

PRESIDENT'S NOTE

Page Baluch, AIMS 2009-2010 President

Welcome to the start of another great year! I would like to extend a big thank you to Phil Anderson, Al Agellon and all the others who planned and hosted the 2009 AIMS conference at the University of Arizona. This year the 2010



conference is scheduled for

Friday **March 12, 2010** at Arizona State University in the Ventana Ballroom at the Memorial Union. Registration for the conference is a two step process. You must first register for membership online at www.azmicroscopy.org at the student, individual or corporate level then register for free admission to the AIMS conference. Corporate members have the option to register at various sponsorship levels which includes a booth at the conference. Due to limited seating, only those registered for conference attendance will be admitted to the luncheon.

ATTENTION STUDENTS:

We would like to invite any undergraduate or graduate student who uses microscopy to visualize their research to present their work at the AIMS conference poster session. We will have four \$150 awards, donated by our Platinum sponsors, for the best posters in the category of either physical or life sciences. We will need a final copy of your poster abstract emailed to page.baluch@asu.edu by **March 1st** to be included in the conference program. Below are the guidelines for the poster design and award evaluation.



Student Poster Guidelines:

1. Applicants must be or have been an undergraduate or graduate student during the academic year of the meeting.
2. The work must consist of original research authored by the participant and be co-authored by his/her advisor.
3. Each student will be given 2 minutes to present the most important aspects of their poster. It is suggested that the student prepare 1-2 PowerPoint slides to assist in the presentation.
4. The poster must be formatted to fit within an area of 48 inches wide by 36 inches high.
5. The poster should contain: title, author and affiliation, abstract, introduction, methods and materials, results, discussion, figures and legends, and references.

Award Evaluation Criteria:

The AIMS judges will use the following criteria to evaluate the student's poster and oral presentation:

1. Scientific merit
2. Soundness of the research proposal
3. Experimental design and thoroughness of investigation
4. Validation of conclusions
5. Application of microscopy/microanalysis in answering the experimental question
6. Quality of micrographs/images/data
7. Presentation
8. Response to questions
9. Diversity of instrumentation and technique
10. Clarity and quality of writing
11. Grammatical correctness



2010 AIMS CONFERENCE PROGRAM

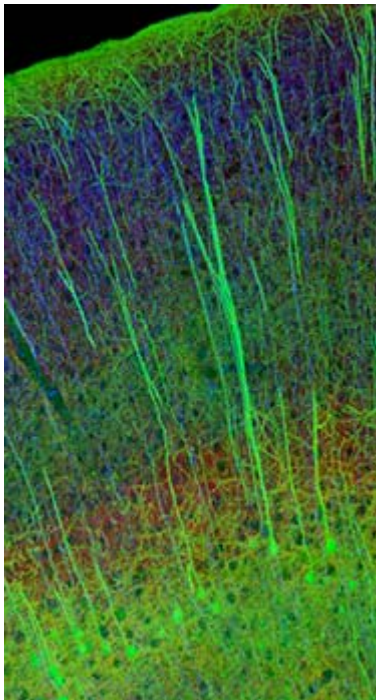
ASU Memorial Union - Ventana Ballroom (MU241)

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|---------------|---|
| 7:30 - 8:15 | Check-In |
| 8:15 - 8:30 | Welcome: Page Baluch- President AIMS |
| 8:30 - 9:15 | Peter Crozier, Arizona State University, Ira A. Fulton Schools of Engineering <i>"Observations of the Synthesis and Evolution of Active Nanostructures "</i> |
| 9:15 - 10:00 | Laimonas Kelbauskas, Arizona State University, Biodesign Center for Ecogenomics <i>"Single-cell Optical Tomography to Reveal Cell Structure-function Relationships"</i> |
| 10:00 - 10:45 | Coffee Break - Vendor demonstrations |
| 10:45 - 11:30 | Brian Smith, Arizona State University, School of Life Sciences <i>"Plasticity in Transient Dynamics of Early Olfactory Processing"</i> |
| 11:30 - 1:00 | Buffet Lunch |
| 1:00 - 1:45 | Rogier Windhorst, Arizona State University, School of Earth & Space Exploration <i>"Deep NASA Hubble Space Telescope Image Analysis, and its Applications to Medical Imaging"</i> |
| 2:00 - 3:00 | Stephen Smith. (Keynote Speaker), Stanford University, <i>" Array Tomography: Imaging the Molecular Architecture and Ultrastructure of Neural Circuits"</i> |
| 3:00 - 3:30 | Student Presentations |
| 3:30 - 4:15 | Break with Student Poster Session |
| 4:15 - 5:00 | Student Awards and Closing Remarks |
| 5:00 - 5:45 | Annual Society General Meeting (open to the public) |
| 6:00 | No Host Dinner |



SPEAKERS

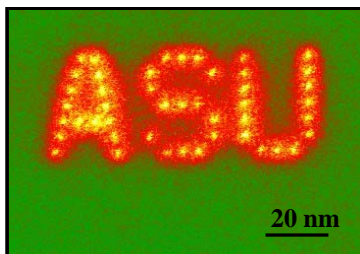
Stephen Smith earned his PhD at the University of Washington in 1977, and did his postdoctoral training at the University of California, Berkeley. He was on the faculty at Yale Medical School from 1980 to 1989. He has been at Stanford since 1989.



The Smith laboratory invents new light and electron microscopy methods to probe brain circuit structure, development, and function. Using these tools, the laboratory has discovered several previously unknown brain signaling pathways, including the NMDA-Ca signal (now widely recognized as fundamental to most synaptic plasticity), and the astrocytic calcium signal (now recognized as linking synaptic activity to vascular response and the NMR BOLD signal). The lab also was first to describe the filopodial dynamics stage of synaptogenesis. Most recently, the lab has invented a new ultra-high-resolution microscopy method called "array tomography". This method is proving a breakthrough in quantitative power for the study of brain synapse populations in health and in neurodevelopmental and

neurodegenerative disorders. Array tomography is also giving us our first glimpse of the really stunning beauty of the brain's vastly intricate cellular and molecular architectures.

Peter A. Crozier School of Mechanical, Aerospace, Chemical and Materials Engineering, Arizona State University, Tempe, AZ

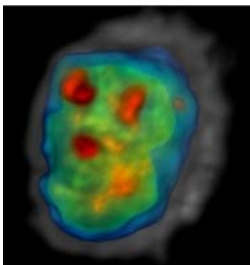


Gas-solid reactions play a major role in the evolution of materials structure and composition. In many applications, materials function in the presence of reactive gases at elevated temperature and systems which are relatively inert at room temperature can become active and undergo significant phase changes

under ambient conditions. Moreover, fundamental processes taking place during nanomaterials synthesis and processing may involve gas-solid reactions (e.g. oxidations, reductions, CVD etc...). These phase changes can be particularly pronounced in porous nanomaterials such as heterogeneous catalysts where the high surface to volume ratio gives rise to large gas contact areas. Transmission electron microscopy (TEM) is a powerful technique for elucidating the structure and chemistry of materials at atomic resolution. However, conventional TEMs operate under high vacuum conditions preventing observation of the structures and dynamic processes that take place in the presence of a reactive gas atmosphere. To address this so-called “pressure gap”, *in situ* environmental transmission electron microscopes (ETEM) have been developed which permit reasonably high gas pressures around the sample area while maintaining high vacuum conditions throughout the rest of the TEM column.

This presentation will review current approaches to performing electron microscopy under gaseous environments. Examples will be presented illustrating the phase changes that take place under different gas environments on metal and oxide nanocatalysts relevant to sustainable energy applications related to hydrogen production, solid oxide fuel cells and photocatalysis. There is wide recognition of the importance of understanding the detailed role of the nanoscale decomposition, diffusion, nucleation and growth processes taking place during catalyst synthesis and operation. Nanoscale identification of the phase with the highest catalytic active is a major goal of ETEM. We are also using the combination of a subnanometer focused electron beam in combination with reactive gases to explore novel approaches to synthesis and processing of nanostructures. Electron beam induced deposition (EBID), electron beam induced transformations (EBIT) and gas enhanced etching can be used to synthesize nanostructures of arbitrary shape at well-defined positions as shown below.

Laimonas Kelbaskas The Biodesign Institute, Arizona State University, Tempe, Az



At the Center of Ecogenomics we have implemented a novel optical tomography method for single cells (cell CT). It is based on absorption imaging of fixed cells stained with hematoxylin, Oil Red O or other absorption dyes. The method features isotropic spatial resolution of



~375 nm in all three dimensions, reliable data collection and reconstruction algorithms and moderate throughput. It permits unique insights into three-dimensional cellular and nuclear morphology and enables quantitative studies of cell architecture-function relationships. Utilizing hematoxylin staining, which specifically stains chromatin and the nuclear envelope, we have conducted a comparative study on nuclear morphology using two different cell lines representing normal and dysplastic stages of Barrett's esophagus, a disease which may culminate in esophageal cancer. We developed algorithms for extraction of 3D nuclear morphometric features for direct quantitative comparisons between the two cell lines. We find that, among the studied morphometric features, the normal esophageal cell line EPC-2 shows lower nuclear-to-cytoplasmic volume ratios, fewer nucleoli, and smoother nuclear surface texture as compared to the dysplastic CP-D cell line.

To complement and extend the microstructural absorption imaging mode to functional imaging, we are implementing fluorescence CT for fixed and live cells. To this end we have developed a custom, biocompatible gel that can support live cells for prolonged periods of time. We have modified the cell CT instrument to accommodate specific excitation and emission detection optical paths for transmission and epi fluorescence illumination modes. Cell CT imaging of live cells will facilitate studies of gene transcription and protein expression related to the nuclear structure in the context of disease progression. Fluorescence functional cell CT will also permit assessment of protein expression levels localized to the subcellular microdomains in which the proteins function.

An updated version of the newsletter will include abstracts from the following speakers.

Brian Smith: Arizona State University, School of Life Sciences, Co-Director of the Neurosciences Program. *"Plasticity in Transient Dynamics of Early Olfactory Processing"*

Rogier Windhorst: Arizona State University, School of Earth & Space Exploration. *"Deep NASA Hubble Space Telescope Image Analysis, and its Applications to Medical Imaging"*



MICROSCOPY & MICROANALYSIS 2010 CONFERENCE

We invite you to join us on August 1-5, 2010 at the Oregon Convention Center in beautiful Portland, Oregon for Microscopy & Microanalysis 2010. Microscopy and Microanalysis 2010 promises to be the epitome of scientific diversity, spanning disciplines from the life sciences to the physical sciences, all unified by the tools of our trade. The program committee has developed a strong program highlighting the latest microscopic and microanalytical advances in fields such as nanotechnology, biological sciences, materials science, clinical diagnoses, and metallurgy. Many interdisciplinary symposia have been organized, reflecting the current environment of collaboration between scientists in different disciplines. Again this year, we will kick off the meeting with a plenary session on Monday morning featuring Dr. Mark Welland and highlighting the winners of our major societal awards. The exhibits will demonstrate state-of-the-art equipment, and the vendor tutorials will continue to be a significant part of the meeting. The meeting will also feature "Back to the Basics" tutorials and workshops to be held during the meeting in addition to the traditional Sunday Short Courses. For more information go to: <http://www.microscopy.org/MandM/2010/index.cfm>.



CURRENT NEWS AT ASU

Ecogenomics group at ASU's Biodesign Institute receives NIH funding for Cancer Research

ASU is one of 12 Physical Sciences-Oncology Centers receiving a total of \$22.7 million in funding this year from the NIH's National Cancer Institute. One of the research projects, based in Biodesign's Ecogenomics Center, will use cancer cell lines and VisonGate's Cell-CT platform, which operates similar to a CAT scan, to synthesize 3-D images of cancerous cells. This technique will give a more accurate view of the fine details of the cancer cell nuclei. It is projected that this research will develop further insight leading to progress in diagnosing, preventing and treating cancer.



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