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NESM news

PROMOTING THE INTERCHANGE OF KNOWLEDGE OF MICROSCOPY
AND ITS TECHNIQUES IN NEW ENGLAND

President's Letter –

Looking Forward

Dear Fellow Microscopists,

Compared to some members, I'm a bit of a newcomer. The 2010 Fall Meeting at Carl Zeiss SMT was my first glimpse of the NESM family -- a cozy group of brilliant scientists with a shared passion for very tiny things. At the time, I didn't realize that the society was still feeling the effects of the economic recession and that membership had hit a record low. As I settled into my position as Corresponding Secretary, I became aware of the difficulties facing the society. With a concerted effort, the Board of Directors worked diligently to make strategic improvements. Since then, the President's Letter has served as an opportunity to reassure members that the society was recovering. This letter is a bit different. With nearly 200 active members, NESM is no longer recovering but is in a state of steady growth. I would like to reflect this transition by shifting the focus of my final President's Letter to the future of NESM.

For the first time in recent history, NESM will hold a themed meeting entitled "Development of Microscopy Tools and Techniques." We hope that this special Fall Symposium will bring developers of microscopy tools together with researchers interested in applying microscopy solutions to their biological or materials questions. For this Fall Symposium at the Whitehead Institute in Cambridge, MA, NESM aims to draw a diverse audience in an effort to highlight and discuss the interface between technology development and application.

We have assembled a panel of five speakers representing leaders in fields ranging from synthetic neurobiology to electrical and mechanical engineering. The meeting will showcase the extraordinary personnel and microscopy resources in the New England region as well as display the importance of disseminating scientific discoveries. Speakers from MIT, the Wyss Institute, and the Broad Institute will discuss groundbreaking tools that are being developed in the heart of Boston. The keynote speaker will be Ben Krasnow, Google X engineer and science hobbyist renowned for his YouTube channel "Applied Science." Mr. Krasnow will be speaking about his home-built scanning electron microscope and will touch on his use of social media to share the scientific process with the general public. For more information about our Fall Symposium, please see the attached meeting schedule or visit our website at nesmicroscopy.org

Aside from planning the next year of meetings, the Board of Directors has identified several initiatives to help us better serve our growing society. We are actively mining the resources provided by our parent societies, [MSA](#) and [MAS](#), to help bolster the content of our meetings by recruiting tour speakers and funding support. In the coming year, we hope to unveil a new program to increase the visibility of our Corporate Members and to help them provide information to members in search of the right microscopy tool or technique for their research. Along with these and other



2014 President Blair Rossetti gives the opening remarks at the Fall Meeting

initiatives, NESM continues to add new and useful features to our website in an effort to simplify your interaction with the society.

As I wrap up my last month as President, I can't help but marvel at how far we've come. The cozy family I joined in 2010 is now five times larger but just as close knit and friendly. Our journey has seen [challenges](#), [growth](#), and [change](#) for the better, and I am grateful to have had the opportunity to help steer NESM towards a bright and promising future. I wish the Board of Directors and the upcoming President, Dr. Jennifer Ross, success, and I look forward to another stellar year of meetings as I transition to my new role as Immediate Past President.

-Blair Rossetti
2014 President

48th Annual Fall Symposium & Business Meeting at The Whitehead Institute

Thursday, December 5th, 2013

“Developing Microscopy Tools & Techniques”

1:00 Registration

1:30 Welcoming Remarks – Blair Rossetti, *President 2014*

1:45 “Electron Induced Near Field Optical Microscopy for Plasmonic Nanostructures”, Jun Xu, PhD., *Massachusetts Institute of Technology*

2:25 “Stable & Monodisperse Membrane Labeling of Neurons with Bright Nitrogen Vacancy Nanodiamonds In-Vitro & in the Live Mouse Brain”, Or Shamesh, PhD., *MIT Media Lab*

3:05 Coffee Break

3:45 “DNA Probes for Highly Multiplexed, Precisely Quantitative, Ultra-Resolution Imaging”, Peng Yin, PhD., *Wyss Institute*

4:25 “Extracting Rich Information from Biological Images to Tackle World Health Problems,” Anne Carpenter, PhD., *Broad Institute*

5:05 Discussion Break

5:20 Keynote – “Building Advanced Scientific Apparatus Quickly and at Low Cost,” Ben Krasnow, *Google X*

6:20 Dinner

7:30 Business Meeting

8:30 Closing Remarks – Jennifer Ross, PhD. *President 2015*

**REGISTER
ONLINE:**

Visit
nesmicroscopy.org
for more details



Symposium Costs:

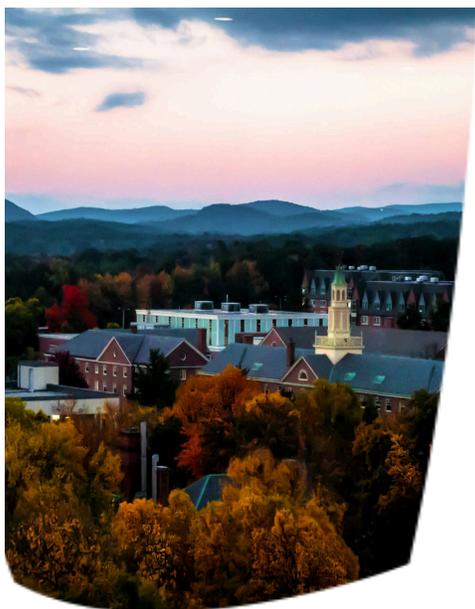
\$40 Regular Members

\$15 Student Members

\$15 Retiree Members



WHITEHEAD INSTITUTE



Business Meeting

Now accepting nominations! email info@nesmicroscopy.org!

The annual NESM Business Meeting is the occasion for registered NESM members to vote and elect new Board Members for any and all open positions. As stated in the Society's bylaws, it is the task of the Nomination Committee to provide a slate of candidates for each open position to the membership for a majority vote. Positions marked "Interim" indicate that the candidate will be fulfilling the remainder of an existing term. In addition to those nominated by the Nomination Committee, NESM encourages all members to suggest candidates to be placed on the ballot. For all nominations, please contact Rylie Walsh (info@nesmicroscopy.org). Once elected, Board Members are encouraged to attend all of the Society's technical meetings and the Board Meetings (typically four per year) during their tenure. All open Board Member positions are outlined and discussed below.

2 year term

President-Elect - The President-Elect is the Program Chairperson tasked with organizing the Society's four technical meetings for the year and is responsible for arranging dates, locations, speakers, and meeting accessories (e.g. meals, coffee, workshops, and poster contests). Additional Board Members are selected by the President-Elect to assist in the identification of speakers. The President-Elect prepares programs and other meeting-related documents and forwards these to the Corresponding Secretary for dissemination to the general membership.

2 year term

Corresponding Secretary - The Corresponding Secretary disseminates information to the general membership, especially notification of upcoming meetings. The Corresponding Secretary handles advance registration and provides feedback to President-elect (e.g. number of meals needed). The Corresponding Secretary, assisted by the Treasurer and Directors, is responsible for meeting-site, collecting fees, nametags, handouts, etc.) The Corresponding Secretary interacts with the Treasurer to maintain membership list and payments such as dues & registration, and is also responsible for setting up the registration website for each meeting & regularly updating the website with meeting reviews & society news.

2 year term

Clerk - The Clerk acts as the Corporate Member Liaison, assisting the President as needed, and helping to arrange the Corporate Exhibits at the Woods Hole Meeting. The Clerk obtains a slate of candidates from the Past President, and tallies votes at the Business Meeting. The Clerk also handles Board Meeting tasks when President is unavailable.

3 year term

Directors - The Biological and Physical Sciences Directors attend the Board Meetings and provide counsel and support to tasks that aid the Society. Directors are the primary officers responsible for identifying speakers and possible meeting venues. Directors also help the President-Elect and Corresponding Secretary run the longer meetings (e.g. Fall and Spring Symposia). There are three Physical and three Biological Science Directors, rotating yearly. Presently two positions are open for Biological Sciences Director and one for Physical Sciences Director.

Available Board Positions:

2016 President-Elect

2016 Corresponding Secretary

2016 Clerk

2016 Interim Biological Sciences Director

2017 Biological Sciences Director

2017 Physical Sciences Director

Past Meetings: A Year in Review

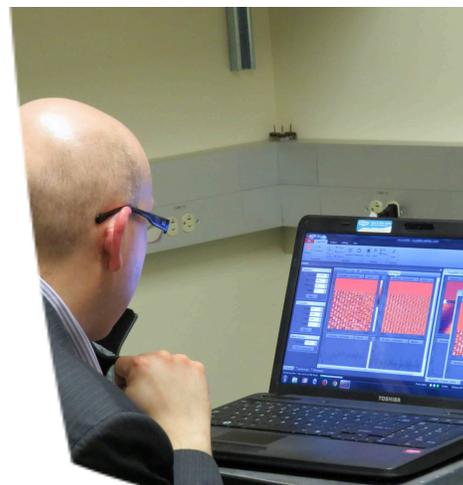
31st Annual Spring Workshops, Marine Biological Laboratory, Woods Hole, MA. May 2, 2013

In the “Introduction to Scanning Probe Microscopy” workshop, the attendees were introduced to the basic principles and applications of Scanning Probe Microscopy (SPM). In the first half, Brent LaPointe from Nanosurf Inc. gave a presentation on how this group of imaging techniques work and how they are employed in various scientific and technical fields. After the coffee break, the attendees had a chance to concentrate on two of the most popular SPM techniques, namely the Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM). Fettah Kosar from Harvard gave a short demonstration on the Nanosurf NaioSTM small desktop system by imaging the surface of a HOPG (Highly Oriented Pyrolytic Graphite) at atomic resolution. Then Brent LaPointe demonstrated the capabilities of the Nanosurf FlexAFM system by imaging a sample provided by Stephen Senft from MBL, which contained sections of the chromatophores (color-changing organelles) from a squid. The level of interest and engagement by all the four attendees were indicated by their questions and comments throughout the session.

The “Digital Image Analysis with ImageJ” workshop was taught by Dr. Lai Ding and Daniel Tom of the Enhanced Neuroimaging Core at Harvard University. ImageJ and its more actively developed derivative, [Fiji](#), are open source image processing packages that have grown a vast user base in the biological and physical sciences. Dr. Ding, a veteran user of ImageJ, presented a neatly organized and engaging overview of ImageJ’s most powerful

functions. Appealing to both beginner and intermediate users, Dr. Ding’s workshop covered everything from image compression and file types to image segmentation. Most of the workshop was performed as hands-on demonstrations and allowed the workshop participants a chance to test the functions for themselves. The overview of ImageJ culminated with a peak into the versatile ImageJ macro language. Workshop participants left with the ability to perform batch operations to their images and make thousands of measurements all with the click of the “Run” button. If you missed Dr. Ding’s NESM workshop, consider attending one of his multi-day workshops at Harvard University. For more information, visit: <http://www.neurodiscovery.harvard.edu/research/imaging.html>

The “Cathodoluminescence Imaging” workshop went off quite well, with a lively talk about the use of CL imaging, which uses the emission of visible wavelength light under electron bombardment in many crystalline materials, to materials investigations in many fields, but with an emphasis on mineralogical applications. The attendees were able to learn about the fundamentals of the dynamics of electron induced luminescence, as well as the ways in which this illumination allows for rapid material identification based on color, as well as quantitative analysis by interpretation of the emission with a monochromator. In addition to examining a wide variety of polished mineral samples from Alaska, Brazil, California, and East Africa, we were able to



Looking over data during the introduction to Scanning Probe Microscopy Workshop

look at granite samples from nearby Carlisle, MA. Applications of this technique to industrial materials science applications were also overviewed, using synthetic crystals manufactured locally. Comparison of the CL effects on samples was also made using optical petrography and SEM-EDS analysis thanks to the use of the Wood’s Hole MBL central microscopy facility laboratory. All in all, the workshop covered a lot of ground, allowed for some dynamic question and answer time, and introduced an underused technique to the suite of tools presented at the Spring Symposium.

Fettah Kosar , Blair Rossetti, Jared Kelly
Immediate Past President, President Clerk



31st Annual Spring Symposium, Marine Biological Laboratory, Woods Hole, MA. May 2, 2014

This year's spring symposium was held on May 2, 2014 at the Marine Biological Laboratory in Woods Hole, MA. The symposium was outstanding in its variety of speakers and the depth of their presentations.

Zvonimir Dogic, Physics Department at Brandeis University: Dr. Dogic showed us the beauty of self-assembling "model membrane" systems made from phage viruses. The phage viruses are used as rod-like colloidal particles that bind to one another and form phase-separated regions of virus, which separate from the aqueous buffer background. The effect is similar to oil drops in water – except the "oil drops" are made from viruses. Using DIC and Phase-contrast microscopy, these solid phases were clearly distinguishable from the buffer background. Using fluorescence and polarization microscopy, the tilt, orientation, and angle of the viruses within the phase-separated region could be directly visualized. All imaging was performed with various forms of light microscopy, showcasing the broad applicability of light microscopy to tackle this problem at the interface of biology and materials science.

Wei Guo, Photonics Laboratory at UMass Lowell: Dr. Guo uses electron and light microscopy to study novel light-emitting materials that could be the next generation of LED lighting systems. Our insatiable craving for power is dominated by our need to light up the night and 22% of all energy use is due to light bulbs of some kind. Thus, making more energy efficient lights could have significant energy-saving consequences. Growing and characterizing gallium-nitride and indium-nitride heterogeneous structures can control the wavelengths to give brighter, whiter light. Dr. Guo fabricates bamboo-like nanowires of repeating intervals of GaN and InN, and characterizes their abilities using SEM and fluorescence imaging. Guo uses microscopic characterizations of these nanostructures to help solve the energy crisis – one nanowire at a time.

Ilke Arslan, Pacific Northwest National Lab: Dr. Arslan is working on cutting-edge methods that use electron microscopy to visualize three dimensional materials systems

and their dynamics over time. By tilting the sample in a scanning transmission electron microscope, Arslan is able to make 3D reconstructions of materials over time. By shaping the material to better fit into the TEM holder, even greater angles can be achieved, which results in more detailed 3D information. In addition to 3D tomography, Arslan is performing chemical reactions and observing the effects on the material in the microscope in real-time. By pushing the boundaries of how we can see, Arslan is learning new information about the microstructure of materials in true four-dimensions – space and time.

Jennifer Morgan, Marine Biology Laboratory: Dr. Morgan is using electron microscopy to study the molecular basis of Parkinson's Disease. Interestingly, Morgan is using an unexpected model system – the lamprey – to study this disease. Lamprey is a good model system because, although more simple than human anatomy, they have a true brain and spinal cord which allows direct imaging the synapses of the motor neurons. The synapse is where the chemical communication between neurons and between neurons and muscles, through small neurotransmitter-containing organelles called synaptic vesicles. The lab studies the synuclein proteins that are associated with Parkinson's Disease and which might play a role in synaptic vesicle trafficking. Morgan is able to examine the effects of missing or mutations of this protein on the synapse structure and number of vesicles at the synapse for signaling using transmission electron microscopy of thin sections of fixed and embedded tissues. Morgan has found that when there is an overabundance of the synuclein protein (as there is in some cases of genetic Parkinson's Disease), there are fewer vesicles and more plasma membrane at the synapse, which suggests that synaptic vesicle endocytosis is somehow being impaired. Through direct microscopy imaging and the use of a unique and useful model system, Morgan is learning about the molecular mechanisms behind this debilitating neurological disease.

Amy Gladfelter, Biology Department at Dartmouth College: Dr. Gladfelter is using numerous microscopic techniques in to discover the molecular and cellular



Dr. Ilke Arslan presented her research using electron microscopy to visualize 3-dimensional materials over time

mechanisms of the little-studied septin proteins. Septins are a cytoskeletal filament that interact with the cell membrane to help organize cellular compartments and communicate with the rest of the cell. Teaming up with groups at the Marine Biological Laboratory at Woods Hole, Dr. Gladfelter has employed Fluorescence Correlation Spectroscopy (FCS), Total Internal Reflection Fluorescence (TIRF) Microscopy, polarized fluorescence, polarized TIRF, and multifocus polarization techniques to study the problems using both cellular and in vitro reconstitution experiments. She has discovered that septin filaments are apolar and often elongate through the annealing of shorter filaments. The orientation of the membrane-bound filaments is controlled in cells and serves to connect with other cytoskeletal elements. Through her multi-method, multi-scale approach that utilizes multiple microscopy methods, Gladfelter is learning how septins function in the cell.

In addition to an excellent assortment of talks, the Symposium featured its annual exhibiting vendor session. Representatives of fifteen of NESM's wonderful corporate sponsors manned tables, gave demonstrations and spoke with meeting attendees about all the latest in microscopy-related technology, equipment, and innovations. It was a treat to get a chance to engage with the vendors and discover firsthand all of the great developments in our field.

Jennifer Ross & Rylie Walsh
President-Elect & Corresponding Secretary

Fall Meeting at UMass Amherst, October 2, 2014

This year's Fall Meeting was held at the University of Massachusetts Amherst on Thursday, October 2nd. The meeting kicked off with an open house at the University's Electron Microscopy facility, hosted by facility director Dr. Alexander Ribbe. The Open House featured a presentation of EM equipment at UMass, facility tours and an EELS/EFTEM demo.

The meeting proper was held on the 10th floor of the Campus Center, in a spacious hall that afforded spectacular views of the autumn countryside -- great microscopy isn't the only perk of living in New England! After a buffet dinner, UMass' own Dr. Ryan Hayward started off the evening's lectures. Dr. Hayward showed us how optical microscopes can be used in 4D printing to manipulate and contour polymer gel sheets. He demonstrated how fluorescence microscopy can be used to generate photo-crosslinkable copolymers that form and fold into complex 3D shapes over time -- just add

water. Next, Dr. Andrew York from the National Institute for Biomedical Imaging & Bioengineering showcased his advances in improving light microscopy. He described the perks and pitfalls of latest imaging techniques and revealed how several of these problems could be avoided by using analog structured illumination microscopy. Dr. York also highlighted the ability of Richardson-Lucy deconvolution to produce high resolution images by combining the components of several mixed-resolution images. As always, it was a lovely evening filled with great food, great company, and great science.

Rylie Walsh
Corresponding Secretary



Andrew York lectures about novel ways of improving light microscopy

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NESM would like to extend our deepest thanks and appreciation to all of our Corporate Sponsors. Your sustained commitment to NESM allows us to continue to promote excellence in microscopy here in New England.

NESM would also like to thank our affiliated societies – MSA, MAS, and ConnMS – for their continued support.