

Microscopy & Microanalysis 2020 Meeting

REGISTER NOW (<https://ww2.eventrebels.com/er/Registration/StepRegInfo.jsp?ActivityID=30847&StepNumber=1&v=M2Y2ZWY1NjYtOTgxNS00NDI2LWlxZD>)

FULL PROGRAM INFO (/MandM/2020/program/program_listing.cfm)

The M&M 2020 Virtual platform is STILL OPEN!

- Registered participants can view pre-recorded content (talks, recorded demos, plenary session, exhibitor booth content, etc.)
- Interact with other participants – attendees and exhibitors – via text chat (video functions not available).
- The platform will close permanently on 7-September, 2020.
- Some talks have been removed per the presenter's request.

Have a colleague or co-worker who missed the meeting? Registration is open until Friday, August 21!

Click **HERE** ([https://ww2.eventrebels.com/er/Registration/StepRegInfo.jsp?](https://ww2.eventrebels.com/er/Registration/StepRegInfo.jsp?ActivityID=30847&StepNumber=1&v=NTY0NmMzMzODMtZGY2NS00YWVWZGZyM2M0OWE2ODI2LWlxZD)

[ActivityID=30847&StepNumber=1&v=NTY0NmMzMzODMtZGY2NS00YWVWZGZyM2M0OWE2ODI2LWlxZD](https://ww2.eventrebels.com/er/Registration/StepRegInfo.jsp?ActivityID=30847&StepNumber=1&v=NTY0NmMzMzODMtZGY2NS00YWVWZGZyM2M0OWE2ODI2LWlxZD)) to register.

(Same registration rates apply.)

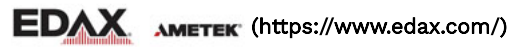
We want your feedback!

Please complete the short survey below by September 1st.

TAKE THE SURVEY (<https://www.surveymonkey.com/r/KXDFHM3>)

2020 Sponsors





(https://www.microscopy.org/)

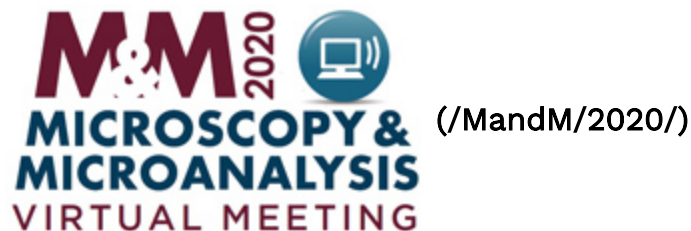


(http://www.microbeamanalysis.org/)

Copyright © 2023 Microscopy Society of America

1130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 - Tel: (703) 234-4115 - Fax: (703) 234-4147

Email: **Association Management** (mailto:AssociationManagement@microscopy.org) - **Terms of Use** (/terms.cfm)



Full Symposium Descriptions

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

Analytical Sciences Symposia

A01 - Advances in Modeling, Simulation, and Artificial Intelligence in Microscopy and Microanalysis for Physical and Biological Systems

ORGANIZERS:

Yi Jiang, Argonne National Laboratory

Huihuo Zheng, Argonne National Laboratory

Colin Ophus, Lawrence Berkeley National Laboratory

Ellen Keene, Dupont Inc.

Numerical modeling, simulation, data analysis, and visualization are crucial steps in microscopy research. This symposium will feature recent advances in simulation, image reconstruction, data acquisition and analysis workflow. Topics include, but not limited to, novel algorithms (e.g. artificial intelligence, machine learning, forward and inverse modeling, and compressed sensing), high-performance computing, and open-source software for microscopy data. We also encourage discussion of practical challenges and solutions in applying advanced algorithms to real experimental datasets.

INVITED SPEAKERS:

- Hamish Brown, Lawrence Berkeley National Laboratory
- Michelle Driscoll, Northwestern University

- Scott Findlay, Monash University, Australia
- Sergei Kalinin, Oak Ridge National Laboratory
- Christoph Koch, Humboldt University of Berlin, Germany
- Hari Krishnan, Lawrence Berkeley National Laboratory
- Phillip Lin, DuPont Inc.
- Alex Lu, University of Toronto, Canada
- Nicolas Piché, Objects Research Systems Inc., Canada
- David Ren, University of California, Berkeley

A02 - Four-Dimensional Scanning Transmission Electron Microscopy (4D-STEM): New Experiments and Data Analyses for Determining Materials Functionality and Biological Structures

ORGANIZERS:

David Muller, Cornell University

Damien McGrouther, University of Glasgow, United Kingdom

Jinwoo Hwang, The Ohio State University

4D-STEM using fast-pixelated detectors has opened tremendous possibilities in the characterization of materials, allowing both physical and life sciences to push to new limits in determining structure and functionality. Through 4D-STEM, great progress has been realized in, for example, electron ptychography for extreme spatial resolution, differential phase contrast imaging of electromagnetic fields, and new imaging methods based on diffraction contrast resolved in multiple dimensions. The symposium will cover the most recent advances and common challenges in 4D-STEM of physical and biological materials, including data acquisition, algorithms and theory for data analysis, new instrumental capabilities and looking further beyond.

INVITED SPEAKERS:

- Paul Midgley, University of Cambridge, UK
- Andrew Minor, University of California Berkeley
- Lena Kourkoutis, Cornell University
- Lothar Houben, Weizmann Institute of Science, Israel
- Knut Muller, Jülich Forschungszentrum, Germany
- Joanne Etheridge, Monash University, Australia
- Laura Clark, University of Oxford, UK
- Colum O'Leary, University of Oxford, UK
- Zhen Chen, Cornell University

A03 - Impact of Recent Advancement in Instrumentation/Detectors on Electron Energy Loss Spectroscopy for Physical and Biological Sciences

ORGANIZERS:

Toshihiro Aoki, University of California-Irvine

William Bowman, University of California-Irvine

Steven R Spurgeon, Pacific Northwest National Laboratory

Fredrik S Hage, SuperSTEM, United Kingdom

Electron energy-loss spectroscopy (EELS) has progressed substantially in recent years. Advancements in electron monochromator and EEL spectrometer design, along with improvements in detector performance, have made possible the exploration of elemental, structural, electronic, and vibrational properties of materials at the nanometer to atomic scales. It would be beneficial for the scientific community to review recent research progress in EELS. Topics covered include (but are not limited to), low-energy transitions, aloof EELS, elemental/fine structure mapping, and temperature effects, especially research pushing the frontier of science by combining new acquisition and processing methods with advanced instrumentation.

INVITED SPEAKERS:

- Richard D Leapman, National Institutes of Health
- Duncan Alexander, The École polytechnique fédérale de Lausanne (EPFL), Switzerland
- Berit H Goodge, Cornell University
- Odile Stéphan, University Paris-Sud, France
- Renu Sharma, National Institute of Standards and Technology (NIST)
- Xingxu Yan, University of California, Irvine
- Guillaume Radtke, Université Pierre et Marie Curie - CNRS, France
- Robert Klie, University of Illinois at Chicago
- Peter Crozier, Arizona State University
- Peter Rez, Arizona State University

A04 - Pushing the Limits of Detection in Quantitative (S)TEM Imaging, EELS, and EDX

ORGANIZERS:

Christian Dwyer, Arizona State University

Paul Voyles, University of Wisconsin-Madison

Philip Batson, Rutgers University

Ye Zhu, Hong Kong Polytechnic University, Hong Kong

Advances in (S)TEM electron optics and detection systems enables the isolation of increasingly weaker scattering signals, which in turn enables both the characterization of subtle structural features within materials and the characterization of radiation-sensitive materials via lower beam doses. For example, STEM-HAADF imaging of individual, heavier dopant atoms within bulk materials is made possible by aberration correction and the high sensitivity of HAADF detectors. As another example, the recent advent of direct electron detectors enables TEM imaging experiments which elucidate the atomic structure of beam-sensitive materials such as zeolites and metal-organic frameworks. Improved detectors also allow a more complete quantification of EELS scattering, for instance, single scattering analyses very close to energy resolution limits in phonon/vibrational scattering. In many cases, data processing, electron scattering simulations and/or materials modeling also play crucial roles. In this symposium, we welcome contributions reporting on such utilizations of weak signals in (S)TEM, EELS and EDX for the characterization of materials, combining advances in instrumentation, image/signal processing, scattering theory, and materials modeling. We also welcome contributions reporting on advances in technique — experimental design, instrumentation, and/or numerical post-processing — that extract subtle, but important detail that might be otherwise be overlooked using standard techniques.

INVITED SPEAKERS:

- Rebecca Nicholls, University of Oxford, UK
- Rhonda Stroud Naval Research Laboratory

A05 - Crystallography at the Nanoscale and MicroED with Electrons and X-rays

ORGANIZERS:

Huifang Xu, University of Wisconsin-Madison

J. G. Wen, Argonne National Laboratory

M. C. Cherukara, Argonne National Laboratory

Marija Gajdardziska, University of Wisconsin-Milwaukee

This symposium will cover full 3D nanocrystal structure and strain determination, including 3D bulk structure, surface structure, crystal defects, nano-precipitates and chemical order/disorder such as grain boundaries, dislocations, impurities and point

defects, etc. using electrons and X-rays. This symposium focuses on the latest techniques, theory and algorithms to achieve atomic-resolution 3D tomography using aberration-corrected electron beam, coherent electron & X-ray diffraction imaging, precession electron diffraction, as well as their applications in functional materials, biological and natural crystals.

INVITED SPEAKERS:

- Tamir Gonen, UCLA
- Petr Brázda, Czech Academy of Sciences Na Slovance, Czech Republic
- Mariana Klementova, Institute of Physics of the CAS, v.v.i., Czech Republic
- Partha Pratim Das, ManoMegas, Belgium
- J. M. Zuo, UIUC
- Paul Voyles, University of Wisconsin - Madison

A06 - Direct Phase Imaging with Coherent Electron Beam in TEM

ORGANIZERS:

Myung-Geun Han, Brookhaven National Laboratory

Lin Zhou, Ames Laboratory

Kai He, Clemson University

Martha McCartney, Arizona State University

Phase imaging with coherent electron beam allows unique access to weak phase objects and magnetic/electric fields down to the atomic scale, providing indispensable experimental data for understanding diverse material properties and designing novel devices. This symposium is intended to facilitate the exchange of information and scientific discussion regarding the recent progress, challenges and future directions of phase retrieval methods in TEM and their latest applications to hard, soft, and biological materials.

INVITED SPEAKERS:

- David J. Smith, Arizona State University
- Rafal Dunin-Borkowski, Forschungszentrum Jülich, Germany
- Tsukasa Hirayama, Japan Fine Ceramics Center, Japan
- Joseph A. Garlow, Stony Brook University
- Marco Beleggia, Technical University of Denmark, Denmark

A07 - Advances in Quantitative Electron Beam Microanalysis (EDS and WDS)

ORGANIZERS:***Stephen Seddio, Thermo Fisher Scientific******Philippe Pinard, Oxford Instruments******Paul Carpenter, Washington University******Nicholas Ritchie, National Institute of Standards and Technology***

What will the compositional measurement instrument of the future look like? How can quantitative electron probe microanalysis be improved to address the characterization challenges in materials and geological sciences (smaller phases, lower concentration elements, higher accuracy, larger data size, etc.)? This symposium will seek to answer these questions by featuring advances in hardware and software for energy- and/or wavelength-dispersive spectrometers installed on either electron microprobes or scanning electron microscopes.

INVITED SPEAKERS:

- William Nachlas, Syracuse University
- Yu Yuan, McGill University, Canada
- Heather Lowers, GS
- Christopher Marvel, Lehigh University
- Aurelien Moy, University of Wisconsin
- Alexandra Valencia Villa, University of Wisconsin
- Nicholas Ritchie, NIST
- John Fournelle, University of Wisconsin

A08 - Electron- and Synchrotron-Based X-Ray Imaging and Analysis**ORGANIZERS:*****Jeffrey Davis, EOS GmbH, Germany******Nikolaus Cordes, Idaho National Laboratory******Eric Telfeyan, GE Global Research******Richard Wuhler, University of Western Sydney, Australia***

This session will bring together researchers performing X-ray imaging with a variety of techniques, including micro-focused X-ray tube methods such as micro XRF, XRD and CT and synchrotron-based coherent beam methods such as X-ray absorption spectroscopy, soft X-ray imaging and holography. We are also actively seeking contributions from

researchers using electron beam methods such as SEM-EDS mapping, specifically those doing area fraction phase analysis and hyperspectral clustering. We are soliciting contributions from vendors with new detectors, mapping hardware and software.

INVITED SPEAKERS:

- Matthias Alfeld, TU Delft, Netherlands

A09 - Surface and Subsurface Microscopy and Microanalysis of Physical and Biological Specimens

ORGANIZERS:

Vincent Smentkowski, General Electric - Research

John A Chaney, The Aerospace Corporation

Xiao-Ying Yu, Pacific Northwest National Laboratory

Igor Sokolov, Tufts University

Surface properties dictate the performance of many physical and biological systems. The surface analyst is asked to detect and image species present in ever-lower concentrations and within ever-smaller spatial and depth dimensions. This symposium emphasizes state-of-the-art surface analytical instrumentation encompassing all aspects of surface and near-surface analyses, such as mass spectrometry, scanning probe microscopy and other probe-based techniques. We will cover advanced data analysis tools; correlative imaging (e.g., AFM and SEM; AFM and SIMS; FIB-SIMS); the use of complementary surface instrumentation to perform a complete analysis of complex systems; quantitative microanalysis; data processing; and surface analytical challenges. Both platform and poster presentations are encouraged.

INVITED SPEAKERS:

- Dario Stacchiola, Brookhaven
- Jason Killgore, NIST
- Xiaoji Xu, Lehigh University
- Thomas Mueller, Bruker Nano
- Greg Haugstead, University of Minnesota
- Peter Grutter, McGill U., Canada
- Felix Kollmer, ION TOF
- Greg Fisher, Physical Electronics
- Chris Moffitt, Kratos
- Ashley Ellsworth, Physical Electronics

- Juergen Scherer, Evans Analytical
- Tim Nunney, Thermo, UK
- Hugues Francois Saint Cyr, Cameca, France
- Sarah Zaccarine, Colorado School of Mines
- Andrei Kolmakov, NIST

A10 - Structural changes in Hard, Soft, and Biological Samples During Imaging: From Transmission Electron to Helium Ion Microscopy

ORGANIZERS:

Jani Kotakoski, University of Vienna, Austria

Gregor Hlawacek, Helmholtz-Zentrum Dresden-Rossendorf, Germany

Olga Ovchinnikova, Oak Ridge National Laboratory

Arkady Krasheninnikov, Helmholtz-Zentrum Dresden-Rossendorf, Germany

Sample degradation in both inorganic and organic materials during imaging is a major problem in transmission electron microscopy. Defects can appear due to kinetic energy transfer from energetic electrons to target atoms, through thermal and electronic excitations or beam-mediated chemical etching. Similar processes also occur in helium ion microscopy. However, structural changes can also be used for modifying the atomic structure of the sample and engineering its properties. We bring together microscopists and experts in atomistic simulations to discuss the current understanding of damage production mechanisms in these microscopy techniques.

INVITED SPEAKERS:

- Ray Egerton, University of Alberta, Canada
- Peter Hosemann, UC Berkeley
- Kazu Suenaga, AIST, Japan
- Toma Susi, University of Vienna, Austria
- Sarah Haigh, University of Manchester, UK
- Elena Besley, University of Nottingham, UK
- Jani Köster, University of Ulm, Germany

~~A11 - Standards, Reference Materials, and their Applications in Quantitative Microanalysis~~

A11 HAS BEEN MERGED WITH OTHER SYMPOSIA

Sponsored by the MSA/MAS Focused Interest Group on Microanalytical Standards (FIGMAS).

ORGANIZERS:

Anette von der Handt, University of Minnesota

William Nachlas, Syracuse University

Owen Neill, University of Michigan

Julien Allaz, ETH Zürich, Germany

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

A12 - High-Resolving Power, Multi-Modal and Correlative SIMS Imaging in Biology, Geology, and Materials

ORGANIZERS:

Jerry Hunter, University of Wisconsin-Madison

Gregory Fisher, Physical Electronics

Christopher Anderton, Pacific Northwest National Laboratory

Tom Wirtz, Luxembourg Institute of Science and Technology (LIST), Luxembourg

This symposium will bring together experts in 2 and 3-dimensional Secondary Ion Mass Spectrometry (SIMS) imaging combined with other morphological, orientation, elemental and molecular imaging techniques (e.g., SEM/EDS, HIM, TEM, EELS, EBSD, APT, SPM, Auger, Raman, MALDI, etc). Topics will include: FIB-SIMS for 3D analysis of heterogeneous materials and buried interfaces; correlative SIMS, Raman and Atom Probe Tomography for geological applications; biological SIMS including correlation with other MS imaging approaches; 2D materials & monolayer films (correlation with Auger, SEM/TEM and morphology with AFM); correlative SIMS, AFM, XPS and Auger analysis for fuel cells, capacitors, batteries, and other industrial applications.

INVITED SPEAKERS:

- Tyler Blum, University of Wisconsin - Madison
- Olivier de Castro, Luxembourg Institute of Science and Technology, Luxembourg
- Mary Kraft, University of Illinois - Urbana-Champaign
- Matthew Steinhauser, Harvard University

A13 - Microscopy and Microanalysis of Biomineralized and Biomimetic Materials and Structures**ORGANIZERS:*****Sue Okerstrom, Lichen Labs LLC******Kenneth Livi, Johns Hopkins University******John Fournelle, University of Wisconsin-Madison******Benjamin Linzmeier, University of Wisconsin-Madison***

Nature builds functional systems with a handful of materials that have emergent properties at different scales. Calcite crystals form both the self-sharpening teeth sea urchins grind into rock, and armor protection on exoskeletons of some ants. Organic molecules are assembled to produce structural color in butterfly wings and peacock feathers, super-hydrophobic lotus leaves, low-friction sharkskin, and super-adhesive gecko feet. In addition, minerals grown with biological influence are important archives of Earth history and offer new frontiers for materials biomimicry research. Microscopy and microanalysis are important in characterizing material structure and chemistry to elucidate biomineralization mechanisms and the processes responsible for properties emergent on the macroscopic scale. This symposium aims to bring together analysts from broad perspectives to share successes and difficulties of measurement of both hard and soft materials from natural, biomimetic, or engineered materials utilizing a variety of radiation sources and detection systems.

INVITED SPEAKERS:

- Yannike Dauphin, MNHN Paris, France
- Cayla Stifler, UW-Madison
- Yihang Fang, UW-Madison
- Greg Doerk, Brookhaven National Laboratory

A14 - Vendor Symposium

ORGANIZERS:***Yimei Zhu, Brookhaven National Laboratory******Melanie Ohi, University of Michigan******Mike Marko, Wadsworth Center***

This symposium is a forum for vendors to highlight important breakthroughs in technology and methodology developed by companies working at the cutting edge of microscopy, microanalysis, and image processing. It covers new instrumentation, technologies and methods that advance all the fields of microscopy and microanalysis for both physical and biological sciences. It will provide an open forum for exchange of ideas and best practices.

INVITED SPEAKERS:

- Chunguang Jing, Euclid Techlabs LLC
- Tracy Lovejoy, Nion Co.

Biological Sciences Symposia

B01 - 3D Structures: From Macromolecular Assemblies to Whole Cells (3DEM FIG)

ORGANIZERS:***Melanie Ohi, University of Michigan******Debbie Kelly, Pennsylvania State University******Teresa Ruiz, University of Vermont******William Rice, NYU Langone Health***

Our understanding of the 3D structure and functional subtleties of complex biological systems has skyrocketed due to recent advances in EM imaging technology and hybrid methodologies. This symposium will highlight structural studies of macromolecules, microorganisms, cells, and tissues using state-of-the-art high-resolution techniques. These techniques include single particle cryo-EM, cryo-electron tomography, helical reconstruction, STEM; AFM, X-ray crystallography, and molecular modeling. Biological topics of interest include cellular architecture, metabolism, trafficking, communication, and division; gene regulation, transcription, and translation; host-pathogen interactions and virus structure; *in situ* studies using TEM and SEM, and all aspects of structure-function studies of biological assemblies.

INVITED SPEAKERS

- Janet Iwasa, University of Utah School of Medicine
- Rebecca Voorhees, Caltech
- Ashleigh Raczkowski, New York Structural Biology Center
- Kem Sochacki, National Heart Lung and Blood Institute, NIH
- Erica Saphire, The Scripps Research Institute

B02 - The Promise of Cryo-Electron Tomography**ORGANIZERS:**

Tommi A. White, University of Missouri

Wim Hagen, EMBL Heidelberg, Germany

Cheri Hampton, UES, Inc. AFRL/RXS

Cryo-electron tomography (CryoET) images a vitrified biological specimen at different tilt angles to make a 3D reconstruction. Imaging limitations are electron dose, tilt-dependent sample thickness, and the current inability to tilt a sample 180 degrees. Sample limitations are thickness and preparation efficiency, especially when preparing cryo-FIB lamellae. Combined with recent technological (direct detection, deep learning), the field of cryo-ET is technically challenging, yet rife with discovery. This session will give an overview of cryoET topics including specimen vitrification, lamella preparation, microscope operation and data collection schemes, reconstruction methods, sub-volume averaging algorithms and data management.

INVITED SPEAKERS

- Alberto Bartesaghi, Duke
- Dmitry Tegunov, Max Planck Institute for Biophysical Chemistry, Germany
- Tao Ni, University of Oxford, England
- Yunjie Chang, Yale University
- Bryan Sibert, University of Wisconsin-Madison
- William Wan, Vanderbilt
- Rui Yan, Janelia, HHMI
- George Chreifi, Cal Tech
- Florian Schur, Institute of Science and Technology, Austria
- Patrick Hoffman, Cambridge, England
- Paula Perez Navarro, Harvard
- Beata Turonova, EMBL-Heidelberg, Germany

B03 - Methods and Applications in Localization-Based Super-Resolution Microscopy

ORGANIZERS:

Aaron Taylor, University of Michigan School of Medicine

Jesse Aaron, Janelia Research Campus

Damon Hoff, University of Michigan

Single molecule localization microscopy (SMLM) utilizes a large sequence of sparse, single molecule fluorescence images to achieve super resolution via estimating the location of many individual fluorophores within a sample. The final 'image' is a graph of the collection of these location estimates. Many probe labeling strategies, both genetic and organic, are now available that provide bright fluorescence as well as the requisite sparse activation. Creative hardware designs based on point-spread function engineering or interferometry can achieve different degrees of axial (z) localization precision as well as different imaging depths, depending on experimental requirements. Using appropriate dyes, image processing algorithms, and system design, sub-20 nm localization precision in x, y, and z can be routinely achieved. This high-localization precision, along with single-molecule sensitivity, has enabled a wide range of biological imaging applications such as sub-diffraction single molecule tracking, very high resolution (50-100 nm) imaging of multiple targets, and even structural reconstructions of macromolecular complexes (<10 nm) where particle averaging is applicable. Methods for fusing SMLM images with other imaging modalities are beginning to emerge.

INVITED SPEAKERS

- Cathy Galbraith, Oregon Health Sciences University
- Elias Puchner, University of Minnesota
- Hu Cang, Salk Institute
- Julie Biteen, University of Michigan

B04 - Jim Pawley Memorial Symposium

ORGANIZERS:

Martin Wessendorf, University of Minnesota

Elizabeth Wright, University of Wisconsin-Madison

James Pawley was known for his contributions in both electron microscopy and in light microscopy. Jim was particularly known for his editing of the Handbook of Biological Confocal Microscopy through its three editions, and for his teaching and mentoring of students via the course "3D Microscopy of Living Cells", which was taught at University of British Columbia. This symposium will provide remembrances of Jim's influential life, as well as speakers on correlational microscopy, which stands at the intersection of light and electron microscopy, and on the new developments in technology fueling each of these two fields.

INVITED SPEAKERS

- Michelle Peckham, Leeds University, Great Britain
- J. Paul Robinson, Purdue University
- Martin Wessendorf, University of Minnesota
- William Bement, University of Wisconsin

B05 - Microbes in Focus

ORGANIZERS:

Elizabeth Wright, University of Wisconsin-Madison

Kristin Parent, Michigan State University

Our understanding of the structure and function of microbes and microbial communities has advanced significantly with the application of optical and electron microscopy techniques and correlative imaging and analysis methodologies. This symposium highlights structural and ultrastructural studies of bacteria, archaea, fungi, protists, and viruses using microscopy techniques singly or combined with other structural methods. Topics will include microbe architecture and function; microbe-host interactions; species diversity in microbial communities; microbial community structure and function; and interactions, signaling, and sensing in microbial communities. Contributions presenting novel microscopic tools, methods development, and education outreach are strongly encouraged.

INVITED SPEAKERS

- Benjamin Orlando, Harvard
- Robert Kirchdoerfer, University of Wisconsin, Madison
- Simon White, University of Connecticut
- Terje Dokland, University of Alabama, Birmingham
- Edward Egelman, University of Virginia

B06 - Correlative and Multimodal Microscopy and Imaging of Physical, Environmental, and Biological Sciences

ORGANIZERS:

Xiao-Ying Yu, Pacific Northwest National Laboratory

Si Chen, Argonne National Laboratory

James Fitzpatrick, Washington University School of Medicine

Jacob Hoogenboom, Delft University of Technology, The Netherlands

Real-world systems encompass large differences in sizes, arrangements, complexity, and operating principles, presenting scientific and technical challenges. Innovated imaging techniques in microscopy and microanalysis play a pivotal role in enabling observations across different space and time scales. This has led to advances in biology, catalysis, and energy storage, amongst others. This symposium will highlight advancement in sample preparation/handling, instrument development, and analysis of multimodal data sets. We seek contributions from novel applications in correlative electron microscopy, spectroscopy, imaging mass spectrometry (i.e., SIMS), x-ray microscopy and tomography or those addressing big data challenges in visualization and data mining of such measurements.

INVITED SPEAKERS

- Hua (Terry) Tian, Penn State Univ.
- Rachel Templin, EMBL Heidelberg, Germany
- Derk Joester, Northwestern University
- Mary Kraft, Univ. of Illinois, Urbana Champaigne

B07 - Biomedical and Pharmaceutical Research on the Development, Diagnosis, Prevention, and Treatment of Diseases

ORGANIZERS:

Ru-ching Hsia, University of Maryland-Baltimore

Daniel Skomski., Merck & Co. Inc.

Claudia López, Oregon Health & Science University

Annie Muske-Dukes, ThermoFisher Scientific

Microscopy is critically important in the research, detection, diagnosis, and therapeutic treatment of diseases. Advances that improve rapid and accurate detection and innovation in drug design and delivery often involve the use of various microscopic and analytical techniques in research, clinical, and manufacturing settings. Discussed will be diverse

content related to the research and diagnosis of diseases in humans, plants, and animals, as well as drug discovery, formulation, and commercialization. Content will feature the use of advanced microscopy and imaging techniques to understand disease mechanisms, early detection, therapeutic intervention, drug delivery, and drug formulation across diverse modalities. Emphasis is placed on using the latest microscopy techniques as well as addressing data integrity and regulatory challenges.

INVITED SPEAKERS:

- Amanda Pluntze, Lonza
- Bill Bement, University of Wisconsin, Madison
- Surya Narayanan, University of Illinois, Chicago
- Qizhen Shi, Medical College of Wisconsin
- Xiangyu Ma, U. of Texas - Austin
- Jiwen Zheng, FDA
- Niyanta Kumar, Merck
- Kevin Eliceiri, University of Wisconsin at Madison
- Cam Robinson, St Jude Children's Research Hospital

B08 - Biological Soft X-Ray Tomography

ORGANIZERS:

Carolyn Larabell, University of California-San Francisco

Kenneth Fahy, SiriusXT

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

INVITED SPEAKERS:

- Venera Weinhardt, Heidelberg University, Germany
- Sergey Kapishnikov, Weizmann Institute, Israel
- Kate White, University of Southern California
- Michal Hammel, Lawrence Berkeley National Laboratory

B09 - Image Processing Developments in Cryo-EM

ORGANIZERS:

Michael Cianfrocco, University of Michigan

Tim Grant, University of Wisconsin-Madison

The focus of this symposium is on the latest advancements in image processing within the cryo-EM field. Invited papers would include those describing new methods and algorithms aimed at improving the results obtained from cryo-EM processing. Specific examples include improving the resolution of single-particle reconstructions and sub-tomogram averages, new ways of dealing with sample heterogeneity, automated processing pipelines, and the use of deep learning techniques. The target audience includes those currently using or planning to use cryo-EM methods who are interested in what is possible using the latest image processing methodologies, and those with a general interest in image processing.

INVITED SPEAKERS:

- Steven Ludtke, Baylor College of Medicine
- Chuck Sindelar, Yale School of Medicine
- Alberto Bartesaghi, Duke University
- Ghoncheh Mashayekhi, University of Wisconsin-Milwaukee
- Dimitry Tegunov, Max Planck Institute for Biophysical Chemistry, Germany
- Ellen Zhong, Massachusetts Institute of Technology

B10 - 3D Scanning Electron Microscopy Imaging of Biological Samples

ORGANIZERS:

Mrinalini Hoon, University of Wisconsin-Madison

Josh Morgan, Washington University of St. Louis

This symposium will discuss current techniques for reconstructing biological samples in 3D using scanning electron microscopy (SEM) techniques. Invited speakers will cover ATUM (automatic tape-collecting ultramicrotome) based SEM reconstruction techniques, serial block face SEM and focused ion beam SEM (FIB-SEM) reconstructions of biological preparations. The topics covered in this symposium will enable the audience to gather a comprehensive understanding of the current SEM-based approaches to perform 3D reconstructions of biological samples; understanding the pros and cons associated with each technique; and insights into the softwares used for alignment and segmentation of

EM stacks and the analyses routines associated with the different methods. Target audience will include cell biologists, scientists studying cellular ensembles and circuits, and scientists interested in SEM imaging and diverse applications of SEM.

INVITED SPEAKERS:

- Shan Xu, Janelia Research Campus
- Wan-Qing Yu, University of Washington

B11 - Advances in Imaging Approaches for Plant Biology

ORGANIZERS:

Marisa S. Otegui, University of Wisconsin-Madison

Kirk Czymmek, Donald Danforth Plant Science Center

This symposium will promote the exchange of knowledge in the development and application of different microscopy modalities in plant cell biology. Invited talks will discuss applications of emerging imaging techniques (e.g. super-resolution, clearing, label-free, Raman, electron microscopy, cryo-electron microscopy) as well as approaches for correlation across scales and imaging and analysis modalities in plant research. The target audience will include cell biologists, plant biologists, and engineers interested in technical challenges and opportunities for imaging plant cells.

INVITED SPEAKERS:

- Federica Brandizzi, Michigan State University
- Kun Huang, University of Delaware
- Keith Duncan, Donald Danforth Plant Science Center
- Kirk Czymmek, Donald Danforth Plant Science Center
- Kaija Goodman, University of Wisconsin-Madison

B12 - Illuminating Health and Disease at New Frontiers of Spatiotemporal Resolution and Adaptive Microscopy

ORGANIZERS:

Jay Potts, University of South Carolina

Rengasayee Veeraghavan, The Ohio State University

This symposium presents four important frontiers that have recently transformed optical imaging, including (i) the various methods in breaking the diffraction limit to achieve super-resolution microscopy, (ii) the renaissance of selective plane illumination (light sheet)

microscopy, (iii) the integration of adaptive methods into optical microscopy to correct for the heterogeneity in refractive indices, dynamic changes in sample size during development of living specimens, and (iv) emerging methods to image live samples at unprecedented temporal resolution. In turn, these technologies have ushered in an era of big data, which brings new computational challenges as well as the promise of heretofore unachievable rich, quantitative descriptions of living systems. In this symposium, we aim to highlight the exciting possibilities and hurdles faced by modern optical microscopy. In addition, the symposium will cover new developments and techniques used to image life as never before.

INVITED SPEAKERS:

- Christian Soeller, University of Exeter, UK
- Przemyslaw Radwanski, The Ohio State University
- Edward Boyden, MIT
- Martin Wessendorf, University of Minnesota

Physical Sciences Symposia

P01 - Advances in Electron Microscopy to Characterize Materials Embedded in Devices

ORGANIZERS:

Andre Mkhoyan, University of Minnesota

Nasim Alem, The Pennsylvania State University

Research in electronics, optics, and spintronics continues to grow rapidly as new materials are synthesized and incorporated into novel devices. Whereas nanoscale characterization of these materials in their free-standing states is routinely performed, characterization of these materials while they are embedded in their device application remains relatively unexplored. Full characterization of materials in devices would require establishing techniques to overcome unique challenges in sample preparation, data collection and analysis. This symposium will highlight advances in innovative sample preparation as well as novel imaging and spectroscopy techniques using analytical TEM/STEM and SEM to obtain information relevant to devices.

INVITED SPEAKERS:

- Danielle Reifsnnyder Hickey, The Penn State University
- Bharat Jalan, University of Minnesota
- Jinwoo Hwang, The Ohio State University
- Matthieu Bugnet, McMaster University, Canada

P02 - New Frontiers in Electron Microscopy of Two-Dimensional Materials

ORGANIZERS:

Pinshane Huang, University of Illinois — Urbana-Champaign

Robert Hovden, University of Michigan

Shize Yang, Brookhaven National Laboratory

2D materials are ideal systems for electron microscopy: they are a rapidly growing class of quantum systems with emergent electronic properties, low-background imaging substrates, and idealized atomically thin test structures for demonstrating methods at the frontiers of electron microscopy. Furthermore, because a single projection image may entirely describe their atomic arrangements, 2D materials are an unparalleled platform for studying the relationships between structure and properties with single atom precision. This symposium seeks to highlight symbiotic developments in electron microscopy and the study of 2D materials, with a focus towards emergent quantum phenomena and pioneering techniques in electron microscopy utilizing 2D materials.

INVITED SPEAKERS:

- Ute Kaiser, University of Ulm, Germany
- David Muller, Cornell
- Jamie Warner, UT Austin
- Jani Kotakoski, University of Vienna, Austria
- Yimo Han, Princeton
- Rebecca Engelke, Harvard
- Sarah Haigh, University of Manchester, UK

P03 - Energy and Soft Materials and the Development of Cryogenic Techniques for Studying Them

ORGANIZERS:

Meng Gu, Southern University of Science and Technology, China

Ruoqian Lin, Brookhaven National Laboratory

Chongmin Wang, Pacific Northwest National Laboratory

Kai He, Clemson University

Cryo-TEM has been traditionally used in the study of biological science. However, recently scientists found it very useful in the study of materials science. The advantage of cryo-TEM lies in the reduced damage to radiation-sensitive materials, for instance, batteries, catalysts, organic-inorganic solar cells, and metal-organic frameworks, etc. This symposium welcomes abstracts in all areas of energy-related materials and soft matters studied using cryo-TEM/STEM, as well as cryo-EELS/EDS spectroscopy techniques.

INVITED SPEAKERS:

- Lena Kourkoutis, Cornell University
- Shirley Meng, University of California, San Diego
- Katherine Jungjohann, Sandia National Laboratories
- Joe Patterson, University of California, Irvine
- Yuzhang Li, Stanford University
- Vinayak Dravid, Northwestern University
- Feng Wang, Brookhaven National Laboratory
- Litao Sun, Southeast University, China
- Lili Han, University of California, Irvine
- Hongkui Zheng, Clemson University

P04 - Advanced Characterization of Nuclear Fuels and Materials

ORGANIZERS:

Yaqiao Wu, Boise State University

Simon Pimblott, Idaho National Laboratory

James Cole, Idaho National Laboratory

Darryl Butt, University of Utah

For more than 10 years the Nuclear Science User Facilities program of the Department of Energy Office of Nuclear Energy has supported the development and application of advanced microstructure characterization and micro-scale testing techniques on nuclear fuels and structural (often referred to as "hot") materials at institutions across the U.S. This application of modern techniques provides unique microstructural and chemical information down to the atomic scale. This symposium highlights the world leading capabilities, and the application of state-of-the-art characterization and testing techniques (STEM, FIB, APT, Nanoindenter, PicoIndenter, etc.) to "hot" materials. Presentations on

advanced methods of imaging and characterizing fluids in nanometer scale porosity potentially applicable to nuclear energy systems are also encouraged (e.g., tomography, *in-situ*).

INVITED SPEAKERS:

- Grace Burke, The University of Manchester, UK
- Janelle Wharry, Purdue University
- Kevin Field, University of Michigan
- Assel Aitkaliyeva, University of Florida
- Daniel Murray, Idaho National Laboratory

P05 - Advances in Microscopy for Quantum Information Sciences

ORGANIZERS:

Manuel Roldan Gutierrez, Arizona State University

Ritesh Sachan, Oklahoma State University

Juan Carlos Idrobo, Oak Ridge National Laboratory

Mathieu Kociak, Universite Paris-Sud, France

Quantum computing has emerged as one of the most interesting research topics in recent years. Materials with active color-centers are identified as promising candidates for achieving energy-efficient quantum computing through individual electron spin manipulation. These color-centers, when precisely positioned in materials, demonstrate switching from a neutral state to negatively charged state when driven by external (photonic, phononic, electric and magnetic) stimuli. This symposium focuses on the recent microscopy-driven advances in the field of color-center manipulated quantum science, which is critical in developing and understanding of the correlations between electron, spin-states and atoms in materials.

INVITED SPEAKERS:

- Andrew Lupini, Oak Ridge National Laboratory
- Sophie Meuret, CEMES-CNRS, France
- Ursel Bangert, University of Limerick, Ireland
- Ben Lawrie, Oak Ridge National Laboratory
- Shery Chang, ASU
- Jianguo Wen, ANL
- Javier Garcia de Abajo, ICREA, Spain
- Jorn Luiten, Eindhoven University of Technology

P06 - *In situ* TEM at the Extremes

ORGANIZERS:

Andrew Minor, Lawrence Berkeley National Laboratory & University of California, Berkeley

Judith Yang, University of Pittsburgh

Djamel Kaoumi, North Carolina State University

Yang Yang, Lawrence Berkeley National Laboratory

In situ TEM provides unique information about the response of materials under extreme conditions, including extreme environments and/or at extreme spatiotemporal resolution. For example, the degradation of materials under extreme environments (i.e., high temperature, corrosion, mechanical deformation and radiation damage etc.) can be investigated at high resolution with specialized holders or microscope systems. Or, the observation of materials that only exist at conditions far from room temperature. Often, extreme timescales are needed to capture transient events or reversible phenomena. This symposium invites contributions from all *in situ* TEM experiments that contribute to the methodology development or the understanding of materials at extreme conditions.

INVITED SPEAKERS

- Khalid Hattar, Sandia National Lab
- Ismail El Baggari, Cornell
- Guangwen Zhou, State University of New York at Binghamton
- Frances Ross, MIT
- Josh Kacher, Georgia Tech
- Zhongwen Yao, Queens university Canada, Canada
- David J. Flannigan, University of Minnesota
- Qian Yu, Zhejiang University, China

P07 - Joint Symposium on FIB-SEM Technology and Electron Tomography for Materials Science and Engineering

ORGANIZERS:

Hua Guo, Rice University

Chunyang Wang, University of California-Irvine

Matthew Thorseth, Dow

Suzy Vitale, Carnegie Institution for Science

Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) are essential techniques for characterizing materials at high spatial resolution. Both imaging techniques can be used to solve complex three-dimensional (3D) structures from the two-dimensional (2D) images/projections captured, which is known as electron tomography. TEM tomography focuses on structures at nanometer and even atomic resolution, while SEM tomography is able to investigate up tens of micron-sized specimens with the aid of a focused ion beam (FIB). Both applications are supported by FIB techniques such as sample preparation, polishing, and serial sectioning for SEM tomography. In addition, these same FIB techniques can be applied to advanced characterization techniques such as 3D EDS/EBSD and SIMS, and can be correlated to other analytics such as WDS, CL, Raman spectroscopy, and u-CT. This symposium will highlight 3D imaging with electrons and other spectroscopies, sample preparation, image data post-processing strategies, as well as broader developments in FIB/SEM instrumentation, applications and techniques.

INVITED SPEAKERS

- Huolin Xin, University of California Irvine
- Peter Ercius, Lawrence Berkeley National Lab
- Kui Du, Chinese Academy of Science, China
- Josh Sugar, Sandia National Lab
- Jianwei Miao, UCLA
- Sara Bals, University of Antwerp, Belgium
- Frances Allen, Lawrence Berkeley National Lab
- Ned Thomas, Rice University

P08 - Approaching *operando* Imaging of Functional Materials

ORGANIZERS:

Marc Willinger, ETH Zürich, Switzerland

Raymond Unocic, Oak Ridge National Laboratory

Thomas Hansen, Technical University of Denmark, Denmark

Functional materials should be studied in their functional state. Imaging in vacuum and detailed investigations of equilibrium structures are insufficient to describe the structural and chemical evolution of materials under working conditions. In recent years, there have been significant developments in electron microscopy instrumentation, *in situ* platforms and detectors which enable *in situ* and *operando* experiments to be performed with high spatial-temporal resolution imaging, diffraction and spectroscopy with unprecedented

detail. This provides us the opportunity to glimpse into the state of materials during synthesis, degradation or desired function in a well-defined environment. Concomitant with these instrumentation advances, solutions for data storage and data analytics for physics-based data extraction, as well as the role of the electron beam, need be considered. In this symposium, we aim to highlight novel approaches to *in situ* microscopy, illustrated with examples from materials science to gain insight into structural and chemical changes transformation mechanisms and kinetics. We seek contributions illustrating equipment development and novel use of existing equipment that can provide new insight into the state of active materials including 2D materials, nanoparticles and catalysts.

INVITED SPEAKERS:

- Jakob Wagner, Technical University of Denmark, Denmark
- Utkur Mirsaidov, National University of Singapore, Singapore
- See Wee Chee, Fritz-Haber-Institute, Germany
- Damien Alloyeau, University of Paris, France
- Joshua Vincent, Arizona State University

P09 - Electron Pulses as an Ultrafast Probe for Non-Equilibrium Processes

ORGANIZERS:

Jing Tao, Brookhaven National Laboratory

Aaron Lindenberg, Stanford University

Xuewen Fu, Nankai University, China

Understanding the structural origin of materials' functionality is challenging to obtain via equilibrium states but promising to unveil through the observation of non-equilibrium processes. The successful development of femtosecond laser systems and pump-probe techniques in the past three decades has allowed us to probe ultrafast dynamics in a variety of materials, which enables opportunities for advanced understanding of materials science. Particularly, taking advantages of strong interaction with matter during scattering, ultrafast electron pulses provide unique opportunities to probe the nonequilibrium dynamics, including the evolution of spin, charge, orbital and lattice in the ultrafast time domain. Moreover, the tidal surge of experiments exploiting non-equilibrium phenomena indicates the importance of the development of forefront facilities, such as ultrafast electron microscopes (UEM), KeV ultrafast electron diffraction (KeV-UED) and MeV ultrafast

electron diffraction (MeV-UED) instruments. This symposium aims to encourage discussions of recent advancements in techniques, scientific findings, and future works employing ultrafast electron probes.

INVITED SPEAKERS:

- Jianqi Li, Institute of Physics, Chinese Academy of Sciences, China
- Martin Centurion, University of Nebraska, Lincoln
- Chong-Yu Ruan, Michigan State University
- Xiaozhe Shen, SLAC
- Jianmin Cao, Florida State University
- Philipp Muscher, Stanford University
- Bolin Liao, UC Santa Barbara

P10 - Call of the Wild: Advances in Microanalysis and Microscopy of Geological and Extraterrestrial Materials

ORGANIZERS:

Chloe Bonamici, University of Wisconsin-Madison

Annie Bauer, University of Wisconsin-Madison

Zack Gainsforth, University of California- Berkeley

Microscopy and microanalysis are indispensable to the study of geological and extraterrestrial materials. High quality analysis enables the extraction of a maximal amount of structural, chemical, and isotopic information from a minimal amount of sample. Natural materials also pose unique challenges for microanalysis, including the potential for extreme and unpredictable compositional variability, the need for well-matched standards over a huge parameter space, a wide variation in physical properties, and sample sizes from the nanoscale to the macroscale, all of which affect preparation and analysis. We invite abstracts that highlight advances in microanalytical techniques as applied to natural materials.

INVITED SPEAKERS:

- Noriko Kita, University of Wisconsin-Madison
- Zhaoping Yang, Geological Survey of Canada, Canada
- Tom Zega, University of Arizona
- Nancy McMillan, New Mexico State University
- Guilherme Goncalves, University of Brasilia, Brazil

P11 - Bridging the Fundamental Electron Dose Gap for Observing Atom Processes in Complex Materials in their Native Environments

ORGANIZERS:

Stig Helveg, Haldor Topsoe A/S, Denmark

Renske van der Veen, University of Illinois - Urbana-Champaign

Dalaver H. Anjum, Khalifa University, United Arab Emirates

Joerg R. Jinschek, The Ohio State University

Current and future applications of complex functional materials are based on physical, chemical and biological processes that occur on surfaces and interfaces. At the atomic scale, these processes are often difficult to understand and challenge our imagination, because our ability to observe atomic structures and dynamics in real space, real-time and real environments using electron microscopy is limited by the fundamental dose gap dividing structural integrity at $\sim 20 \text{ e}/\text{\AA}^2$ (typical for soft matter) and reaching single-atom detection at $\sim 10\,000 \text{ e}/\text{\AA}^2$ (typical for hard matter). It is therefore crucial to develop new techniques and methods to bridge this classical dose gap. Path-breaking approaches will involve structuring electron probes in space and time in any environmental settings. Here we welcome submissions addressing the development or application of (electron) microscopy instrumentation, techniques and detection schemes that aim at probing atom processes in complex materials.

INVITED SPEAKERS:

- David Flannigan, University of Minnesota
- Chris Russo, MRC Laboratory of Molecular Biology, UK
- Nestor Zaluzec, Argonne National Laboratory
- Adam Hitchcock, McMaster University, CA
- Hideto Yoshida, Osaka University, JP
- Andrei Khlobystov, University of Nottingham, UK
- Petra Specht, University of California, Berkeley
- Sandra Van Aert, Antwerpen University, BE
- Cheng-Han Li, Ohio State University

P12 - Collaborative Analysis Using Atom Probe Tomography Including TEM/APT Characterization of Metal Alloys and Other Material Systems

ORGANIZERS:

Timothy Spila, University of Illinois

Hugues Francois Saint Cyr, Cameca Instruments Inc.

François Vurpillot, Université de Rouen-Normandie, France

Xiaobing Hu, Northwestern University

This symposium on Atom Probe Tomography (APT) focuses on both its complementary and correlated aspects as part of the broad range of materials characterization techniques available today. Since one of the major goals sought by researchers is to achieve more accurate reconstructions and analyses of matter in three dimensions at the atomic level, this symposium will encompass all aspects of the APT field. Presentations will emphasize innovative specimen preparation, best known analytical conditions for APT data collection, latest simulations coupled with other imaging techniques for data reconstruction, and development of better algorithms and schemes for advanced data analysis. Advanced application of APT and TEM on metal alloys and other materials systems will also be covered.

INVITED SPEAKERS:

- Stoichko Antonov, Max Plank Institute Metals, Germany
- David Seidman, Northwestern University
- Mukesh Bachav, Idaho National Laboratory

X34 - Management and Operation of Microscopy Facilities

Sponsored by the MSA Facilities Operations Management (FOM) Focused Interest Group

ORGANIZERS:

Luisa Amelia Dempere, University of Florida

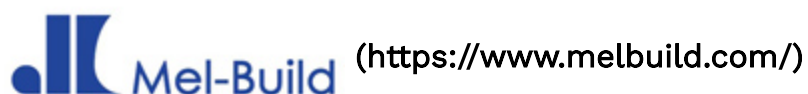
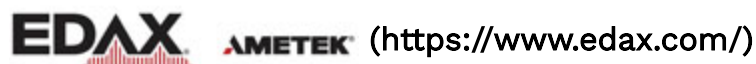
John Fournelle, University of Wisconsin-Madison

William Scheineider, University of Wisconsin

The operation and management of microscopy facilities encompass the understanding and implementation of protocols that adhere to federal government compliance as well as regulations and policies pertaining to its umbrella organization. The purpose of this symposium is to present policies, rules and best practices in the management and operation of an instrumentation centered multi-user facility. The topics covered are diverse in nature and scope and include: use rates calculation and review methodology, tracking and using operations data, evaluating the institutional impact of the facility, engaging users in compliance and safety practices, enhancing communications with users,

what a day in the life of lab manager looks like, planning for instrument (hardware and software obsolescence), using social media and on-line tools to create engagement and community support, service contracts and other options for instrument support and maintenance, critical considerations for space renovation and instrument relocation, best practices for instrumentation training, liabilities associated with providing instrumentation analysis as a service.

2020 Sponsors





(<https://www.microscopy.org/>)

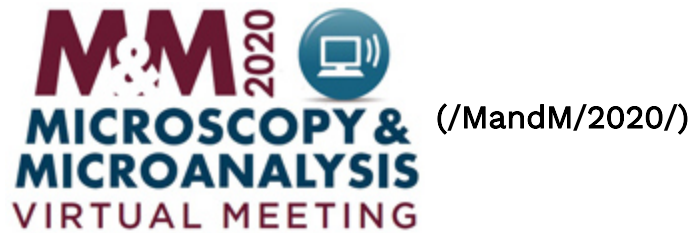


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



Plenary Speakers

The Executive Program Committee is pleased to present a Plenary session with lectures from Dr. Yi Cui, a Professor in the Department of Materials Science and Engineering at Stanford University and a world-renowned scholar, and Dr. Maria McNamara, a paleobiologist and Senior Lecturer in Geology at University College Cork, Ireland.

Yi Cui, Ph.D.

Stanford University, Stanford Institute for Materials and Energy Sciences and SLAC National Accelerator Laboratory

In-situ and Cryogenic Electron Microscopy for Energy Materials

Developing new energy materials for batteries, solar cells, catalysts and gas storage requires understanding their structural evolution across multiple length and time scale. Over the past 15 years, the Cui group has been developing a set of electron microscopy tools to realize this purpose including in-situ electrochemical cell, in-situ gas reaction, in-situ mechanical indentation and cryogenic electron microscopy (cryo-EM). In this presentation, he will discuss how these advanced electron microscopy techniques impact energy materials.

Yi Cui is a Professor in the Department of Materials Science and Engineering at Stanford University. He received B.S. in Chemistry in 1998 at the University of Science and Technology of China (USTC), Ph.D in 2002 at Harvard University. After that, he went on to work as a Miller Postdoctoral Fellow at University of California, Berkeley. In 2005 he became an Assistant Professor in the Department of Materials Science and Engineering at Stanford University. In 2010 he was promoted with tenure. He has published ~430 research papers and has an H-index of 185 (Google). In 2014, he was ranked NO.1 in Materials Science by Thomson Reuters as "The World's Most Influential Scientific Minds". He is a Fellow of Materials Research Society, Electrochemical Society and Royal Society of

Chemistry. He is an Associate Editor of *Nano Letters*. He is a Co-Director of the Bay Area Photovoltaics Consortium and a Co-Director of Battery 500 Consortium. His selected awards include: Dan Maydan Prize in Nanoscience (2020), Nano Today Award (2020), Blavatnik National Laureate (2017), MRS Kavli Distinguished Lectureship in Nanoscience (2015), the Sloan Research Fellowship (2010), KAUST Investigator Award (2008), ONR Young Investigator Award (2008), Technology Review World Top Young Innovator Award (2004). He has founded three companies to commercialize technologies from his group: Amprius Inc., 4C Air Inc. and EEnovate Technology Inc.



Maria McNamara, Ph.D.

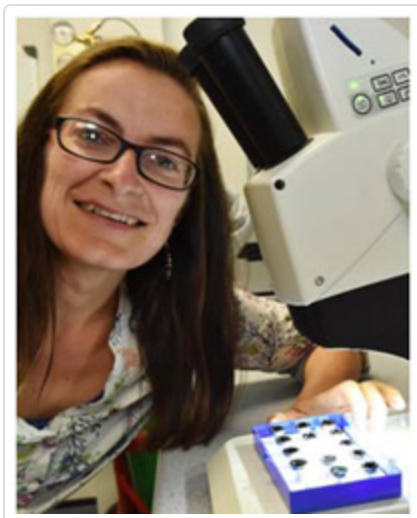
University College Cork, Ireland

Melanin through Deep Time: Experimental and Analytical Approaches to Decoding the Fossil Record of Melanin

Spectacular discoveries of evidence of melanin pigments in fossils over the last 12 years have driven the birth of a new field in palaeontology, i.e. that of fossil colour. But how do we know that we can trust the fossil evidence? In this seminar I will review current developments in this emerging field with examples from diverse vertebrates, highlighting key controversies and developments in analytical approaches, and how taphonomy — the process of fossil preservation — is key to interpreting evidence of colour in fossils.

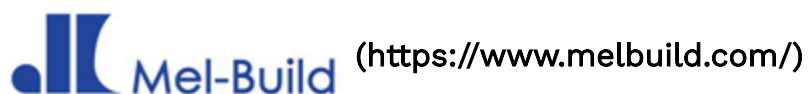
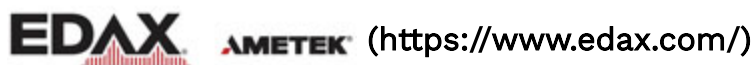
Dr Maria McNamara is a palaeobiologist and Senior Lecturer in Geology based at University College Cork, Ireland. Her research is based on the application of analytical and experimental approaches to understanding the preservation of soft tissues in fossils, in order to constrain interpretations of fossil anatomy, chemistry, and taxonomy. She has particular interests in the evolution of animal coloration and of feathers. Recent research

highlights include the discovery of tissue-specific chemical signatures for fossil melanosomes, of feathers in pterosaurs, and of near-modern avian skin structure in feathered dinosaurs and early birds.



2020 Sponsors





[\(https://www.microscopy.org/\)](https://www.microscopy.org/)

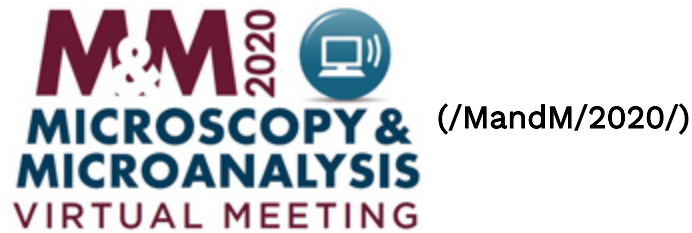


[\(http://www.microbeamanalysis.org/\)](http://www.microbeamanalysis.org/)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



Pre-Meeting Congresses

X60 — Annual Pre-Meeting Congress for Students, Post-Docs, and Early Career Professionals in Microscopy & Microanalysis

(/MandM/2020/program/congress_x60.cfm)

Organized by the Microscopy Society of America Student Council (StC)

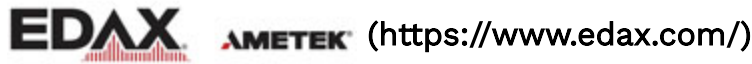
X61 — Current Status and Horizons of Electron Microscopy in Liquids and Gases (/MandM/2020/program/congress_x61.cfm)

Organized by the MSA Electron Microscopy in Liquids and Gases (EMLG) Focused Interest Group

X62 — Contemporary Electron Microscopy Advances in Biomedical Research — POSTPONED to M&M 2021

Organized by the MSA Diagnostic and Biomedical Microscopy Focused Interest Group

2020 Sponsors



(<https://www.microscopy.org/>)

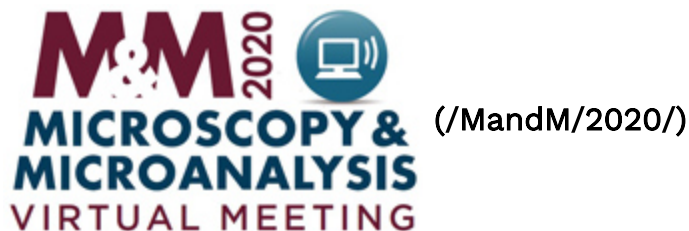


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



Microscopy Outreach Sessions

Please note: Except for Project MICRO, which is included in the MSA Megabooth, all other Microscopy Outreach sessions and events have been CANCELLED for 2020.

Please watch MSA Updates and social media for more Outreach information in the fall.

X90: Microscopy in the Classroom

Organizers:

Jane Howe, University of Toronto, Canada

Donovan N. Leonard, Oak Ridge National Laboratory

Josh Silverstein, Pacific Northwest National Laboratory

Rengasayee (Sai) Veeraraghavan, The Ohio State University

At the frontiers of science, the microscope is an interdisciplinary tool which allows students to glimpse into the unknown and link structure and function. The Education Outreach Committee of MSA seeks to connect individuals and institutions and ensure that the pathways to microscopy careers and education are exciting, engaging and clear.

- Best practices for incorporating microscopy into K-12 and post-secondary classrooms and curricula
- Local and national initiatives emphasizing STEM education and outreach
- Methods to expose students to microscopy in a fun, engaging and impactful manner

X91: Microscopy Explorations for Families and Kids of All Ages (*formerly "Family Affair"*)

Organizers:

Elaine Humphrey, University of Victoria, Canada

Pat Connelly, National Institutes of Health

Please check back here for updated information about this session.

X92: Project MICRO

Organizers:

Elaine Humphrey, University of Victoria, Canada

Janet Schwarz, University of Vermont

Pat Connelly, National Institutes of Health

The Outreach booth is part of the MSA Megabooth and is available every day the exhibit hall is open. Learn how to set up different stations in a classroom and share your fun microscopy outreach classroom experiences! See different microscope systems in action for use in a classroom; peruse a selection of books suitable for elementary school-age children; and put your name into the draw for a daily door prize.

X93: High School & Undergraduate STEM Student Workshop

Organizers:

Josh Silverstein, Pacific Northwest National Laboratory

High school and undergraduate STEM students attend a day-long workshop at an area university, then attend a full day of M&M 2020 to get experience with professional learning and activities. Students will present original research during the poster presentation on Monday in the exhibit hall.

Please check back frequently for additional information as it becomes available.

X94: STEM Roundtable: Building Skills for the Future

Organizers: Lori Harvey, Hitachi High Technologies America

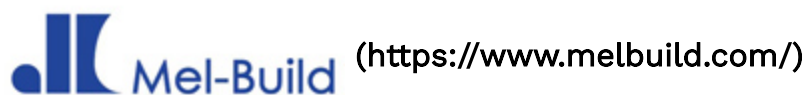
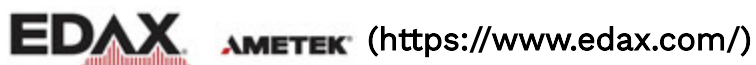
We will explore how to integrate varied resources to have broader, sustainable impacts in STEM education, including bridging K-12 outreach with undergraduate and graduate education, and emphasizing the importance of diversity and inclusion which will lead to a stronger workforce for everyone.

Session is open to all — no separate registration fee required.

Participants are welcome from the following areas: Academia, Education, all levels of Government, Business/Industry, and change leaders within Science, Technology, Engineering, and Math sectors.

2020 Sponsors





(<https://www.microscopy.org/>)

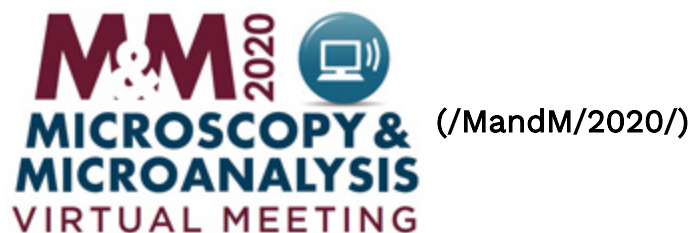


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



Sunday Short Courses

Please note: All 2020 Short Courses have been rescheduled for M&M 2021.

X-10 High-Resolution Structure Determination by Cryo-EM

LEAD INSTRUCTORS:

Tim Grant, Morgridge Institute / University of Wisconsin-Madison

Mike Cianfrocco, University of Michigan

This one-day course will provide an overview of the theory and steps required for high resolution structure determination by single-particle cryo-EM, with a particular focus on image processing. The course will begin with lectures providing an introduction to the theory and methods relevant to specimen preparation, data collection and image-processing of the data. This will be followed by an interactive single-particle processing session and live processing of a dataset to high resolution using the cisTEM software package.

X-11 Explaining the New World Order of Biological Fluorescence Microscopy

LEAD INSTRUCTORS:

Bob Price, University of South Carolina School of Medicine

Jay Jerome, Vanderbilt University

Fluorescence microscopy is a primary method for visualizing structure in three dimensions. Since our Basic Confocal Microscopy short course more than 10 years ago, tremendous advances in hardware and software have been made that have led to improved imaging depth/3D reconstruction technology and super-resolution imaging techniques such as PALM, STORM, SIM and several variations of these. We will review the

basic principles of fluorescence and confocal imaging, provide information on how these principles relate to several new modes of fluorescence imaging, and discuss/compare how these new imaging modes have improved our understanding of fluorescence applications in biological/biomedical research.

X-12 Guidelines for Performing 4D-STEM Characterization from the Atomic to >Micrometer Scales: Experimental Considerations, Data Analysis and Simulation

LEAD INSTRUCTORS:

David Muller, Cornell University

Colin Ophus, Lawrence Berkeley National Laboratory

With modern electron detector technology, it is now possible to record full images of a converged STEM probe while scanning it over the sample surface, resulting in a 4D-STEM dataset. Because the atomic-scale scattering information contained in an atomic-scale STEM probe is decoupled from the step size between STEM probe positions, 4D-STEM can be used for experiments ranging from sub-Angstrom resolution phase contrast imaging to statistical characterization of functional materials over large length scales. In this course, we will give tutorials on how to perform 4D-STEM experiments, analyze the (potentially very large!) resulting datasets, and perform 4D-STEM simulations.

X-13 SerialEM for EM Data Acquisition

LEAD INSTRUCTORS:

Cindi Schwartz, Rocky Mountain Laboratories/NIAID/National Institutes of Health

Guenter Resch, Nexperion, Austria

Jason de la Cruz, Memorial Sloan Kettering Cancer Center

Developed by David Mastronarde at the University of Colorado, SerialEM is open-source and widely used in automated TEM data acquisition on a multitude of microscope platforms and detectors. The course will be of interest to both beginners and advanced users in both biological and materials sciences. Installation and calibration of SerialEM will include use of direct-electron detectors and imaging energy filters. Imaging techniques such as tilt-series acquisition, low-dose imaging, single-particle acquisition, montaging, and mapping, as well as use of scripts (macros) and working with the navigator file or image data to extend SerialEM beyond its native capabilities will be covered.

X-14 In situ and Operando Approaches to TEM

LEAD INSTRUCTORS:

Robert Sinclair, Stanford University

Peter Crozier, Arizona State University

In situ and operando transmission electron microscopy are becoming increasingly important in advanced materials characterization. Being able to observe materials in state that are similar to real world applications is now recognized as vital for relating structure to functionality. The ability to perform atomic level analysis while the sample is exposed to different stimuli/environments such as heat, strain, gas, liquids, electric field, magnetic field, light, etc....is a key part of the in-situ approach. Operando approach require simultaneous measurement of some technologically relevant functionality such as current flow, deformation or catalysis.

X-15 Data Analysis in Materials Science

LEAD INSTRUCTORS:

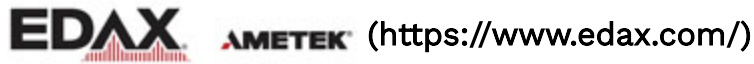
Eric Prestat, University of Manchester and SuperSTEM Laboratory, United Kingdom

Joshua Taillon, National Institute of Standards and Technology

This short course will introduce the use of HyperSpy and related Python libraries (atomap, pixStem, pyXem) for analysis of microscopy datasets. No prior Python knowledge is required. Attendees will learn how to perform basic machine learning, multi-dimensional curve fitting for EELS and EDS quantification, atomic resolution image analysis and big data processing (such as 4D STEM) on desktop computers.

For this hands-on and interactive short course, attendees will need to install software on their own laptop in advance and bring it with them to the short course (instructions will be provided).

2020 Sponsors



(<https://www.microscopy.org/>)

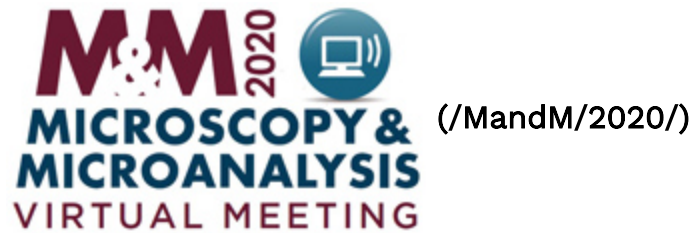


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



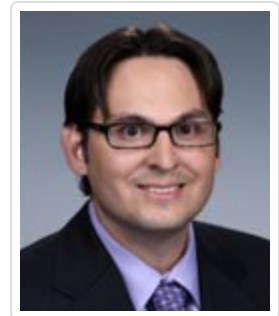
Physical Sciences Tutorials

X40 - Advanced Cryo-FIB Specimen Preparation and Handling of Environmentally Sensitive Materials for APT and TEM Analysis

PRESENTER:

Daniel Perea, Pacific Northwest National Laboratory

Dr. Perea is a senior staff scientist at the Environmental Molecular Sciences Laboratory at the Pacific Northwest National Laboratory. He received his Ph.D. in materials science & engineering from Northwestern University in 2009. Dr. Perea has over 14 years of experience using atom probe tomography, with much of his expertise in semiconductor and structural materials. His current interests at PNNL include developing unique cryogenic-based hardware and protocols to pioneer the use of atom probe tomography to probe the composition and structure of hydrated materials.



- Applications of APT to hydrated interfaces such as those in biological and environmental materials
- Development of a site-specific liftout and attachment scheme for cryogenically cooled specimens
- Challenges of handling and transfer of post cryo-prepared specimens between tools.
- Specimen shuttle suitcase devices for transfer of environmentally sensitive materials between the FIB and other tools enabling APT and TEM analysis

X41 - Entrepreneurship in the Microscopy Community

PRESENTER:

Benjamin Bammes, Direct Electron

Benjamin has a broad scientific background, including physics, computer science, biology, and chemistry, working with small businesses related to science since 2003 in addition to academic research. He has a Ph.D. in Molecular Biophysics from Baylor College of Medicine, where he worked under National Academy of Sciences member Dr. Wah Chiu to optimize cryo-EM data collection and image processing. In 2011, Benjamin joined Direct Electron and now leads our collaborative approach to delivering high-tech solutions to the scientific community.



Several entrepreneurs from the microscopy community participate in an open Q&A forum on topics related to starting and running a microscopy-related business. Topics may include:

- How to identify and develop potential new products
- Steps for successful commercialization
- Methods for funding the early stages of a business
- Marketing and gaining initial customers
- Protecting and leveraging intellectual property
- The role of academic collaborations

X42 - TriBeam Tomography for 3D Data Acquisition

PRESENTER:

McLean Echlin, University of California-Santa Barbara

McLean Echlin is a research scientist at UC-Santa Barbara where his interests are in problems related to 3D materials science, strain mapping, and other advanced characterization techniques that are applicable at the mesoscale. Over the past decade he has developed multiple iterations of the femtosecond laser enabled TriBeam microscope for mm-scaled 3D measurements in a wide range of materials.



In this tutorial, the femtosecond laser enabled TriBeam microscope for use in tomography and bulk sample excavation is discussed, which will include the following topics:

- Femtosecond laser material interactions during serial sectioning
- Multimodal data acquisition and experimental setup
- Automation and dynamically varying experiment parameters during tomography
- Reconstruction and image processing of 3D data

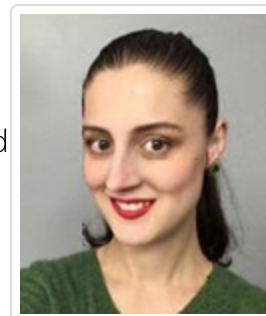
Biological Sciences Tutorials

X43 - Liquid Cell TEM Imaging Techniques and Optimization for Biological Samples

PRESENTER:

Madeline Dukes, Protochips, Inc.

Madeline Dukes is an applications scientist with Protochips, Inc. She has more than 10 years of experience in the field of liquid-cell transmission electron microscopy (LC-TEM) and has worked with multiple labs around the world to improve in-situ LC-TEM technology and develop new sample preparation techniques for a broad range of applications.



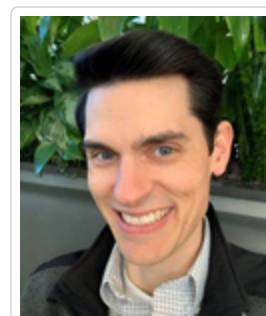
- Liquid Cell Transmission Electron Microscopy (LC-TEM) for biological systems — challenges & applications
- Strategies to minimize beam and radiolysis damage when imaging biological samples using LC-TEM
- Selecting the best parameters for imaging biological samples in liquid, including E-chip selection, flow conditions, etc.
- Sample preparation workflows for optimizing LC-TEM experiments, such as affinity-coating, staining, cell culture etc.

X44 - Optimization of Cryo-EM Data Collection using Advanced Direct Detectors

PRESENTER:

Michael Spilman, Direct Electron

Michael is broadly interested in applying novel imaging methods using direct electron detectors to bridge high resolution biological structures with real-time dynamics. At Direct Electron, he supports and collaborates with customers on numerous projects including single particle cryoEM, microED, and liquid cell in situ.



- Optimizing CryoEM data collection for direct electron detectors
- When to use counting and linear modes for certain experiments

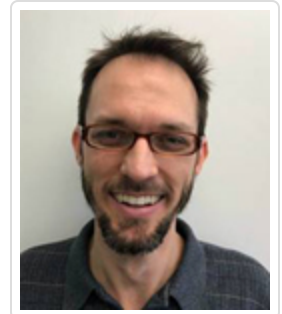
- Discussion of single particle, tomography, microED, and additional methods using direct electron detectors

X45 - CryoEM Sample Preparation: Problems and Potential Solutions

PRESENTER:

Alex Noble, New York Structural Biology Center

Alex is broadly interested in developing and applying methods for solving biomedical problems. He is the primary tomographer at SEMC. He works on several projects including cryo-FIB/SEM, tomography of cells, reconstituted systems, purified protein samples, tomography software development, and deep learning applications in cryoEM.



- What potential air-water interface issues exist in cryo-EM/ET?
- Why is preferred orientation an issue?
- How may air-water interface issues be reduced or avoided?
- How may preferred orientation issues be ameliorated?
- What are the basics for preparing cell samples for cryo-FIB/SEM?

2020 Sponsors





(<https://www.microscopy.org/>)

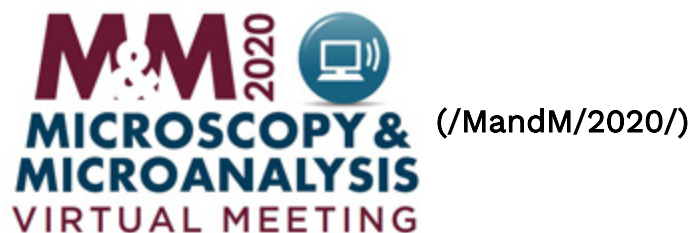


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



Technologists' Forum and Other Sessions

X30 - DIY: Microscopy-Inspired Mkrspace 3D Printing

ORGANIZERS:

Page Baluch, Arizona State University

Ru-Ching Hsia, University of Maryland-Baltimore

- How 3D printers are used to create cellular scaffolds, and how this has influenced the field of regenerative medicine
- 3D printed tools that have been designed and are used by microscopists
- Microscopy-inspired 3D art to promote cross-disciplinary education and collaboration
- Customized 3D teaching tools available commercially and/or using 3D printers available at most universities
- Sources of available CAD templates for 3D printing

X31 - Technologists' Forum Roundtable: Commercial Technical Careers in Microscopy — No PhD? No Worries

ORGANIZERS:

Richard Martens, The University of Alabama

Sara Dickens, Sandia National Laboratories

- There are many careers in advanced analytical and scientific fields that do not require a PhD
- Learn about careers from professionals that entered the microscopy community with skills and expertise garnered from previous employment, effective networking and military service
- Commercial technical careers in microscopy include instrument technicians, service engineers, applications, sales, marketing and account managers

- Panelists include many professions represented at this conference
- Advice that can help with a new or different career path

X32 - Technologists' Forum — Negative Staining of Small Molecules in Non-CryoEM Facilities

ORGANIZERS:

Janice Green Pennington, University of Wisconsin-Madison

Claudia López, Oregon Science and Health University

- Negative staining of small proteins and liposomes in non-cryoEM core facilities
- Obtaining negative stain models as a prerequisite for cryo-electron microscopy
- Preparation of samples for negative stain
- Best stains for small molecules and how to apply them
- Imaging small negatively-stained proteins in the electron microscope
- For the novice or anyone trying to troubleshoot negative stain

X34 - Management and Operation of Microscopy Facilities

(Organized by the Facilities Operations Management Focused Interest Group “FOM FIG”)

ORGANIZERS:

Luisa Amelia Dempere, University of Florida

John Fournelle, University of Wisconsin-Madison

William Scheineider, University of Wisconsin-Madison

- Management of facilities
- Facilities operation
- Use rate development
- Tracking operations
- Multi-user facilities
- Instrumentation support

2020 Sponsors



(<https://www.microscopy.org/>)

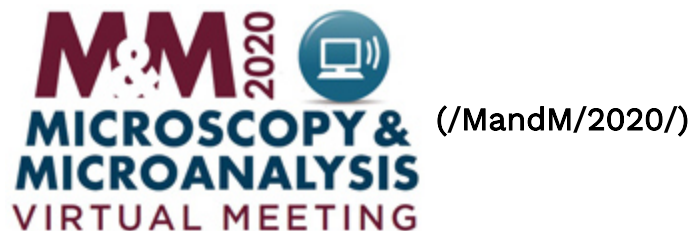


(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)



MEETING AWARDS

The deadline for M&M 2020 Meeting Awards application has passed. Please see the M&M 2021 paper submission site after December 5, 2020 to apply for a meeting award for M&M 2021.

How to Apply For an M&M Meeting Award:

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.

The applicant must appear as first author and presenter of the paper submitted for award. 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 students in good standing 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. If an applicant is not a full-time student, their submitted work ***MUST*** have been done at their academic institution in their role as student. Student applicants are required to provide their advisor's name and email address during the application process.

POSTDOCTORAL RESEARCHERS:

All postdoctoral researchers are eligible. Applicants are not required to be members of the sponsoring society. If an applicant is not a full-time researcher, their submitted work ***MUST*** have been done at their institution in their role as post-doc researcher. Postdoctoral researchers are required to provide their advisor's name and email address during the application process.

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.

AMOUNT OF AWARD:

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

NOTIFICATION OF AWARD:

All award applicants will be notified of their award status approximately eight weeks following the Call for Submissions 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. Awards or award monies are non-transferable.

ONSITE AWARDS

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

MSA Student Poster Awards

We believe poster presentations are an excellent format for all participants to engage in intensive discussion with other researchers in the field. To especially encourage students

to take advantage of this opportunity and submit papers for poster presentation, MSA provides cash awards to the most outstanding student posters (first author) each day (up to one in each of three categories).

Diatome Poster Awards

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

MAS Best Paper Awards

MAS annually confers awards for papers presented at the M&M meeting deemed to be best in four categories.

Each comes with a cash award generously provided by MAS Sustaining Members.

Microscopy Today Micrograph Awards

Scientifically significant micrographs:

Published category (images published in 2020)

Open category (unpublished images)

Video category (movies and 3-D reconstructions)

Submission site will be available in January through the M&M and MSA websites.

Deadline for submission is February 21, 2020

Prizes awarded at M&M 2020 in Milwaukee, Wisconsin!

2020 Sponsors





(<http://www.gatan.com/>)



(<http://www.jeolusa.com/>)



(<https://www.edax.com/>)



(<https://www.melbuild.com/>)



(<https://www.microscopy.org/>)



(<http://www.microbeamanalysis.org/>)

Copyright © 2023 Microscopy Society of America

11130 Sunrise Valley Drive, Suite 350, Reston, VA 20201 – Tel: (703) 234-4115 – Fax: (703) 234-4147

Email: **Association Management** (<mailto:AssociationManagement@microscopy.org>) – **Terms of Use** (</terms.cfm>)