

22ND INTERNATIONAL CONFERENCE

2014

BIODETECTION TECHNOLOGIES



Technological Advances in Detection & Identification of Biological Threats

JUNE 10-11, 2014 | SHERATON BALTIMORE CITY CENTER | BALTIMORE, MD

PROGRAM TOPICS

- Simultaneous detection of multiple threats and pathogens
- Discovery and analysis of biosignatures for the detection of host response
- Point-of-care/clinical applications for pathogen/virus/ threat detection and identification
- Advances in microarray and sequencing technologies
- Non-PCR-vs. PCR-based detection techniques
- DNA chips, nucleic acid sensors and aptasensors
- Lab-on-a-chip
- Microfluidics and immobilization technology
- Proteomics, single-cell analysis and cancer-cell detection

DINNER SHORT COURSE

Application of Next-Generation Sequencing and Bioinformatics to Human Identification, Microbial Detection and Biosurveillance

HIGHLIGHTED SPEAKERS



Increased Discrimination of Pathogens and Blood Donor Sample Multiplex Testing with an OpenArray Platform
Robert Duncan, Ph.D., Staff Scientist, U.S. Food and Drug Administration



Direct Multiplexed Virus Detection
John H. Connor, Ph.D., Professor, Department of Microbiology, Boston University School of Medicine



Addressing Complex Clinical Problems with Novel Diagnostic Strategies
Harshini Mukundan, Ph.D., Research Scientist, Los Alamos National Laboratory



Treatment Guiding Detection of *Burkholderia*
R. Paul Schaudies, Ph.D., CEO, GenArraytion, Inc.

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Conference Agenda

Biodetection Technologies 2014 - the 22nd conference in the Knowledge Foundation's Detection Technologies conference series - is an internationally recognized meeting for experts in detection & identification of biological threats and point-of-care analytical methods. This conference will review feedback from the end-users on biodefense and biomedical technologies and explore the cutting edge in R&D and commercialization efforts in the field.

TUESDAY, JUNE 10, 2014

7:30 Registration with Morning Coffee

8:20 Welcome Remarks from Conference Director

GENE AMPLIFICATION FOR BIOLOGICAL TARGET IDENTIFICATION

8:25 Chairperson's Opening Remarks

Amy Altman, Ph.D., Vice President, Biodefense, Luminox Corporation

8:30 Increased Discrimination of Pathogens and Blood Donor Sample Multiplex Testing with an OpenArray Platform

Robert Duncan, Ph.D., Staff Scientist, FDA Center for Biologicals Evaluation and Research, U.S. Food and Drug Administration

Detection of pathogens in blood is required for donor screening and diagnostics. We recently demonstrated effective multiplex screening for 9 pathogens simultaneously with the OpenArray nanofluidic real-time PCR platform. The blood-borne pathogen OpenArray platform has been expanded to screen 26 pathogens with discrimination to the species, strain or genotype level. High sensitivity of detection was demonstrated with 92 blood donor specimens.

9:00 Treatment Guiding Detection of *Burkholderia*

R. Paul Schaudies, Ph.D., CEO, GenArray, Inc.

In collaboration with USAMRIID, thirty isolates each of *Burkholderia pseudomallei* and *mallei* were screened using a genotyping microarray. Results were combined with antibiotic sensitivities to generate multiplexed real-time PCR to identify and characterize these organisms.

9:30 Conductive DNA Real-Time Simultaneous Detection of Multiple Targets

Fred Albert, Ph.D., President, Bridger Technologies, Inc.

While progress is being made on the rapid and simultaneous detection of multiple targets, evolutionary improvements to conventional biodetection systems are unlikely to overcome their inherent limitations. A breakthrough technology that enables the simultaneous detection of multiple targets in less than one minute will be presented. This non-PCR, conductive DNA-based technology has been shown to be highly sensitive, highly specific, and deliver accurate results even in the presence of background and contaminants that debilitate or foul other detection systems.

10:00 Coffee Break with Exhibit and Poster Viewing

10:30 A Fully Autonomous Biodetection System for Environmental Surveillance

Mark Burton, Northrop Grumman Corporation

The Next Generation Automated Detection System (NG-ADS) Biodetector that continuously collects and analyzes air samples to detect and identify biological threat agents will be presented. The biodetector operates autonomously between routine consumables replenishment, and can be operated 24/7 year round. The detector is designed to use a multiplexed PCR assay to reliably detect threat agents simultaneously with high sensitivity, low limit of detection, and an extremely low false positive rate. Samples are archived for further analysis if desired. These systems have recently participated in a field test to demonstrate performance in an operational environment.

11:00 Addressing Complex Clinical Problems with Novel Diagnostic Strategies

Harshini Mukundan, Ph.D., Research Scientist, Los Alamos National Laboratory

We will discuss advanced and integrated biodiagnostic strategies at LANL, spanning from rapid biomarker detection to advanced sequencing-based analysis, to understand the circulation, emergence and occurrence of drug resistance in a pediatric population in rural Kenya. In addition, we will also talk about novel detection strategies used for the detection of bacteremia, including active tuberculosis, for the first time in this population.

11:30 Enabling Point-of-Care Test Development for the STD Market

*Joany Jackman, Ph.D., Investigator, Center for Point-of-Care Tests for STDs, Johns Hopkins University School of Medicine**

The mission of the Johns Hopkins University Center for Point-of-Care Tests for Sexually Transmitted Diseases (JHUC) is to provide expertise, guidance and samples to enable the development of the best available test platforms for diagnosis of sexually transmitted infections (STIs). To that end, JHUC has conducted focus groups, facilitated meetings and other studies to determine the most important attributes of a successful test for STIs in a variety of point-of-care settings. These data and their relevance to the global market for POCT for STIs will be presented. *In collaboration with: M.Jett-Goheen, A.Rompalo, T.Hogan, C.Gaydos

12:00 pm Sponsored Presentation (Opportunity Available)

12:30 Luncheon Presentation (Sponsorship Opportunity Available) or Lunch On Your Own

NOVEL DETECTION STRATEGIES FOR BIOLOGICAL TARGETS

1:55 Chairperson's Opening Remarks

R. Paul Schaudies, Ph.D., CEO, GenArray, Inc.

2:00 Direct Multiplexed Virus Detection

John H. Connor, Ph.D., Professor, Department of Microbiology, Boston University School of Medicine

We have developed an LED-based virus detection technology that is label-free and multiplexed. This technology allows the identification of viruses that cause hemorrhagic fever without the need for nucleotide isolation and amplification on a rapid time-scale in platform that can be used at the point of care.

2:30 Optimization of a Lateral Flow Immunoassay (LFI) for the Rapid Diagnosis of Melioidosis

David AuCoin, Ph.D., Research Assistant Professor, Department of Microbiology and Immunology, University of Nevada School of Medicine

Burkholderia pseudomallei is a soil-dwelling bacterium that is the causative agent of melioidosis. Laboratory detection of *B. pseudomallei* is difficult and slow, because of challenges with culturing and a lack of validated diagnostic reagents, but this has been the best approach for diagnosis of melioidosis. Our goal, therefore, has been to develop a rapid point-of-care immunoassay for the diagnosis of melioidosis. Our initial efforts have focused on developing a CPS-specific monoclonal antibody (mAb). The same mAb was used to produce a prototype lateral flow immunoassay (LFI) that is capable of detecting CPS in a

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variety of patient samples. The CDC is currently testing the LFI against a large panel of *B. pseudomallei*, related and near neighbor strains. Results of these tests and plans for further field testing will be reported.

3:00 Towards PCR-Free, Visual DNA Detection

Mahesh Uttamchandani, Ph.D., Assistant Professor, DSO National Laboratories, National University of Singapore

Novel methods to detect DNA sequence specifically through color change reactions will be described. To transduce molecular recognition events into visual readouts, we have engineered assays which have exploited split DNAszymes and gold nanoparticles. The G-quadruplex DNAszymes were successfully applied to the detection of *Salmonella* and *Mycobacterium* DNA, as well as in genotyping a single base difference from within human genomic DNA samples. An integrated workflow was capable of detecting DNA samples through a color change within just 5-15 minutes. The gold nanoparticle method offered much greater sensitivity, lowering the limit of detection visually, without the need for PCR amplification.

3:30 Refreshment Break with Exhibit and Poster Viewing

4:00 Magneto-Hydrodynamic Focusing for Point-of-Care Applications

Christian Reis, Group Lead, Biotechnology Processes, Fraunhofer IPA, Germany

Magnetic bead handling is a common tool in on-chip biodetection systems and research is improving fast. A technology for detecting the load of a magnetic particle by forcing the particle to describe certain trajectories with switching magnets will be presented. This allows us to net-focus magnetic beads in a hydrodynamic system and to provide quantitative insight for the number of molecules bound to the particle surface.

4:30 Bioaerosol Standoff Detection Using Lidar Technology Allowing Cloud Mapping and Spectrometric LIF Classification

*Sylvie Buteau, Ph.D., Scientist, Defence Research and Development Canada**

A standoff sensor called BioSense was developed to demonstrate the capacity to map, track and classify bioaerosol clouds from a distant range and over wide area. The concept of the system is based on a two steps dynamic surveillance: 1) cloud detection using an infrared (IR) scanning cloud mapper and 2) cloud classification based on a staring UV Laser Induced Fluorescence (LIF) interrogation. The main challenge is classification, which relies on a spectrally resolved UV LIF signature library. The system showed good performances even prior to further optimization.

*In collaboration with: J.R.Simard, G.Roy, P.Lahaie

5:00 iTIRF – Cell Phone-Based Biosensor for Molecular Diagnostics

Alexander N. Asanov, Ph.D., President and CSO, TIRF Labs, Inc.

A novel molecular diagnostics technology based on Total Internal Reflection Fluorescence, termed iTIRF, will be presented. iTIRF is capable of simultaneously detecting proteins, nucleic acids, and metabolite biomarkers. iTIRF microarrays employ silk fibroin, which allows for much greater immobilization of reagents and a resulting signal that is a thousand-fold greater than that with classical TIRF. Additional advantages of the biosensor, and plans for further development, will also be described.

5:30 Genomic-Based Approach for Tracking and Discriminating Pathogens

Willy Valdivia-Granda, Ph.D., CEO, Orion Integrated Biosciences, Inc.

The microbiome of an animal contains approximately 10 times the number of bacterial cells than host cells, and around 150 times more genes. Using a library of motif fingerprints and genomic signatures for pathogens of biodefense and agrodefense relevance, we performed an extensive survey of the metagenomic samples of humans and domestic animals. We have used our motif fingerprint scanning technology to perform inclusion/exclusion bioforensic and attribution analysis. The implications of our work in biosurveillance and standardized nucleic acid- or antibody-based detection system development will be discussed.

6:00-7:00 Welcome Reception in the Exhibit Hall with Poster Viewing

TUESDAY, JUNE 10, 2014 7:00-9:00pm

Dinner Short Course:

Application of Next-Generation Sequencing and Bioinformatics to Human Identification, Microbial Detection and Biosurveillance*

Instructors:

Rita Colwell, Ph.D., Distinguished Professor, University of Maryland

Seth Faith, Ph.D., Principal Research Scientist, Battelle

Brian Young, Ph.D., Technology Initiatives Leader, Battelle

Topics To Be Covered:

- NGS-based approaches to biodetection and biosurveillance
- NGS sample preparation and sequencing workflows for forensic genomics
- Bioinformatic approaches to NGS-based allelotyping in human identification

* Separate registration required for short courses

WEDNESDAY, JUNE 11, 2014

7:30 am Morning Coffee

CHEMICAL AND TOXIN DETECTION

8:25 Chairperson's Opening Remarks

Harshini Mukundan, Ph.D., Research Scientist, Los Alamos National Laboratory

8:30 Novel Cell-Based Assay for Testing Active Ricin in Environmental Samples

Baolin Zhang, Ph.D., Senior Investigator, Division of Therapeutic Proteins, Office of Biotechnology Products, Food and Drug Administration

Ricin is a deadly protein toxin with potential use as a bioterror agent. The threat of ricin attack has increased over the past decade and it has been linked to over a dozen criminal cases. The purpose of this project is to advance the current science of detection of active ricin based on its binding to the cell surface by functional ricin Chain B, cellular uptake of the catalytic Chain A, and subsequent cell death. The ability to discriminate between active and 'dead' ricin forms with the cell-based analysis can provide additional information on the risk factors associated with the sample.

9:00 Automatic Online Real-Time Detection of Microcystin-LR based on Optical Biosensing System

Han-Chang Shi, Ph.D., Professor, School of Environment, Tsinghua University, PR China

To minimize the health risks to the public, cyanotoxin detection methods that are rapid, sensitive, real time, and high frequency must be established. A novel automated optical biosensing system (AOBS) was developed for the rapid detection of microcystin-LR (MC-LR). Results using an indirect competitive detection mode will be presented. The quantification of MCLR ranges from 0.2 to 4 µg/L, with a detection limit determined as 0.09 µg/L.

9:30 Microcantilever-Enabled Biodetection

Rick Venedam, Ph.D., Senior Scientist, National Security Technologies, LLC

Embedded piezoresistive microcantilever (EPM) sensors have been used in the detection of a variety of analyte species. EPM sensors utilize a tiny piezoresistive microcantilever partially embedded into a sensing material to produce a sensing element that is compact, simple, resistant to movement and shock, and suitable for remote sensing applications. In this project we used sensing materials consisting of an immobilizing polymer functionalized with either target enzymes or antibodies to detect two biological agents, *Bacillus subtilis* and Diisopropyl fluorophosphates, a simulant for organophosphate nerve agents. Sensing results are presented for both types of EPM sensors.



10:00 Sponsored Presentation (Opportunity Available)

10:30 Coffee Break with Exhibit and Poster Viewing

11:00 The Photonic Nose: A Versatile and Simple Sensing Tool

Leonardo Bonifacio, Ph.D., Research Scientist, Opalux Inc.

The Photonic Nose platform, which is the first platform to make use of photonic crystals as an artificial nose, will be presented. It is a simple, cost-effective and versatile chemical sensing platform applicable for the detection of various analytes both in gas and liquid phases. Most current nose technology is based on relatively complex and costly platforms. The photonic nose can be used for analysis of both liquid and vapor phase samples, and is based on arrays of specially designed photonic sensors. The combinatorial response can be analyzed by use of simple digital cameras for remote and near instantaneous verification. We have implemented proof-of-concept projects that addressed challenges in areas that include bacterial detection and identification, safety testing for food, beverages, water and crude oil quality, and a number of other applications.

11:30 New MEMS-Based Micro-Coriolis Density Measurement Technology

Mike Touzin, Endress+Hauser Flowtec, Switzerland

Laboratory and field hazardous area applications of a novel MEMS technology for density measurement will be presented. This microfluidic sensor, based on the Coriolis principle, can measure density/specific gravity, temperature and viscosity. These very compact MEMS devices are immune to vehicular vibration and have an extremely fast response time, due to their high resonant frequencies. The ability to differentiate between types of fuels such as gasoline, ethanol, methanol, diesel, biodiesel, butanol, and to detect water and air contamination using density measurement, will be demonstrated. Concentrations of fuel blends such as E85 and others can be accurately determined.

12:00 pm Mid-Infrared QC Lasers for Molecular Recognition

Mariano Troccoli, Ph.D., Director Product Development, AdTech Optics, Inc.

Recent results with high performance mid-infrared quantum cascade lasers both for high power and single-mode operation will be presented. In addition, their applications to molecular recognition will be described and results on multi-wavelength detection of important chemical compounds in a single multi-laser system are detailed.

12:30 Luncheon Presentation (Sponsorship Opportunity Available) or Lunch On Your Own

1:55 Chairperson's Opening Remarks

Willy Valdivia-Granda, Ph.D., CEO, Orion Integrated Biosciences, Inc.

2:00 Host-Response-Based Biodetection by Immunosignatures

Stephen Albert Johnston, Ph.D., Co-Director, Center for Innovations in Medicine; Professor, School of Life Sciences, Biodesign Institute, Arizona State University

Most biodetection efforts have focused on sensing the pathogen. This has serious basic and practical limitations. A simple technology based on immunosignatures for detecting host changes in response to pathogens will be presented. It is very sensitive and inexpensive. It is commercializable and importantly would enable new levels of biosecurity as a by-product of standard clinical practice.

TOOLS FOR DETECTION – MICROFLUIDICS AND ENZYMES

2:30 Tool Box of Engineered Microfluidic Components Shortens Development Time and Reduces Risk

Leanna Levine, Ph.D., CEO, Aline, Inc.

A toolbox of engineered microfluidic components, including metering channels, valves, vents, pumps, and de-bubbling, can be engineered into any number

of desired footprints. Optimized actuation inputs and protocols, and design specifications ensure well-characterized and repeatable performance. Through choice of materials and design constraints, we demonstrate data on the repeatable performance of a device that meters, mixes, debubbles and dispenses. Data is presented on component reproducibility and scalable production.

3:00 SoundStream – A Microfluidic-Based Assay Platform for Rapid Portable Diagnostics

Arlene Doria, Ph.D., CEO, DEFINEQA, Inc.

An innovative microfluidic technology known as SoundStream, will be described. The field of microfluidics is plagued with challenges in integration, fluid control, and limited sample preparation strategies. SoundStream employs the use of oscillating microbubbles to perform multiple assay steps including pumping, mixing, bead assay detection, plasma/serum separation, cell lysis, and particle size separation. The technology is easy to integrate with bioassay detection methods. It reduces the complexity of the microchip design and is scalable. Finally, the platform can be powered by simple batteries for rapid portable diagnostics.

3:30 Refreshment Break with Exhibit and Poster Viewing

4:00 Application of a Recombinant Topoisomerase for the Specific Enrichment of Prokaryotic DNA

Natalia Sandetskaya, Ph.D., Fraunhofer Institute for Cell Therapy and Immunology IZI, Germany

The development and application of the novel molecular tool for the targeted enrichment of prokaryotic DNA in complex samples will be presented. The DNA binding subunit of the bacterial topoisomerase II, gyrase, was expressed, purified and immobilized on magnetic particles. Results showing specific affinity towards bacterial DNA in the samples with high background of eukaryotic DNA will be described. This method is a promising approach for the preparation of such type of the samples, for example, in molecular diagnostics of sepsis.

4:30 A Novel Thermostable Viral DNA Polymerase Facilitates Point-of-Care Molecular Detection of DNA and RNA Targets

David Mead, Ph.D., CEO, Lucigen Corp.

Point-of-care (POC) molecular detection of pathogens requires improvements in enzymes, formulation and stability. OmniAmp enzyme is a novel isothermal amplification polymerase for loop-mediated amplification (LAMP) amplification of RNA or DNA. The unique inherent reverse transcriptase activity of the enzyme allows single enzyme detection of RNA targets. OmniAmp can be formulated dry for ambient storage and transport. Detection of amplification products can be accomplished using multiple methods.

5:00 Concluding Remarks, End of Conference

THURSDAY, JUNE 12, 2014

TWO CONCURRENT SYMPOSIA

8:00am-5:00pm Oak Ridge National Laboratory's 3rd Annual Biosurveillance Symposium

2:00-5:30pm Iowa State & Purdue University's Emerging Sensor Technologies for Food Safety Symposium

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Poster Submissions: Poster abstracts are due by May 10, 2014. Once your registration has been processed and payment has been received we will email you a confirmation of the acceptance of your poster. The Knowledge Foundation reserves the right to publish your poster title and abstract in the marketing materials related to this conference.

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The Knowledge Foundation, a division of CHI
250 First Avenue, Suite 300 | Needham, MA 02494 USA

Tel: (617) 232-7400 | Fax: (617) 232-9171
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