SENSOI, Université Catholique de Louvain, Belgium

In medical applications, simple, low cost and low consumption devices are required. In our laboratory aluminum oxide interdigitated capacitors have been developed and successfully tested on DNA hybridization test on HIV and cancer (TP-53), as well as on bacteria and humidity or condensation (coupled to a wireless breathing monitoring system), all of them showing comparable results to the state of the art using existing standard biological protocols procedures that open new opportunities for Medical Applications.

5:00 **Selected Oral Poster Highlights/Concluding Discussion**

5:30 *End of Day One*

14th International Conference

Biodetection Technologies 2009

CONFERENCE AGENDA

June 25-26, 2009

Friday, June 26, 2009

8:15 *Exhibit Viewing/Poster Setup, Coffee and Pastries*

BIOINFORMATICS FOR BIODEFENSE

9:00 **RIGEL: A Bioinformatics System for Biodefense**

Willy A. Valdivia-Granda, PhD, CEO, Orion Integrated Biosciences Inc.

In this talk we present an integrated approach for the development of standardized and interoperable diagnostics, detection and surveillance systems. Our approach in the recognition of bacterial and viral biothreats will be discussed.

OPTICS BASED SINGLE MOLECULE DETECTION

9:30 **Role of Non-Linear Optics in Meeting the Challenges of Near-Single Molecule/Organism Detection**

H. James Harmon, PhD, Professor of Physics; Director, Center for Sensors and Sensor Technology, Oklahoma State University

The ability to detect chem/bio analytes at sub-pM levels in 10 seconds or less utilizes several aspects of "non-linear optics" and/or quantum effects inlcuding: (1) Multiple photon absorbance; (2) 'Up-conversion'; (3) Minimizing self-quenching; (4) Absorbance enhancement of evanescent wave transmission in waveguides; (5) Alteration of analyte symmetry and extinction coefficient; (6) Alteration of excited state lifetimes; (7) Quantum confinement (not limited to just 'quantum dots'); and (8) Multiple exciton generation (carrier multiplication). Understanding the role of these aspects is crucial to decreasing the LOD of detection using any form of EM radiation and can increase sensitivity by several orders of magnitude compared to "linear optic" effects.

10:00 **Optical Mapping: A Novel Single Molecule System for Microbial Comparative Genomics and Identification**

Trevor Wagner, PhD, Field Applications Scientist, OpGen, Inc.

Rapid identification of bacteria is important to biodefense. Current methods typically require pure cultures thereby lengthening the time to identification or requiring prior knowledge of the organism to choose the appropriate test. In contrast, Optical Mapping can provide rapid identification of organisms in mixed cultures without prior information or PCR amplification. Optical Mapping is a *de novo* technology allowing for the detection of genetic variation including rearrangements, indels, and other genetic modifications across the entire genome not detected by other methods.

10:30 *Networking Refreshment Break, Exhibit/Poster Viewing*

FLUORESCENCE BASED DETECTION

11:00 **The Veritide Ceeker™: A Close Look at the Function and Performance of this Handheld Bacterial Spore Detector**

Lou Reinisch, PhD, Principal Scientist, Veritide Ltd., New Zealand

Veritide Limited has created a portable, battery operated spore detector that uses a combination of photochemistry and fluorescence to non-destructively determine if a white powder contains bacterial spores. This detector, the Ceeker™, is simple to use, requires less than 10 minutes to identify a sample and can be fully decontaminated. There are hundreds of white powders that have been used as hoax substances for bacterial spores. We have tested the Ceeker™ on more than 150 different hoax substances multiple times and find that it has impressive sensitivity (fraction of true positives accurately identified) and specificity (fraction of the true negatives accurately identified) for bacterial spores. The Ceeker™ identifies the dipicolinic acid that is unique to bacterial spores to discriminate against a wide array of hoax compounds. This presentation will discuss the theory of operation for the Ceeker™, how the detector is used, and the results of several thousands of tests.

11:30 **Detection of Airborne Bio-Particles Using 2P Intrinsic Fluorescence and Aerodynamic Diameter**

Jorge E. Gonzalez, PhD, President, Caribbean Biotechnologies, Inc.

We describe the development of an airborne bio-particles monitoring technique and system for real time field detection and identification using 2-photon intrinsic fluorescence excitation combined with the aerodynamic diameter of airborne particles. The intrinsic fluorescence of environmental bioaerosols such as bacteria, fungus, and viruses provide a high degree of specificity given the high energy levels required to induce fluorescence with 2-photons, and the required degree of beam focus of the light source.

ELECTROACTIVE POLYMERS BASED INTELLIGENT SENSORS

12:00 **Intelligent Sensors for Pathogen Detection and Identification**

Yanxiu Zhou, PhD, President, Y&Z Innovation LLC; and

Kalle Levon, PhD, Professor, Dept of Chemical and Biological Sciences, Polytechnic Institute of New York University

The human system interacts with the environment via a range of polymeric sensors that allow us to smell, see, taste, touch and hear by converting physical and chemical stimuli into electric impulses that transmit along the nervous system.

14th International Conference

Biodetection Technologies 2009

June 25-26, 2009

CONFERENCE AGENDA

Conducting polymers are good candidates for such purpose that their electroactive polymer chains can be used to immobilize recognition ligands to interact with target analytes and transfer the recognition process into electrical signal, and no labeling process needed. Here we mimic nature by attaching pathogen recognition elements onto electroactive polyaniline backbone to develop intelligent sensors to identify and detect biological warfare agent: *anthracis* spores. The pathogen recognition elements, such as peptides, were covalently bond to polyaniline chain and formed an interpolymer. The resulting intelligent sensor system has been used to real-time detect bacterial spores with high sensitivity and low limit of detection, it can be used to detect a few spores within minutes.

12:30 *Lunch on Your Own*

WATER PROTECTION AND MONITORING APPLICATIONS

2:00 **Automated Real-Time On-Line Measurement of Bacteria in Water Using Multi-Angle Light Scattering Techniques**

John A. Adams, PhD, Chief Scientist Sensor Products, JMAR Technologies, Inc.

JMAR's BioSentry water-monitoring system utilizes multi-angle light scattering (MALS) to detect and classify microorganisms through continuous slip-stream analysis. MALS enables the generation of a species-specific light-scattering pattern. As a microbe passes through the detection area, the pattern is captured by a photo detector and classified using proprietary algorithms (based on size, shape and morphology) in real-time. BioSentry is able to detect the presence of microbes (e.g. *E. coli*) down to 600 organisms/ml, compared with conventional water sensors (e.g. turbidity, particle counters, chlorine residual measurements) which had a detection minimum of 25,000 organisms/ml.

2:30 **Ultrasensitive Biosensor for Monitoring of Trace Amounts of Biological Macromolecules**

Bo Mattiasson, PhD, Professor, Dept of Biotechnology, Lund University, Sweden

Design of ultrasensitive assays makes it possible to analyse samples with very low content of the analyte. Often one does not need the sensitivity per se, but due to the good sensitivity it is possible to dilute the sample thereby reducing matrix-effects on the analysis. A capacitive biosensor has been developed that has a sensitivity surpassing those of most other biosensors. Thus, *cholera* toxin has been detected in buffer solutions at concentrations in the range 10^{-19} to 10^{-20} moles per liter. When spiking a natural water from a local river with a lot of suspended material, it was possible to quantify the toxin down to 10^{-18} moles per liter. The assay is relatively simple. It has been used for detection of a range of macromolecules, e.g. bacterial toxins and DNA. Quantification of virus particles is ongoing. Most of the assays have been on discrete samples, but continuous monitoring is also possible. When the sensor surface is saturated, one will then have to regenerate it. This can be done by dissociating the bound material from the sensor surface, or by using disposable electrodes. The capacitive biosensor serves the need to detect primary indicators of presence of bacteria. PCR will be used to demonstrate the presence by quantifying the DNA. This means that these two techniques complement each other. The biosensor in its present configuration is of a typical lab-design, but a new version being developed is more adopted to field applications.

3:00 **Early Warning of Microbiological Contamination of Water**

Yuliya Shakalisava, PhD, Research Fellow, Chemical Sciences - Adaptive Sensors Group, Dublin City University, Ireland

Microbial contamination of public water resources represents serious health risk. Monitoring of microbial water quality rely on culture growth methods and require at least 18-24 hours for analysis. This is not acceptable in cases where immediate action has to be taken. The presented work evaluates several strategies for utilizing surrogate measurements of water quality, such as turbidity, particle size and video sensing, as early warning systems for microbiological contamination, using parallel cell-based measurements for reference measurements. Results from initial field studies will be presented, along with a discussion on potential strategies for maximizing the usefulness of the surrogate approaches, in particular, through minimization of false positives and false negatives.

3:30 *Networking Refreshment Break, Exhibit/Poster Viewing*

ISSUES OF FIELD TESTING AND RESULTS INTERPRETATION

3:45 **Five Questions to Answer before Implementing Biological Field Testing**

Speaker to be confirmed

Following the Anthrax Letters, a demand for field identification of biological agents led to a plethora of commercially developed assays to fulfill this perceived need. This presentation will outline questions participants should ask before deciding to implement field tests to detect or identify biological agents. Using the tools presented, participants can develop answers enabling them to determine if a field test is likely to be reliable and appropriately useful, justify costly investments, integrate field decisions concerning when and when not to do field testing, coordinate field testing with outside agency requirements, and provide a sound basis for interpreting results.

4:15 **Selected Oral Poster Highlights/Concluding Discussion**

4:45 **Summary, Concluding Remarks**

5:00 *End of Conference*

Technological Responses to Biological Threats

14th International Conference

Biodetection Technologies 2009

Registration Information

KNOWLEDGE FOUNDATION
TECHNOLOGY COMMERCIALIZATION ALLIANCE

2009 Member Benefits

We would like to invite you to consider becoming a member of the Knowledge Foundation Technology Commercialization Alliance

- 15% Discount on Conferences, Exhibit Space & Live Webcasts
- 15% Discount on Knowledge Press Publications
- Member Working Groups
- Member Chat Rooms
- Online Member Directory
- Working Group Forums
- Online Networking
- Discussion Boards
- Knowledge Blog
- Industry News
- Speaking Opportunities
- Plus More Benefits

New Member Benefit for 2009

Knowledge Foundation Digital Library

Membership gives you free instant access to download all past and future conference webcasts and speaker PowerPoint presentations.

For complete membership information go to: **knowledgefoundation.com**

REGISTRATION FORM

3009 ONLINE

Please register me for	Member	Non-Member
❑ 3 DAY PASS Commercial *(June 24-26, 2009)*	❑ $1359	❑ $1599
❑ 3 DAY PASS Academic/Gov't *(June 24-26, 2009)**	❑ $934*	❑ $1099*
❑ 2 DAY PASS Commercial *(June 25-26, 2009)*	❑ $1019	❑ $1199*
❑ 2 DAY PASS Academic/Gov't *(June 25-26, 2009)**	❑ $679*	❑ $799*
❑ Poster Space Reservation	❑ $65	❑ $65

Become a member of the Alliance & take 15% off your registration fee

❑ I would like to become a member of the Knowledge Foundation Technology Commercialization Alliance:
❑ $229/yr Individual Commercial Member **❑ $49/yr Individual Student Member**
❑ $169/yr Individual Government/Academic Member

❑ I cannot attend, but please send the conference documentation.
❑ Enclosed is my check for $99. ❑ Invoice Me

❑ Enclosed is a check/bank draft for US$_____

❑ Invoice me ❑ Charge my Credit Card: ❑ VISA ❑ MC ❑ AMEX in the amount of US$_____

Card #:_____Exp.: _____

❑ Please send me information on exhibit and sponsorship opportunities.

Name: _____

Job Title: _____

Organization: _____

Division: _____

Address: _____

City/State/Zip: _____

Tel:_____Fax: _____

Email: _____

*The academic/government rate is extended to all participants registering as full time employees of government and universities. To receive the academic/government rate you must not be affiliated with any private organizations either as consultants or owners or part owners of businesses.

FAX, MAIL, CALL, E-MAIL TO:

The Knowledge Foundation, Inc.
18 Webster Street
Brookline, MA 02446 USA
Tel: (617) 232-7400
Fax: (617) 232-9171
E-Mail: custserv@knowledgefoundation.com

Payment: All payments must be made in U.S. funds drawn on a U.S. bank. Please make check(s) payable to The Knowledge Foundation, Inc. and attach to the registration form even if you have registered by phone, fax or e-mail. To guarantee your registration, payment must be received prior to the conference. Confirmation of your booking will follow.

Discount Accommodations and Travel: A block of rooms has been allocated at a special reduced rate. Please make your reservations by June 2, 2009. When making reservations, please refer to the The Knowledge Foundation. Contact The Knowledge Foundation if you require assistance.

Venue: Marriot Baltimore Inner Harbor
110 South Eutaw Street
Baltimore, MD 21201

For Hotel Reservations Contact:

Andersen Travel
Phone: (508) 429-6494 or 1-800-229-6494
Fax: (508) 429-7380
Email: kramer@andersentvl.com

Substitutions/Cancellations: A substitute member of your company may replace your attendance at any time at no charge if you find your schedule prevents you from attending. Please notify us immediately so that materials can be prepared. If you do not wish to substitute your registration, we regret that your cancellation will be subject to a $100 processing fee. To receive a prompt refund, we must receive your cancellation in writing 30 days prior to the conference. Unfortunately cancellations cannot be accepted after that date. In the event that Knowledge Foundation cancels an event, The Knowledge Foundation cannot resume responsibility for any travel-related costs.

Unable to Attend?

You can purchase a full set of conference documentation. Simply check the box on the registration form and send it to us along with your payment. Please allow 4 weeks after the conference date for delivery.