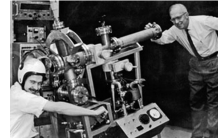
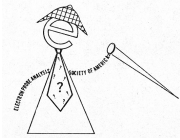




(/MandM/2017/)



## Full Symposium Descriptions

- Biological Sciences Symposia
- Physical Sciences Symposia
- Analytical Sciences Symposia

### Biological Sciences Symposia

#### B01 Gina Sosinsky Memorial Symposium: Imaging of Cellular Communications

***Bernard Heymann, Esther Bullitt, Alasdair Steven***

Gina Sosinsky's recent passing represents a severe loss. Gina was a valuable contributor to the 3DEM community and a delightful person. We are organizing this symposium to honor her and her work on cellular communication. One of her main interests was the junctions between eukaryotic cells, and how these serve both structural and communication functions. The former is essential to maintain the integrity of tissues, while the latter ensures propagation of signals between cells. Gina made important contributions to how gap junctions form selective channels between cells, and couple their cytoplasm to allow solute exchange. Adherens junctions and desmosomes provide mechanical contacts involved in transmitting force signals. Tight junctions offer selectivity to the passage of solutes in the spaces between cells. Retinoschisin is involved in maintaining the layered structure of the retina. Synaptic transmission affords the communication of information. The extracellular matrix forms a scaffolding for these and other proteins in the interstices between cells. Defects in these proteins cause debilitating diseases. The symposium will highlight the progress that has been made towards determining the structures and functions of proteins mediating cell-cell interactions using electron microscopy, light microscopy and other visualization techniques.

***Invited Speakers:***

- Atsunori Oshima, Nagoya University, Japan
- Dorit Hanein, Sanford-Burnham-Prebys Medical Discovery Institute
- Bernard Heymann, National Institutes of Health

**B02 Microstructure Characterization of Food Systems*****Jinping Dong, Joel Wallecan***

Understanding of microstructure and functionality correlations leads the recent trend in food research. Various microscopy and microanalysis techniques are constantly employed by scientists to characterize food microstructures. However, many challenges are faced in this field due to the high complexity nature of the food. Many unique imaging and characterization methods have been developed in individual labs. There is a high demand for the exchange of experience and knowledge in the field, which is the intent of this symposium. This symposium will present applications of microscopy related techniques to characterize food microstructures and to draw their relationship with functionalities. Topics include, but are not limited to light, fluorescence, electron, ion, x-ray, and spectroscopy based microscopy techniques with their applications in food research.

***Invited Speakers:***

- Chathurada Sage Gajadeera, University of Minnesota
- Owen Jones, Purdue University
- Joël Wallecan, Cargill
- Peter Lillford, University of Birmingham
- Steven Zbylut, General Mills

**B03: Imaging the Biology of Cells and Tissues: Just Do It Right*****Eduardo Rosa-Molinar, Jay Potts***

This symposium will serve as a forum for the exchange of information, ideas, and knowledge regarding rigor and reproducibility in imaging sciences, a topic of increasing frequency and importance. Assuring confidence in and reproducibility of imaging results and their interpretation requires thoughtful consideration of the microscopic and experimental controls and procedures, detailed reporting of experimental design, methodologies, and means of analysis, as well as a review of a long and rich literature in the imaging sciences. Using case studies, panelists will discuss the most significant and recurring imaging issues, strive to reach a consensus about the extent to which rigor and reproducibility is a problem, and, suggest individual and organizational means of addressing the concern. Target attendees include undergraduate and graduate students, post-doctoral researchers, and scientists of all levels of experience/expertise and related backgrounds.

***Invited Speakers:***

- Le Trinh, University of Southern California
- Paul Kulesa, Stower Institute for Medical Research
- Richard Powell, Nanoprobes Inc.
- John Rash, Colorado State University

**B04 3D and Intravital Imaging in Development and Beyond*****David Entenberg, Kevin Eliceiri, Sandra Rugonyi***

While conventional optical imaging tools like 2D in vitro assays offer the ability to tightly and reproducibly control experimental conditions, they do not adequately reflect the topography or diversity of environments encountered by cells in vivo. 3D and intravital imaging can remove these restrictions and restore the heterogeneity of environments present in the living organism. For example, 3D organoid cultures free cells from the culture dish's two dimensional confines revealing more physiologically relevant motility and extracellular matrix interactions; whole mount imaging preserves the structural integrity and spatial arrangement of the living organism; and intravital imaging further restores multiple host cell interactions, connection to lymphatic and vascular circuits and regulatory signals from distant organs. These increasingly more physiological environs come at the price of greatly increased challenges for the design of experiments and extraction of interpretable information from them. This session is intended to be a forum for highlighting new developments and techniques in the art and science of 3D and intravital imaging as well as what can be learned from their application to areas ranging from development to pathology.

***Invited Speakers:***

- Jan Huisken, University of Wisconsin and Morgridge Institute
- Mary Dickensen, Baylor College of Medicine

## B05 Pharmaceuticals and Medical Science

***Bridget Carragher, Jason Mantei***

This symposium will present diverse content related to the manufacturing and use of pharmaceuticals and medical products. There will be detailed case studies that demonstrate the use of advanced techniques to address the unique problems that arise during drug discovery, vaccine research, formulation, biocompatibility, production, product life cycle, and eventual patient use. There will also be in-depth technical presentations covering the development of methods specially optimized for use with these real-world material and biological systems. The research may involve use of hybrid or correlative techniques that are inclusive and generally include any of the instruments and methods found in the exposition. As always, contributed papers for both platform and poster presentation are encouraged.

***Invited Speakers:***

- Giovanna Scapin, Merck
- Priyamvada Acharya, National Institutes of Health
- Gabriel Lander, The Scripps Research Institute
- Debra Joslin, McCrone Associates
- Jim Troedel, Baxter Healthcare

## B06 3D Structures of Macromolecular Assemblies, Cellular Organelles, and Whole Cells

***Deborah F. Kelly, Elizabeth Wright, Teresa Ruiz***

Our understanding of the 3D structure and functional subtleties of cells, microorganisms and macromolecular assemblies has skyrocketed due to recent advances in EM imaging technology and hybrid methodologies. This symposium will highlight structural studies of cells, microorganisms and macromolecules using state-of-the-art high resolution techniques. These techniques include, electron tomography; electron crystallography; single particle cryo-EM; helical reconstruction; STEM; AFM; X-ray crystallography, and molecular modeling. Biological

topics of interest include: cellular architectures, metabolism, trafficking, and division; gene regulation, transcription, and translation; host-pathogen interactions and virus structure; In situ studies using TEM and SEM; and all aspects of structure-function studies of biological assemblies.

***Invited Speakers:***

- Alasdair Steven, National Institutes of Health
- Melanie Ohi, Vanderbilt University Medical School
- Jason Mears, Case Western Reserve University School of Medicine
- Elitza Tocheva, Université de Montréal, Canada
- Elizabeth Villa, University of California, San Diego
- Terje Dokland, University of Alabama, Birmingham

## **B07 Bridging the Gap: Technologies and Methods for Correlative Light and Charged Particle Microscopy of Biological Systems**

***James A.J. Fitzpatrick, Matthew S. Joens, Joshua Z. Rappoport***

Correlating light and charged particle (both electron, ion and x-ray) microscopy methodologies serves to bridge the multi-scale gap that hinders both the two- and three-dimensional analyses of rare cellular and sub-cellular level events that remain beyond reach due to the diffraction limit of light. The need to correlate information obtained from both types of datasets has proven a significant challenge, but has evolved in recent years with the advent of new probes, processing techniques, and detectors with substantially increased sensitivity. We seek to highlight the scientific innovations that address the correlation of light and charged particle microscopy of biological samples and soft materials. This symposium is intended to be a forum for the dissemination of correlative workflows and advanced sample preparation methods. Invited papers would include those describing novel approaches for correlating information from multiple light modalities with x-ray, electron and ion microscopy datasets. Of particular interest are innovative developments of new CLEM probes and contrast agents, advanced methods for ultrastructural preservation and dynamic in situ measurements. Target attendees will include engineers and scientists from all levels of bio-imaging expertise and all related backgrounds.

***Invited Speakers:***

- Mark Ellisman, National Center for Microscopy and Imaging Research
- David Piston, Washington University
- Paul Verkade, University of Bristol, UK

## **B08 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals**

***Gang (Greg) Ning, Ru-ching Hsia, Trace Christensen, Jon Charlesworth***

Microscopy is not only useful but also critically important in the ongoing research, detection, diagnosis and treatment of disease. Advances that improve rapid and accurate detection and treatment often involve the use of various microscopic techniques. These varied techniques provide us with an improved ability to diagnose and research the origins, development and response of diseases in human, plant and animal specimens. This is an opportunity to share information on the investigation of pathogenic cells, tissues and entire organisms in clinical, diagnostic and research laboratories. Emphasis will be placed on using latest microscopy in both clinical and research laboratories.

***Invited Speakers:***

- Hani Suleiman, Washington University School of Medicine
- James Fitzpatrick, Washington University School of Medicine
- Eric Wartchow, Children's Hospital Colorado
- Keith Cheng, Pennsylvania State University School of Medicine

## Physical Sciences Symposia

### P01 Characterization of Semiconductor Materials and Devices

*Moon J. Kim, Michael Gribelyuk, Jayhoon Chung, Esther Chen*

The symposium aims to review progress in advanced characterization of current and emerging semiconductor materials and devices. This includes 3-D and planar devices, wide-gap semiconductors and heterostructures for nanoelectronics applications. The emphasis is on understanding the microstructure, defects, failure mechanisms, correlation of structure with device performance. Presentations are sought to include state-of-the-art characterization of current semiconductor materials/devices as well as new and emerging semiconductors.

***Invited Speakers:***

- Zonghoon Lee, Ulsan National Institute of Science and Technology (UNIST), South Korea
- Myung-Geun Han, Brookhaven National Laboratory
- Bianghu Fu, GlobalFoundaries
- Martha McCartney, Arizona State University
- Jean-Luc Rouviere, CEA - Univ. Grenoble Alpes INAC/MEM/LEMMA, France

### P02 TEM/STEM/EELS/SNOM of Ultralow Energy Excitations

*Ian MacLaren, Philip E. Batson*

New monochromated microscopes and new high stability EEL spectrometers are allowing dramatic advances in understanding low energy excitations in materials, nanostructures and even organic molecules at high spatial resolution. This includes atomic and molecular vibrations, low energy electronic excitations (e.g. interband transitions), and surface plasmons. Scanning Near-Field Optical Microscopy, SNOM, uses optical techniques to obtain similar information. Topics of interest will include new developments in each field and cross-disciplinary discussion. Contributions are invited on hardware developments; software techniques and algorithms for data analysis; theory of the measurement science; low loss interactions between fast electrons and solids and near-field optical interactions with matter; and applications covering both physical and biological sciences. Additionally contributions would be welcomed where these new developments are correlated with complementary techniques such as Raman spectroscopy, cathodoluminescence, inelastic neutron scattering, and low energy electron based high resolution EELS.

***Invited Speakers:***

- Surong Gao, Max Planck Institute for Solid State Research, Germany
- Luis Galvao-Tizei, Université Paris-Sud, France
- Les J. Allen, University of Melbourne, Australia
- Markus Raschke, University of Colorado
- Peter A. Crozier, Arizona State University

## P03 Advanced Microscopy and Microanalysis of Complex Oxides

*Xiaoqing Pan, Peng Wang, Elizabeth Dickey*

Complex oxide materials exhibit a broad range of functional properties, such as high temperature superconductivity, metal-insulator transitions, colossal magnetoresistance, (anti-) ferromagnetism, (anti-) ferroelectricity, piezoelectricity, and multiferroicity. In many of these materials, unique functionality is derived from local structure and disorder, and there is a need to understand the interplay between chemistry, atomic structure and electronic structure at the atomic scale and across correlation lengths of tens to hundreds of nanometers. In addition, recent technical advances in the atomic-scale synthesis of oxide materials have provided a fertile new ground for creating fascinating phenomena and novel states of matter at their interfaces. A completely new class of electronic devices can be envisaged and engineered by tailoring the physical properties on the atomic scale. This symposium will focus on analytical transmission electron microscopy techniques, aberration-correction, spectroscopy, and in-situ methods to characterize these emerging properties across interfaces, thin films and bulk materials for the understanding of new phenomena that occur in these complex-oxide materials. We welcome contributions that report on either new technique advances or novel applications of microscopy and microanalysis tools.

### *Invited Speakers:*

- Xiuliang Ma, Chinese Academy of Sciences, China
- María Varela, Universidad Complutense de Madrid, Spain
- Huolin Xin, Brookhaven National Laboratory
- Yuichi Ikuhara, The University of Tokyo, Japan
- Jiyan Dai, The Hongkong Polytechnic University, Hong Kong
- Andre Mkhoyan, University of Minnesota
- Brian Gorman, Colorado School of Mines
- Alexandre Gloter, Université Paris Sud, France
- James LeBeau, North Carolina State University
- Susanne Stemmer, University of California, Santa Barbara

## P04 Advanced Microscopy and Microanalysis of Low-Dimensional Structures and Devices

*Marta D. Rossell, Jordi Arbiol, Valeria Nicolosi, Quentin Ramasse*

Low-dimensional systems, which are restricted in one, two or even three dimensions, exhibit many properties that are notably different from those of their bulk counterparts. With reduction in size, intriguing and extraordinary electronic, thermal, mechanical, chemical, magnetic, and optical phenomena can be introduced. Suitable control of the properties and responses of these low-dimensional structures may result in the development of new devices and disruptive technologies. This symposium will focus on the use of cutting-edge microscopy and microanalysis techniques to characterize these emerging low-dimensional structures and devices. The techniques include, but are not limited to, analytical transmission electron microscopy techniques, aberration-correction, spectroscopy, and in-situ methods (optical, electronic, mechanical). Of particular interest are contributions that apply state-of-the-art instrumentations to investigate and model defects, interfaces, diffusion, ordering, and doping. Presentations are sought from the areas of nanowires, nanotubes, nanoribbons, nanobelts, nanosheets, rings, heterostructures, homostructures, and quantum structures.

### *Invited Speakers:*

- Sara Haigh, The University of Manchester, UK
- Maya Bar Sadan, Ben-Gurion University, Israel
- Juan G. Lozano, University of Oxford, UK
- Kimberly Dick-Thelander, Lund University, Sweden
- András Kovács, Forschungszentrum Jülich, Germany
- Andreas Rosenauer, University of Bremen, Germany
- César Magén, University of Zaragoza, Spain

## P05 Imaging and Spectroscopy of Beam-Sensitive Materials

***K. Andre Mkhoyan, Osamu Terasaki, Ray F. Egerton, Prashant Kumar***

This symposium will highlight (not limited to) the experimental and theoretical research advances for electron beam sensitive materials in innovative imaging and spectroscopy methods, electron beam damage mechanisms, low-dose analytical TEM/STEM and SEM imaging, EELS and EDX spectroscopy, and analysis. Need of cleaner, environment friendly technologies for energy production, storage and electronics in the future, has created a demand for advanced materials and devices. Metal-organic frameworks (MOFs), zeolites and mixed organic-inorganic composites have shown huge potential in catalysis, separation, carbon capture and energy storage. However, these materials bring unique challenges due to their very-high electron beam-sensitivity, making routine imaging and spectroscopy a challenge.

### ***Invited Speakers:***

- Eric Stach, Brookhaven National Laboratory
- Alvaro Mayoral, Universidad de Zaragoza, Spain
- Xueyi Zhang, The Pennsylvania State University
- Kenneth Downing, Lawrence Berkeley National Laboratory
- Nan Jiang, Arizona State University

## P06 Nanoparticles: Synthesis, Characterization, and Applications

***Thomas W. Hansen, Abhaya Datye, Marc-George Willinger***

Nanoparticles find a wide range of applications varying from food additives, medical applications as well as industrial catalysis. A broad array of techniques is utilized to study nanoparticles, but they tend to average information over a large collection of particles. Electron microscopy remains the most important technique since it provides information at the level of single particles. As the level of resolution has approached the atomic scale, with the wide spread deployment of aberration correction, we can do a lot more than determine particle size distributions.

In this symposium we aim at highlighting the properties of nanoparticles as determined from electron microscopy and related techniques. We seek contributions that highlight novel synthesis techniques to prepare nanoparticles, especially those that combine organic and inorganic materials. We will highlight the essential role of computational modelling through molecular dynamics simulations and density functional theory that help us in understanding the properties of nanoparticles.

### ***Invited Speakers:***

- Thierry Epicier, INSA Lyon, France
- Ilke Arslan, Pacific Northwest National Laboratory
- Damien Alloyeau, University of Paris, France

- Lewys Jones, University of Oxford, UK

## P07 Advanced Characterization of Energy-Related Materials

*Meng Gu, Chongmin Wang, Katherine Jungjohann, Judith Yang*

Energy-related materials are key to the sustainable development of modern society. This symposium covers the aspect of energy generation, capture, conversion, storage, and efficiency. The topics include but are not limited to materials for: batteries, solar energy, fuel cells, thermoelectrics, ferroelectrics, piezoelectrics, and catalysts. Characterization methods are rapidly developing that are providing heretofore new fundamental understanding of structure-property relationships. Microscopy and spectroscopy capabilities for studying energy materials has moved beyond the static imaging for structural and chemical analysis, into real-time operando studies. The use of electron microscopy for understanding growth, phase transformations, reaction and degradation mechanisms, and electron-beam induced processes for these materials highlights the key interest to the community and will develop strategies for future technologies. Contributions are welcome in areas relevant to energy-related materials – structure, property measurement, advanced characterization such as three-dimensional microscopy, EDS, EELS, in-situ environmental and external probing, as well as failure analysis for energy storage and conversion materials.

### *Invited Speakers:*

- Yuichi Ikuhara, University of Tokyo, Japan
- Guangwen Zhou, State University of New York, Binghamton
- Nigel Browning, Pacific Northwest National Laboratory
- Shirley Meng, University of California, San Diego
- Abhaya Datye, University of New Mexico
- Haimei Zheng, Lawrence Berkeley National Laboratory
- Ray Unocic, Oak Ridge National Laboratory
- Zhiwei Shan, Xi'an Jiao Tong University, China
- Jiangwei Wang, Zhejiang University, China

## P08 Geological Sample Characterization using Various Imaging Modalities

*Lori A Hathon, K. N. (Bobby) Hooghan, Michael J. Jercinovic, Bradley T. De Gregorio*

This symposium is intended to be a forum for the exchange of information and knowledge regarding the combined use of multiple imaging and microanalysis tools for the characterization of geological samples. Invited papers would include those involving quantitative image interpretation, the integration of multiple imaging and microanalysis techniques for estimation of rock and mineral properties, innovative solutions to long standing technical challenges for imaging/analysis/sample preparation, and applications of machine learning (deep learning) using image data. Target attendees will include engineers and scientists from all levels of analytical expertise in geology-related backgrounds, including oil and gas industry, earth science, and planetary science.

### *Invited Speakers:*

- Kenneth Edgett, Malin Space Science Systems
- Paul Hackley, U.S. Geological Survey
- Patrick Smith, University of Texas, Austin
- Christine Floss, Washington University
- Thomas Sharp, Arizona State University



## P09 Application of Advanced Characterization Methods to Examine Materials Used in Nuclear Power Systems

***M. Grace Burke, Bryan D. Miller, Arthur T. Motta***

Materials used in nuclear power systems are subjected to extreme environmental conditions that can strongly affect their performance over many years of plant operation. The focus of this symposium is how the application of advanced characterization methods can be used to examine materials-related issues common to nuclear power systems. A broad range of topics related to characterization of low alloy steels, austenitic stainless steel, Ni-Cr alloys, and zirconium are welcome for presentation at this symposium.

### ***Invited Speakers:***

- Djamel Kaoumi, University of South Carolina
- Jovan Lim, Culham Centre for Fusion Energy, UK
- Gene Lucadamo, Naval Nuclear Laboratory
- Emmanuelle Marquis, University of Michigan
- Greg McMahon, University of Manchester, UK

## P10 Diamonds: From the Origins of the Universe to Quantum Sensing in Materials and Biological Science Applications

***Nestor J. Zaluzec***

On this 75th Diamond Anniversary of the Microscopy Society of America we will revisit the microstructure and spectroscopy of diamonds as well as the development of the diamond knife as a tool in microscopy. Invited speakers will discuss topics that range from nano-diamonds and the origins of solar systems, color centers in native diamonds, engineered ultrananocrystalline diamond as layered coatings, excitonic defects in diamond for quantum computing, and sensors in bio-systems. Using Optical, Electron and Atom Probe techniques they will present current research using both imaging and associated spectrometers to explore questions ranging from the micro to the nanoscale. Contributed papers on the use and characterization of diamonds in all its forms and at all scales in Materials and Life Sciences are welcome.

### ***Invited Speakers:***

- Nick Wilson, CSIRO, Australia
- Raul Arenal, University of Zaragoza, Spain
- Philipp R. Heck, Field Museum of Chicago
- Jianguo Wen, Argonne National Laboratory
- Wolfgang Jaeger, University of Kiel, Germany
- Ettienné Minnaar, Nelson Mandela Metropolitan University, South Africa

## Analytical Sciences Symposia

### A01 Vendor Symposium

***Paul Voyles, Esther Bullitt***

This symposium is a forum for vendors to highlight advances in the development and improvement of their products. It covers new methods and technologies that advance the fields of microscopy and microanalysis for both physical and biological sciences, and provides a forum for exchange of ideas and best practices.

## A02 Compressive Sensing, Machine Learning & Advanced Computation in Microscopy

***Andrew Stevens, Rowan Leary, Volkan Ortolan***

This symposium is concerned with the use of advanced statistical, mathematical, and computational methods, in microscopy and spectroscopy. Papers will focus on important topics in both machine learning and compressive sensing - especially their application to the acquisition and analysis of image, diffraction, and spectral data. The symposium will cover new microscope designs that depend on computational recovery techniques and other novel *post facto* machine learning and computational techniques for powerful analysis of microscope data. Our target audience is generic microscope users, to introduce new techniques to the community and facilitate communication leading to their adoption.

### ***Invited Speakers:***

- Nigel Browning, Pacific Northwest National Laboratory
- Michael Gehm, Duke University
- Paul Midgely, Cambridge University, UK
- Charles Bouman, Purdue University

## A03 Big, Deep and Smart Data in Microscopy

***Sergei V. Kalinin, Eric Stach***

The symposium is intended to be the forum for scientists interested in opportunities offered by the rapidly developing technologies for data intensive computer imaging. It aims to cover the full knowledge generation cycle in imaging, starting from data stream capture in electron, probe, and optical microscopies, automatic image compression and storage, and compressed sensing technologies. Special attention will be devoted to physics-based multivariate methods for data analysis, combining the power of statistical methods with physical insights into the origins of the signal. We further welcome contributions on automatic image analytics, including extraction of physical order parameter fields and chemical phases, defect and phase boundary identification, and registration between multimedia images for direct structure-property relationship mapping and data mining. Finally, we welcome contributions concerning materials property extraction from static and dynamic imaging data as well as integration between materials genomics and experimental data analyses.

### ***Invited Speakers:***

- Ichiro Takeuchi, University of Maryland
- Colin Ophus, Lawrence Berkeley National Lab
- Simon Billinge, Columbia University
- Benji Maruyama, Air Force Research Laboratory, Wright Patterson AFB

## A04 Advances in Programming of Quantitative Microscopy for Biological and Materials Science

***Hendrix Demers, Philippe Pinard***

Cutting-edge quantitative analyses do not only require state-of-the-art instruments but also innovative programs to collect and analyze data. The development of programs, scripts, and libraries opens the door to new applications of microanalysis, helps solve more challenging and important problems, and promotes the advancement of microscopy. This symposium aims to showcase programs written by microscopists for their particular biological and materials applications, to encourage the community to write or contribute to existing programs, and to promote collaborative work that will allow the development of new ideas and projects in microanalysis. Contribution in the following categories and related subjects are welcome.

***Invited Speakers:***

- Nicholas Ritchie, National Institute of Standards and Technology
- Francisco de la Pena, Cambridge University, UK
- Ivan Lobato, Antwerpen University, Belgium
- Marc De Graef, Carnegie Mellon University

## A05 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

***Keana Scott, Nabil Bassim, Assel Aitkaliyeva***

Focused ion beam instruments are now available with a widening choice of ions and with new applications involving both imaging and milling with ions. With recent advances in detector technology and analysis techniques, applications span the needs of the semiconductor industry, materials science, and biology. In this symposium, we encourage abstracts on all aspects of ion beam technology. Topics such as theoretical or experimental work on ion-solid interactions, FIB-based specimen preparation, processing and fabrication methods, FIB-based 2D and 3D analyses of hard and soft materials, novel data acquisition and processing methods, and practical data handling strategies are welcome. Advances in new instrumentation or methods such as light ion sources, high current ion sources, mass filtered ion sources or low energy ion milling are also of interest.

***Invited Speakers:***

- Julia Mahamid, Max Planck Institute of Biochemistry, Germany
- Peter Hosemann, University of California, Berkeley
- Jebez McClelland, National Institute of Standards and Technology
- Olga Ovchinnikovo, Oak Ridge National Laboratory

## A06 Bridging Length Scales with 2D, 3D, and 4D Multiscale/Multimodal Microscopy

***Nikhilesh Chawla, James Evans, Jeff Gelb***

Multiscale imaging aids in the understanding of how changes at each scale of interaction impacts whole systems. For material science applications, this can mean linking the atomic scale to bulk material or engineering scales. Whereas in biology it means placing macromolecular complexes and other subcellular components into a whole cell context or localizing single cells in a larger community, plant or animal scale context. Although each sample may have different temporal and spatial requirements, a common need exists to create hierarchical volumetric imaging data with increasing resolution or field-of-view under both static and in situ conditions in order to observe structural evolution (e.g. 4D). This symposia will bring together leaders in both materials science and biological fields for bridging scales in 2D, 3D and 4D microscopy using a variety of modalities alongside appropriate quantitative analysis techniques.

***Invited Speakers:***

- Manfred Auer, Lawrence Berkeley National Laboratory
- Vincent de Andrade, Argonne National Laboratory
- Ken Kemner, Argonne National Laboratory
- Peter Voorhees, Northwestern University

**A07 Materials Characterization Using Atomic-scale EDX/EELS Spectroscopy*****Ping Lu, Jian-Min Zuo, Mark Oxley***

Advances in atomic-scale chemical imaging using EDX and/or EELS signals in STEM/TEM provide an unprecedented opportunity for materials characterization. Chemical structures of crystal lattices and defects can be directly imaged in principle at atomic-scale in real space under proper imaging conditions. Such information greatly facilitates understanding of materials' physical properties. However, because of the strong electron interaction with solids and the technical challenges in data collection and interpretation, quantitative analyses as well as the types of materials problems can be addressed by atomic-scale chemical imaging are still challenging and further development requires concerted experimental and theoretical efforts. This symposium will address the latest development and technical advances in the field, and in particular highlight recent applications of the techniques in resolving structures of crystals, thin films, interfaces, and defects in various materials systems including metals, oxides and semiconductors, and developments in quantification methods as well as advanced theoretical models.

***Invited Speakers:***

- Quentin Ramasse, SuperSTEM, UK
- Masashi Watanabe, Lehigh University
- Gianluigi Botton, MacMaster University, Canada
- Scott Findlay, Monash University, Australia
- Matt Chisholm, Oak Ridge National Laboratory
- Maria Varela, University Complutense of Madrid, Spain
- Lin Zhou, Ames Lab

**A08 Advances and Applications of Aberration-Corrected Electron Microscopy*****David Muller, David Smith***

The major objective of this symposium is to provide an overview of recent advances and applications of aberration-corrected TEMs and aberration-corrected STEMs, in particular to illustrate the wide diversity of materials that are being studied and problems that are being solved using these instruments. Topics of special interest will include novel imaging and detector modes that are enabled by correctors, resolution and dose limits including AC-cryoEM, data acquisition and image artifacts, and approaches for extracting quantitative information about atomic locations and identity in 3-D environments.

***Invited Speakers:***

- Jim Ciston, Lawrence Berkeley National Laboratory
- Lena Kourkoutis-Fitting, Cornell University
- Jannik Meyer, University of Vienna, Austria
- Ben McMorrin, University of Oregon
- Kazu Suenaga, AIST, Japan

- Paul Voyles, University of Wisconsin, Madison

## A09 Standards, Reference Materials, and their Applications in Quantitative Microanalysis

*Julien Allaz, Anette von der Handt, Owen Neill*

Standards and reference materials are essential for obtaining accurate quantitative compositional data from X-ray microanalysis by EPMA or SEM (WDS/EDS), as well as from other microanalytical techniques (LA-ICP-MS, SIMS, -XRF, FTIR, Raman spectroscopy, etc.). These materials must be rigorously evaluated for their reference compositions and homogeneity, must be widely available to the analytical community, and must be properly maintained to avoid contamination or deterioration. We welcome contributions on the synthesis, evaluation, distribution, and maintenance of standards and reference materials, as well as their appropriate use in microanalysis. We further encourage submissions on standard-based applications of quantitative microanalysis, or on the development of new quantitative microanalytical protocols.

### *Invited Speakers:*

- John Hanchar, Memorial University, Canada
- Will Nachlas, Syracuse University
- Tim Rose, Smithsonian Institution
- Steve Wilson, United States Geological Survey

## A10 Advances in Scanning Electron Microscopy: Transmission Modes and Channeling Effects

*Robert Keller, Raynauld Gauvin, Shirin Kaboli*

This symposium presents recent advances in two growing realms of methods that extend established limits of conventional SEM characterization. Transmission techniques for diffraction, imaging, and spectroscopy in the SEM are seeing rapid adoption in varied areas such as nanocrystalline materials, nanoparticles, corrosion, highly-deformed materials, geology, and biology. Electron channeling plays an important role in contrast mechanisms for imaging of grain substructures, defects, strain fields, and magnetic domains in materials. While these characterization realms tend to see separate development in terms of instrumentation and applications, they share many aspects of electron scattering theory. Channeling phenomena will also affect data collected by transmission techniques. We seek contributions addressing contrast mechanisms, instrumentation, improvements in resolution, and novel problems solved by transmission techniques and channeling methods in any class of materials. Target attendees include scientists, engineers, and laboratory technicians working in materials science, metallurgy, nanotechnology, geology, and biology.

### *Invited Speakers:*

- Patrick Trimby, University of Sydney, Australia
- Jason Holm, National Institute of Standards and Technology
- John Mendenhall, University of Texas, Austin
- Joseph Michael, Sandia National Laboratories
- David Bell, Harvard University
- Hendrix Demers, McGill University
- Stefan Zaefferer, Max Planck Institute for Iron Research, Germany
- Angus Wilkinson, University of Oxford
- Martin Crimp, Michigan State University

## A11 Instrumentation of Atom Probe: 50 Years and Counting

*Ross Marceau, Prakash Kolli, Thomas Kelly*

*\*Featured Invited Speaker: John Panitz, Emeritus Professor of Physics, University of New Mexico*

The year 2017 marks the 50th anniversary of atom probe. The technique has a rich history from its origin with field ion microscopy as a precursor, through the evolution of many advancements, to the recent flourishing of its most prominent form, atom probe tomography (APT). The proliferation of APT has continued with its impact upon an increasingly broad range of materials research. The aim of this symposium is twofold: to capture and showcase some of the key historical breakthroughs that underpin the technique to this day, noting their associated impacts on scientific research; and to highlight ongoing research at the cutting edge of APT instrumentation and technique development. Contributions are welcome from both these areas. Please also see below for suggested topics of interest.

### *Invited Speakers:*

- John Panitz, University of New Mexico
- Douglas Barofsky, Oregon State University
- Gary Kellogg, retired (formerly with Sandia National Laboratories)
- Ty Prosa, Cameca Instruments

## A12 Reconstruction, Simulations, and Data Analysis in Atom Probe Tomography

*Baptiste Gault, Arun Deveraj, David J. Larson*

This symposium is part of the event organized for the 50th anniversary of the atom probe, and will focus on the methods used to treat raw data, in order to build the point-cloud that constitutes the tomographic reconstruction, as well as the methods applied to the point cloud to extract information regarding the presence of secondary phases, atomic clusters, or local structure (e.g. atomic planes). Another aspect that will be covered are numerical simulations of the field evaporation process which underpins atom probe tomography, and which enable to gain a better understanding of the fundamental aspects of the technique, including the image formation and some of the artifacts commonly affecting the data. Target attendees will include scientists and engineers from all levels with an interest in atom probe tomography.

### *Invited Speakers:*

- Francois Vurpillot, Université de Rouen, France
- Jon Hyde, National Nuclear Laboratory, UK
- Brian Geiser, Cameca Instruments

## A13 Applications of Atom Probe Tomography

*Michael Moody, Mattias Thuvander, Didier Blavette*

Atom probe tomography (APT) continues to be adapted for the atomic-scale characterisation of an increasingly diverse range of materials and devices. APT underpins research into a wide variety of alloys and semiconductors, and more recently, the analysis of materials previously considered too exotic for APT, such as minerals, bio-materials and large band gap insulators. Furthermore, APT is playing an increasingly important

role in device failure-analysis, and in understanding in-service degradation of microstructure of materials subject to, for example, elevated temperatures, nuclear irradiation or corrosive conditions. All contributions featuring research enabled by APT, and in particular the development of APT for new applications, are welcome.

***Invited Speakers:***

- Rachel Oliver, Cambridge University, UK
- Paul Koenraad, Eindhoven University of Technology, Netherlands
- Taisuke Sasaki, National Institute for Materials Science, Japan

## A14 Nanomechanical Characterization of Materials using Microscopy and Microanalysis Techniques

***Sanjit Bhowmick, Andrew Minor, Daniel Kiener, Nan Li***

Nanomechanical testing inside an electron microscope provides an opportunity for real-time imaging of the dynamics of deformation in materials at the micrometer, nanometer, and atomic scale. Recent advances in microscopy techniques, analytical detectors, high-speed cameras, and computing resources are able to provide unprecedented insights and fundamental understanding of elasticity, plasticity, fatigue, and fracture in nanostructured materials. The focus of this symposium is to bring the growing in-situ mechanical characterization community together to discuss key developments in techniques and experimental methods that aid in the understanding of deformation mechanisms of small-scale materials. Contributions on advanced mechanical characterization in controlled environments, which include elevated temperature, cryogenic temperature, electrical and magnetic fields, gas, and humidity, are particularly welcome.

***Invited Speakers:***

- Gerhard Dehm, Max-Planck-Institut für Eisenforschung GmbH, Germany
- Peter Hosemann, University of California, Berkeley
- Amit Misra, University of Michigan
- Mitra Taheri, Drexel University
- Christian Kübel, Karlsruhe Institute of Technology
- Christian Rentenberger, University of Vienna, Austria
- Khalid Hattar, Sandia National Laboratories
- Tevis Jacobs, University of Pittsburgh
- Josh Kacher, Georgia Tech
- Chen Youxing, Los Alamos National Laboratory

## A15 Pushing the Limits of Cryo-TEM: Development and Applications

***Mike Marko, Radostin Danev***

Cryo-EM is attracting great interest now that technological advances are facilitating single-particle maps with resolution in the 3 Å range, and sub-tomogram-averaged maps in the 1 nm range, all with the sample in a near-native, hydrated state. This symposium will highlight technology and applications, with invited speakers who are key to the latest developments, and will include contributed papers from participants in this exciting field.

***Invited Speakers:***

- Robert Glaeser, Lawrence Berkeley National Lab
- Paul Mooney, Gatan
- Yifan Cheng, University of California - San Francisco

- Stephan Pfeffer, Max Planck Institute for Biochemistry, Germany
- Steven Ludtke, Baylor College of Medicine
- Anchi Cheng, New York Structural Biology Center
- Muyuan Chen, Baylor College of Medicine
- Lingbo Yu, Thermo Fisher
- Michael Elbaum, Weizman Institute of Science
- Katherine Spoth, Cornell University

## A16 *In situ* and *operando* Characterization of Material Processes in Liquids and Gases

**Raymond Unocic, Guangwen Zhou, Libor Kovarik**

Within the past few years, *in situ* and *operando* electron microscopy has evolved to the point where high spatial and temporal resolution imaging, diffraction, and spectroscopy can be performed to elucidate the behavior of materials within liquid and gaseous environments either in response to external stimuli (*in situ*) or under a working condition (*operando*). This symposium intends to focus on the development of advanced techniques for *in situ/operando* experimentation and utilization of such techniques to study fundamental materials structure and chemistry, functional properties, dynamical behavior under non-equilibrium conditions, and materials synthesis/degradation. Understanding the effect of sample-beam interactions, which often limits the applicability of *in situ* TEM techniques, will also be of interest in this symposium. The symposium will focus on all aspects of imaging and analysis, covering imaging, diffraction and chemical analysis approaches available through *in situ* TEM.

### **Invited Speakers:**

- Eric Stach, Brookhaven National Laboratory
- Thomas Hansen, Technical University of Denmark, Denmark
- Ai Leen Koh, Stanford University
- Haimei, Zheng, Lawrence Berkeley National Laboratory
- Taylor Woehl, University of Maryland
- Katherine Jungjohann, Sandia National Laboratory
- Nan Jiang, Arizona State University

## A17 Biological Soft X-ray Tomography

**Carolyn Larabell, Kenneth Fahy**

This symposium is a forum for the exchange of information and knowledge on the use of soft X-ray tomography for imaging biological specimens. Soft X-ray tomography images fully hydrated, intact cells in 3D without the use of contrast agents or other visualization enabling molecules. Invited papers would include those describing technical advances in specimen preparation, data processing and reconstruction, imaging formation theory, and novel applications of the soft X-ray tomography in cell science. Target audience will include cell biologists, and scientists and engineers interested in novel microscopies, including correlative imaging methods.

### **Invited Speakers:**

- Lucy Collinson, The Francis Crick Institute, UK
- Gerry McDermott, University of California, San Francisco
- Emily Sontag, Stanford University



## A18 Celebrating 50 Years of Microanalysis

*Paul Carpenter, Edward Vicenzi, Julie Chouinard*

We celebrate 50 years of microanalysis with a perspective of past, present, and future scientific accomplishments, and the evolution of MAS over half a century. To mark this golden anniversary, invited and contributed papers will be solicited regarding: the history and development of quantitative microanalysis, current microanalysis challenges, and especially important developments for the future of our discipline. We encourage submissions including EPMA, SEM, WDS, EDS, STEM, EELS, correction algorithms, data processing and visualization, cathodoluminescence, micro-XRF spectrometry, and historical and educational aspects of MAS.

### *Invited Speakers:*

- Miriam Hebert, University of Maryland
- George Havrilla, Los Alamos National Laboratories
- Nick Wilson, CSIRO Australia
- Colin McRae, CSIRO Australia
- Amy Walker, University of Texas - Dallas
- Brad Jolliff, Washington University
- Andrew Herzing, National Institute of Standards and Technology
- Ondrej Krivanek, NION Company
- Thomas Kelly, Ametek

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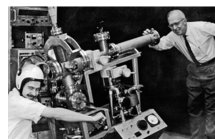
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## Anniversary Lectures by Pioneering Figures in Microscopy & Microanalysis

[MSA 75th Anniversary Lecture in the Biological Sciences \(X70\):](#)

**[Development of High-resolution TEM for Imaging Native, Radiation-sensitive Biomolecules \(Development\\_of\\_High\\_Resolution\\_paper.pdf\)](#)**

*Robert M. Glaeser, Lawrence Berkeley National Laboratory; University of California, Berkeley*

[MSA 75th Anniversary Lecture in the Physical Sciences \(X71\):](#)

**[Smarter Than an iPhone: The Emergence of the Modern Microscope \(Smarter\\_than\\_an\\_iPhone\\_paper.pdf\)](#)**

*Ondrej L. Krivanek, Nion R&D; Arizona State University*

[MAS 50th Anniversary Lecture in the Analytical Sciences \(X72\):](#)

**[Microanalysis: What Is It, Where Did It Come From, and Where Is It Going? \(MAS\\_50th\\_Anniversary\\_paper.pdf\)](#)**

*Dale E. Newbury, National Institute of Standards and Technology*

[IFES Lecture Marking the 50th Anniversary of the Invention of the Atom Probe \(X73\):](#)

# Point-Projection Microscopy (Panitz\_Plenary\_Short.pdf)

*John A. Panitz, University of New Mexico*

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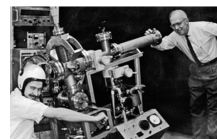
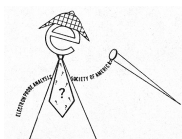
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## Plenary Talks

Monday, August 7, 2017

Cervantes Convention Center — St. Louis, Missouri

PLENARY SPEAKER #1

### Eric Betzig, PhD

Janelia Farm Research Campus, Ashburn, VA

#### *Imaging Cellular Structure and Dynamics from Molecules to Organisms*

Eric Betzig obtained a BS in Physics from Caltech and a Ph.D. in Applied Physics at Cornell. In 1988, he became a PI at AT&T Bell Labs where he extended his thesis work on near-field optical microscopy, the first method to break the diffraction barrier. By 1993, he held a world record for data storage density, and recorded the first super-resolution fluorescence images of cells as well as the first single molecule images at ambient temperature. Frustrated with technical limitations and declining standards as more jumped into the field, he quit science and by 1996 was working for his father's machine tool company. Commercial failure of the technologies he developed there left him unemployed in 2003 and looking for new directions. This search eventually culminated in his co-invention of the super-resolution technique PALM with his best friend, Bell Labs colleague Harald Hess. For this work, Betzig was co-recipient of the 2014 Nobel Prize in Chemistry along with Stefan Hell and William E. Moerner. Since 2005, he has been a Group Leader at the Janelia Research Campus, developing new optical imaging technologies for biology.



PLENARY SPEAKER #2

## Keith Riles, PhD

University of Michigan, Ann Arbor

### *Detecting Massive Black Holes via Attometry - Gravitational Wave Astronomy Begins*

In their first observing run, the two detectors of the Advanced Laser Interferometer Gravitational-Wave Observatory (Advanced LIGO) simultaneously observed transient gravitational-wave signals. The detected waveforms indicated the inspiral and merger of pairs of massive black holes more than 1 billion years ago. These discoveries marked the first direct detections of gravitational waves and the first observations of binary black hole mergers. Ironically but perhaps not surprisingly, the detection of these cataclysmic events so far away depended on measuring distance changes between mirrors at the attometer level. The first gravitational-wave discoveries and the instruments that made them possible will be presented.

Professor Riles carries out research into the fundamental forces of nature, working in both gravitational wave and elementary particle physics. He leads the Michigan Gravitational Wave Group and is a member of the LIGO Scientific Collaboration (LSC), which in September 2015 discovered gravitational waves from the merger of two massive black holes. This \$300 million project, led by Caltech and MIT, operates 4-km Michelson laser interferometers at sites in Hanford, Washington and Livingston, Louisiana. These interferometers are designed to measure minute disturbances in space itself to a relative precision better than 1 part in a billion trillion ( $10^{-21}$ ). Transient "ripples in space" can emanate from violent but distant astrophysical phenomena, including colliding black holes or neutron stars and from supernovae.

Using LIGO data, the Michigan Gravitational Wave Group has placed upper limits on longer-lived but still weaker ( $<10^{-24}$ ) ripples from unknown, rapidly spinning neutron stars in the Milky Way. Searches are now under way for gravitational waves emitted by isolated neutron stars using an algorithm called PowerFlux and for binary neutron stars, using an algorithm called TwoSpect. Both programs were developed by the University of Michigan group. In addition, the group has carried out extensive work on LIGO detector characterization, including calibration, and on detector commissioning.

Professor Riles has also spent part of his research time in recent years studying the physics potential and the detector requirements of a future linear electron positron collider with a center of mass energy of 350 GeV and higher.



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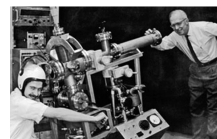
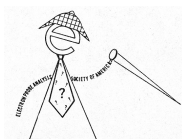
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## 2017 Pre-Meeting Congresses

- Separate registration fee required; see registration information on website, and form for details (form available March 1, 2017).
- Click on the individual Congress listings below for information on meals and breaks.

**X60 Inaugural Pre-Meeting Congress for Early Career Professionals in Microscopy & Microanalysis (congress\_X60.cfm)**

**X61 Focused Ion Beam Applications and Equipment Developments (congress\_X61.cfm)**

**X62 Smaller, Faster, Better: New Instrumentation for Electron Microscopy (congress\_X62.cfm)**

**X63 Understanding Radiation Beam-Damage during Cryo-, ETEM, Gas- and Liquid-Cell Electron Microscopy (congress\_X63.cfm)**

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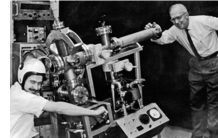
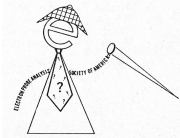
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## Microscopy Outreach

### X90 Microscopy in the Classroom: Strategies for Education and Outreach

***Alyssa Waldron, Dave Becker***

Local educators and registered conference attendees are invited to participate in presentations, round table discussions, and demonstrations of effective strategies for microscopy outreach and education from K-12 and beyond. This session will show how microscopy in education serves as an important learning tool for inspiring our future STEM professionals. Those involved in microscopy education or educational outreach are encouraged to submit a paper about their successful program or lesson for platform or poster presentation.

### X91 Family Affair

***Elaine Humphrey, Janet Schwarz, Stuart McKernan***

The exciting world of microscopy opens up for attendees' family and friends. This session includes:

- Some new Microscopic Explorations
- A mystery to solve using microscopy
- Materials science and biological science

### X92 A Project MICRO Workshop

***Elaine Humphrey, Caroline Schooley***

The Project MICRO workshop has its venue in the MegaBooth all week after the Exhibit Hall opens. Visit the Outreach booth every day to see how to set up different stations in a classroom, and share your experiences

with how you have fun with microscopy outreach. See different microscope systems for use in a classroom, in action; peruse the books suitable for elementary school age children; and put your name into a draw for the daily door prize.

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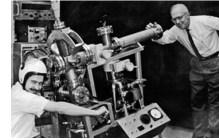
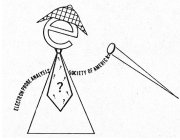
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## M&M 2017 Sunday Short Courses

**Organizer: Elizabeth Wright, Emory University**

- These full-day courses run from 8:30 AM to 5:00 PM on Sunday, August 6, 2017.
- A certificate of participation will be issued to each requesting participant, following the conclusion of the M&M 2017 meeting.
- Two (2) Continuing Microscopy Education Units are available (registration fee \$10 for members).
- Morning and afternoon coffee breaks are included (breakfast and lunch are on your own).
- Separate registration with additional fees is required (see registration form for more information). Registration will open on March 1, 2017.

### X10 Specimen Preparation for Biological EM of Resin-embedded Samples: Cryo-methods, Correlative LM-EM and 3-D Imaging

**Lead Instructor: Kent McDonald**

In this course, we will review why cryo-techniques for biological specimen preparation are superior to conventional methods. We will discuss high-pressure freezing, freeze substitution, and preserving fluorescence in polymerized resins. Persons taking this course should leave with a better understanding of biological EM cryotechniques and their role in different applications such as correlative LM - EM, EM tomography, EM immunolabeling, and as the best method for preservation of cellular fine structure. Specimen preparation procedures for resin-based 3-D imaging methods will also be discussed.

### X11 Immunolabeling Technology for Light and Electron Microscopy

**Lead instructor: Caroline Miller**



The requirements for successful immunohistochemical and immunocytochemical labeling vary widely with different biological systems. The optimal techniques for light-microscope labeling often differ greatly from those needed for electron microscopy. The basics of immunolabeling at the light- and electron-microscope levels will be presented, illustrated with examples from several different biological systems. Some of the more complex methods and applications used in electron microscopy will be discussed in depth. The course will cover specimen preparation, immunogold labeling and enhancement methods, multiple labeling and correlative LM/EM techniques.

## X12 Practical Considerations for Image Analysis and Use of ImageJ/Fiji

***Instructor: James Grande***

This workshop covers a wide range of practical topics in the field of image analysis. Subjects will be covered in an easy-to-understand format so that users with little or no experience can understand how image analysis can provide extensive quantitative measurements that may lead to better understanding of material performance. Topics range from input devices to image-processing algorithms and how best to extract quantitative data. Treating image analysis as a problem-solving tool along with discerning key metrics within a microstructure is discussed through several real-life examples. Comparisons using ImageJ/Fiji and a commercial image analysis product will be demonstrated.

## X13 3-D Reconstruction with SerialEM and IMOD

***Lead Instructor: Cindi Schwartz***

This workshop will cover the use of SerialEM for data acquisition and IMOD for 3-D reconstruction and analysis. For SerialEM, topics include basic operation, low dose mode, STEM imaging, use of direct detector cameras, tilt series acquisition, montaging, and automatic acquisition from multiple areas. For IMOD, topics include reconstruction from single and dual-axis tilt series, alignment of slices or tomograms from serial sections, automated processing of multiple tilt series, and modeling and visualization. Cryo and room-temperature applications will be covered. Although the emphasis will be on biological samples, many points are applicable to materials science.

## X14 Detectors: If You Can't Detect It, Then You Can't Measure It

***Lead Instructor: Nestor J. Zaluzec***

Imaging and spectroscopy have long played pivotal roles in characterization of materials in both the biological and physical sciences. Of course, a signal must absolutely be detectable from an object in order to make any observations or measurements. For this course, we will assemble a cadre of researchers from both academia and industry, who will discuss the principles of various imaging and spectroscopic detectors, their limitations, and future prospects and technologies. Topics will include optical sensors and single-particle sensors for photons, x-rays, electrons and ions, as well as electromagnetic-field sensors, and the use of these sensors as imaging/spectroscopic detectors.

## X15 Variable Pressure and Environmental Scanning Electron Microscopy: What Can They Do For Me?

***Lead Instructor: John Mansfield***

Variable-pressure scanning EM (VPSEM) and environmental scanning EM (ESEM), while readily available, are not used as frequently as they should be. This course will compare the structure, operation, and special detectors of the two. The practicality of x-ray spectroscopy will be examined. The unique contrast mechanisms in these microscopes will be discussed. The use of the VPSEM as an in-situ platform for hot, cold and mechanical testing experiments will also be covered. Applications experts from instrument manufacturers will be invited to describe new developments. A summary presentation comparing the VPSEM with conventional SEM will conclude the course.

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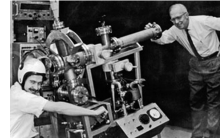
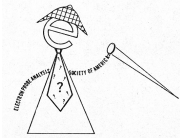
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## Tutorials

### Physical Sciences Tutorials

*Organizer: D.N. Leonard, Oak Ridge National Laboratory*

#### X40 Large Scale Data Acquisition and Analysis for Materials Imaging and Spectroscopy

*Stephen Jesse, Sergei Kalinin, Oak Ridge National Laboratory*

- Increasing Bandwidth, Control, and Resolution of Microscopes Using Customized Data Acquisition Hardware
- Multivariate Analysis for Mining Spectral-Imaging Data to Map Functional Properties
- Microscopy in the Cloud – Utilizing High Performance Computing Infrastructure for Advanced Large Scale Analysis
- Microscopy in a Crowd – Building Environments for Collaborative Data Analysis and Processing

#### X41 Entrepreneurship in the Microscopy Community

*Robert Hirche, ICMAS Inc.*

Several entrepreneurs from the microscopy community will be in attendance for a round table Q&A with tutorial attendees on topics including, but not limited to:

- Instrumentation development and commercialization

- Practical steps to take when starting your own microscopy based business
- Panel discussion on business start-up best practices
- Role of local affiliated microscopy societies in bringing microscopists and businesses together

## Biological Sciences Tutorials

*Organizer: Tommi A. White, University of Missouri*

### X42 CryoEM with Phase Plates

*Radostin Danev, Max Planck Institute of Biochemistry (Germany)*

- Introduction to phase plates
- Setting up cryo-tomography and single particle data acquisition with a phase plate
- Processing of phase plate single particle data

### X43 Practical Strategies for Cryo-CLEM Experiments

*Cheri Hampton, Emory University*

- Available methodologies for Correlative Light and Electron Microscopy (CLEM)
- Emphasis on cryo-fLM paired with cryo-EM/ET
- Practical considerations and troubleshooting for biological sample preparation
- Applications for virus-host interactions and virus structure including bacterial and mammalian systems

### X44 Freeze Fracture, Deep-Etch & 3D Anaglyphs

*Robyn Roth, Washington University*

- Freeze fracture
- Deep-Etch
- 3D Anaglyphs

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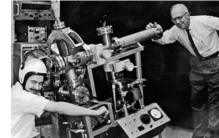
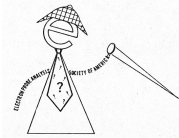
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## Technologists' Forum Sessions

### **X30 Tech Forum: Cryo-Tomography of Macromolecular Complexes in Whole Cells: Lessons in Cryo-Fib Milling and Vitreous Cryo-Sectioning**

Thinning of tissue in vitreous ice so that macromolecular complexes may be viewed in their native environment for cryo-tomography may be accomplished by cryo-FIB milling (Focused Ion Beam Milling) or vitreous cryo-sectioning. Both techniques require expensive equipment and are technically challenging. This forum will focus on the practical aspects of these techniques so the attendee will have an understanding of the basic process for each technique as well as each techniques strengths and limitations. Vitreous cryo-sections have been the method of choice for thinning cells to 500nm or less but cryo-focused ion beam milling has become popular because samples are free of sectioning artifacts like compression and crevasses. Cryo-FIB samples may be milled into wedges, lamellas or the lift-out technique may be used to place the lamella on a TEM grid. The techniques may be combined to trim down bulk samples in the cryo-microtome before cryo-FIB milling a lamella. Recent developments in micromanipulator assisted cryo-sectioning have improved the quality of vitreous sections for tomography.

### **X31 Tech Forum: Atomic Force Microscopy for Imaging and Materials/Biomaterials Properties: Characterization of Surfaces, Films, and Interfaces**

This symposium, focused on Atomic Force Microscopy (AFM), is intended to be a forum for the exchange of ideas and knowledge on the characterization of materials/biomaterials. Invited papers will include those utilizing AFM instrumentation and force spectroscopy techniques for characterization of structure-function



relationships and materials properties of surfaces, films and interfaces. Specifically, topics including force spectroscopy, fast scanning, conductive tip, or new imaging methodologies are of interest. Target attendees will have a variety of backgrounds from engineering and/or scientific disciplines at all levels of analytical expertise.

## X32 Tech Forum: Developing and Applying Light Sheet Imaging Technology to the Study of Dynamic Biological Systems

Light sheet microscopy, also known as Selective Plane Illumination Microscopy (SPIM), has emerged in recent years as the technique of choice to capture dynamic biological processes over multiple spatial and temporal scales. The unique parallelized "sheet" illumination strategy of SPIM enables high imaging speed, high signal to noise ratio, and reduced photo-induced damage. I will review recent work in our own lab in implementing SPIM with nonlinear excitation, and in applying SPIM to a variety of in vivo imaging applications. Our current work will be described in extending and combining SPIM with other imaging approaches to achieve synchronous volumetric imaging, at cellular resolution, over mesoscopic-scaled volume regions, to observe dynamic processes such as the blood flow in embryonic beating hearts and brain-wide neuronal activity in small live animals.

[Registration Information \(/MandM/2017/registration/fees.cfm\)](/MandM/2017/registration/fees.cfm)

[Full Scientific Program \(/MandM/2017/program/Scientific\\_Program.pdf\)](/MandM/2017/program/Scientific_Program.pdf)



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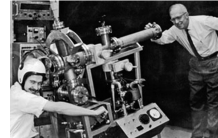
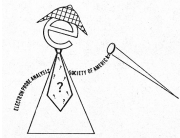


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(/MandM/2017/)



## Apply for a Meeting Award

Meeting award applications are made during paper submission. The online submission site opened on December 1, 2016 and closed on February 22, 2017.

No additional scholarships or travel awards are available for M&M 2017. Several **onsite awards** will be given during the meeting, which do not require advance application.

## Onsite Awards

The M&M meeting's co-sponsoring societies confer competitively judged awards at the meeting.

### MSA Student Poster Awards

We believe poster presentations are an excellent format for all participants to engage in intensive discussion with other researchers in the field. To especially encourage students to take advantage of this opportunity and submit papers for poster presentation, MSA provides cash awards to the most outstanding student posters (first author) each day (up to one in each of three categories).

### Diatome Poster Awards

All posters illustrating the use of diamond-knife ultramicrotomy are eligible. Prizes include cash and Swiss watches.

### MAS Best Paper Awards

MAS annually confers awards for papers presented at the M&M meeting deemed to be best in four categories. Each comes with a cash award generously provided by MAS Sustaining Members.

## MSA Micrograph Competition

This competition rewards the innovative blending of art and science. Winning micrographs will be selected on the basis of artistic merit and general audience appeal. The winner of the 2016 Micrograph Competition is featured on the cover of the 2017 Call for Papers brochure. A maximum of three (3) awards will be presented; First Prize: \$200; Two Second Prizes: \$50 each.

### Criteria

- Entries must be scientifically significant
- Entries must contain novel information useful in resolving a scientific issue, and/or
- Present established information in a way that dramatically enhances its comprehension or interpretation.

### Rules

1. An individual may submit a maximum of two (2) entries (one award per entrant).
2. Entries must have overall dimensions of 11" x 14" (horizontal or vertical), and be affixed to a stiff lightweight support (e.g. "foam board"). Micrographs may be mounted so that they have borders.
3. Each entry must have a separate text sheet with the title and a 200-word (max) description of the image, including the technique and its scientific significance. Text is recommended to be printed in 14-pt Times New Roman font on a separate 8½" x 11" sheet. Entrant's name, address, employer/institution, email address, and image title shall be posted on the back of the mounted entry(ies).
4. ***Entries must be brought to the meeting in St. Louis and mounted on the display boards by 12:00 noon on Monday, August 7, 2017.***
5. Non-winning entries must be removed Thursday afternoon by 3:00 PM. Micrographs remaining after that time will be discarded.
6. Winners will be announced at the meeting during the Wednesday afternoon poster awards. Submitted micrographs remain the property of the entrants subject to the conditions above.

*The winning image of the 2016 MSA Micrograph Competition is featured on Page 1 (cover) of the M&M 2017 Call for Papers brochure.*

## M&M Meeting Awards

The Microscopy Society of America (MSA) and the Microanalysis Society (MAS) annually sponsor awards for outstanding papers contributed to the Microscopy & Microanalysis (M&M) meeting, which are competitively judged based upon the quality of the submitted paper. These awards are provided to students, postdoctoral researchers, and professional technical staff members to help defray travel, lodging and other costs of attending the meeting. All awardees must fit the award criteria, as described below, at the time of the M&M meeting.

### General Considerations

Award applicants will automatically be considered for memorial scholarships, conferred by MSA based on the generous support of society sponsors.

Applicants who have previously received an M&M Meeting Award will not be considered for a second award in the same category.

## Students

All full-time students enrolled at accredited academic institutions are eligible for student awards. High school, undergraduate, and graduate students are encouraged to apply. Applicants are not required to be members of the sponsoring society.

## Postdoctoral Researchers

All full-time postdoctoral researchers are eligible for post-doc awards. Applicants are not required to be members of the sponsoring society.

## Professional Technical Staff Members

Full-time technologists are eligible for staff awards. In addition, the **applicant must be a member of the sponsoring society**, current in his or her dues for the year of the meeting.

## Amount of Award

M&M Meeting Awards and memorial awards consist of full meeting registration and up to \$1,000 for travel-related expenses. Original receipts must be provided to receive travel reimbursement. All award winners also receive an invitation to the Presidents' Reception, held on the Tuesday evening of the meeting.

## Notification of Award

All award applicants will be notified by email of their award status approximately eight weeks after the Call for Papers deadline. Unsuccessful applicants will be permitted to withdraw their papers, should their ability to attend the meeting be contingent on the award, within one week following notification.

## Requirements of Award

All award winners must present their paper in person at the M&M meeting in order to receive their award. Awardees are expected to attend and participate in the entire meeting, which runs from Sunday evening's opening reception through late Thursday afternoon.

Awardees are required to attend the Monday morning plenary session, at which their award will be conferred.

## How to Apply For an M&M Meeting Award

1. As part of the on-line paper submission process, an applicant must flag his or her paper for award consideration. Only one paper may be designated and considered per applicant.
2. **The applicant must appear as first author and presenter of the paper submitted for award.**
3. The applicant must provide the name, title, institution, and e-mail address of his or her supervisor, who will be contacted to provide a supporting letter and confirmation of applicability for the indicated award category (e.g. student, post-doc, or technical staff).

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