A JEROME B. WIESNER SYMPOSIUM

Strengthening the Role of Universities in National Science Policymaking

March 30–31, 2015

Symposium Summary

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Executive Summary

On March 30 – 31, 2015, a symposium on "Strengthening the Role of Universities in National Science Policymaking" was held at the University of Michigan, Ann Arbor. Sponsored by the U-M Office of the Vice President of Research, the meeting was convened to explore how universities can more productively inform and engage in the formulation of national policies affecting the sciences and engineering as well as policies involving the effective application of science and technology to a host of societal challenges. An explicit goal was to develop and recommend specific action items encompassing education, research, and engagement to present to the leadership at the nation's universities.

An overarching theme that emerged was that campuses must cultivate a culture of public service, encouraging both faculty and students to become "civic scientists" who engage in current issues related to science policy and science-based policy and draw on their special expertise and perspectives to inform and shape its formulation. Below are summaries of the seventeen specific symposium recommendations:

Recommendation 1: Promote science for policy and policy for science by promoting the model of "Civic Scientist" for all STEM faculty and students.

Recommendation 2: Enhance science literacy for all students by integrating the issues and processes of science-based policy into undergraduate and graduate-level curricula across all disciplines.

Recommendation 3: Create opportunities for students to get involved in real policy experiences at state and national levels.

Recommendation 4: Assess the range of existing science policy activities and programs on each campus and combine or coordinate them for maximum impact.

Recommendation 5: Restructure the faculty evaluation process to explicitly reward science policy service, outreach, and mentoring, as well as quality of teaching.

Recommendation 6: Launch a national awareness campaign about opportunities to serve in science policy positions in early-, mid-, and late-careers.

Recommendation 7: Create a culture of openness and transparency that encourages proactive communication to stakeholders about the nature of university of research and other activities and the impact they have on the economy and quality of life, both regionally and nationally.

Recommendation 8: Provide faculty and students with training for high-quality and effective communication with non-scientist constituents across campus and beyond to promote broad understanding of new initiatives as well as of goals and needs.

Recommendation 9: Develop and publish lists of faculty volunteers to advise local, state, and national policymakers on matters of science policy and science-based policy.

Recommendation 10: Develop better methods to provide policymakers with access to reports and ongoing research relevant to current policy issues.

Recommendation 11: Develop executive education programs at universities to provide government leaders and staff members with the perspectives of the scientific community on current issues.

Recommendation 12: Establish state-level academies of science to foster improved interactions between faculty and the public at the local level.

Recommendation 13: Conduct rigorous studies of academia from a systemic viewpoint to show qualitatively and quantitatively where research funding comes from, how it is spent, and what the returns on investment are for individuals and society as a whole.

Recommendation 14: Foster better integration of STEM disciplines with social and behavioral science disciplines on campus to better address the human dimensions of emerging societal challenges and policy approaches.

Recommendation 15: Encourage the development of interdisciplinary partnerships, programs, and centers that can address the full complexity of challenges that face our society.

Recommendation 16: Enhance diversity in STEM fields by tapping the underutilized body of existing research in this area and studying in more detail the dynamics of the pipeline in order to develop more effective and efficient interventions.

Recommendation 17: Commit to developing national standards for teacher education and certification.

Introduction

Science and technology are at the heart of many of the most pressing challenges facing society today, including climate change, health care, national security, energy, economic competitiveness, and a variety of social issues. Over the last several decades, our nation's investment in scientific research, particularly at universities, has provided a stream of ideas, insights, technologies, and talent that has been central to our ability to address evolving challenges while ensuring the health of our economy and our quality of life. Never has it been more important to sustain this investment and make effective use of the resources it funds.

To address these challenges and take advantage of the opportunities, a Jerome B. Wiesner Symposium on "Strengthening the Roles of Universities in National Science Policymaking: Education, Research, and Engagement" was held at the University of Michigan, Ann Arbor, on March 30-31, 2015. Sponsored by the University of Michigan's Office of Research, the Symposium brought together national leaders to develop recommendations for U.S. universities. The Symposium featured keynote speakers and panels on topics of education, research, and engagement and had a live and webstream attendance of about 400 people, including graduate students, faculty members, administrators, policymakers, and more, from 25 states and 14 countries.

The Organizing Committee asked the participants address the following questions:

1. What are the major policy challenges, e.g. climate change, pandemics, energy?
2. Is there a need for additional policymakers or science advisors?
3. Should science policy be a part of every undergraduate liberal arts program?
4. What is the role of graduate programs in science policy?
5. How do we bridge the science-citizen gap?
6. What is the role of new technologies in educating future policy makers, science advisors and the public?
7. Why have our interventions to increase diversity in STEM at all levels in all fields plateaued or failed?
8. What is the role of STEM in K-12 education in the science-citizen gap?

The first day focused on the national picture, including science and technology challenges for the nation, and the role of the National Academies, PCAST (President's Council of Advisors on Science and Technology), AAU (American Association of Research Universities) and professional societies in supporting strong and coordinated science and technology initiatives and budgets. Key needs and more detailed trends in the social, physical, biomedical, engineering, space, policy, and education fields were also discussed.

The second day focused on identifying best practices in the science-policy arena and ways to enhance research universities' presence and impact in this space. In particular, there was the desire to better educate the next generation of science-literate policymakers as well as the next generation of policy-literate scientists. Attendees also called for more of our faculty and researchers to actively participate in science-policy activities at the local, state, national, and international levels.

The purpose of this document is to summarize the key recommendations synthesized from the presentations and discussions. A full agenda is included in Appendix A. Appendix B lists the presenters and panelists, and Appendix C includes a biography of Jerome B. Wiesner, the man who inspired the Wiesner Symposium series. More background information and videos of the symposium are available at **Wiesnersymposium.umich.edu.**

Recommendations

Recommendation 1: Promote science for policy and policy for science by promoting the model of "Civic Scientist" for all STEM faculty and students.

Almost all of the speakers referred to the idea of the "civic scientist." Many agreed that every faculty member should contribute a minimum of about 2% of their time to participate in the dialogue between scientists and the public. There are many ways to do this, including speaking to advocacy groups, teaching ethics and responsible research, serving in government for a period of time, engaging with policy makers, or talking to their neighbors about what they do. Faculty have a responsibility to consider the broader societal issues and the impact their research can have, as well as to train their students to do so.

Let's hope that one of the outcomes of this symposium is that we will help identify, build and encourage these objective disinterested scientists with a strong sense of public responsibility and public obligation. Let's hope we will help to lift up that view of science that's intended to uplift people everywhere, that science is integrated into all policy, domestic and international.

– *Rush Holt, American Association for the Advancement of Science*

Faculty may also engage in the political process by running for office, going to town hall meetings, or asking questions at election rallies. Additional opportunities, as well as resources and training for outreach, are provided by the professional organizations. AAAS, the American Association for the Advancement of Science, has the specific mission to communicate and advocate science. Another way to engage is by participating in the research process that goes into advisory reports submitted to various government agencies. The best known is the National Research Council, an arm of the National Academies of Sciences, Engineering, and Medicine (NASEM). There, and other boards, scientists volunteer their efforts to assist agencies in setting priorities and planning.

You can be a civic scientist by engaging with policy makers, or being involved in the policy making process. You can be someone who's very important and very senior in your career and have the opportunity to speak to large public forums, to speak to advocacy groups but I think it's also important to acknowledge and recognize it just by talking to your neighbor about what you do and why.

– *Jennifer McCormick, Mayo Clinic*

Recommendation 2: Enhance science literacy for all students by integrating the issues and processes of science-based policy into undergraduate and graduate-level curricula across all disciplines.

More and more decisions in our democratic society will be based on science and technology. We should send our graduates out knowing the fundamentals of science as well as research integrity.

– *Homer A. Neal, University of Michigan*

Today's undergraduates are tomorrow's policy makers, scientists, and tax-paying citizens. Speakers repeatedly stressed that science policy and policy for science must be incorporated into liberal arts education. Recommendations included altering existing curricula for both majors and non-majors, offering elective courses, developing minors for undergraduates, and certificate programs for graduate students.

At the same time, the curriculum for STEM students should be structured to provide exposure to the disciplines, such as history, economics, and public policy, that provide context for the need and approaches for engaging in public issues.

Many people think science literacy is 'I know some science.' Much more important than that, is science research literacy, scientific method literacy, understanding what is involved when scientists do science.

– *Sharon Glotzer, University of Michigan*

Recommendation 3: Create opportunities for students to get involved in real policy experiences at state and national levels.

Faculty should instill in their students at every level that advocacy and outreach is a critical aspect of the scientific and technical professions. Ph.D. students should be encouraged to apply for fellowships, such as those offered by the National Academies of Sciences, Engineering, and Medicine (NASEM). Additionally, universities should expose students to non-academic STEM careers, and non-STEM jobs for which scientific literacy is a major asset.

We need to create more opportunities for undergraduate and graduate STEM students to learn about science policy and about the system of which they are a part.

– *Toby Smith, Association of American Universities*

Students should be encouraged to participate in cooperative programs in industry, internships in government, and research experiences in other countries—all without excessive expense or loss of time towards degrees. Students should also be encouraged to participate in outreach. For STEM majors, this can include learning how to present research to a non-technical audience, or sponsoring student chapters of professional societies. The National Science Policy Group, started by graduate students and open to students in all programs, should be invited to campuses to speak and perhaps start chapters.

We should expose all STEM students in our universities to science, technology and policy issues and opportunities so that they're aware of them.

– *John Holdren, White House Office of Science and Technology Policy*

Recommendation 4: Assess the range of existing science policy activities and programs on each campus and combine or coordinate them for maximum impact.

Every scientist should ask not "Should I get involved in science policy?" but instead "What ways should I get involved in science policy?"

– *Sharon Glotzer, University of Michigan*

It is important to acknowledge that many universities already have a number of science policy-related activities going on, although they may not be fully recognized or leveraged for the best impact. For example, faculty perform service activities that they neglect to report, courses directly related to science policy are offered, centers and institutes are bridging the divide between academia and the public. To maximize impact and avoid duplication of effort, universities should catalog the assets they already have, including existing courses and programs as well as faculty already active in the science-policy space.

Universities can also work with their marketing and public relations departments to develop local, statewide and national campaigns to disseminate research activities that are relevant to current and emerging issues of policy.

We need more scientists who are willing to engage. It needs to be incorporated as a valued part of one's professional, scientific or engineering career.

– *Toby Smith, Association of American Universities*

Recommendation 5: Restructure the faculty evaluation process to explicitly reward science policy service, outreach, and mentoring, and other forms of engagement, as well as quality of teaching.

Faculty have a wide variety of responsibilities within the arenas of teaching, research, and university governance, and there are many competing demands on their time. Indeed, a common theme was the burden on faculty, specifically to do all that the tenure system values as success, as well as to meet the requirements of grant funding, teaching, mentoring and outreach. Often faculty are not adequately trained for these functions, and priorities for such areas as science policy services are not clear. This training and prioritization are essential.

It was suggested that every scientist should tithe 2% of their time to outreach and advocacy. It is our recommendation that faculty work with their universities to realign their true responsibilities with the processes in place to evaluate and reward their efforts. Faculty should receive recognition for outreach and mentoring activities, as well as training for teaching, mentoring, management, and advocacy and communication to lay audiences.

Faculty should also have release time to serve in government or other policy positions. This could allow them to serve in government at some level, as a policy advisor, for example, or even as school board member, state legislator, or congressman, for example. One recommendation was for faculty to develop closer ties with industry, perhaps through advisory boards, so as to align curricula with business needs, and be better able to advise students on careers inside and outside of STEM pathways.

Other recommendations for engagement and outreach included cultivating relationships with local K-12 systems, or by designing participatory research projects that involves the community. Recommendations for teaching include faculty familiarizing themselves with the large body of research on academic success, incorporating evidence-based improvements into teaching and curricula, and release time for training.

> Engaging with the public does not get put on my CV and is not counted as one of the many publications that I have to have to advance to the next career. It's in the way of publishing, of getting a grant out. We have a responsibility to be true to the scientific process and the scientific community but we also have a responsibility to society, to talk with non-scientists about what we do and why we do it
>
> – *Jennifer McCormick, Mayo Clinic*

> From the president down we need a signal that the campuses must cultivate a culture of communication, public service and civic scientist. This has to be valued at the very top or all the things that you're talking about will not emanate.
>
> – *Rosina Bierbaum, University of Michigan*

Recommendation 6: Launch a national awareness campaign about opportunities to serve in science policy positions in early-, mid-, and late-careers.

A number of internships, co-ops, fellowships, post-docs and other opportunities for engagement exist for STEM professionals in every stage of their careers. Of particular note are AAAS Fellowships and fellowships through the National Academies of Sciences, Engineering, and Medicine (NASEM)s. Both students and faculty should be encouraged to take advantage of these activities and positions. Faculty should be made aware of the benefits of participating, and must play a role in encouraging others to do so. Opportunities for service by professionals late in their careers, such as those just rotating off of a departmental chair or associate dean position, are not well recognized and should be promoted as well.

> There are a variety of opportunities for faculty and our students to get experience in Washington, in Lansing, and discussions here on the campus about science policy. More and more opportunities exist. If you start early it's likely that these activities will develop.
>
> – *Gil Omenn, University of Michigan*

> Encourage and support faculty forays into science, technology, and policy positions in government via sabbaticals, interagency personnel agreements, fellowships. And exploit the experiences of the returnees when they come back in classes, seminars and symposia to interest others on the campuses in science, technology, and policy.
>
> – *John Holdren, White House Office of Science and Technology Policy*

Recommendation 7: Create a culture of openness and transparency that encourages proactive communication to stakeholders about the nature of university of research and other activities and the impact they have on the economy and quality of life, both regionally and nationally.

Universities play many roles in teaching, research, outreach to the broader community, and advocating for sound science policy. To sustain these roles, it is incumbent upon the university community to maintain the public trust in the current climate of challenge and change, and that involves changing the cultural paradigm. First, universities must recognize and embrace the fact that they are a public good, and therefore must be proactive and transparent in showing good stewardship of public funds. They must also incorporate ethics training in all levels of STEM education. Second, analyze the data they have on themselves to improve reporting and operations.

We have to learn how to engage. Maybe we even have to change our attitude so that we have some sharing of the goals. It's not just a matter of the R&D financial statistics. It's the love of doing the science and it's the goal of making science deliver.

– *Gil Omenn, University of Michigan*

Furthermore, it was suggested that universities develop a new university-wide evaluation program that focuses on public good-aspect of universities' missions, such as documenting contributions to the region, the impact on and opportunities for students, and the benefits from basic research and technology transfer initiatives. An important recommendation that arose was the idea of developing a university-wide marketing plan. This would include training faculty, staff scientists, and students on how to communicate with different stakeholders about what their research is and why it is relevant to different sectors of the public. Universities can stress the importance of outreach activities by requiring them to be reported in annual reviews, or developing outreach programs.

The National Academies of Sciences, Engineering, and Medicine (NASEM) are preparing modules for non-STEM schools to help teach them the importance of science in decision-making. Universities should assist in disseminating those modules. Partnerships should be developed with organizations dedicated to advocacy and outreach, such as the American Association of Universities and Research!America.

Getting in touch with the public's perception of scientists is important. The point is to say and convey that "I work for you." This can change the whole conversation about support for research.

– *Mary Woolley, Research!America*

Recommendation 8: Provide faculty and students with training for high-quality and effective communication with non-scientist constituents across campus and beyond to promote broad understanding of new initiatives as well as of goals and needs.

Every speaker made the point that all stakeholder groups throughout the university have a responsibility to improve communication among themselves, and with non-scientists. Several speakers noted however that effective communication to broader audiences requires a special kind of ability and training. Communicating to groups ranging from the lay public, to researchers in other disciplines, to Congress, requires skills that are not normally taught to students, researchers or faculty. Universities can and should offer such training across the board so our community can better articulate key messages to various audiences.

that and communicate it, and that leads to all sorts of problems. If we did a better job of stripping away the methodology and the terminology of science, members of congress and the general public would be less likely to think of science as a checklist of what is known and what is unknown.

– *Rush Holt, American Association for the Advancement of Science*

Areas of communication that should be cultivated include the importance of basic research, the connection of science and technology to policy issues such as national security, the scientific process, how science is funded, the connection between climate and public health, the connection between space research and broader societal benefits, science myth vs. science fact, and the role of science in challenging and enriching our understanding ourselves and the world around us.

Ways to improve communication include offering training courses or communication coaches for faculty and staff; incorporating a 30-second "elevator speech" requirement in courses; holding brown bag lunch series , participating in TED talks, or providing congressional testimonies. Similarly, universities can invite political staffers to present seminars on campus. Public relations departments often provide training on how to craft concise messages for responding to the media. In addition, all of the professional societies, from AAAS to the ACS to IEEE, have many resources to improve communication with the public and government officials.

Universities should also encourage more communication among and between departments and programs on campus. Briefings and newsletters about current policy concerns should be disseminated widely.

It's not just how we communicate science; it's how are we being seen and perceived and sometimes we're rather oblivious to that. This is all about learning to think about the listener much more in the way that we're talking.

– *Deborah Ball, University of Michigan*

Recommendation 9: Develop and publish lists of faculty volunteers to advise local, state, and national policymakers on matters of science policy and science-based policy.

My job is one of cross-cultural communications translating the work of scientists to make it understandable for the layperson which, again, include most members of Congress. We have to do a better job at teaching and helping.

– *Toby Smith, Association of American Universities*

Many faculty regularly advise policymakers at different levels of government. However, most universities do not keep track of these activities in any systemic manner, nor do they promote these relationships. By developing these lists, universities can build ties to lawmakers and policymakers by helping them draw on the skills and experience of subject experts. At the same time, researchers can gain a better understanding of how their efforts pay off in the public sphere. By developing and maintaining these lists centrally, faculty who may be willing to donate their expertise but are unaware of how to do so, will have a place to turn to for advice and support.

Our biggest opportunity is in harnessing the full potential of all kinds of partnerships: with local, state and federal governments, across public and private sectors, and with academic, civil society, and international groups. The power of those partnerships is immense.

– *John P. Holdren, White House Office of Science and Technology Policy*

Recommendation 10: Develop better methods to provide policymakers with access to reports and ongoing research relevant to current policy issues.

How do we share knowledge in a different way making use of social media—all the new tools that we have—so that people can learn from it and they can build in a faster way more knowledge that will help them and not repeat all the wrong ways that we've gone before.

– *France Córdova, National Science Foundation*

The results and insights of university research often reach government officials through the National Academies, the National Science Foundation, and special groups convened by government bodies. Universities have a responsibility to take the initiative to regularly and clearly communicate the research they do, why they do it, and the impact it may have. A key goal would be to ensure that policymakers have immediate access to the best information available from the university community on a wide range of topics. This flow of information can not only inform science-based policymaking, but also help justify government funding for universities and university research.

Reports from the National Academies have become progressively more important over the last 50 or 60 years. They've become very useful to a number of federal agencies in planning, especially for large expenditure items in certain fields, where they really need the advice, the critical advice of the affected communities.

– *Ralph Cicerone, National Academy of Sciences and National Research Council*

Recommendation 11: Develop executive education programs at universities to provide government leaders and staff members with the perspectives of the scientific community on current issues.

Create workshops and seminars for your congressional delegation to acquaint them with the relevance of science and technology, including your science and technology to society's interest. Conduct adult-education and public-outreach activities aimed at improving the science and technology literacy of decision makers and the public and advocate for science and technology and for sensible science and technology policies.

– *John P. Holdren, White House Office of Science and Technology Policy*

Legislators and political staff members are typically trained in political science, history, law, or similar disciplines. However, the solutions to most challenges facing the nation rely critically on science and technology. As educational institutions, universities should develop executive education programs, similar to executive MBAs, that will provide legislative staffers and policymakers with the background, perspective and insight required to deal effectively with these challenges.

The National Academies of Sciences are working on modules that they will offer to law schools, to policy schools, to medical schools that help to teach the folks in those schools the importance of how science can play a role on decision-making. Research can inform policymaking and certainly enhance decision making, and it helps to grow our economy.

– *Toby Smith, Association of American Universities*

Recommendation 12: Establish state-level academies of science to foster improved interactions between faculty and the public at the local level.

There are some state academies that I think have a large margin to improve and to be more effective. The Texas Academy of Medicine, Engineering, Science and Technology was created by Senator Kay Bailey Hutchison and Rick Smalley years ago. They are doing some important work in Texas education, making people in Texas much more aware of what their research universities are doing.

– *Ralph Cicerone, National Academy of Sciences and National Research Council*

Presenters noted that one of the reasons state legislators have been cutting university budgets is the gap between the academy and the public. By establishing state-level academies of science, as the states of Virginia and Washington have done, state legislators can have access to similar cutting-edge research as provided to the federal government by the National Academies. Proactively providing information, perspective, and advice can serve to narrow the gap between universities and the public at the state and local levels, and promote mutual understanding.

INFEWS (Innovations at the Nexus of Food, Energy and Water Systems) and other centers like it around the country are inspired examples of how research applied to public problems, local problems, state problems, can provide great public benefits. At its heart, this is about community action around interdisciplinary research that's fostered at research universities.

– *France Córdova, National Science Foundation*

Recommendation 13: Conduct rigorous studies of academia from a systemic viewpoint to show qualitatively and quantitatively where research funding comes from, how it is spent, and what the returns on investment are for individuals and society as a whole.

The idea is you want to build a science for science. One of the things that surprise me a little bit in the discussions today was how heavy on anecdotes scientists were in describing what they do. There was very little evidence out there about what the results of science investments were.

– *Julia Lane, American Institutes for Research*

One comment that came up consistently was that the academic community tends to use anecdotes to convey the value and impact of universities in society, instead of using its expertise to conduct rigorous, systematic studies of academia itself. A growing community of researchers working on the "Science of Science," an effort to catalog the uses and returns on the investments made by the government, the taxpayers and the students paying tuition dollars. The tools and methods of social science can be used to objectively evaluate the performance of universities in research and education to determine what is successful and how best to focus resources for optimum impact.

Universities must commit to sharing certain data to create accurate models. A partnership among the Committee on Institutional Cooperation, the Association of Public & Land-grant Universities, and 24 research universities, known as UMETRICS, is gathering a range of data from a growing number of research universities to assess the public value of the research enterprise to inform effective policymaking, support outreach, and aid in research management.

We lack the kind of high quality, micro-level data on the process, products and eventual impact of science and education. What we need is a mechanism to take data on grants and transform it into data on people and follow it up. It's incumbent on us to turn our very best science and particularly our best social science, on our own activities in order to understand them and improve them.

– *Jason Owen-Smith, University of Michigan*

Related recommendations focused on increasing the productivity of the research enterprise. These included developing a STEM-focused business/management program for the management of science, as well as developing programs to train lab managers and principal investigators in team management.

Recommendation 14: Foster better integration of STEM disciplines with social and behavioral science disciplines on campus to better address the human dimensions of emerging societal challenges and policy approaches.

The barriers between STEM and non-STEM disciplines were artificially imposed as academia evolved to help organize the growing body of human knowledge, and greater specificity required in training, to do the increasingly more complex research. These separations are now barriers, and several speakers pointed out the benefits of teaching students to be systems thinkers. Technology is only one aspect of solutions to emerging challenges facing society. Realistic approaches and solutions include social, political, economic, legal, psychological, historical, and business dimensions as well.

There have been many efforts to increase interdisciplinary cooperation in universities, but not across the board at the cultural level. With the support of senior administration, faculty should work together to incorporate social and behavioral sciences in STEM education. At the same time, universities must work to ensure that social and behavioral sciences are considered in determination of science funding and science policy.

It's becoming more widely appreciated that despite the wonderful public benefits science and technology bring, they cannot by themselves enable us to meet the current grand challenges. Understanding the social and cultural factors that underline decision-making help us to better understand challenges, weigh trade-offs, further educate ourselves and ultimately, pursue a wiser course.

– *France Córdova, National Science Foundation*

There is incredible power to bringing scientific expertise together with those who understand the policy process, as well as those who look at these issues from a variety of social science perspectives including history, psychology, economics, and political science. Universities should play a role in training leaders who are well versed in, or at least have exposure to, such disciplines.

– *Susan Collins*

Recommendation 15: Encourage the development of interdisciplinary partnerships, programs, and centers that can address the full complexity of challenges that face our society.

An important way to encourage interdisciplinary collaboration at universities is to pull together multidisciplinary teams in centers and institutes to focus on "grand challenges," in areas such as K-12 education that require diverse perspectives to devise effective approaches. Breaking down barriers between disciplines on major projects not only encourages outside-of-the-box thinking, but also helps establish a culture of collaboration that may extend to other areas across the university. Partnerships should also engage the general public as well as local, state, and national government bodies, and industry. Insights gained from such collaborations can be effective in demonstrating the value of universities—and their various disciplines—to legislators and the public.

Institutes and centers have a lot of diversity in them, and they still have very deep physics, chemistry, mathematics courses that are taught by a plethora of professors. People there really think of themselves as aligning with grand challenges and with people from other fields a lot, and that's where graduate students really do their work.

– *France Córdova, National Science Foundation*

Universities must make room for interdisciplinary and policy-relevant research as additions to their research portfolios. They should provide STEM PhD students and postdocs with an introduction to how to translate discovery into application in society –partnering with business where appropriate to leverage resources and exploit science and technology advances for societal gain.

– *John P. Holdren, White House Office of Science and Technology Policy*

Recommendation 16: Enhance diversity in STEM fields by tapping the underutilized body of existing research in this area and studying in more detail the dynamics of the pipeline in order to develop more effective and efficient interventions.

In addition to the basic societal need to include a more representative demographic in STEM areas in order to create opportunities for all, studies have shown that diversity can enhance the performance of research teams. Yet attracting students with diverse backgrounds to STEM areas has long been a challenge. Participants noted that while progress has been made, there is still much work to be done.

Addressing the challenge is complicated by such issues as subconscious bias as well as the fact that diversity intersects with many other concurrent areas and issues and cannot be considered on its own. Participants recommended revisiting the large body of research and data already available on this subject that it is not being fully utilized. At the same time, they noted that researchers have not been able to determine definitively where exactly in the pipeline bottlenecks occur, or why they occur. Further analysis of the pipeline itself will be critical to the design of more efficient and effective interventions that will lead to greater diversity in STEM fields.

> Providing an adequate supply of scientists and engineers for the economy often comes to a discussion around getting women and minorities into science and engineering careers. There is also an immigration policy component of it. The university certainly can get engaged in all of these areas by providing the encouraging spaces on campus, and by encouraging connections to the K-12 system.
>
> – *Susan Cozzens, Georgia Institute of Technology*

> There's got to be a cultural shift. Diversity is good. Diversity of people from around the world brings about a greater diversity of thought. We live in a multicultural world, and we need to accept that.
>
> – *Vasudevan Lakshminarayanan, University of Waterloo*

Recommendation 17: Commit to developing national standards for teacher education and certification.

An issue of critical concern to the pipeline of students in STEM and other fields—and thus to the pipeline of professionals engaged in effective national science policymaking—is the educational system in the United States. A major component of the educational system, both in K-12 as well as at the university level, is the training of teachers, the majority of whom are trained and certified through colleges and universities. Opportunities for universities to engage in improving the system of teacher training include recognizing that many faculty learn how to teach by observing the faculty who taught them when they were students. Universities can provide greater access to training for faculty in the art and science of teaching, and encourage or require that faculty utilize these resources. Universities are also a major repository of research on teaching and interventions to improve learning for students from pre-K through the Ph.D. They should commit to making these resources widely available and to encouraging their use.

> It has been the case that many faculty are not taught really how to teach. They think that it's fine to just do it the way they were taught and to do lectures, but we know from evidence that there are better ways to do it. There's a lot we can do on that front, and we have to do it not only for the people we are teaching to go out into K-12 and teach, but also we have to provide that training to our own faculty.
>
> – *Toby Smith, Association of American Universities*

One area of research results that is not widely known or adopted is the body of information on how best to teach and what it takes to be a good teacher. Studies have also shown that our notions of talent in recruiting students into teaching are too narrow. Universities, specifically through education schools and programs, can use the available research to broaden the criteria of "the best and brightest" to recruit future teachers, as well as incorporate evidence-based curricula to train education students.

Another suggestion was to collaborate with other stakeholder groups to start a national campaign that makes clear the research evidence on the importance of skillful teaching to students' livelihoods and well being. It is also important to actively recruit a racially and socioeconomically diverse teaching force. It was also recommended that universities work with stakeholder groups to develop a "safe-to-practice" threshold that requires that all prospective teachers demonstrate minimum threshold of skill before entering their teaching careers.

> The cultivation of the next generation of thinkers, doers, problem solvers, we leave largely to chance because we don't actually have a system for reliably preparing teachers in this country. There are no common professional standards, unlike any other profession you might name, or even skilled trades. The improvement of K12 education through teacher education is a problem of national imperative.
>
> – *Deborah Ball, University of Michigan*


Thanks, Wolverines!
http://www.cnip.gov
Bile Salts Help Take Up Digestion Products and Lipid-Soluble Vitamins by Micems

Conclusion

Our nation's universities have made extraordinary contributions to social and economic progress, as well as to the quality of life. They provide the education that lays the foundations for virtually every profession: business, medicine, engineering, science, law, government, education, entrepreneurship, and the arts. At the same time, they provide new ideas that lead to new products, new processes, new services, new companies, and entirely new industries. Moreover, the solutions to many of the challenges our society faces rely on the expertise generated by, and resident in, the university community. To sustain this resource, and to strengthen it, Universities must be more proactive in the public arena. By taking opportunities to bring their expertise to bear on current issues, faculty can not only inform effective policymaking, but also serve as role models for their students to become actively engaged. In the process, they can demonstrate on a continuing basis the remarkable value that universities bring to our society.

A central goal of the symposium was to find ways to encourage faculty, students, and staff to become more engaged. A related goal was to find ways to encourage legislators and the public to see universities as a resource for more informed decision making regarding policy for science and science-based policy.

A number of big picture ideas and some finer-grained recommendations emerged from the two-day symposium. A central theme underlying the recommendations was that campuses must cultivate a culture of public service, encouraging both faculty and students to become "civic scientists," and improving communication flow – both inward and outward, on policy for science and science-based policy. This culture must be valued and promoted by campus leadership and embraced by the entire research community if we are to achieve rapid and sustained progress. All universities have made some progress in this arena. But there are many strengths that can be better coordinated, built on, and made more visible. The timing is ripe to make the goals of public service, civic science, and communication more systemic in our culture.

Appendix A: Symposium Agenda

Jerome B. Wiesner Symposium

March 30-31, 2015

DAY 1—Challenges and Opportunities in Science Policy Making

Session 1

Moderator: Jack Hu

7:30 Registration Open – Continental Breakfast Served

8:30 Call to Order
Homer Neal

8:35 Welcome and Introduction of President Mark Schlissel
S. Jack Hu

8:40 Welcome to the Symposium and Introduction of
John Holdren
Mark Schlissel

8:50 **Major S&T Policy Challenges for the Nation and Engagement of Academics in this Endeavor**
John Holdren

9:30 **Participation in the President's Council of Advisors for Science & Technology (PCAST)**
Rosina Bierbaum

Session 2

Moderator: James Duderstadt

10:05 **Participation of Academics Through the National Academies and National Research Council**
Ralph Cicerone

10:45 **Challenges in Space Policy**
Len Fisk

11:00 **Challenges in Social Science Policy**
James Jackson

11:15 **Redefining American Research Universities**
James Duderstadt

11:30 Discussion
All Participants

Session 3

Moderator: Deborah Ball

1:20 **Science Policy: Educating the Next Generation of Decision-Makers**
France Córdova

2:00 **Will Universities Respond?**
Toby Smith

2:15 **University Data for Science Policy**
Jason Owen-Smith

2:30 **Educational Imperatives for the Nation**
Deborah Ball

2:45 Discussion
All Participants

Session 4

Moderator: Gil Omenn

3:55 **The View from Congress**
Rush Holt

4:35 **Mobilizing Public Support for S&T Investment**
Mary Woolley

4:50 **What Should Academics Know About the Science of Science Policy**
Julia Lane

5:05 **Bipartisan Interest in Biomedicine and Health Risks**
Gil Omenn

5:20 Discussion
All Participants

6:10 Reception

DAY 2—How do universities mobilize to play a larger role in national science policy through education, research centers & convening power?

Session 1

Moderator: Carl Simon

7:30 Registration Open – Continental Breakfast Served

8:30 Welcome Remarks
S. Jack Hu and Homer Neal

8:35 **Leading Examples Among Research Universities**
Susan Cozzens

9:05 **Perspectives from the Ford School of Public Policy**
Susan M. Collins

9:20 **Biomedicine**
Huda Akil

9:35 **Physical Sciences**
James Wells

9:50 **Engineering**
Sharon Glotzer

Session 2

Moderator: Carl Simon

10:25 **Research Ethics & Scientific Responsibility**
Jennifer McCormick

10:40 **International Perspectives**
Vasudevan Lakshminarayanan

10:55 **Should Science Policy Be a Universal Topic in a Liberal Arts Education?**
Homer Neal

11:10 Discussion
All Participants

12:05 Recommendations
Rosina Bierbaum and Deborah Ball

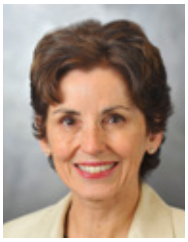
12:50 Lunch


France A. Córdova
Huda Akil
Deborah Loewenberg Ball
Rosina Bierbaum
Susan M. Collins

Appendix B: Symposium Speakers and Panelists

John P. Holdren is Assistant to the President for Science and Technology, Director of the White House Office of Science and Technology Policy, and Co-Chair of the President's Council of Advisors on Science and Technology (PCAST). Prior to joining the Obama administration Dr. Holdren was Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government, as well as professor in Harvard's Department of Earth and Planetary Sciences and Director of the independent, nonprofit Woods Hole Research Center. Previously he was on the faculty of the University of California, Berkeley, where he co-founded in 1973 and co-led until 1996 the interdisciplinary graduate-degree program in energy and resources. During the Clinton administration Dr. Holdren served as a member of PCAST through both terms. Dr. Holdren holds advanced degrees in aerospace engineering and theoretical plasma physics from MIT and Stanford. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences, as well as a foreign member of the Royal Society of London and former president of the American Association for the Advancement of Science.

Rush D. Holt, Ph.D., is the 18th chief executive officer of the American Association for the Advancement of Science (AAAS) and executive publisher of the Science family of journals. Before coming to AAAS, Holt served for 16 years in the U.S. House of Representatives, representing New Jersey's 12th Congressional District. On Capitol Hill, Holt established a long track record of advocacy for federal investment in research and development, science education, and innovation. He served on the National Commission on the Teaching of Mathematics and Science, founded the Congressional Research and Development Caucus, and served as co-chair of the Biomedical Research Caucus. His legislative work earned him numerous accolades, including being named one of Scientific American's "50 National Visionaries Contributing to a Brighter Technological Future" and a "Champion of Science" by the Science Coalition. From 1987 to 1998, Holt was assistant director of the Princeton Plasma Physics Laboratory, a Department of Energy lab that is the largest research facility of Princeton University. Previously, Holt served on the faculty of Swarthmore College, where he taught courses in physics and public policy. He is an elected fellow of AAAS, the American Physical Society, and Sigma Xi.

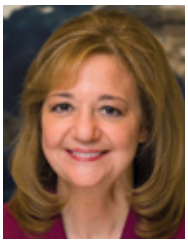


France A. Córdova is the 14th director of the National Science Foundation (NSF). Córdova leads the only government science agency charged with advancing all fields of scientific discovery, technological innovation, and science, technology, engineering and mathematics (STEM) education. Córdova is president emerita of Purdue University. She led the University of California, Riverside, as chancellor and was a distinguished professor of physics and astronomy. Córdova was the vice chancellor for research and professor of physics at the University of California, Santa Barbara. Córdova served as NASA's chief scientist. Prior to joining NASA, she was on the faculty of the Pennsylvania State University where she headed the department of astronomy and astrophysics. Córdova was deputy group leader in the Earth and space sciences division at Los Alamos National Laboratory and staff scientist. She received her B.A. from Stanford University and her Ph.D. in physics from the California Institute of Technology. More recently, Córdova served as chair of the Board of Regents of the Smithsonian Institution and on the board of trustees of Mayo Clinic. She served as a member of the National Science Board (NSB). As NSF director, she is an ex officio member of the NSB.

Ralph J. Cicerone is President of the National Academy of Sciences and Chair of the National Research Council. In 2001, he led a National Academy of Sciences study of the current state of climate change requested by President Bush. Dr. Cicerone is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society. He is a foreign member of the Accademia Nazionale dei Lincei, the Russian Academy of Sciences, the Korean Academy of Science and Technology, Academia Sinica, the Real Academia de Ciencias, and the Royal Society. Dr. Cicerone was educated at the Massachusetts Institute of Technology and the University of Illinois. He began his research career at the University of Michigan. In 1989 he joined the University of California, Irvine, where he was founding chair of the Department of Earth System Science and later Chancellor (1998-2005). Dr. Cicerone has served on the Secretary of Energy's Advisory Committee (2009-2013), and is a trustee of the Carnegie Corporation of New York.

Huda Akil, Ph.D. is the Gardner Quarton Distinguished University Professor of Neuroscience and Psychiatry and the co-Director of the Molecular & Behavioral Neuroscience Institute (MBNI) at the University of Michigan. Dr. Akil is a member of the Institute of Medicine of the National Academy of Science, and National Academy of Sciences. She is the past President of the American College of Neuropsychopharmacology and the Society for Neuroscience.

Deborah Loewenberg Ball is the William H. Payne Collegiate and Arthur F. Thurnau Professor in education at the University of Michigan. She is dean of the School of Education. She serves on the National Science Board and the Mathematical Sciences Research Institute Board of Trustees. Ball is a member of the American Academy of Arts and Sciences, the National Academy of Education, & a fellow of the American Mathematics Society.



Rosina Bierbaum is a Professor and Dean Emerita at the University of Michigan with appointments in both the School of Natural Resources and Environment, and the School of Public Health. She chairs the Scientific and Advisory Panel of the Global Environment Facility, serves on President Obama's Council of Advisors on Science and Technology, is an Adaptation Fellow at the World Bank, and the lead author of the recently completed U.S. National Climate Assessment. She is a Fellow of the Ecological Society of America.

Susan M. Collins is the Joan and Sanford Weill Dean of Public Policy and professor of public policy and economics at the University of Michigan's Gerald R. Ford School of Public Policy. Dean Collins is currently a nonresident senior fellow in the Economic Studies program at Brookings, president of the Association for Professional Schools of International Affairs (APSIA), a member of the Board of Directors of the Detroit Branch of the Federal Reserve Bank of Chicago, and a research associate at the National Bureau of Economic Research.

Susan E. Cozzens is the Vice Provost for Graduate and Undergraduate Studies at the Georgia Institute of Technology. Dr. Cozzens has served as a consultant to the National Research Council, Office of Science and Technology Policy, National Science Foundation, Institute of Medicine, Office of Technology Assessment, General Accounting Office, the National Institutes of Health, and the National Institute on Occupational Safety and Health, and on advisory committees for the American Association for the Advancement of Science, and the National Academy of Sciences.

James J. Duderstadt is President Emeritus and University Professor of Science and Engineering at the University of Michigan. He currently co-chairs the University's program in Science, Technology, and Public Policy. He is a member of the National Academy of Engineering, the American Academy of Arts and Science. Dr. Duderstadt is chair of the Policy and Global Affairs Division of the National Research Council.

Lennard A. Fisk is the Thomas M. Donahue Distinguished University Professor of Space Science at the University of Michigan. Prior, Dr. Fisk was the Associate Administrator for Space Science and Applications of NASA. He is a Member of the National Academy of Sciences and the International Academy of Astronautics; he is a Foreign Member of Academia Europaea and a Fellow of the American Geophysical Union.

Sharon C. Glotzer is the Stuart W. Churchill Collegiate Professor of Chemical Engineering, and Professor of Materials Science and Engineering, Physics, Applied Physics, and Macromolecular Science and Engineering at the University of Michigan. She is member of the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences, the American Physical Society, and the American Association for the Advancement of Science.

S. Jack Hu is the Interim Vice President for Research at the University of Michigan. He is also Professor of Mechanical Engineering, Professor of Industrial and Operations Engineering, and the J. Reid and Polly Anderson Professor of Manufacturing in the College of Engineering. Dr. Hu is a fellow of the American Society of Mechanical Engineers, the International Academy for Production Engineering, and the National Academy of Engineering.

James S. Jackson is the Daniel Katz Distinguished University Professor of Psychology, Professor of Afroamerican and African Studies, and Director of the Institute for Social Research. He is a member of the Institute of Medicine, the National Research Council, & the National Science Board. He is Co-Director of the "Center for Integrative Approaches to Health Disparities" and the "Michigan Center for Urban African American Aging Research".

V. Lakshminarayanan is a professor of Vision Science, Physics, and ECE at the University of Waterloo. He has received numerous honors, including Fellow of OSA, SPIE, AAAS, APS, and IoP. He is a founding member of the UNESCO ALOP program. He served as Chair for the US International Commission on Optics, for the APS Committee on International Scientific Affairs, & the Steering Committee of the International Year of Light 2015.

Julia Lane is an Institute Fellow at AIR, professor of economics, BETA University of Strasbourg CNRS, Chercheur, Observatoire des Sciences et des Techniques, Paris, and professor, University of Melbourne. She was formerly director of the NSF's Science of Science and Innovation Policy program, senior vice president at NORC at the University of Chicago and senior research fellow at the U.S. Census Bureau.

Jennifer McCormick is an Assistant Professor of Biomedical Ethics in the departments of Medicine and Health Sciences Research at the Mayo Clinic. She was a fellow with the Stanford Center for Biomedical Ethics. She also is one of the primary consultants on the Clinical and Translational Research Ethics Consultation Service and works closely with clinical investigators and the IRB to enhance the quality of our research protections.

Homer A. Neal is the Samuel A. Goudsmit Distinguished University Professor of Physics, Interim President Emeritus, Vice President Emeritus for Research, director of the University of Michigan ATLAS Collaboratory Project. He co-authored Beyond Sputnik: U.S. Science Policy in the 21st Century. He has served on numerous boards and advisory committees. He is a fellow of AAAS and the American Academy of Arts and Sciences.

Gilbert S. Omenn is Professor of Computational Medicine & Bioinformatics, Internal Medicine, Human Genetics, and Public Health, and director of the Center for Computational Medicine and Bioinformatics at the University of Michigan. He is the Chair of the global Human Proteome Project. He serves on the Council of the Institute of Medicine, the Scientific Management Review Board of the NIH, and the boards of several organizations.

Jason Owen-Smith is the Executive Director of the Institute for Research on Innovation and Science. He directs the Barger Leadership Institute. He is the Barger Leadership Institute Professor of Organizational Studies, Professor of Sociology and Public Policy as well as Research Professor in the Institute for Social Research.

Carl P. Simon is Professor of Mathematics, Economics, Complex Systems and Public Policy at The University of Michigan. He was the founding Director of the Center for the Study of Complex Systems and the Associate Director for Social Science and Policy of the Michigan Memorial Phoenix Energy Institute. He is currently Director of the UM Science and Technology Policy Program. He received the U-M Distinguished Faculty Achievement Award in 2012.

Tobin (Toby) Smith is Vice President for Policy at the Association of American Universities (AAU). Included among his other areas of responsibility are policy and funding issues relating to science, innovation, energy, research compliance and costs, technology transfer and openness and security. He is the co-author of Beyond Sputnik – U.S. Science Policy in the 21st Century. He is a fellow of the American Association for the Advancement of Science.

James Wells is a Professor of Physics at the University of Michigan. He held subsequent appointments at SLAC/Stanford and the European Center for Nuclear Research (CERN). He has won the Sloan Research Fellowship and the Department of Energy's Outstanding Junior Investigator Award. He is a Fellow of the APS. He currently serves as member of two sub-committees of the Panel on Public Affairs of the American Physical Society.

Mary Woolley is the president of Research!America. She is a member of the Institute of Medicine & served on its Governing Council. She is a Fellow of the AAAS & serves on the National Academy of Sciences Board on Life Sciences. She is a Founding Member of the Board of Associates of the Whitehead Institute for Biomedical Research, a board member of the Institute for Systems Biology, & of the visiting committee of the University of Chicago Medical Center.


Bulletin
Atomic
Scientists

Appendix C: Biography of Jerome B. Wiesner

Jerome B. Wiesner (1915-1994) was one of the University of Michigan's most distinguished alumni (BS '37, MS '38, Ph.D. '50, D.Sc. '62). His contributions to higher education, scientific and technological research, and national policy in the areas of science and technology have been unsurpassed.

Born in Detroit in 1915, Jerry Wiesner grew up in the city of Dearborn and entered the University of Michigan in 1933, where he majored in electrical engineering. He received his Bachelor of Science degree in 1937 and entered the graduate program in engineering, completing his M.S. in 1938. In 1937, he also became Associate Director of the University's radio station, a position that allowed him to experiment with new sound recording techniques. Among other accomplishments in that position, he engineered a live state-of-the-art broadcast of a lecture given by Archibald MacLeish, then Librarian of Congress. In 1940 Wiesner joined the Library of Congress as Chief Engineer of the Acoustics and Recording Lab. In 1940 he also married Laya, whom he had met at Michigan; they eventually had four children.

In 1942, Jerome Wiesner joined the staff of the MIT Radiation Laboratory; he moved to Los Alamos Scientific Lab in 1945. In 1946, he became assistant professor at the Massachusetts Institute of Technology. In the meantime, he continued to work toward his doctoral degree, and in 1950 he received that degree from the University of Michigan, with a thesis titled Pre-ignition Phenomena in Gas Switching Tubes and Related Rectifier Burnout Problems.

Jerry rose quickly through the ranks at MIT. He directed the Electronics Lab from 1952 to 1961 and was named Head of the Department of Electrical Engineering in 1959. During this period he was also increasingly active in issues of science and education policy. In 1954, he served on a panel chaired by James Killian that made a study for President Eisenhower on national defense against surprise attack. In 1957, he was a member of the Gaither Panel, which studied the means to defend large civilian populations against nuclear attack.

In 1961, Wiesner accepted President John F. Kennedy's invitation to serve as Special Assistant for Science and Technology and director of the Office of Science and Technology policy. During this period of rapid growth in the nation's science research infrastructure, Wiesner was key in the creation and refinement of a national framework for the investment in science and technology research and development. With his background in nuclear weaponry and defense systems, he was also a key figure in the work that led to the first Nuclear Test Ban Treaty.

In 1964, Wiesner returned to MIT as Dean of Science and in 1966 he became Provost. He served as president from 1971 – 1980, when he retired as Institute Professor and President Emeritus. Throughout this period, he continued to be an active and valuable contributor to national science and technology policy formation, and was a member and chair of the Technological Advisory Commission of the Office of Technology Assessment from 1974 to 1981. He also became more and more deeply involved in discussions of nuclear arms reductions and was a driving force in the Pugwash conferences.

Jerry Wiesner received numerous honors during his lifetime. He was a member of the National Academies of Sciences, Engineering, and Medicine (NASEM) and the National Academy of Engineering, and he held honorary degrees from the Polytechnic Institute of Brooklyn, the University of Michigan, Lowell Technological Institute, the University of Massachusetts, Brandeis University, Lehigh University, Northwestern University, and Rensselaer Polytechnic Institute. His greatest honor, however, may be in the memories of the numerous individuals – ranging from students to world leaders – whose lives he touched and influenced with his wit, care, compassion and intellect.