Minnesota Microscopy Society

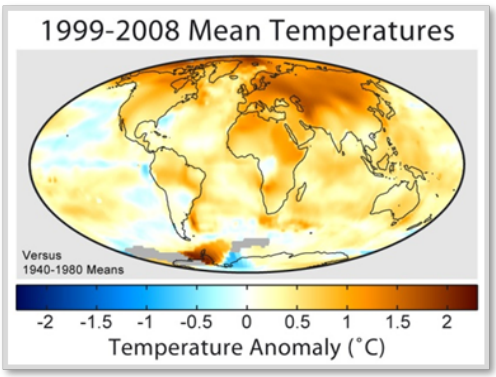
*Local affiliate of the **Microscopy Society of America***
*and the **Microbeam Analysis Society***

Newsletter ***March 2011***

9th Annual MinnTS

(Minnesota Technical Symposium)

www.minnts.org



Date: Thursday, March 24, 2011
Time: 5:00 – 9:00 pm
Location: Medtronic Headquarters
710 Medtronic Parkway
Fridley, MN 55432
(I-694 and Hwy 65/Central Ave.)
Parking: In attached ramp north of building

Agenda

5:00 - 6:00	Registration, social with refreshments
5:00 - 5:30	Medtronic Lab tours (departing every 5 min)
6:00 - 7:00	Dinner (followed by move into auditorium)
7:00 - 7:15	Welcome message, introductions (Gary Korba)
7:15 - 8:00	***The Science of Global Warming: Often Confused But Actually Clear*** **– Katsumi Matsumoto**
8:00 - 8:15	Break
8:15 - 9:00	***Global Warming Mitigation and Adaptation Options*** **– J. Drake Hamilton**

Menu

- Garden salad with assorted dressings
- Bakery fresh rolls with butter
- Herb crusted chicken with pan glaze or wild mushroom strudel
- Potatoes
- Steamed carrots
- Assorted desserts (mini tarts, chocolate dipped fruits, mini cakes and pies)
- Assorted soda and water
- Coffee service with hot tea

Reservations

Cost for MinnTS is $30. Reservations are being taken through **midnight on Friday, March 18**.
Please make your reservation by either:

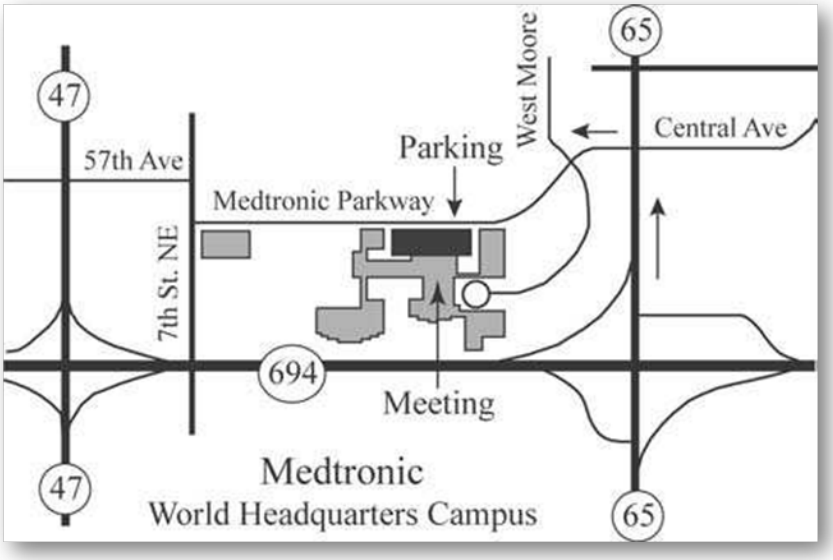
- email (preferred): reservations@minnts.org or
- phone: Bede Willenbring, H.B. Fuller Company; 651-236-5470 (9a – 5p)

Please include your name, affiliation, the sponsoring society to which you belong, and a phone number at which you can be reached. **Cancellations must be received before March 19.**

MinnTS – Map and Speakers

continued

Directions



Speakers

Katsumi Matsumoto, Associate Prof., University of Minnesota

The Science of Global Warming: Often Confused But Actually Clear

Abstract

The two pillars of the science of global warming are detection and attribution. Can we detect global warming? To what can we attribute the warming? These two questions and how much consensus there is amongst scientists about them are often not clear in public discourse. In this lecture, Matsumoto will present various lines of evidence of global warming and discuss the reasoning that ties global warming to human activities.

Speaker Bio

With training in oceanography and geochemistry, Matsumoto conducts research on carbon cycle and climate change. In recent years, his focus has been on the global ocean and Lake Superior, which both comprise a complex natural network involving mechanisms of fluid interaction, biogeochemistry, and chemical exchange. His research group tries to characterize the biogeochemical controls of air-sea CO2 exchange and carbon distribution within the ocean both at the present time and times of ice age climate. He runs numerical models of global climate and carbon cycle. Because of Matsumoto's research, he was a contributing author of the most recent Intergovernmental Panel on Climate Change (IPCC) report, which is the 'official' document that provides the common knowledgebase for all countries to negotiate a carbon emissions treaty.

MinnTS – Speakers

continued

J. Drake Hamilton, Science Policy Director, Fresh Energy

Global Warming Mitigation and Adaptation Options

Abstract

Knowledge about global warming and its likely causes raises questions about actions people, companies, and governments may choose to mitigate climate change and adapt to its results. The mitigation and adaptation options under consideration by leaders around the nation will be described. The presentation will focus on the magnitude of emissions reductions and the relative costs of leading strategies.

Speaker Bio

Hamilton is Science Policy Director at Fresh Energy, a 20-year-old private nonprofit organization working to lead the transition to a clean, efficient energy system, one that will create significant economic opportunities for Minnesota and the Midwest. Her responsibilities include scientific analysis, policy development, and outreach on clean energy solutions. Hamilton serves on the boards of the United States Green Building Association (Minnesota Chapter) and of the United States Climate Action Network. She was appointed by Governor Tim Pawlenty to serve on the Minnesota Climate Change Advisory Group, a group that recommended a Climate Action Plan that will substantially reduce Minnesota's greenhouse gas emissions at lowest possible cost. Hamilton earned degrees in physical geography from Dartmouth College and the University of Minnesota. Previously, she worked as a water quality planner for the Metropolitan Council, modeling nonpoint source pollution in the Minnesota River. Prior to joining Fresh Energy in 1995, she was Assistant Professor at George Washington University. In 2005, Hamilton was awarded an international leaders fellowship from the European Union.

Minnesota Microscopy Society Spring Symposium

Date: Friday, May 6, 2011

Location: Science Museum of Minnesota
120 W. Kellogg Blvd., St. Paul
Discovery Hall

Parking: Science Museum or River Centre parking ramps

Schedule

7:30 - 8:15 AM	Registration, Continental Breakfast, Vendor Displays
8:15 – 8:30 AM	Welcome
8:30 - 9:30 AM	**Joseph A. Zasadzinski, Professor, University of Minnesota** *Seeing is Believing and Other Lies*
9:30 - 10:30 AM	**John Yorston, Senior Applications Specialist, Carl Zeiss NTS LLC** *Low Voltage Multi Mode Scanning Transmission Electron Microscopy and Extreme Field of View Imaging*
10:30 - 11:00 AM	Break and Vendor Displays
11:00 - 12:00 PM	**Ray Twesten, Product Manager, Analytical Instruments Gatan, Inc.** *Recent Advances in EELS Instrumentation and Analysis: High-Speed Spectroscopy with Extended Energy and Dynamic Range*
12:00 - 1:30 PM	Lunch and Vendor Displays
1:30 - 1:45 PM	Business Meeting
1:45 - 2:45 PM	**Greg Haugstad, Senior Research Associate, Characterization Facility, U of M** *New developments in atomic force microscopy: the subtleties of nanotouch*
2:45 - 3:45 PM	**James P. DiOrio, Senior Research Scientist, Baxter Healthcare Corporation** *Correlative Imaging to Study Hemostats*

Spring Symposium

continued

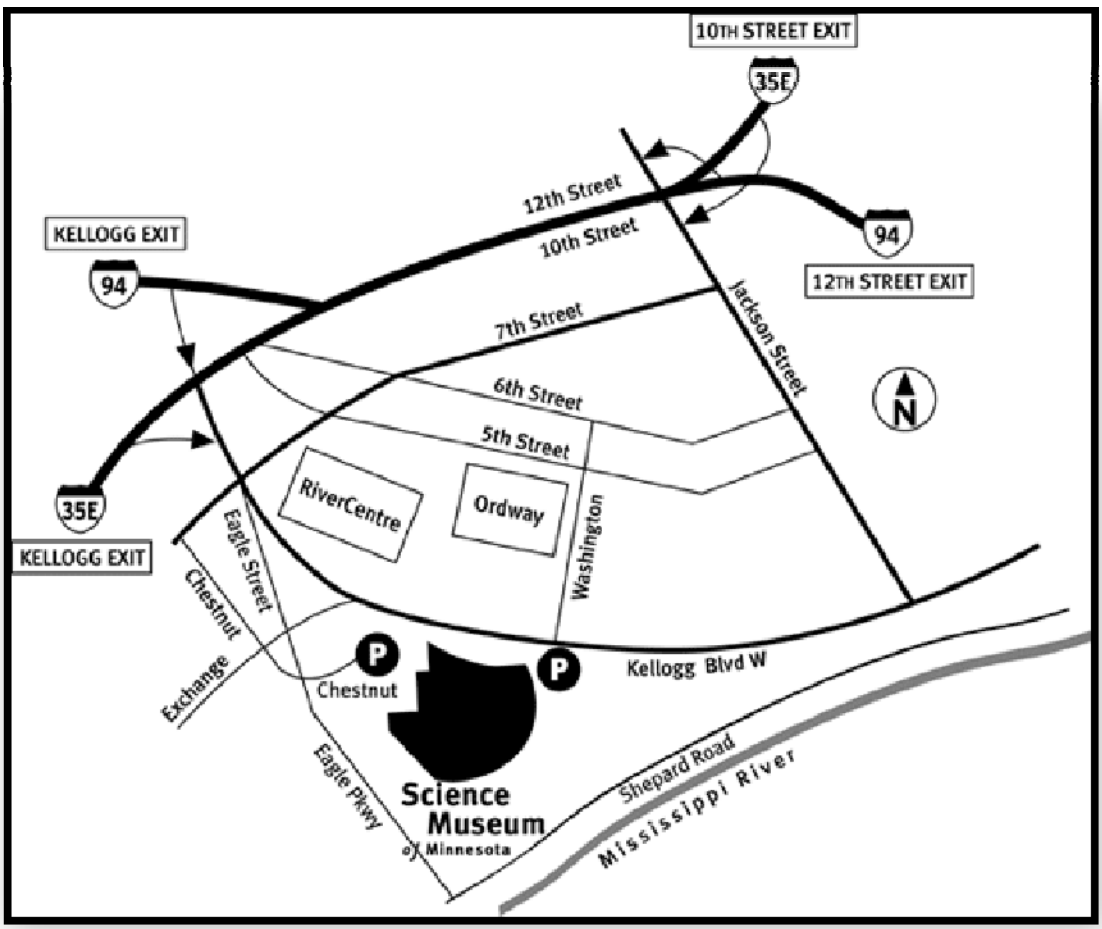
Registration

The cost of the meeting will be $80 for MMS members, $90 for nonmembers, and $25 for students and K-12 teachers. The fee includes the meeting, buffet lunch, breakfast, coffee breaks and a free pass to the Museum exhibits (a $7 value). Registrants can pay at the door, but **reservations must be made no later than Monday, May 2nd**. Register by e-mail (preferred) to Bede Willenbring at reservations@mnmicroscopy.org, or by phone at 651-236-5470. Include your name, company, phone number and email address.

Directions

The Science Museum's parking ramp can be accessed from either Kellogg Blvd or Chestnut St. Enter museum by taking parking ramp elevator to the Lobby level. The River Centre ramp is an alternative to the Science Museum ramp.

The meeting will be held in Discovery Hall. If entering the museum from Kellogg Boulevard, go through the Lobby, angle left just after the box office and continue to the stairs/elevators. The Discovery Hall is one floor down.



Spring Symposium 2011 - Speakers

Seeing is Believing and Other Lies

Joe Zasadzinski
Professor, Chemical Engineering and Materials Science
University of Minnesota

Direct imaging of liquids and soft materials is, in theory, the best way to determine microstructure at all lengthscales. However, the interaction between the microscope and the soft material must be properly managed. I will discuss the benefits and limitations of two cryo-fixation based methods – direct low-temperature imaging and freeze-fracture replication. These methods, while complementary, offer distinctly different challenges to the microscopist in sample preparation, imaging conditions and image interpretation. These methods also work best in concert with less invasive methods such as rheology, small angle X-ray scattering and optical microscopy.

Biography
Joseph A. Zasadzinski returned to Chemical Engineering and Materials Science at the University of Minnesota after 25 years at UC Santa Barbara and currently is the 3M Harry Heltzer Multidisciplinary Chair in Science and Technology. His research is in the characterization of complex fluids and biomaterials using a combination of microscopy, X-ray and rheological techniques.

Low Voltage Multi Mode Scanning Transmission Electron Microscopy and Extreme Field of View Imaging

John Yorston
Senior Applications Specialist,
Carl Zeiss NTS LLC, Peabody, MA

This talk will discuss two novel uses of the scanning electron microscope (SEM) and will focus on it as a compelling alternative to the transmission electron microscope (TEM) for many samples.

The talk will outline multimode low-voltage scanning transmission electron microscopy (MM-LV-STEM) in the field emission scanning electron microscope (FESEM), including high-resolution imaging of nanoparticles, nanotubes and ultra-sections, both biological and polymeric.

It will also discuss the application of novel digital scan generators and acquisition systems capable of automated acquisition of enormous single images of up to 1 gigapixel in size. These huge images and their mosaics are very efficient, having extremely large fields of view (X-FOV) and yet they retain nanometer scale structural information. This is particularly advantageous in the reconstruction of enormous 3D voxels (serial EM) and when combined with high throughput MM-LV-STEM, it becomes a very compelling alternative to traditional serial TEM.

Spring Symposium 2011 - Speakers

continued

Recent Advances in EELS Instrumentation and Analysis: High-Speed Spectroscopy with Extended Energy and Dynamic Range

Ray Twesten
Product Manager
Analytical Instruments Gatan, Inc., Pleasanton, CA

The acquisition of high-quality EELS data in the transmission electron microscope (TEM) presents many challenges not experienced by most TEM acquisition modes. The central challenges are dose efficiency and dynamic range. For EELS, the range of intensities of interest in a single spectrum can often span 6 to 7 orders of magnitude making recording problematic. Since the spectrum is recorded in parallel, EELS acquisition can be very dose efficient, but only if the acquisition device can be read out quickly and efficiently.

To address these issues, we have developed a next generation post-column energy filter, the GIF Quantum®, which excels at energy-filtered imaging but also incorporates several new features that allow the optimal collection of energy-loss spectra generated by the high-brightness electron sources currently available. Key features of the GIF Quantum® include a new CCD camera design that achieves high-spectra readout rates (>1 kHz) with very little overhead, and a system of electrostatic deflectors that allows the nearly simultaneous (<10µs delay) recording of dual energy-loss ranges with microsecond exposure control. These deflectors enable the optimized acquisition of both high-energy core-loss electrons together with the zero-loss and low-loss electron signal.

In this talk, we will present details and advantages afforded by these new developments and show application data collected under optimized conditions.

Biography

Ray Twesten has been working in the field of electron microscopy for the past 20 years. He started his career as a Ph.D. student at the University of Illinois at Urbana-Champaign studying surface physics using a specially-designed UHV TEM. From there, he moved to Sandia National Labs in Albuquerque, N.M., working to understand morphological instabilities in III-V and group-IV semiconductors. He rejoined the University of Illinois in 1997 as a staff scientist and laboratory manager for the TEM operations of the Center for Microanalysis of Materials. Since 2005, Dr. Twesten has been with Gatan in Pleasanton, Calif., first with the EELS R&D group, and later as the manager of the EELS product development group. He is currently the product manager for Gatan's STEM, EELS and GIF products.

Spring Symposium 2011 - Speakers

continued

New developments in atomic force microscopy: The subtleties of nanotouch

Greg Haugstad
Senior Research Associate, Characterization Facility
University of Minnesota

The atomic force microscope (AFM) became commercially available in 1988 (~$100k), following the first publication of the AFM concept by Binnig, Gerber and Quate in 1986. The almost immediate availability of sharp AFM tips attached to microfabricated cantilevers, along with off-the-shelf components such a piezoelectric scanning devices, solid-state lasers and quad photodetectors (for measuring cantilever bending and twisting), allowed the technology to reach hundreds of hands-on users in this astonishingly rapid time frame. Although the ability to image surface topography down to the near-atomic scale – in both ambient and liquid environments – was by itself a remarkable achievement, the development of additional modes of operation – exploiting the subtleties of tip-sample interaction – quickly ensued. By the mid- to late 90s, several modes sensitive to material properties (*e.g.*, mechanical, chemical, electric/magnetic) were being utilized by scores of academic research groups and corporate laboratories worldwide. Although several AFM instrument vendors had done well to implement these modes shortly after their first appearance in the literature, there were a number of long-since reported methods that did not receive commercial development until at least the early 2000s, and in some cases as recently as the past three years. By this time, the novelty and advantages of many of these “higher” methods, as originally published in journal papers in the late 1980s and early 1990s, had long since dimmed on the radar screens – or had never appeared on radar screens at all – of tens of thousands of AFM users. Thus, old modes and technologies (*e.g.*, “tapping mode” with “phase” imaging) continue to dominate most reported usages of AFM, at least among the (majority of) users for whom the AFM is a glorified camera or profilometer.

This talk will introduce basic operational concepts and provide example applications of several of these “newer” commercial methods and understandings. Included are (1) Fourier-analyzed and temperature-controlled shear modulation (revealing shear stiffness, glass transition and stiction), (2) humidity/temperature-controlled and in-liquid “pulsed force mode”, otherwise known as “peak-force tapping” (*i.e.*, high spatial density force-distance mapping), (3) contact resonance (quantitative modulus measurements at high frequency), (4) attractive-regime dynamic imaging (*e.g.*, of liquidy droplets or domains without tip-sample contact), (5) multifrequency AFM (exploiting cantilever motions at higher vibrational resonances, to provide more sensitive materials contrast), and (6) single-pass electric/magnetic modes (utilizing two vibrational frequencies to enable, *e.g.*, Kelvin-probe imaging at low-probe fly heights).

Spring Symposium 2011 - Speakers

continued

Greg Haugstad, cont'd

Biography

Greg Haugstad is technical staff member and director of the Characterization Facility ("CharFac"), a core facility at the University of Minnesota. The CharFac is closely affiliated with the University's (1) NSF Materials Research Science and Engineering Center, especially as a member of the national-reach Materials Research Facilities Network, and (2) Industrial Partnership for Research in Interfacial and Materials Engineering. Dr. Haugstad received his B.A. from Gustavus Adolphus College and Ph.D. from the University of Minnesota, both in physics, with minors in mathematics and materials science. His doctoral work explored metal-semiconductor interfaces with synchrotron radiation photoelectron spectroscopy at cryogenic temperatures. After postdoctoral research with DuPont in the University's NSF Center for Interfacial Engineering, focusing on the interfacial science of imaging media, he joined the CharFac, where his focus has included atomic force microscopy (AFM) and ion beam analysis (Rutherford backscattering and related). His teaching has included courses at the Ph.D., undergraduate and technical-college levels, as well as ~500 user trainings and several national-reach short courses. He is also a member of the graduate faculty, serving as a Ph.D. thesis adviser within the materials science and chemistry programs.

Greg's 20-year research program includes (i) special AFM methods, (ii) nanotribology, (iii) soft thin films (polymer, surfactant, biological), and (iv) drug-release coatings / pharmaceutics. He has more than 70 publications and has given more than 60 oral presentations at international conferences, primarily in AFM methods. His industrial collaborations have included companies spanning medical imaging, personal care products, ocular materials, medical device coatings and analytical instrumentation.

Spring Symposium 2011 - Speakers

continued

Correlative Imaging to Study Hemostats

James P. DiOrio
Senior Research Scientist, Technology Resources
Baxter Healthcare Corporation, Round Lake, IL

Baxter Healthcare Corporation currently has on the market wound management products which are used to control bleeding (hemostasis). FloSeal [Hemostatic Matrix] is composed of a cross-linked gelatin matrix combined with thrombin to produce a highly viscous gel that functions as a topical hemostatic agent used to control bleeding when conventional surgical procedures are ineffective or impractical. Tisseel [Fibrin Sealant] is a two-component fibrin sealant composed of sealer protein (mostly fibrinogen) and thrombin. It is indicated for use as an adjunct to hemostasis in surgeries involving cardiopulmonary bypass and splenic injury when control of bleeding by conventional surgical techniques is ineffective or impractical. Correlative microscopic techniques (SEM, TEM, Micro-CT, LM-Confocal) were used to study these products as well as to develop methods to investigate the interactions of the biologics with the matrix material. A sintered polyethylene material was also examined that is part of a novel in-line device in development for mixing of the above biologics.

Biography

James (“Jim”) DiOrio is originally from Connecticut and came to the Midwest in 1970 where he did his undergraduate and graduate work at Marquette University in Milwaukee. During the course of his career, he has worked as an electron microscopist at the University of North Carolina Chapel Hill and Marquette University, managed a clinical electron microscopy laboratory at Sinai Samaritan Medical Center in Milwaukee as well as managed the core EM facility which supported an NIH program project grant to study clotting proteins. He was also owner of an NVLAP-accredited TEM laboratory doing environmental analyses. Jim has been with Baxter Healthcare in Round Lake, Ill., for the last 19 years and is currently a Senior Research Scientist and manages the Microscopy Group in Technology Resources which supports product development as well as products in the field. His research interests over the years has been in the area of hemostasis particularly on the ultrastructure of clotting proteins, biopolymers, fibrin sealants and various hemostats.

November 5

What: **Microscope Day**

Time: 1:00 – 4:00 pm

Location: Science Museum
St. Paul, MN

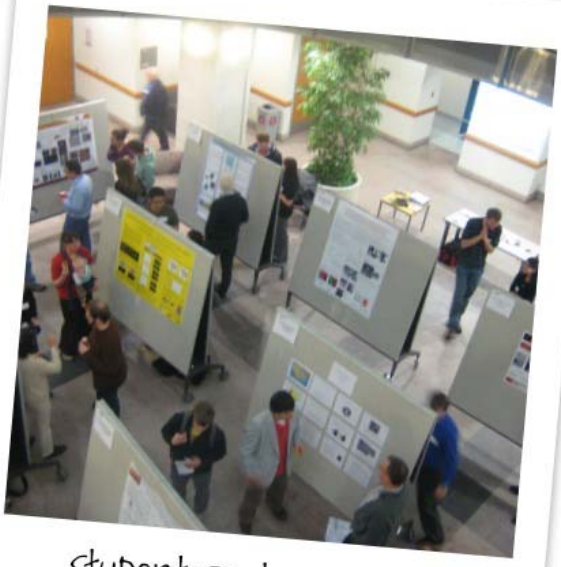
Anyone interested in volunteering or to suggest activity ideas, please contact Ann Palmer – palme003@umn.edu

On the Lighter Side

Question: What is made in a nanofabrication facility?

Answer: Little white lies.

Past Events



Student Poster Session at the U - 01/27/11

Student Poster Session at the U - 01/27/11

Bureau of Crim
Apprehension T

Criminal
on Tour - 02/17/11

Bureau of Criminal Apprehension Tour - 02/17/11

MMS Corporate Sponsors

Corporate Sponsors are the backbone of financial support for the Society. These members make it possible for the Society to support Project Micro and to cover many expenses of the regular meetings and the Spring Symposium. MMS gratefully acknowledges the Corporate sponsorships provided by the following companies in 2009-2010. To become a Corporate Sponsor, complete and return the MMS membership form at the end of the newsletter.

John Benson	**Thermo Electron**	608-826-9049
Mike Boykin	**Mager Scientific, Inc.**	734-426-3885
Laurie Carlone	**EDAX**	312-238-0260
Bill Chauvin	**Oxford Instruments USA**	608-831-0760
Matt Dugas	**ARC**	651-789-9000
Chris Frethem	**The Characterization Facility at the U of MN**	612-624-4652
Jeff Gschwend	**Hitachi High Technologies**	847-816-6098
Larry D, Hanke, P.E.	**Materials Evaluation & Engineering, Inc.**	763-449-8870
Gary Hawkinson	**FEI Company**	608-291-0157
Brad Johnson	**North Central Instruments, Inc. / Leica**	763-559-3008
Mark Kelsey	**Bruker AXS Microanalysis**	708-386-9684
Stacie Kirsch	**Electron Microscopy Sciences / Diatome**	215-412-8400
Lori La Vanier	**Evans Analytical Group, LLC**	952-641-1242
Peter McSwiggen	**McSwiggen & Associates**	612-781-2282
Robert Mierzwa	**JEOL USA, Inc.**	920-803-8945
Eugene Rodek	**SPI Supplies**	610-436-5400 x 109
Jean Schlosser	**Crane Engineering**	763-557-9090
Jim Smith	**Carl Zeiss SMT, Inc.**	978-395-5553
Chad M. Tabatt	**Gatan, Inc.**	775-657-8808
Yianni Tousimis	**Tousimis Research Corporation**	301-881-2450
Nicole Ulseth	**Imation Corp.**	651-704-4738
Jack Vermeulen	**Ted Pella, Inc.**	800-237-3526
Ted Weldon	**Leeds Precision Instruments**	612-546-8575
Dehua Yang	**Ebatco**	952-334-5486
Peter Yurek	**Medtronic Inc.**	

If any Corporate Sponsors are missing from this list, *please* contact Jason Heffelfinger (763-514-1021, jason.r.heffelfinger@medtronic.com).

The Minnesota Microscopy Society would like to express sincere thanks to our Sustaining and Patron Members. These members provide financial support to the organization above the standard membership fee. This additional support makes it possible for MMS to maintain its financial well being. To become a Patron or Sustaining Member, complete and return the MMS membership form at the end of the newsletter.

MMS Sustaining Members

Michael Coscio	Medtronic Inc. - Retired	Steven Skorich	Medtronic Inc., Mpls

MMS Patron Members

Tony Anderson	Surmodics Inc., Eden Prairie	Robert Peterson	3M Company, St. Paul
Dale Case	Imation, St. Paul	Ky Pham	Medtronic Inc., Mpls
Carolyn Casoria	Honeywell, Mpls	Paul Resler	3M Company, St. Paul
Dan DeVos	Nikon Metrology, Inc.	Ryan Stromberg	Hysitron, Mpls
Rick Freiberg	Seagate Technology	Mary Swierczek	3M Center, St. Paul, MN
Robert Hafner	University of Minnesota	Jerry Tangen	JEOL USA, Inc., Monticello
Jeff Haggerty	Haggerty Analytical, St. Paul Park	Joseph Tersteeg	ARC Technologies
Farida Kasumzade	Medtronic, Inc.	Jeff Thole	Macalester College, St. Paul
Robert Lundquist	Boston Scientific, Mpls	Srikanth Vengasandra	Hysitron, Mpls
Alon McCormick	University of Minnesota	Jeremiah Vieregge	Hysitron, Mpls
Stuart McKernan	3M Company, St. Paul	Oden Warren	Hysitron, Mpls
Richard Nay	Hysitron, Mpls	Bede Willenbring	H.B. Fuller Co., St. Paul
Ozan Ogurlu	University of Minnesota, Mpls	Mark Windland	Honeywell, Plymouth
Susan Okerstrom	Medtronic, Inc., Mounds View	Klaus Wormuth	SurModics, Eden Prairie
Ev Osten	3M Company - Retired	Mike Wroge	Cymbet Corp., Elk River
Ann Palmer	University of Minnesota, Mpls	Elizabeth Wurdak	St. John's University
Jeff Payne	3M Company, St. Paul	Chris Wurst	ARC Technologies

MMS BOARD and OFFICERS 2010-2011

President: Ozan Ogurlu, Univ. of Minnesota, 55 Shepherd Labs, 100 Union St. S.E., Minneapolis, Oakdale, MN 55128; (651) 704-4738, MN 55455; (612) 626-3613, ozan@umn.edu

Past-President: Nicole Ulseth, Imation Corp., Discovery 1D-25, 1 Imation Way, Oakdale, MN 55128; (651) 704-4738, nulseth@imation.com

President-Elect: Dale Case, Aerotek Scientific Infection Prevention Div., 3M Co. 270-4N-04 Maplewood, MN 55144-1000 djcase2@gmail.com

Secretary: Patricia Sanft, H.B. Fuller Co., P.O. Box 64683, St. Paul, MN 55164; (651) 236-5384, patricia.sanft@hbfuller.com

Treasurer: Bede Willenbring, H.B. Fuller Co., St. Paul, MN; (651) 236-5470; treasurer@mnmicroscopy.org

MAS Representative: Michael Coscio, Medtronic Inc. (retired), 12650 88th Ave N., Maple Grove, MN 55369; (763) 493-3500; mike.coscio@medtronic.com

ProjectMicro Director: Jeff Payne, 3M Center, Bldg. 201-BE-16, St. Paul, MN 55144-1000; (651) 733-2352; jjpayne@mmm.com

Corporate Liaison: Jason Heffelfinger, Medtronic Inc., 6700 Shingle Creek Parkway, Brooklyn Center, MN 55350; (763) 514-1021; jason.r.heffelfinger@medtronic.com

Webmaster: Stuart McKernan, 3M Center, Bldg. 201-BE-16, St. Paul, MN 55144-1000 (651) 736-5993; smckernan@mmm.com

Other Board Members

Paul Baker, Medtronic, Inc., Minneapolis, MN;
(763) 514-4519; paul.baker@medtronic.com
Steve Block, JEOL USA, Inc., s-block@comcast.net
Dwight Erickson, 3M Center, St. Paul, MN;
(651) 736-2830; dderickson3@mmm.com
Robert Lundquist, Boston Scientific, Maple Grove, MN
(763) 494-7945; robltt@juno.com
Peter McSwiggen, McSwiggen & Associates
St. Anthony, MN, PMcS@McSwiggen.com

Sue Okerstrom, Medtronic, Inc., Mounds View, MN
(763) 526-0225; sue.okerstrom@medtronic.com
Ev Osten, Woodbury, MN; efosten@gmail.com
Ann Palmer, University of Minnesota
Dept. of Pediatrics, Mpls, MN; palme003@umn.edu
Ky Pham, Medtronic, Inc., Minneapolis, MN;
(612) 514-4705; ky.pham@medtronic.com
Mary Swierczek, 3M Center, St. Paul, MN;
(651) 736-5087; mswierczek@mmm.com

Reminder: Membership in MMS runs from January through December.
Have you paid your 2011 dues?

Please visit the MMS website, http://www.mnmicroscopy.org/MMSform.pdf, for a fill-and-print pdf version of the membership form.

Minnesota Microscopy Society – Membership Form

All microscopists are urged to support their Society at one of the membership levels offered below. Often, supervisors will support MMS memberships out of their project budget because they recognize that it is a very inexpensive way to maintain and increase the skills of their microscopists. If you have been a member over the years and recognize the value of MMS to the community of microscopists it serves, consider upgrading your membership this year to the patron or sustaining level. Thank you.

Name _____ **Dr** _____ **Mr** _____ **Ms** _____ **Phone (_____)**_____

Affiliation _____ **Position** _____

Address _____ **ZIP** _____

E-mail address _____

***A legible e-mail address is critical for delivery of your newsletter.**
Newsletters are sent via email only.

Check here _____ if you do NOT want your name and address to appear in the Society directory.

Are you an MSA member? ____ MAS member? ____ Other professional groups? _____

Student ($5) _____ Basic ($10-$24) _____ Patron ($25-$99) _____ Corporate Sustaining ($100+) _____

Payment: ____ Check ____ Visa ____ MasterCard ____ American Express Amount: $_____

Credit Card Number: _____-_____-_____-_____ Exp. Date: _____/_____

Signature (for credit card payment):

_____

Make checks payable to MMS and mail to our Treasurer:
Bede Willenbring, MMS Treasurer, 4763 Decatur Ave. North, New Hope, MN 55428-4402
Fax: 763-208-7741 | email: treasurer@mnmicroscopy.org