INTERSECTIONS
Materials Research & Science Policy
News and information from the MRS Government Affairs Committee
Advancing materials. Improving the quality of life.

FALL 2015 NEWSLETTER

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WELCOME TO OUR FALL 2015 NEWSLETTER!

With Congress back in session and completing a difficult budget agreement, the Government Affairs Committee (GAC) has much to report on activities that impact support for science and technology. GAC aims to understand the dynamically changing legislative policy environment and its impact on materials research. Damon Dozier, MRS Director of Government Affairs, describes the significance of these events in terms of research appropriations for key Federal science and technology agencies and the Department of Defense, improved flexibility in guidelines for federal employees to attend scientific and technical meetings, and other successful MRS advocacy initiatives for materials research support in 2015. GAC Chair Kevin Whittlesey emphasizes the need for advocacy on behalf of materials science with the new House of Representatives leadership, and he previews exciting new opportunities for GAC volunteers with the new Advocacy, Education, and Outreach Subcommittee. Grassroots Subcommittee, Chair Brent Carey, describes the success of the 2015 MRS Fall Meeting letter-writing campaign advocating for COMPETES legislation and resources to address the challenges of energy-critical elements for our nation. Congressional Fellows Subcommittee Chair, Gavi Begtrup, describes the assignments and portfolios of our newest Congressional Fellows as well as the opportunity to apply for one of these positions. Congressional Visits Day Subcommittee Chair, Linda Olafsen, describes this fall's visit of MRS leadership to Capitol Hill and their meetings at many Congressional offices to advocate for COMPETES reauthorization and federal employee travel to scientific and technical meetings. David Norton, Chair Government Agency Subcommittee, describes the wide range of federal agency presentations at 2015 MRS Fall Meeting and the numerous funding directions that these agencies discussed. On behalf of the Policy Subcommittee, Ashley White provides a comprehensive overview of important issues and possible directions for the Open Data initiative including a forum on data management by federal agency program managers at the 2015 MRS Fall Meeting and their recommendations relevant to materials research. Finally, Eric Stach's article on value-added materials science in this issue features yet another success story, highlighting how investments in materials science pay off in ways that the general public and especially our elected officials can relate to.

MRS is working hard to make sure that the materials research community is being heard and that it has input in developing effective government policy for support of materials science. Here is the latest news.

GREETINGS FROM THE GAC CHAIR

Kevin Whittlesey
Chair, Government Affairs Committee

Once again we find ourselves in the holiday season, on the heels of another successful fall meeting. As usual, GAC had a busy week sponsoring numerous activities at the 2015 MRS Fall Meeting. GAC accomplished a lot in 2015, and I look forward to an even more active 2016 as my first full year as committee chair. In 2016 we will be engaging with a House of Representatives under new leadership, and we are moving into the election year that will yield an entirely new administration with new priorities. We will, therefore, need to continue to put forward our messages advocating for the importance of materials research to a whole new crop of policy makers in a highly partisan environment.

The Policy Subcommittee continues to move forward with its first study, examining issues related to open data and that policy's impacts on the materials community. GAC helped coordinate a roundtable meeting at the conclusion of the 2015 MRS Fall Meeting's Symposium AAA regarding open data to begin to gather thoughts and input. Some of the points raised at that session were presented to the MRS Board of Directors the next day, so this is a topic that has tremendous attention from the highest levels of MRS, and GAC clearly has a central role in it.

GAC leadership met at the Fall Meeting for the purposes of strategic planning for 2016. While there were a number of issues addressed, an important part of the discussion was formulating ideas to engage more volunteers and increase our advocacy bandwidth. A key aspect of that will be the new Advocacy Education and Outreach Subcommittee that will replace and encompass the existing Congressional Fellows Subcommittee. The new subcommittee will offer numerous new opportunities for volunteers, based on both recurring and ad hoc project-based activities, enabling us to utilize volunteers able to dedicate varying levels of time commitment to MRS. This is a new approach for GAC and one that I think will fit well with and nicely complement our existing subcommittees and their respective activities. Stays tuned for more details on this exciting new development, and please contact me if you are interested in getting involved in the many new activities that this subcommittee will be engaged with years.

WHAT'S HAPPENING IN WASHINGTON

Damon Dozier
MRS Director of Government Affairs

After a summer and fall of intense negotiations, Congress and the Administration this past October finally agreed to a budget deal/debt limit increase package that would both set out a budget blueprint for the next two years and extend the nation's ability to pay existing debts until March of 2017.

The agreement provides $80 billion in increases over sequestration-level spending to be evenly split between non-defense and defense accounts. Out of the $80 billion total, $50 billion would be set-aside for the first year and $30 billion for the second. In the budget deal, there is also an extra $32 billion for a special defense account, the overseas contingency fund, which brings the amount of the total agreement to $112 billion.

The increases under the budget deal would be offset by selling additional broadcast spectrum bandwidth and oil from the strategic petroleum reserve, as well as by making changes to crop insurance programs. Also included are extensions to a plan to cut reimbursements to Medicare doctors by two percent, as well as cuts to the Social Security Disability Insurance program. The bill would also remove a provision in Obamacare (not yet applied) that would require employers with over 200 employees to automatically enroll them in health insurance.

Two months after the budget deal was released, Congress also reached agreement on a spending package that would fund government operations next year. Overall the bill contains $1.15 trillion dollars in discretionary spending, and includes modest increases for several key agencies that MRS has supported through its advocacy efforts over the past year - the National Science Foundation (NSF), the National Institute for Standards and Technology (NIST), and the Department of Energy's (DOE) Office of Science.

NSF will be funded at $7.463 billion, a one percent increase over last year, NIST will receive $964 million, an increase of 11.6 percent and the DOE would receive over $5.35 billion dollars, an increase of 5.5 percent.

It is worth noting that these increases are not only a reflection of Congressional interest in making domestic science and technology funding a priority, but it is also a reflection of the direct advocacy of thousands of MRS members who sent letters to their members of Congress from the Materials Voice kiosk at both the MRS Spring and Fall Meetings this year and those that participate in the Congressional Visit Day activities each year. Remember: Without your voice, these successes would not be possible, and we thank you for your support each year.

Also included in the final appropriations deal was a provision that would allow the Office of Management and Budget to pursue substantial changes to Memorandum M 12-12 – the guidance that has severely limited the ability of federal employees to attend scientific and technical conferences. While groups like the Department of Defense and the Department of Energy recently released internal guidance with the aim of easing travel restrictions, the new language in the appropriations bill opens the door to more comprehensive change. Again, this issue is one that MRS members and staff have advocated for over the past year, and movement of this issue would not have been possible without your efforts.

This past fall, a day after the Congressional Visits Day activities, MRS staff (Executive Director Todd Osman and myself), as well as GAC Chair Kevin Whittlesey and MRS President-Elect Kristi Anseth, met with NSF representatives in the Division of Materials Research, Department of Defense (DoD) officials in the Office of the Assistant Secretary of Defense for Research and Engineering, and officials from the White House Office of Science and Technology Policy (OSTP).

During the NSF visit, DMR officials discussed their interest in having a closer working relationship with MRS and establishing more of a presence at our meetings—beginning with the 2016 MRS Spring Meeting. MRS staff is working on creative ways to have a greater interface with the agency.

During the DoD visit, MRS committed to communicating with Hill offices the effect of sequestration on DoD employees and also extended an offer to have DoD participation at the Science Policy Forum to be held at the 2016 MRS Spring Meeting.

Finally, while meeting with OSTP, we discussed the Administration's efforts around nanomanufacturing and process science, as well as outreach to the National Nanotechnology Coordination Office (NNCO) about the "grand challenges" in nanotechnology that were issued earlier in the year.

Overall, it was a successful year in advocacy, thanks to the dedication of our volunteers, and we look forward to even greater participation and success in 2016.

PROVIDING CONTEXT FOR IMPORTANT R&D LEGISLATION

Brent Carey
Chair, Grassroots Subcommittee

It's been just over a month since the 2015 MRS Fall Meeting, and I am pleased to report that we had another effective letter-writing campaign! A total of 1,710 letters were sent to congressional offices and to the President on three topics of particular importance in R&D and materials research.

One letter focused on the reauthorization of the America COMPETES Act, an important piece of perennial legislation that strives to preserve US leadership in STEM fields and STEM education. We also were vocal in support of the proposed Smart Manufacturing Leadership Act, which ventures to promote the proliferation and adoption of smart manufacturing practices in the US, particularly for small businesses.

We additionally reiterated support for relaxing restrictions on government-funded scientists and engineers for travel to conferences and professional meetings. As a positive note, the omnibus budget bill passed in mid-December included verbiage that empowers the Office of Management and Budget to make changes to their original memo that enacted these restrictions without further congressional oversight. This is indeed an encouraging development.

There is still work to do, but it is great to see progress on the topics that we have been vocal on. Your letters can indeed help move the needle on these issues, so thanks for your participation!

MRS CONGRESSIONAL SCIENCE & ENGINEERING FELLOWSHIP CORNER

Gavi Begtrup
Chair, Congressional Fellows Subcommittee

First things first: the 2016-17 MRS Congressional Science and Engineering Fellowships are still open with **applications due Friday, January 8, 2016**. Remember, if you work in a field related to materials science and technology, you are eligible for both the MRS/OSA and the MRS/TMS fellowships. For more information, visit www.mrs.org/congressional-fellows.

The 2015-16 MRS Congressional Fellows have hit the ground running with placement in their respective congressional offices where they will spend the year as Special Legislative Assistants. Peter Winter, the MRS/OSA Congressional Fellow, will spend his year working in the office of Senator Chris Coons (D-DE) where his portfolio will focus on innovation and manufacturing issues. Meanwhile Jeremy Ward, the MRS/TMS Congressional Fellow, will be working in the office of Senator Dick Durbin (D-IL), where his portfolio will focus on higher education, STEM Education, and Defense-funded research. They both have an exciting year ahead of them.

If you missed it in the *MRS Bulletin*, please check out Gail Oare's 20-year retrospective of the Congressional Fellowship program. It's a wonderful piece with interviews of many former fellows and does a great job of explaining the work the fellows do and the impact the program has had. A link to the article can be found at www.mrs.org/congressional-fellows.

Tune in for the next issue of *INTERSECTIONS* when we'll get an update from our Fellows now that they've settled in.

FALL CONGRESSIONAL VISITS DAY, BROADER IMPACT

Linda J. Olafsen
Chair, Congressional Visits Day Subcommittee

The Congressional Visits Day subcommittee organized a Washington, DC visit on October 13-14 oriented to participation by members of the MRS Presidential Line and Board of Directors. MRS Vice President Kristi Anseth, Secretary Sean Hearne, Treasurer Michael Fitzsimmons, Board of Directors member Charles Black, Past President James De Yoreo, and MRS Executive Director Todd Osman, teamed up with GAC Chair Kevin Whittlesey and CVD co-chairs Bill Hammetter and Linda Olafsen as well as MRS Director of Government Affairs Damon Dozier to visit the offices of their respective members of Congress.

While Congress was not in session that week, resulting in most members of Congress having returned to their home districts, MRS participants had a variety of productive meetings with Congressional staff members. Even with the relatively small group of MRS participants, there was the opportunity to visit the offices of new members of Congress and offices that MRS had not visited previously, in addition to continuing to build relationships with staff members in offices that have been visited before. Conversations centered on appropriations of research funding for FY2016, with a look ahead to FY2017, as well as discussions about COMPETES reauthorization and

federal employee travel. Among the fruitful conversations that day was a meeting in Senator Cory Gardner's office in which a staff member offered a lot of substantive information regarding the America COMPETES reauthorization and the input that Senator Gardner has sought through roundtable meetings to develop a bi-partisan authorization bill with widespread support.

2015 MRS FALL MEETING: LEARNING ABOUT FUNDING OPPORTUNITIES FOR MATERIALS RESEARCH

David P. Norton
Chair, Government Agency Subcommittee

At the 2015 MRS Fall Meeting this past December, the Government Agency Forum featured seven invited speakers from various government agencies whose research programs are of significant importance to the materials research community. Presentations were made the evenings of Tuesday and Thursday so as to be accessible to MRS attendees who would otherwise be attending the daytime scheduled technical sessions.

The Government Agency Forum presentations were very well attended with some session attendance at or near 100. Dr. Linda Sapochak, Acting Division Director within the National Science Foundation Division of Materials Research, described NSF's interest in supporting fundamental research in materials and condensed matter physics. The Division of Materials Research is the largest division in NSF with funding of approximately $307M. Sapochak described the Division's interests in supporting the discovery of new materials and states of materials, a better understanding of material properties and behavior, and new capabilities to study materials. Funding opportunities highlighted in her presentation included single investigator proposals, the Early-Concept Grants for Exploratory Research (EAGER), and Designing Materials to Revolutionize and Engineer the Future (DMREF). She discussed the role of NSF in preparing the next generation of materials researchers through various programs.

Dr. Andrew Schwartz from the Department of Energy (DOE) Basic Energy Sciences (BES) described the various fundamental research programs that support the DOE's missions in energy, environment, and national security. BES is one of the largest supporters of fundamental research in the US with a requested budget for FY2016 of $1,849M. Schwartz described the three modalities within BES to support materials research, namely through Core Research, Energy Frontiers Research Centers, and Energy Innovation Hubs. He highlighted specific research results in crystal growth, materials by design, and novel materials development. He emphasized how the focus of BES is on fundamental research with applied energy R&D being supported elsewhere with the DOE. Programs within BES are interested in hypothesis-driven fundamental science with energy relevance, discovery science, and use-inspired basic research. Schwartz encouraged researchers interested in BES support to first contact the relevant program manager and submit white papers prior to full proposals.

Dr. Antti Makinen, Program Officer within the Office of Naval Research (ONR), provided an overview of ONR funding interests. He reviewed the focus areas within the Naval S&T Strategy and how ONR supported basic, applied, and advanced research that aligned with future needs of naval warfighters. He described how to best engage ONR, beginning with the program officer. He emphasized the importance of having a good understanding of the relevant problem and a well-articulated approach when investigators engage ONR program officers for funding. Specific research areas discussed by Makinen included high performance functional and structural materials, environmental resiliency, and optimization through design.

Dr. Paul Albertus, Program Director at the Advanced Research Projects Agency-Energy (ARPA-E) described the role of ARPA-E in supporting R&D that addressed long term and high risk barriers in the development of energy technologies. He described the program cycle for ARPA-E which differs from other DOE agencies. Albertus also discussed a new program to be released in January 2016 focused on selective ion conduction and the future of the electrochemical cell.

Dr. Thomas Christian, Director of the Air Force Office of Scientific Research (AFOSR), provided an overview of the mission and interest of AFOSR as the basic research funding arm of the US Air Force. His presentation included a discussion of how AFOSR works in terms of funding opportunities. Specific areas discussed included dynamic materials and interactions, low density materials, and aerospace materials for extreme environments.

Dr. Michael Switkes, Science Advisor for the Science for Peace and Security (SPS) Program with the NATO Emerging Security Challenges Division, provided an overview of international research opportunities through his program. His presentation described the goals of the SPS program and the practical aspects of applying for and performing within SPS grants. One can learn more about the NATO Science for Peace and Security Program at www.youtube.com/watch?v=2jVLtCAm9Ok.

Finally, Dr. James Gavigan, head of the Research, Technology and Innovation Section at the European Union's Delegation to the United States in Washington, DC, emphasized Horizon 2020, the European Union's main instrument for funding research and innovation activities with a budget of nearly €80 billion. Horizon 2020 funds research in all areas of science and innovation and is open to participants across the globe. Its focus is on excellent science, industrial leadership and societal challenges. Emphasis was given to materials research topics foreseen in the 2016–2017 work programs.

POLICY SUBCOMMITTEE INVESTIGATES OPEN DATA

Ashley White
Advanced Light Source Director of Communications, Lawrence Berkeley National Laboratory
and
Member, Policy Subcommittee, GAC

The Policy Subcommittee is coordinating a study on the topic of "open data," the concept of providing public access to the digital data associated with federally funded research. The study is designed to provide the MRS community's perspective on open data policy to the US Congress, federal agencies, and other stakeholders. Mark Asta (UC Berkeley) and Gerd Ceder (UC Berkeley and Lawrence Berkeley National Laboratory) are co-chairing the effort, which is just getting underway.

Open data has been a high-profile topic of legislation and executive branch initiatives and actions over the past few years, including a February 2013 memo from White House Office of Science and Policy director John Holdren, instructing federal agencies to develop public access plans, and the Materials Genome Initiative's strategic plan, which cites making digital data accessible as one of the initiative's four key challenges. As a result of the attention, there is a growing community of practice around sharing, making discoverable and reusing experimental and computational data to bring about new insight and innovations. Of course, "data" may have different meanings, depending on the context and audience, from data linked to and explained in a published article on one end of the spectrum to raw data and data sets not associated with a publication on the opposite end. Ongoing workshops led by federal agencies and other organizations are helping resolve the detailed logistics of data sharing, such as creating data curation and metadata standards and building the infrastructure needed to share and maintain access to data, so the MRS study will aim more broadly to communicate the opportunities presented by open data and recommend the tools and other resources needed to take advantage of those opportunities.

Two events at the 2015 MRS Fall Meeting focused on data management and access—a forum featuring a panel of federal agency program managers discussing the data management plans agencies have developed in response to the 2013 White House memo and a focus group of Meeting attendees convened to gather input for MRS' open data study. One of the important points emphasized in the data management forum was that agencies like NSF and DOE have built a degree of flexibility into their data management policies in recognition that the most useful or practical form of data sharing will vary from field to field. For instance, rather than make a prescriptive list of requirements, NSF will let peer reviewers drive the criteria for a good data management plan by letting them judge whether a principal investigator has made a convincing argument in their proposal for which data they plan to share, in what format, and how it will be made accessible.

One of the main points that came up in the focus group discussion was that open data provides opportunities to all areas of materials science, not just those that deal with larger experimental and computational data sets. Although there has been some angst in the scientific community about the potential burdens of making available and storing extremely large data files in particular, the vast majority of materials data sets are relatively small in size, and their combined power could contribute to important scientific advances. One recommendation made was to start by making existing data from published articles available—for instance, the data available in tables and graphs that today exists primarily in PDF files where it is not readily gleaned and combined with other data. Another suggestion was that open data could provide opportunities to facilitate interdisciplinary studies as well as science outreach, allowing students and other members of the public to participate in the scientific process and develop tools for analyzing data that are not yet envisioned. The importance of enabling proper data citation and establishing procedures for data attribution were other issues raised. Although it is possible to obtain a digital object identifier (DOI) for data sets, it is not yet common practice. In addition, for open data to fulfill its potential it will be critical for data sharing and proper attribution to become part of established, expected practice across materials science disciplines.

As the open data study progresses, the committee will keep these points in mind as well as examine additional US federal agency and international data management policies and their current and predicted impact on the materials research community.

A VALUE-ADDED MATERIALS RESEARCH STORY

Hummingbird Scientific, Inc.— Tools for Nanotechnology

Eric Stach
Group Leader, Brookhaven National Laboratory

The promise of nanotechnology is being fulfilled daily: scientists are now routinely taking advantage of new ways to control the structure of materials at atomistic length scales to solve important societal problems. These include the development of new materials in applications as diverse as advanced electronics, improvements in energy efficiency in systems as complex as airplanes and as simple as the humble light bulb, and new ways to efficiently convert petrochemicals to useful products. Researchers in Materials Science manipulate the structure of materials to create useful new products. To do so, it is important to understand the

structure of materials at the level of atoms: this requires new and powerful ways to image the structure of materials. My company—Hummingbird Scientific, based in Olympia, Washington—makes instrumentation that allows researchers worldwide to more deeply understand how materials function. My partner and I built this high-technology company from a concept to an employer of approximately 25 people, with significant assistance from Small Business Research and Innovation (SBIR) grants along the way.

The instruments that we manufacture are to be used in "electron microscopes"—powerful, complex instruments that use electrons to image the inner structure of materials at incredibly high levels of magnification (> 1 million times) and with extreme resolution (< 0.1 nm). Conventionally, these instruments are used to take pictures of samples after they have been created, always at room temperature and in a high vacuum environment. However, scientists often want to see materials "in a working condition." This allows them to explore relationships between how things like temperature or liquid environment change a sample's structure, composition, and even how it performs.

Thus, it seems pretty simple—all you need to do is make these things happen in the microscope and watch! However, this is in fact very difficult. In order to achieve extreme levels of resolution, these microscopes must a have a very small working volume (of several square millimeters) so that they can create a very high, controlled magnetic field to focus the electrons. This means that you have to design the entire laboratory to fit inside this small of a space: our company builds and sells these miniature laboratories.

Initially, the primary engine for the growth of our company was through the Small Business Innovation and Research process. In the fall of 2004, my business partner Norman and I sat down together and wrote three Phase I SBIR projects to the Department of Energy and managed to win them all. This was an incredible lifeline—three $80,000 infusions allowed Norman to eat, and for us to start the company in a small garage we rented in his hometown of Olympia. Two of the first three projects were successful enough to move on to Phase II and Phase III – an influx of $1.6 million – which we used to start hiring employees, purchase infrastructure and to start selling our initial systems for the scientific market.

SBIR and Small Business Technology Transfer (STTR) have continued to help us fund new innovations and build new product lines. In fact, we were recognized with a Tibbetts Award by the US Small Business Administration in 2011 for "exemplifying the best in the SBIR and STTR programs" for our development of a fluid cell holder that allows researchers to image samples in their native liquid or gaseous environments. This technology in particular was enabled by the developments in microfabrication that have fueled the semiconductor industry: We take advantage of their manufacturing tools and approaches to build our systems. This is a classic example of how developments in one area of science and technology can profoundly influence other areas of technology, manufacturing and commercialization.

While it has been rewarding to work to build a company over the past decade, it is even more rewarding to see the diverse and creative ways that other scientists use our instrumentation to advance so many different areas of science. One of our biggest growth areas has been in so-called "electrochemical systems." These instruments allow researchers to directly visualize how batteries operate—insights that are absolutely critical in developing more practical electric cars that can travel longer distances, as well as batteries to enable energy storage for the electric grid. I feel confident that some of the insights gained from these studies will lead to true breakthroughs in this critical area of technology.

FEEDBACK

We welcome your feedback and invite you to submit topics for consideration in future issues of this newsletter. If you have or know of stories that illustrate how an investment in materials research paid off in real dollar terms, please send your suggestions to *INTERSECTIONS* Editor, Len Brillson, at brillson.1@osu.edu. Please send your comments to publicaffairs@mrs.org.

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