Emerging Technologies for both Clinical Microbiologists and Basic Scientists: Sweet Ideas for Cool Dudes

Jill E. Clarridge, III, PhD D(ABMM) and Amanda T. Harrington, PhD, D(ABMM) co-conveners **ASM NW Regional Branch Meeting—October 16, 2010**

1. Thomas Jarvie Thomas.jarvie@roche.com

Thomas Jarvie has a Ph.D. in physical chemistry from The University of California, Berkeley and was a Damon Runyon Cancer Research Foundation Postdoctoral Fellow at The University of Washington. He worked at CuraGen, a start-up biotech company, on rational drug design. When CuraGen joined the genomics revolution, he led a high-throughput cloning and cDNA sequencing facility. Currently he is involved in new product and application development at 454 Life Sciences.

2. Mark Priebe mpriebe123@aol.com

Mark Priebe received his undergraduate degree from Marquette University and his Medical Technology training from The Medical College of Wisconsin. After serving as a laboratory manager in a 200 bed hospital, Mark joined Dade Diagnostics, now Dade Siemens Healthcare and held expanding roles of responsibility. Over the past 10 years his focus has been laser based technology for both medical and dental applications.

3. Terry Raich traich@nanosphere.us

Dr. Terry Raich has recently moved to Nanosphere, where she currently serves as Director of Clinical Affairs and Director of Product Development. In this position her responsibilities include management of sponsored and investigator-initiated studies as well as the development of the microbiology product portfolio. She previously was Director of Assay Development at HandyLab (now BD Diagnostics) and Director of Medical & Scientific Affairs at Roche Diagnostics.

4. Christiane Honisch CHonisch@sequenom.com

Christiane Honisch obtained her Ph.D. in Microbiology on molecular and serological diagnosis of mycobacteria at the German National Center for Biotechnology (GBF) in 1998. After a career start in functional genomics her involvement in mass spectrometry at Sequenom GmbH and Inc. started in 2000. Combining her experience in microbiology and mass spectrometry, Christiane Honisch was leading the development of a nucleic acid comparative sequence analysis tool and launched a product extending Sequenom's application portfolio into microbial/ viral genetic marker identification and beyond. Sequenom's microbial application is gaining acceptance and large research centers such as The Health Protection Agency in the UK and the CDC in Atlanta, US have embraced the technology.

5. Nedal Safwat Nedal.SAFWAT@biomerieux.com

Nedal Safwat is the Marketing Manager for clinical microbiology responsible for identification and susceptibility testing products at BioMerieux US. He held previous marketing and product management positions in life science and diagnostic companies with a clear emphasis on molecular biology. He received his Bachelors and PhD from North Carolina State University and his studies focused on molecular biology including gene expression and mass spectrometry. He is currently leading the marketing and product management for MASS Spectrometry in the US.

1. 454 Sequencing: Enabling Microbiology and Metagenomics	454 Sequencing is a method for rapidly sequencing DNA. With this technology we are able to get a full characterization of the genomic material of single organisms and collections of organisms in an environment.
2. Raman Spectroscopy: The science about and application for bacterial strain typing used in search and destroy initiatives for the control of community and hospital acquired infections.	When light of a specific wavelength falls on a molecule it will lead to an interaction whereby a molecular vibration occurs. Each molecular vibration comes with its own precisely defined wavelength shift, Raman light shift, and each molecule can have many shifts in light depending on its makeup. Together this results in spectra of scattered light which are molecular specific. The fact that different cell types differ in their overall molecular composition is reflected in their Raman spectrum, the spectrum can therefore be used as a highly specific spectroscopic fingerprint.
3. Small Particles, Big MDx World—Decreasing Testing Complexity in the Clinical Laboratory	Assay applications are performed on the Verigene® System – a 'sample-to-result' device. The Verigene® System consists of two core instruments: The Verigene® Reader and the Verigene® Processor *SP*. The Verigene Reader is a bench-top, free-standing instrument with a touch screen control panel and a wand-based barcode scanner. It utilizes a graphical user interface to guide the user through the process of ordering tests and reporting results. There are no serviceable parts and no user calibration is required. Interaction with the touch screen is minimized through the use of barcodes. This instrument also serves as the reader of the Test Cartridges using advanced optics. The key functions of the Verigene Reader include: (i) Entry and tracking of specimen identification numbers via manual keyboard input or via barcode-reader wand, (ii) Test selection for each specimen, (iii) Automated transfer of specimen processing instructions on Test Cartridge-specific basis to linked Processor *SP* units(s); a single Reader unit can control up to 32 Processor *SP* units, (iv) Automated imaging and analysis of Test Cartridges, (v) Results display, and (vi) Results report generation. The Verigene System Processor *SP* or *SP* performs assays under the direction of the Reader and automates the following steps of: (i) Sample Preparation – Magnetic bead-based DNA/RNA isolation (ii) Target Amplification (if needed) – Multiplex RT-PCR/PCR-based amplification of the eluted DNARNA to generate specific amplicons; and (iii) Verigene Hybridization Test – Gold nanoparticle probe-based detection of the specific amplicons on a microarray. The *SP* utilizes single-use disposables to perform the assay, including an Extraction Tray, Amplification Tray (if applicable), and Verigene Test Cartridge. A separate Tip Holder Assembly contains two pipette tips that are used to transfer and mix reagents during the assay. The user initiates the test protocol on the Reader by scanning or entering the barcode ID located on the Test Cartridge along with sample information. Operationally, the user tests a sample by loading the single-use disposables into the *SP* and pipetting the specimen sample into the sample well of the Extraction Tray. Following assay completion, the user collects data on the Reader by scanning the barcode ID on the Test Cartridge and inserting it into the Reader for Analysis.
4. The MassARRAY® System: A molecular multi-applications platform for the detection and identification of microbes and viruses	Mass spectrometry has played a central role in the study of biological molecules and is a cornerstone in proteomics. A combination of clever experimental designs that connect molecular biological methods with the detection of nucleic acids and automated data analysis by the MassARRAY® System (MALDI-TOF mass spectrometry) makes the technology a user-friendly method for the characterization of RNA and DNA. Single nucleotide polymorphism (SNP), reference-sequence-based as well as quantitative MassARRAY applications are generic approaches, which facilitate the identification of any microbial and viral taxa with a broad application across the fields of microbiology and epidemiology. With the appropriate marker sets in place, a wide range of isolates to the genus, species or sub-species level are detectable, typeable and populations can be monitored. It is usually possible to design highly multiplexed assays so that many targets can be detected and quantified in a single PCR reaction. The system is a generic platform and allows for the usage of any existing sequence based database. This allows for flexible updates to cover additional target regions of interest or new species and variants.
5. Mass Spectrometry–Microbial Identification Beyond and Application in Microbiology Lab	Mass Spectrometry is a technology using protein expression patterns to identify bacterial organisms. The speed, accuracy, and cost efficiency position the technology as the next leap forward for the microbiology lab.

INSTRUMENT NAME	GS FLX and GS Junior	SCRA; SpectraCell RA	The Verigene® System	MassARRAY System	VITEK MS
SPEAKER NAME, CREDENTIALS	1. Thomas Jarvie, Ph.D.	2. Mark Priebe, MT(ASCP)SBB	3. Terry Raich, Ph.D.	4. Christiane Honisch, Ph.D.	5. Nedal Safwat, Ph.D.
SPEAKER TITLE	Technical Application Manager	President and General Manager	Director, Clinical Affairs Director, Product Development	Director Research and Development	Clinical Marketing Manager – Identification and Susceptibility
COMPANY	454 Life Sciences www.454.com	River Diagnostics www.riverd.com	Nanosphere, Inc. www.nanosphere.us	Sequenom, Inc. www.sequenom.com	BioMerieux www.biomerieux.com
TALK TITLE	454 Sequencing: Enabling Microbiology and Metagenomics	Raman Spectroscopy: The science about and application for bacterial strain typing used in search and destroy initiatives for the control of community and hospital acquired infections.	Small Particles, Big MDx World—Decreasing Testing Complexity in the Clinical Laboratory	The MassARRAY® System: A molecular multi-applications platform for the detection and identification of microbes and viruses	Mass Specrometry – Microbial Identification Beyond and Application in Microbiology Lab
ARE YOU OWNED BY A LARGER COMPANY?	454 Life Sciences is owned by Roche	Erasmus University Medical Center, located in Rotterdam The Netherlands	No	No	No
PREVIOUSLY KNOWN AS	NA	NA	NA	NA	AXIMA ASSURANCE
TECHNIQUE—GENERIC OR TECHNICAL NAME	454 Sequencing, pyrosequencing, next gen sequencing, massively parallel sequencing by synthesis.	Raman spectroscopy	Gold nanoparticle technology Sample-to-Result automation	Matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS)	MALDI - TOF
HOW READY IS YOUR TECHNOLOGY FOR THE CLINICAL LABORATORY? RATE 1-10 (1 BEING BEGINNING STAGES, 10 BEING ALREADY THERE)	Rate them as a 10. Our instruments are officially labeled 'For Life Science Research Only. Not for Use in Diagnostic Procedures.' Both the GS FLX and GS Junior are currently used in clinical research settings	9, Final report format and functionality updates coming in Q4, 2010.	10	6-7	3
ESTIMATED COST PER TEST OR INSTRUMENT COST	To learn about GS Junior, check out gsjunior.com	If you perform 100-200 tests per month complete system, service and consumable cost is $38 per isolate.	Varies with application—approximately $30.00-100.00/test list price	384 MassARRAY System - $375K 96 MassARRAY System - $240K	$1-2

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DOES YOUR TECHNIQUE UTILIZE A DATABASE?	Our technology can utilize all of the sequencing databases, such as GenBank.	An on board database of molecular Raman finger prints can be archived and compared to recently run isolates. In addition River Diagnostics is working with Bionumerics to develop a inter-lab database to share Raman spectrum between laboratories.	No		A database is used to take the protein expression analysis and generate organism identification. The SARAMIS database contains a large archive of data for over 600 species. The database utilizes an intelligent algorithm named SuperSpectra that enables the identification of key biomarkers for each organism.
OTHER IMPORTANT INFORMATION ATTENDEES MIGHT FIND USEFUL	454 Sequencing is a well established technology with over 900 peer reviewed publications. Approximately one-half of the publications are on microbial genomics or metagenomics.	No extractions steps. Simple dilution procedure from pure culture. 24 results can be read in 60-90 minutes ID capable.		Applications as featured in the talk: iPLEX® Genotyping iSEQ™ Comparative Sequence Analysis	