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M&M 2017
MICROSCOPY & MICROANALYSIS
August 6-10, 2017 • St. Louis, MO

www.microscopy.org/MandM/2017
for up-to-date meeting information
Meet us in St. Louis!

ON THE FRONT COVER: Cascading Confetti - Eric Formo, University of Georgia  
First Place Winner of the 2016 MSA Micrograph Competition
Microscopy & Microanalysis 2017 Meeting | August 6-10 | St. Louis, MO

**B01 Gina Sosinsky Memorial Symposium: Imaging of Cellular Communications**
Bernard Heymann, Esther Bullitt, Alasdair Steven
- Cellular junctions: gap, adherens, tight junctions, and desmosomes
- Cellular adhesion: focal adhesion, extracellular matrix
- Intercellular communication: synapses and cell surface receptors, including ion channels, G-protein-linked receptors, and enzymic receptors
- Extracellular matrix

**B02 Microstructure Characterization of Food Systems**
Jingpang Dong, Joel Wallecan
- Microstructure characterization of food products and ingredients
- Food microstructure-functionality correlations
- Microscopy techniques applied to food: electron microscopy (SEM and TEM), light microscopy, fluorescence microscopy, FTIR and confocal Raman microscopy, hyperspectral imaging, confocal laser scanning microscopy (CLSM), microscopic X-ray computed tomography (micro-CT), atomic force microscopy (AFM/SPM), etc.
- Microanalysis techniques applied to food: energy dispersive spectroscopy (EDS), x-ray fluorescence (XRF), laser-induced breakdown spectroscopy (LIBS), etc.
- Using microstructure techniques to solve food contamination and food safety problems

**B03 Imaging the Biology of Cells and Tissues: Just Do It Right**
Eduardo Rosa-Molinar, Jay Potts
- Scholarship
- Rigor and reproducibility
- Live cell and time-lapse imaging
- Volume electron microscopies
- Three and four dimensional imaging, reconstruction, and analysis
- Analysis of cellular geometry
- Immunohistochemistry
- Immunoelectron microscopy
- Imaging and experimental control

**B04 3D and Intravital Imaging in Development and Beyond**
David Entenberg, Kevin Eliceri, Sandra Rugonyi
- Optical Imaging techniques that reveal the 3 dimensional structure
- Studies utilizing high resolution optical imaging of 3D cultures
- Studies utilizing whole mount optical imaging
- Computational techniques for 3D reconstruction, extracting spatial or temporal dynamics from 3D imaging data
- Novel techniques for intravital imaging
- Intravital imaging windows

**B05 Pharmaceuticals and Medical Science**
Bridget Carragher, Jason Mantei
- Novel methods development
- Pharmacology challenges (polymorphs, contaminants, particles, etc.)
- Device challenges (failure mode analysis, biocompatibility, sterility, etc.)
- Case studies

**B06 3D Structures of Macromolecular Assemblies, Cellular Organelles, and Whole Cells**
Deborah F. Kelly, Elizabeth Wright, Teresa Ruiz
- Structural studies of biological systems using cryo-EM techniques and hybrid methodologies
- Cellular architectures, metabolism, trafficking, and division
- Gene regulation, transcription, and translation
- Host-pathogen interactions including bacterial adhesion, motility, and secretion
- Virus-host interactions and virus structure
- In situ TEM and SEM of biological entities

**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
- Correlative workflows for the 3D imaging of biological and soft materials
- Using light, electron, ion and x-ray microscopy to characterize biological ultrastructure
- New correlative probes and contrast agents for multi-modal imaging
- Innovative sample preparation and ultrastructural preservation techniques
- In situ measurements of dynamic phenomena using CLEM approaches
- New computational tools for visualizing and manipulating large 3D datasets

**B08 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals**
Gang (Greg) Ning, Ru-ching Hsia, Trace Christensen, Jon Charlesworth
- Research findings in renal and ciliopathic diseases
- Basic and clinical research technical applications
- The use of microscopy for improving the quality and durability of crops and livestock
- Investigation of organisms and their related pathogens in clinical and research laboratories
- Techniques that improve rapid detection and treatment of diseases
P01 Characterization of Semiconductor Materials and Devices
Moon J. Kim, Michael Gribelyuk, Jayhoon Chung, Esther Chen
- Recent advances and innovations in the field of characterization of semiconductor materials and devices
- 3D and planar devices, wide bandgap devices, heterostructures for nanoelectronics
- Strain analysis, dopant potential/chemical mapping, tomography, scanning probe microscopies, compositional analysis of ultrathin structures, in-situ thermal/electrical probing
- Characterization techniques for understanding defects, interfaces, failure mechanisms, materials properties and device performance

P02 TEM/STEM/EELS/SNOM of Ultralow Energy Excitations
Ian MacLaren, Philip E. Batson
- New developments in instrumentation, experimental techniques and data analysis for investigating excitations at energies from a few meV to a few eV
- Experimental studies of such low energy excitations including, but not limited to: plasmonics and EM-radiation-matter interactions; phonons and vibrational spectroscopy; interband transitions, band gaps and excitons
- Theoretical studies of low energy excitations in materials and nanostructures and their interactions with the probe radiation (electrons or photons)
- Correlation to complementary techniques including Raman spectroscopy, cathodoluminescence, inelastic neutron scattering, and high resolution EELS (with low energy electrons)

P03 Advanced Microscopy and Microanalysis of Complex Oxides
Xiaoqing Pan, Peng Wang, Elizabeth Dickey
- Structure and electronic structures of complex oxides at the atomic scale
- Local atomic distortions and polarizations
- Point defect disorder
- Charge and field distributions
- Local chemistry fluctuations and interfacial segregation
- Temperature- and field-induced phase transitions

P04 Advanced Microscopy and Microanalysis of Low-Dimensional Structures and Devices
Marta D. Rossell, Jordi Arbiol, Valeria Nicolosi, Quentin Ramasse
- New or innovative uses of analytical transmission electron microscopy techniques, aberration-correction and spectroscopy to characterize low-dimensional structures
- In-situ methods for testing nano-devices
- Electronic structure of low-dimensional systems
- Analysis of the physical properties of nanostructures (including plasmonics, photonics and phononics)
- Multiscale computer modeling of defect creation and evolution in low-dimensional materials
- Novel 2D materials, nano-carbons
- Non-planar nanostructures: nanowires, nanobelts, tripods, nanorods and their related homo, hetero and quantum structures (quantum-wells, -wires and -dots)

P05 Imaging and Spectroscopy of Beam-Sensitive Materials
K. Andre Mkhoyan, Osamu Terasaki, Ray F. Egerton, Prashant Kumar
- Theoretical insights into electron beam damage in TEM and STEM
- Instrumentation and analytical techniques for low-dose imaging
- Combining TEM/STEM and SEM imaging, EELS and EDX for structure determination
- Development and application of innovative spectroscopy methods for beam sensitive materials
- Electron beam sensitive materials like zeolites, metal-organic frameworks, organic-inorganic composites

P06 Nanoparticles: Synthesis, Characterization, and Applications
Thomas W. Hansen, Abhaya Datye, Marc-George Willinger
- Applications of aberration correction
- Nano-Bio composites
- High spatial resolution EDS and EELS
- In situ and operando studies
- Synthesis and application of functionalized nanoparticles
- Novel characterization techniques
- Modelling

P07 Advanced Characterization of Energy-Related Materials
Meng Gu, Chongmin Wang, Katherine Jungjohann, Judith Yang
- Energy generation, storage and conversion materials
- Catalysts research relevant to energy and sustainability
- Real-time in-situ/operando studies for reaction and phase transformation mechanisms
- Advanced characterization of structure and chemistry at high spatial/temporal resolution and 3D
- Coupled multimodality characterization of energy materials
- Novel materials research for nuclear plants or materials in extreme conditions
- Electron-beam induced processes contributing to structural and chemical analysis

Micro-Sailboat Racing - Dale Hensley and Bernadeta Srijanto, Oak Ridge National Laboratory 2016 MSA Micrograph Contest Entry
P08  Geological Sample Characterization using Various Imaging Modalities
Lori A. Hathon, K.N. (Bobby) Hooghan, Michael J. Jercinovic, Bradley T. De Gregorio
- Correlating/ Registering data from multiple microscopy tools (e.g., Optical microscopy, Micro- and Nano-CT, SEM, EDS, EBSD, TEM, SIMS and NanoSIMS)
- Applications for oil/gas drilling, petrology, geochronology, mineralogy, and planetary science
- Emerging tool sets (Helium Ion Microscopy, Raman Microscopy, Auger Nanoprobe, etc.)
- 3D imaging; tools and applications
- Impacts of imaging conditions on image analysis and approaches for upscaling
- Real-time imaging and microanalysis

P09  Application of Advanced Characterization Methods to Examine Materials Used in Nuclear Power Systems
M. Grace Burke, Bryan D. Miller, Arthur T. Motta
- Stress corrosion cracking
- Corrosion fatigue
- General corrosion processes
- Fuel cladding
- Irradiation damage
- Welds

P10  Diamonds: From the Origins of the Universe to Quantum Sensing in Materials and Biological Science Applications
Nestor J. Zaluzec
- Diamond Knives—an historical retrospective
- Defects in diamond and color centers
- Nanodiamonds and stellar processes
- Engineered ultrananocrystalline diamond
- Excitonic defects and quantum computing using diamond
- Quantum sensing using diamond in materials and biological sciences
- Diamonds/Diamonoids and their applications

A01  Vendor Symposium
Paul Voyles, Esther Bullitt
- New methods and techniques; new developments and technologies
- Breakthroughs and new instrumentation
- Improvements to existing instrumentation

A02  Compressive Sensing, Machine Learning & Advanced Computation in Microscopy
Andrew Stevens, Rowan Leary, Volkan Ortalan
- Prototypes and simulations of computational imaging and spectroscopy
- Methods for decreasing radiation dose, acquisition time, and noise
- Feature extraction methods for biol/chem/physical properties
- Large datasets, intelligent summaries, inverse problems, imputation, super-resolution, visualization
- Quantitative comparisons showing improvement over traditional methods

A03  Big, Deep and Smart Data in Microscopy
Sergei V. Kalinin, Eric Stach
- Direct data streaming from electron and scanning probe microscopes
- Hyperspectral imaging and multivariate statistics
- Automatic feature finding, image segmentation, and compressed sensing approaches
- Physics-based multivariate and image recognition methods
- Extraction of materials properties from static and dynamic microscopy data
- Closing the loop between deep data and computational prediction

A04  Advances in Programming of Quantitative Microscopy for Biological and Materials Science
Hendrix Demers, Philippe Pinard
- Computer programs and user scripts applied to quantitative microscopy (x-ray, EELS, tomography, image processing, hyper-spectral imaging)
- Quantitative microscopy simulation codes (Monte Carlo, multi-slice, Bloch waves)
- Open source libraries (programming practices, community projects)
- Practical biological and materials applications of these programs in the SEM, EPMA, TEM/STEM, AEM

A05  Advances in FIB Instrumentation and Applications in Materials and Biological Sciences
Keana Scott, Nabil Bassim, Assel Aitkaliyeva
- Advances in ion-beam instrumentation
- Applications of ion-beam imaging
- FIB-milling applications for physical and biological sciences
- Advances in FIB-based 2D and 3D analytical techniques
- Novel FIB data acquisition and processing methods
- Practical data handling strategies for large data experiments
- Theoretical and experimental research on ion-solid interactions

A06  Bridging Length Scales with 2D, 3D, and 4D Multiscale/Multimodal Microscopy
Nikhilesh Chawla, James Evans, Arno P. Merkle
- Multimodal imaging spanning multiple length scales in 2D, 3D and 4D
- Materials Science and Life Science applications: commonalities and differences in multiscale imaging
- Strategies that combine multiple imaging methods into usable/scalable workflows
- Quantitative analysis and correlation of multi-scale microscopy datasets
- In situ (or 4D) imaging to study structural evolution in a multi-scale context

A07  Materials Characterization Using Atomic-scale EDX/EELS Spectroscopy
Ping Lu, Jian-Min Zuo, Mark Oxley
- Atomic-scale chemical imaging using EDX, EELS, and other analytical signals in STEM/TEM
- Advances in hardware, software and collection methods
- Experimental and theoretical modeling efforts in data interpretation and quantitative analyses
- Advanced materials characterization by combining STEM imaging, EDX and EELS
- Applications in resolving structures of defects, crystals, thin films and interfaces

An Emerging Story - Timothy Pegg, Miami University (OH)
2016 MSA Micrograph Contest Entry
A08  Advances and Applications of Aberration-Corrected Electron Microscopy
David Smith, David Muller
- Novel imaging and detector modes
- Resolution and dose limits
- Exploring aberration-corrected cryoEM
- Image processing, modeling and simulations
- Applications of probe-corrected and image-corrected instruments

A09  Standards, Reference Materials, and Their Applications in Quantitative Microanalysis
Julien Allaz, Anette von der Handt, Owen Neill
- The use of standards and reference materials in quantitative microanalysis, and the needs of the analytical community for improving such materials
- Synthesis, evaluation, distribution, and maintenance of standards and reference materials
- Development of new protocols for microanalytical techniques
- Applications of standard-based techniques to solving microanalytical problems

A10  Advances in Scanning Electron Microscopy: Transmission Modes and Channeling Effects
Robert Keller, Raynauld Gauvin, Shirin Kaboli
- Transmission imaging in the SEM (BF, DF, mixed imaging modes, Z-contrast, diffraction contrast)
- Transmission electron diffraction in the SEM (t-EBSD/TKD)
- Transmission spectroscopy in the SEM (EDS, EELS)
- Transmission methods in the helium ion microscope or FIB
- Electron channeling contrast imaging; Electron channeling patterns
- STEM-FIB channeling contrast imaging

A11  Instrumentation of Atom Probe: 50 Years and Counting
Ross Marceau, Prakash Kolli, Thomas Kelly
- State-of-the-art instrumentation development
- Correlative technique and instrumentation development
- Technique development with respect to specimen preparation
- Historical accounts of the people and technology of atom probe

A12  Reconstruction, Simulations, and Data Analysis in Atom Probe Tomography
Baptiste Gault, Arun Deveraj, David J. Larson
- New or alternative methods for atom probe data reconstruction
- Methods to correlate atom probe data with other microscopy or analysis techniques
- Investigation of artifacts and methods to correct atom probe data
- Data analysis, data mining techniques to extract information from APT datasets
- Numerical simulation and modeling of field evaporation

A13  Applications of Atom Probe Tomography
Michael Moody, Mathias Thuander, Didier Blavette
- APT characterization in the research and development of alloys and semiconductors
- Development of new applications of APT, in particular geological, biological and large-gap semi-conductor materials
- APT for atomic-scale analysis of microstructural evolution of materials in extreme environments
- APT applied with complementary characterization techniques enabling novel materials research

A14  Nanomechanical Characterization of Materials using Microscopy and Microanalysis Techniques
Sanjit Bhowmick, Andrew Minor, Daniel Kiener, Nan Li
- In-situ TEM and SEM characterization of elasticity, plasticity, cyclic deformation, and fracture of small-scale materials
- In-situ nanomechanical instrument and technique development
- Imaging and analytical techniques to correlate microstructures, defects, and strain fields with mechanical properties
- Nanomechanical tests under various environmental conditions such as high temperature, cryogenic temperature, irradiation, electrical and magnetic fields, gas, liquid and humidity

A15  Pushing the Limits of Cryo-TEM: Development and Applications
Mike Marko, Radostin Danev
- Sample preparation, including cryo-FIB
- EM instrumentation (cameras, phase plates, automation)
- Image processing for single-particle and tomographic reconstruction
- Applications using high-end technology

A16  In situ and operando Characterization of Material Processes in Liquids and Gases
Raymond Uncic, Guangwen Zhou, Libor Kovarik
- Liquid and gas cell microscopy, environmental tem, radiation chemistry
- Electrochemical processes, nucleation and growth, ultrafast electron microscopy
- Corrosion, catalysis, advanced data analytics

A17  Biological Soft X-ray Tomography
Carolyn Larabell, Kenneth Fahy
- Soft X-ray microscope instrumentation and optical systems
- Software for data processing and calculating tomographic reconstructions
- Modeling image formation in a soft X-ray microscope
- Specimen handling and cryo-preservation
- Correlation of soft X-ray tomography data with information from other modalities

A18  Celebrating 50 Years of Microanalysis
Paul Carpenter, Edward Vicenzi, Julie Chouinard
- Development and evolution of instrumentation in EPMA and SEM, including wavelength-dispersive and energy-dispersive spectrometry, field-emission sources, and computer integration
- History and advances in STEM-XEDS and -EELS, energy-filtered imaging, atom probe tomography, and scanning transmission X-ray microanalysis
- Theory of quantitative microanalysis, correction algorithms, and software tools for the analyst
- Education in microanalysis: from measurement to quantification for beginners to experts
- Advances in cathodoluminescence and micro-XRF spectrometry
- Opportunities and challenges for the next fifty years: novel approaches under development in microanalysis, future needs and trends
Talks Given by Pioneering Figures in Microscopy & Microanalysis

**MSA 75TH ANNIVERSARY LECTURE IN THE BIOLOGICAL SCIENCES:**

**Development of High-Resolution TEM for Imaging Native, Radiation-Sensitive Biomolecules**

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

Following the commercial introduction of “direct detection” cameras in ~2012, single-particle electron cryo-microscopy (cryo-EM) has produced atomic-resolution structures for a large number of biological macromolecules. This new capability requires that the native, hydrated structure be maintained during imaging, of course. This is something that, at first glance, is not compatible with putting specimens into the vacuum of the electron microscope. Furthermore, ionization damage happens so easily for such specimens that high-resolution features are too noisy to be discerned in images recorded with a “safe” exposure. While practical work-arounds have partially circumvented these problems, current results still fall well short of what is physically possible. Additional technical improvements are thus very welcome and, indeed, expected. These include reliable phase plates, which have just begun to appear, and cameras whose quantum efficiency is at least 2x-improved at high resolution.

**MSA 75TH ANNIVERSARY LECTURE IN THE PHYSICAL SCIENCES:**

**Smarter than an iPhone: The Emergence of the Modern Microscope**

Ondrej L. Krivanek, Nion R&D, Dept of Physics, Arizona State University

Much like mobile phones, microscopes in general and electron microscopes in particular have made great strides in sophistication, power and user-friendliness. The underlying technology is the modern microprocessor, which has automated the mundane, and made the sophisticated readily accessible. The progress has happened on many fronts:

- microscope optics, which can include several hundred independently adjustable optical elements, in order to resolve <0.5 Å and <10 meV
- autotuning algorithms, which are able to adjust tens of independent optical parameters in quasi-real-time, and make the instrument user-friendly despite all the optical elements “under the hood”
- detectors, which are getting close to the ultimate; capturing the X, Y, t (time) and E (energy) signature of every arriving electron
- analysis software, which is able to separate weak signals from noise and discern subtle data patterns in data sets amounting to many Gigabytes.

This talk will review the progress made, and provide practical examples of new capabilities.

**MAS 50TH ANNIVERSARY LECTURE IN THE ANALYTICAL SCIENCES:**

**Microanalysis: What is it, Where did it come from, and Where is it going?**

Dale E. Newbury, NIST Fellow, National Institute of Standards and Technology

“Microanalysis” in the Microanalysis Society parlance refers to spatially-resolved elemental and molecular analysis performed at the micrometer to nanometer to picometer scales. Our “founding father”, Raymond Castaing, achieved the first practical elemental microanalysis at the micrometer scale in his seminal PhD thesis of 1951, wherein he not only made the first successful microprobe instrument for electron-excited x-ray spectrometry but also described the physical basis for converting the measured x-ray intensities into concentration values. Electron-excited x-ray microanalysis has been the backbone of MAS and its predecessors (EPASA, the Electron Probe Analysis Society of America and the Microbeam Analysis Society), and it has been joined by other excitation beams (ions and photons) and spectrometries (ion, electron, and photon). Although every niche in excitation-detection combinations has been explored, present excitement comes from exploiting large scale data structures collected as multi-dimensional spectrum images with the advanced software systems that can mine these vast structures for the information contained therein. The future as always is unpredictable, but improvements in spatial resolution, efficiency, and specificity are likely.

**IFES LECTURE MARKING THE 50TH ANNIVERSARY OF THE INVENTION OF THE ATOM PROBE:**

**Microscopes without Lenses**

John A. Panitz, University of New Mexico

The first microscope without lenses, the Field Emission Microscope, was introduced in 1937. This talk will highlight the legacy of the Field Emission Microscope and its progenies: the Field Ion Microscope, the Topografiner, the Scanning Tunneling Microscope and the Atom-Probe. The Atom-Probe Field Ion Microscope was introduced in 1967. For the first time a microscope became available that could “… determine the nature of one single atom seen on a metal surface and selected from neighboring atoms at the discretion of the observer.” The paradigm shifted away from single atom analysis with the introduction of the 10 cm Atom Probe in 1973. Atom Probe Tomography was introduced in 1983 and provides the latest advance in the legacy of microscopes without lenses.
Professor Riles has also spent part of his research time in recent years studying the detector characterization, including calibration, and on detector commissioning. Of Michigan group. In addition, the group has carried out extensive work on LIGO using an algorithm called TwoSpect. Both programs were developed by the 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.

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.

- Best Practices for incorporating microscopy into K-12 classrooms and curricula
- Corporate and academic institutions and programs involved in microscopy outreach, both locally and nationally
- Methods to expose students to microscopy in an engaging and successful manner

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 Schwoley

- 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
- 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
- Put your name into a draw for the daily door prize

Microscopy Outreach
Technologists’ Forum Sessions

X30  Cryo-Tomography of Macromolecular Complexes in Whole Cells: Lessons in Cryo-FIB Milling and Vitreous Cryo-Sectioning
Janice Pennington and Frank Macaluso
- Cryo electron tomography imaging of macromolecular complexes in their native environment
- Basic techniques of cryo-FIB milling for wedges, lamellas and the lift-out technique
- Basic techniques of vitreous cryo-sectioning and identifying and avoiding artifacts
- Special considerations for specimen handling and preventing ice contamination

X31  Special Topic: Atomic Force Microscopy for Imaging and Materials/Biomaterials: Properties Characterization of Surfaces, Films and Interfaces
Caroline Miller
- AFM imaging of novel materials/biomaterials for understanding structure-function relationships
- Force Spectroscopy for characterization of materials/biological film properties
- Applications of Fast Scanning AFM, when temporal resolution is essential to the measurement
- Recent development in new AFM imaging methodologies

X32  Special Topic for 35th Anniversary: Developing and Applying Light Sheet Imaging Technology to the Study of Dynamic Biological Systems
Caroline Miller
- Light sheet microscopy, often referred to as single plane illumination microscopy (SPIM), is a rapidly emerging technology
- A technique to capture dynamic biological processes by combining optical sectioning with multiple-view imaging
- Ideal for examining all the way from a whole animal to single cells
- Able to view specimens labeled with fluorescent proteins and other fluorophores

How to Apply For an M&M Meeting Award:
1. As part of the online 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 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).

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. 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. 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. Full-time technologists are eligible. In addition, the applicant must be a member of the sponsoring society.

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.

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. Award winners are expected to attend and participate in the entire meeting, which runs from Sunday evening’s opening reception through late Thursday afternoon. Award winners are required to attend the Monday morning plenary session, at which their award will be conferred.
Sunday Short Courses

ORGANIZERS: Elizabeth Wright, Emory University, and Mike Marko, Wadsworth Center

> 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
- Introduction to low-temperature sample preparation, esp. high pressure freezing and rapid freeze substitution
- Correlative light and electron microscopy techniques
- Sample preparation methods for Array Tomography, Serial Block Face and Focused Ion Beam SEM imaging

X11 Immunolabeling Technology for Light and Electron Microscopy
LEAD INSTRUCTOR: Caroline Miller
- Specimen preparation considerations for optimizing morphological preservation and labeling efficiency for either light microscopy, electron microscopy, or both
- Consideration of the location of the antibody target within the cell or on its surface
- Matching the localization technique to the antigen of interest
- Correlative techniques bridging light and electron microscopy

X12 Practical Considerations for Image Analysis and ImageJ and Clemex Vision
LEAD INSTRUCTOR: James Grande
- Practical use of image analysis tools
- Image analysis as a problem solving tool
- Multiple imaging programs demonstrated
- Many real world examples

X13 3-D Reconstruction with SerialEM and IMOD
LEAD INSTRUCTOR: Cindi Schwartz
- Use of SerialEM for tilt series and other data acquisition
- Automated acquisition from multiple areas
- Tomographic reconstruction from cryo and room-temperature tilt series
- Automated batch processing of tilt series
- Reconstruction from serial sections and serial block face images
- Modeling, visualization, and analysis

X14 Detectors: If You Can’t Detect It, Then You Can’t Measure It
LEAD INSTRUCTOR: Nestor J. Zaluzec
- Understanding the characteristics of signals and noise
- Photon/optical/x-ray sensors
- Charged-particle (electron/ion) sensors
- Single-atom sensors
- EM-field sensors
- Quantum sensors
- High sensitivity vs. high speed
- Position-resolved sensors

X15 Variable Pressure and Environmental Scanning Electron Microscopy, What Can They Do For Me?
LEAD INSTRUCTOR: John Mansfield
- Imaging with secondary electrons, backscattered electrons and light, and the physics of each of the detection systems
- Optimizing the performance of variable-pressure and environmental scanning electron microscopes
- Use of novel contrast mechanisms
- Use of hot, cool, cold and mechanical-deformation stages
- Manufacturers’ latest innovations

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

Organizer: Donovan 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 Hirsch, 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

Please check the M&M 2017 website frequently for updates to the Tutorials offerings.
Pre-Meeting Congresses

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

**X60  Inaugural Pre-Meeting Congress for Students and Early-Career Scientists in Microscopy & Microanalysis**

**Saturday, August 5, 2017 | 8:30 AM - 5:00 PM**

**INCLUDED IN REGISTRATION FEE:**
- Breakfast, AM Break, Lunch, PM Break
  (Offsite social gatherings are being planned for Friday and Saturday evenings, as well.)

**Organized by MSA Student Committee**

**ORGANIZERS:**
- Program Chair: William J. Bowman, Arizona State University
- Program Co-Chair (Biological Sciences): A. Cameron Varano, Virginia Tech
- Program Co-Chair (Physical Sciences): Janet L. Gbur, Case Western Reserve

**Activities & Social Chair:** Ethan L. Lawrence, Arizona State University

Focus areas for this pre-meeting congress, organized by the MSA Student Committee, include:

- A unique opportunity to sample award-winning research from across the spectrum of microscopy & microanalysis disciplines
- A forum for early career professionals to deliver their M&M presentation to peers ahead of the main meeting
- Disseminating research and data in an engaging and interactive setting
- Expanding professional networks and engaging students and early career scientists attending the meeting and affiliated with the various societies represented at M&M 2017
- Career development mentoring from peers and recent graduates
- Best poster prize awarded by peer voting

**X61  Focused Ion Beam Applications and Equipment Developments**

**Sunday, August 6, 2017 | 10:00 AM – 5:00 PM**

**INCLUDED IN REGISTRATION FEE:**
- Lunch, PM Break

**Organized by the Focused Ion Beam (FIB) Focused Interest Group**

**ORGANIZERS:**
- Nicholas Antoniou, ReVera, Inc.
- Srinivas Subramaniam, Intel Corporation

Focused Ion Beam technology is used in a variety of fields from electronics to life sciences. The applications space can be divided into categories such as cryogenic FIB, Direct-write lithography, 3D structure creation etc. The topics will be grouped together into sessions as follows:

- TEM Sample prep
- Cryogenic FIB-SEM
- FIB Lithography and general patterning
- Gas Assisted etching and deposition
- Instrumentation, other

One hour will be allotted to each category with 2-3 papers and 20 minutes of open discussion. At the end of the congress, posters will be set up for informal interaction with the authors and participants.

**X62  Smaller, Faster, Better: New Instrumentation for Electron Microscopy**

**Sunday, August 6, 2017 | 8:30 AM – 5:00 PM**

**INCLUDED IN REGISTRATION FEE:**
- Breakfast, AM Break, Lunch, PM Break

**Organized by the Aberration-Corrected Electron Microscopy (ACEM) Focused Interest Group**

**ORGANIZERS:**
- Paul Voyles, University of Wisconsin
- Huolin Xin, Brookhaven National Laboratory
- Juan-Carlo Idrobo, Oak Ridge National Laboratory
- Philip M. Rice, IBM

Topical areas for this Pre-Meeting Congress include:

- Advances in detectors beyond CCDs and annular detectors
- Advances in electron optics: meV monochromation and low-voltage aberration correction
- New acquisition modes made possible by structured illumination and computational imaging modalities like compressed sensing
- Methods in data processing and simulation that support new techniques

The Congress will consist of invited talks and a poster session.

**X63  Understanding Radiation Beam-Damage during Cryo-, ETEM, Gas- and Liquid-Cell Electron Microscopy**

**Sunday, August 6, 2017 | 8:30 AM – 5:00 PM**

**INCLUDED IN REGISTRATION FEE:**
- Breakfast, AM Break, Lunch, PM Break

**Organizers:**
- Katherine Jungjohann, Sandia National Laboratories
- Taylor Woehl, University of Maryland
- Patricia Abellan, SuperSTEM Laboratory (UK)

- Radiation damage and main radicals produced during cryo, gas-phase, and liquid-EM studies
- Strategies for the control and mitigation of electron-beam induced damage
- Detailed analysis of radiolysis species and their impact on the environment
- Discussion of radiation tolerances for various materials, gases, and fluids during environmental EM imaging
- Effect of supports, membranes, small volumes involved, and temperature on imaging
- Goal of this workshop is to enhance the EM communities understanding of high-energy electron beam effects on cryo, gas and liquid containing environments and to develop collaborations for building knowledge between these communities

*Leaded Flowers - Eric Formo, University of Georgia 2016 MSA Micrograph Contest Entry*
Thank you to our Sustaining Members

As of October 1, 2016

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Advanced Microscopy Techniques Corp.
Angstrom Scientific, Inc.
Applied Physics Technologies, Inc.
AYO Technologies, Inc.
Birla Carbon Company
Boeckeler Instruments, Inc.
Bruker Nano Analytics
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