



Indiana Section of the Society for Applied Spectroscopy

March/April 2000 Newsletter

ISSAS 1999-2000 SEMINARS

Dr. David M. Hercules from Vanderbilt University in Nashville, Tennessee gave the February seminar in the 1999-2000 Indiana Section of the Society for Applied Spectroscopy (ISSAS) lecture series. The topic of Dr. Hercules' seminar was the use of mass spectrometry to study block copolymers. Thank you Dr. Hercules and all who attended.

There has been a schedule change for the next ISSAS meeting. Our April speaker in the seminar series will be Dr. Scott A. McLuckey from Purdue University in West Lafayette, Indiana. Dr. McLuckey will be discussing ion chemistry and electrospray quadrupole ion trap mass spectrometry techniques for rapid DNA sequencing. The seminar will be held in Bloomington at the Indiana University Chemistry Building (C127) at 6:00 p.m. on Thursday, April 20, 2000. A dinner will be held with Dr. McLuckey after

the seminar at Janko's Little Zagreb. If you are interested in attending the dinner with Dr. McLuckey, please RSVP Andrew Leach by April 18.

Dr. Evan Williams from the University of California Berkeley has been selected as our tour speaker for the 1999-2000 seminar series. Dr. Williams will be speaking on June 6, 2000. More details concerning Dr. Williams' seminar will be posted on the ISSAS website and in the next ISSAS newsletter.

SPECTROSCOPY NEWS

Matrix assisted laser desorption time-of-flight mass spectrometry (MALDI-TOFMS) has recently been used to analyze single cellular organelles. Jonathan Sweedler and co-workers at the University of Illinois demonstrated the use of MALDI-TOFMS to examine the contents of single vesicles having 1-2 μm diameters. The authors

demonstrated that by using improved sample preparation methods, a commercial MALDI-TOFMS is capable of detecting sub-attomole quantities of proteins and profiling individual cellular organelles. This technique provides researchers with a method to locate the packaged products of multiple genes within single vesicles. Furthermore, the authors indicate that vesicles as small as 200 nm could be sampled in a similar manner, which may make it possible to examine the peptide content of single neuronal vesicles. (*Nature Biotech.*, 18 (2) 2000)

Although the far-infrared (FIR) region of the spectrum is not routinely used for spectroscopic investigations, it contains a wealth of vibrational and rotational information. One factor hampering research in this area is the lack of sensitive detectors at wavelengths greater than about 1.5 μm . Researchers at the University of Tokyo and the Japan Science and Technology Corporation recently made strides towards increasing the accessibility of this region by introducing a novel detector sensitive to single FIR photons. The sensor consists of a semiconductor quantum dot placed in a magnetic field, forming a single electron transistor. Although quantum efficiency was very low (1%) due in part to non-optimized optics, the sensitivity of the detector is 10^4 greater than previously reported

detectors for the FIR region. (*Nature*, 403 (27) 2000)

THIS MONTH IN SPECTROSCOPY

What technique, developed in 1985, combines scanning tunneling microscopy (STM) with stylus profilometry (SP) to achieve atomic resolution for insulators?

In January, 1970, W.S. Boyle and G.E. Smith [*Bell Sys. Tech J.*, **49** (1970) 587] described the theory of a new type of imaging detector consisting of an array of conductor-insulator-semiconductor capacitors. This new system, called a charge coupled device (CCD) stored charge in electronic potential wells formed on the surface of a semiconductor chip. The charge could be moved across the surface of the semiconductor between adjacent capacitors by controlling the location of potential barriers and minima. By moving the charge to the edge of the capacitor array, the magnitude of the charge could be measured by an appropriate detector. Immediately following this theoretical description, G.F. Amelio, M.F. Tompsett and G.E. Smith [*Bell Sys. Tech J.*, **49** (1970) 593] experimentally verified the CCD's operating principle with charge transfer efficiencies of greater than 98 percent and transfer times of less than 100 nanoseconds. Today, charge coupled devices are widely used for

industrial and recreational applications in systems ranging from imaging spectrometers to digital cameras.

Spectroscopy Trivia:

Who, in 1842, while observing celestial bodies, described a changing in light wave frequency when a light source and observer are in motion relative to one another?

The answer to this question can be found in next the addition of "This Month in Spectroscopy" or log on to the ISSAS trivia page at <http://www.indiana.edu/~issas/trivia.html>.

CALL FOR ISSAS OFFICER NOMINATIONS

Elections for the 2000-2001 ISSAS officers will be held Thursday, May 11, 2000. If you are interested in becoming an ISSAS officer, please submit your nomination by April 20, 2000.

ISSAS ONLINE

You can find your ISSAS homepage at: <http://www.indiana.edu/~issas>. As always, the ISSAS homepage will keep you updated on local section and national events as well as provide information about our corporate sponsors.

If you have a non-commercial spectroscopy related website that you would like us to link on our web page please contact Denise McClenathan.

NEW MEMBERSHIPS

Your local Indiana Section of the Society for Applied Spectroscopy is looking for new members. We invite you to recommend membership to any of your colleagues or students who you may feel would benefit from membership in such an organization. The fee for joining is very reasonable for both professionals and students alike. Membership also includes a subscription to the journal *Applied Spectroscopy*. For further information, please feel free to contact any of the current officers or visit our website (<http://www.indiana.edu/~issas>).

CONTACT INFORMATION

You may contact any of the ISSAS officers via phone (812) 855-7905, email (issas@indiana.edu), fax (812) 855-0958, or write to:

Society for Applied Spectroscopy -
Indiana Section
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Indiana University
Bloomington, Indiana 47405

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Indiana Section of the Society for Applied Spectroscopy
1999-2000 Seminar Series

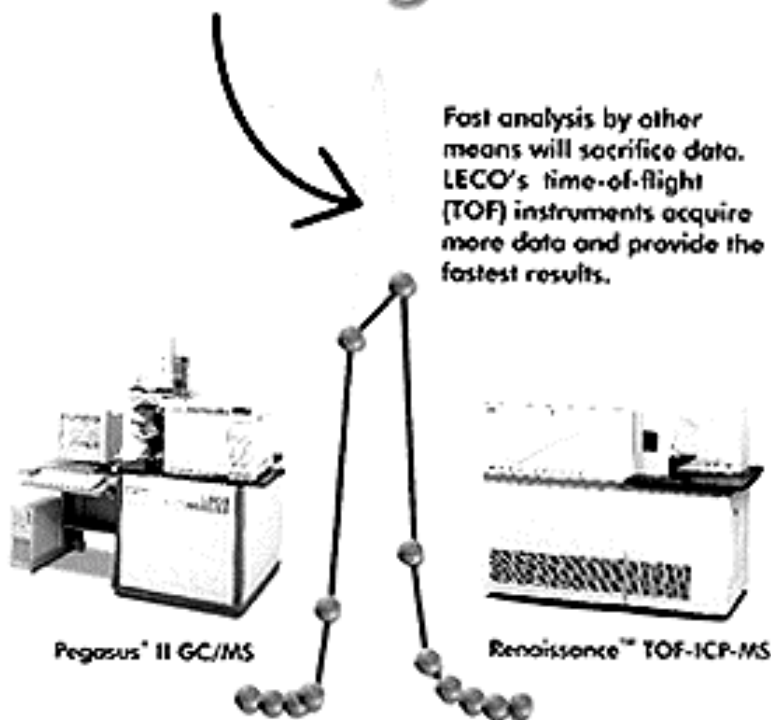
**RAPID DNA SEQUENCING VIA ELECTROSPRAY AND
ION/ION CHEMISTRY IN A QUADRUPOLE ION TRAP**

Scott A. McLuckey, Department of Chemistry, Purdue University

My colleagues at Oak Ridge National Laboratory and my group at Purdue are pursuing a methodology for high speed DNA sequencing based on electrospray ionization mass spectrometry employing gas-phase ion/ion chemistry in a quadrupole ion trap. DNA sequencing via mass spectrometry has been pursued by a number of groups in recent years due to its promise for the obviation of time-consuming electrophoresis-based separations required with established sequencing strategies. By far, most effort has been directed toward matrix-assisted laser desorption ionization (MALDI) combined with time-of-flight mass spectrometry. While a MALDI-based approach may yet fulfill its promise, limitations encountered in ionizing relatively large DNA oligomers have proved to be difficult to overcome. In contrast, ionization of large DNA oligomers is not a limitation for electrospray ionization. However, electrospray-based approaches for high speed DNA sequencing have not been extensively pursued due to spectral congestion associated with the multiple charging phenomenon that is characteristic of electrospray. The formation of multiple charge states from a single oligomer severely limits the mixture complexity amenable to direct analysis via electrospray. For this reason, electrospray usually follows a separation method, such as liquid chromatography or capillary electrophoresis, when applied to mixtures. We have recently shown that gas-phase ion/ion chemistry involving oppositely charged ions within a quadrupole ion trap greatly expands the mixture analysis capability of electrospray. In this work, the idea is to subject Sanger mixtures to electrospray and ion/ion chemistry as a core element in a strategy for high speed DNA sequencing. This talk describes the methodology and progress to date.

6:00 pm
Thursday, April 20, 2000
Chemistry Building Rm C127
Indiana University, Bloomington, IN

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Biographical Sketch

Scott A. McLuckey received a Bachelor of Science degree in chemistry from Westminster College in New Wilmington, PA in 1978 and a Ph.D. in chemistry from Purdue University in West Lafayette, IN in 1982. He spent a year at the FOM Institute for Atomic and Molecular Physics in Amsterdam, The Netherlands on a post-doctoral appointment and joined Oak Ridge National Laboratory in late 1983 as a Wigner Fellow. He served as a research staff member until January of 1992 when he became Head of the Analytical Spectroscopy Section of the Chemical and Analytical Sciences Division. He served in that capacity, as well as acting leader of the Organic and Biological Mass Spectrometry Group, until late 1999. In January of 2000 he joined the Department of Chemistry at Purdue University as a professor in the analytical chemistry division. McLuckey's research interests are in the areas of gas-phase ion chemistry and instrumentation for organic and biological mass spectrometry.



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Post-Seminar Dinner with
Dr. Scott A. McLuckey

Thursday, April 20, 2000

Seminar

Chemistry Building, Rm C127
Indiana University
Bloomington, IN
6:00 p.m.

Dinner

Janko's Little Zagreb
223 West Sixth Street
Bloomington, IN
7:30 p.m.

For dinner, please RSVP Andrew
Leach
(issas@indiana.edu) or (812) 855-
7905) by April 18, 2000.

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FEATURES

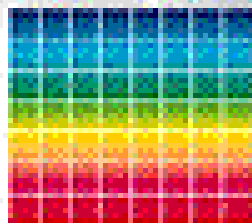
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