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Department of Chemistry

Student Seminar Series

9:45 a.m. Thursday, March 29, 2012 • 331 Smith Hall

Professor

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Metabolomics and Chemical Imaging for Probing the Cellular Heterogeneity in the Brain

Website:
http://chemistry.illinois.edu/faculty/Jonathan_Sweedler.html

Abstract

TIn the postgenomic era, one expects the suite of chemical players in a brain region to be known and their functions uncovered. However, many cell-to-cell signaling molecules remain poorly characterized and for those that are known, their localization and dynamics are oftentimes unknown. A suite of bioanalytical approaches are described that allow the investigation of individual neurons and small brain regions; these approaches include capillary scale separations coupled to mass spectrometric detection, and direct mass spectrometric-based profiling and imaging. Several applications of single cell microanalysis are highlighted: investigating novel indolamine neurochemistry, determining the role of d-aspartate in the brain, and characterizing the peptides in single cells. Specifically, new serotonin-related compounds and literally hundreds of new neuropeptides have been characterized in well-defined neuronal networks, and in several cases, the functional roles of these molecules described. Imaging mass spectrometry and dynamic sampling of the extracellular environment are used for elucidating novel cell to cell signaling molecules in a range of neuronal model systems. Current technology efforts involve extending the depth of metabolome coverage and adapting these analytical approaches to higher throughput single cell assays. Our overarching goal is to uncover the complex chemical mosaic of the brain and pinpoint key cellular players in physiological and pathological processes. Several additional examples of neuropeptide and neuromodulator discovery are described across a range of metazoan life.

Jonathan Sweedler received his doctorate in chemistry from the University of Arizona in 1988, and spent three years at Stanford before moving to the University of Illinois at Urbana-Champaign. He currently holds the James Eiszner Family Chair in Chemistry as well as is the director of the Roy J. Carver Biotechnology Center. He is also affiliated with the Institute of Genomic Biology and the Beckman Institute for Advanced Science and Technology. His research emphasizes analytical neurochemistry. Specific areas of technology development include small-volume peptidomics and metabolomics approaches. These involve single cell mass spectrometry, mass spectrometry imaging, capillary electrophoresis separation methods, laser-based detection methods, nanoliter volume NMR and micro/nanofluidic sampling. The second research theme applies these technologies to the study of the distribution and dynamic release of neuropeptides and classical transmitters, as well as their metabolism, in a cell-specific manner. Sweedler has authored or coauthored more than 300 peer-reviewed manuscripts and has delivered more than 350 invited lectures. Acknowledging the impact of his research, Sweedler has received numerous awards including the Ralph N. Adams Award from the Pittsburgh Conference, the Fields Award from the Eastern Analytical Symposium, the Gill Prize, the Merck Prize, and the Instrumentation Award from the Analytical Division of the ACS. He is currently the editor-in-chief of *Analytical Chemistry*.

Host:
Audrey Meyer