SAS SPECTRUM eNEWS

Women in Spectroscopy, SAS-Sponsored Symposium

A proposal submitted to the Pittcon organizing committee by Ellen Miseo and Gloria Story was intended to be a straightforward sharing and mentoring of female professionals in spectroscopy, but the session turned out to be so much more. Our speakers included: Rina Dukor (BioTools), Karla McCain (Austin College), Linda McGown (Rensselaer Polytechnic Institute), Katherine Bakeev (B+W Tek), Diane Parry (P&G), Anna Tisinger (Agilent), and Ellen Miseo (Analytical Answers, Inc.). Unfortunately, Marilyn Jacox of NIST was also slated to speak, but we learned that she had passed away last fall. We were fortunate to have interviewed Marilyn before her passing. A write-up of the interview will appear in the May issue of Spectroscopy. Despite this sad news, a lively and engaged discussion and Q&A filled what would have been Marilyn's speaking time.

We look forward to proposing another "Women in Spectroscopy" session next year.

— Ellen Miseo, Analytical Answers Inc.

Women in Spectroscopy symposium speakers: Ellen Miseo, Anna Tisinger, Karla McCain, Linda McGown, Diane Parry, Gloria Story, Rina Dukor, Katherine Bakeev.

Applications of Vibrational Spectroscopy in Medical Diagnostics

The well-attended SAS Symposium entitled "Applications of Vibrational Spectroscopy in Medical Diagnostics" was held at Pittcon 2014 on Wednesday, March 5, 2014. This symposium was organized to inform practicing vibrational spectroscopists of the enormous progress in terms of instrumentation, theory, data analysis and bio-analytical breakthroughs that has occurred in the field of biomedical vibrational spectroscopy. These advances are so far reaching that they will affect many other areas of vibrational spectroscopy.

The first speaker was Prof. Peter Gardner from the University of Manchester, UK, who introduced the field of infrared histopathology, as applied to large tissue resections, and discussed confounding effects. These effects that were published earlier demonstrated that sample morphology can greatly affect the observed infrared spectra, an insight that was largely unknown previously. His presentation was followed by that of Prof. Jürgen Popp, Universität Jena, Germany, who introduced complimentary Raman techniques, emphasizing the ability of Raman microscopy-based methods for bacterial identification. It is now possible to identify certain bacteria, dried or in suspension, by Raman microscopy at the single particle level. This influences medical practice enormously, since the time to culture bacteria before identification can be drastically reduced or eliminated. This, in turn, will allow physicians to prescribe antibiotics much earlier than previously, thus reducing the patient mortality in diseases like sepsis. Prof. Rohit Bhargava from the University of Illinois, USA, presented aspects of the theory underlying infrared microspectroscopy, with particular emphasis on optimizing image acquisition and aspects of optical resolution.

After the break, Prof. Nick Stone, University of Exeter, UK, introduced results from the efforts of his group in deep tissue optical diagnostics. This technique holds enormous promise in the diagnosis of suspicious lesions, for example, in breast cancer detection, since the Raman signatures from breast calcification are different for benign and malignant cases. It is now possible to measure these signals from points in tissue many centimeters under the tissue surface. The final presentation of this symposium was given by Prof. Max Diem, Northeastern University, Boston, USA, who was also the organizer and presider of this symposium. His talk was aimed at demonstrating how infrared spectral histopathology (SHP) can be used to classify, grade, and sub-classify benign and malignant lung tumors in a study that comprised hundreds of patients, and that SHP can produce sensitivities and specificities that, at this time, can only be achieved by methods of immunohistochemistry.

— Max Diem, Northeastern University

Mass Cytometry: An In-Depth View of Cell Heterogeneity and Signaling

SAS sponsored a symposium at PittCon 2014 on the use of fast, simultaneous atomic mass spectrometry applications to the analysis of dozens of proteins in single cell: the "Mass Cytometry" technology. Scott Tanner (Fluidigm Canada, formerly DVS Sciences) presented the building blocks of the technology including metal-labeling reagents, instrumental considerations and the initial processing of the GB/s data stream. With the support of the other speakers, the open, second speaking slot was filled with a summary of the major publications of 2011-2013, better than the song-and-dance interlude that was the alternative!

Dr. Erin Simonds (UCSF) presented three examples of how the high-dimensional single-cell data can be used to reveal the cellular organization and diversity in leukemia. He described how the dimensionality-reduction and visualization tool called viSNE helped pick out a complex protein signature that describes a clinically relevant subpopulation of leukemia cells. In a second example, Dr. Simonds described multiple surface protein signatures of stem-like cells in acute myeloid leukemia. In the final example, he showed how mass cytometry and next-generation sequencing synergize to provide new insight into the relationship between cancer mutations and cellular behavior.

Prof. Jonathan Irish (Vanderbilt University) applied the extended panel depth (targeting more phenotypic and functional molecules) to interrogate normal and aberrant signaling in phenotypically resolved sub-populations of cells associated with disease. He showed how the development and application of unsupervised multivariate algorithmics can clarify the functional signatures that distinguish states of health and disease and provide focus on subset cell activation that drives that differentiation.

Dr. Charlotte Giesen (University of Zurich) described an exciting new technology called "Imaging Mass Cytometry" that combines mass cytometry with immunocytochemical (ICC) and immunohistochemical (IHC) techniques. The new method involves a novel high-resolution laser ablation system to image 32 proteins and their modifications simultaneously at a subcellular resolution of 1 µm. She reported the application to FFPE samples and adherent cells. Of particular interest, the method was applied to human breast cancer FFPE samples and allowed delineation of cell subpopulations and cell-cell interactions, highlighting tumor heterogeneity. Clear differences in protein expression were visible within the same tumor and between individual cells.

— Scott Tanner, Fluidigm Canada

Lippincott 2013 Award Presented

The Ellis R. Lippincott Award is presented annually to an outstanding vibrational spectroscopist. It is co-sponsored by the Coblentz Society, the Society for Applied Spectroscopy, and the Optical Society of America.

This award was established in 1975 to honor the unique contributions of Ellis R. Lippincott to the field of vibrational spectroscopy. The purpose of the Ellis R. Lippincott Award is to honor Dr. Lippincott's memory by the recognition of significant contributions and notable achievements in the field of vibrational spectroscopy.

The 2013 awardee is Prof. Xiaoliang (Sunney) Xie of Harvard University. The award was presented at a joint meeting of the New England Chapters of OSA and SAS on March 12, 2014, held at the offices of Thermo Fisher Scientific in Tewksbury, MA. Thirty-five members of the local societies were in attendance. The talk spanned the importance of Lippincott and other luminaries in spectroscopy and their contribution to his work and delved into the details of CARS microscopy and stimulated Raman spectroscopy.

Xiaoliang (Sunney) Xie (born 1962 in Beijing, China) is the Mallinckrodt Professor of Chemistry and Chemical Biology at Harvard University. Xie is considered a founding father of single-molecule enzymology. He has also made major contributions to biomedical imaging by developing CARS microscopy. Xie received his Ph.D. in 1990 from the University of California at San Diego. He conducted postdoctoral research at the University of Chicago and in 1992 joined Pacific Northwest National Laboratory, where he later became a Chief Scientist. In 1999, he became the first full professor at Harvard University from the People's Republic of China. Among the first to conduct fluorescence studies of single molecules at room temperature in the early 1990s, his research group has contributed to the emergence of the field of single-molecule biophysical chemistry and its application to biology. His work focuses on single-molecule enzymology, protein conformational dynamics, and the study of gene expression and regulation in living cells. His group also pioneered CARS microscopy and stimulated Raman scattering microscopy, sensitive biomedical imaging techniques that allow 3D imaging of live cells and organisms based on vibrational spectroscopy.

— Richard Crocombe, ThermoFisher Scientific

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