The Knowledge Foundation's 17th International Conference

Detection Technologies 2010

New Developments in Identification of Microorganisms & Chemicals

November 9-10, 2010 • Arlington, VA USA

Conveniently Timed With

nano 2010 KAP

November 8, 2010

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Detection Technologies 2010

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Nothing can substitute the benefits derived from attending **nanoKAP & Detection Technologies 2010**. But if your schedule prevents you from attending, this invaluable resource is available to you. Please allow 3-4 weeks after the conference date for delivery. *Note: Documentation is included with conference fee for registered delegates*

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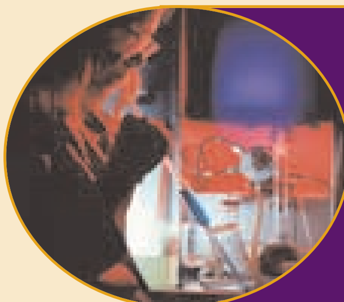

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Conference Agenda

Monday, November 8, 2010

8:30 *Registration, Exhibit Viewing/Poster Setup, Coffee and Pastries*

9:25 **Organizer's Welcome and Opening Remarks**

9:30 **Semiconductor Quantum Dots: From Biochemical Sensing to Cellular Delivery and Labeling**

James B. Delehanty, PhD, Research Biologist, Center for Bio/Molecular Science and Engineering, U.S. Naval Research Laboratory*

Luminescent semiconductor quantum dots (QDs) possess several unique optical properties that make them superior reagents relative to traditional organic fluorophores for sensing and cellular labeling applications. Chief among these properties are 1) high quantum yields, 2) broad absorption spectra with size-tunable emissions, 3) ability to excite multiple QD populations at a single wavelength and 4) ability to be used as a scaffold for the construction of nanoassemblies for the labeling and sensing of cellular processes. This talk will present several examples that highlight the utility of quantum dot nanoassemblies (QD-peptide and QD-polymer hybrids) in biological sensing and cellular labeling applications. *In collaboration with: C.E.Bradburne, D.Farrell, T.Pons, J.R.Deschamps, I.L.Medintz, and A.Huston, NRL; F.M.Brunel and P.E.Dawson, Scripps Research Institute

10:00 **SIOS - A New Technology for the Detection and Characterization of Pathogens**

Dietrich Ruehlmann, PhD, MBA, Director, Izon Science USA, a subsidiary of IZON Science Ltd

Detection, characterization and concentration measurement of viruses, virus-like particles and synthetic nanoparticles traditionally required expensive equipment, time-consuming processes or both. We (www.izon.com) have developed and successfully commercialized a nanoparticle characterization tool based on our "scanning ion occlusion spectroscopy" (SIOS). Our cost-effective and rapid methods to measure virus concentration in liquids have suggested significant potential for environmental monitoring applications. The presentation will show real-world data and discuss strengths and limitations of this new technology platform with respect to its proposed role in homeland security.

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

11:00 **TIRF-EC Technology for Sighted Nanoengineering of Reagentless Bioassays**

Alexander N. Asanov, PhD, CEO & President, TIRF Technologies, Inc.

The development of robust, sensitive and selective bioassays that require no or minimum sample preparation is a challenging task for the entire area of biodetection. Bioassays based on Molecular Beacons (MB) contain embedded fluorescent reporters. MB assays are capable of detecting unlabelled nucleic acids without the necessity of labor intense sample preparation. In conjunction with Total Internal Reflection Fluorescence (TIRF) and confocal microscopy, MB assays provide ultimate limit of detection - down to single molecules and are capable of discriminating single nucleotide polymorphism. Similar to MB, Fluorescence Molecular Switches (FMS) assays contain embedded molecular reporters that change their fluorescence upon binding to unlabelled protein or metabolite markers. Gold nanoparticles, quantum dots, and molecular metals promise to enable MB and FMS assays with enhanced fluorescence response and resistance to photobleaching. However, traditional methods of nanoengineering are empirical and labor intense; typically, they probe only end-point result of preparations. In this presentation we report about two novel applications of TIRF for "sighted" nanoengineering of bioassays. In contrast to traditional "blinded" methods, TIRF provides real-time monitoring of the entire course and the dynamics of interactions between nanoparticles and biomolecules. Combining TIRF with ElectroChemistry and Electric Field Control enables the manipulation of nanoparticles and biomolecules, thereby stimulating desired processes and preventing undesired interactions. We describe principles of novel TIRF-EC technology for rapid discovery of aptamers and synthetic antibodies from combinatorial libraries of nucleic acids and peptoids and report on a new application of TIRF-EC for nanoengineering of MB and FMS assays equipped with gold nanoparticles.

11:30 **Multiplexed Silicon Nanowire (SiNW) Detection Technologies**

Graeme K. Frith, PhD, Chief Scientific Officer and Co-Founder, Exocyte Ltd, United Kingdom

Exocyte is developing a real-time multiplexed Silicon Nanowire (SiNW) based detection and reporting platform. The SiNW technology is capable of detecting, quantitating and reporting the presence of multiple antigens or nucleic acid sequences. Exocyte will report on progress across a number of programs.

12:00 **Spectrum Sensor Based on Novel Nano-Optic Technology**

Bill Choi, CEO, nanoLambda, Inc.

Spectrum Sensor™, an ultra-compact, low-cost spectrometer-on-a-chip, based on novel nano-optic devices. Each pixel of the chip detects a predefined wavelength of light, yielding a spectral fingerprint for each material being imaged. Unlike expensive and bulky conventional solutions, nanoLambdaís Spectrum Sensor™ chip enables non-invasive and multi-target monitoring capability at an ultra compact size, only a few mm*mm, and at very competitive cost, lower by multiple magnitude of order than conventional solutions.

12:30 *Lunch*

2:00 **Highly-Sensitive DNA Genotyping without Amplification of the Target Nucleic Acid**

Melik C. Demirel, PhD, Associate Professor, Pennsylvania State University

A biosensor not requiring DNA amplification has to exploit a high sensitivity detection mechanism, coupled with a specific DNA probe. This sensor should detect at least 1000 copies of the target sequence with >99% specificity. Applications would involve general laboratory genotyping, early detection of infectious diseases and single nucleotide polymorphism (SNP) genotyping for drug resistance and drug induced adverse reaction. This sensor should also be affordable and user-friendly for general research use, point of care, management care and field use. With the objective of meeting these challenging requirements, we have developed a biosensor, which is based on a molecular probe conjugated nanoparticles in a micro-array format. Sensing occurs as the analyte containing the complementary DNA sequence (i.e. the target DNA of Respiratory Syncytial Virus (RSV), and Hepatitis-B virus (HBV)) binds to the molecular probe, and subsequently a distinct molecular fingerprint of the analyte is elicited by the Raman spectrum. The ability of our sensor to detect multiplexed genomic RNA/DNA with ultra sensitive detection (<1000 copies of target sequence) offers a substantial advantage over conventional detection methods such as electrochemical or fluorescent-dye-based technologies.

2:30 **Development of Europium Nanoparticle-Based Immunoassay for Sensitive Detection of HIV-1 p24 Antigen**

Shixing Tang, MD, PhD, Lab of Molecular Virology, DETTD/OBRR/CBER, U.S. Food and Drug Administration

A europium nanoparticle-based immunoassay was developed for sensitive detection of HIV-1 p24 antigen. The ultrasensitive assay could detect as low as 0.1~0.5 pg/ml of HIV-1 p24 and was 50-100-fold more sensitive than conventional ELISA. The immune response to HIV-1 p24 was further characterized for making better antigen (p24)-based diagnostics.

3:00 *Networking Refreshment Break, Exhibit/Poster Viewing*

3:30 **Direct Detection of Bacteremia in Human Blood Samples**

Lisa-Jo Clarizia, PhD, Senior Scientist, Immunochemistry, nanoMR

Sepsis is a severe clinical condition requiring extensive hospitalization and is the 10th leading cause of death in the US. Currently, bacterial and fungal infections are diagnosed by blood culture, requiring an initial incubation of 12-72 hr to detect growth, followed by subsequent 12-36 hr incubation for organism identification. NanoMR has developed rapid, total assay time 90 min, system for the detection of infection directly in patient blood with single-cell sensitivity. The process involves labeling and separating blood-borne bacteria with magnetic particles, followed by detection of the microbial cells by PCR. Studies using Gram-positive bacteria spiked into blood and analysis of clinical samples confirm analytical sensitivity comparable with bacterial concentrations found in clinical samples (1-10 CFU/mL).

4:00 **Palladium - An Automated Portable Field Diagnostic System**

Michael Connolly, PhD, President, Integrated Nano-Technologies, LLC

Integrated Nano-Technologies is developing an automated field diagnostic system for use in the security, veterinary and medical markets. The system has automated sample preparation and an electronic array to detect nucleic acid sequences. The system is currently being validated with bacterial and viral targets from environmental and medical samples. PCR amplification can be run in the system to generate high sensitivity. Next generation systems will eliminate the need for amplification and provide quantitative capabilities as well as the ability to run immunodiagnostics.

4:30 **Plasmon Assisted Single Virus Detection**

Alexander Zybin, PhD, Materials Analysis, Leibniz Institute for Analytical Sciences - ISAS, Germany

According to common notion, the surface plasmon resonance imaging is not suitable for detection of small objects. We demonstrate, however, that individual nano-size particles bound to the gold surface can be detected by appropriate image processing. Any bound particle gives rise to a light spot on the image and particles can be simply counted. Functionalizing the surface provides the selectivity of detection. The method is tested by detection of dielectric particles down to 40 nm and single HIV virus-like particles.

5:00 *Concluding Discussion*

5:15 *End of Symposium*

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Conference Agenda

Tuesday, November 9, 2010

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

8:55 **Organizer's Welcome and Opening Remarks**

9:00 **KEYNOTE ADDRESS**

Optical Biosensors and Systems Integration

Frances S. Ligler, DPhil, DSc, Senior Scientist for Biosensors & Biomaterials, U.S. Naval Research Laboratory

New concepts for molecular recognition, integration of microfluidics and optics, simplified fabrication technologies, and improved approaches to biosensor system integration are producing smaller, faster, cheaper biosensors with capacity to provide effective and actionable information. We have combined microfluidic mixers, Dean-based separation systems, magnetic field control, and hydrodynamic focusing methods to move target molecules and cells into a variety of interrogation devices. These approaches achieve improved target delivery to sensors and reduced clogging. Most importantly, we have focused on issues critical for effective systems integration, including the interactivity of the choices for sampling technology, biochemistry, optics, fluidics, and electronics. The overall sensing geometry, size, power, and data readout must address the sensing needs and the user requirements - in a final format that is as simple, robust, and inexpensive as possible.

9:45 **Microfluidics-Based Systems for Rapid Identification and Characterization of Novel Pathogens**

Steven S. Branda, PhD, Senior Member of Technical Staff, Biosystems Research & Development Department, Sandia National Laboratories*

Bioweapons and emerging infectious diseases pose serious and growing threats to our national security. Effective response to an outbreak critically depends upon rapid and accurate identification and characterization of the causative pathogen. Probe-based methods are problematic due to need for *a priori* knowledge of pathogen properties such as nucleic acid (NA) sequences. In recent years, unbiased Next Generation Sequencing (NGS) of NA extracted from clinical samples has enabled discovery of novel pathogens. This brute-force approach can be powerful, but it is inefficient and frequently ineffectual, primarily because the signal-to-background (pathogen-to-host NA) ratio in clinical samples is often vanishingly small. We are developing a new automated molecular biology technology that selectively suppresses host background in NA extracts from clinical samples; and prepares the residual NA (enriched for pathogen-derived content) for NGS analysis. This microfluidics-based technology, coupled with a new bioinformatics pipeline for efficient analysis of NGS datasets, comprises a Rapid Threat Organism Recognition (RapTOR) system for focused sequencing of pathogen genome/transcriptome constituents in the context of complex host backgrounds. Additionally, RapTOR's technology platform serves as a foundation for development of a new system for automated, high-content analysis of host-pathogen interactions. This complementary system is designed to support functional characterization of novel pathogens, primarily based on the transcriptional responses that they elicit in host cells. Application of the two systems in tandem will greatly accelerate identification and characterization of novel pathogens, and thereby support rational and effective response to infectious disease outbreaks. *In collaboration with: K.Patel, J.S.Schoeniger, H.Kim, S.A.Langevin, V.A.VanderNoot, M.Misra, R.F.Renzi, J.A.Fruetel, M.Bartsch, J.N.Kaiser, B.Carson, R.Meagher, C.D.James, C.F.Brooks, N.Thaitrong, P.Lane, D.Curtis, Z.Bent, E.La Bauve, A.Sinha, D.Maar, O.Negrete, D.C. Roe, V.De Sapio, J.B.Ricken, E.May, A.J.Powell, T.W.Lane

10:15 **FEATURED PROGRAM PRESENTATION**

BioWatch and Public Health Surveillance: Evaluating Systems for the Early Detection of Biological Threats

R. Paul Schaudies, PhD on behalf of the Committee on Effectiveness of National Biosurveillance Systems: BioWatch and the Public Health System, The National Academies

The study committee was asked to evaluate the effectiveness of BioWatch and compare it to an enhanced national surveillance system that relies on the health care and public health systems. The charge focuses specifically on surveillance and detection of infectious diseases or biological agents that pose a serious threat to human health. Bioterrorism, as the primary context for the BioWatch program, was the principal focus of attention. This presentation will review the specifics of the study charge, the committee process and deliberation, as well as the findings and recommendations of the committee.

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

11:00 **Impedimetric Platform for Bio-Affinity Assays**

John Hartzell, Senior Director, SHARP Laboratories of America, SHARP Corporation

An impedimetric platform for bio-affinity assays based on real-time, label-free detection has been developed. The platform includes: (i) multiplexed array capable for different types of bio-functionalization; (ii) instrument for parallel reading of multiple electrode pairs; (iii) software package for data analysis. The assay selectivity was demonstrated using closely related but different *Escherichia coli* strains. The platform is adaptable for detection of a wide range of analytes of practical significance.

11:30 Development of Treatment Guiding Multiplexed Molecular Assays for Infectious Disease Organisms

R. Paul Schaudies, PhD, President and CEO, GenArraytion, Inc.

During Phase I of a Department of Defense funded SBIR, we generated a 4,500 feature microarray containing both unique and functional molecular signatures for *Staphylococcus aureus*. The molecular signatures included both antibiotic resistance and virulence factor related sequences. We conducted hybridizations using randomly amplified and labeled DNA from eight different Staph isolates. These included both hospital and community acquired MRSA as well as drug susceptible MSSA strains. All eight of the isolates generated unique hybridization patterns. Genetic sequence information was only available for three of the eight strains. During Phase II of the funded SBIR we are collaborating with two major medical centers that are providing clinical isolates of Staph for microarray analysis. The hybridization results will provide the molecular basis for the generation of a multiplexed PCR assay using the Luminex xMap platform. We have previously generated multiplexed PCR based assays for CDC Category A organisms using Luminex magnetic beads and the LX-200 flow cytometer system. In collaboration with Luminex, we have demonstrated that these assays perform well on the newer, more compact and rugged MagPlex system.

12:00 UV Resonance Raman as a Modular Chemical and Biological Detection Platform

Jay Pendell Jones, PhD, Senior Scientist, Advanced Engineering and Sciences, ITT Industries

UV Resonance Raman (UVRR) spectroscopy at variable wavelengths provides highly specific signatures that directly reflect the bio-molecular composition of a species. ITT envisions the use of UVRR as a technology that leads to all optical and reagent-less gold-standard-level detection and identification capabilities for a broad spectrum of chemical and biological threats. Ultimately, ITT seeks optical and reagent-less techniques that relate to known taxonomic differences between biological warfare agents in a rapid (<5 minutes) and quantifiable manner. Extending the capabilities and understanding the limitations of UV Raman sensors for biological detection maximizes the capability and utility for chemical and biological detection that hopes to substantially reduce the logistics burden for the warfighter. Furthermore, the optical components provide access to orthogonal spectroscopic techniques or signatures and this is also envisioned as a monumental advantage towards developing multiplicative sensing capabilities within a single platform.

12:30 *Luncheon Sponsored by the Knowledge Foundation Membership Program*

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2:00 Mulitplex DNA-Based Determination of Antibiotic Resistance of Three Select Agents

P. Scott White, PhD, Team Leader, Biosecurity Applications and Analysis, Bioscience Division, Los Alamos National Laboratory

Detection of a biothreat agent requires additional information about treatment options in a timely manner. We have developed multiplex assays for rapid determination of resistance of three biothreat agents to two antibiotics. The tests can be completed in less than four hours, and use a flow cytometer as readout. We will discuss our Antibiotic Resistance Database and tools for assay design, as well as results from testing multiplex assays.

2:30 Selective Single Nucleotide Polymorphism Differentiation Using Cooperative Probes

Jay A.A. West, PhD, Chief Technology Officer, Founder, Arcxis Biotechnologies

The failure to correctly identify single nucleotide polymorphisms (SNPs) significantly contribute to the misdiagnosis of infectious disease. Contrary to the strategy of creating shorter probes to improve SNP differentiation, we created larger probes that appeared to increase the selectivity. Specifically, probes with enhanced melting temperature differentials (>13x improvement) to SNPs were generated by linking two probes that consist of both a capture sequence and a detection sequence which acting cooperatively improve selectivity over a wider range of reaction conditions. These cooperative probe constructs (Tentacle probes) were then compared by modeling thermodynamic and hybridization characteristics to both Molecular Beacons (stem loop DNA probes) and Taqman probes (a linear oligonucleotide). The biophysical models reveal that cooperative probes compared to either Molecular beacons or Taqman probes have enhanced specificity. This was a result of increased melting temperature differentials and the concentration independent hybridization revealed between wild type and variant sequences. We believe these findings of order of magnitude enhanced melting temperature differentials with probes possessing concentration independence and more favorable binding kinetics have the potential to significantly improve molecular diagnostic assay functionality.

3:00 PCR Detection of a Single Surrogate Marker of Antibiotic Resistance

Matthew C. Mulvey, PhD, Project Manager, Diagnostics R&D, Sequella, Inc.

Antibiotic resistance detection using nucleic acid amplification (NAA) requires identification of all mutations conferring resistance to a drug. NAA does not detect uncharacterized mutations or epistatic mechanisms of antibiotic evasion. For bio-threat agents, resistance mechanisms rationally designed to avoid NAA-based identification may preclude the benefits of rapid detection. To create a rapid diagnostic without these limitations, we developed a system that facilitates NAA of a single surrogate marker of resistance.

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

4:00 **Ultrasensitive Immunoassays for Detection of Trace Amounts of Bacterial Toxins**

Bo Mattiasson, PhD, Professor, Department of Biotechnology, Lund University; and CapSenze AB, Sweden*

Immunoassays are potentially selective and sensitive. This has earlier been utilized when designing ELISA protocols for analyzing a range of different compounds. However, when it comes to detection of molecules of potential biological warfare type, then ELISA is not enough. The development of capacitive biosensors have demonstrated clearly that sensitivity can be improved with several orders of magnitude. Reasons for that are several: application of the antibodies on nanoparticles on the sensor surface has been demonstrated to improve sensitivity by 2 orders of magnitude. Use of immobilized antibodies on the special sensor surfaces has in some cases been demonstrated to improve sensitivity substantially over that from conventional assays. Furthermore, measuring capacitance changes is per se very sensitive, and the new technology developed in our laboratories has reduced background noise such that stability is markedly improved and lower limit of detection further improved. The high sensitivity can be used for detection of very low concentrations of hazardous molecules, or when the concentrations are higher, one can dilute the sample up to 100.000 times, thereby reducing the matrix effects and still carry out an assay in the concentration range where most assays are done today. Results will be presented based on use of a newly developed instrument. *In collaboration with: J.Larsson, M.Hedström

4:30 **Handheld TIRF-EC Sensor for Rapid and Accurate Chemical and Biological Detection**

Alexander N. Asanov, PhD, CEO and President, TIRF Technologies, Inc.

First responders encounter in the field an increasingly broad spectrum of chemical and biological warfare agents, which dictates the necessity for integrated chem-bio sensors with highly multiplexed capabilities. We have developed an advanced chem-bio detection platform and built prototypes of the handheld sensors and cartridges based on the combination of Total Internal Reflection Fluorescence (TIRF) with ElectroChemistry and Electric filed Control (TIRF-EC). TIRF-EC is capable of supersensitive and rapid detection of thousands of nucleic acid signatures, protein and metabolite markers. In addition to biodetection, a broad range of chemical agents can be identified both in liquids and air. In this presentation we report on the latest advancements in the development of handheld TIRF-EC chem-biosensors for first responders and point-of-care diagnostics. The ability of our sensor platform to support supersensitive and highly multiplexed TIRF, as well as electrochemical, electro-chemi-luminescence (ECL), bioluminescence, chemical resistor, and other chem-bio detection methods offers unique advantages over conventional detection devices. TIRF-EC sensor cartridges and integrated sample preparation modules are easily reconfigurable to satisfy the requirements of a wide range of applications and environments.

5:00 **Update Review on Department of Commerce Controls on Biological and Chemical Detection Related Items**

Kimberly Orr, DVM, PhD, dACVPME, Chemical/Biological Controls Division, Office of Nonproliferation and Treaty Compliance, Bureau of Industry and Security, U.S. Department of Commerce

The Department of Commerce controls the export of biological and chemical items and equipment not specially designed for military use, including detection equipment. Such controls are informed by multilateral commitments to the Australia Group and to the Wassenaar Arrangement both of which meet annually for review of control lists. Items may require a license for export depending upon their classification, destination, and designated end use and user.

5:30 *Concluding Discussion, End of Day One*

Wednesday, November 9, 2010

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

9:00 **Modular Automated Processing System (MAPS) for Analysis of Biological Samples**

Gabriela Chirica, PhD, Analytical Chemist, Sandia National Laboratories

We have developed a novel modular automated processing system (MAPS) that enables reliable, high-throughput analysis as well as sample-customized processing. This system is comprised of a set of independent modules that carry out individual sample processing functions: cell lysis, protein concentration (based on hydrophobic, ion-exchange and affinity interactions), interferent depletion, buffer exchange, and enzymatic digestion of proteins of interest. Taking advantage of its unique capacity for enclosed processing of intact bioparticulates (viruses, spores) and complex serum samples, we have used MAPS for analysis of BSL1 and BSL2 samples to identify specific protein markers through integration with the portable microChemLab™ and MALDI. *In collaboration with: V. VanderNoot, R. Renzi, J. Fruetel

9:30 **Evaluation of the PLEX-ID Biodefense Kit for Use in Environmental Air Samples**

Niveen Mulholland, PhD, Principal Scientist, MRI-NCR, Midwest Research Institute

Midwest Research Institute (MRI), an independent not-for-profit organization, has collaborated with Ibis Biosciences, Inc., a

subsidiary of Abbott Molecular/Abbott Laboratories, to finalize design and evaluation of the PLEX-ID Biodefense kit. The kit provides a method capable of rapidly detecting biological threat agents in environmental air samples. The basis of the PLEX-ID approach is, first, the use of primers to amplify PCR products from broad groupings of organisms, rather than single organisms; second, the use of mass spectrometry to analyze the products; and third, the use of nucleic acid base composition (i.e., the number of adenosines, cytosines, guanosines, and thymidines in the PCR amplicon) to identify the organisms present. Data from the evaluation studies clearly demonstrate the specificity and sensitivity of the assays included on the Biodefense kit.

10:00 Integrated Sample Preparation Method with Physical Enrichment of Biological Agents

Sebastien Ribault, PhD, Applied Biology R&D Manager, Lab Solutions, Merck Millipore, Millipore SAS, France

Sample preparation prior to molecular detection has to accommodate a broad range of matrices originating from biopharmaceutical industry, diagnostics and environmental monitoring. We developed a device for mycoplasma testing focusing on ease-of-use, reduced hands-on time, and false positive risk management. Its filter technology enables physical enrichment and improves viable/non-viable discrimination. Our ability to process large volumes is key to representativeness. This device was modified for Gram+/Gram- bacteria detection in urine, plasma, and cerebrospinal fluid at hospitals. A great deal of effort was spent on the DNA-free topic to avoid false positives with universal amplification assays.

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

11:00 Ultra High Throughput Sequencing for Bio-Threat Detection

Robert T. Yamamoto, PhD, Director of Microbial Genomics, ICx Biosystems

ICx Biosystems is developing portable sample prep devices for Ultra High Throughput Sequencing applications, strategies for sequence clutter mitigation, and a New Emerging or Engineered Threat database with corresponding UHTS data analysis pipeline to rapidly query UHTS data for comprehensive detection and understanding of threats. The latter is incorporated in a self-contained laptop, which can identify threat species in under an hour. This application can readily be converted for metagenomics applications as well.

11:30 Multi-Use FilmArray Instrument Tests Environmental Samples for Biothreats and Performs Clinical Diagnostics

Todd Ritter, PhD, Chief Corporate Development Officer, Idaho Technology

Idaho Technology has developed the FilmArray Pathogen Detection System; PCR based pathogen detection/identification system that can quickly and simultaneously screen for panels of pathogens from a raw sample. The system fills a multi-role capability as a dual use device for both environmental and clinical diagnostic testing. The instrument is a Commercial-Off-the-Shelf device while the test panels are in various stages of development ranging from early prototypes to a completed submission to the FDA for clearance. These panels include those of clinical significance - respiratory disease, sexually transmitted disease, gastro-intestinal disease, and sepsis - and those of dual environmental/clinical significance - biothreat. We will present the technical basis of the system, data from a number of panels including respiratory disease and a biothreat panel tested on a range of environmental samples including soil. The clinical utility of our respiratory disease panel is well documented and proven, while early results from the biothreat testing show very promising results from multiple sample matrices. These system traits dramatically decrease the overall logistical burden for pathogen detection by combining multiple lab systems into a compact easy-to-use automated system. There is great advantage to having a single system capable of multiple different tests panels for day-to-day clinical utility. This utility is further enhanced by its capability to respond to rare event applications such as a biowarfare/terror incident. The FilmArray is also seamlessly integrated into the National Health Information Network (NHIN) to review results and enable both clinical and environmental testing data integration into the larger operational awareness.

12:00 The Florida Center of Excellence for Biomolecular Identification and Targeted Therapeutics (FCoE-BITT): Resources for Biodetection Research

Tammy A. Spain, PhD, Associate Director, Florida Center of Excellence for Biomolecular Identification and Targeted Therapeutics, University of South Florida

The FCoE-BITT is a comprehensive center that provides resources to scientists and engineers to develop novel methods for use in detection, diagnosis, prevention and treatment of human disease. This presentation will focus on the Center's resources that support biodetection research by the exploration of case studies with academic and industrial customers. FCoE-BITT programs to improve education initiatives to better address the needs of the biodetection industry will be discussed based on specific technological projects and case studies.

12:30 *Lunch on Your Own*

2:00 Real-Time Bio-Electronic Pathogen Detector

William Chadsey, BioWarn, LLC, a subsidiary of Defense Group Inc.

Biowarn, LLC has developed, tested and demonstrated a real-time pathogen detector based on bio-FET technology. Design advancements over previous bio-FET concepts has afforded a sensor with high signal-to-noise ratio, very rapid detection, very high sensitivity, and high specificity. Laboratory tests have demonstrated peformance for multiple pathogen types including bacteria, viruses, and toxins. The sensor design concept, test results, and future research requirements will be presented.

2:30 **Automated Reagentless Identification of Plasmodia in Blood Smears**

Kenneth Puzey, President, QuantaSpec Inc.

An evaluation of infrared microspectroscopy for automated reagentless identification of malaria in thin film blood smears found a sensitivity of 98.47% to 100% (95% CI) and a specificity of 98.85% to 100% (95% CI). The study further revealed that the detection of a single ring stage infected red blood cell can be achieved with infrared microspectroscopy. Further three drug resistant strains of *P. falciparum* were easily differentiated from three drug susceptible strains by infrared microspectroscopy.

3:00 **Contactless Dielectrophoresis: A New Method to Manipulate Rare Cells**

Hadi Shafiee, Scientist, Institute for Critical Technology and Applied Sciences (ICTAS), Virginia Tech

We invented a new technology for manipulation and detection of circulating tumor cells (CTCs) in biological fluids during early stages of tumor growth, known as contactless dielectrophoresis (cDEP). We demonstrated the ability of cDEP to isolate human Leukemia cancer cells from blood cells as well as live cells from dead. This method has great promise in the early detection of cancer.

3:30 **Selected Oral Poster Highlights and Open Discussion**

4:00 *Concluding Remarks, End of Conference*

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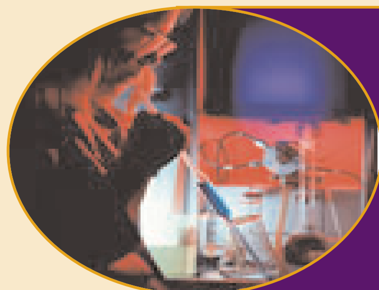

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