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Microscopy & Microanalysis 2010 Meeting

On behalf of the sponsoring societies, we would like to thank all attendees at the M&M 2010 Meeting. We hope you enjoyed your visit to Portland. Plan to join us in Nashville, TN for the M&M 2011 Meeting next August.

Remember! There are now over 200 invited speakers who are leading researchers in their particular field. You may browse the names of these speakers in the page describing the full symposia descriptions & program information.

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You may also order when you register for M&M 2010 through Thursday, July 29.

Remember – all attendees get a complimentary CD version of the proceedings onsite in Portland.

Dear Colleagues and Friends,

We invite you to join us on August 1-5, 2010 at the Oregon Convention Center in beautiful Portland, Oregon for Microscopy & Microanalysis 2010. Portland, the City of Roses, is a welcoming venue for the meeting, and many of you fondly remember our last visit there in 1999. This year, we will once again welcome the Microscopical Society of Canada/Société de Microscopie du Canada. We are looking forward to another successful joint meeting, following the recent joint meetings in Chicago (2006) and Quebec City (2002). With a wide range of attendees from around the globe, M&M 2010 will be a prime opportunity for you to showcase your research, network with other scientists, learn about the latest technical advances, and contact possible employers and clients. We encourage all of you, whether newcomers or veterans of M&M, to submit an abstract of your work for presentation in Portland.

Microscopy and Microanalysis 2010 promises to be the epitome of scientific diversity, spanning disciplines from the life sciences to the physical sciences, all unified by the tools of our trade. The program committee has developed a strong program highlighting the latest microscopic and microanalytical advances in fields such as nanotechnology, biological sciences, materials science, clinical diagnoses, and metallurgy. Many interdisciplinary symposia have been organized, reflecting the current environment of collaboration between scientists in different disciplines. Again this year, we will kick off the meeting with a plenary session on Monday morning featuring Dr. Mark Welland and highlighting the winners of our major societal awards. The exhibits will demonstrate state-of-the-art equipment, and the vendor tutorials will continue to be a significant part of the meeting. The meeting will also feature "Back to the Basics" tutorials and workshops to be held during the meeting in addition to the traditional Sunday Short Courses.

Attending Microscopy & Microanalysis 2010 will allow you to stay abreast of new technologies, learn new techniques, and see the latest instrumentation. We hope that you will be able to join us in Portland for what is shaping up to be a very exciting and educational meeting.

Sincerely,

Dave Piston	Edward Vicenzi	Frauke Hogue	Daniel Beniac
President, MSA	*President, MAS*	*President, IMS*	*President, MSC/SMC*

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Keynote Speakers

Opening Plenary Session

The M&M 2010 Program committee is pleased to present the Opening Plenary Session. Two exciting talks are planned by internationally known scientists whose research is dominated by microscopy and microanalysis. The time and location of the he Opening Plenary Session are as follows:

Monday, August 2, 2010, 8:30 am
Oregon Convention Center - Oregon Ballroom

Keynote Speaker #1:
Professor Mark Welland
The Nanoscience Centre
University of Cambridge, UK

Professor Mark Welland, FRS, FREng will present an intriguing talk on his research entitled: "What Microscopy Can Tell Us about Alzheimer's and Related Diseases." Prof. Welland's talk will focus on the ability of scanned probe techniques to quantify the properties of materials at the the nanoscale. In particular, it will demonstrate how structural properties of protein aggregates, such as those deposited during diseases such as Alzheimer's, provide a basis for the elucidation of the underlying physical principles that characterize the progression of and challenges in treatment of Alzheimer's and related diseases.

Mark Welland is currently on secondment to the Ministry of Defence as Chief Scientific Adviser, where he directs the science and technology programme, chairs the Investment Approvals Board that authorises all major capital procurement projects and acts as the Principal of the 1958 Mutual Defence Agreement between the US and the UK on nuclear matters. During his secondment he remains Professor of Nanotechnology at the University of Cambridge.

Mark started his career in nanoscience and nanotechnology at IBM Research Laboratories, Yorktown Heights, USA, where he was part of the team that developed one of the first scanning tunnelling microscopes. Upon moving to Cambridge in 1985 he set up the first tunnelling microscopy group in the UK and in 1991 he began the nanoscience research group.

He established a purpose built facility at the University of Cambridge, the Nanoscience Centre, which undertakes a variety of nano-related research programmes of an interdisciplinary nature. This was the base for the Interdisciplinary Research Collaboration (IRC) in Nanotechnology of which Mark was the Director and whose highly successful legacy has been far reaching. He has strong commercial interests which include both directing the substantial Nokia/Cambridge research activity centred around Nanoscience and the Open Access facility that supports commercial exploitation of nanoscience funded by the UK Government TSB (The Technology and Strategy Board).

In 2002 Mark gave the annual Turing Lecture, in 2003 was appointed the annual Sterling Lecturer in India and in 2007 gave the annual Max Planck Society lecture in Stuttgart, Germany. He was a winner of the Red Dot Award for Technical Innovation in 2008. He was elected Fellow of the Institute of Physics in 2002, Fellow of the Royal Society in 2002 and Fellow of the Royal Academy of Engineering in 2002.

Mark has many contributions at an International level and leads the UK side of the World Premier International (WPI) Research Centre Initiative, a 200 million USD program sponsored by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan. He is Co-Director of the Science and Technology Research Centre at the American University in Cairo, Egypt that he co-founded in 2003. In recognition of his work with India, Mark was elected as a Foreign Fellow of the National Academy of Sciences India in 2008.

In addition to his scientific work Mark has been involved in a number of reports, national and international, dealing with the societal, ethical and environmental issues of nanotechnology and was a member of the Royal Society/Royal Academy of Engineering Nanotechnology Study Working Group that reported to the UK Government in July 2004.

He has taken part in many television and radio programmes for the BBC, SKY, Open University and University of the Air, Japan and written articles for the Guardian, FT and The Times in the UK

Keynote Speaker #2:
Professor J. William Schopf
Center for the Study of Evolution and the Origin of Life
University of California, Los Angeles

Professor Schopf will present a talk entitled "The Early History of Life: Solution to Darwin's Dilemma." He will show how confocal laser scanning microscopy and Raman spectroscopy have elucidated the earliest history of life on Earth. The application of these techniques, now less than a decade old, has helped resolve a dilemma that Darwin faced in 1859, namely, that though evolution was supported by the fossil record of plants and animals, no earlier evidence of life was known. Such evidence has been unearthed. What was unknown and presumed unknowable, is no longer so to us.

Director of the Center for the Study of Evolution and the Origin of Life at the University of California, Los Angeles, J. William Schopf received his undergraduate training in geology at Oberlin College, Ohio, and his Ph.D. degree, in biology, from Harvard University. A member of the UCLA faculty since 1968, he has received all of his university's campus-wide

faculty awards: for teaching, research, and academic excellence. A leader in studies of the Precambrian (earliest 85%) history of life and discoverer of the oldest evidence of life now known, he has pioneered the use of confocal laser scanning microscopy and Raman spectroscopy to analyze the three-dimensional cellular anatomy and chemistry of ancient rock-embedded fossil microbes. Prof. Schopf is a member of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences. He is recipient of three national book prizes and of medals from the National Science Board, the National Academy of Science, and the International Society for the Study of the Origin of Life; twice he has been awarded Guggenheim Fellowships.

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Invited Speakers

Full Symposia Descriptions & Program Information

Biological Sciences Symposia

B01 George E. Palade Memorial Symposium
Caroline Miller & Vincent Gattone
Invited Speakers
Philippe Male - Yale University (retired), *Michael Caplan* - Yale University School of Medicine

B02 Imaging of Cytoskeletal Dynamics and Abnormalities in Disease
Heide Schatten and Kathryn Eisenmann
Invited Speakers
Gary Banker - Oregon Health and Science University, *Dahong Zhang* - Oregon State University, *Martin Poenie* - University of Texas at Austin, *Hilda Amalia Pasolli* - The Rockefeller University, *Andreas Hoenger* - University of Colorado, *Johnny L. Carson* - The University of North Carolina at Chapel Hill

B03 Microscopy Continues to Lead Advances in Alzheimer's Disease
George Perry and Mark Smith
Invited Speakers
Alejandra Alonso - College of Staten Island, City University of New York, *Ismael Santa Maria* - Mount Sinai School of Medicine

B04 Man, Machine, Microscope
Simon Watkins and Sarah Richardson Burns
Invited Speakers
Mohammed Reza Abidian - University of Michigan, *Tracy Cui* - University of Pittsburgh, *Warren Zipfel* - Cornell University

B05 Atomic Force Microscopy for Cell Biology
Helen A. McNally
Invited Speakers
Manfred Radmacher - Institut fur Biophysik, *Arvind Raman* - Purdue University, *Ben Ohler* - Veeco

B06 Microfluidic Devices: Emerging Platforms for Live Cell Microscopy
Jonathan V. Rocheleau
Invited Speakers
David Eddington - University of Illinois at Chicago, *Aaron Wheeler* - University of Toronto, *Adam Quiring* - UBC, *Shuichi Takayama* - University of Michigan

B07 3DEM: Cellular, Bacterial and Viral surfaces: What Is Out There?
Teresa Ruiz, Esther Bullitt and Georgios Skiniotis
Invited Speakers
Dorit Hanein - Burnham Institute, Molecular machines involved in the assembly and regulation of the actin cytoskeleton at the leading edge of motile cells; *Jenny Hinshaw* - NIH/NIDDK, Dynamin, and its role in constriction and fission of clathrin-coated pits; *Jun Liu* - Univ of Texas Medical School, Flagellar motor structure and motility; *Carmen Manella* - Wadsworth Center; NY State Dept. of Health, Mitochondria and their role in metabolic, neurological and muscular disorders; *Phoebe Stewart* - Vanderbilt University, Adenovirus - integrin complexes

B08 Clinical and Investigative Microscopy of Infectious Diseases
Daniel Beniac
Invited Speakers
Gregory Czarnota - University of Toronto, *Elizabeth Fischer* - Rocky Mountain Laboratories, *Alasdair Steven* - National Institutes of Health

Physical Sciences Symposia

P01 Nanoscale Characterization of Next-Generation Photovoltaic Devices and Materials
Jun Jiao and Zhigang Rick Li
Invited Speakers
Liang Liang - Dupont, *Katharine Dovidenko* - General Electric, *Brent Wacaser* - IBM, *Yong-Hyum Kim* - Korea Advanced Institute of Science and Technology, *Lian-Mao Peng* - Peking University, *Jingyue (Jimmy) Liu* - University of Missouri-St. Louis

P02 Imaging and Spectroscopy of Interfaces and Surfaces in Advanced Materials and Nanostructures
Xiaoqing Pan and Wayne Kaplan
Invited Speakers
Hengjiang Ye - Institute of Matal Research, Chinese Academy of Science, *Jing Zhu* - Tsinghua University, *Yuichi Ikuhara* - University of Tokyo, *Isao Tanaka* - Kyoto University, *Judith Yang* - University of Pittsburgh, *Yimei Zhu* - Brookhaven National Laboratory, *David Muller* - Cornell, *Kai Sun* - University of Michigan, *Christoph Koch* - MPI-Stuttgart, *Christina Scheu* - University Munich, *Alex Recnik* - JSI-Slovenia, *Susanne Stemmer* - UCSB, *Lothar Houben* - Julich Research Center, Germany, *Ulrich Dahmen* - LBNL

P03 Microscopy and Analysis in Forensic Science
Frank Platek and Mary-Jacque Mann
Invited Speakers

Chesterene Cwiklik - Cwiklik & Associates, *Susan Wilson* - Washington State Patrol Tacoma Crime Lab, *Andrew Vogt* - Abbott, *S. Frank Platek* - US Food and Drug Administration Forensic Chemistry Center, *Diana Wright* - DOJ - Federal Bureau of Investigation, *Michael Platek* - University of Rhode Island

P04 Structural and Chemical Analysis of Materials in the Nuclear Power Industry
Jie Lian, Jeremy Busby and Paul Crawford
Invited Speakers
Mike Miller - Oak Ridge National Laboratory, *Robert Odette* - UC Santa Babara, *Amit Misra* - Las Almos National Laboratory, *Somei Ohnuki* - Hokkaido University, *James Bentley* - Oak Ridge National Laboratory, *Zhijie Jiao* - University of Michigan, *Djamel Kaoumi* - The University of South Carolina

P05 Particles, Pores and Composites - Nano to Macro
Tom Murphy, Jian-Min Zuo and David C. Bell
Invited Speakers
Lionel Vayssieres - NIMS Japan, *Suprakas Sinha Ray* - CSIR, South Africa, *Thomas Dittrich* - Helmholtz Center Berlin, *Paul Voyles* - University of Wisconsin, Madison, *Venkatesan Murali* - University of Illinois, Electrical Engineering, *Ilke Arslan* - UC Davis, materials science, *Ray Egerton* - University of Alberta, Canada

P06 Probing the Properties of Nanomaterials with Microscopy
Andrew Minor, Moon Kim and Martin Saunders
Invited Speakers
Zhiwei Shan - Xian Jiatong University & Hysitron, Inc., *Horatio Espinosa* - Northwestern University, *Marc Legros* - CEMES-France, *Stig Helveg* - Haldor Topsoe, Denmark, *Gyeong-Su Park* - Samsung Advanced Institute of Technology

P07 T3DEM: Quantitative Analysis at the Nano and Microscale using Tomographic Techniques
Ilke Arslan and Christian Kuebel
Invited Speakers
Peter Nellist - University of Oxford, *Mary Comer* - Purdue University, *Richard Leapman* - National Institute of Biomedical Imaging and Bioengineering, *Michael Uchic* - Air Force Research Laboratory, *Katja Schladitz* - Fraunhofer ITWM

P08 Inside Modern Micro-devices at the Atomic Scale
John Mardinly, David Muller and Vincent Hou
Invited Speakers
Colin Humphreys - University of Cambridge, *Edward Keyes* - Semiconductor Insights Inc., *Gary Tompkins* - Chipworks, Inc., *Ling Pan* - Intel, *John Bruley* - IBM, *Sergey Babin* - aBeam Technologies, Inc.

Instrumentation and Techniques Symposia

A01 Vendor Symposium: Creating the Tools for Science
Mike Bode, Andree Kraker and Tom Nuhfer
This symposium provides an opportunity for the vendor community to share important and exciting new developments with the attendees of the M&M meeting. The symposium is focused on new hardware, software and techniques for the Microscopy community. Initiated for M&M 2009 in Richmond, this symposium was well attended, and we encourage all vendors to submit abstracts for the meeting in Portland 2010. The symposium is limited to presentations by vendors who participate in the exhibition, and all submissions will be considered. The selection of the papers for presentation will be done by a non-vendor.
No Invited Speakers
A Vendors' and Manufacturers' Special Symposium

A02 Aberration-Corrected Electron Microscopy: Exploring Materials Through New Eyes
Juan Carlos Idrobo, Rolf Erni and Miaofang Chi
Invited Speakers
Matthew Chisholm - Oak Ridge National Laboratory, *Judy Cha* - Stanford University, *Nigel Browning* - University of California-Davis, *Sorin Lazar* - FEI, Arizona State University, *Teray Mizoguchi* - University of Tokyo, *Quentin Ramasse* - National Center for Electron Microscopy, *Marta Rossell* - ETH, *Masashi Watanabe* - Lehigh University, *Peter Hartel* - CEOS, *Martin Link* - Triebenberg Laboratory, University of Dresden, *Valeria Nicolosi* - Oxford University

A03 FIB Science and Applications in Materials and Biology
Joe Michael, F. Scott Miller and Haiping Sun
Invited Speakers
Keana Scott - NIST, *Michael Marko* - Wadsworth Center, *Alexandria Imre* - Argonne National Lab, *Lucille Gianuzzi* - FEI Company, *David Adams* - Sandia NationalLab, *Joanna Wojewoda-Budka* - Polish Academy of Sciences

A04 Computational Aspects of Data Visualization and Quantitative Microscopy and Microanalysis
Raynald Gauvin, Marc De Graef and Paul Kotula
Invited Speakers
Hans Fitting - University of Rostock, *Francesc Salvat* - Universitat de Barcelona, *Johan Verbeeck* - University of Antwerp, *Nick Wilson* - CSIRO, *Chris Stork* - Sandia National Laboratories

A05 Transmission EM and Spectroscopy at or Near Realistic Conditions
Chongmin Wang, Niels de Jonge and Jakob B. Wagner
Invited Speakers
Charles H. F. Peden - Pacific Northwest National Laboratory, *Eric Stach* - Purdue University, *Ulrich Dahmen* - Lawrence Berkeley National Laboratory, *Kristian Molhave* - Technical University of Denmark, *Lawrence Allard* - Oak Ridge National Laboratory, *Henny Zandbergen* - Delft University of Technology, *Nigel Browning* - University of California, Davis, *Frances Ross* - IBM, *Longqing Chen* - Pennsylvinia State University, *Agnes Bogner* - INSA de Lyon, *Thomas W. Hansen* - Technical University of Denmark

A06 Surface Microscopy and Microanalysis in Materials and Biological Systems
Vincent Smentkowski, Jennifer Pett-Ridge and John Chaney
Invited Speakers
Tony Ohlhausen - Sandia National Laboratory, *Sankar Rama* - Physical Electronics, *Dave Surman* - Kratos, *Bill Sgammato* - Thermo Fisher, *Dave Castner* - University Washington, *David Joy* - University of Tennessee, *Scott Bryan* - Physical Electronics, *Barry Wise* - Eigenvector Research, *Ben French* - Intel, *Peter Williams* - Arizona State University, *Manfred Auer* - Lawrence Berkeley National Laboratory, *Peter Weber* - Lawrence Livermore National Lab, *Steve Golledge* - University Oregon, *Al Schultz* - Ionwerks, *Jeff Lince* - The Aerospace Corporation, *Matt Linford* - Brigham Young University, *Clive Walker* - European Commission Joint Research Centre, *Don Baer* - PNNL

A07 Scanned Probe Microscopies: Probing Advanced Material Properties on the Micro- and Nano-Scale
Phil Russell and Lou Germinario
Invited Speakers
Stephen Jesse - Oak Ridge National Laboratory, *Maxim Nikiforov* - Oak Ridge National Laboratory, *Alexander Tselev* - Oak Ridge National Laboratory, *Richard Vaia* - Wright-Patterson AFB, *Sergei Magonov* - Agilent, TBA - Veeco, *TBA* - Asylum, *Kevin Kjoller* - Anasys, *TBA* - Hysitron, *Stephen Ducharme* - University of Nebraska Lincoln

A08 Ultrafast EM and the Effects of Ultrafast Events on the Structure and Chemistry of Materials

Nigel Browning, Bryan Reed, Thomas LaGrange and Steve Yalisove
Invited Speakers
John Spence - Arizona State University, *Dwayne Miller* - University of Toronto, *Samuel Sonderegger* - nanophotonics, *Frank Meyer zu Heringdorf* - University of Duisberg-Essen, *Joel McDonald* - Sandia National Laboratories, *Ted Norris* - University of Michigan, *Fabrizio Carbone* - Ecole Polytechnique Federale de Lausanne, *Chong-Yu Ruan* - Michigan State University, *Pietro Musumeci* - University of California Los Angeles

A09 TEM Phase Contrast Imaging in Biological and Materials Science
Mike Marko and Marek Malac
Invited Speakers
Radostin Danev - Okazaki Institute for Integrative Bioscience, *Robert Glaeser* - University of California, Berkeley, *Rasmus Schroder* - University of Heidelberg, *Kuniaki Nagayama* - Okazaki Institute for Integrative Bioscience, *Christian Kisielowski* - National Center for Electron Microscopy, *Wah Chiu* - National Center for Macromolecular Imaging, *Bastian Barton* - Max-Planck Institute of Biophyics, *Fu-Rong Chen* - National Tsing Hua University, *Sohei Motoki* - JEOL, Ltd., *Harald Rose* - University of Darmstadt

A10 Imaging Fields with Holography
Molly McCartney and Hannes Lichte
Invited Speakers
Falk Roder - Triebenberg Lab, *Rafal Dunin-Borkowski* - Center for Electron Nanoscopy, Technical University Denmark, *Tsukasa Hirayama* - JFCC, Nagoya, Japan, *Etienne Snoeck* - Centre National de la Recherche Scientifique, Toulouse, *Michael Gribelyuk* - IBM Fishkill

A11 Slow Electrons, Fast Ions: How Well Do We Image and What Do We Image With Scanning Beam Microscopy?
Brendan Griffin and David Joy
Invited Speakers
Cornelia Rodenburg - University of Sheffield, UK, *Yimei Zhu* - Brookhaven National Laboratory

A12 Microscopy, Microanalysis and Image Analysis in the Pharmaceutical Sciences
Lynn M DiMemmo, Jennifer Liang and Andrew Vogt
Invited Speakers
Sina Bavari - United States Army Medical Research Institute of Infectious Diseases, *Alejandra Camacho* - L'Oreal, *John Reffner* - John Jay College, *Phoebe Stewart* - Vanderbilt University, *Jim DiOrio* - Baxter, *Gerard Gagne* - Abbott, *M. Sherry Ku* - Wyeth, *Jack Megill* - Bristol-Myers Squibb, *Frank Platek* - Food and Drug Administration

A13 Specimen Preparation for SEM and EBSD
James Martinez, George Vander Voort and Scott Walck
Invited Speakers *Michael Zolensky* - Astromaterials Research and Exploration Science Directorate NASA Johnson Space Center, *Frank Mucklich* - University of Saarland, Saarbruken, Germany, *John Radavich* - Purdue University, *Andrew Sullivan* - Deakin University, Australia

A14 Image Analysis & Quantitative Microscopy
Don Susan and Rob Panaro
Invited Speakers *Alexander Kazakov* - Saint Petersburg State Polytechnic University, *Arun Gohkale* - Georgia Tech, *Gabe Lucas* - Buehler, Ltd., *Tom Murphy* - Hoeganaes Corp.

A15 Failure Analysis: Practical Microscopy, Metallography and Fractography from Real World Applications or Research Case Studies
Stephen Banovic, Dan Dennies and Doug Puerta
Invited Speakers
Mark Fischer - The Boeing Company, *Tom Tong* - Intel Corporation, *Mark Lisin* - Lisin Metallurgical, *Ron Parrington* - IMR Test Labs, *Bill Heady* - Chromalloy Gas Turbine Corporation

A16 Scanning Cathodoluminescence Microscopy and Spectroscopy: New Developments and Applications
Matthew Philips, Dominique Drouin and Colin Macrae
Invited Speakers
Juergen Christen - Otto-von-Guericke-Universitat Magdeburg, Institut fur Experimentelle Physik, *Marek Godlewski* - Institute of Physics, Polish Academy of Sciences, *Giancarlo Salviati* - Istituto CNR-IMEM

A17 3DEM: A Real Bridge Between Light and X-Rays
Teresa Ruiz, Esther Bullitt, Georgios Skiniotis, Ilke Arslan and Christian Kuebel
Invited Speakers
Ingeborg Schmidt-Krey - Georgia Institute of Technology, *Gina Sosinsky* - University of California, San Diego, *Sriram Subramaniam* - National Institutes of Health, *Rudolf Reichelt* and *Lubomir Kovacik* - Reichelt: Westfaelische Wilhelms-Universitaet Kovacik:Charles University in Prague, *Deborah Kelly* - Harvard Medical School, *Daniela Nicastro* - Brandeis University, *Adam Hitchcock* - McMaster University

A18 Compositional X-Ray Imaging
Jeff Davis, Craig Schwandt and Paul Carpenter
Invited Speakers *Edward Vicenzi* - Museum Conservation Institute, *Dan Hodoroaba* - BAM, *Volker Rose* - Argonne, *Koen Janssens* - University of Antwerp, *John Henry Scott* - NIST, *Andrew Herzing* - NIST, *Harald Ade* - North Carolina State University

X-30 Technologists' Forum Platform Session
Frank Macaluso and Victoria Bryg
Invited Speakers *Helen Hansma* - University of California, Santa Barbara, *Wei Tan* - University of Collorado, Boulder, *Hongjun Wang* - Stevens Institute of Technology

X-31 Technologists' Forum Special Topics: Materials Characterization of Nanomaterials: Health and Environmental Impact
Frank Macaluso
Invited Speakers *Kristin Bunker* - R.J. Lee Group, *Victoria Bryg* - NASA, *Jiwen Zheng* - NIH, *Konstantin Sokolov* - University of Texas at Austin, *Erik Snapp* - Albert Einstein College of Medecine

X-32 Technologists' Forum Roundtable: Live Cell Fluorescence Imaging: Selecting Equipment and Designing Experiments
Frank Macaluso
Invited Speakers *Simon Watkins* - University of Pittsburgh, *Erik Snapp* - Albert Einstein College of Medecine

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Welcome from the Program Committee

The annual Microscopy & Microanalysis Meeting is the premier meeting for materials scientists, biological scientists, and nanotechnologists who use microscopy or microanalysis in their professional activities. Microscopy & Microanalysis 2010 will be no exception! In recent years there has been a special emphasis placed on fostering greater inclusiveness in the Microscopy & Microanalysis meetings. We welcome researchers and technologists who may not routinely attend this meeting.

To this end, there are several areas of specific focus for M&M 2010, including an exciting plenary, opening symposium. The keynote speaker of this plenary session will be Professor Mark Welland of the University of Cambridge, UK. His talk, entitled "What Microscopy Can Tell Us about Alzheimer's and Related Diseases," will feature extensive application of scanning probe techniques. Professor Welland's presentation will serve as an anchor for symposia in scanning probe microscopy in both biological and physical science. There will be an extensive surface science symposium that will feature many of the techniques that are complementary to scanning probe microscopy, including Auger electron spectroscopy, X-ray photoelectron spectroscopy, and secondary ion mass spectrometry. Secondary ion mass spectrometry, classically a technique limited to materials and geological sciences, has become a popular and extremely powerful technique in chemical mapping in biological systems as well.

This year we will celebrate the accomplishments of George Palade with the Palade Memorial Symposium, for his work in microscopy that led him to determine the intricate inner workings of cells. And, as always, we will continue to feature several symposia that emphasize microscopy and microanalysis of materials in nanotechnology and advanced energy systems.

The Executive Program Committee is pleased to welcome all microscopists and microanalysts, both veteran and novice, to the vibrant and exciting city of Portland, Oregon. We look forward to meeting you there!

Sincerely,

John Mansfield *Program Chair*	David Giovannucci *Program Vice-Chair*	Brendan Foran *MAS Co-Chair*	Jaret Frafjord *IMS Co-Chair*
Daniel Beniac *MSC/SMC Co-Chair*	Luke Brewer *MSA 2011 Ex officio*	Mashashi Watanabe *MAS 2011 Ex officio*	Don Susan *IMS 2011 Ex officio*

MSA does not permit any type of recording (photography, video, audio, etc.) of lectures, posters, tutorials, workshops and commercial exhibits at the Microscopy & Microanalysis meeting without prior permission of MSA or the individuals concerned.

Full Symposia Descriptions & Program Information

Biological Sciences Symposia

B01 George E. Palade Memorial Symposium
Caroline Miller & Vincent Gattone

George E. Palade is considered to be the father of modern cell biology for his work combining the use of electron

microscopy and cell fractionation to study the structure and function of cellular membranes. He is best known for his pioneering work in the transport of proteins along secretory pathways. This symposium will highlight some of his early work, but also invites the latest scientific contributions that continue the work of this great scientist to better understand the complexity of cellular structure and function.
Invited Speakers
Philippe Male - Yale University (retired), *Michael Caplan* - Yale University School of Medicine

B02 Imaging of Cytoskeletal Dynamics and Abnormalities in Disease
Heide Schatten and Kathryn Eisenmann

The cytoskeleton plays critically important roles in several cell cycle activities and cytoskeletal abnormalities are implicated in a number of different diseases including disorders of the immune system, reproduction, cancer, neurological disorders such as Alzheimer's, and others. This symposium is focused on recent advances in molecular cytoskeletal imaging using TEM, SEM, AFM and various forms of light microscopy including confocal and multiphoton live cell imaging. We will also highlight the impact microscopy has on the advancement of specific areas of science.
Invited Speakers
Gary Banker - Oregon Health and Science University, *Dahong Zhang* - Oregon State University, *Martin Poenie* - University of Texas at Austin, *Hilda Amalia Pasolli* - The Rockefeller University, *Andreas Hoenger* - University of Colorado, *Johnny L. Carson* - The University of North Carolina at Chapel Hill

B03 Microscopy Continues to Lead Advances in Alzheimer's Disease
George Perry and Mark Smith

Since the discovery of Alzheimer's disease, through the development of neuropathology specific stains with light microscopy, innovations in biochemical analysis with topographic resolution have played a major role in defining the disease. Electron microscopy revealed that the pathology was marked by filaments not found in the normal brain, paired helical filaments embedded in amyloid. There are limitations in the use of analytical biochemistry to define the molecular composition due to insolubility of the filments. Hence, antibodies, coupled with a variety of microscopy techniques have been instrumental in defining and characterizing the filaments. The recent evolution of new microscopic methods in confocal, atomic force, magnetic, Raman, multi-photon, mass spectroscopy and electron probe offer the promise of developing a fundamental molecular understanding of Alzheimer's disease. Contributed papers are welcomed that are an instrumental part of the route to solving the puzzle of Alzheimer's disease.
Invited Speakers
Alejandra Alonso - College of Staten Island, City University of New York, *Ismael Santa Maria* - Mount Sinai School of Medicine

B04 Man, Machine, Microscope
Simon Watkins and Sarah Richardson Burns

The bioengineering of tissues, organs and other body parts has become a centrally important research theme in medical science. It allows physicians to save and improve lives in an environment where the demand for replacement organs far outstrips resources. These devices will alleviate complications due to rejection of transplanted tissues, and may in time be produced rapidly and reproducibly and hence economically. The development of these materials has presented an extraordinary challenge to researchers; commonly the bioengineered tissue demands biocompatible scaffolds, stem cells and a developmental environment similar to that found in the living body. As such, the science needed to make these tissues rides at the nexus of cellular engineering, polymer chemistry, molecular biology and cell biology and physiology. Furthermore, as assessments of function, structure and health need to be made without disrupting the bioengineered tissue, there is an absolute need to use the microscope to study these parameters at the inherently complex interface of living and bioinert, bioactive or bioresorptive materials. This symposium will focus on the application of imaging tools to the development of bioengineered materials for use in humans to act as a regenerative substrate or as a replacement or assist device for tissues or organs. We invite papers which describe ongoing research using optical tools to facilitate progress in this field. This can include specific optical methodologies, novel use of reporter proteins and dyes, development of project specific bioreactors as well as examples of the application of synthetic replacements in model systems and man.
Invited Speakers
Mohammed Reza Abidian - University of Michigan, *Tracy Cui* - University of Pittsburgh, *Warren Zipfel* - Cornell University

B05 Atomic Force Microscopy for Cell Biology
Helen A. McNally

Since the development of Atomic Force Microscopy (AFM) in 1986, biologists have been intrigued by its possibilities to study biological systems. Previous research has investigated biologics ranging from single molecules and DNA to whole cells and tissues. This symposium will explore the development of AFM systems specifically for biological applications including integration with optical and physiological techniques. The AFM techniques for cell biology which are currently used and being developed will be discussed as well as their limitations of each. Ongoing research to overcome these restrictions will be explained. Examples of cell biology application of AFM will be presented.
Invited Speakers
Manfred Radmacher - Institut fur Biophysik, *Arvind Raman* - Purdue University, *Ben Ohler* - Veeco

B06 Microfluidic Devices: Emerging Platforms for Live Cell Microscopy
Jonathan V. Rocheleau

Microfluidic devices provide unique tools for the manipulation and assay of living cells and tissues. Laminar flow in these devices allow specific control of the microenvironment (limited dispersion, gradient generation, temporal control of stimulation, controlled shear stimulation) with use of minimal reagent. Due to the transparent nature of microfluidic devices, these tools can also be coupled with light microscopy to allow unprecedented ability to manipulate the sample while watching the response. The applications provided by these devices are growing, and this symposium will provide insight into how these tools are enhancing a wide range of studies.
Invited Speakers
David Eddington - University of Illinois at Chicago, *Aaron Wheeler* - University of Toronto, *Adam Quiring* - UBC, *Shuichi Takayama* - University of Michigan

B07 3DEM: Cellular, Bacterial and Viral surfaces: What Is Out There?
Teresa Ruiz, Esther Bullitt and Georgios Skiniotis

We are advancing our understanding of cell/cell and cell/virus interactions, and the communication of cells and viruses with the environment, through structural studies by 3D EM and image processing. This symposium will elucidate molecules and macromolecular assemblies involved in these interactions using data from electron tomography; electron crystallography; single-particle EM analysis; EM helical reconstruction; light microscopy; and x-ray crystallography. Topics will include cellular and bacterial adhesion, motility, including e.g. flagella and filopodia, secretion systems, trans-membrane signaling, including e.g. cell-surface receptors cell-cell interactions, lipid rafts and their role in biological processes, and virus-host interactions, including e.g. viral surface structures.
Invited Speakers
Dorit Hanein - Burnham Institute, ***Molecular machines involved in the assembly and regulation of the actin cytoskeleton at the leading edge of motile cells***; *Jenny Hinshaw* - NIH/NIDDK, ***Dynamin, and its role in constriction and fission of clathrin-coated pits***; *Jun Liu* - Univ of Texas Medical School, ***Flagellar motor structure and motility***; *Carmen Manella* - Wadsworth Center; NY State Dept. of Health, ***Mitochondria and their role in***

metabolic, neurological and muscular disorders; *Phoebe Stewart* - Vanderbilt University, ***Adenovirus - integrin complexes***

B08 Clinical and Investigative Microscopy of Infectious Diseases
Daniel Beniac

The application of light, electron, and allied imaging approaches in the investigation of pathogens in clinical, diagnostic, and research laborites are a crucial component of the diagnostic process, and our understanding of disease development. These approaches can be applied to both chronic disease, and emerging pathogens. Recent improvements in methodologies permit rapid detection, and provide insight into disease development. Contributions in diagnostics and research are encouraged ranging from investigations of molecular interactions up to the examination of cells, tissues, entire organisms, and their associated pathogens.
Invited Speakers
Gregory Czarnota - University of Toronto, *Elizabeth Fischer* - Rocky Mountain Laboratories, *Alasdair Steven* - National Institutes of Health

Physical Sciences Symposia

P01 Nanoscale Characterization of Next-Generation Photovoltaic Devices and Materials
Jun Jiao and Zhigang Rick Li

Though awareness about the need to employ alternative energy technologies to combat climate change and reduce our addiction to oil is universal, implementing these strategies is still at the developmental level. As the demand for the creation of a renewable infrastructure increases, the scientific community needs to take a critical look at the technologies meant for commercialization, taking great care to investigate the quality and longevity. This conference symposium offers an opportunity for professionals share their ideas and research results on these subjects, specifically about photovoltaic (PV) technology. An example of a topic to be addressed is the microstructure characterization of solar cells (crystalline Si, amorphous Si, CIGS, CdTe, etc.) using existing and new electron microscopy techniques.
Invited Speakers *Liang Liang* - Dupont, *Katharine Dovidenko* - General Electric, *Brent Wacaser* - IBM, *Yong-Hyum Kim* - Korea Advanced Institute of Science and Technology, *Lian-Mao Peng* - Peking University, *Jingyue (Jimmy) Liu* - University of Missouri-St. Louis

P02 Imaging and Spectroscopy of Interfaces and Surfaces in Advanced Materials and Nanostructures
Xiaoqing Pan and Wayne Kaplan

This symposium focuses on application of state-of-the-art imaging and spectroscopy techniques for the quantitative analysis of crystal defects, interfaces and surfaces in advanced materials and nanostructures. The goal of this symposium is to provide a platform for discussing the recent progress in the understanding of structure-property relationships for advanced materials including metals, ceramics, thin films, nanostructures, catalysts, ferroelectrics, semiconductors and superconductors. Papers on these topics using a combination of TEM/STEM with other techniques such as scanning probe microscopy (SPM) and in-situ techniques are strongly encouraged.
Invited Speakers
Hengjiang Ye - Institute of Matal Research, Chinese Academy of Science, *Jing Zhu* - Tsinghua University, *Yuichi Ikuhara* - University of Tokyo, *Isao Tanaka* - Kyoto University, *Judith Yang* - University of Pittsburgh, *Yimei Zhu* - Brookhaven National Laboratory, *David Muller* - Cornell, *Kai Sun* - University of Michigan, *Christoph Koch* - MPI-Stuttgart, *Christina Scheu* - University Munich, *Alex Recnik* - JSI-Slovenia, *Susanne Stemmer* - UCSB, *Lothar Houben* - Julich Research Center, Germany, *Ulrich Dahmen* - LBNL

P03 Microscopy and Analysis in Forensic Science
Frank Platek and Mary-Jacque Mann

Microscopy serves a critical role in forensic science from a primary examination tool to qualitative and quantitative analytical instrumentation. From the classic, hand-held magnifying glass to the electron microscope, some type of microscopy is used in the majority of forensic sample analyses. Presentations in this symposium will be devoted to the application of microscopic examination and analysis to forensic sample and related research by any type of microscope (LM, SLM, PLM, SEM, TEM, Confocal, etc) and integral detection and spectroscopic instrumentation (XEDS, CL, IR, etc.).
Invited Speakers
Chesterene Cwiklik - Cwiklik & Associates, *Susan Wilson* - Washington State Patrol Tacoma Crime Lab, *Andrew Vogt* - Abbott, *S. Frank Platek* - US Food and Drug Administration Forensic Chemistry Center, *Diana Wright* - DOJ - Federal Bureau of Investigation, *Michael Platek* - University of Rhode Island

P04 Structural and Chemical Analysis of Materials in the Nuclear Power Industry
Jie Lian, Jeremy Busby and Paula Crawford

Materials in future nuclear energy systems will be utilized in an extreme environment of high temperature and stress, intense radiation and highly corrosive conditions. Structural and chemical analysis of materials, specifically at the nano-scale, is needed to understand the fundamental processes governing materials degradation and develop novel nuclear materials with enhanced performance more capable of tolerating the extreme environment. This symposium will focus on recent development of new materials required for advanced nuclear energy systems, and the application of microscopy and microanalysis techniques for characterizing microstructural and chemical variation of materials under extreme environments. The materials of interest include clad and structural materials, fuels, waste forms and materials for fusion reactors.
Invited Speakers
Mike Miller - Oak Ridge National Laboratory, *Robert Odette* - UC Santa Babara, *Amit Misra* - Las Almos National Laboratory, *Somei Ohnuki* - Hokkaido University, *James Bentley* - Oak Ridge National Laboratory, *Zhijie Jiao* - University of Michigan, *Djamel Kaoumi* - The University of South Carolina

P05 Particles, Pores and Composites - Nano to Macro
Tom Murphy, Jian-Min Zuo and David C. Bell

This symposium includes a range of topics related to nanocomposites, particulate and porous materials and nanopores. Particulate materials (not limited to metallics and ceramics) and materials containing pore structures,and nanostructured materials. This symposium will also focus on the fabrication and application of nanopores.
Invited Speakers
Lionel Vayssieres - NIMS Japan, *Suprakas Sinha Ray* - CSIR, South Africa, *Thomas Dittrich* - Helmholtz Center Berlin, *Paul Voyles* - University of Wisconsin, Madison, *Venkatesan Murali* - University of Illinois, Electrical Engineering, *ilke Arslan* - UC Davis, materials science, *Ray Egerton* - University of Alberta, Canada

P06 Probing the Properties of Nanomaterials with Microscopy
Andrew Minor, Moon Kim and Martin Saunders

Understanding the structure, composition and properties of different classes of nanomaterials (nanoparticles, thin films, fullerenes, nanowires, nanocrystalline materials and nanostructured materials) is sometimes only possible by using advanced microscopy and microanalysis techniques. This symposium will focus on studies that directly probe the properties of nanomaterials using microscopes, including investigations of nanomaterial properties inside the microscope (in-situ techniques). With in-situ microscopy the response of individual nanostructures to external stimuli such as

temperature, gas environment, stress, and applied fields, can be observed in real-time. Sessions will focus on studies of nanomaterial properties using relevant characterization tools, including but not limited to scanning, transmission and low-energy electron microscopy (SEM, TEM, LEEM), scanning probe microscopy (SPM), and X-ray microscopy.
Invited Speakers
Zhiwei Shan - Xian Jiatong University & Hysitron, Inc., *Horatio Espinosa* - Northwestern University, *Marc Legros* - CEMES-France, *Stig Helveg* - Haldor Topsoe, Denmark, *Gyeong-Su Park* - Samsung Advanced Institute of Technology

P07 T3DEM: Quantitative Analysis at the Nano and Microscale using Tomographic Techniques
Ilke Arslan and Christian Kuebel

This cross-disciplinary symposium will present recent advances achieved in electron and x-ray tomographic techniques, opening the road towards a quantitative structural and compositional understanding of materials and biological specimens in 3D. We will explore new applications and developments in image acquisition, reconstruction and segmentation techniques leading to a reliable quantitative analysis using tomography. The presentations on tomographic techniques will be complemented by recent experimental and theoretical developments in 3D STEM/SCEM and serial sectioning techniques.
Invited Speakers
Peter Nellist - University of Oxford, *Mary Comer* - Purdue University, *Richard Leapman* - National Institute of Biomedical Imaging and Bioengineering, *Michael Uchic* - Air Force Research Laboratory, *Katja Schladitz* - Fraunhofer ITWM

P08 Inside Modern Micro-devices at the Atomic Scale
John Mardinly, David Muller and Vincent Hou

This symposium explores both the challenges faced by modern technologies at the atomic scale, as well as opportunities for new characterization methods to understand and solve those problems. Papers describing the microscopy techniques that could aid the development, production and perfection of microelectronic, photonic and storage devices are solicited. These include methods that can resolve the properties of the sub-nanometer layers and structures that now control the device performance such as transistors, magnetic read heads and memories (dynamic and non-volatile); metrology and defect analysis of today's integrated circuits at the 32-45nm process node, and characterize materials and devices for Photon Emitting and Detecting Devices: Displays, Image Detectors and Illumination Sources.
Invited Speakers
Colin Humphreys - Univerisy of Cambridge, *Edward Keyes* - Semiconductor Insights Inc., *Gary Tompkins* - Chipworks, Inc., *Ling Pan* - Intel, *John Bruley* - IBM, *Sergey Babin* - aBeam Technologies, Inc.

Instrumentation and Techniques Symposia

A01 Vendor Symposium: Creating the Tools for Science
Mike Bode, Andree Kraker and Tom Nuhfer

This symposium provides an opportunity for the vendor community to share important and exciting new developments with the attendees of the M&M meeting. The symposium is focused on new hardware, software and techniques for the Microscopy community. Initiated for M&M 2009 in Richmond, this symposium was well attended, and we encourage all vendors to submit abstracts for the meeting in Portland 2010. The symposium is limited to presentations by vendors who participate in the exhibition, and all submissions will be considered. The selection of the papers for presentation will be done by a non-vendor.

A02 Aberration-Corrected Electron Microscopy: Exploring Materials Through New Eyes
Juan Carlos Idrobo, Rolf Erni and Miaofang Chi

This symposium focuses on the advances in analytical (scanning) transmission electron microscopy that have become possible through the implementation of aberration correctors, monochromators, novel detectors, and stages. The symposium will give room to present novel applications and to discuss various aspects that are of practical relevance for aberration-corrected analytical electron microscopy. The topics to be address are: Imaging and spectroscopy with atomic resolution in three dimensions, at low (< 79 K) and high (>1000 K) temperatures, and under different electric field conditions. Factors that impose the new limits in analytical electron microscopy and how can they be tackled in future.
Invited Speakers
Matthew Chisholm - Oak Ridge National Laboratory, *Judy Cha* - Stanford University, *Nigel Browning* - University of California-Davis, *Sorin Lazar* - FEI, Arizona State University, *Teray Mizoguchi* - University of Tokyo, *Quentin Ramasse* - National Center for Electron Microscopy, *Marta Rossell* - ETH, *Masashi Watanabe* - Lehigh University, *Peter Hartel* - CEOS, *Martin Link* - Triebenberg Laboratory, University of Dresden, *Valeria Nicolosi* - Oxford University

A03 FIB Science and Applications in Materials and Biology
Joe Michael, F. Scott Miller and Haiping Sun

Focused ion beam tools have become essential instrumentation in modern research laboratories due to the many important capabilities of these tools. These capabilities range from TEM and SEM sample preparation to 3D characterization and new methods of nanofabrication. The development of new, high-current ion sources for efficiently removing large amounts of material quickly will extend the usefulness of FIB processing to larger structures. Other new ion sources using species other than Ga are also of interest. This symposium will focus on the above mentioned topics and others to in order to provide an in-depth picture of the current and future state of FIB tools engineering, science and applications.
Invited Speakers
Keana Scott - NIST, *Michael Marko* - Wadsworth Center, *Alexandria Imre* - Argonne National Lab, *Lucille Gianuzzi* - FEI Company, *David Adams* - Sandia National Lab, *Joanna Wojewoda-Budka* - Polish Academy of Sciences

A04 Computational Aspects of Data Visualization and Quantitative Microscopy and Microanalysis
Raynald Gauvin, Marc De Graef and Paul Kotula

Electron microscopy and microanalytical observations are often accompanied by extensive simulations and numerical data analysis. Recent advances in computational and detector speeds make it possible to acquire large volumes of data in a nearly automated fashion; this data must then be analyzed, preferably with minimal user intervention. In this symposium, we solicit contributions in all computational aspects of electron microscopy and microanalysis, including, but not limited to: aberration-corrected high resolution TEM, quantitative CBED, EELS and EDS, hyperspectral data visualization, quantitative phase reconstructions, handling and storage of large experimental and/or computational data sets, parallel computations, development and applications of Monte Carlo and Molecular Dynamics methods to TEM and SEM, and image processing/analysis.
Invited Speakers
Hans Fitting - University of Rostock, *Francesc Salvat* - Universitat de Barcelona, *Johan Verbeeck* - University of Antwerp, *Nick Wilson* - CSIRO, *Chris Stork* - Sandia National Laboratories

A05 Transmission EM and Spectroscopy at or Near Realistic Conditions
Chongmin Wang, Niels de Jonge and Jakob B. Wagner

The aim of this symposium is to review the state-of-the-art in technology and progress on science involving in-situ microscopy, and to identify future directions. Key topics from materials science include, real-time observation of catalytic process at elevated temperature and pressure, structural evolution across the interfaces of solid-solid and solid-liquid as

well as solid-gas, oxidation and reduction, nucleation and growth, microstructural evolution, stress and strain related to defect generation and interactions, charge and ion transport. In-situ electron microscopy of specimens in liquid and wet environments present new ways to image biological materials and cells with nanometer resolution. This emerging interdisciplinary field will be covered as well.

Invited Speakers

Charles H. F. Peden - Pacific Northwest National Laboratory, *Eric Stach* - Purdue University, *Ulrich Dahmen* - Lawrence Berkeley National Laboratory, *Kristian Molhave* - Technical University of Denmark, *Lawrence Allard* - Oak Ridge National Laboratory, *Henny Zandbergen* - Delft University of Technology, *Nigel Browning* - University of California, Davis, *Frances Ross* - IBM, *Longqing Chen* - Pennsylvinia State University, *Agnes Bogner* - INSA de Lyon, *Thomas W. Hansen* - Technical University of Denmark

A06 Surface Microscopy and Microanalysis in Materials and Biological Systems

Vincent Smentkowski, Jennifer Pett-Ridge and John Chaney

Surface properties (composition, uniformity, thickness, etc) dictate the performance of many materials 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 will emphasize state of the art surface analytical instrumentation, advanced data analysis tools, the use of complementary surface analytical instrumentation to perform a complete analysis of complex materials and/or biological systems, and surface analytical challenges. Contributed papers on surface analysis are solicited for both platform and poster presentation.

Invited Speakers

Tony Ohlhausen - Sandia National Laboratory, *Sankar Rama* - Physical Electronics, *Dave Surman* - Kratos, *Bill Sgammato* - Thermo Fisher, *Dave Castner* - University Washington, *David Joy* - University of Tennessee, *Scott Bryan* - Physical Electronics, *Barry Wise* - Eigenvector Research, *Ben French* - Intel, *Peter Williams* - Arizona State University, *Manfred Auer* - Lawrence Berkeley National Laboratory, *Peter Weber* - Lawrence Livermore National Lab, *Steve Golledge* - University Oregon, *Al Schultz* - Ionwerks, *Jeff Lince* - The Aerospace Corporation, *Matt Linford* - Brigham Young University, *Clive Walker* - European Commission Joint Research Centre, *Don Baer* - PNNL

A07 Scanned Probe Microscopies: Probing Advanced Material Properties on the Micro- and Nano-Scale

Phil Russell, Lou Germinario and Bryan Huey

Advanced engineering materials from diverse disciplines, which include metals, ceramics, semiconductors, plastics, and biological materials, often exhibit heterogeneity in morphology, composition and material properties. Imaging such materials with nano-scale resolution is of great importance for both advancement of fundamental knowledge and for material development. Example topics to be covered in this symposium will include a variety of scanned probe-based methods which not only provide morphological information, but also supply material property data on the electronic structure, optical, thermal, dielectric constants, magnetic, elastic modulus, adhesive force, energy dissipation and biological nanomechanics, at standard imaging rates and nano-scale resolution.

Invited Speakers

Stephen Jesse - Oak Ridge National Laboratory, *Maxim Nikiforov* - Oak Ridge National Laboratory, *Alexander Tselev* - Oak Ridge National Laboratory, *Richard Vaia* - Wright-Patterson AFB, *Sergei Magonov* - Agilent, *TBA* - Veeco, *TBA* - Asylum, *Kevin Kjoller* - Anasys, *TBA* - Hysitron, *Stephen Ducharme* - University of Nebraska Lincoln

A08 Ultrafast EM and the Effects of Ultrafast Events on the Structure and Chemistry of Materials

Nigel Browning, Bryan Reed, Thomas LaGrange and Steve Yalisove

The goal of this symposium is to provide a forum to discuss the latest developments in the implementation and application of ultrafast methods in electron microscopy. In particular, contributions related to the design and operation of new guns, electron optics, and detectors able to cope with the demands of imaging, diffraction and spectroscopy on the nanosecond to femtosecond timescale are encouraged. In addition, contributions related to the design and operation of in-situ stages to be used in either regular and/or ultrafast TEMs, and all applications of in-situ and ultrafast microscopy, diffraction and spectroscopy for the materials and biological sciences are encouraged.

Invited Speakers

John Spence - Arizona State University, *Dwayne Miller* - University of Toronto, *Samuel Sonderegger* - Attolight, F*rank Meyer zu Heringdorf* - University of Duisberg-Essen, *Joel McDonald* - Sandia National Laboratories, *Ted Norris* - University of Michigan, *Fabrizio Carbone* - Ecole Polytechnique Federale de Lausanne, *Chong-Yu Ruan* - Michigan State University, *Pietro Musumeci* - University of California Los Angeles

A09 TEM Phase Contrast Imaging in Biological and Materials Science

Mike Marko and Marek Malac

Conventional TEM phase-contrast imaging limits maximum information transfer to a narrow band of spatial frequencies. This can be avoided by in-focus imaging with a physical phase plate. The theory, construction, and practical use of phase plates will be explored. In biological cryo-TEM, high-contrast, high-resolution imaging at low electron dose is facilitated. In materials science, the combination of a physical phase plate with tunable Cs offers an unparalleled opportunity for characterization of both atomic details and larger structures. Since the number of laboratories starting to employ phase-plates is growing, this will be a timely opportunity to learn and to share experiences.

Invited Speakers

Radostin Danev - Okazaki Institute for Integrative Bioscience, *Robert Glaeser* - University of California, Berkeley, *Rasmus Schroder* - University of Heidelberg, *Kuniaki Nagayama* - Okazaki Institute for Integrative Bioscience, *Christian Kisielowski* - National Center for Electron Microscopy, *Wah Chiu* - National Center for Macromolecular Imaging, *Bastian Barton* - Max-Planck Institute of Biophyics, *Fu-Rong Chen* - National Tsing Hua University, *Sohei Motoki* - JEOL, Ltd., *Harald Rose* - University of Darmstadt

A10 Imaging Fields with Holography

Molly McCartney and Hannes Lichte

Electron holography is a powerful imaging technique that provides unique access to the amplitude and phase of the electron wave, enabling quantitative measurement of electromagnetic fields in many important classes of nanostructured materials. This symposium will address recent developments in using holographic phase imaging to characterize nanoscale magnetic and electrostatic fields. Platform and poster presentations will encompass the development of novel approaches and instrumentation for electron holography, as well as describing latest applications to dopant profiling in semiconductor devices, piezoelectric and ferroelectric materials, and magnetic nanostructures, both man-made and naturally occurring.

Invited Speakers

Falk Roder - Triebenberg Lab, *Rafal Dunin-Borkowski* - Center for Electron Nanoscopy, Technical University Denmark, *Tsukasa Hirayama* - JFCC, Nagoya, Japan, *Etienne Snoeck* - Centre National de la Recherche Scientifique, Toulouse, *Michael Gribelyuk* - IBM Fishkill

A11 Slow Electrons, Fast Ions: How Well Do We Image and What Do We Image With Scanning Beam Microscopy?

Brendan Griffin and David Joy

The SEM is, by a large margin, the most versatile and widely used electron microscope. But now, 60 years after its arrival, significant enhancements and changes seem to be required if it is to retain its position. This symposium will therefore examine some key questions about the future of the SEM, including:

- Are ion beams really the future of the SEM?

- Can we agree on a reliable way to measure SEM and SIM imaging resolution and performance?
- Can the iconic Everhart-Thornley detector be brought into the 21st century?
- Now that secondary electrons can image single atoms in a 200keVSEM, is there still a future for the low-voltage SEM?

Invited Speakers
Cornelia Rodenburg - University of Sheffield, UK, *Yimei Zhu* - Brookhaven National Laboratory

A12 Microscopy, Microanalysis and Image Analysis in the Pharmaceutical Sciences
Lynn M DiMemmo, Jennifer Liang and Andrew Vogt

Pharmaceutical research and development laboratories are at the forefront of science and have developed specialized technologies and themes that are of particular value to microscopists in industry. This symposium will present a variety of biological and materials science applications of significance to the pharmaceutical community. In response to feedback from previous meetings, an informal forum will be provided for sharing of thoughts and strategies related to regulatory and other issues faced in our laboratories in addition to talks by invited speakers. Contributed papers for platform or poster presentation on related topics are also welcome.
Invited Speakers
Sina Bavari - United States Army Medical Research Institute of Infectious Diseases, *Alejandra Camacho* - L'Oreal, *John Reffner* - John Jay College, *Phoebe Stewart* - Vanderbilt University, *Jim DiOrio* - Baxter, *Gerard Gagne* - Abbott, *M. Sherry Ku* - Wyeth, *Jack Megill* - Bristol-Myers Squibb, *Frank Platek* - Food and Drug Administration

A13 Specimen Preparation for SEM and EBSD
James Martinez, George Vander Voort and Scott Walck

Obtaining high-quality SEM micrographs requires excellent preparation and proper choice of etchants (or lack of etching). Electron backscattered diffraction patterns are highly susceptible to specimen preparation effects since the diffraction pattern is generated by low energy electrons that originate from a few outer atomic layers. This symposium provides a forum for discussion of preparation procedures, such as mechanical polishing, electrochemical polishing, and ion beam milling for any material to reveal their influence on SEM imaging using all imaging modes and success with EBSD diffraction and mapping. Materials discussed include alloys, ceramics, minerals, and geological samples.
Invited Speakers
Michael Zolensky - Astromaterials Research and Exploration Science Directorate NASA Johnson Space Center, *Frank Mucklich* - University of Saarland, Saarbruken, Germany, *John Radavich* - Purdue University, *Andrew Sullivan* - Deakin University, Australia

A14 Image Analysis & Quantitative Microscopy
Don Susan and Rob Panaro

Through new image analysis techniques and accurate computational analysis, the information now obtained from these tools provides precise quantification for broad applications from nanoscale materials research to practical industrial materials selection. At both the micro- and the nanoscale, new methods of image capture and analysis will be needed to meet the requirements of today's demanding research environment. With further sophistication, these techniques may be applied to diverse technical research, from mapping blood-flow efficiency in living tissue to defect characterization in failure analyses. This session will cover modern techniques, methods, technology, and applications within the field of image analysis and quantitative microscopy.
Invited Speakers
Alexander Kazakov - Saint Petersburg State Polytechnic University, *Arun Gohkale* - Georgia Tech, *Gabe Lucas* - Buehler, Ltd., *Tom Murphy* - Hoeganaes Corp.

A15 Failure Analysis: Practical Microscopy, Metallography and Fractography from Real World Applications or Research Case Studies
Stephen Banovic, Dan Dennies and Doug Puerta

Failure analysis is an important function crossing all engineering disciplines. This symposium will include real-world applications and research case studies to determine the root cause of the failure. In particular, this symposium will highlight the various correlative microscopes and special techniques that can be used. Any and all optical, scanning, and microanalytical techniques will be discussed. Topics covered include metal fatigue and fracture, biomaterials/medical implants, semiconductor failures, etc.. Contributions are encouraged from industry failure analysts and researchers active in any of these areas.
Invited Speakers
Mark Fischer - The Boeing Company, *Tom Tong* - Intel Corporation, *Mark Lisin* - Lisin Metallurgical, *Ron Parrington* - IMR Test Labs, *Bill Heady* - Chromalloy Gas Turbine Corporation

A16 Scanning Cathodoluminescence Microscopy and Spectroscopy: New Developments and Applications
Matthew Philips, Dominique Drouin and Colin Macrae

Scanning cathodoluminescence microscopy and spectroscopy is an important microanalysis tool, which is routinely used to study bulk and nanostructured semiconductor materials, electronic devices as well as geological specimens. Recent developments in SEM and optical detector technologies have considerably expanded and improved the analytical capabilities of the CL technique and its range of applications. In this symposium invited speakers will cover a broad range of advanced CL applications as well as recent developments in CL instrumentation and analysis techniques. Contributed papers as either platform or poster presentations are welcome.
Invited Speakers
Juergen Christen - Otto-von-Guericke-Universitat Magdeburg, Institut fur Experimentelle Physik, *Marek Godlewski* - Institute of Physics, Polish Academy of Sciences, *Giancarlo Salviati* - Instituto CNR-IMEM

A17 3DEM: A Real Bridge Between Light and X-Rays
Teresa Ruiz, Esther Bullitt, Georgios Skiniotis, Ilke Arslan and Christian Kuebel

Advances in preparative methods, instrumentation and analytical tools are giving a larger breadth to 3D imaging techniques. The dream of characterizing the structure of materials and biological specimens across length scales in 3D appears now more reachable providing an approach to understand their multiple components and interactions. This symposium will present advances of technical, materials and biological nature covering: correlative microscopy: LM/EM, AFM/EM, X-ray/EM, AP/EM, new tools to achieve correlative microscopy with minimal artifacts (e.g. tags), electron tomography, conical tomography, 3D correlative averaging of tomographic data, 3D image reconstruction methods, pushing the resolution to atomic numbers, time-resolved and cryo-electron microscopy techniques.
Invited Speakers
Ingeborg Schmidt-Krey - Georgia Institute of Technology, *Gina Sosinsky* - University of California, San Diego, *Sriram Subramaniam* - National Institutes of Health, *Rudolf Reichelt and Lubomir Kovacik* - Reichelt: Westfaelische Wilhelms-Universitaet Kovacik:Charles University in Prague, *Deborah Kelly* - Harvard Medical School, *Daniela Nicastro* - Brandeis University, *Adam Hitchcock* - McMaster University

A18 Compositional X-Ray Imaging
Jeff Davis, Craig Schwandt and Paul Carpenter

This broad symposium aims to cover all aspects of X-ray excited and electron excited compositional X-ray imaging. We

welcome contributions from the X-ray fluorescence and synchrotron communities, and we're encouraging papers on quantitative imaging algorithms, methods and advances in instrumentation. We hope the symposium will encourage participation from the often disparate communities of X-ray fluorescence, electron probe microanalysis, synchrotron methods and biological applications of applied X-ray imaging.

Invited Speakers

Edward Vicenzi - Museum Conservation Institute, *Dan Hodoroaba* - BAM, *Volker Rose* - Argonne, *Koen Janssens* - University of Antwerp, *John Henry Scott* - NIST, *Andrew Herzing* - NIST, *Harald Ade* - North Carolina State University

Technologists' Forum

Organizer: Frank Macaluso

X30 Technologists' Forum Platform Session: Imaging Biomaterials

Biomedical imaging techniques serve an increasingly essential role in the characterization of engineered tissues and biomaterials. There is a need to understand what chemical and biological species are present in a biomaterial and how those species are spatially distributed. Recent advances have extended the application of imaging technologies to reveal complex biological events at biomaterial-tissue interfaces.

X31 Technologists' Forum Special Topics:
Materials Characterization of Nanomaterials: Health and Environmental Impact

Nanomaterials and nanodevices offer the promise for cancer therapeutics, drug delivery, imaging, diagnostics and monitoring applications. Their size, which allows them easy entry into cells, may create potential health hazards. Microscopy techniques used to characterize nanomaterials and examine potential adverse health or environmental effects will be highlighted in this symposium.

X32 Technologists' Forum Roundtable:
Live Cell Fluorescence Imaging: Selecting Equipment and Designing Experiments

Live cell fluorescence imaging has become routine in many laboratories. Many vendors offer turnkey systems, but you must determine which components are essential for your application. Once you microscope is in place, what do you need to design and execute a successful experiment? Hear from a panel of experts and share your experience in this roundtable discussion. The format for this symposium is a short presentation from the experts followed by open discussion among the attendees.

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Biological Science Tutorials

Organizer: Elizabeth Wright

X40 Cryo-HRSEM Techniques for Biological and Soft Materials Specimens
Chris Frethem

The field emission scanning electron microscope (FESEM) is used for high-resolution imaging of cryo-preserved specimens. In this tutorial, the following topics will be discussed: methods for freezing biological and soft materials specimens, metal coating for high-resolution imaging, sublimated vs. the non-sublimated specimen, morphology identification, and future perspectives.

X41 Focused Ion Beam Techniques in Biology
Mike Marko

The focused ion beam / SEM instrument is being used with greater frequency in biology, both with room-temperature and frozen specimens. Topics will include: preparing and imaging simple cross-sections; specimen preparation and methodology for "FIB tomography" by sequential milling and imaging; preparing room temperature TEM samples; proper methods of freezing specimens for cryo-FIB; imaging strategies for cryo-SEM, and cryo-TEM specimen preparation.

Physical Science Tutorials

Organizer: Peter Sarosi

X50 EELS & EFTEM Imaging: Instrumentation, Applications and Artifacts
Gerald Kothleitner

Studying the energies lost by electrons transmitted through a thin TEM sample (electron energy-loss spectroscopy, EELS) allows one to study chemical and physical properties of a specimen at high spatial resolution. Energy-filtering TEM (EFTEM) can harness these signals to form 2D (and 3D tomographic) images to comprehensively characterize material- and life-science samples.

The tutorial gives an introduction to the basics of EELS, required to understand EFTEM images. Emphasis will be put on instrumental (both TEM and imaging filter) parameters, influencing the quality of the data. Spatial resolution, thickness effects and the signal-to-noise behavior of EFTEM images will be discussed for typical applications, together with advanced techniques such as spectrum imaging acquisition and processing and possible artifacts.

X51 Principles and Practice of HREM and HAADF Imaging
Budhika Mendis

High resolution electron microscopy (HREM) and high angle annular dark field (HAADF) are important techniques for imaging solids at the atomic scale. In HREM parallel beam illumination is used to form an interference pattern of the crystal while in HAADF the high angle scattered intensity from a focused probe scanned across the specimen is used to form the image. Correct interpretation and optimization requires a detailed understanding of the principles of image formation which includes lens aberrations, coherence effects, dynamic scattering from the specimen etc. Multislice image simulation, data processing methods (e.g. exit- wave reconstruction) and aberration correction instruments will also be discussed.

Topic List for Contributed Papers not Submitted to Organized Symposia

Organizers: Executive Program Committee

If you wish to submit a paper to the conference that does not fit into one of the organized symposia, you may choose from the following list of contributed session topics. However, if the Executive Program Committee believes that a paper

belongs to an organized symposium, it will automatically be moved to that session. Contributed sessions will be formed based on the number of papers submitted on the range of topics. The remaining papers will be redirected to the closest organized symposium.

Biological Sciences

C-01 Biological Sciences - General
C-02 Biological Microanalysis
C-03 Biological Specimen Preparation
C-04 Biomaterials
C-05 Biomedical Applications
C-06 Biomimetics
C-07 Blood / Immunology
C-08 Botany
C-09 Cell Biology
C-10 Cytochemistry (Histochemistry, Immunochemistry, In-Situ Hybridization)
C-11 Cytoskeleton
C-12 Developmental / Reproductive Biology
C-13 Entomology
C-14 Histology
C-15 Live Cell Imaging
C-16 Macromolecules
C-17 Microbiology
C-18 Microorganisms
C-19 Molecular Biology
C-20 Neurobiology
C-21 Parasitology
C-22 Pathology
C-23 Structural Biology
C-24 Ultrastructure (Cells, Tissues, & Organ Systems)
C-25 Vascular Corrosion Casting

Physical Sciences

C-26 Physical Sciences - General
C-27 Amorphous Materials
C-28 Catalysts
C-29 Ceramics
C-30 Composites
C-31 Ferroelectrics
C-32 Films / Coatings
C-33 Geology / Mineralogy
C-34 Interfaces
C-35 Magnetic and Superconducting Materials
C-36 Metals and Alloys
C-37 Modulated Structures
C-38 Nanostructured materials
C-39 Nanotechnology
C-40 Oxidation / Corrosion
C-41 Particle Analysis
C-42 Pharmaceuticals
C-43 Phase Transformations
C-44 Polymers
C-45 Porous Materials
C-46 Radiation Effects in Materials
C-47 Self-Assembly
C-48 Semiconductors
C-49 Specimen Preparation for Materials Sciences
C-50 Surfaces

Instrumentation and Techniques

C-51 Advances in Instrumentation and Technique - General
C-52 Instrumentation Performance & Development
C-53 Electron Optics and Aberration Correction
C-54 Transmission Electron Microscopy
C-55 Scanning Transmission Electron Microscopy
C-56 Electron Holography
C-57 High-Resolution Electron Microscopy
C-58 Analytical Electron Microscopy
C-59 Electron Energy-Loss Spectroscopy / Energy- Filtered TEM
C-60 Convergent Beam Electron Diffraction
C-61 In-situ
C-62 Scanning Electron Microscopy
C-63 Low-voltage SEM
C-64 Variable Pressure / environmental SEM
C-65 Electron Backscatter Diffraction
C-66 X-ray Spectrometry
C-67 Quantitative X-ray Microanalysis
C-68 Spectral Imaging
C-69 X-ray Imaging, Diffraction and Spectroscopy
C-70 Crystallography
C-71 Tomographic Methods
C-72 Focused Ion Beam
C-73 Surface Analysis techniques
C-74 Atom Probe Field Ion Microscopy
C-75 Scanned Probe Microscopy
C-76 Metallography and Metallographic Specimen Preparation
C-77 Stereology
C-78 Optical (Light) Microscopy
C-79 Confocal Microscopy
C-80 Multi Photon Excitation Microscopy

C-81 Optical Fluorescence Microscopy
C-82 Infrared and Raman Microscopy and Microanalysis
C-83 Molecular Spectroscopy
C-84 Correlative Microscopy
C-85 Combinatorial Methods
C-86 Cryogenic Techniques and Methods
C-87 In-vivo Imaging
C-88 Digital Image Acquisition, Processing, and Analysis
C-89 Computational Methods
C-90 Remote Microscopy and Collaboration
C-91 Education in Microscopy and Microanalysis
C-92 Failure Analysis
C-93 Forensic Science
C-94 Industrial "Real World" Microscopy
C-95 Quality Systems and Standards
C-96 Technologists' Forum
C-97 Core Facility Management
C-98 User Facilities

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Other Educational Opportunities

X89 Learn to See with the Private Eye: A Project MICRO Workshop for Attendees and Teachers
Caroline Schooley and Kerry Ruef
This special session will introduce "The Private Eye", an outstanding educational program for teachers. Among the notable features are:

- Private Eye uses inexpensive jeweler's loupes!
- Project MICRO's workshop will use "The Private Eye" to help meeting attendees, spouses, and teachers introduce magnification in school classrooms.
- Does your funding source require outreach? The Project MICRO/Private Eye workshop can help you do it effectively.
- Learning how to SEE is more basic than learning how to use a microscope. Project MICRO's "Private Eye" workshop will show you how to teach critical observation.
- "Think with the eyes and see with the brain. Deep revelations into the nature of living things continue to travel on beams of light." (Cell biologist Daniel Mazia, 1996). In the workshop you will learn how to do this!
- A teacher must capture the eye to capture the mind; the workshop will show you how.

X90 Microscopy in the Classroom: How to Use It and How to Teach It
Donovan Leonard and Elaine Schumacher
Local educators, school administrators and registered conference attendees are invited to participate in this special session to:

- Learn how microscopy can be incorporated into classroom curricula and outreach programs to engage students in cutting-edge science learning.
- Learn best practices for training students of all ages to work in the field.
- View state-of-the-art microscopy equipment for classroom use.
- Take part in discussion and Q&A with researchers and faculty who have experience using microscopy in the classroom.

X91 It's a Family Affair
Elaine Humphrey
This exciting session is designed to pique the scientific interest of children of all ages.

- Speakers will present a number of interesting images, ranging from insects to atoms and plants to metals, that will demonstrate the wide range of science.
- Hands-on activities and demonstrations will prove that science is fun!
- Children will have the opportunity to participate in a guided tour of the exhibit floor and view the microscopes and see how they work.

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In-Week Intensive Workshops

Organizer: Mike Marko

- These in-depth courses will be held Monday-Thursday from 1:00 PM to 5:00 PM.
- A certificate of participation will be issued to each participant.
- The course fee includes full registration to M&M 2010.
- Additional registration fees apply; see online registration form for details.

X-22 — Basic Confocal Light Microscopy
Once More, Jay and Silent Bob do Basic Confocal Microscopy

Jay Jerome
Associate Professor, Pathology and Cancer Biology, Vanderbilt University

Bob Price
Research Professor, Cell and Developmental Biology and Anatomy Director, Instrumentation Resource Facility, University of South Carolina School of Medicine.

Confocal microscopy has become a primary method for visualizing structure in three dimensions. The technology is rapidly evolving with new instruments, lasers, detectors, and spectral imaging capabilities. Bob and Jay will instruct beginning and intermediate researchers on carrying out successful biological confocal microscopy experiments. Emphasis will be on practical aspects of specimen preparation, instrument setup and operation and enhancement and analysis of the digital images collected by confocal microscopy. A general knowledge of optical microscopy is helpful, but no prior knowledge of confocal microscopy is necessary to benefit from the workshop.

Topics to be covered:

- Introduction and overview: Resolution, basics of digital images, image formats
- Specimen fixation, processing and labeling
- Basics of microscopic fluorescence and dye characteristics
- Types and component parts of confocal microscopes; proper set up of operating parameters

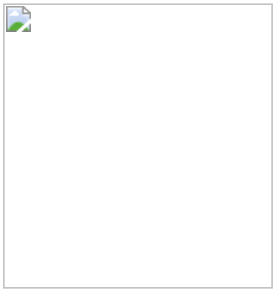


Image: Fluorescently labeled mouse small intestine

Drs. Price and Jerome have been teaching variations of the Basic Confocal Microscopy Workshop for the past 10 years for the Microscopy Society of America and its Local Affiliate Societies, The Australian Microscopy and Microanalysis Society, and on site courses for Universities. The Microscopy Society of America has also produced their lectures on the use of confocal microscopy as instructional videotapes.

X-23: Introduction to SEM Imaging and X-ray Compositional Analysis

David Joy
Distinguished Professor, University of Tennessee,Knoxville and Distinguished Scientist, Oak Ridge National Laboratory.

Brad Thiel
Associate Professor of Nanoscience Research, UAlbany College of Nanoscale Science & Engineering

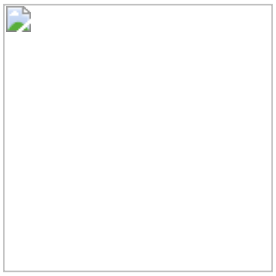
This introductory level workshop will involve classroom lectures and live demonstrations. The SEM topics will be taught by David Joy and will cover basic instrument operation and imaging modes. The EDS topics will be taught by Brad Thiel and will cover basic compositional analysis using an SEM with energy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

Topics to be covered:

- Instrument features
- Operation basics
- Sample preparation
- Spectral optimization
- Qualitative and quantitative analysis

David Joy has joint appointments as a Distinguished Professor at the University of Tennessee,Knoxville and as Distinguished Scientist at Oak Ridge National Laboratory. He has written and edited nine books and 400 papers in the areas of Scanning Electron Microscopy, X-ray microanalysis, Monte Carlo modeling of electron interactions with solids, and associated topics. He has lectured at the Lehigh Electron Microscopy Schools every year sine 1975 and conducted short courses in SEM in more than a dozen countries world wide. He is a past-President of MSA, and is current Editor in Chief of SCANNING.

Brad Thiel is a Professor at the College of Nanoscale Science and Engineering at the University at Albany. Additionally, he is the Director of the Advanced Metrology Program at SEMATECH. As devices, structures, and particularly defects approach the nanometer scale, it becomes more and more critical to understand and measure structure - property relationships on atomic dimensions. Accordingly, his research centers on the development of new characterization and metrology techniques using electron and ion beams, x-rays and optical methods. He has authored over 120 papers related to microscopy and is a lecturer at the Lehigh Microscopy School.



NaCl recrystallized in the ESEM, overlaid with an EDX spectrum of Pt.

X-24 - Nanomaterial Microscopy and Microanalysis: Tools and Preparation

Phillip E. Russell
Distinguished Professor of Science Education and Physics at Appalachian State University, a Director of MSA, Education Chair for MAS, and President of the Appalachian Regional Microscopy Society.

Donovan N. Leonard
Electron microscopist affiliated with both the University of Tennessee, Knoxville, Dept. of Materials Science & Engineering and the STEM group, Materials Science Division, Oak Ridge National Laboratory.

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

Topics to be covered:

- Choosing the proper preparation technique
- Minimizing the introduction of artifacts
- Ensuring that representative samples are identified for subsequent analysis
- Tools to be discussed:
- SEM, ESEM, and EBSD; FESEM: X-ray Microanalysis
- TEM and HRTEM; STEM/EELS: Nanoanalysis

- FIB: Sample Prep and Nanofabrication
- AFM: Imaging and Nanofabrication

Phillip E. Russell is the Distinguished Professor of Science Education and Physics at Appalachian State University. He spent 21 years of his career at NC State University where he was Professor of Materials Science and Engineering, and funding Director of the Analytical Instrumentation Facility. He has been actively teaching both University and specialty short courses in microscopy and microanalysis for the past 25 years. He is a Director of MSA, Education Chair for MAS, and President of the Appalachian Regional Microscopy Society.

Donovan N. Leonard is an electron microscopist affiliated with the Dept. of Materials Science & Engineering at University of Tenessee, Knoxville and working closely with the STEM group at Oak Ridge National Laboratory. He holds a Ph.D., M.S. and B.S. degree in Materials Science & Engineering from North Carolina State University in Raleigh, NC and researched bio-related nanotechnologies for his dissertation using state-of-the-art electron microscopy techniques. He is also currently an instructor for the Duke University Talent Identification Program and teaches both classroom and online Nanotechnology courses for high school students.

Thin film of ZnO containing Au nanodots (bright contrast hexagons), prepared for 360° STEM Z-contrast imaging by FIB milling

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Sunday Short Courses

Organizer: Mike Marko

- These full-day courses run from 8:30 AM to 5:00 PM on Sunday, August 1st.
- Additional registration fees apply; see online registration form for details.
- AM & PM coffee breaks and lunch breaks are on your own. On-site concessions available for purchase.
- A certificate of participation will be issued to each participant.

Biological Sciences

X-10 Cryo-preparation for TEM
Kent McDonald and Helmut Gnaegi

In this course we will briefly review why cryo-techniques for specimen preparation are superior to conventional methods. We will discuss some low-cost-alternative cryo-methods, as well as demonstrate some of the latest equipment and techniques for high pressure freezing, plunge freezing and cryosectioning. CryoSEM, and freeze fracture. The Tokuyasu method for immunolabeling will also be covered briefly. Persons taking this course should leave with a better understanding of these cryotechniques and their role in different applications such as EM tomography, vitreous cryosectioning, EM immunolabeling, as well as routine use for the best available preservation of cellular fine structure.

X-11 Immunolabeling Technology for Light and Electron Microscopy
Caroline Miller

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

X12 3D Electron Microscopy of Macromolecular Assemblies
Teresa Ruiz, Michael Radermacher, and Stefan Birmanns

This short course will provide a comprehensive description of the methods used for 3D structure determination of macromolecular complexes from electron micrographs. First specimen preparation techniques for single particles (deep stain, vitreous ice), will be presented and the selection of imaging conditions including low-dose imaging. This will be followed by a detailed explanation of image processing techniques with special emphasis on the random conical reconstruction technique. In the last part structure interpretation and docking of X-ray structures to 3D EM densities will be demonstrated.

X-13 Live Cell Imaging Using Fluorescence Methods
Simon Watkins

Microscopic imaging tools are one of the principal methodologies applied to the living system. This day-long workshop concentrates on live cell imaging using fluorescence methods, focusing on optimization of the entire microscope system. The goal is to collect the highest quality, most robust quantitative data without perturbing the cells being imaged. Lectures on the fluorescent proteins will be presented as well as discussions of the merits of newer methods such as TIRF and multiphoton imaging. Demonstrations using cutting edge integrated systems from the major manufacturers will conclude the lectures: hands on experience of the power of live cell imaging approaches.

Multi-Disciplinary

X-14 Electron Tomography in Life and Material Sciences
Montserrat Barcena, Christian Kubel, and Heiner Friedrich

This short course will explain the basics of tomography, the experimental setups, and the instrumental prerequisites, illustrated by application examples. Bright-field, energy-filtered, and STEM tomographic methods will be discussed, emphasizing high resolution for materials applications, and low-dose cryo imaging for biological applications. A variety of reconstruction algorithms will be covered, as well as a survey of 3-D analysis and visualization methods. We intend the course to be of interest to both beginners and already-experienced users of electron tomography.

X-15 Scientific Digital Imaging: Ethics and Execution
John Mackenzie

There is a need for standardization in scientific digital imaging in order to ensure proper ethical manipulation. This newly designed course will include a new Handbook for Scientific Digital Imaging. This handbook presents a standardized workflow with relevant theory to help kick start the standardization discussion. Topics covered include: The proper optimization of digital images; preparation of images for Powerpoint, posters, and publication including newer enhanced on-line versions; selection of the top-rated and most affordable printers, scanners, and software; best practices for archiving scientific digital images. Step by step demonstrations of the best strategy for reproducible image optimization

using Photoshop.

X-16 Imaging and Analysis with Variable Pressure or Environmental SEM
Brendan Griffin and Matthew Phillips

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

X-17 Scanning Cathodoluminescence Microscopy and Spectroscopy
Matthew R. Phillips and Dominique Drouin

Cathodoluminescence in the SEM has been used successfully for many years to non-destructively image in three-dimensions the distribution and concentration of luminescent impurities, dopants and point defects in geological specimens, technologically important ceramics and semiconductors. In addition to oxidation-state sensitive chemical microanalysis, the CL signal can also provide an abundance of information on the sample's electrical (band gap, carrier lifetimes and diffusion length) and structural properties (strain and deformation) at sub-micron resolution. This short course will cover the basic principles and practice of CL microscopy and spectroscopy as well as recent developments in the CL technique and instrumentation.

X-18 Advanced Focused Ion Beam Methods
Joe Michael and Lucille Giannuzzi

The use of single platform FIB and dual platform FIB/SEM instruments in materials and biological science laboratories is growing rapidly. The versatility and the capabilities of these tools are also rapidly improving. This course will first cover ion/solid interactions that are so important for a user of FIB instrumentation to understand. We will then discuss techniques of sample preparation for SEM and TEM. The course will conclude with discussions of 3D applications and nanofabrication.

Physical Sciences

X-19 High-Resolution TEM and STEM
Yimei Zhu & David C. Bell

Modern-day electron microscopes can routinely produce lattice fringes at the 1Å level or better. However, obtaining useful structural information at similar length scales requires a basic understanding of imaging theory and a working knowledge of microscope operation and correct adjustment methods. The first part of the workshop will concentrate on these basic aspects of high-resolution imaging. Later topics to be covered will include recent progress towards quantitative electron microscopy, an introductory overview of aberration-corrected electron microscopy as well as a brief review of related high-resolution methods.

X 20 Microstructural Analysis Techniques and Interpretation for Electronic Devices
Becky Holdford

Materials forensics and failure analysis are important tools in the effort to ensure reliability of electronic products and systems throughout their life cycle. Identification of materials, methods of manufacturing, and verification of failure mechanisms are achieved by cross-sectional analysis and materials characterization. Emphasis will be placed on specific sample preparation techniques of components with combinations of materials with varying properties. Case studies will be presented outlining successful analysis techniques for printed circuit boards, BGAs, solar thin films, and micro vias.

X21 Microscopy & Nanomechanical Characterization
Julia Nowak

Nanomechanical testing is a versatile technique used for measuring and evaluating the mechanical properties of materials including modulus, hardness, fracture toughness, wear resistance, adhesion, and friction coefficient. This type of characterization can provide crucial information concerning the performance of materials. Nanomechanical testing is often combined with scanning probe microscopy and in recent years is being performed in conjunction with both transmission electronmicroscopy and scanning electron microscopy. In this course we will explain the fundamentals of nanomechanical testing and its role in the microscopy arena, illustrated by application examples.

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Posters

Poster Presentation Times - Exhibit Hall

Monday, August 2	3:30 - 5:00 PM
Tuesday, August 3	3:30 - 5:00 PM (includes Late Breaking Posters)
Wednesday, August 4	3:30 - 5:00 PM

Papers will be assigned by the Program Committee to either a Platform or Poster presentation, unless "Prefer Poster" is selected on the Author Data Form in the online paper submission site. Authors will be notified of their assignment on or around April 15, 2010. Poster assignments will specify a presentation day; however, all posters are required to be displayed for the duration of the meeting.

PLEASE NOTE:

- No A-V equipment will be provided for ANY poster presentations.
- All posters will be displayed Monday morning through Thursday Noon.
- Poster presenters must remain at their poster on their assigned day between 3:30 and 5:00 pm.
- Each poster will be allocated a 92" wide x 46" high display area.
- Authors must provide their own male velcro hooks or push pins for mounting.
- A 12-in. high strip at the top should contain the title of the paper and the name and affiliation of the authors.
- The poster should have large legible text and figures, and describe the results in a manner that would be clear to a reader in the author's absence.
- Stereo images may be mounted and presented for stereo viewing using viewers provided by the author.
- Authors with videotape data are strongly advised to seek a platform presentation.

Late-Breaking Poster Session

The Microscopy and Microanalysis 2010 paper submission process is now complete and all accepted abstracts will be published on a DVD, with optional on-demand hardcopy printout (this option costs $90 and is NOT included with any conference registration). The Microscopy and Microanalysis 2010 Executive Program Committee invites submission of abstracts for a special late-breaking poster session at M&M 2010. Submissions are encouraged that include progress in microscopy and microanalysis in physical, biological and analytical science. To have your presentation accepted for the late breaking poster session, you MUST compile a full two page abstract in the accepted M&M Conference Paper Template format and submit it to the Program Chair by close of business (5pm EDT) on the 16th of July 2010. Microsoft Word documents will be accepted, however, PDFs are preferred. The object of the two page abstract is to allow the Executive Program Committee to review the proposed presentation and determine if it meets the standards set by that committee.

List of currently accepted late breaking posters (titles are links to PDF abstracts of the submissions):

Title	Corresponding Author(s)	Email Address
Helium Ion Microscopy versus Scanning Electron Microscopy	Bruce Arey	bruce.arey@pnl.gov
Comparison of Anatomy, Cytology and Distribution of Nickel in Leaves of Ni hyperaccumulating and Non-hyperaccumulating *Berkheya zeyheri*	Alban D Barnabas	alban@tlabs.ac.za
Electron Microscopy Analysis Shows Insignificant Dermal Penetration of Titanium Dioxide from Sunscreen Formulations Containing Nanoparticles	Ulrich Baxa	baxau@mail.nih.gov
Detection and identification of iron and steel particulate in 4200 hour Bus stack MEAs using SEM and TOF-SIMS	Myles Bos	myles.bos@ballard.com
Characterization of Laser Ablation Spots on Silicon and Gallium Arsenide Surfaces by FIB, SEM and TEM	Miles Brodie	Miles.J.Brodie@aero.org
Project Nano: Introducing K-12 Students to Nanoscale Phenomena	Sherry L. Cady	cadys@pdx.edu
A Microcalorimeter Spectrometer for High-Resolution X-ray Microanalysis	Robin Cantor	rcantor@starcryo.com
NanoGrande: electron microscopy pedagogy and outreach by a collaboration of scientists and artists	Palma Catravas	catravap@union.edu
Solid Oxide Fuel Cell Composite Cathode Performance and Morphology: Effects of Particle Size Distribution	Anh Duong	duongat@uci.edu
Analysis of Macromolecules by Negative Stain Tomography	Andrea Fera	feraandr@ninds.nih.gov

Dynamic process measurements in the complex plane with vibrational phase contrast CARS	Erik Garbacik	e.t.garbacik@student.utwente.nl
In-Situ, Time-Resolved Electron Microscopy of Thermal-Induced Phase Transitions in Nanostructured Materials	Louis Germinario	germ@chartertn.net
Method to separate markers, area from observing area for rod-shaped specimen	Misa Hayashida	misa-hayashida@aist.go.jp
Elucidating the pathway of plant FtsZ assembly	Andreas Holzenburg	holzen@mic.tamu.edu
High Efficiency CT with Optimized Recursions (HECTOR™)	Wolfram Jarisch	wolfram@cyber-inc.us
Helium Ion Microscopy of Microstructures and Biological	Weilin Jiang	weilin.jiang@pnl.gov
The Australian Microscopy & Microanalysis Research Facility (AMMRF) - A National Core Facility	Eleanor Kable	eleanor.kable@sydney.edu.au
Transmission Electron Microscopy Study of GaAs/AlGaAs Semiconductor QWIPstructures	Tugçe Karakulak	karakulaktugce@hotmail.com
Accurate TEM analysis of electron beam induced defects in GaN combined with defect-eliminated specimen preparation technique	Mitsuo Koike	mitsuo.koike@toshiba.co.jp
Influence of embedded Au-nanoclusters on the Atom Probe Tomography of Bulk MgO	Satyanarayana Kuchibhatla	satya@pnl.gov
Advanced Characterization Methods for CdTe/CdS/TCO Interfaces	Laurie Le Tarte	letarte@ge.com
Structural Analysis of GaN_{1-x} As_x Alloys for Solar Energy Application	Zuzanna Liliental-Weber	z_liliental-weber@lbl.gov
STEM/EELS Characterization of Thin Film Solid Oxide Fuel Cell Cathodes with Improved Electrocatalytic Properties	Donovan Leonard	donovan.leonard@gmail.com
Comparison of Tungsten Contacts formed by FIB and e-beam Depositions	Shusaku Maeda	smaeda@scu.edu
Low-Energy EELS of Au Nanoparticles	Douglas Meier	douglas.meier@nist.gov
In-situ Observations of Amorphous Germanium Nucleation and Nanocrystallisation by Dynamic Transmission Electron Microscopy	Liliya Nikolova	nikolova@emt.inrs.ca
Elucidation of the Drosophila Myosin Filament Binding Protein Flightin: An Electron Microscopic Approach	Lori Nyland	lnyland@uvm.edu
Understanding the effect of ZnO addition and SPS sintering on KNN densification by using transmission electron microscopy	Cigdem Ozsoy	ozsoycigdem@googlemail.com
Fabrication of Size-tunable Gold Nanoparticles Using Plasmid DNA as a Biomolecular Reactor	Irene Piscopo	irene.piscopo@gmail.com
Crystallographic image processing for scanning probe microscopy	Paul Plachinda	paul.pl.pl@gmail.com
High Resolution Imaging and X-Ray Microanalysis in the FE-SEM	Camille Probst	camille.probst@mail.mcgill.ca
Effects of impurities on crystal growth in sucrose crystallization using a photomicroscopic technique	Lie-Ding Shiau	shiau@mail.cgu.edu.tw
Laser Assisted Atom Probe Tomography analysis of nanoscale, energy and environment related materials at EMSL	Theva Thevuthasan	theva@pnl.gov
Investigation of the Electron Beam Damage Mechanisms on Zeolites	Ozan Ugurlu	ozan@umn.edu
Ultra-Fast Raman Microscopy: Line Scanning Confocal Raman Microscopy using Diffraction Limited Optics	Barry Weavers	bweavers@lcinst.com
Structural Studies of the β2-Adrenergic Receptor Gs Complex	Gerwin Westfield	gerwin@umich.edu
Characterization of nano-scale porosity in molecular crystal explosives	Ryan R. Wixom	rrwixom@sandia.gov
Relative Sensitivity of XEDS vs EELS in the AEM	Nestor Zaluzec	zaluzec@microscopy.com
Microtructural Characterization of Encapsulated Phase Change Nanoparticles as Biosensors	Qi Zhang	qizhang@mail.ucf.edu

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Awards & Scholarships

Awards Information

Please see below and scroll down for details regarding each specific award, criteria and prize(s). In order to be considered for the MAS Distinguished Scholar Awards, MSA Presidential Student Awards and the MSC/SMC Awards, the appropriate box must be checked on the paper submission site. The email address of the person providing the supporting letter must be provided as well. (That person will be contacted via email and asked to submit their support letter via email.) All support letters must be received no later than February 22, 2010. All applicants will be notified of their awards status by March 31, 2010. Unsuccessful applicants are permitted to withdraw their papers by April 7, 2010.

MSA Presidential Student Awards (PSA)

Criteria:

- Applicants must be bona fide students at a recognized college or university at the time of the meeting (August 2010).
- Awards are based on the quality of the paper submitted for presentation at the meeting.
- Applicant must be the first author of the submitted paper.
- Paper must be submitted for platform presentation.
- Successful applicants must present their papers personally at the meeting in order to receive their award.
- Awardees are expected to attend and participate in the entire meeting.
- **Please note: Former winners are ineligible for another award.**

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2010 (includes proceedings and social event ticket)
- Invitation to the Presidential Reception
- Up to $1,000 for travel (lowest roundtrip domestic USA airfare)
- Complimentary student housing accommodations

Robert P. Apkarian Memorial Scholarship

- Will provide support for two (2) post-doctoral students to attend M&M 2010.
- One (1) award designated for biological sciences.
- One (1) award designated for materials science, education or instrumentation.

Criteria (In addition to satisfying all criteria above):

- Applicant must be a full-time, post-doctoral student (open to both domestic U.S. and international candidates).
- Submission procedures must be followed as indicated above for Presidential Student Awards.
- A supporting letter must be received from a member of MSA, preferably the director or supervisor, attesting to the applicant's status.
- Applicant must be a current member of MSA (dues paid through 2010).

Successful applicants will receive:

- Complimentary full registration for M&M 2010 (including proceedings & social event ticket)
- Invitation to the Presidents' Reception
- Award plaque designating the Robert P. Apkarian Memorial Scholarship
- Limited travel and lodging support will be made available

Eric Samuel Scholarship

Sponsored by 

Criteria:

- Identical to Presidential Student Awards, except also open to postdocs.

Successful applicants will receive:

- Complimentary full meeting registration to M&M 2010 (including proceedings & social event ticket)
- Invitation to Presidents' Reception
- Up to $1,500 for lodging and travel (lowest available roundtrip airfare)
- Complimentary student (or equivalent) lodgings

Raleigh & Clara Miller Scholarship Award

The award is provided by the family in honor of the parents of Dr. Sara Miller, past president of MSA. Both Raleigh and Clara Miller were keenly aware of the importance of education, and strongly supported student activities.

Criteria:

- Applicant must be the first author of a paper submitted for platform presentation.
- Applicant must have been a student (undergraduate, graduate, post-doctoral) when work to be presented was done.
- Preference is for biological topics, but materials and technical projects will be considered.

Successful applicants will receive:

- $1,000 to attend the meeting.

MAS Distinguished Scholar Awards (DSA)

Criteria:

- Applicants must be bona fide students at a recognized college or university at the time of the meeting (August 2010).
- Awards are based on the quality of the paper submitted for presentation at the meeting.
- Applicant must be the first author of the submitted paper.
- Successful applicants must present their papers personally at the meeting in order to receive their award.

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2010 (includes proceedings and social event ticket);
- Invitation to the Presidential Reception;
- Monetary contribution towards travel and lodging expenses.

MSA Professional Technical Staff Awards (PTSA)

(up to 4 awards given)

Criteria:

- Awards are designated for professional technical staff.
- Applicants must be regular, current members of MSA (dues fully paid for 2009).
- Awards are based on the quality of the paper submitted and are judged by the MSA Technologists' Forum.
- Applicant must be the first author of the submitted paper.
- Successful applicants must present their papers personally at the meeting in order to receive their award.
- Awardees are expected to attend and participate in the entire meeting.
- Please note: Former winners are ineligible for another award. This category also includes the Raleigh and Clara Miller Awards.

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2009 (includes proceedings and social event ticket)
- Up to $600 for travel/lodging/meeting expenses

MSA Student Poster Awards

Criteria:

- Presented for best posters in categories of:
    1. Instrumentation & Techniques;
    2. Applications of Microscopy & Microanalysis - Biological;
    3. Applications of Microscopy & Microanalysis - Physical.
- The first author of each awarded paper must be a student (contact information must be provided for someone who can verify student status).
- Awardees' posters must be displayed at the meeting from Monday through Thursday.

Prizes will be awarded in each category:
First Prize: $400; Second Prize: $200

Diatome Awards

Sponsored by DiATOME

Criteria: Presented for the posters illustrating the best use of diamond-knife ultramicrotomy in either biological or physical sciences.
First Prize: One week, all-expense-paid trip to Switzerland
Second Prize & Third Prize: Swiss watches

IMS International Metallographic Contest

Criteria:

- The contest embraces 11 classes representing various materials and methods revealing structure such as microphotography, optical and electron microscopy, and unique techniques.
- In general, an exhibit should tell a story about a problem and how it was solved.
- For complete requirements, detailed rules, and submission procedures, visit http://www.internationalmetallographicsociety.org/contest.html or contact IMC Chair, Jeff Stewart (jeff@metallography.com).

Prizes will be awarded in each category.

First Prize: $200;
Second Prize: $100;
Third Prize: $50;
Best in Show Prize: $3,000

All entries must be received by July 21, 2010 and should be sent to:

Douglas G. Puerta
VP-Technical Director, IMR KHA - Portland
5687-A SE International Way
Portland, OR 97222

MSC/SMC Awards

Gerard T. Simon Awards:

- Full details for this award can be found on the MSC/SMC website at http://msc.rsvs.ulaval.ca/
- Applicants must be a student or technologist who has been employed for no longer than five years in a Canadian institution, and be the main or sole author of the paper.
- These awards are made on the basis of work described in the paper submitted for M&M 2010.
- Candidates must indicate on the Submission Form their intention to be considered for the award.

Canadian Foundation for the Development of Microscopy (CDFM):

- Full details for this award can be found on the MSC/SMC website at http://msc.rsvs.ulaval.ca/, where both the application form and guidelines for this bursary are present. The CDFM will contribute towards the travel expenses of students attending a Canadian University.
- Candidates must indicate on the Submission Form their intention to be considered for the award.

MSA Micrograph Competition

Sponsored by Microscopy Society of America
Held at the M&M Meeting each year, this micrograph competition promotes the innovative blending of art and science. Open to all forms of microscopic imaging, winners of this competition are selected on the basis of artistic merit and general audience appeal. A maximum of three (3) awards will be presented.

Criteria:

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

Rules:

1. Any individual may submit a maximum of two (2) entries (one award per entrant).
2. Entries must have overall dimensions of 11" x 14" (horizontal or vertical), and be affixed to a stiff lightweight support (e.g. ¼" foam board). Micrographs may be mounted so that they have borders.
3. Each entry must have a separate text sheet with the title and a 200-word (max) description of the image, including the technique and its scientific significance. Text is recommended to be printed in 14-pt Times New Roman font on a separate 8 ½" x 11" sheet. Entrant's name, address and image title shall be posted on the back of the mounted entry(ies).
4. Entries must be brought to the meeting and mounted on the display boards by 12:00 noon on Monday, August 2, 2010. Non-winning entries must be removed Thursday afternoon by 3:00 PM. Micrographs remaining after that time will be discarded. Winning micrographs will be incorporated into the MSA Traveling Poster Exhibit for 2010-2011, and will be returned to the owner during the summer of 2011. Winners will be announced at the meeting. Submitted micrographs remain the property of the entrants subject to the conditions above.

First Prize: $200; **Two Second Prizes:** $50 each.