

Strategies and Applications for High-Throughput Electrophoresis (and Mass Spectrometry)

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Abstract:

The throughput of electrophoretic analysis has typically been improved using two main approaches. Miniaturization of electrophoresis channels allows application of high electric fields over short distances to reduce separations times to a few seconds or less. This approach has been mostly used for “sensing” applications where concentration of separated and detected substances is monitored over time. We have developed systems that allow rapid separations to be coupled to sampling devices for application to neuroscience (in vivo monitoring) and process analytical technology. Advances in fabrication and detection technology have also allowed development of systems with parallel channels for improved throughput. This latter technology has mostly been applied to genetic analysis. We have combined rapid separations on microchips with parallel architectures (up to 48 channels) for a substantial improvement in overall throughput, up to ~17,000 assays/hour. This high throughput allows a variety of new applications. In one example, 36 individual enzymatic reactions are monitored at 10-s intervals using rapid, serial electrophoresis in parallel. This system allows, for example, optimization of enzymatic conditions or determining rate constants in a single experiment. Another application is to monitor cellular secretions from discrete tissue samples over time in parallel. We have shown the utility of a 15-channel system for monitoring insulin secretion from 15 individual islets of Langerhans. Both of these cases monitor concentration changes that are generated within sample chambers on the chip. A more difficult problem is introducing discrete samples to a chip for high-throughput analysis. We are exploring use of segmented flows, where aqueous samples are manipulated as droplets within an immiscible carrier fluid, as a method of preparing and introducing discrete samples to electrophoretic channels. Such a system would allow samples to be pumped into the chip for injection with minimal carry-over for continuous introduction and separation of discrete samples. This system may have application to high-throughput screening. Similar approaches are being explored for high-throughput mass spectrometry and chromatography.

About the Speaker:

Robert T. Kennedy and his research group are interested in identifying problems of biological interest and then developing appropriate analytical techniques to address those problems. Techniques utilized in the laboratory include capillary electrophoresis, capillary chromatography, mass spectrometry, confocal imaging, microfluidics, and sensors. These techniques are applied to studies of signal transduction and biological recognition, in vivo neurochemical signaling (especially as it relates to addiction), and insulin secretion. A key feature of our group is the use of nanoscale measurements that allow detection of attomole or zeptomole quantities of material in complex mixtures.

Professor Kennedy received his B.S. in chemistry from the University of Florida, earned his Ph.D. at the University of North Carolina-Chapel Hill, and did post-doctoral research with Mark Wightman at UNC-Chapel Hill. Bob was a member of the Chemistry faculty at the University of Florida from 1991–2002 and moved to the University of Michigan in 2002, where he currently serves as the Hobart Willard Collegiate Professor of Chemistry & Professor of Pharmacology. He has over 140 publications and has served as the US associate editor of the *Analyst*; is currently an editor for *Journal of Chromatography, A*; and is on the scientific advisory board for *CellBioSciences*. Bob has earned many awards, including Merit Award, NIBIB; Merit Award, NIDDK; Fellow of the American Association for the Advancement of Science; American Microchemical Society’s Benedetti-Pichler Memorial Award; NSF Award for Special Creativity; Denise Desty Memorial Award for Most Innovative Paper in Separations; ACS Findeis Award in Analytical Chemistry; NSF Presidential Faculty Fellow; Alfred P. Sloan Fellow; Lilly Analytical Research Fellow; Beckman Young Investigator Award; and NSF National Young Investigator Award.

Location:
D'Ignazio's Towne House
117 Veterans Square
Media, PA 19063

Times:
Executive Mtg - 5:00 pm
Social "Hour" - 5:45 pm
Dinner - 6:30 pm
Presentation - 7:30 pm

Directions:
Below

Cost of Dinner:
\$30 or MC/Visa /AmEx

NOTE TO STUDENTS: Full-time students with valid ID may attend dinner meetings at half price. **Faculty members at colleges and universities are urged to bring one or more students to the meeting. If they do, they also can attend at half-price.**

Dinner Choices: **Chicken w Bread Stuffing, Veal Parmesan & Spaghetti, Eggplant.** Please specify choice of entree when making dinner reservations.

For Reservations:

Please register/call before 4 p.m., **Friday, September 11th, 2008.** Please note that "no-shows" will be billed for the dinner.

Late reservations: We still want you to attend, so call now. However, we cannot guarantee your entrée selection for dinner.

Contact: We strongly recommend online registration <http://www.cfdv.org/> but you can also e-mail sheree@cfdv.org, or FAX 610-485-9467. For FAX/e-mail, please include your name, employer, work telephone & meal choice. Alternatively, call Ms. Sheree Gold at 610-485-3479 and provide same information.

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Directions to the Towne House

Take I-95 to the Blue Route, I-476; take Exit 3 (Media). Go west on Baltimore Pike past intersection of Rt. 252. The Towne House is 10 blocks further, on the right corner of Veterans Square. (address: 17 Veterans Square, Media, PA 19063; Phone: 610-566-6141)

