

## MeetingReport

# Microscopy & Microanalysis 2019

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The Microscopy & Microanalysis 2019 (M&M 2019) meeting was held this past August 4–8 in wonderful Portland, Oregon. The conference was co-sponsored by the Microscopy Society of America (MSA), the Microanalysis Society (MAS), and the International Field Emission Society (IFES). The meeting hosted a record participation of 3,516 attendees (2,074 scientific participants and 1,442 exhibitors) from over 40 countries and featured 1,412 scientific papers (749 platform presentations and 663 posters). The M&M Expo Exhibition showcased state-of-the-art instruments, microscopy support equipment, and specialized services from 136 companies from around the world.

There were two very well-attended pre-meeting congresses. On Saturday, the third annual “Pre-meeting Congress for Early Career Professionals in Microscopy and Microanalysis” was hosted by the MSA Student Council (Figure 1). This Congress included a day full of seminars, fruitful discussions, and great opportunities for networking that culminated with a lovely dinner cruise on the Willamette River. The second pre-meeting event, “NexTEM: Next-Generation Transmission Electron Microscopy – Beyond Current Limits of Resolution, Environment, and Data Analysis” took place on Sunday and was sponsored by the MSA Aberration-Corrected Microscopy Focused Interest Group, as well as by several vendors. It presented lectures on the latest developments and advances in detectors, *in situ* imaging and analysis, electron spectroscopies, and machine learning topics.

The opening plenary session featured two Nobel Prize laureates, Drs. Joachim Frank and Richard Henderson, who presented truly inspirational talks on their achievements in cryo-electron microscopy (cryo-EM). Both speakers were awarded, along with their colleague Dr. Jacques Dubochet, the Nobel Prize in Chemistry in 2017 for “Developing Cryo-Electron Microscopy for the High-Resolution Structure Determination of Biomolecules in Solution.”

First, Professor Joachim Frank (Molecular Biophysics and Biological Sciences, Columbia University) presented his work, “Studying Kinetics by Counting Particles in Time-Resolved Cryo-EM,” and addressed to what extent the method of kinetic measurement can be used in practice (Figure 2, left). Professor Frank discussed various obstacles that must be considered in the precise quantification of the numbers of particles in experiments and provided examples of time-resolved cryo-EM by measuring the kinetics of macromolecular reactions in a sequence of experiments with microfluidic chips designed for imaging at a series of time points. He concluded that in the near future, a reliable method for measuring reaction kinetics of macromolecules by counting particles in micrographs collected by cryo-EM will be a significant addition to the biophysics tool chest.

The second plenary lecture, “Single Particle Cryo-EM: Potential for Further Improvement,” was delivered by Dr. Richard



**Figure 1:** Members of the MSA Student Council. From left to right: Cameron Varano (Penn State University), Aubrey Penn (North Carolina State University), Erica Stevens (University of Pittsburgh), Jackson Spurling (University of Tennessee), and Abinash Kumar (Massachusetts Institute of Technology).

Henderson (Medical Research Council Laboratory of Molecular Biology (MRC LMB), Cambridge, UK) (Figure 2, right). Dr. Henderson discussed technical limitations that prevent cryo-EM from reaching its ultimate potential and presented quantitative evaluations of effects such as specimen motion and charge buildup and fluctuation that can contribute to information loss in single-particle cryo-EM. Dr. Henderson further discussed aspects that are critical for achieving the goal of making single-particle cryo-EM analysis less expensive and more widely accessible.

The plenary session continued with the presentation of awards that honored numerous scientists and students. Philip E. Batson (Rutgers University, Department of Physics and Astronomy) and Bridget Carragher (Simons Electron Microscopy Center, New York Structural Biology Center) were honored with MSA Distinguished Scientist Awards in Physical and Biological Sciences, respectively. Additionally, eight of our colleagues were installed as MSA Fellows: Wilbur C. Bigelow, Edward D. Boyes,



**Figure 2:** Prof. Joachim Frank (left) and Dr. Richard Henderson (right) present their plenary addresses at M&M 2019.



**Figure 3:** MSA and MAS student awardees.

Pratibha L. Gai, Ronald Gronsky, Maximilian Haider, Michael Marko, David W. McComb, and Karren L. More. The Burton Medal, for distinguished contributions by a scientist younger than 40, was awarded to Hari Shroff of the National Institutes of Health; B. Layla Mehdi of University of Liverpool was awarded the Albert Crewe Award for physical science research by a scientist not more than 6 years removed from postdoctoral graduation; and Alex Noble of the New York Structural Biology Center received the George Palade award for life science research by an investigator not more than 6 years from postdoctoral graduation. Matthew S. Joens (Washington University School of Medicine) received the Hildegard H. Crowley Award for Outstanding Technologist in the Biological Sciences, and Dmitri Zakharov (Brookhaven National Laboratory) was awarded the Chuck Fiori Award for Outstanding Technologist in the Physical Sciences.

MAS introduced its inaugural class of 26 fellows to recognize eminent scientists, engineers, and technologists in the field of microanalysis of materials for their outstanding research and service to the microanalysis community. MAS also honored David N. Seideman (Northwestern University) with the Peter Duncumb Award for Excellence in Microanalysis, and Miaofang Chi of Oak Ridge National Laboratory with the Kurt F. J. Heinrich Award for research by an individual less than 15 years from their terminal degree. Lawrence Allard of Oak Ridge National Laboratory was awarded the MAS Presidential Science Award, and Lucille Giannuzzi (EXpressLO LLC) was honored with the Presidential Service Award. IFES recognized outstanding scholars with the 2019 IFES Travel Scholarship Awards to Olivia G. Licata of the University at Buffalo and Yi-Sheng (Eason) Chen of The University of Sydney, Australia. In addition, over 50 Student and Postdoctoral Scholar Travel Awards sponsored by MSA and

MAS were awarded (Figure 3). Best poster awards were also given out each day of the meeting. Congratulations to all awardees!

The technical program of the meeting consisted of 35 symposia covering several topics in the biological, physical, and analytical sciences. One of the highlights of the meeting was a memorial symposium showcasing the work of the late Professor Ken Downing of the Berkeley Laboratory Molecular Biophysics and Integrated Bioimaging Division, which was titled “Cryo-EM – from Physics to Cell Biology: Honoring the Remarkable Legacy of Ken Downing.” The symposium featured talks on single-particle cryo-EM, cryo-EM tomography, and other cutting-edge microscopy methods he used for his seminal discoveries. Dr. Downing, MSA Fellow and former MSA president, was enormously influential in the field of electron microscopy and a wonderful mentor to the next generation of scientists.

Figure 4 shows participants in other excellent symposia that covered important areas of development within the fields of microscopy and microanalysis, including Data Acquisition Schemes, Working with Large Data in Both Biological and Physical Sciences Imaging, Machine Learning Algorithms and Open Source Software, New Frontiers in Atom Probe Tomography Developments and Applications, Current Trends and Challenges in Electron Energy-Loss Spectroscopy, Cutting-Edge Microscopy in the Pacific Northwest, Investigations of Energy Applications in Materials, and Advances in Cryo-EM Technology—to mention a few. Other presentations included Biological and Physical Sciences tutorials, dynamic roundtable discussions organized by the Technologists’ Forum, and the Microscopy STEM Outreach Microscopy Explorations program, which included hands-on activities, a workshop, and poster presentations for local middle and high school students (Figure 5).





Figure 4: M&M 2019 oral and poster session participants.



Figure 5: Participants in the M&M 2019 Microscopy STEM Outreach Microscopy Explorations program.

As always, Portland provided a delightful venue for established and new colleagues to meet and discuss their science, and it also provided several fun activities and places to visit. I can proudly say that M&M 2019, with its compelling program and record scientific participation and attendance, was a great success. We hope to repeat the success when we see you back here in Portland for M&M 2022. Meanwhile, let's look forward to M&M 2020 in Milwaukee, Wisconsin, August 2–6, 2020.

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