CONTACT: MATT HOELTER (SEE P4)

January, 2005

Volume 10, Issue 1

AES Newsletter

The Sky's the Limit for 2005!

Inside this issue:

President's Message: A Biased View of the Society

Once again this year, without pomp, the American Electrophoresis Society went through one of its minor face changes. At the annual meeting in November the cast of characters comprising the officers and council of AES (collectively known as the Board) changed. But although the composition of the Board is different now, the overall goals and priorities of the society have not altered.

The Board remains committed to supporting electrophoresis in general as a field of separation technology rather than focusing attention on any one particular method or area of study. Several times in recent history temptations arose to alter the scope of AES so that it would represent the currently-reigning hot topic. Most recently the fad has been proteomics. Other national electrophoresis societies became proteomics societies in recent years to increase membership. However, the door swings both ways: people's interests re-change as new fields emerge. Since there is usually an electrophoresis component in new fields, it makes sense to maintain a commitment to the full spectrum of theoretical and practical applications of electrophoresis while staying flexible enough to embrace and highlight current trends. Besides, if we were to become the American Proteomics and Electrophoresis Society our acronym would be APES giving license to all manner of comedians.

The current AES Board reflects a diversity of electrophoretic applications. (See the AES web site www.aesociety.org for photos) Of the 12 Board members, 9 are biochemists/molecular biologists and 3 are chemical engineers. Among the former, 7 are primarily associated with protein work (Gaertner, Garfin, Gruia-Gray, Gombocz, Kendrick, Rodkey, and Stevenson), 2 are concerned with using electrophoresis for studying nucleic acids (Grossman and Stellwagen)

Many thanks to our Sponsors for contributions funding the 2004 meeting.

Bio-Rad Labs

CBS Scientific

GE Healthcare

Genencor International

Nonlinear Dynamics

Proteome Systems

Scimagix

Syngene

Our traditionally strong meetings, with sessions chaired by invited plenary speakers discussing state-of-the-art topics, would simply not be possible without funding from sponsors. These donations are greatly appreciated.

and 1 (Grossman) is beginning to embrace bioinformatics. The interests of the engineers (Arce, Minerick, and Ugaz) span the field from macroscopic to microfluidic and from theoretical to practical, as might be expected of engineers.

The annual meeting is the major activity of AES where we make and renew acquaintances with collaborators and learn about the latest advances and applications in electrophoretic methods. We have been holding our meetings as Topical Sessions at the much larger meetings of the American Institute of Chemical Engineers (AIChE). Association with the engineers has been fruitful and synergistic, fostering an interdisciplinary approach toward the refinement of electrophoretic methods. The average attendance at AES sessions has consistently surpassed the attendance figures for AIChE sessions on the whole, indicating that there is much interest in our discussion topics among the chemical engineering community as well as among biochemists and molecular biologists. Some favorite meeting events snapped by Erich Gombocz, webmaster, are shown below. A detailed meeting review is too long for the newsletter and will be presented in the journal *Expert Reviews in Proteomics*.

AUSTIN TEXAS MEETING MOMENTS

Winners of the 2004 Poster Contest (left to right)

Mario Oyanader, Universidad Catolica del Norte, Chile Honorable Mention
Robert Meagher, Northwestern U, Honorable Mention
Shawn Llopis, Louisiana State U. Honorable Mention
Faisal Shaikh, Texas A&M University, 2nd Place

Christa Hestekin, Northwestern University, 1st Place (not shown)

Scott Rodkey meets Milan Bier.

The ***Stone Crab*** appetizers at the AES dinner at Truluck's restaurant were wonderful!

Dr. Ronald Pethig, a plenary speaker from the University of Wales, Bangor, UK gave a fascinating talk on whole cell dielectrophoresis. The movie on cell separation showed novel technologies.

For more information see his recent paper: JALA 9: #5, 324-330, 2004 "Cell Physiometry Tools Based on Dielectrophoresis," Ronald Pethig, Richard S Lee, and Mark S Talary.

A review of the 2004 Meeting will appear in an upcoming edition of a new journal, Expert Reviews in Proteomics.

Dave Garfin
President

Invited Review: Microdevices for DNA analysis

Microfabricated devices have the potential to offer portable low-cost alternatives to conventional benchtop-scale DNA analysis instrumentation, ultimately making a wide range of genomic-based assays feasible for routine use in the diagnosis and treatment of disease. Many applications of miniaturized technology also exist in the development of new and more powerful sensors to detect infectious disease agents (e.g. influenza, *E. coli*, SARS) and provide early warning capabilities for emerging biowarfare/bioterror threats (e.g. anthrax). Since these devices require only nanoliter sample volumes and do not rely on the availability of a pre-existing laboratory infrastructure, they are readily deployable in remote field locations for use in a variety of medical and biosensing applications. Impressive progress continues to be made toward improving separation performance in miniaturized DNA electrophoresis systems, largely as a result of efforts focused on scaling down conventional capillary electrophoresis (CE) technology—a logical approach given the success of CE-based systems in high-throughput sequencing and genotyping applications.

By virtue of their small size, miniaturized systems offer the advantage of reduced reagent consumption, thereby lowering costs associated with performing biochemical reactions. However, the economic benefits of miniaturization extend even further to the hardware itself because photolithographic microfabrication techniques can be used to produce hundreds or thousands of devices at once, yielding per-device costs of $1 or less. These enormous savings are possible since per-wafer fabrication costs remain essentially constant regardless of whether the wafer contains a single device or 1,000 devices. A common analogy is that of your office photocopier, where the per-copy cost is independent of the number and arrangement of characters on the page. Consequently, as has been repeatedly demonstrated in the microelectronics industry, the cost benefits of microfabrication become most compelling when the device size is as small as possible. In terms of electrophoresis, this means that the ability to employ the shortest possible separation distance while still maintaining sufficient levels of resolution and sensitivity are issues of extreme importance.

Commercial DNA analysis systems based on microchip capillary electrophoresis technology are beginning to appear on the market. For example, the Agilent 2100 Bioanalyzer, the most widely used commercial chip-based DNA analysis device, is based on a Caliper LabChip platform incorporating arrays of glass electrophoresis microchannels loaded with a low viscosity gel-dye mixture. This system uses interchangeable electrophoresis chips that interface with a benchtop power supply and optical detection system. Newer systems, including Hitachi's SV1100 Microchip CE system and Network Biosystems' BioMEMS-768 sequencer, offer additional platforms for performing microdevice-based DNA analysis, although still operating as components of benchtop-scale systems.

Despite these remarkable advancements, the current generation of miniaturized devices have yet to offer improvements in cost or performance at a level compelling enough to seriously compete with existing macroscale CE systems. These limitations are primarily a consequence of (i) an inability to achieve high-resolution separations in devices occupying a footprint small enough to realize the enormous cost savings available through mass production via photolithographic fabrication, combined with (ii) difficulties in interfacing these devices with either microscale liquid handling components or macroscale laboratory workflow. These issues present a number of opportunities for advancements, particularly with respect to the development and characterization of improved sieving gel media. Systematic fundamental studies to gain a more complete understanding of the physics of gel electrophoresis and maximize separation performance in ultra-short distances are more important than ever.

Electrophoresis technology continues to maintain a ubiquitous presence in the modern molecular biology laboratory. However, unless significant progress can be made toward achieving orders of magnitude advances in cost and performance, electrophoresis may risk becoming less attractive for use as an analytical component in miniaturized systems. These challenges present tremendous opportunities for us in the electrophoresis community to make meaningful contributions toward the development of next-generation genomic analysis technology. The AES, which uniquely brings together researchers from academic, industrial, and health care settings, is ideally positioned to play a central role in promoting research aimed at addressing these needs.

Further reading: Recent progress toward the development of miniaturized electrophoresis technology for DNA sequencing and genotyping has been reviewed in the following articles.

Kan, C-W., Fredlake, C.P., Doherty, E.A.S., and Barron, A.E. "DNA sequencing and genotyping in miniaturized electrophoresis systems." *Electrophoresis* **25** (2004): 3564-3588.

Ugaz, V.M., Elms, R.D., Lo, R.C., Shaikh, F.A., and Burns, M.A. "Microfabricated electrophoresis systems for DNA sequencing and genotyping applications: current technology and future directions." *Philosophical Transactions of the Royal Society (Series A: Mathematical, Physical and Engineering Sciences)* **362** (2004): 1105-1129.

Dr. Victor Ugaz
Texas A&M University
Chem Engineering Dept
College Station, TX

Contact: Matt

Matt Hoelter
Executive Director
American
Electrophoresis Society

1202 Ann St
Madison, WI 53713
Phone: 608-258-1565
Fax: 608-258-1569
Email: matt-aes@tds.net

Electrophoresis past, present and future

Published quarterly. To submit articles contact:

Nancy Kendrick, Ph.D.
Editor
nancy@kendricklabs.com
608-258-1565

Newsletter subscriptions are complimentary with AES membership. For more information or to join contact Matt Hoelter at the address above.

Treasurer's Report — Fiscal Year 2004

The Austin meeting, although it didn't have the extra boost of that San Francisco magic, was nevertheless successful, and is keeping us in modest growth mode. Our balance sheet (below), updated to the end of the year from that presented at the business meeting in Austin, shows a somewhat better picture than last year, resulting from having reduced our debt while keeping our income approximately constant. This is heartening during a period when we are broadening our scientific constituency, and suggests we are in the sort of lag phase that precedes growth. Our main need continues to be to increase membership and corporate supporters, both as exhibitors and as sponsors.

Balance sheet - 2004

Current assets			$ 14,564	
	Cash	$ 7,547		
	Accounts receivable	$ 7,017		Meeting income
Liabilities			$ 7,200	
	Long-term	$ 7,000		CaSSS (loan)
	Short-term	$ 200		Poster costs
BALANCE			$ 7,364	

Larry Grossman
Treasurer

2005 Meeting Update:

Planning for the 2005 AES Meeting in Cincinnati is moving forward. Chairs are either in place or are close to being assigned for all the sessions. Following the strategy that worked well at last year's Austin meeting, programming will be broadly sub-divided into three categories: Proteomics, Miniaturization, and Electrokinetics/Fundamentals. We have renamed some of the sessions to reflect this emphasis to hopefully (i) make them easier to find in the meeting program, and (ii) increase attendance by promoting our programming as a complete package so that people interested in those areas will want to stay for multiple talks and/or sessions. The abstract deadline is May 1. We're looking forward to another great meeting and hope to see all of you there!

Adrienne Minnerick and Victor Ugaz
Meeting Co-Chairs

Adrienne

Victor

The many faces of bioinformatics

The National Library of Medicine's National Center for Biotechnology Information provides a wealth of data that could seem staggering to someone who doesn't use it regularly. Start with http://www.ncbi.nlm.nih.gov/gquery/gquery.fcgi for queries and http://www.ncbi.nlm.nih.gov/Education/index.html for tutorials and other education resources. A recent "hot" paper based on bioinformatics and molecular evolutionary analyses was "Accelerated Evolution of Nervous System Genes in the Origin of *Homo sapiens,* " Dorus *et al., Cell* **119**, 1027-1040, 2004.