Microscopy & Microanalysis

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

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P10 Microscopy and Microanalysis for Real World Problem Solving

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X41 Physical Sciences Tutorial: In situ Liquid S/TEM: Practical Aspects, Challenges, and Opportunities

X42 Bio Tutorial - Maximizing the Likelihood of Successful Maximum Likelihood Classification

X43 Bio Tutorial - Advances in Light Sheet Microscopy

X44 Bio Tutorial - Optimizing Specimen Preparation for Macromolecular Electron Microscopy

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X90 Microscopy in the Classroom

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Welcome from the Society Presidents

Dear Fellow Microscopists, Microanalysts, Students, and Friends,

On behalf of our respective societies, we are excited to welcome you once again to Portland, Oregon, the City of Roses, and one of the most beautiful cities in America, for the 2015 Microscopy & Microanalysis meeting. M&M, serving as the annual meeting of the Microscopy Society of America, the Microanalysis Society, and the International Metallographic Society, continues to be the premier meeting for scientists, technologists, and students who use microscopy or microanalysis in their research.

The Program Committee for 2015 has assembled an exceptional, diverse scientific program with a record number of over 1250 papers, featuring researchers from around the world presenting the latest advances in the biological and physical sciences, techniques and instrumentation. In synchrony with this remarkable program is one of the world's largest exhibitions of state-of-the-art microscopy and microanalysis instrumentation. In addition, there are number of educational opportunities during M&M, in particular the excellent Short Courses, tutorials, educational outreach events, and the always-popular evening vendor tutorials during the week.

Whether you are new to M&M or a longtime participant, M&M 2015 is the perfect place to network with others in your field, to learn the newest techniques, to see the latest exhibits, and to check out future job opportunities. Sunday night's Opening Reception provides an enjoyable start to the meeting. You can renew old friendships and make new acquaintances while enjoying a selection of locally sourced dishes and your favorite beverages.

The Monday morning plenary session will be highlighted by talks from two extraordinary microscopists: Nobel laureate Roger Y. Tsien who will discuss "New Molecular Tools for Light and Electron Microscopy" and NASA Astronaut Donald Pettit who will present "Some Unexpected Difficulties in Microscope Operation in Microgravity." In addition, participating Societies will recognize their major society award winners, as well as student, post-doc and technologist Meeting winners. During the week, there will be daily student poster awards acknowledging the talents of the best young researchers in instrumentation and techniques, and biological and physical applications of microscopy & microanalysis.

Portland is an inviting location with hotels, shops, numerous restaurants, a number of craft breweries and historical sites for your enjoyment. We hope the science presented at Microscopy & Microanalysis 2015 will inspire you to great things!

Have a wonderful week and we look forward to seeing you next year in Columbus, Ohio!

John F. Mansfield
President, MSA

Microscopy Society of America

Thomas F. Kelly
President, MAS

MICROANALYSIS Society

Jaret J. Frafjord
President, IMS

IMS International Metallographic Society
ASM INTERNATIONAL

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Welcome from the Program Chairs

Welcome to Microscopy & Microanalysis 2015 in Portland, Oregon!

The Microscopy Society of America, the Microanalysis Society, and the International Metallographic Society welcome you to Microscopy & Microanalysis 2015 in Portland, Oregon.

The overarching M&M 2015 Portland theme is correlative imaging, with a nod to light-based technologies. The United Nations General Assembly proclaimed 2015 as the "International Year of Light and Light-Based Technologies" which blends well with the interdisciplinary symposia that reflect the current environment of collaboration between scientists in different disciplines synonymous with our annual M&M meeting.

Once again the latest and most innovative applications and instrumentation developments are on show utilizing microscopy and microanalysis techniques in the biological and physical sciences. This year's program features two plenary lectures, 40+ symposia covering a broad range of topics, numerous educational opportunities in the form of Outreach opportunities, Biological and Physical Sciences tutorials, Sunday Short Courses, and a pre-meeting Congress, organized by the MSA Electron Microscopy in Liquids and Gases (EMLG) Focused Interest Group.

This year we are excited to host Professor Roger Tsien as one of two plenary speakers, who will discuss *"New Molecular Tools for Light and Electron Microscopy"*. He is a member of the National Academy of Sciences and the Royal Society. Dr. Tsien is best known for designing and building molecules that either report or perturb signal transduction inside living cells. These efforts lead to a Nobel Prize in Chemistry (shared with O. Shimomura and M. Chalfie, 2008). The second plenary speaker is NASA Astronaut Donald Pettit who will present *"Some Unexpected Difficulties in Microscope Operation in Microgravity."* As is typical, M&M 2015 will have the largest microscopy/microanalysis instrument exhibition in the world. Over 100 companies will display their latest equipment and services. The social activities of the opening reception and accompanying each day's poster and awards sessions have now become an afternoon tradition in the exhibition hall.

The Executive Program Committee and the large number of symposium organizers have created the palette for Microscopy & Microanalysis 2015. This 2015 M&M meeting promises to be the showcase meeting of the year. On behalf of MSA, MAS, and IMS, welcome to Portland!

Mark A. Sanders
Program Committee Chair
University of Minnesota

Donovan Leonard
MAS Co-Chair
Oak Ridge National Laboratories

Joseph Michael
Program Vice Chair
Sandia National Laboratories

James E. Martinez
IMS Co-Chair
NASA Johnson Space Center

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Plenary Session

PLENARY SPEAKER

Professor Roger Y. Tsien
University of California – San Diego

"New Molecular Tools for Light and Electron Microscopy"

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

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

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

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[3.] Dept. Neurosciences and National Center for Microscopy and Imaging Research, University of California San Diego, La Jolla CA, USA.
[4.] Howard Hughes Medical Institute.

Fluorescent proteins (FPs) are invaluable tools for biology, enabling tracking of gene expression, cell fate, and genetically encoded fusion proteins for precise localization within a cell. Traditional FPs developed from jellyfish and coral are limited in wavelengths, consume O_2, and produce a stoichiometric amount of H_2O_2 upon chromophore formation, thus requiring an aerobic environment tolerant of reactive oxygen species. Far-red/near-infrared FPs are desirable for imaging in living animals because less light is scattered or absorbed or reemitted by endogenous biomolecules. Previous near-infrared FPs were engineered from nonfluorescent phytochrome precursors and have had poor quantum yield (QY). We have developed a new class of FP by evolving an allophycocyanin α-subunit from a cyanobacterium, *Trichodesium erythraeum*. Native allophycocyanin is a highly fluorescent hexamer composed of three β+α dimers and uses an auxiliary protein, known as a lyase, to incorporate phycocyanobilin (PCB). The new FP, named small Ultra-Red FP (smURFP), was engineered to bind biliverdin (BV), an endogenous heme metabolite ubiquitous to mammals, without an auxiliary lyase or autoxidation chemistry. It is a dimer of 15 kDa subunits or a tandem dimer of 32 kDa, and has excitation and emission maxima at 642 and 666 nm and the largest QY (0.18), BV incorporation rate, metabolic stability, and photostability of any BV binding FP so far. SmURFP is even more photostable than GFP or Cy5. Collaborations are currently underway to utilize smURFP for superresolution imaging. SmURFP expressed in HT1080 mouse xenografts show significant, visible fluorescence without exogenous BV, but provision of extra chromophore by various means increases the fluorescence yet further. Using smURFP and a phytochrome FP, a far-red/near-infrared fluorescent ubiquitination cell cycle indicator (FUCCI) was created, which should be suitable for monitoring cell cycle progression in intact mammals. The development of this new class of FP and far-red/near-infrared biosensors should dramatically increase our ability to image and monitor dynamics deep in tissues of living animals.

Electron microscopy (EM) achieves the highest spatial resolution in protein localization and has long been the main technique to image cell structures with nanometer resolution. However, making specific molecules standout for EM is a challenge. Recently, powerful genetically-encoded tags have been introduced that allow specific proteins to be tracked by EM via genetic fusion, in a manner similar to how green fluorescent protein (GFP) is used to track proteins

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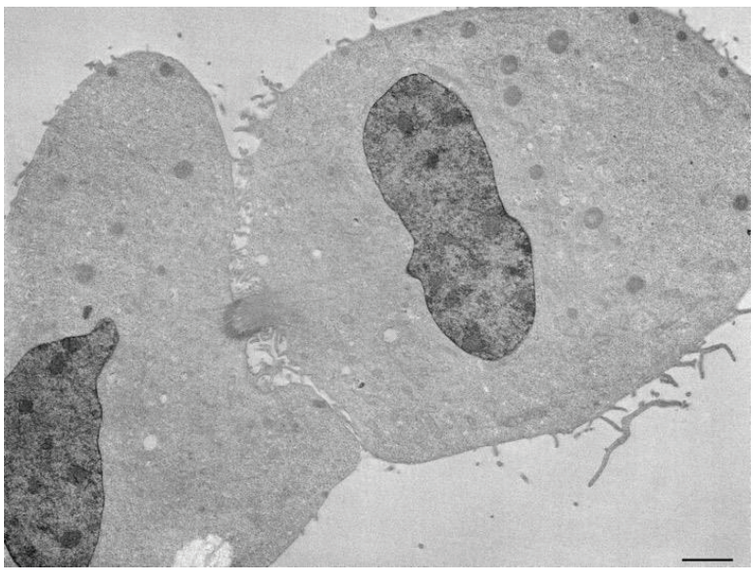
New Molecular Tools for Light and Electron Microscopy

by light microscopy (LM). Tagged proteins are revealed by tag-mediated conversion of 3,3′-diaminobenzidine (DAB) into a localized osmiophilic polymer that is readily distinguished under the electron microscope. Currently available EM tags precipitate DAB either enzymatically through peroxidase activity or via photo-generated singlet oxygen. While such tags are powerful tools for "painting" individual proteins, researchers lack analogous tools for marking biochemical processes, or non-proteinaceous molecular species for EM. To complement the existing EM tags, we describe "Click-EM," a new method for imaging nucleic acids, lipids, and glycans via bio-orthogonal ligation of photo-sensitizing dyes to functionalized metabolic analogs. These analogs mimic the fates of their natural counterparts and can be used to track cellular metabolism. Analogs functionalized with azides and alkynes can be selectively ligated to chemical probes that do not react with endogenous (unlabeled) biomolecules. For detection, azide- and alkyne-functionalized analogs can be revealed by Cu(I)-catalyzed azide–alkyne cycloaddition (CuAAC), a reaction often referred to as "click chemistry," to appropriately functionalized dyes. These labeled structures, conjugated to a singlet oxygen-generating fluorescent dye (a "photosensitizer"), can be visualized first by fluorescence and subsequently by EM through photogeneration of singlet oxygen for DAB precipitation. Using these methods, we have imaged neuronal protein assemblies within the full context of cellular ultrastructure and have visualized DNA replication (see Fig. 1) and mRNA transcription at the nanometer scale.

Distinguishing multiple biomolecules in EM is presently limited to attachment of different sizes of gold particles or quantum dots to specific antibodies, which poorly penetrate into the strongly fixed cells or tissue required for optimal cellular ultrastructure. Localized precipitation of DAB by antibody conjugates or genetically-encoded chimeras with photosensitizers and subsequent staining with osmium can overcome many of these constraints but is limited to a single protein or tracer "color". For "multi-color" EM, we have now synthesized "Ce-DAB" and "Pr-DAB", shorthand for conjugates of DAB with chelates of Ce or Pr. Ce-DAB is locally photooxidized with the first photosensitizer tracer, and then the polymer is quenched. Pr-DAB is either oxidized by a peroxidase-antibody conjugate to a second label, or photooxidized with a second targeted photosensitizer irradiated at much longer wavelengths than the first. The two deposited lanthanides can be detected by electron energy loss spectroscopy (EELS), selectively imaged with energy-filtered transmission EM, and overlaid as elemental maps on a conventional electron micrograph. Pancreatic cancer cells labeled with NBD-ceramide and an EpCAM antibody gave the expected Golgi and plasma membrane staining respectively. We detect sharing of a single synapse by two adjacent astrocytes in mouse brain slices and reveal the endosomal localization of cell-penetrating peptides in tissue culture cells, demonstrating high spatial resolution and selectivity.

Supported by NIH grants GM86197, GM103412 and NS27177 and HHMI.

Fig. 1. Click-EM imaging of newly replicated DNA in a dividing HeLa cell. Live cells were pulsed for 12 hr with 5-ethynyl-2′-deoxyuridine (EdU), a nucleoside analog readily in-corporated into DNA during replication. After fixation with glutaraldehyde, alkyne-containing DNA was conjugated to azidodibromofluorescein (DBF) via CuAAC. Cells were incubated with DAB and illuminated for 5 min with blue light for singlet oxygen generation and photo-oxidation of DAB, which formed optically dense precipitates coincident with DBF fluorescence. Cells were stained with OsO_4, embedded in resin, and thin sectioned for EM. Scale bar 2 μm.



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Plenary Session

PLENARY SPEAKER
Donald R. Pettit, PhD
NASA-Johnson Space Flight Center, Houston

"Some Unexpected Difficulties in Microscope Operation in Micrograv ity"

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

Dr. Donald Pettit is a veteran NASA astronaut and scientist who has spent a total of 370 days in space and over 13 EVA (spacewalk) hours during three separate spaceflights. He received a Bachelor of Science in Chemical Engineering from Oregon State University in 1978, and a Doctorate in Chemical Engineering from the University of Arizona in 1983.

Before joining NASA, he served as a staff scientist at Los Alamos National Laboratory, Los Alamos, New Mexico. Projects included reduced gravity fluid flow and materials processing experiments onboard the NASA KC-135 airplane, atmospheric spectroscopy on noctilucent clouds seeded from sounding rockets, fumarole gas sampling from volcanoes and problems in detonation physics. He was a member of the Synthesis Group, slated with assembling the technology to return to the moon and explore Mars (1990) and the Space Station Freedom Redesign Team (1993).

Selected as a NASA astronaut in April 1996, Dr. Pettit completed his first spaceflight in 2003 as an International Space Station Science Officer, logging more than 161 days in space. The Expedition 6 crew launched on STS-113 Space Shuttle Endeavour and returned to Earth on Soyuz TMA-1, after completing more than five months of science experiments and continuing to prepare the orbital outpost for further growth.

He returned to space aboard Space Shuttle Endeavour on STS-126 (November 14 to November 30, 2008,) the 27th shuttle/station assembly mission, which expanded the living quarters of the space station and delivered a new resident to the station, replacing Greg Chamitoff with Sandy Magnus. The STS-126 crew returned to Earth with Chamitoff after completing 250 orbits in more than 6 million miles.

On his most recent spaceflight, Expedition 30/31 (December 21, 2011 to July 1, 2012), he launched aboard the Soyuz TMA-03M craft from Kazakhstan. As a NASA Flight Engineer, Dr. Pettit continued microgravity scientific research and mark a new era of U.S. commercial resupply services by greeting the first SpaceX Dragon spaceship. Following a series of tests of its maneuverability and abort systems, the capsule was grappled and berthed to the space station by the crew members of Expedition 31. Dr. Petit landed in Kazakhstan after 193 days in space orbiting the Earth 3,088 times and traveling more than 76 million miles.

Donald Pettit[1]

[1.] NASA Johnson Space Center, Houston, TX

The International Space Station (ISS) is a research laboratory in low earth orbit where the magnitude of gravitational forces are reduced by a factor of one million. Changing any other earthly parameter by this magnitude rapidly takes one into an experimental frontier, and this orbital environment is no exception. Many facilities typical of ground-based laboratories are onboard ISS: furnaces, centrifuges, freezers, incubators, plant growth and combustion chambers, with supplied resources of vacuum, inert gas, oxygen, liquid and forced air cooling, 28 and 120 volt DC power, and near-continuous real-time communication of data, voice and high definition video transmitted over distances approaching 50,000 miles (roundtrip to geostationary orbit). Microscope facilities include many state-of-the-art imaging techniques: transmission, reflection, brightfield, darkfield, epi illumination, phase contrast, differential interference contrast, fluorescent, confocal, polarization, and student educational instruments [1]. During the operation of these microscopes in low earth orbit, some unexpected difficulties unrelated to the undergoing research but directly resulting from their operation in microgravity can delay the progress of an experiment. Difficulties can stem from errant fluid behavior, residual gravity gradients, cosmic rays, and safety of flight.

Subtle forces stemming from surface tension, liquid-solid contact angle, and static electric charge dominate fluid behavior in microgravity. These can conspire to give non-intuitive behaviors [2] resulting in possible operational delays or equipment maintenance. The precise placement of immersion oil on a slide using a pipette can be challenging (Fig. 1 left). Filling a sample chamber with bubble free liquid requires significant on-orbit practice. Flow induced charging of liquids, a small charge developed when a dielectric fluid (such as immersion oil) is forced through a small insulated capillary (such as a Teflon pipette), can result in subtle charge forces making the liquid misbehave [3]. These subtle forces under microgravity can interfere with the sample placement within the optical path (bubbles) or result in the fouling of optical surfaces (Fig. 1 center). The time necessary to learn the handling skills or to keep the instrument in operating order can cause delays in experimental progress.

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Some Unexpected Difficulties in Microscope Operation in Microgravity

The magnitude of residual acceleration on ISS is near 1.2 E-6g, nominally referred to as microgravity, where g is the acceleration due to gravity on the surface of Earth. At this level of residual acceleration, sample motion is possible [4,5]. The direction of this residual acceleration in relation to the orientation of the experimental sample can cause unexpected fluid-particle-bubble motion within a sample chamber. Such motion might cause the intended subject to settle out of suspension or migrate outside the optical field of view over a period of a few hours.

The flux of cosmic rays in low earth orbit causes camera CCD or CMOS detector arrays to degrade after periods of about one year. They produce images strewn with hot pixel "snow" that can compromise their scientific usefulness (Fig 1. right). By design, some instrument cameras were never meant to be replaced, and after years in orbit, can suffer significant image degradation. A maintenance plan including periodic camera replacement should be considered.

When subjected to microgravity while living in a sealed thin shell surrounded by infinite vacuum, flight crew safety becomes paramount. Standard means of conducting research on ISS may require seemingly prohibitive constraints when compared to similar ground-based research. Other than water (recovered from urine,) there are no cleaning solvents available on ISS due to their detrimental effects on the regenerative life support systems. The lack of solvents complicates cleaning of optics and other delicate surfaces especially from unintended fluid migration (Fig. 1 center). Microgravity promotes the possibility of inhalation or eye damage from small free floating objects with possible serious consequences. On ISS, the handling of small parts (screws and nuts) or shards created from accidental breakage of fragile glass components (cover slips and slides) presents a significant crew hazard. Laborious, time-consuming practices are often required for what would normally be a trivial operation on Earth. Sometimes a compromise must be made between the safety requirements needed for the best scientific practices versus non-optimum materials, substituted to ease the handling requirements, such as plastic cover slips and slides.

[1] https://iss-science.jsc.nasa.gov/investigation_detail.cfm?investigationsid=541

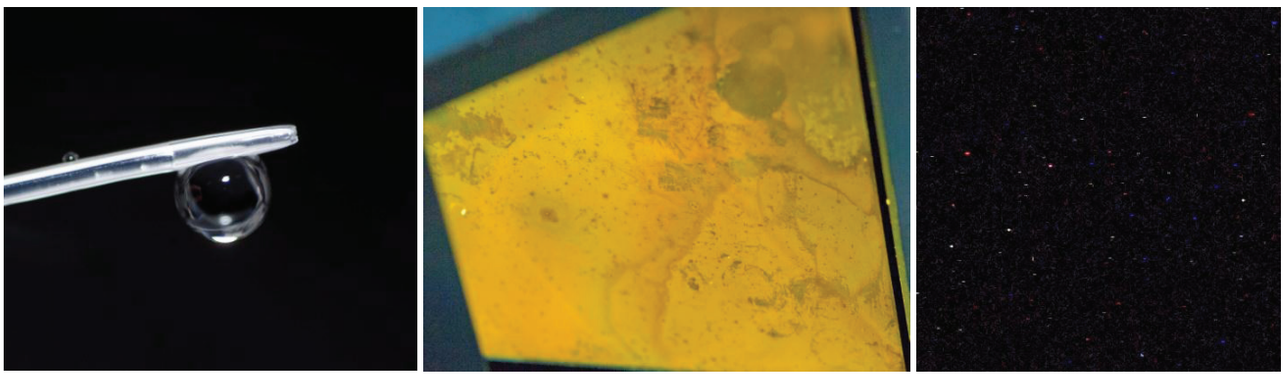
[2] Pettit, D, "Exploring the Frontier: Science of Opportunity on the International Space Station", Proc. Am. Philo. Soc. vol. (153), No. 4, Dec. 2009, pp. 381-402.

[3] Pettit, D, "Flow Induced Charging of Liquids in Reduced Gravity", Eng. Const. & Op. in Space, Space 96, S Johnson, Ed., ASCE Pub. Vol. I (1996), pp.545-551.

[4] Alexander, I, and Lundquist, C, "Residual Motions Caused by Micro-Gravitational Accelerations," Jour. Astro. Sci., Vol (35), no. 2, 1987, pp 193-211.

[5] Delombard, R, Kelly, E, Hrovat, K, Nelson, E, Pettit, D, "Motion of Air Bubbles in Water Subjected to Microgravity Accelerations", 43rd AIAA, Reno, Jan. (2005), AIAA-2005-0722.

FIGURE 1. Examples of unexpected experimental difficulties on ISS: pipette tip (1.5mm diameter) showing migration of a water drop from the tip to the side during fluid operations on Exp. 6 (left) complicating its precise placement; front surfaced gold mirror (100mm wide) inadvertently contaminated with silicone oil that migrated from the experimental stage during Exp. 30 requiring about two hours of crew time with a three week schedule delay to clean (center); and a 450 by 450 pixel enlargement from a camera C-MOS detector dark frame image showing red-green-blue-white hot pixels from one year of cosmic ray damage during Exp. 42 (right).Cells were incubated with DAB and illuminated for 5 min with blue light for singlet oxygen generation and photo-oxidation of DAB, which formed optically dense precipi-tates coincident with DBF fluorescence. Cells were stained with OsO_4, embedded in resin, and thin sectioned for EM. Scale bar 2 μm.



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1960	D. Gordon Sharp	1984	J. David Robertson	2008	William T. Gunning
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1963	Charles Schwartz	1987	Linn W. Hobbs	2011	Nestor Zaluzec
1964	Sidney S. Breese	1988	Jean Paul Revel	2012	Janet Woodward
1965	Virgil G. Peck	1989	Ray Carpenter	2013	Ernest Hall
1966	Walter Frajola	1990	Keith R. Porter	2014	Jeanette Killius

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2015

Rafal Dunin-Borkowski
E. Ann Ellis
Miguel Jose-Yacaman
Kent McDonald
Stanley Platek
Michael Postek
Susanne Stemmer
Michael Treacy

2014

Gianluigi Botton
Abhaya Datye
Marijia Gajdardziska-Josifovska
Lucille A. Giannuzzi
Thomas Kelly
John Mansfield
Martha McCartney
Xiaoquing Pan
David Piston
Wah Chiu
David J. Smith

2013

Timothy Baker
Nigel Browning
Hamish Fraser
David C. Muller
Michael Radermacher
David J. Smith
Eric Stach
David DeRosier

2012

Uli Dahmen
Ann Goldstein
Moon Kim
William J. Landis
Jingyue Liu
Beverly Maleeff
Bob Price
Frances Ross
David Seidman
Debra Sherman
Nan Yao

2011

Ueli Aebi
Phil Batson
Patricia Calarco-Isaacson
Peter A. Crozier
Alwyn Eades
Brendan J. Griffin
William T. Gunning, III
W. Gray Jerome
Richard D. Leapman
Hannes Lichte
Charles E. Lyman
Michael A. O'Keefe
George Perry
Robert B. Simmons
Janet H. Woodward

2010

Ralph M. Albrecht
Lawrence F. Allard
Kenneth H. Downing
Joseph I. Goldstein
Michael Isaacson
Michael K. Miller
George Pappas
Stephen J. Pennycook
John P. Petrali
Zhong L. Wang
David B. Williams

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Ron Anderson
James Bentley
Mary Grace Burke
Ray W. Carpenter
C. Barry Carter
Albert V. Crewe
Marc De Graef
Vinayak P. Dravid
Jacques Dubochet
Patrick Echlin
Raymond F. Egerton
Marilyn G. Farquhar
Don W. Fawcett
Joachim Frank
Robert M. Glaeser
Audrey M. Glauert
Raymond Kenneth Hart
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Hugh E. Huxley
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Dale E. Newbury
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Jean-Paul Revel
Harald Rose
F.O. Schmitt
Caroline Schooley
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Robert Sinclair
S. J. Singer
Fritiof Sjostrand
Kenneth C.A. Smith
Avril V. Somlyo
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Alasdair Steven
Peter R. Swann
Gareth Thomas
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Nigel Unwin
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Yimei Zhu

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MSA Microscopy Society of America Distinguished Scientist Awards

PHYSICAL SCIENCES (2015)

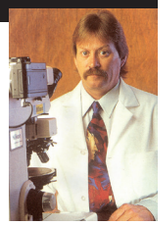
Peter Hawkes

Peter Hawkes, now retired, was Director of Research at the CNRS Laboratory of Electron Optics (now the CEMES) in Toulouse. He has a PhD (1963) and Sc.D. (1982) from the University of Cambridge, where he was a Research Fellow of Peterhouse and later, a Senior Research Fellow of Churchill College. He was Director of the Laboratory of Electron Optics in 1987 and received the Silver Medal of the CNRS in 1983. He was founder-president of the European Microscopy Society (1988–1990) and President of the French Microscopy Society (1998–1999), of which he is an honorary member. He has written several books on electron optics and electron microscopy as well as long book chapters, especially on electron lens aberrations. He writes regular round-ups of publications in the broad area of microscopy and charged-particle optics for Ultramicroscopy; he is a member of the editorial board of the Journal of Microscopy and Ultramicroscopy and editor-in-chief of Advances in Imaging & Electron Physics, launched more than 50 years ago by Bill Marton, who was the second recipient of the DSA award, in the same year as Albert Crewe (1976).

Over the years he has worked on many aspects of electron optics and electron image processing, with special reference to aberration studies, and has attempted to introduce image algebra into the world of electron imaging. He has also contributed to the history of electron microscopy, notable by editing "The Beginnings of Electron Microscopy" and attracting biographies of Ernst and Helmut Ruska, Bodo von Borries and Jan Le Poole and a tribute to Sir Charles Oatley to the Advances and writing histories of aberration correction in electron microscopy.

In 1987, he was elected Fellow of the Optical Society of America, sponsored by Emil Wolf.

BIOLOGICAL SCIENCES (2015)



Michael Davidson, Florida State University
Director, Optical Microscopy Division of the National High Magnetic Field Laboratory

Michael W. Davidson is the director of the Optical Microscopy Division of the National High Magnetic Field Laboratory at The Florida State University. As research scientist, he has been deeply involved in microscopy for over 3 decades and his scientific interested include the packaging of DNA into viruses, liquid crystallinity in biological systems and is considered one of the world's experts in developing fluorescent probes and techniques for microscopy; a subject he has published on extensively. He has coauthored numerous research articles with some of the top researchers in their fields, including several Nobel Laureates, and the imaging tools that he helped create have deeply impacted the work of hundreds of microscopists around the world. His facility at FSU houses the largest and most diverse collection of fluorescent proteins and related tools which he has made readily available and that has become an indispensable resource to the biomedical research community. He created several immensely popular educational websites, including Molecular Expressions, Nikon's MicroscopyU and the Olympus Microscopy Resource Center, all providing a tremendous resource not only to those wishing to learn about microscopy, but also to expert microscopists wishing to broaden their knowledge base. Mike is the driving force behind the two preeminent microphotography competitions; Nikon's Small World and Olympus' BioScapes, both of which recognize the intersection of art and science under the microscope and draw thousands of entries annually. His popular "Pioneers in Optics" series he writes for Microscopy Today serves as a K-12 educational resource to introduce kids to optics and microscopy. Mike has mentored hundreds of students who have come through his laboratory on their way to careers in biomedical research and imaging and his tireless work and dedication to advancing the state-of-the-art in optical microscopy will have an enduring impact on science.

	BIOLOGICAL SCIENCES	PHYSICAL SCIENCES
1975	Keith Porter	Robert Heidenreich
1976	L.L. Marton	Albert Crewe
1977	Robley C. Williams	James Hillier
1978	Thomas Anderson	Vernon E. Cosslett
1979	Daniel C. Pease	John M. Cowley
1980	George E. Palade	Gareth Thomas
1981	Sanford L. Palay	Vladimir K. Zworykin
1982	Richard M. Eakin	Benjamin M. Siegel
1983	Hans Ris	Otto Scherzer
1984	Cecil E. Hall	Sir Charles Oatley
1985	Gaston Dupouy	Ernst Ruska
1986	F. O. Schmitt	Peter Hirsch
1987	Marilyn G. Farquhar	Jan B. LePoole
1988	Morris J. Karnovsky	Hatsujiro Hashimoto
1989	Don W. Fawcett	Elmar Zeitler
1990	Audrey M. Glauert	Gertrude F. Rempfer
1991	Hugh E. Huxley	Archie Howie
1992	Fritiof Sjöstrand	Oliver C. Wells
1993	Jean-Paul Revel	Kenneth C.A. Smith
1994	Andrew P. Somlyo	Dennis McMullan

	BIOLOGICAL SCIENCES	PHYSICAL SCIENCES
1995	Shinya Inoue	David B. Wittry
1996	Myron C. Ledbetter	John Silcox
1997	S. J. Singer	Peter R. Swann
1998	Avril V. Somlyo	Michael J. Whelan
1999	Sir Aaron Klug	Takeo Ichinokawa
2000	K. Tokuyasu	S. Amelinckx
2001	Patrick Echlin	Thomas Mulvey
2002	Marc Adrian	Ryuichi Shimizu
2003	Joachim Frank	Harald Rose
2004	Robert M. Glaeser	Raymond F. Egerton
2005	Richard Henderson	Sumio Iijima
2006	Joseph S. Wall	John C.H. Spence
2007	Nigel Unwin	Terence E. Mitchell
2008	Alasdair Steven	Ondrej L. Krivanek
2009	Jacques Dubochet	Robert Sinclair
2010	George Papas	Michael Isaacson
2011	Ueli Aebi	Hannes Lichte
2012	Timothy Baker	Ulrich Dahmen
2013	David DeRosier	C. Barry Carter
2014	Wah Chiu	David J. Smith

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Major Society Awards

BURTON MEDAL AWARD

Andrew Minor (2015)
University of California, Berkeley

Andrew Minor received a B.A. in Economics and Mechanical Engineering from Yale University and his MS and PhD in Materials Science and Engineering from the University of California, Berkeley. Currently, he is an Associate Professor at U.C. Berkeley in the Department of Materials Science and Engineering and also holds a joint appointment at the Lawrence Berkeley National Laboratory where he is the Acting Director of the National Center for Electron Microscopy in the Molecular Foundry. He has co-authored over 120 publications and presented over 80 invited talks on topics such as nanomechanics, lightweight alloy development, characterization of soft materials, and in situ TEM technique development. He was twice awarded the LBL Materials Science Division Outstanding Performance Award (2006, 2010) and in 2012 he was awarded the AIME Robert Lansing Hardy Award from TMS.

YEAR	RECIPIENT
1975	James Lake
1976	Michael S. Isaacson
1977	David C. Joy
1978	Robert Sinclair
1979	Norton B. Gilula
1980	John C.H. Spence
1981	Barbara J. Panessa-Warren
1982	Nestor J. Zaluzec
1983	Ronald Gronsky
1984	David B. Williams
1985	Richard D. Leapman
1986	J. Murray Gibson
1987	Ron A.Milligan
1988	A.D. Romig, Jr.
1989	Laurence D. Marks
1990	W. Mason Skiff
1991	Joseph R. Michael
1992	Kannan M. Krishnan
1993	Joseph A.N. Zasadzinski
1994	Jan M. Chabala
1995	Joanna L. Batstone
1996	Vinayak P. Dravid
1997	P.M. Ajayan
1998	Ian M. Anderson
1999	Zhong Lin Wang
2000	Eva Nogales
2001	Jian Min Zuo
2002	Nigel D. Browning
2003	Frances M. Ross
2004	Z. Hong Zhou
2005	David J. Larson
2006	David A. Muller
2007	Peter D. Nellist
2008	Steven J. Ludtke
2009	Eric Stach
2010	Sergei V. Kalinin
2011	Radostin Denev
2012	David Ginger
2013	John L. Rubinstein
2014	Maria Varela

ALBERT CREWE AWARD

Meng Gu (2015)
University of California, Davis

Meng Gu received his B.S. degree (2008) in materials science and engineering in Shanghai Jiao Tong University in China and PhD degree (2011) in materials science in the University of California Davis. His PhD research centered on the growth and atomic scale characterization of complex oxide thin films using pulsed laser deposition and aberration corrected scanning transmission electron microscopy (STEM). After joining Environmental Molecular Sciences Laboratory in the Pacific Northwest National Laboratory in 2011, his research shifted to the study of energy materials including batteries materials, and catalyst, metal-oxide electronics. He has developed the operando setup of a nano-battery for in-situ TEM observations and three dimensional chemical imaging using X-ray energy dispersive spectroscopy (XEDS) tomography. Recently, Dr. Gu has joined Dow Corning Corporation as a senior analytical scientist focusing on Cryo-TEM study of soft materials and advanced microscopy analysis of silicon alloy, catalysis, and solar energy. He has 63 peer-reviewed journal publications and 20 meeting abstracts and proceedings. His publications have been highlighted by U.S. DOE, PNNL, SLAC national lab, London Center for Nanotechnology, Imperial College London and other social media.

YEAR	RECIPIENT
2012	Wu Zhou
2013	Lena Fitting-Kourkoutis
2014	Jinwoo Hwang

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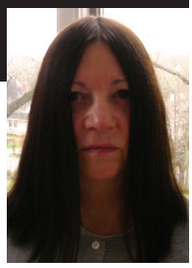
Major Society Awards

MORTON D. MASER DISTINGUISHED SERVICE AWARD



JoAn Hudson (2015)
Clemson University

JoAn Hudson has been an MSA member since 1982. She served on the Education Committee (1989-1994) and was appointed chair of the committee from 1997-1999. Elected to Council as Biological Director (1997-1999), she was appointed to the Editorial Board (2000-2003) and the Publications Committee (2005-2008). Two terms as Elected Treasurer, from 2008-2013, are followed by her attention to the ongoing concerns and interests of MSA.

JoAn's professional work began at Clemson University in 1974. In 2001, she joined CAMCOR at the University of Oregon where she taught and served as Director of the Electron Microscopy, Confocal and Histology Facilities. She returned to Clemson University in 2004 where she was appointed Director of the Electron Microscopy Facility in the newly founded Advanced Materials Laboratory. As Research Professor in the Department of MSE and as Director of the EM Facility, JoAn retired from Clemson University in 2014.

YEAR	RECIPIENT
1992	Ronald Anderson
	G. W. Bailey
	Frances Ball
	Blair Bowers
	Deborah Clayton
	Joseph Harb
	Kenneth Lawless
	Morton D Maser
	Caroline Schooley
	John H.L. Watson
1993	E. Laurence Thurston
1994	Richard Crang
1995	Raymond K. Hart
1996	José Mascorro
1997	William T. Gunning III
1998	Nestor J. Zaluzec
1999	Charles Lyman
2000	Barbara A. Reine
	Hildegard H. Crowley
2002	Beverly Maleeff
2003	M. Grace Burke
2004	Ralph Albrecht
2005	W. Gray (Jay) Jerome
2006	Jeanette Killius
2007	Robert L. Price
2008	Stuart McKernan
2010	Pamela Lloyd
2011	Janet Woodward
2012	Gina Sosinsky
2013	Caroline Miller
2014	Mike Marko

GEORGE PALADE AWARD

Alexey Amunts (2015)
Medical Research Council, Laboratory of Molecular Biology (U.K.)

During his PhD at Tel Aviv University, Alexey Amunts elucidated X-ray crystal structure of plant Photosystem I. It is a multi-subunit complex of protein and pigment components that catalyzes the capture of sunlight and its transformation into electrochemical energy, regarded as the most efficient energy conversion device in nature.

Since 2011, Alexey has been a postdoctoral researcher in Venki Ramakrishnan's lab at MRC-LMB. He is working on elucidating the molecular mechanism of how the mitochondrial genetic code is translated into proteins, with the aim of harnessing this knowledge to develop novel therapeutics. Recently, the team achieved a major breakthrough by resolving the architecture of mitochondrial protein synthesis machinery at atomic details entirely by cryo-EM. Methodologically, this work shows that we are moving toward a time when structural knowledge of otherwise intractable multi-component, low abundant complexes that are at the heart of many biological processes will be determined by cryo-EM that would transform the structural biology.

YEAR	RECIPIENT
2012	Gabriel Lander
2013	Peng Ge
2014	Ricardo Guerrero-Ferreira

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Major Society Awards

HILDEGARD H. CROWLEY OUTSTANDING TECHNOLOGIST AWARD FOR BIOLOGICAL SCIENCES

Norman Olson (2015)
University of California, San Diego

Norm Olson was born and grew up in a small town in Northwestern Minnesota. He got his Bachelor of Arts degree in Biology from Concordia College in Moorhead, Minnesota and his Master's degree from North Dakota State University. He did his graduate research in electron microscopy at NDSU. Norm then taught college for several years before accepting a microscopist position at Purdue University. There he did research on the structure of viruses and he worked to set up a state-of-the-art microscopy facility. In 2004, Norm followed his supervisor, Dr. Timothy Baker, out to the University of California San Diego where he set up another state-of-the-art-electron microscopy facility. Since that time he has mentored well over 100 graduate students. Norm retired in October of 2014.

CHUCK FIORI OUTSTANDING TECHNOLOGIST AWARD FOR PHYSICAL SCIENCES

Masahiro Kawasaki (2015)
JEOL

Masahiro Kawasaki is a technical director at JEOL USA Inc. and has been enthusiastically involved in the application and development of electron microscopy techniques since joining JEOL Ltd. in 1985. He received Bachelor of Engineering and Doctor of Engineering degrees from Kyoto Institute of Technology in 1985 and 1998, respectively. In the 1990s, he collaborated on the development of JEOL's first commercial field emission (FE) high-resolution analytical TEM. In 1996 when a scanning unit was installed for general scanning purposes on an FE-TEM, he became curious about high resolution STEM imaging and successfully developed the electron optics conditions that enabled the first atomically resolved Z-contrast imaging capability. He collaborated with a number of researchers on materials characterization using this new STEM technique with TEM. He has continued to work with various researchers by assisting them to advance microscopy techniques including phase plate, high energy backscattered electron and analytical electron microscopies.

YEAR	RECIPIENT
1993	Ben O. Spurlock
1994	Bernard J. Kestel
1995	Kai Chien
1996	David W. Ackland
1997	John P. Benedict
	Stanley J. Klepeis
1998	Charles J. Echer
	Hilton H. Molehauer
1999	John C. Wheatley
	John M. Basgen
2000	Nancy Crise Smith
2001	Conrad G. Bremer
2002	José A. Mascorro
2003	Edward A. Ryan
2004	Mark C. Reuter
2005	Chris Nelson
	John J. Bozzola
2007	Thomas Deerinck
2009	Lynne Gignac
	Mary Morphew
2010	E. Ann Ellis
2011	Robert Grassucci
2012	Kunio Nagashima
2013	Robyn Roth
	K. Shawn Reeves
2014	Hong Yi
	Eddy Garcia-Meitin

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(as of May 20, 2015)

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Carnegie Mellon University
Columbian Chemicals Co
Diatome U.S.
Direct Electron, LP
E.A. Fischione Instruments, Inc.
Electron Microscopy Sciences
EXpressLO LLC
FEI Company
Hitachi High Technologies America
HREM Research Inc.
ibss Group, Inc.
International Centre for Diffraction Data
IXRF Systems, Inc.
Ladd Research Industries
Lehigh Microscopy School
Leica Microsystems, Inc.
Mager Scientific, Inc.
Micron, Inc.
Olympus Soft Imaging Solutions- GMBH
Oxford Instruments
PulseTor, LLC
Scientific Instrumentation Services, Inc.
SGX Sensortech (MA) Ltd
Ted Pella Inc.
Tescan USA Inc.
Tousimis Research Corporation

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Established 1968

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PAST PRESIDENTS

1968	L.S. Birks
1969	K.F.J. Heinrich
1970	R.E. Ogilvie
1971	A.A. Chodos
1972	K. Keil
1973	D.R. Beaman
1974	P. Lublin
1975	J.E. Colby
1976	E. Lifshin
1977	J.I. Goldstein
1978	J.D. Brown
1979	D.F. Kyser
1980	O.C. Wells
1981	J.R. Coleman
1982	R.L. Myklebust
1983	R. Bolon
1984	D.C. Joy
1985	D.E. Newbury
1986	C.G. Cleaver
1987	C.E. Fiori
1988	W.F. Chambers
1989	D.B. Wittry
1990	A.D. Romig, Jr
1991	J.T. Armstrong
1992	D.B. Williams
1993	T.G. Huber
1994	J.A. Small
1995	J.J. McCarthy
1996	D.E. Johnson
1997	J.R. Michael
1998	R.B. Marinenko
1999	J.J. Friel
2000	C.E. Lyman
2001	R.W. Linton
2002	G.P. Meeker
2003	E.S. Etz
2004	P.K. Carpenter
2005	I.H. Musselman
2006	R. Gauvin
2007	P.G. Kotula
2008	I.M. Anderson
2009	C. Johnson
2010	E.P. Vicenzi
2011	J.H.J. Scott
2012	J.F. Mansfield
2013-14	K.L. Bunker

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Major Society Awards

DUNCUMB AWARD FOR EXCELLENCE IN MICROANALYSIS

Sponsored by Bruker-Nano Analytics

Peter J. Statham (2015)
Oxford Instruments (U.K.)

Dr. Peter J. Statham has been a leader in the science and technology of microanalysis for 40 years, responsible for many contributions in the scientific literature (more than 90 papers) as well as patents and important advances in commercial energy-dispersive X-ray spectrometry measurement platforms. Beginning with an invited paper at the 1974 MAS conference in Ottawa, he has a long and distinguished history with the Microanalysis Society, serving our organization in many roles over the years, and he is the recipient of some of the most prestigious awards granted by our society.

Peter began his career in the United Kingdom, receiving a first degree in Physics from Cambridge before obtaining a PhD from the same institution based on a thesis entitled "Quantitative X-ray energy spectrometry". He then continued his work on energy-dispersive spectrometry in the United States as a post-doctoral fellow at the University of California at Berkeley, where he also began a long-term interest in image processing. Peter returned to the UK to accept a position at Link Systems, which in 1989 became part of the Oxford Instruments Group; he is currently Director of Research at Oxford Instruments Nanoanalysis.

Peter has served on MAS Council and on the Institute of Physics EMAG Committee, and he is currently the UK technical expert for energy-dispersive spectrometry appointed to the ISO/TC 202 Committee on Microbeam Analysis. It is perhaps not surprising that Peter has earned such recognition during his career in microanalysis because in 1986 then-MAS-President Gordon Cleaver presented Peter with the very first K. F. J. Heinrich Award, honoring his distinguished technical contributions as a scientist under the age of forty. Peter also received the Presidential Science Award from the Microanalysis Society in 2011 and Honorary Membership of EMAS in 2015.

Previous Awardees

2007	D.B. Williams
2008	J. I. Goldstein
2009	D.E. Newbury
2010	D. Joy
2011	J. Michael
2012	J. Bentley
2013	E. Lifshin
2014	O. L. Krivanek

KURT F.J. HEINRICH AWARD

Philippe Pinard (2015)
RWTH Aachen University, Central Facility for Electron Microscopy (Germany)

Philippe Pinard obtained a Master of Engineering degree in materials engineering from McGill University under the supervision of Prof. Raynald Gauvin and Dr. Pierre Hovington. He is currently pursuing a PhD at the RWTH Aachen University in Germany under the supervision of Prof. Joachim Mayer and Dr. Silvia Richter. His research interests include scanning electron microscopy, x-ray microanalysis, Monte Carlo simulations, and electron backscattered diffraction. As a programming enthusiast, he has developed throughout his studies three open source software for electron microscopy: EBSD-Image (post-processing of electron diffraction patterns), pyPENELOPE (application and graphical interface for the Monte Carlo code PENELOPE) and pyMonteCarlo (generic interface for Monte Carlo simulation programs).

In his young career, Philippe received several awards. In 2010, he was presented a Distinguished Scholar award from the Microanalysis Society and the Gerald T. Simon award from the Microscopical Society of Canada. He was honoured to be selected among the Early Career Scholars at the International Union of Microbeam Analysis Societies meeting in 2014. He received a Young Scientist award at the European Microbeam Analysis workshops in 2011 and 2013, as well as the Presidential award for the best contributed paper in 2015. For his studies, he was granted two scholarships from the Natural Sciences and Engineering Research Council of Canada, including the Julie Payette scholarship given to the top 24 Master candidates in the country. He is author or co-author of 9 papers in international journals and 12 conference presentations including 3 invited talks.

Previous Awardees

1986	P.J. Statham
1987	J.T. Armstrong
1988	D.B. Williams
1989	R.D. Leapman
1990	R.W. Linton
1991	A.D. Romig, Jr.
1992	S.J. Pennycook
1993	P.E. Russell
1994	J.R. Michael
1995	E.N. Lewis
1997	R. Gauvin
1998	V.P. Dravid
1999	J. Bruley
2000	H. Ade
2001	C. Jacobsen
2002	D.A. Wollman
2005	M. Watanabe
2006	M. Toth
2007	G. Kothleitner
2008	P.G. Kotula
2009	D. Drouin
2010	H. Demers
2011	L.N. Brewer
2012	E.A. Marquis
2013	J.M. LeBeau
2014	B.P. Gorman

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Major Society Awards

PRESIDENTIAL SCIENCE AWARD

Mike Keenan (2015)
Sandia National Laboratories (Ret.)

Prior to his retirement, Dr. Mike Keenan was a Distinguished Member of the Technical Staff at Sandia National Laboratories. He joined Sandia after being awarded a PhD in physical chemistry by the University of Illinois at Urbana-Champaign. Dr. Keenan spent most of his career in the Materials Science Center where his early research interests included the physical properties of polymers and packaging of electronic components. Subsequently, Dr. Keenan managed Sandia's Analytical Chemistry Department; following that, he took advantage of an opportunity to pursue long-standing interests in computing and statistics by applying them to the multivariate analysis of hyperspectral images. The analysis of such images, where a full spectrum is acquired at each point in a 2D or 3D sample, poses significant challenges ranging from the massive sizes the data sets generated by current imaging systems to the low signal-to-noise typical of the individual spectra.

Dr. Keenan's contributions included developing efficient algorithms to extract chemical information from spectral images in an optimal and unbiased manner, and providing approaches to deal with the critically important task of accounting for the noise characteristic of counting measurements. These accomplishments were recognized by a 2002 R&D 100 Award shared with Paul Kotula, also at Sandia, for Component Analysis Software. This development enabled the routine multivariate statistical analysis of large spectral images, given the modest computing resources generally available in the lab. Dr. Keenan was also member of the Sandia team that was awarded an R&D 100 Award in 2009 for the Hyperspectral Confocal Fluorescence Microscope System.

Since his retirement from Sandia, Dr. Keenan has continued to pursue research in this area as an independent scientist. His interests include developing and applying efficient numerical algorithms, general noise models, and new analysis approaches that accentuate selectable aspects of the multivariate models with the goal of improving interpretability.

Previous Awardees

1977	R. Castaing
1978	K.F.J. Heinrich
1979	P. Duncumb
1980	D.B. Wittry
1981	S.J.B. Reed
1982	R. Shimizu
1983	J. Philibert
1984	L.S. Birks
1985	E. Lifshin
1986	R.L. Myklebust
1987	O.C. Wells
1988	J.D. Brown
1989	J. Hillier
1990	T.E. Everhart
1997	D.B. Williams
1998	F.H. Schamber
1999	R.A. Sareen
2000	R.F. Egerton
2001	P.E. Batson
2002	K. Keil
2003	P.E. Russell
2004	J.T. Armstrong
2005	G. Slodzian
2006	B.J. Griffin
2007	R.D. Leapman
2008	T. F. Kelly
2009	J.R. Michael
2010	J.J. Donovan
2011	P.J. Statham
2012	N.J. Zaluzec
2013	P. Echlin
2014	H.L. Fraser

PRESIDENTIAL SERVICE AWARD

Stuart McKernan (2015)
3M

Stuart McKernan received his initial education at Bristol University in the UK, earning his B.Sc., M.Sc., and PhD in Physics. His interest in electron microscopy began as a final-year B.Sc. project on the handedness determination of quartz by electron microscopy. Following a postdoctoral fellowship at Bristol he moved to Cornell University in 1986 when he became a member of the Society. In 1991 Stuart moved to the University of Minnesota and also became a member of the Minnesota Microscopy Society where he has been a director, president, and webmaster as well as being involved locally with project MICRO. He now works for 3M in the electron microscopy group at the central research and analytical lab.

Stuart has supported MAS in a number of different capacities including serving as a Director on Council from 2008–10. He was the Program Chair for the Microscopy and Microanalysis 2000 meeting in Philadelphia, and coordinator of the database used to program annual meeting since 1998. He was the editor of the meeting proceedings from 2002 to 2012, and has attended every program planning meeting since 1996.

Previous Awardees

1977	P. Lublin
1978	D.R. Beaman
1979	M.A. Giles
1980	A.A. Chodos
1981	R.L. Myklebust
1982	J. Doyle
1983	D.E. Newbury
1984	J.I. Goldstein
1985	M.C. Finn
1986	V. Shull
1987	D.C. Joy
1988	C.G. Cleaver
1989	W.F. Chambers
1990	C.E. Fiori
1991	T.G. Huber
1992	E.S. Etz
1993	H.A. Freeman
1994	J.L. Worrall
1995	R.W. Linton
1996	P. F. Hlava
1997	J.A. Small
1998	J.J. McCarthy
1999	T.G. Huber
2000	R.B. Marinenko
2001	C.E. Lyman
2002	J.F. Mansfield
2003	I.H. Musselman
2004	J.R. Michael
2005	G.P. Meeker
2006	H.A. Freeman
2007	P.K. Carpenter
2008	L.M. Ross
2009	V. Woodward
2010	S.A. Wight
2011	D.T. Kremser
2012	C. Johnson
2013	J. McGee
2014	I.M. Anderson

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Major Society Awards

MAS OUTSTANDING PAPER AWARDS (2014)

These awards are presented annually to the authors of outstanding papers from the previous annual meeting in each of four categories.

BIRKS AWARD:

Hideyuki Takahashi, JEOL
(For best contributed paper) – Sponsored by JEOL USA

Exciting Possibilities of Soft X-ray Emission Spectroscopy as Chemical State Analysis in EPMA and FE-SEM

MACRES AWARD:

Kirstin Alberi, National Renewable Energy Laboratory
(For best instrumentation or software paper) – Sponsored by Oxford Instruments, Inc.

Photoluminescence Imaging of Semiconductors

COSSLETT AWARD:

Xavier Llovet, University of Barcelona (Spain)
(For best invited paper) – Sponsored by MAS

Application of Monte Carlo Calculations to Improve Quantitative Electron Probe Microanalysis

CASTAING AWARD:

Chantelle Venter, University of Pretoria (South Africa)
(For best student paper) – Sponsored by CAMECA, Inc.

An* In Ovo *Investigation of the Ultrastructural Effects of the Heavy Metals Cadmium and Chromium on Liver Tissue

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Past Presidents

1968–1971	John H. Bender Jr.
1971–1973	Arthur E. Calabra
1973–1975	E. Daniel Albrecht
1975–1977	James H. Richardson
1977–1979	Robert J. Gray
1979–1981	P.M. French
1981–1983	George Vander Voort
1983–1985	James E. Bennett
1985–1987	William E. White
1987–1989	M.R. Louthan, Jr.
1989–1991	Donald W. Stevens
1991–1993	Ian LeMay
1993–1995	Japnell D. Brown
1995–1997	E. Daniel Albrecht
1997–1999	Mahmoud T. Shehata
1999–2001	Elliot A. Clark
2001–2003	Richard K. Ryan
2003–2005	Allan J. Lockley
2005-2007	Dennis W. Hetzner
2007-2009	David J. Fitzgerald
2009-2011	Frauke Hogue
2011-2013	Natalio T. Saenz
2013-2015	Richard A. Blackwell

We would like to thank the following volunteers who helped organize the M&M 2015 Meeting:

James E. Martinez, *M&M 2015 IMS Co-Chair*
Daniel P. Dennies, *M&M 2016 IMS Co-Chair*
Coralee McNee, *M&M 2017 IMS Co-Chair*
Frederick Schmidt, *Sunday Short Course Instructor*
Rhonda Stroud, *Symposium Co-Chair*
George Vander Voort, *Symposium Co-Chair*
Andre Mkhoyan, *Symposium Co-Chair*
Jay Potts, *Symposium Co-Chair*
Elaine Schumacher, *Symposum Co-Chair*
Ke-Bin Low, *Symposium Co-Chair*
Lucille Giannuzzi, *Symposium Co-Chair*
Masashi Watanabe, *Symposium Co-Chair*
Greg Haugsted, *Symposium Co-Chair*
Jorg Wiezorek, *Symposium Co-Chair*
David Bell, *Symposium Co-Chair*
Brendan Griffin, *Symposium Co-Chair*

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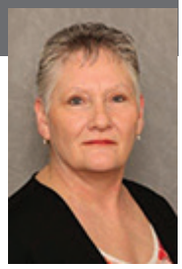
Major Society Awards

IMS International Metallographic Society
ASM INTERNATIONAL

PRESIDENT'S AWARD (SERVICE TO IMS)



Judith L. Arner (2014)

Judith Arner, senior metallographer at Struers Inc., in Westlake, Ohio, since 1989, received her associate's degree in metallurgical engineering technology from Penn State University, Shenango Valley Campus, Sharon, Pa. Her responsibilities at Struers include developing metallographic techniques for a wide range of materials and teaching metallography, and the use of semiautomatic and automatic metallographic preparation equipment. She also serves as a volunteer "Materials Mentor" at the ASM International Eisenman Materials Camp, helping high-school students learn about metallography.

Judy was presented the 2014 IMS President's Award "in sincere and grateful appreciation for many years of service to IMS as Secretary of the Board of Directors."

Previous Awardees

1977	Carus K. H. DuBose
1978	Richard D. Buchheit
1979	Arthur E. Calabra
1980	James L. McCall
1981	E. Daniel Albrecht
1982	James H. Richardson
1983	Robert J. Gray
1984	Japnell D. Braun
1986	P. Michael French
1987	George F. Vander Voort
1988	Robert S. Crouse
1989	Ian Le May
1990	William E. White
1991	Chris Bagnall
1992	Gary W. Johnson
1993	Donald W. Stevens
1994	MacIntyre R. Louthan, Jr.
1995	Gunter Petzow
1996	James Nelson
1997	John Wylie
1998	John W. Simmons
1999	William Forgeng, Jr.
2000	Natalio T. Saenz
2001	William W. Scott, Jr.
2002	George Blann
2003	Jeff Stewart
2004	Elliot A. Clark
2005	Chris Bagnall
2006	Art Geary
2007	Richard K. Ryan
2008	Thomas S. Passek
2009	David & Dale Fitzgerald
2010	Jaret Frafjord
2011	Donald F. Susan
2012	Sarina Pastoric
2013	Frauke Hogue

History of the IMS Awards

HENRY CLIFTON SORBY AWARD: The Sorby Award was established to recognize outstanding contributions to the field of metallography by an internationally recognized senior figure in the field of metallography. This award is a personalized plaque, and the recipient is honored during the M&M Conference Sorby lecture and at the IMS Annual Meeting banquet.

PIERRE JACQUET-FRANCIS F. LUCAS AWARD: The Jacquet-Lucas Award is given each year to the International Metallographic Contest entry judged "Best in Show" by a panel of judges. This is a joint IMS/ASM award with origins dating back to 1946, and has been endowed by Buehler Ltd. since 1976. The winners receive the Jacquet Gold Medal, the ASM Lucas Award, a cash award, and are honored at banquets at both the IMS Annual Meeting and the ASM Annual Event.

PRESIDENT'S AWARD: This award is presented to an individual deemed deserving of special recognition by the Society. This award is a plaque personalized for the recipient.

BUEHLER TECHNICAL PAPER MERIT AWARD: This award shall be given annually to the authors of the technical paper published that year in the journal Materials Characterization that was determined most outstanding by a panel of IMS judges. A plaque and cash award is given to the recipients each year by Buehler Ltd.

PAST-PRESIDENTS AWARD: This award shall be presented by the Board of Directors to the out-going Past-President in recognition of their contributions to the Society. This award is a plaque personalized for the recipient.

PRESENTATION OF THE IMS AWARD: The awards are presented at the annual banquet on Wednesday, August 5, 2015, at 6:30 PM.

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Major Society Awards

JACQUET-LUCAS AWARD

Thomas Nizolek (2014)

The ASM Metallographic Award was established in 1946 for the best entry in the annual ASM metallographic competition. In 1958, it became known as the Francis F. Lucas Metallographic Award. In 1972, ASM joined with The International Metallographic Society (IMS) in sponsoring the Pierre Jacquet Gold Medal and the Francis F. Lucas Award for Excellence in Metallography. This award has been endowed by Buehler Ltd. since 1976.

The 2014 Recipient of the Jacquet-Lucas Award is Thomas Nizolek, a doctoral student at the University of California Santa Barbara, advised by Prof. Tresa Pollock, FASM, for his entry entitled: *Deformation of Bulk Metallic Nanolaminates.*

Nizolek received his B.S. in Materials Science and Engineering from Lehigh University in 2010 where he was a Dean's Scholar and an active member of the local chapter of ASM. During his undergraduate studies, he worked on a variety of research projects on topics including laminated steels, titanium nitride thin films, and titanium-tantalum shape memory alloys.

During the course of his PhD research, Nizolek worked at Los Alamos National Laboratory as part of a team focused on improving the deformation processing and properties of bulk bimetallic nanolaminates. He is a previous Jacquet-Lucas recipient (2008), a Department of Defense NDSEG fellow, and a member of ASM since 2005.

Previous Awardees

1946	G.R. Kuhn
1947	R.H. Hays
1948	E.C. Pearson
1949	D.H. Rowland
1950	S.O. Modin
1951	H.P. Roth
1952	H. Griffin
1953	B.C. Leslie, R.J. Gray
1954	R.D. Buchheit, J.E. Boyd, A.A. Watts, F.C. Holden
1955	F.M. Cain, Jr.
1956	D. Mannas
1957	T.K. Bierlein, B. Mastel
1958	J.C. Gower, E.P. Griggs, W.E. Denny, J.E. Epperson, R.J. Gray
1959	F.M. Beck
1960	G.C. Woodside
1961	J.F. Radavich, W. Couts, Jr
1962	D. Medlin
1963	W.C. Coons
1964	B.C. Leslie, R.J. Gray
1965	W.C. Coons, A. Davinroy
1966	D.M. Maher, A. Eikum
1967	J.F. Kisiel
1968	R.M.N. Pelloux, Mrs. H. Wallner
1969	R.H. Beauchamp, R.P. Nelson
1970	D.R. Betner, W.D. Hepfer
1971	R.J. Gray
1972	C.J. Echer, S.L. Digiallonardo
1973	M.S. Grewal, B.H. Alexander, S.A. Sastri
1974	M.P. Pinnel, D.E. Heath, J.E. Bennett, G.V. McIlharagie
1975	W.C. Coons
1976	L.E. Soderqvist
1977	R.H. Beauchamp, D.H. Parks, N.T. Saenz, K.R. Wheeler
1978	C. Bagnall, R. Witkowski
1979	M.J. Bridges, S.J. Dekanich
1980	R.H. Beauchamp, K. Fredriksson
1981	F. Kurosawa, I. Taguchi, H. G. Suzuki
1982	M.J. Carr, M.C. Mataya, T.O. Wilford, J.L. Young
1983	V. Carle, E. Schmid
1984	R.H. Beauchamp, N.T. Saenz, J.T. Prater
1985	U. Taffner, R. Telle
1986	N.T. Saenz, C.A. Lavender, M.T. Smith, D.H. Parks, G.M. Salazar
1987	S.A. David, J.M. Vitek, C.P. Haltom, A.G. Barcomb
1988	A. David, J.M. Vitek, A. Boatner, G.C. Marsh, A.B. Baldwin
1989	G. Hoerz, M.C. Kallfass
1990	A. David, J.M. Vitek, A.B. Baldwin
1991	M.R. Jones
1992	G.F. VanderVoort
1993	T. Leonhardt, F. Terepka, M. Singh, G. Soltis
1994	J.W. Simmons, B.S. Covino, Jr., S.D. Cramer, J.S. Dunning
1995	Kamal, K. Soni, R. Levi-Setti, S. Shah, S.J. Gentz
1996	R.L. Bodnar, S.J. Lawrence
1997	J. Yewko, D.L. Marshall
1998	R. Pereyra, E.G. Zukas
1999	K.R. Luer
2000	D.J. Lewis, S. Allen
2001	D. Chakrapani
2002	F.F. Noecker, II
2003	F.F. Noecker, II
2004	R. Unocic, P.M. Sarosi, M.J. Mills
2005	K. Kimura, S. Hata, S. Matsumura, T. Horiuchi
2006	R. Deacon
2007	K.A. Unocic, G.S. Daehn
2008	T. Nizolek
2009	B. Gerard
2010	C. Roberts
2011	C. Marvel
2012	Z. Luo
2013	N. H. Alharthi

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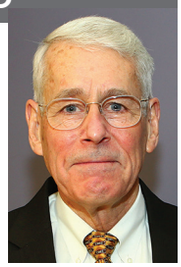
Major Society Awards

IMS International Metallographic Society
ASM INTERNATIONAL

HENRY CLIFTON SORBY AWARD



David K. Matlock (2014)

David K. Matlock received his B.S. in engineering science from the University of Texas at Austin. He then attended Stanford University in California where he received his M.S. and PhD in materials science and engineering and also served as a research assistant. His early career included working at Esso Production Research Co. in Houston and Lawrence Radiation Laboratory in Livermore, Calif.

The bulk of his career was spent teaching at the Colorado School of Mines. He started out as an Assistant Professor in 1972, was the Armco Foundation Forgarty Professor (1980-2013), and is now Emeritus Professor at the school. He also has served as the Director of Advanced Steel Processing and Products Research Center at the Colorado School of Mines.

His specialty courses include Mechanical Properties of Materials, Metal Forming Operations, Analysis of Metallurgical Failures, Fatigue and Fracture, and Strengthening Mechanisms.

He is a member of ASM, AIME, ASTM, SAE, and AIST. Over 400 publications, primarily related to microstructures and mechanical properties with an emphasis on steels, bare his name.

He is a member of the National Academy of Engineering, Honorary Member of AIME, and Fellow of the American Welding Society. His numerous awards also include the AIME Robert Lansing Hardy Gold Metal (1975), the ASM Bradley Stoughton Award for Young Teachers in Metallurgy (1979), SAE/AISI Sydney H. Melbourne Award (1998), three time winner of the AIST Jerry's Silver Awards, and American Iron and Steel Institute Medal (2013).

Previous Awardees

1976	Georg L. Kehl
1977	Cyril Stanley Smith
1978	Adolph Buehler
1979	Frederick N. Rhines
1980	Len E. Samuels
1981	Robert J. Gray
1982	Gunter Petzow
1983	William D. Forgeng
1984	Ervin E. Underwood
1985	Alan Price
1986	Robert W. K. Honeycombe
1987	Gareth Thomas
1988	Franz Jeglitsch
1989	Tanjore R. Anantharaman
1990	E. Daniel Albrecht
1991	W. C. Leslie
1992	Charles S. Barrett
1993	Raimond B. Castaing
1994	F. Brian Pickering
1995	Erhard Hornbogen
1996	Peter Duncumb
1997	Robert T. DeHoff
1998	Kay Geels
1999	Joseph Goldstein
2000	Hans Eckhart Exner
2001	Brian Ralph
2002	Walter Mannheimer
2003	Enrica Stagno
2004	George F. Vander Voort
2005	Iain LeMay
2006	Arlan Benscoter
2007	McIntyre R. Louthan, Jr.
2008	Lawrence E. Murr
2009	Chris Bagnall
2010	Albert C. Kneissl
2011	David Williams
2012	Michael Pohl
2013	Arun M. Gokhale
2014	Stanley P. Lynch

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