PARTICULARS

The E-Newsletter of the American Association for Aerosol Research

SPRING 2019

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As always, we'd love any feedback or suggestions you may have for ***Particulars***

Simply email **info@aaar.org** with the subject line ***'Particulars'***

Jason Surratt, *Editor*

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President's Message

Dear Colleagues,

As the weather begins to warm, and memories of the winter deep freeze and heavy snow/rain begin to fade, I hope you experience a renewed sense of purpose and a continuing excitement for our field of aerosol science and technology.

After hosting the International Aerosol Conference last year, we return to our normal schedule this year, with the annual conference in **Portland, Oregon, 14-18 October 2019**. **Sally Ng** is this year's conference chair, and she is hard at work planning another "can't miss" event. In addition to the regular schedule of plenary, platform and poster presentations, several new initiatives will be introduced. These include a **"Meet the Job Seekers"** poster session, an aerosol video competition, and enhanced travel support for aerosol researchers outside the U.S. **Keep your eye open for updates** to the conference web site describing these and other aspects of the meeting. I'm looking forward to seeing everyone in Portland!

The financial position of our Association continues to be strong. Despite a substantial market dip at the end of 2018, we finished the year with assets totaling almost 200% of our investment goal of at least one-year operating budget in unrestricted reserve. This strong financial position serves the Association well in many ways, including allowing us to conceive of and fund new initiatives such as those mentioned above for the upcoming conference.

I am excited to announce that the **AS&T Outstanding Publication Award** fund has reached endowment status by exceeding $25,000 in donations plus a $25,000 match from Association reserves. I would like to thank **Peter McMurry** for his outstanding leadership of the endowment campaign, and of course many thanks to all who contributed to the effort. If you "missed the boat" with this campaign, it is not too early to start thinking about a mid- or end- of year donation to the many endeavors that AAAR supports.

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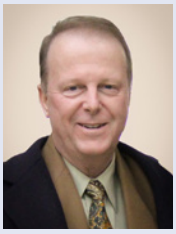
The Association's journal, ***Aerosol Science and Technology***, continues to do well under the leadership of Editor-in-Chief Warren Finlay. Recently, the AAAR Board of Directors unanimously approved the appointment of **Jason Olfert** as a new Editor of AS&T. Congratulations to Jason, and a hearty thank you to all Editors for the substantial effort you make to enable publication of the latest and greatest in aerosol research.

Please have an enjoyable and productive spring, and remember to highlight the annual conference dates in your calendar. ***See you then!*** ●

Murray Johnston
AAAR President

In Memoriam:



Thomas Maynard Merrifield

(Oct 23, 1950–March 9, 2019)

The air quality community mourns the loss of **Mr. Thomas M. Merrifield**, who passed away suddenly on March 9, 2019, at the age of 68. He is survived by his wife (Deborah) and daughter (Megan), as well as his mother (Barbara), brother (John), and sister (Carol).

Tom joined AAAR in 1993 and has been actively involved in supporting instrument manufacturers at annual meetings as the chair of the Exhibition committee (2003-2005; 2010-2011) as well as a member of the committee for an additional 5 years. Tom also chaired the exhibit committees for the 2005 and 2010 AAAR specialty conferences and himself by personally participating as an instrument vendor in many of the annual and specialty conference meetings throughout the years. Having a love for aerosol instrumentation, Tom enjoyed its history and was chair of the History of Aerosol Working Group in 2007 and a member for several years besides.

Tom is respected for his expertise in particulate matter measurement system and its application to quantifying community exposures. Tom was instrumental in the development and testing of size selective inlets and sampling systems that have been incorporated into Federal Reference and Equivalent Methods to determine compliance with $PM_{2.5}$ National Ambient Air Quality Standards. These methods have been adopted worldwide. Tom's experience in characterizing urban air quality and pollution sources, assessing visibility impairment, and developing state implementation plans was recognized through invitations to conferences and training workshops in Russia, India, Pakistan, Malaysia, Japan, China, Brazil, Columbia, and Mexico. In 2014, Tom received the certificate of "Foreign Experts," one of the highest honors recognized by the State Administration of Foreign Expert Affairs in Beijing, China.

Tom earned his Bachelor of Sciences degree in Environmental Sciences from the University of Kansas in 1973 and started as a field operator, then project manager at the Midwest Research Institute (Kansas City, MO) working on fugitive dust sampling. In 1978, Tom joined Andersen Samplers/Graseby Instruments (Smyrna, Georgia) as one of the first employees and partners, which led to his career in designing, developing, and testing aerosol instruments for the following ~40 years. He later worked at MetOne Instruments and BGI Instruments before forming Merrifield & Associates in 2012.

Tom will be remembered for his dedication to air quality improvement, his contributions to the aerosol sampling instrumentation, his generosity for assisting colleagues worldwide, his polite demeanor, and his long-lasting "smiles." ●

Editor's Note:
This memorial piece was prepared by **Judith Chow**, **John Watson**, **Paul A. Solomon**, and **John Tisch**

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AS&T Article Highlight

By Gabriel Isaacman-VanWertz

"The Simultaneous Effects of Image Force and Diffusion on Ultrafine Particle Deposition onto Vegetation: A Wind Tunnel Study"

Ming-Yeng Lin, Cheng-Wei Huang, Gabriel Katul, Chia-Ren Chu & Andrey Khlystov

https://doi.org/10.1080/02786826.2019.1567908 (in press)

Interest in ultrafine particles (with diameters below ~100 nm) has been growing due to their high surface area concentrations, which magnifies their adverse health effects and facilitates particle growth by condensation of gases. These small particles are lost from the atmosphere primarily by diffusion to surfaces. A large fraction of ultrafine particles is consequently lost to vegetation due to its high surface area and large area of coverage. Understanding global particle concentrations consequently requires an accurate model of deposition of ultrafine particles to branches and leaves, which can also have a major impact on the plants themselves. Lin and co-workers explore this process using a clever approach: packing juniper branches into a wind tunnel and directly measuring particle penetration through the vegetation-packed chamber. One of the most unique aspects of this work is that the researchers measure particle size distributions by electrical mobility both with and without an inline neutralizer.

Particles naturally have some arbitrary distribution of charges, which is typically neutralized prior to measurements using electrical mobility particle sizers. While neutral particles will deposit on vegetation only by diffusion to surfaces, naturally charged particles may also be lost by electrostatic interactions with the neutral surface of vegetation. This interaction, called the "image force," can lead to additional losses of small particles that are often not considered in discussions of particle deposition. For instance, image force does not even appear in many of the standard textbooks we use to teach these topics! By comparing the penetration of particles measured with and without the neutralizer, the researchers were able to quantify the magnitude of the image force for small particles. Penetration of ultrafine particles through the vegetation-packed chamber was significantly lower for charged particles than neutral particles *(see Figures on next page)*. The magnitude of the image force was observed to follow a fairly simple square-root relationship that could be calculated as a function of particle diameter.

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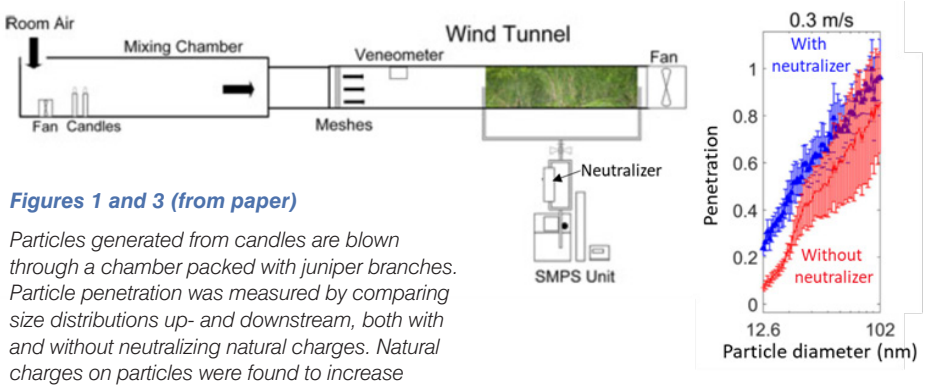

Figures 1 and 3 (from paper)

Particles generated from candles are blown through a chamber packed with juniper branches. Particle penetration was measured by comparing size distributions up- and downstream, both with and without neutralizing natural charges. Natural charges on particles were found to increase deposition to vegetation.

By using basic atmospheric instrumentation (a wind tunnel, a neutralizer, and an electrical mobility sizer) in a novel way, Lin and co-workers provide quantitative understanding of a complex and important physical process. They demonstrate that the impact of natural charge on deposition of small particles is larger than expected, able to be reasonable modeled, and, importantly, independent from diffusional losses. An impressive achievement of this work is that it provides a clear and observable demonstration of the importance of natural charges on particles, a difficult issue not often included in considering particle dynamics. These researchers provide an excellent example of developing simple experiments to observe complex processes and advance fundamental knowledge of aerosols. ●

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Aerosol Scientist in the Spotlight

On Manjula Canagaratna

1. How did you get involved in the aerosol science community, or how did you first become interested in aerosol science?

I was first introduced to aerosol science when I received a postdoctoral fellowship at MIT from the Camille and Henry Dreyfus Program in Environmental Chemistry. My PhD work was in physical chemistry (Ken Leopold's lab at University of Minnesota) and involved using microwave spectroscopy to determine the structures of weakly bound clusters of 2-3 molecules. In my post-doctoral work I wanted to explore applications of spectroscopy to fields such as atmospheric chemistry, and so the goal of my work at MIT was to develop and demonstrate spectroscopic methods for detecting radicals in flow tube kinetics experiments. As part of this work, I spent the first few months of my project in Mario Molina's lab and it was during this time that I first started to learn about aerosol science. During this time period I was exposed to a wide range of topics in aerosol science and had the chance to get to know and learn from many excellent aerosol scientists. This time period was also a turning point in my career because my project involved a collaboration with my future bosses—**John Jayne** and **Doug Worsnop**—from **Aerodyne Research** (ARI).

2. Which people or programs in our field have been the most influential to you and your path, or who have most influenced your ideas about aerosol research?

I would say that John Jayne and Doug Worsnop have had the biggest influence on my path and my ideas about aerosol research. When I started at ARI, the Aerosol Mass Spectrometer (AMS) was still in its infancy. So, I was fortunate enough to be able to work closely with John and Doug in further development and applications of the AMS. Over the years I have continued to learn a lot about how to creatively approach and solve needs in aerosol research from John and Doug as well as our entire CACC (Center for Aerosol and Cloud Chemistry) group at ARI. One aspect of my work that I greatly enjoy is the chance to collaborate with scientists from around the world. Collaboration has been key to expanding my knowledge in the area of aerosol science. Close collaborators who have influenced my scientific approach and work include **Jose Jimenez**, **Sally Ng**, and **Jesse Kroll**.

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3. What are, in your opinion, the most interesting or important research contributions you've made so far?

Much of my work has involved trying to understand organic aerosol composition and its evolution in the atmosphere via factor analysis of aerosol mass spectra. I think aspects of my work that have involved holistic and integrated analyses of organic aerosol measurements from worldwide field campaigns or of field and laboratory measurements have been particularly useful. This work has been useful for understanding the sources and processes that drive the spatial and temporal evolution of organic aerosol species and also for providing data to constrain theoretical models.

4. You've been on a lot of field campaigns. Are there any that stand out to you as most memorable/exciting/interesting?

My first official day at work for ARI was actually in the field during the **TEXAQS00 Campaign**. Since all my prior experience had only involved laboratory research, that initial campaign is probably the most memorable field campaign for me. It was daunting and also exciting to see the various real-time measurements of the atmospheric chemistry that I was starting to learn about. It was also impressive to see how the wealth of information that was available from the multiple instruments, sites, and platforms were combined together and with modelling to address the real and pressing issue of air quality in areas influenced by the **Houston Ship Channel**. Looking back at the data we got from that campaign, I am also struck by the realization of how much useful information that we didn't understand at the time, but now understand better, was already available in that AMS dataset. Other memorable field deployments include bus-chasing measurements in New York and measurements in Mexico City aboard ARI's mobile laboratory.

5. Are there new aerosol research directions that you see as particularly important or interesting?

I am excited about new developments in chemical ionization mass spectrometry (CIMS) that are allowing for improved molecular-level characterization of a range of gas and particulate-phase organic species in the atmosphere. Since sensitive time-of-flight CIMS methods now allow for measurements of a wide range of low, semi and high volatility species, it is possible to obtain more detailed information about gas phase oxidation chemistry and gas-particle phase partitioning. I am currently involved in projects that compare lab and ambient CIMS data with the aim of better identifying sources and precursors of organic aerosol in complex environments like China. I am also interested in connecting molecular-level CIMS measurements of particle composition with the bulk chemical measurements provided by the AMS. ●

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In Case You Missed It

By Ben Murphy

HOMEChem experiment brings new data, insights and public awareness to indoor air pollution.

The House Observations of Microbial and Environmental Chemistry (HOMEChem) experiment, led by **Drs. Marina Vance** and **Delphine Farmer**, assembled more than 20 research groups and 60 scientists at a dedicated ranch house at the University of Texas at Austin to study the emissions and chemistry from common indoor activities like cooking, cleaning and body care. Particulate concentrations during cooking, for example, reached levels well above those in the most polluted cities in the world. A detailed, plain-language, profile of the experiment's motivation and methods as well as interesting reflections and anecdotes from the team was published in the New Yorker under the title "The Hidden Air Pollution in Our Homes".

"The Hidden Air Pollution in Our Homes," The New Yorker, 1 Apr 2019

https://www.newyorker.com/magazine/2019/04/08/the-hidden-air-pollution-in-our-homes

South Korea has employed drastic measures to curb extreme urban air pollution.

Particulate pollution in South Korea reached and sustained dangerous levels this winter, leading authorities to implement emergency measures to protect public health and mitigate what has been labeled a "social disaster". Local and regional sources like vehicles, coal-fired power plants and dust generation from nearby building sites were targeted for temporary cuts. The government has passed emergency bills to give funds to authorities to install high-capacity air purifies in schools and encourage sales of lower emission vehicles. The weather agency also reportedly attempted to seed clouds and induce rainfall around the country.

"South Korea plans artificial rain to reduce Seoul air pollution," Aljazeera, 6 Mar 2019

https://www.aljazeera.com/news/2019/03/south-korea-plans-artificial-rain-reduce-seoul-air-pollution-190306095309023.html

"'Social disaster': South Korea brings in emergency laws to tackle dist pollution," The Guardian, 13 Mar 2019

https://www.theguardian.com/environment/2019/mar/13/social-disaster-south-korea-brings-in-emergency-laws-to-tackle-dust-pollution

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Aerosol transmission shown to be a substantial contributor to influenza spread on par with direct contact.

Researchers have teased apart the roles of direct contact (through droplets of size 10^1-10^2 μm) and aerosol ($<<10^1$ μm) transmission of the influenza virus for a case study in a high school. Using wireless sensors and high-resolution data collection to track the location of students within the school, the authors built a weighted network model to predict the spread of the virus among students and estimate the size and duration of potential outbreaks. By varying assumptions in the model about air exchange rates, school volume, and vaccination coverage, the authors demonstrated that increasing air exchange rates to levels recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers has a similar effect as vaccinating 50-60% of the population in the poor ventilation scenario.

Smieszek et al. (2019), Assessing the dynamics and control of droplet- and aerosol-transmitted influenza using an indoor positioning system, Scientific Reports.

https://doi.org/10.1038/s41598-019-38825-y

Exposure of mice to ultrafine particles in utero leads to pulmonary immunosuppression.

Studies have shown links between early life exposure to fine particles and both acute and chronic respiratory problems. Rychlik and coauthors have further contributed to the emerging evidence on the impacts of ultrafine particles by exposing populations of mice at 0-18 days gestation to urban-relevant particle concentrations and composition. The mice were then exposed after birth (0 to 4 weeks of age) to house dust mites and tested for inflammatory response. Mice that were exposed to ultrafines showed reduced airway inflammatory response compared with the control mice, indicating the necessity to protect fetuses from ultrafine exposure.

Rychlik et al. (2019), In utero ultrafine particulate matter exposure causes offspring pulmonary immunosuppression, PNAS.

https://doi.org/10.1073/pnas.1816103116 ●

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