

Discovery Park Impact Analytical Instrumentation Development

NEED

Progress in bioscience and biomedical research requires innovative instruments with new capabilities. One instrument with great potential in several research fields is the mass spectrometer. Mass spectrometry has provided powerful progress in biomedical, food safety, and defense applications, but the original instrumentation was confined to laboratories because the instrument weighs hundreds of pounds and requires extensive and complicated support systems.

RESOLUTION

Dr. R. Graham Cooks and his research teams have pursued the miniaturization of this technology for the past decade. Additionally, his group invented the unique desorptive electrospray ionization (DESI) method that enables sample analysis outside the laboratory without special preparation of samples.

IMPACTS

First, Dr. Cooks and his research team developed a smaller technology that was licensed for defense applications by a start-up company, Griffin Analytical. Griffin Analytical has been so successful that it was recently acquired by a large company, icx technologies. Second, a few years later, another start-up company, Prosolia, licensed the DESI application and is now developing and manufacturing this and other ambient ionization sources for commercially available mass spectrometers. Prosolia continues to work with Discovery Park to further develop the sensitivity of this technique and new applications.

Third, Dr. Cook's instrumentation developments are one of the technological strengths that led to the creation through Discovery Park's Bindley Bioscience Center of the Center for Analytical Instrumentation Development (CAID). This Center includes faculty research teams at Purdue, Indiana University, the University of Notre Dame, and the University of Illinois, Urbana-Champaign. The goal of the center is to: "Lead America in creating the next generation of innovative 'machine-tools of science' that enable discoveries across the life sciences." For example, Griffin Analytical staff continue to work with CAID to prototype miniature mass spectrometry products through a major research and development partnership. CAID was the backdrop for the recent development of rapid, highly sensitive tests for melamine, the toxic protein mimic molecule found in counterfeit infant formula in China.



Tetrahydrocannabinol, an active ingredient in marijuana, on a latent fingerprint

CAID researchers are producing smaller mass spectrometers with multiple uses. With Dr. Zhang Ouyang at Purdue, a fully self-contained mass spectrometer about the size of a kid's shoe box that weighs 10 pounds has been developed that has full mass spectrometry capabilities. This instrument was recently profiled in "CSI: Miami." An article about the technology was published in *Science* in August 2008. The instrument provides a "molecular fingerprint" which not only identifies an individual's fingerprint, but can unearth fingerprints buried below the surface print. Importantly, the fingerprint itself is comprised of chemical substances handled by the individual that are detected by the instrument — for example, compounds found in drugs or explosives.

Dr. Cooks' research teams are not finished. He believes that miniature DESI mass spectrometry will be used to locate tumor margins during surgical procedures, for better understanding of drug distributions in the body, and for additional chemical, defense, and forensic applications. Dr. Cooks believes that someday we may all own a personal chemical analyzer based on this technology to monitor personal health and environmental conditions.