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## Microscopy & Microanalysis 2015 Meeting

M&M 2015 will be held August 2-6 at the [Oregon Convention Center](#) in [Portland, Oregon](#).

### 2015 Onsite Program & Mobile App (download)

Check back often for updates and new information!

**The paper submission deadline of February 19, 2015 has now passed. The submission site is closed. We look forward to seeing your work at M&M 2016 in Columbus, Ohio.**



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Dear Fellow Microscopists, Friends and Colleagues,

On behalf of the sponsoring societies, we would like to thank everyone who attended the M&M 2014 meeting. We hope your time in Hartford was as enjoyable as it was informative. Now we invite you to join us August 2-6, 2015 at the Oregon Convention Center in wonderful Portland, Oregon for Microscopy & Microanalysis 2015. Portland, known as the City of Roses, is a wonderful summer venue for the meeting, as many of you may fondly recall our previous visits there in 1999 and 2010.

This year, we look forward to another successful M&M meeting. The Program Committee has put together the epitome of scientific diversity that reflects our societies' interests. The program will highlight the latest techniques, methodologies and findings, spanning nano-to-macroscopic scales, and advances in fields such as nanotechnology, biological and clinical sciences, materials science, 3D manufacturing, and metallurgy. The overarching M&M 2015 theme is correlative imaging, with a nod to light-based technologies. As many of you are aware, the United Nations General Assembly proclaimed 2015 as the "International Year of Light and Light-Based Technologies" which will blend nicely with the interdisciplinary symposia that reflect the current environment of collaboration between scientists in different disciplines synonymous with M&M. We encourage all, whether neophytes or trouperes of M&M, to submit an abstract of your work for presentation in Portland, as M&M 2015 promises to have something for everyone in the field.

The meeting will officially start on Sunday evening with a welcome reception. The technical program will commence on Monday morning with two plenary lectures featuring Nobel laureate Dr. Roger Tsien and a NASA Astronaut bookending the winners of our major society and meeting awards. The exhibit floor will showcase the latest state-of-the-art microscopy-related equipment. The vendor tutorials will continue to play a significant role in the meeting. The meeting will also feature an in situ EM pre-meeting congress, in-week intensive workshops, and tutorials, in addition to the traditional Sunday Short Courses.

No matter where you are in your career, participating at M&M 2015 will allow you to stay abreast of new technologies, learn new techniques, see the latest instrumentation, and most importantly, network with colleagues and make new connections. We hope that you will be able to join us in Portland for what is certain to be a very exciting and educational meeting.

John F. Mansfield  
President  
Microscopy Society of America

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Microanalysis Society

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## Full Symposium Descriptions

[Application & Instrumentation Symposia](#) | [Biological Sciences Symposia](#) | [Physical Sciences Symposia](#)

### Application & Instrumentation Symposia

#### A01 Vendor Symposium: New Tools for Life and Materials Sciences

Organizers: *William Russin, Chris Kiely*

This symposium provides an opportunity for instrument manufacturers and vendors to showcase new developments resulting in improved technology solutions. Topics include: new methods and techniques; new developments and technologies; breakthrough and new instrumentation; and improvements to existing instrumentation.

#### A02 TEM Phase Contrast Imaging

Organizers: *Mike Marko, Radostin Danev*

Conventional defocus phase-contrast imaging provides poor contrast at low resolution, and transfers information in a non-uniform manner with regard to spatial frequency. Phase plates can provide a practical solution to these problems. The theory, construction, and practical use of phase plates will be explored. In biological cryo-TEM, high-contrast, high-resolution imaging at low electron dose is facilitated. In materials science, the combination of a physical phase plate with tunable Cs offers an unparalleled opportunity for characterization of both atomic details and larger structures. The number of laboratories exploring the use of phase plates is growing, and applications in biology are soon becoming routine. This will be a timely opportunity to learn from each other.

#### A03 Electron Holography for Nanofields in Solids

Organizers: *Hannes Lichte, Molly McCartney, Ken Harada*

Conventional intensity images do not reveal the phase modulation hence are blind, e.g., for electric and magnetic nanofields. Electron holography is uniquely healing this phase loss in that it records the complete electron wave passing through the TEM specimen. Reconstructed amplitude and phase allow both atomic-scale analysis as well as measurement of nano-scale items such as electrostatic and magnetic fields. However, uniquely attributing the findings to specific object properties is an increasing challenge. This symposium will consider recent advances in electron holography techniques and applications. Platform and poster presentations will include the emergence of novel approaches and instrumentation for electron holography, as well as providing an overview of latest applications to piezoelectric and ferroelectric materials, measurement of charge, magnetic nanostructures, both natural and man-made, and dopant profiling in semiconductor devices.

#### A04 Advances in FIB: New Instrumentation and Applications in Materials and Biological Sciences

Organizers: *Srinivas Subramaniam, Keana Scott, Lucille Giannuzzi*

The recent decade has seen a renaissance in FIB instrumentation with research and development of multiple ion sources aimed at addressing a wide range of scientific issues. A broad spectrum of FIB instrumentation using Helium, Neon, Gallium, Xenon and Laser sources are available for applications ranging from high spatial resolution imaging and lithographic applications to high throughput material removal and macrofabrication, enabling researchers to probe current and emerging fields of interest.

This session will try to showcase new developments and research in FIB/Laser instrumentation with the aim of better understanding their capabilities and application sweet spot. Design, performance and practical applications in physical and biological research will be looked at while attempting to make objective comparisons between different FIB technologies. Theoretical understanding and computational modeling of limiting and enabling features of these instruments will also be discussed.

#### A05 Fast and Ultrafast Imaging with Electrons and Photons

Organizers: *David Flannigan, Hermann Durr, Joanna Atkin*

The successful development of methods for visualizing the atomic-scale nature of matter has proven to be invaluable for enhancing our understanding of structure-function relationships in biological, chemical, and materials systems. Owing to the dynamic nature of function, the advent of techniques for generating femtosecond laser pulses has now led to the emergence of new approaches for the direct elucidation of such relationships on the necessary spatiotemporal scales. This symposium will highlight imaging methodologies that have been developed for probing a variety of dynamic processes spanning a range of distance and time, from atoms to the mesoscale and from femtoseconds to milliseconds. Such methodologies will include (but are not limited to): electron-based approaches such as ultrafast and dynamic electron microscopy, photon-based approaches such as fast and ultrafast (near-field) optical and X-ray microscopies, and tip-based near-field approaches such as ultrafast STM.

#### A06 Advanced Analytical TEM/STEM

Organizers: *Paul Kotula, Masashi Watanabe, Gerald Kothlietner*

Recent innovations in STEM / TEM hardware including high-brightness guns, high-energy resolution monochromators, and collection-efficient detectors for both XEDS and EELS signals, have made analytical investigations much more powerful and reliable. Enhancement in the acquisition speed also allows us to apply tilt-series tomography with these analytical signals in reasonable times. In addition, improved analysis software, new ways in image simulation and totally new approaches such as chiral techniques, precession acquisition or the use of cathodoluminescence signals now allow obtaining more comprehensive information about materials than ever before. This session aims to review the latest scientific achievements and their impact on the field as well as new applications of analytical electron microscopy.

#### A07 Scanning Probe Microscopy: New Methods and Applications

Organizers: *Greg D. Haugstad, Dalia G. Yablou*



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This symposium covers developments in scanning probe microscopy (SPM) in the areas of (i) biomedical and pharmaceutical materials; (ii) controlled environmental conditions including gas, liquid and sample temperature; and (iii) hybrid instrumentation systems that combine force microscopy with other near-field probes like SNOM and tip-enhanced Raman spectroscopy, or far-field imaging methods utilizing light or electron/ion beams. The application space for topics (i) and (ii) continues to foster new SPM-based research, given an array of heterogeneous material systems in biomed/pharma as well as many scientific issues for which environmental variables are central. Topic (iii) includes very new combination methods such as AFM/SEM or AFM/SIMS, whereas hybridization with near- and far-field light microscopy has been under continual development for more than two decades. This symposium aims to both familiarize the uninitiated and provide a forum for the exchange of ideas among experts.

#### A08 Advances in Qualitative and Quantitative X-ray Microanalysis: From Detectors to Techniques

Organizers: *Nicholas Ritchie, Paul Carpenter, Phillippe Pinard*

This session will cover the techniques of SDD EDS and WDS for quantitative analysis and focus on capabilities of scanning electron microscopy (SEM) and electron-probe microanalysis (EPMA). We invite presentations on research, technical, and applications of these analytical tools with an emphasis on how to make analysis easier, more precise and accurate, and how real-world samples can be treated.

- Role of SDD-EDS and WDS in quantitative analysis: How should we best merge the strengths of the wavelength dispersive spectrometry (WDS) with the strengths of the SDD.
- Role of Monte Carlo modeling in the quantification of ideal and non-ideal samples: How can we best take advantage of recent advances in CPU and GPU power and parallelism.
- Advances in hardware and software
- Advances in multi-beam energy analysis of bulk and thin-film samples

#### A09 Advances in Combining Simulation and Experiment for Materials Design

Organizers: *Paul Voyles, Gianluigi Botton*

Simulation plays an ever-increasing role in the quantitative interpretation of microscopy data for materials characterization, and microscopy provides essential constraints and feedback to simulations of fundamental materials structure and properties with density functional theory, molecular dynamics, and other methods. This symposium will cover advances in simulation of electron imaging, diffraction, and spectroscopy (EELS and EDS) and how those simulations can be used to increase the information obtained from electron microscopy experiments. It will also cover how microscopy can interact and be integrated with simulations for materials discovery and design across length scales, in the spirit of the Materials Genome Initiative.

#### A10 Advances in Electron Diffraction and Automated Mapping Techniques

Organizers: *Jorg Wiezorek, Sergei Rouvimov, Ben Britton, Muriel Veron*

Advances in electron diffraction and automated mapping techniques enable quantitative crystal orientation, phase, structure, strain and defect analyses. Robust automated mapping techniques and new instrumentation provide high spatial and angular resolution required to drive forward studies of exciting materials, such as nano-crystals, utilizing TEM and SEM platforms. This symposium celebrates these advances and will present state-of-the-art developments in instrumentation, methods and research applications of quantitative electron diffraction. Topics such as precession, convergent-beam, diffraction tomography, Kikuchi (EBSD) electron diffraction and electron channeling will be discussed. This will highlight new approaches to acquisition, data handling and processing to realize new insights in materials.

#### A11 Electron Vortex Beams and Higher-Order Beam Modes

Organizers: *Benjamin J. McMoran, Juan Carlos Idrobo*

Electron vortex beams, composed of free electrons with helical wavefronts possessing quantized orbital angular momentum, are a specific example of higher-order electron beam modes with engineered wavefront dislocations. The unique phase, coherence, and angular momentum properties of these beams hold promise for providing new contrast mechanisms in electron microscopy, and are already being used to gain new insights in electrostatics, the evolution of quantum systems, and into the operation of the electron microscope itself. These beams can be produced in conventional electron microscopes using a variety of new experimental techniques, which themselves have uses for phase imaging and electron interferometry. This symposium will highlight recent experimental and theoretical advances in these areas, as well as opportunities for future investigations with electron vortex beams.

#### A12 Low Voltage Electron Microscopy

Organizers: *David C. Bell, Natasha Erdman, Jingyue Liu*

This symposium will cover the physical and instrumental aspects as well as the application of Low Voltage SEM, TEM and STEM. With this symposium we attempt to find out if there are optimum energies when working with beam sensitive materials and what are the limitations with respect of resolution, applicable dose, achievable contrast and specimen preparation. Use of novel electron column design, beam deceleration techniques and new detector technologies for improvements of both imaging and microanalysis at low voltages will be covered. Analytical aspects of operating at low electron energies will also be discussed. We encourage submissions from both materials science and biological perspectives.

#### A13 Advancing Data Collection and Analysis for Atom Probe Tomography

Organizers: *Brian Gorman, R. Prakash Kolli, Richard Martens*

Atom probe tomography is a rapidly advancing area of materials characterization. Hardware advancements in the recent past have allowed data acquisition from semiconductor, organic, and insulating materials, but also have illustrated difficulties in data interpretation and reconstruction. This symposium will highlight recent research focused on APT analysis of energy materials, steel nanostructures, organic materials, and oxidation and corrosion reactions. Advances in mathematical methods for data analysis as applied to these materials are able to advance the atomic scale understanding of materials science processes. Improved reconstruction research performed using correlative analyses combining APT and computational methods such as first principles, Monte Carlo simulations, and finite element methods will also be highlighted.

#### A14 Surface Plasmons, Cathodoluminescence, and Low-Loss EELS

Organizers: *Gerd Duscher, David McComb, Ritesh Sachan, Robert Williams*

Spatially resolved measurements of low energy (0-10eV) excitations can now be probed using methods such as probe microscopies, confocal methods, STEM-cathodoluminescence and monochromated EELS. Correlation of optical and electronic transitions with collective excitations such as localized surface plasmons resonances (LSPR) and phonons provides an opportunity for improved understanding of materials that are the basis of future technologies. We welcome contributions using low-loss EELS to characterize phonons, LSPRs, optical properties and low energy electronic transitions. In particular, correlative approaches using optical/electron/probe microscopies that are encouraged. Contributions that describe new instrumentation and methods such as the influence of monochromators to low-loss EELS, STEM-cathodoluminescence techniques, as well as new methods of quantification and acquisition of low-loss EELS data are anticipated as are contributions that address theory and data interpretation.

#### A15 Imaging Mass Spectrometry-SIMS/Imaging Mass Spectrometry-MALDI

Organizers: *Joseph Dalluge, Christopher Anderton*

Imaging mass spectrometry (Imaging MS) offers direct examination of chemical patterns from cells, tissues, and materials. It is accomplished by acquiring mass spectra across selected material or tissue areas. A two-dimensional image of mass spectral data for each material slice reveals the spatial distribution of chemicals at sub-micron to 100  $\mu\text{m}$  resolution. Its ability to generate beautiful chemical images from a variety of surfaces makes it a seemingly ideal tool for diagnostics and histology. This symposium will cover instrumentation, strategies and applications for imaging MS. Application areas of both MALDI and SIMS imaging MS, including

biomarker discovery, pharmaceutical metabolism, imaging of endogenous proteins and metabolites, compositional characterization of cell membranes, and imaging MS in art and archaeology will be showcased. These examples will demonstrate the capabilities of a range of imaging mass spectrometry technologies, including recent advances. Each platform session will consist of invited and contributed presentations with opportunities for discussion. In addition, there will be one 2-hour imaging MS poster session.

#### **A16 Advances in Electron and Ion Scanning Microscopies**

*Organizers: David Joy, Brendan Griffin*

Scanning ion and electron microscopies continue to develop rapidly. Neon is routinely available as an alternative to helium, for example. Detector technologies for both conventional imaging signals (SE and BSE) increase with most SEM have at least 2 or 3 SED and 2 BSED. The BSED include annular rings designs. Stage biasing is also being used more widely to enhance signal collection and improve final probe size (resolution). Of particular interest is the re-examination of origins of the signals (electrons) collected by the new detectors. We seek presentations addressing or comparing such developments; their strengths, weaknesses and applications. Invited presentations exploring the new regimes of SEM are being compiled but contributed presentations are essential.

#### **A17 Standardization and Metrology in Electron Microscopy and Microbeam Analysis**

*Organizers: Dan V. Hodoroaba, Ryna B. Marinenko, Mike Matthews*

Significant effort has been made in the recent two decades to the development of written standards on the measurement, parameters, methods and reference materials used in electron microscopy and microbeam analysis. Contributions of ongoing standardization projects in the technical committee ISO/TC 202 "Microbeam Analysis" and envisioned proposals will be the focus of the symposium. In addition, reports on metrological activities dealing with measurement uncertainties, e.g. intra- and interlaboratory comparisons, for quality assurance will be included. Because such a special topic is more rigorously considered just at a later career stage, the participation of young(er) scientists who could possibly bring their own ideas on how to accurately measure specific instrumental parameters or sample properties is strongly encouraged.

### **Biological Sciences Symposia**

#### **B01 The R.P. Apkarian Memorial Symposium on Cryo-HRSEM**

*Organizers: Elizabeth Wright, Cameron Ackerley*

This symposium will honor the work of Robert P. Apkarian by presenting and discussing the history of and most recent work in the field of cryo-HRSEM. Many biological systems and bio-inspired materials are extremely challenging to prepare for SEM analysis because conventional preparation methods dehydrate and fix the specimens, which subsequently introduce structurally-significant artifacts. Cryo-HRSEM methods were pioneered to enable investigators to examine a broad range of materials in their bulk phase and in a near-to-native frozen-hydrated state. This symposium will cover technique development; highlight important biological findings that have been facilitated by cryo-HRSEM; and feature several future directions emerging in the field.

#### **B02 To the Rhizosphere — and Beyond!**

*Organizers: Alice Dohnalkova, Marvin Whiteley*

From Arabidopsis to Zaluzianskya, this symposium will cover topics in environmental, agricultural and ecosystems areas, including but not limited to the plant physiology, plant-pathogen interactions, light energy capture, and nutrient and carbohydrate transport. Fundamental and applied research in biomass crops and biofuels production, and soil conservation will be discussed. We will also focus on the belowground portion of the plants, where the interaction of roots, soil fungi and microbes occurs, resulting in carbon sequestration and mineral weathering. Presentations on advanced microscopy methods such as multimodal, multi-scale and high-speed imaging are encouraged to participate in this session.

#### **B03 Optogenetics: Shining New Light on Neural Circuit Function**

*Organizers: Mark J. Thomas, Erin B. Larson*

Microscopy and microanalysis studies can provide powerful constraints on the formation and processing histories of natural materials, ranging from refractory oxides to macromolecular organic polymers. Recent technical advances in analysis methods for natural materials include isotopic composition measurements at the 10 nm scale for determination of materials origin, and low voltage aberration-corrected electron microscopy for investigation of nanocarbon phases with single atom sensitivity. Papers are solicited that address these or other technical advances in microanalysis methods, and/or novel applications of established methods, for Earth and planetary materials research.

#### **B04 Advances in Specimen Preparation and Correlative LM- EM (CLEM) of Biological Samples**

*Organizers: Kent McDonald, Danielle Jorgens*

Embedding samples in resins is still the predominant specimen preparation procedure for electron microscopy of biological samples. While projection imaging of thin sections is the most common form of data output, exciting new technologies such as serial block face-SEM, focused ion beam-SEM, array tomography, and correlative light and electron microscopy are also generating spectacular images and 3-D models of cell structures. In the best cases some form of rapid freezing is the fixation method of choice, followed by freeze substitution and resin embedding. Topics will include: novel freezing methods, ultra-rapid freeze substitution and embedding procedures, preservation of fluorescence in polymerized resin for correlative light and electron microscopy, 3-D imaging of cells and tissues, and novel methods for preparing cells for on-section immunolabeling. Applications of these methods to wide-ranging questions in molecular, cellular, and developmental biology will be considered.

#### **B05 3D Structures of Macromolecular Assemblies, Cellular Organelles, and Whole Cells**

*Organizers: Teresa Ruiz, Esther Bullitt, Melanie Ohi*

We are advancing the basic understanding of 3D structures of macromolecular assemblies, viruses and cells, as well as their communication with the host environment, through advanced EM techniques and hybrid methodologies. This symposium will highlight structural and ultrastructural studies of cells, macromolecules and macromolecular assemblies using techniques including electron tomography; electron crystallography; single-particle EM analysis; EM helical reconstruction; scanning and transmission electron microscopy; atomic force microscopy, X-ray crystallography, and modeling. Topics will include cellular metabolism, cell division and protein translation; cellular and bacterial adhesion; flagellar and filopodial motility; secretion systems; cell-cell communication and cell signaling; virus structure and virus-host interactions.

#### **B06 Deep Tissue Imaging and Light Sheet Microscopy**

*Organizers: Meng Cui, Liang Gao*

In vivo fluorescence microscopy has revolutionized biomedical research in recent years. Two of the frontiers of the technological development are the deep tissue imaging and the high spatial-temporal resolution volumetric imaging. Various schemes have been employed to extend the imaging depth, including adaptive optics, long wavelength multi-photon excitation and optical clearing. With minimum photobleaching and phototoxicity, light sheet microscopy has emerged as a popular solution for high spatial-temporal resolution imaging. This session covers the latest progress of the two exciting research fields and provides an opportunity to germinate ideas and explore new applications.

#### **B07 Microscopy, Microanalysis and Image Cytometry in the Pharmaceutical Sciences**

*Organizers: Lynn M. DiMemmo, John Bruce Green*

Pharmaceutical research and development presents unique challenges that have led to the development of highly specialized analytical methods. This symposium will present applications of microscopy associated techniques to biological and materials science problems that arise during drug discovery, vaccine research, formulation and production. Topics will include high-content/ high-

throughput screening, therapeutic targets and mechanisms, pathology, foreign material (particulate and contaminant) analysis, and characterization of drug substance and drug product. Contributed papers for platform or poster presentation on related topics are also welcome.

#### **B08 Dynamic Fluorescence Microscopy**

*Organizers: Michelle Digman, Alan F. "Rick" Horwitz*

The ability to detect molecular interactions in live cellular systems has been evolving over the past decade through the advancement of fluorescence correlation spectroscopy (FCS) techniques. Most recently the use of laser scanning and light sheet imaging microscopes, has led to the development of fluorescence imaging correlation microscopy techniques and 3D particle tracking allowing access to spatio-temporal information of fluorescently tagged molecules in living cells. Improvements on super-resolution microscopy approaches have also been developed to monitor molecular dynamics at a high spatial scales. This session will focus on the latest developments which are able to detect protein-protein interactions, molecular aggregation dynamics as well as mapping diffusion, flows and velocity.

#### **B09 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants, and Animals**

*Organizers: W. Gray Jerome, Jon Charlesworth, Gang Ning, Betty Johns*

Microscopy is not only useful but 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.

#### **B10 Multiscale Biological Imaging: From Micro to Macro — Animal to Clinical Models**

*Organizers: Kevin Eliceiri, David Entenberg*

The ability to understand modern biological or medical phenomena be it the conformational dynamics of proteins, cellular division or tumor progression requires sophisticated methods that would allow interrogation in a variety of environments across multiple time and size scales. Imaging is the method of choice, but its success requires the ability to not only image the structure, but also the associated electronic, magnetic, optical, chemical and behavioral properties. There are great challenges and opportunities of scale in imaging, not only in spatial and temporal but non-spatial dimensions.

### **Physical Sciences Symposia**

#### **P01 Bringing the Real World into the Electron Microscope: Peter R. Swann Memorial Symposium on In situ TEM and STEM**

*Grace Burke, Ondrej Krivanek, Peter Crozier*

Peter Swann had a huge impact on TEM and materials science with his many outstanding contributions. He designed over 600 pioneering instruments, including a differentially-pumped gas reaction cell that brought the "real world" inside the electron microscope. With his brother Rex, Peter founded Gatan, which introduced in-situ cooling/heating, imaging of cryo-transferred samples, many new TEM specimen preparation tools, EELS as a popular analytical technique, CCD cameras and digital TEM imaging, among others. Dr. Swann died in 2013. This symposium will honor his legacy by soliciting papers in the fields he pioneered, with particular emphasis on in-situ TEM and STEM.

#### **P02 Materials Problem Solving with Aberration-Corrected EM**

*David Smith, Lena Kourkoutis, Jian-Min Zuo*

Aberration-corrected instruments nowadays produce striking pictures of carefully chosen test objects, and information-rich images and spectra are readily obtained. However, providing meaningful solutions to 'Real-World' problems is a continuing challenge. The goal of this symposium is to bring technical experts together with existing and potential users of AC-TEMs and AC-STEMs, in particular to illuminate the path towards practical materials problem solving using these sophisticated (and expensive) machines. Successful applications will be featured, while further topics of interest include improvements to instrumentation, practical aspects of specimen preparation, data acquisition, and artifacts, and extracting quantitative information about atomic column positions, identity and bonding environment using modeling and simulations.

#### **P03 Advances in Microanalysis of Earth and Planetary Materials**

*Rhonda Stroud, Eve L. Berger*

Microscopy and microanalysis studies can provide powerful constraints on the formation and processing histories of natural materials, ranging from refractory oxides to macromolecular organic polymers. Recent technical advances in analysis methods for natural materials include isotopic composition measurements at the 10 nm scale for determination of materials origin, and low voltage aberration-corrected electron microscopy for investigation of nanocarbon phases with single atom sensitivity. Papers are solicited that address these or other technical advances in microanalysis methods, and/or novel applications of established methods, for Earth and planetary materials research.

#### **P04 Nano-characterization of Low Dimensional Materials: Carbon to 2D TMDs**

*Moon Kim, Zonghoon Lee, Quentin Ramasse*

New materials and devices can lead to disruptive advances in nano-electronics, energy and environment-related areas. For example, carbon-based materials and devices have made significant progresses, and yet still more to be accomplished. Advent of recent 2D transition metal dichalcogenides is stimulating new applications in many new areas. This symposium will focus on analytical transmission electron microscopy techniques, aberration-correction, spectroscopy, and in-situ methods to characterize these emerging low dimensional materials of interest. Presentations are sought from the areas of nanoparticles, nanowires and nanotubes, growth morphology of various 2D materials, defects and healing of defects, interfaces, and new and emerging devices.

#### **P05 Nuclear and Irradiated Materials: Fundamental Defect Properties**

*Chad M. Parish, Khalid Hattar, Arthur T. Motta*

Materials in fission, fusion, accelerator, or space environments are subjected to irradiation and undergo compositional and structural evolution as a result. Because damage cascades and transmutation are atomistic processes, understanding and predicting the changes in properties and performance in radiation environments require atomistic and microstructural tools. Radiation environments vary from low temperatures, high energy, and low flux environments often found in space applications, to neutron damage of liquid helium-cooled superconductors and 1200°C tungsten under helium and neutron bombardment in fusion reactors. Modern tools provide the means to study the smallest defects at the atomic scale and the real-time evolution of radiation damage. Coupling these techniques with modeling can enable the understanding to be extended from nm through mm or larger. This symposium aims to bring together instrumentation, modelling, and applications in materials for radiation environments.

#### **P06 Failure Analysis Applications of Microanalysis, Microscopy, Metallography, and Fractography**

*Daniel Dennies, William Kane*

This symposium is intended to be a forum for the exchange of information and knowledge regarding the use of microanalysis, microscopy, metallography and fractography in materials-related failure analysis. Invited papers would include those involving failure investigations where microstructures, metallography and fractography are critical to identifying the root cause. Of particular interest are unique, innovative, and/or challenging applications of microscopy, metallography, fractography, and sample preparation in failure

analysis. Target attendees will include engineers and scientists from all levels of analytical expertise and all related backgrounds, not just materials engineers.

**P07 Metallography and Microstructural Characterization of Metals**

*George Vander Voort, James E. Martinez*

The realm of materials science offers many challenges for revealing and characterizing microstructures of metals. The art and science of metallography continue to meet these challenges with new automated techniques for new materials and traditional engineering alloys. This symposium will cover all aspects of specimen preparation for metals, microelectronics, and virtually any other material, as they influence characterization techniques. Contributions are welcome for all specimen preparation methods, not solely mechanical grinding/polishing, such as ion-beam techniques. The effects of specimen preparation on revealing and characterizing microstructure will be highlighted in this symposium, including applications of light microscopy, quantitative metallography and image analysis, micro- and nano-indentation hardness, SEM imaging, EBSD or EDS, and any other relevant method.

**P08 Microscopy and Characterization of Ceramics, Polymers and Composites**

*Andre Mkhoyan, Jong Seok Jeong, Laxmikant Saraf*

This symposium will cover application of analytical scanning and transmission electron microscopy and spectroscopy on variety of ceramic, polymer and composite materials. While in recent years substantial advances are made in higher special and energy resolution instrumentations, many new phenomena in materials are still remained to be discovered by use of these microscopes. Therefore, in particular, contributions that show successful implementations of aberration-corrected STEM combined with high sensitivity X-ray or electron energy-loss spectroscopy to study and characterize such ceramic, polymer and composite materials are welcomed.

**P09 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology**

*John Porter, John Wooten, Jay Potts*

Additive manufacturing/3D printing encompasses multiple methods for building parts directly from feedstock such as powders, wires, and biomaterials with only minimal or no post build machining to produce a final shape. Resultant microstructures can be unique to the process and properties can be strongly dependent on such microstructures. In recent years, technologies have been developed for the additive manufacturing of polymers, metals, and ceramics. Processes include layer-based processes as well as spray processes for repair of worn parts. More recently, biological and medical opportunities have sprung up taking advantage of 3D bioprinting. Heart valves, blood vessels and whole organs have begun to be manufactured. Each of these processes brings unique challenges to build parts and tissues that meet specifications and biocompatibility. Papers are sought highlighting additive manufacturing and 3D printing in all areas of science from materials and ceramics to biology and medicine.

**P10 Microscopy and Microanalysis for Real-World Problem Solving**

*Elaine Schumacher, Janet Woodward, Stuart McKernan, Ke-Bin Low*

Microscopy and microanalysis of real-world samples present special challenges. Non-ideal samples may not lend themselves to established methodologies for preparation and analysis. Sample amounts and background information about the materials and the problem may be limited, and the time frame for producing results may be short. This symposium will focus on ways in which microscopists and Microanalysts develop unique and creative solutions for sample preparation, data acquisition and analysis, providing meaning results to solve problems in the real world.

**P11 Advances in Transmission Electron Microscopy and Spectroscopy of Energy-Related Materials**

*Chongmin Wang, Raymond Unocic, Arda Genc*

The key challenges for imaging and spectroscopy study of energy materials are twofold: (1) Probing the structure and chemistry of energy related materials at high spatial resolution and sensitivity, (2) Real time observation of the structural and chemical evolution of the material under dynamic operating condition. We have witnessed dramatic progress along these directions, such as direct atomic resolution imaging of lithium and oxygen ions using ABF imaging, advances in chemical analysis using high efficient XEDS and EELS and in-situ to operando TEM studies of catalytic reactions in gas environment, electrodes during electrochemical charge and discharge for Li ion batteries, and the nucleation and growth of nanoparticles in liquids. It is anticipated that this symposium will provide an outstanding opportunity for participants to exchange ideas and promote discussions on recent advances in the field of using TEM and STEM imaging and spectroscopy method for energy related materials.

**P12 Advanced Microscopy and Microanalysis of Soft and Hybrid Nanomaterials**

*Jihua Chen, Honggang Cui*

This symposium is focused on the use of cutting-edge microscopy and microanalysis techniques to characterize synthetic or naturally occurring nanomaterials, relevant to important applications in energy-related and biomedical/biological research. The techniques include, but are not limited to cryo-TEM, low-dose high-resolution TEM, energy-filtered TEM, STEM, X-ray microscopy, X-ray and neutron scattering. Of particular interest is the use of these state-of-art instrumentations to investigate emerging nanomaterials, ranging from organic semiconductors, polymeric materials, biomimetic or bioinspired materials, to inorganic nanoparticles and hybrid nanomaterial systems. We welcome contributions that report on either new technique advances or novel applications of microscopy and microanalysis tools.

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## Additional Topics for Papers

Organizers: Executive Program Committee

Potential additional session topics in the three categories (Instrumentation & Techniques, Biological Sciences, and Physical Sciences) are listed below. If a sufficient number of submissions on a topic are received, the Executive Program Committee will organize a special session on that topic; if not, the papers will be redirected to the closest topical area.



### Instrumentation & Techniques



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- C01 Advances in Instrumentation and Techniques — General
- C02 Convergent Beam Electron Diffraction
- C03 Variable Pressure/Environmental SEM
- C04 Imaging, Diffraction, Holography, Spectroscopy
- C05 Stereology
- C06 Infrared and Raman Microscopy and Microanalysis
- C07 Remote Microscopy and Collaboration
- C09 Forensic Science
- C10 Quality Systems and Standards
- C11 Core Facility Management

### Biological Sciences

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- C12 Biological Sciences — General
- C13 Specimen Preparation for Biological Sciences
- C14 Biomimetics
- C15 Blood/Immunology
- C16 Botany
- C17 Cytoskeleton
- C18 Developmental/Reproductive Biology
- C19 Entomology
- C20 Histology and Cytochemistry
- C21 Microbiology
- C22 Neurobiology
- C23 Parasitology

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### Physical Sciences



- C24 Physical Sciences — General
- C25 Specimen Preparation for Materials Sciences
- C26 Amorphous Materials
- C27 Alloys and Composites
- C28 Engineered Materials
- C29 Interfaces
- C30 Magnetic, Superconducting & Ferroelectric Materials
- C31 Modulated Structures
- C32 Oxidation/Corrosion
- C33 Phase Transformations
- C34 Porous Materials
- C35 Self-Assembly
- C36 Semiconductors



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## Plenary Session

MONDAY, AUGUST 3, 2015  
Oregon Convention Center, Oregon Ballroom



### PLENARY SPEAKER

Professor Roger Y. Tsien, University of California — San Diego  
*"New Molecular Tools for Light and Electron Microscopy"*



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Dr. Roger Y. Tsien is best known for designing and building molecules that either report or perturb signal transduction inside living cells. These molecules, created by organic synthesis or by engineering naturally fluorescent proteins, have enabled many new insights into signaling. Extension of these methods to electron microscopy aims to reveal biochemistry at nanometer resolution. At mm-cm scales, he is exploiting new ways to target contrast agents and therapeutic agents to tumors and sites of inflammation based on their expression of extracellular proteases, and to highlight peripheral nerves to aid surgery. Also he is testing the hypothesis that life-long memories are stored as the pattern of holes in the perineuronal net, a specialized form of extracellular matrix deposited around selected neurons during critical periods of brain development.

Dr. Tsien is an Investigator of the Howard Hughes Medical Institute and Professor in the Depts. of Pharmacology and of Chemistry & Biochemistry. Honors include the Artois-Baillet-Latour Health Prize (1995), Gairdner Foundation International Award (1995), Award for Creative Invention from the American Chemical Society (2002), Heineken Prize in Biochemistry and Biophysics (2002), Wolf Prize in Medicine (shared with Robert Weinberg, 2004), Rosenstiel Award (2006), E.B. Wilson Medal of the American Society for Cell Biology (shared with M. Chalfie, 2008), and Nobel Prize in Chemistry (shared with O. Shimomura and M. Chalfie, 2008). Dr. Tsien is a member of the National Academy of Sciences and the Royal Society.

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### PLENARY SPEAKER

The M&M 2015 Program Committee is pleased to announce that one of three NASA astronauts will be giving a talk about onboard microscopy in spaceflight. Due to mission scheduling, the exact speaker will be determined closer to the meeting dates. *Stay tuned for this exciting addition to the program!*

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The spaceflight environment remains one of discovery on scales large and small. Since the US Skylab orbital station, when onboard microscopy was used in flight to examine bacterial and fungal growth, many diverse samples have been microscopically analyzed both in flight and following return to Earth by state of the art facilities. These samples have included microbiological analysis of organisms and cabin atmospheric dust particles for environmental monitoring, human, animal, and plant tissue analysis examining the many changes occurring during adaptation to weightlessness, and external structures analysis for the response of materials to the harsh space environment. Onboard microscopy has taken a significant step forward with the deployment of the Light Microscopy Module on the International Space Station. Future exploration missions back to the moon and to Mars will certainly involve onsite microscopy for field sample examination for mineralogical and possible biologic analysis.



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## Tutorials

### PHYSICAL SCIENCES AND BIOLOGICAL SCIENCES TUTORIALS

The physical sciences and biological sciences tutorials serve mainly as an educational tool for attendees of the annual Microscopy & Microanalysis meeting by affording a select number of researchers to give extended lectures on the practical aspects of certain microscopy techniques, methods, and computations. Generally focused on cutting-edge and/or immediately relevant microscopy, the tutorials give speakers the opportunity to venture well beyond the cursory introductory material of a platform presentation, which provides attendees with an in-depth and practical understanding of a given technique.

#### X40 Physical Sciences Tutorial:

##### ABF STEM - Direct and Robust Atomic-resolution Imaging of Light Elements in Crystalline Materials

*Scott Findlay*

Annular bright field (ABF) imaging in atomic-resolution scanning transmission electron microscopy has been shown to give direct, robust and real-time imaging of light elements in crystalline materials. Columns of lithium, even hydrogen, can be imaged in some circumstances. This brief tutorial will promote the usefulness of the technique. Practical aspects will be emphasized, in particular what specimen characteristics and experimental parameters are most suited to this imaging mode. The conceptual underpinnings and limitations of ABF imaging will be discussed, drawing from a mix of exploratory simulations and experimental results. Strategies for implementing ABF imaging and recent extensions of the technique will be described.

#### X41 Physical Sciences Tutorial:

##### In situ Liquid S/TEM: Practical Aspects, Challenges, and Opportunities

*Raymond R. Unocic*

Recent advances in platforms for in situ/operando liquid S/TEM experimentation has brought forth new research opportunities in the physical and life sciences, where it is now feasible to image static and dynamic processes of materials in their native liquid environment, at high spatial resolution, and under an external stimuli. In the context of performing quantitative in situ experiments and across this progressively growing research field, there is a need to understand complex electron beam interactions, recognizing and separating out experimental artifacts, coupling analytical microscopy methods for chemical analysis, performing electrochemical measurements for electrochemistry, data collection and interpretation.

#### X42 Biological Sciences Tutorial:

##### Maximizing the Likelihood of Successful Maximum Likelihood Classification

*Dmitry Lyumkis*

Maximum likelihood methods are being increasingly used in three-dimensional electron microscopy to determine the structures of challenging biological molecules. This tutorial will feature a brief introduction to maximum likelihood methods and will discuss best practices for performing maximum likelihood classification of EM data.

#### X43 Biological Sciences Tutorial:

##### Advances in Light Sheet Microscopy

*Liang Gao*

Light sheet microscopy is an up-and-coming technique in light microscopy as it offers reduced photobleaching, highly efficient image recording, and significant depth penetration. This tutorial will feature an introduction to the technique and will discuss new developments and results that the technique has enabled.

#### X44 Biological Sciences Tutorial:

##### Optimizing Specimen Preparation for Macromolecular Electron Microscopy

*Deborah Kelly*

Specimen preparation can one of the most challenging steps for macromolecular electron microscopy. This tutorial will discuss some new approaches for preparing optimal samples for three-dimensional electron microscopy.

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## Technologists' Forum Sessions

**X30 Technologists' Forum: Emerging New Specialized Techniques for Correlative Microscopy**  
*Organizers: Caroline Miller, John Chandler, Frank Macaluso*

This symposium will explore:

- Emerging new technologies to advance correlative microscopy from LM to EM
- Correlative techniques and instrumentation development
- Extending basic preparation techniques to new imaging modes



**X31 Technologists' Forum: Safety in the Microscopy Laboratory**  
*Organizers: E. Ann Ellis, Beverly E. Maleeff*

This symposium will cover:

- Basic laboratory safety
- Problem specific to EM labs
- Fume hoods
- Biohazards
- Waste disposal

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## Microscopy Outreach

### X90 Microscopy in the Classroom

*Craig Queenan, Alyssa Waldron, Dave Becker*

- Best Practices for incorporating microscopy into K-12 classrooms and curricula
- Local and national institutions and programs involved in microscopy outreach
- Methods to expose students to microscopy in an engaging and successful manner



### X91 Family Affair

*Elaine Humphrey, Frauke Hogue, Stuart McKernan*

- The exciting world of microscopy for attendees' family and friends
- A mystery to solve with microscopy
- Materials science and biological science



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### X92 A Project MICRO Workshop: Learn to See with the Private Eye

*Kerry Ruef, David Melody*

- Project MICRO workshop of microscopy in classrooms for teachers and meeting attendees
- Does your funding source require outreach? The Private Eye workshop can help you
- Learning how to SEE is more basic than learning how to use a microscope
- Think with the eyes and see with the brain. Come to this workshop to learn how to do this!
- Learn how to bring arts-based teachers into science with the Private Eye

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## Sunday Short Courses

Organizer: Mike Marko

- These full-day courses run from 8:30 AM to 5:00 PM on Sunday.
- A certificate of participation will be issued to each qualifying participant.
- Eight instructional hours; two Continuing Microscopy Education Units are available (registration fee \$10 for members).
- Morning and afternoon coffee breaks are included; lunch is on your own.
- Separate registration is required; see Registration page for fee information.



## SUNDAY SHORT COURSES IN BIOLOGICAL SCIENCES



### X-10 Cryo-preparation for Biological EM

*Instructors: Kent McDonald, Richard Webb*

In this course, we will review why cryo-techniques for biological specimen preparation are superior to conventional methods. We will discuss some low-cost cryo-methods, as well as some of the latest equipment and techniques for high-pressure freezing, freeze substitution, cryosectioning and correlative LM-EM. We will show how to recognize ice-damage artifacts and provide a library of reference materials that can be accessed online after the course. Persons taking this course should leave with a better understanding of these biological cryotechniques and their role in different applications such as EM tomography, EM immunolabeling and cryo-EM of vitrified sections, as well as their routine use for the best-available preservation of cellular fine structure.

### X-11 Immunolabeling Technology for Light and Electron Microscopy

*Instructors: Caroline Miller, Rick Powell, Steven Goodman*

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. Guidelines and representative methods will be presented for pre-embedding and post-embedding EM labeling, cryo-EM techniques, and labeling cells, protein complexes and single particles in suspension. Some of the more complex methods and applications used in electron microscopy will be discussed in depth.

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## MULTI-DISCIPLINARY SUNDAY SHORT COURSES

### X-12 3-D Reconstruction with SerialEM and IMOD

*Instructors: David Mastrorarde, 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, montage, 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.

### X-13 Imaging and Analysis with Variable Pressure or Environmental SEM

*Instructors: Brendan J. Griffin, Matthew Phillips*

This short course aims to take the challenge out of imaging in variable-pressure SEM mode. We will sequentially address VPSEM column components and operation: electron (SE and BSE), and light (CL) imaging and x-ray analysis strategies and detectors for both biological and materials samples. Procedures for monitoring instrument performance and optimizing image quality will then be presented. Examples of the novel charge-related contrasts available in VPSEM will also be discussed. The appropriate use of hot, cool and cold stages is included. The course will conclude with invited manufacturer presentations on new developments and a final lecture comparing VPSEM with conventional SEM. Lecture pdfs will be available online.

### X-14 Advanced Focused Ion Beam Methods

*Instructors: Lucille Giannuzzi, Joe Michael*

The use of FIB instruments in materials and biological science laboratories is growing rapidly. The versatility and capabilities of these tools are also rapidly improving. This course will first cover ion/solid interactions, which are so important for a user of FIB instrumentation to understand. We will then discuss techniques of sample preparation for SEM and TEM, using conventional liquid-metal Ga<sup>+</sup> ion FIBs. We will introduce liquid-metal alloy sources, the gas field-ionization source, the plasma-ion source, and the various ions that are now commercially available to benefit differing applications. The course will conclude with discussions of 3D applications and nanofabrication.

### X-15 Practical Considerations for Image Analysis and ImageJ

*Instructor: James Grande*

The course first focuses on a wide range of practical topics in the field of image analysis, covered in an easy-to-understand format so that users with little or no experience can comprehend how image analysis can provide extensive quantitative measurements leading to better understanding of material performance. Treating image analysis as a problem-solving tool, along with discerning key metrics within a microstructure, will be discussed through several real-life examples. The course then will cover the use of the public-domain image-analysis package ImageJ/Fiji. This analysis tool will be explored in terms of its extensive capabilities and types of image-analysis projects, using several examples. Programming considerations will be discussed, with basic examples of batch-processing

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images for enhanced analysis of structural features. Finally, the strengths and weaknesses of image-analysis tools, and options for applying them in various types of imaging systems, will be described and discussed.

## SUNDAY SHORT COURSES IN PHYSICAL SCIENCES

### X16 Overview of Scanning Probe Microscopy (SPM/AFM) for Nanoscale Morphological, Mechanical, and Optical Characterization of Materials - **CANCELED**

Instructors: Dalia Yablon, Greg Haugstad

Scanning probe microscopy (SPM) has developed into a widely used commercial tool in many applied R&D applications while still actively growing in new frontiers and research. This course will cover an overview of the method and operating principles of scanning probe microscopy to provide the audience with enough technical background to understand SPM's nanoscale characterization capabilities. General concepts of SPM will be covered including: hardware elements and software; various modes including contact mode, tapping mode, force curves, in addition to more advanced modes such as multifrequency methods and dynamic contact methods. Emphasis will be on using SPM for nanoscale morphological (topographic), mechanical (modulus), and optical (Raman/IR) based characterization. Finally, specific examples of how SPM is used to solve industrial R&D problems will be demonstrated. This course is suitable for any scientist or engineer with basic physics/math/chemistry background who wants to learn more about this powerful and flexible nanoscale characterization tool.

### X17 Standard Practice for Production and Evaluation of Field Metallographic Replicas - **CANCELED**

Instructor: Frederick Schmidt

This course will cover the use, application and practice of making quality acetate replicas for future examination and evaluation to solve engineering problems. The use of acetone replication during inspection of objects of evidence has the advantage of preserving the evidence. It makes a clear, clean mold of the surface and is totally non-destructive per ASTM E1351. A review of non-destructive testing methods will be followed by the actual making of your own replica tapes. Specific examples of case histories for problem-solving using methods in the field will be presented.

### X-18 Nanomaterial Microscopy & Microanalysis: Tools and Preparation

Instructors: Phillip Russell, Lou Germinario, Donovan Leonard, John Thornton

With the wide variety of analytical instrumentation available, the selection of the correct "tool" for analysis of nanomaterials is critical. By introducing various microscopy and microanalysis methods, this workshop should provide a solid foundation for nanomaterial characterization for the beginning to intermediate investigator. The importance of choosing the proper preparation technique, to minimize introduction of artifacts and to ensure that representative samples are identified for subsequent analysis, will also be discussed.

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### In-week Workshops

- These in-depth courses will be held Monday-Thursday from 1:00 PM to 5:00 PM.
- A certificate of participation will be issued to each qualifying participant.
- Total of 16 instructional hours; four Continuing Microscopy Education Units are available (registration fee \$10 for members).
- Course fee includes Full Meeting registration to M&M 2015.
- See [Registration page](#) for fee details.

#### X-19 Introduction to SEM Imaging and X-ray Compositional Analysis

*David Joy, Brad Thiel*

This introductory-level workshop will involve classroom lectures and live demonstrations. The SEM topics will be taught by David Joy and will cover basic instrument operation and imaging modes. The EDS topics will be taught by Brad Thiel and will cover basic compositional analysis using SEM with an energy dispersive x-ray spectrometer. The lessons in the lectures will be complemented with hands on demonstrations of SEM operation and x-ray microanalysis. Demonstrated topics will include the effects of working distance, accelerating voltage, probe size, imaging detector, detector bias, probe current, dead time, detector choice, sample geometry, etc.

#### X-20 Specimen Preparation for Biological Microscopy

*Kent McDonald, Mark Sanders, Danielle Jorgens*

Lecture material will provide information on the basic components of specimen-processing systems, the basics of live-cell incubation using fluorescent probes, biological specimen preparation for light, electron and super-resolution microscopy, strategies and protocols for antibody labeling, and an overview of advanced applications, including in-situ hybridization and decalcification. There will be a special focus on the advantages of microwave-assisted processing. The workshop will include a hands-on component as well as lectures from experts in the field of sample preparation for live, fixed-cell and tissue imaging.

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## Pre-Meeting Congress

- Sunday, August 2, 2015
- 8:30 am – 5 pm
- Breakfast, Lunch and Breaks included in registration fee
- Separate registration required; see Registration page for details

[CLICK HERE FOR CONGRESS PROGRAM ITINERARY](#)

### Measuring Materials' Functionalities and Dynamics in Liquid and Gaseous Environments

*Organizers: Huolin Xin, Raymond R. Unocic, Renu Sharma, Judith C. Yang*

The emerging capabilities to deliver liquid and gaseous environments in a transmission electron microscope (TEM) have enabled high-resolution measurements of materials structures, chemistry, and functionalities in their native growth and operando conditions. This one-day pre-meeting congress (PMC), organized by the MSA Electron Microscopy in Liquids and Gases (EMLG) focused interest group (FIG), will provide a forum for the communication of emergent opportunities, challenges, and practical limitations of measuring materials functionalities and dynamics in the presence of liquids and gases in electron microscopes. Topics include but not limited to the development of sample environment with functional stimuli and measurements, progress in developing high-throughput analytical imaging of materials dynamics, big data storage, mining, and quantification, sample-beam interactions, and applications of environmental TEM in electrochemistry, nucleation and growth, catalysis, and corrosion.



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## Post-Deadline Posters

**Submission Deadline: Monday, July 6; 10:00 AM ET**

Click on each paper title to link to the original 2-page paper. All Post-Deadline Papers below will be presented as Posters on Monday, August 3, 2015 from 3-5 PM, in the poster area of the M&M 2015 Exhibit Hall.

**The post-deadline poster submission deadline has passed. No additional submissions are being accepted at this time. We look forward to seeing your work at M&M 2016 in Columbus.**

- [Click here](#) for the 2-page paper template.
- Post-Deadline posters are not included in the program proceedings and are not considered "published".
- Post-Deadline poster papers will be available for review and download (PDF) on the M&M 2015 site around July 20.
- No travel support is available for Post-Deadline posters.
- Post-Deadline Poster presentation day will be determined on or after April 1, 2015.
- Notifications of acceptance of post-deadline posters will be made on Friday, July 10 at the latest.
- Post-deadline poster presenters will need to register for the meeting for at least the day of their presentation.
- Questions? Contact the Meeting Manager at [meetingmanager@microscopy.org](mailto:meetingmanager@microscopy.org)



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PDP Board Number	Author Name	Paper Title
1	Yusuke Abe	SEM Image Analysis of CNT Interconnect Vias
2	Saide Tang	Electron Tomography Study on 3D Responsive Assembly of Hairy Silica Nanoparticles in Polymer Matrices
3	Ed Vicenzi	Assessing Color Cathodoluminescence Imaging in the Scanning Electron Microscope
4	Ricardo Guerrero	Structural Analysis of Listeria Phage A511 Baseplate by Cryo-Electron Microscopy and Cryo-Electron Tomography
5	Sean Yu	Helical Viruses at Near-Atomic Resolution: Problems and Solutions
6	Jesus Gerardo Galaz Montoya	Depth Aware 3-D Per-Particle CTF Correction for Cryo Electron Single Particle Tomography
7	Yuanyuan Zhu	Chemical Mapping of Peptide-mediated Bimetallic Nanoparticles
8	Amanda Lawrence	Morphology and Distribution of Setae on the Forewing of Two Parasitic Wasps, <i>Theocolax elegans</i> and <i>Anisopteromalus calandrae</i> (Hymenoptera:Pteromalidae)
9	Michele C Darrow	Quantification of Variation in Manual Annotations of CryoET Data
10	Circe A. Verba	Biocementation Induced by Sporosarcina Pasteurii Intended for CO2 Storage
11	Rodrigo Madeiro	Automated Label-Free Microscopy in Multi-Dimensional Data Capture for Human Stem Cell Derived Microglia Inflammatory Responses
12	Jianguo Zhang	Fabrication of Frozen-hydrated Sections by Focused Ion Beam(FIB) Method
13	Lisa Hartnell	Highly Connected Mitochondrial Reticulum in Skeletal Muscle As Revealed by Focused Ion Beam-Scanning Electron Microscopy
14	Yoshiyuki Kubota	Correlative Light and Electron Microscopy of Brain Tissue Using Two-Photon Microscope and FIB/SEM
15	Yi-min Wu Zernike	Phase Plate Cryo-EM Reveals Structural Variations of Protein Complexes in Solution State



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16	David Entenberg	In vivo Subcellular Resolution Optical Imaging in the Lung Reveals Early Metastatic Proliferation and Motility
17	Jade Noble	Cryo-Electron Tomography of Chromatophore in Rhodospirillum rubrum
18	Mahsa Sina	Comprehensive Insights into the SEI Layer Formation of Silicon Anode Using STEM/EELS
19	Akira Yasuhara	Observation of Magnetic Field in STEM by Using Blade-shape Aperture with DeScan Function
20	Simon BURGESS	Sub-10nm spatial resolution for SEM-EDS using a novel EDS detector design
21	Adam Kammers	Accelerating Next Generation Battery Development Through the Application of Cross-Correlative In Situ Microscopy
22	Benjamin Stripe	New High Flux X-ray Excitation Beam Delivery System Using a Novel Super Bright X-ray Source and High Efficiency X-ray Mirror Lens
23	Sylvia Lewis	Toward Development of a High Throughput, Micron-Resolution Microprobe for Compositional Analysis of Geological and Material Samples
24	Soon-Huat Lim	Sideway FIB TEM Sample Preparation for Improved Construction Analysis in TEM
25	Amy Ng	STEM Characterization of Clean 2D Materials Produced via Chemical Exfoliation with Ionic Liquids
26	Fumitake Kametani	Atomic Investigation of Ca Segregation at [001] Tilt Low Angle Grain Boundaries in YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-<math>\delta</math></sub> High Temperature Superconductor Bicrystal Thin Films
27	JITENDRA SHAH	Improvement in the Accuracy of the Derivative Method
28	Raul Versaci	Microstructural Characterization of Zr-2.5Nb by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM).
29	John Mardinly	Characterization of Multisegment Quaternary Chalcogenide Alloy Nanosheets for Photonic Applications over a Wide Spectral Range
30	Prafull Purohit	High-Speed, High Dynamic Range Diffractive Imaging Camera for Scanning Transmission Electron Microscopy
31	Thais Milagres	Focal Series Reconstruction in Bismuth Telluride and Silicon
32	Frédéric Voisard	Simulation of Time-Sensing Electron Tomography for Beam Sensitive Materials like Lithium Iron Orthosilicate
33	Pengzi Liu	Thickness and Stacking Sequence Determination of Exfoliated Dichalcogenides Using Scanning Transmission Electron Microscopy
34	Kaori Nakajima	High Speed and/or High Spatial Resolution X-ray Mapping at Low Landing Voltage Using FE-SEM with In-lens Gun
35	Sung-Dae Kim	Measurements of Piezoelectric Response from a Single BaTiO <sub>3</sub> Nanoparticle
36	Henrik Pettersson	Microstructural Characterization of the Initially Formed Surface Film on Mg and MgAl Alloys
37	Ichiro Ohnishi	In situ Experiments using Aberration Corrected 300 kV Microscope with Gas-Cell Specimen Holder
38	Benjamin Bammes	Electron Counting with a Low-Noise Direct Detection Device
39	Hideki MATSUSHIMA	Evaluation of Cross Sections Fabricated by FIB with a Cooling Stage for Low Melting Point Metals
40	Daniele Filippetto	High-flux Ultrafast Electron Diffraction at LBNL
41	Andrew Lang	HRTEM Investigation of Microstructural Defects in Degraded AlGaIn/GaN HEMTs
42	Ellen LaVoie	A Techniques Comparison of Preparation for the Ultrastructure of Trabeculae in <i>Caulerpa</i> sp.
43	Claudia Lopez	Correlative Light and Electron Microscopy Methods for SEM and Dual-Beam applications

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### 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, 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.



#### STUDENTS:

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

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#### POSTDOCTORAL RESEARCHERS:

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

#### PROFESSIONAL TECHNICAL STAFF MEMBERS:

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

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

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

#### 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.

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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 of their award status approximately eight weeks following 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 per applicant.
2. The applicant must appear as first author 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).



### Other Awards

The M&M meeting's co-sponsoring societies confer competitively judged awards at the meeting, in addition to those associated with paper submission.

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### MSA Poster Awards

#### 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. Posters in each of the three categories (Biological, Physical, Instrumentation) will be considered.

#### Diatome Awards:

Presented for three posters best illustrating the use of diamond knife ultramicrotomy — with first prize a trip to Switzerland!

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## Micrograph Competitions

### IMS Metallographic Contest:

This annual contest solicits micrographs that illustrate problem-solving using a variety of imaging techniques, with cash prizes awarded in each of several classes.

### 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 2014 Micrograph Competition is featured in the 2015 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:

Any individual may submit a maximum of two (2) entries (one award per entrant).

- 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.
- 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).
- **Entries must be brought to the meeting in Portland and mounted on the display boards by 12:00 noon on Monday, August 3, 2015.**
- Non-winning entries must be removed Thursday afternoon by 3:00 PM. Micrographs remaining after that time will be discarded.
- Winners will be announced at the meeting. Submitted micrographs remain the property of the entrants subject to the conditions above.

### 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.

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