Jonathan V. Sweedler

University of Illinois at Urbana/Champaign

Understanding our brain neuron by neuron: Analytical Chemistry for neuroscience research

Why study the chemical content of individual cells? A concerted research effort has been to understand why some cells are different than others, and use this information to understand disease progression and how cell differences map to function. As an important example, understanding the functioning of the brain has been hampered by a lack of knowledge of the full complement of neurotransmitters used in many brain regions. As neurochemistry can be different even in adjacent neurons, single cell measurements allow a unique perspective on cell-cell signaling. Because neurotransmitters range from gaseous molecules such as nitric oxide to large peptides that are only bioactive with particular chemical modifications, a variety of analytical approaches have been developed in our laboratory to perform single cell measurements. Here, a range of the sampling and chemical characterization approaches to allow such measurements are highlighted. Several capillary electrophoretic methods and mass spectrometric approaches allow neurotransmitters to be measured at individual neurons and neuronal release sites. Using this technology, new serotonin-related compounds and literally hundreds of new neuropeptides have been discovered. These technologies are used for characterizing neurotransmitters from neuronal networks from neurons from a range of animal models.

Bio

Jonathan V. Sweedler obtained a Ph.D. in analytical chemistry from the University of Arizona in 1988. He spent three years at Stanford before moving to the University of Illinois at Urbana / Champaign. Sweedler is now the James R. Eiszner Family Chair in Chemistry, is the director of the Carver Carver Biotechnology Center, and has appointments in the Neuroscience Program, the Department of Physiology, the Beckman Institute, the Institute of Genomic Biology and the Bioengineering Program. His research interests are in bioanalytical chemistry, and focus on developing new methods for assaying small volume samples, and applying these methods to study novel neurochemistry. He and his group are developing new sampling methods interfaced to capillary scale separations, nanoliter volume NMR, single-cell mass spectrometry, information rich spectroscopic detectors for capillary-scale separations, and hybrid nanofluidic/microfluidic devices for neuronal sampling. Using this suite of technologies, he is investigating the roles that peptide hormones, neurotransmitters and neuromodulatory agents play in behavior, learning and memory. He has received numerous awards including the Pittsburgh Analytical Chemistry Award, the Instrumentation Award from the Analytical Division of the ACS, and this year's Ralph Adams Award being presented next month at PittCon; he is currently the Editor-in-Chief of *Analytical Chemistry*.