The MMS Scope

Minnesota Microscopy Society

Local affiliate of the **Microscopy Society of America**
and the **Microanalysis Society**

april 2016

In this Issue:

Spring Symposium:
Join us for an exciting Spring Symposium at the Science Museum's Discovery Hall. The fee for the symposium includes a pass to museum exhibits. Register by Apr. 22!

Remember to vote:
Election of next year's officers will take place during the business meeting at the Spring Symposium.

Also up ahead:
American Vacuum Society (AVS) short courses on Apr. 19.

Project MICRO:
The Project MICRO program recently took some scopes to Eagle Creek Elementary School in Shakopee. See photos of MMS members volunteering inside.

MINNESOTA MICROSCOPY SOCIETY
SPRING SYMPOSIUM

FRIDAY, APRIL 29, 2016

SCHEDULE on APR 29

7:30 – 8:15 a.m.	Registration, continental breakfast, vendor displays
8:15 – 8:30 a.m.	Welcome
8:30 – 9:30 a.m.	**Jeff Jansen, Sr Managing Engr, The Madison Group** *Failure Analysis of Plastics*
9:30 – 10:30 a.m.	**Scott Walck, Senior Scientist, TKC Global** *TEM Examination of Armor Ceramic Materials*
10:30 – 11:00 a.m.	Break and vendor displays
11:00 – 12:00 p.m.	**Tammy Lai, Lead Metallurgist, Nalco/Ecolab** *The Microscopic Smoking Gun: Failure Analysis in Water Systems*
12:00 – 1:30 p.m.	Lunch and vendor displays
1:30 – 1:45 p.m.	Business meeting
1:45 – 2:45 p.m.	**Katie Igowsky, Forensic Scientist, BCA** *The Role of Microscopy in Solving Crimes*
2:45 – 3: 45 p.m.	**Jake Popp, Principal Materials Engr, Medtronic plc** *Failure Analysis of Medical Devices: Process & Impact*

LOCATION

Minnesota Science Museum
Discovery Hall (*one floor down from main level*)
St. Paul, MN **map it**
Parking: Science Museum or River Centre parking ramps

120 W. Kellogg Blvd. | 55102

RESERVATIONS

Cost: $75 **Deadline:** Friday, Apr. 22

Reservations may be made via PayPal by going to the MMS calendar page. Fee includes the meeting, buffet lunch, breakfast, coffee breaks and a free pass to Science Museum exhibits.

Spring Symposium | 2016

continued

SPEAKER BIOS and ABSTRACTS

Jeff Jansen

Jeffrey A. Jansen is Senior Managing Engineer and a Partner at The Madison Group, an independent plastics engineering and consulting firm. Jeff specializes in failure analysis, material identification and selection, as well as compatibility, aging, and lifetime prediction studies for thermoplastic materials. He has been solving polymer-related problems for 23 years. In that time, he has performed more than 1,470 failure investigations, both for industrial clients and as a part of litigation. He regularly presents educational webinars covering a wide range of topics related to plastics failure, material performance, testing and polymer technology. Jeff is a graduate of Carroll College and the Milwaukee School of Engineering.

The goal of a failure analysis is to discern the mechanism and cause of the component failure - essentially to identify how and why the part broke.

Fractography plays a critical role in this, particularly in identifying the failure mode. Cracking occurs as a result of the exertion of stresses, both external and internal, on a component. Cracking is simply a stress relief mechanism in which the material is attempting to reach a lower energy state.

Plastics fail through a disentanglement mechanism in which polymer chains slide past each other. The features on the fracture surface are created based upon a number of parameters:

- Type of material and formulation constituents;
- Type of applied forces (tensile, compression, shear);
- Magnitude of forces;
- Frequency of forces (continuous, intermittent, rapidly applied);
- Environmental effects (temperature, presence of chemical).

Much of the information regarding the failure mechanism can be gleaned by interpreting the features found on the fracture surface. The examination and interpretation of the fracture surface is known as fractography. A fractographic examination begins with a thorough macroscopic inspection of all of the failed parts. This is typically followed by examination at increasing magnifications using a stereomicroscope, a digital microscope, and when necessary a scanning electron microscope (SEM). The key to interpreting the fracture surface is to be able to recognize and interpret the features left from crack generation. It is like reading a roadmap. This presentation will explore some common plastics failure mechanisms and the associated telltale features.

Spring Symposium | 2016

continued

SPEAKER BIOS and ABSTRACTS

Scott Walck

Scott Walck received his B.A. from Gettysburg College in physics and math. He received his M.S. and Ph.D. from the Univ. of Florida in materials science and engineering where he designed and constructed a field ion microscope/ imaging atom probe with an integrated ion implantation system and studied the low-energy ion implantation in metals. Scott's research centered on developing and characterizing thin films for various applications using electron microscopy techniques. As Assistant Professor at the Univ. of Alabama at Birmingham, he worked on biocompatible hydroxyapatite thin films. He focused his attention on tribological thin films and molecular beam epitaxy heteroepitaxial III-V quantum well structures while at Wright Patterson Air Force Base as a Visiting Scientist and National Research Associate. As a Team Leader and Project Leader at PPG Industries' Glass Technology Center, he worked on low-E coatings and self-cleaning, photocatalytic coatings on glass. Scott then became Technical Director at South Bay Technology where he designed new products and instrumentation and improved on older laboratory materials processing instrumentation, including those for EM sample preparation. He is currently a Senior Scientist employed by TKC Global on the Scientific Engineering & Technical Assistance contract at the Army Research Laboratory at the Aberdeen Proving Ground. He is the electron microscopy subject matter specialist within Materials and Manufacturing Science Division of the ARL Weapons and Materials Research Directorate.

Armor ceramics are perhaps the most important component in ceramic armor systems. The armor ceramic spreads the extremely high dynamic loads during a ballistic impact event and blunts or abrades the incoming round. The most important attributes of the armor ceramic are its hardness, fracture toughness, density, and cost of manufacture, with these being somewhat at odds with each other. Our work centers on identifying and understanding the inelastic deformation mechanisms that are active in armor ceramic materials and how to improve their material design. Understanding the deformation mechanisms in these materials is crucial for developing and optimizing next-generation ceramic materials in body and vehicle armor systems. In an effort to better understand the mechanistic response of polycrystalline boron carbide and silicon carbide materials to large contact stresses, transmission electron microscopy (TEM) methods were used to examine thin cross-sections of the inelastically deformed regions beneath Knoop indents of various loads and load-dwell times. Indentation allows the study of deformation of microstructural features as a function of distance and depth from the loading and allows for comparison to mechanistic modeling. We have developed new, multi-step techniques for the TEM sample preparation below the indented region of ceramic materials that preserve the state of deformation of the material. We report here the microstructural observations of TEM cross-sections that were prepared from 0.3, 1, and 2 kgf Knoop indents in commercially available a hot-pressed polycrystalline boron carbide and three silicon carbide variants (hot-pressed, liquid-phase sintered, and solid-state sintered) that illustrate the complexity of the task at hand.

Spring Symposium | 2016

continued

SPEAKER BIOS and ABSTRACTS

Tammy Lai

Tammy Lai joined Nalco, an Ecolab Company, in 2007 as a member of the metallurgy group, performing root cause failure analyses on components from a variety of systems and industries, including boilers, cooling water systems, chemical processing, oil and gas, and food and beverage. She is the co-author of *The Nalco Guide to Boiler Failure Analysis,* Second Edition, and *The Nalco Guide to Cooling Water Systems Failure Analysis*, Second Edition. Dr. Lai has previous experience in the semiconductor industry and in teaching materials science at Northwestern University. She earned a B.S. in chemical engineering from Rice University, followed by a Ph.D. in materials science and engineering from Northwestern University in 2006.

Failure analysis is often compared to detective work. As failure analysts, we are always searching for the crucial pieces of evidence on which to base our conclusions. Sherlock Holmes used a magnifying glass and an optical microscope to find features not visible with the naked eye. Similar tools are still central to failure analysis today, along with more sophisticated ones such as scanning electron microscopes. I will be presenting case histories of failed metal components from a variety of systems that were treated by Nalco, an Ecolab Company, in which microscopy played a central role in determining the cause of failure. Since water treatment is a very significant portion of our business, corrosion mechanism identification is an important component of most investigations in our laboratory. In high-temperature environments, microstructural examinations can provide insight into the thermal history of a sample, revealing whether overheating occurred. I will also discuss operational and chemical factors that led to the failures, as well as the suggested remedial actions.

Spring Symposium | 2016

continued

SPEAKER BIOS and ABSTRACTS

Katie Igowsky

Katie Igowsky has been working at the Minnesota Bureau of Criminal Apprehension (BCA) for 11 years. She started in the FBI Regional Mitochondrial DNA program doing microscopical hair analysis and then moved on to other trace evidence examinations such as paint, tape, glass, footwear, tire tracks, head lamps, and building materials. She is also a part of the BCA crime scene team. Over the course of eight years, Katie has responded to more than 70 crime scenes all over southern Minnesota.

Paint, glass, tape, clothing found at crime scenes can be analyzed and compared to samples from suspects, suspects' homes, or suspects' vehicles. Comparing these items could provide connections between suspects and the scene of the crime. The analysis of these items involves a vast array of analytical techniques such as polarized light microscopy, comparison microscopy, FTIR, GCMS, SEM-EDS(EDX), etc. This talk will demonstrate how the analysis of items found at a crime scene with microscopical techniques may provide the crucial information in solving a crime.

Jake Popp

Jacob Popp works in the Cardiac Rhythm and Heart Failure business unit at Medtronic plc. At both the corporate and business unit level, Jacob has characterized devices and materials for 15 years. To ensure the reliability of these materials, he pushes for a fundamental understanding of their behaviors. This includes developing *in vivo*-based test methods and understanding a component's unique failure modes. He has conducted development and field return analyses to support product reliability. While establishing returned product analysis departments in other Medtronic divisions, he developed a course on Failure Analysis & Fractography to share the collective experiences of the company, now with 90,000+ employees. Jake holds a bachelor's degree in materials science from the University of Minnesota.

In order to improve a device or component, understanding the mechanism under which it fails yields not only a clear understanding of the failure, but often a range of solutions. This requires a knowledge of the material's properties, the applied stresses, and their interplay resulting in a given fracture appearance. Small size, challenging use environments and high reliability requirements make conducting a medical device failure analysis a non-trivial event. We will discuss the process used in our group, as well as several case studies where a clear failure analysis has positively impacted the product performance.

CALENDAR of EVENTS

19 APR 2016

AVS Minnesota Chapter Short Courses
Normandale Community College
9700 France Avenue S.,
Bloomington, Minn. 55431

AVS Minnesota Chapter and Normandale Community college are cosponsoring the following short courses on April 19, 2016 in Normandale's new Partnership Center. Normandale is home to the Vacuum and Thin Film Technology program within our Science, Technology, Engineering and Mathematics (STEM) and Education division. The Vacuum and Thin Film program offers an Associate of Applied Science Degree as well as Certificates.

- Basics of Vacuum Technology
- Fundamentals of Scanning Electron Microscopy and Microanalysis
- Thin Film Deposition

Learn more and register here.
(Early registration deadline 3/31/16.)

DON'T FORGET!

Election of MMS officers for 2016/2017 will be conducted during the business meeting following lunch.

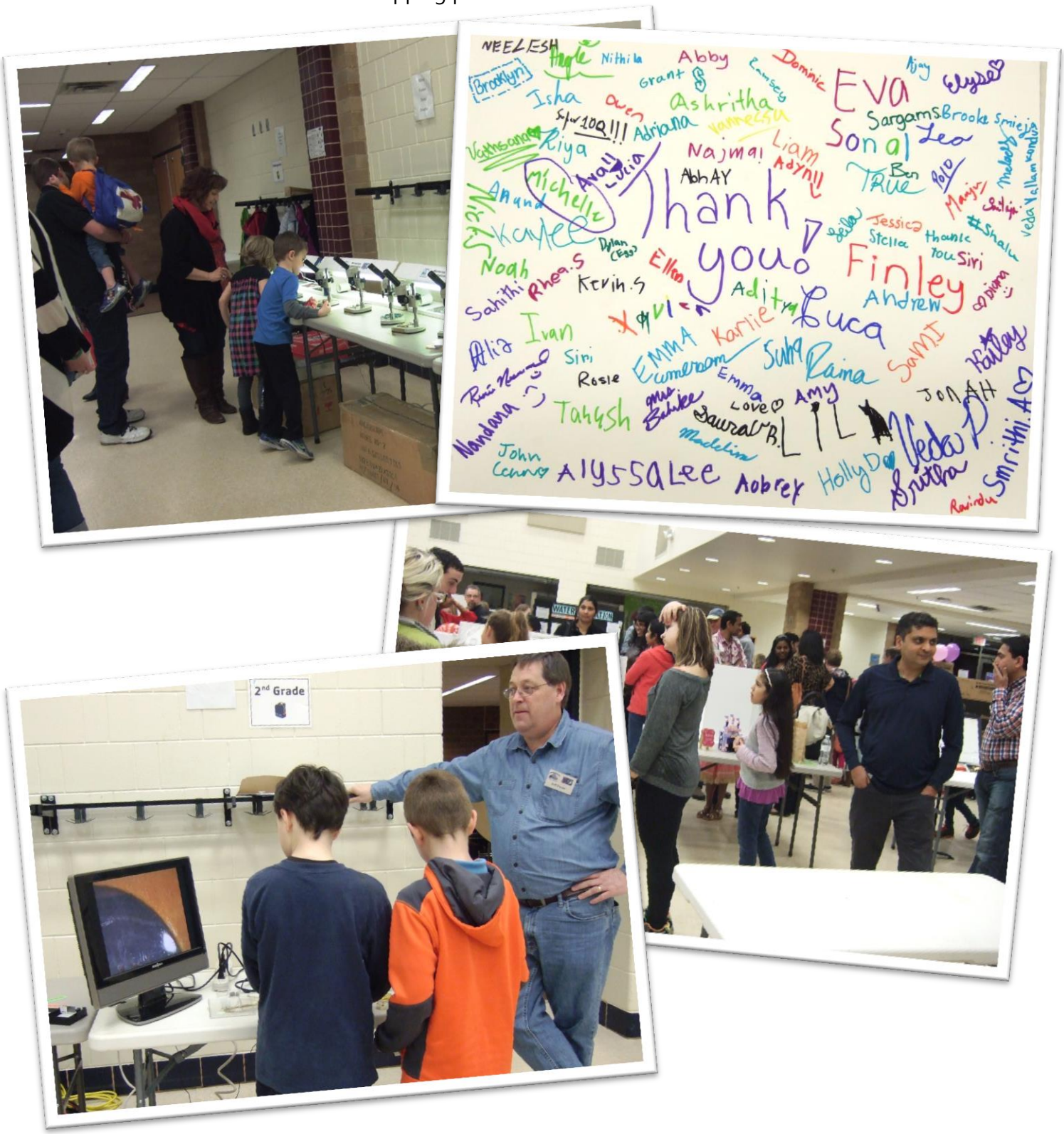
Candidates proposed by the board:

- President Elect – Dehua Yang
- Secretary – Patti Sanft
- Treasurer – Bede Willenbring

* *Nominations will be accepted from the floor.*

PHOTO ALBUM

Enjoy these photos from the March 11, 2016 visit by Project MICRO volunteers to the **Eagle Creek Elementary School Art & Science Fair** in Shakopee, Minn. Many thanks to volunteer Muriel Gavin for snapping photos.



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 2015-2016. To become a Corporate Sponsor, complete and return the MMS membership form at the end of the newsletter.

Joel Ash	**Focus Precision Instruments**	952-380-3696
Mike Boykin	**Mager Scientific, Inc.**	734-426-3885
Brandon Brandt	**Oxford Instruments**	763-370-7304
Dave Bush	**IXRF Systems, Inc**.	512-386-6100
Doug D'Arcy	**DMS, Inc.**	630-983-1704
Chris Frethem	**Characterization Facility at the U of MN**	612-624-4652
Jeff Gschwend	**Hitachi High Technologies**	847-816-6098
Larry Hanke, P.E.	**Materials Evaluation & Engineering, Inc.**	763-449-8870
Gary Hawkinson	**TESCAN-USA, Inc.**	608-358-1934
Mike Hehr	**North Central Instruments, Inc.**	763-559-3008
Mark Kelsey	**Bruker AXS Microanalysis**	708-386-9684
Stacie Kirsch	**Electron Microscopy Sciences / Diatome**	215-412-8400
Dean Krogman	**FEI Company**	608-358-2455
Laurie Krupa	**EDAX**	312-238-0260
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
Steve Nagy	**Gatan, Inc.**	612-616-9557
Mark Nelson	**Microscopy Innovations, LLC**	715-384-3292
Sue Okerstrom	**Lichen Labs, LLC**	763-432-5630
Hyun Park	**Tousimis Research Corp.**	301-881-2450
Hugh Robinson	**Crane Engineering, Inc.**	651-395-0912
Joe Robinson	**Thermo Fisher Scientific**	503-327-9256
Eugene Rodek	**SPI Supplies**	610-436-5400 x 109
Ryan Stromberg	**Hysitron, Inc.**	952-835-6366
Mike Toalson	**Ted Pella, Inc.**	800-237-3526
Dehua Yang	**Ebatco**	952-334-5486
Peter Yurek	**Medtronic**	763-514-1250

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

MMS SUSTAINING & PATRON MEMBERS

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 (retired)	Steve Skorich	Medtronic
Bede Willenbring	H.B. Fuller Co., St. Paul (retired)	Ann Palmer	University of Minnesota, Mpls

MMS Patron Members

Tony Anderson	Surmodics, Eden Prairie
Steven Axdal	Seagate Technology, Mpls
Amanda Borchardt	Pace Analytical, St. Cloud
Mary Buckett	3M Company, St. Paul
Sam Fotch	Mpls
Rick Freiberg	Seagate Technologies, Richfield
Jeff Haggerty	Haggerty Analytical, St. Paul Park
Kathy Hough	Farmington
Lisa Lagoo	Medtronic, Mpls
Carolyn Lewis	Honeywell, Plymouth
George Luxton	University of Minnesota, Mpls
Guillermo Marques	University of Minnesota, Mpls
Stuart McKernan	3M Company, St. Paul
Cindy Moes Little	3M Company, St. Paul
Eric Morrison	Self-employed, West St. Paul
Jason Myers	CharFac, Univ of Minn., Mpls
Ev Osten	3M Company - Retired
Jeffrey Payne	3M Company, St. Paul
Robert Peterson	3M Company, St. Paul
Mark Sanders	University of Minn., St. Paul
Craig Smith	Honeywell, Plymouth
Bill Stratton	3M Company, St. Paul
Mary Swierczek	3M Company, St. Paul
Jerry Tangen	JEOL USA, Monticello
Bill Theilacker	Medtronic, Mpls
Jeff Thole	Macalester College, St. Paul
Oden Warren	Hysitron, Inc.
Mark Windland	Honeywell, Plymouth
Mike Wroge	Cymbet Corp., Elk River
Elizabeth Wurdak	St. John's University
Karen Zaruba	University of Minnesota, Mpls

MMS Board & Officers 2015-2016

President: Jeff Haggerty, Haggerty Analytical, 1032 Marshall Ave., St. Paul Park, MN 55071; (651) 387-9682; ptfeconsultant@yahoo.com

Past-President: Eric Morrison, 1202 Cherokee Ave., West St. Paul, MN 55118; (651) 795-5644; mister.ericm@yahoo.com

President-Elect: David Burleson, Ecolab, 655 Lone Oak Dr., Eagan, MN 55121-1651; (651) 206-8045; david.burleson@ecolab.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. (retired), 4763 Decatur Ave N, New Hope, MN; (763) 533-0649; treasurer@mnmicroscopy.org

MAS Representative: Michael Coscio, Medtronic (retired), 12650 88th Ave N., Maple Grove, MN 55369; (763) 493-3500; mikecoscio@comcast.net

Project MICRO 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, 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

Newsletter Editor: Maria Graff, Minneapolis, MN; mariagraff@me.com

Other Board Members

Peter McSwiggen, McSwiggen & Associates
St. Anthony, MN; PMcS@McSwiggen.com

Ann Palmer, University of Minnesota
Dept. of Pediatrics, Mpls, MN; palme003@umn.edu

Sue Okerstrom, Lichen Labs, LLC,
5942 Benjamin St. NE, Fridley, MN 55432;
763-432-5630; sue@lichenlabs.net

Please visit the MMS website @ http://www.mnmicroscopy.org/MMSform.pdf for a pdf version of the membership form that can be filled in online, printed and mailed or saved and emailed. To pay via credit card, please go to http://www.mnmicroscopy.org/MMSMembership.html and use the PayPal link at the bottom.

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 _____

(Newsletter notifications will be e-mailed to the address above.)

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

Are you an MSA member? ☐ MAS Member? ☐

Student ($5-$9) ☐ Basic ($10-$24) ☐ Patron ($25-$99) ☐ Sustaining (≥ $100) ☐

Payment: Check ☐ PayPal ☐ (Please make your payment via PayPal at **http://www.mnmicroscopy.org/MMSMembership.html**.)

Make checks payable to MMS and mail to our Treasurer:

Bede Willenbring, MMS Treasurer
4763 Decatur Ave. North, New Hope, MN 55428-4402
E-mail: Treasurer@MNmicroscopy.org