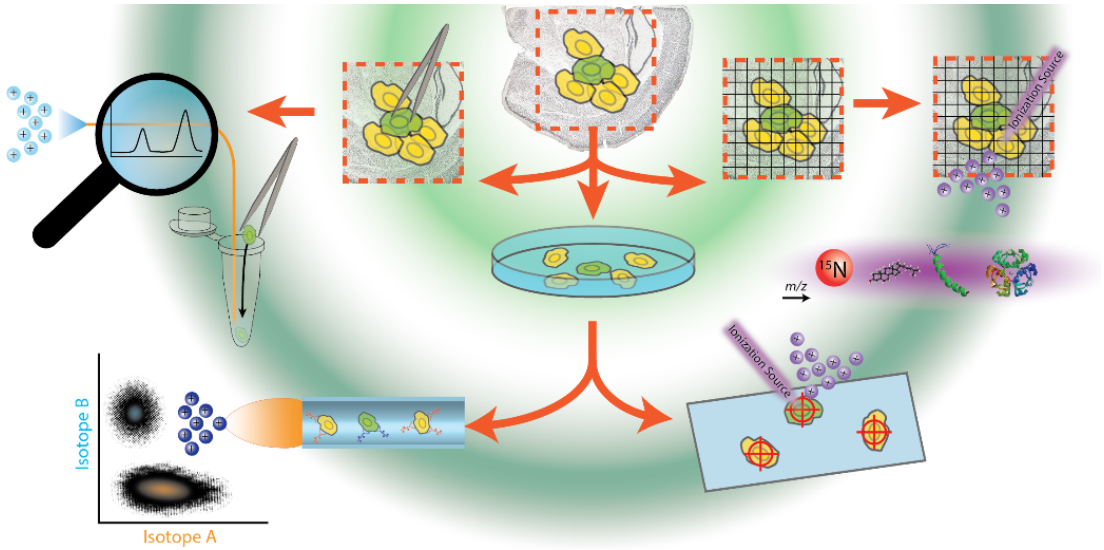
The chemical characterization of the brain:

from new measurement tools to new neurochemical insights

Jonathan V. Sweedler

University of Illinois at Urbana-Champaign, Urbana IL 61801 USA

In 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 small-scale measurement approaches are described that allow the investigation of individual neurons and small brain regions; these approaches include capillary scale separations, direct mass spectrometric-based profiling and mass spectrometry imaging. Several applications of single cell microanalysis are highlighted including the discovery of unusual metabolites to characterizing the neuropeptides in single cells. Single cell assays allow differences in the metabolome and peptidome from supposedly homogeneous populations of cells to be explored. As a further example, a unique matrix assisted laser desorption / ionization time of flight mass spectrometry approach is described that probes thousands of endocrine cells for their peptide content. Current technology efforts involve extending the depth of metabolome coverage and adapting our approaches to high throughput single cell assays. By obtaining information from tens of thousands of individual cells, rare cells are found and subtle differences in cell populations are measured. Imaging mass spectrometry and dynamic sampling of the extracellular environment also provide a functional context for the discovery of novel cell to cell signaling molecules. Our overarching goal is to uncover the complex chemical mosaic of the brain and pinpoint key cellular players in a range of physiological and pathological processes.



Jonathan V. Sweedler

Department of Chemistry
University of Illinois, Urbana IL 61801 USA

217 244 7359

jsweedle@illinois.edu

http://www.chemistry.illinois.edu/faculty/jonathan_sweedler.html

Biography:

Jonathan Sweedler received his Ph.D. in Chemistry from the University of Arizona in 1988, spent several years at Stanford before moving to the University of Illinois at Urbana-Champaign in 1991 where he has been ever since. At Illinois, he is currently the James R. Eiszner Family Endowed Chair in Chemistry, Director of the School of Chemical Science, and affiliated with the Institute of Genomic Biology and the Beckman Institute for Advanced Science and Technology. His research interests focus on developing new approaches for assaying small volume samples, and in applying these methods to study novel interactions between cells. These analytical approaches include capillary separations, micro and nanofluidics, miniaturized separations, mass spectrometry and NMR. He has used these tools to characterize small molecules and peptides in a range of animal models across the metazoan and in samples as small as individual cells and cellular domains. Recent work includes the development of a series of high throughput mass spectrometry approaches for characterizing tens of thousands of individual cells. Sweedler, with large international teams of biologists and technologists, has performed comprehensive interrogation of the genome, transcriptome and peptidome in a range of animal models to uncover signaling peptides and pathways involved in wide range of functions and behaviors.

Sweedler has published more than 400 manuscripts and presented 480 invited lectures. He has received numerous awards including the American Chemical Society (ACS) Analytical Division Arthur Findeis Award, the Benedetti-Pichler Award in Microanalysis, the Gill Prize in Neuroscience, the Instrumentation Award from the Analytical Division of the ACS, the Pittsburgh Analytical Chemistry Award, the ACS Award in Analytical Chemistry and the ANACHEM Award. He is a fellow of both the American Association for the Advancement of Science and the American Chemical Society. He is currently the Editor-in-Chief for ***Analytical Chemistry***.