Science Advocacy in a Changing Political Climate: Speak Up and Speak Well

Thomas J Hund and Peter J Mohler

Freedom, the first-born of science.

Thomas Jefferson

Thomas Jefferson's passion for science is well documented.[1] His published writings include important treatises on natural history and paleontology. He served as president of the American Philosophical Society for 18 years. Before sending Meriwether Lewis westward to explore the Louisiana Purchase, Jefferson arranged for his instruction in a variety of scientific disciplines, including medicine, in Philadelphia. Central to Jefferson's love of science was his belief that the discipline was the bedrock for a successful America.

Today, the American public largely embraces advances brought about by scientific research. At the same time, thanks to increased specialization, competition for resources, and real (and perceived) societal threats, our discipline is in danger of straying from Jefferson's higher ideal of science as a vital equalizing force in society. Scientists have become increasingly siloed from each other and, perhaps more alarming, from the general public. In neglecting the nobler aspects of the scientific profession, Jefferson might argue, beyond threatening our own livelihood, we serve as tacit accomplices to the gradual erosion of the fabric of our democracy.

In line with Jefferson's notion of the importance of science in our democracy, President Obama has issued a clarion call for scientists to engage the public—young people in particular. On the surface, such a dialogue should not be difficult. Federally funded science continues to produce transformative basic and translational breakthroughs with tangible implications for human health and wellness.[2] For example, the incidence of heart disease is down ~68% and life expectancy has increased by almost a decade over just the past 50 years.[3] According to a 2015 Pew survey, the majority of Americans hold a favorable view of the impact science has on quality of life (health care, food, environment).[4] An overwhelming majority (>70%) also agree that government investments in engineering, technology, and basic science pay long-term dividends. On the other hand, the same survey revealed significant gaps between the views of the public and those of scientists on a range of specific scientific issues, including use of animals in research (47% of public in favor, compared with 89% of scientists, representing a 42-point gap), safety of genetically modified foods (51-point gap), and role of human activity in climate change (37-point gap). Some of this disagreement comes down to an unavoidable conflict of belief systems. It is, however, interesting to consider how much of the gap may be attributed to a breakdown in communication. For example, most biomedical scientists would view it as a contradiction for a person to advocate both *for* the benefits of science and simultaneously *against* one of the fundamental tools in biomedical science (e.g., animal studies). At the same time, it is reasonable for a layperson to view with skepticism the ethical bearings of a scientist or a scientist's ability to trace out the full ramifications of his or her discoveries (i.e., do scientists really know what they are doing?). The public may appreciate the end goals of science but not fully understand the steps (or time) required to attain those goals. Scientists may not necessarily feel a responsibility (or have the time or skills required) to make the work accessible to a general audience. The new perspectives that arise from scientific investigation often clash with widely held and long-established belief systems. This is perhaps best illustrated by the tension between scientists providing evidence for climate change and those who deny its existence. It is in these domains especially that scientists must excel when communicating to the public not only their findings but the mission of the research. Thus, the challenge for scientists in engaging the public and fulfilling our civic duty becomes twofold: 1) how do we push back against a vocal minority espousing antiscience sentiment? and more importantly, 2) how do we better communicate with the large number of

THOMAS J HUND is an associate professor of biomedical engineering in the Departments of Biomedical Engineering and Internal Medicine at The Ohio State University Wexner Medical Center, College of Medicine, and College of Engineering.
PETER J MOHLER is the director of the Dorothy M. Davis Heart and Lung Research Institute and chair of the Department of Physiology and Cell Biology at The Ohio State University Wexner Medical Center and College of Medicine.

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people who acknowledge the benefits of science and find it a worthwhile pursuit? To make inroads will require increased efforts by scientists and supporting institutions in outreach, advocacy, and communication.

Within the biomedical field, there has been growing acceptance that increased outreach and communication among scientists is an important endeavor.[4–6] On top of that, a somewhat surprising 86% of 3,748 scientists surveyed in 2014 stated that they already interact with public audiences "often or occasionally."[7] The challenge then appears to be how to increase the frequency and, more importantly, efficacy of our outreach efforts. Higher Jeffersonian ideals aside, in reality there are few incentives for scientists to engage in community outreach activities or training. Furthermore, scientists do not necessarily excel at addressing a public audience. One approach then is to lend our skills to ongoing outreach efforts aimed at promoting early interest and knowledge of science among children. A growing number of STEM-related programs throughout the country may help lower the time and energy barrier for faculty involvement. For example, at The Ohio State University, the Translating Engineering Research to K-8 program converts targeted summer undergraduate research experiences into outreach activities for underserved K-8 Columbus classrooms.[8] In a similar vein, Ohio State faculty regularly serve as mentors for students at the Metro Early College High School, a STEM-focused Columbus City school that requires a 10-week professional internship in an area of interest. On a larger scale, a fascinating and potentially game-changing effort may be found in the US Army's Educational Outreach Program, a nationwide network (more than 45,000 participants in 2015) of Army-sponsored STEM programs aimed at increasing scientific literacy across the country (while promoting awareness of US Department of Defense STEM-related careers). Important unifying aspects of these examples are that 1) they provide accessible gateways to outreach for scientists (low energy barrier) and 2) the target audiences are underserved. Related to the second point, in line with the notion of science as an equalizing force in society, it is important that our message reaches beyond affluent, highly educated communities and into poorer rural and urban areas. Aside from spanning the socioeconomic divide, it is essential that we also reach across race and gender lines. Approximately half of all students who initially display interest in science change their plans within the first two years of undergraduate study.[9,10] In general, underrepresented minority students are less likely than peers to complete undergraduate or advanced degrees.[11,12] In a similar vein, women now represent half of medical school graduates. However, in these same academic medical centers, women represent only 21% of full professors, 15% of department chairs, and 16% of deans.[13] For science to fulfill its potential as a vehicle for equality (and for the United States to gain in global competitiveness and reduce the flow of high-skilled jobs to other countries), it is imperative that we fix the STEM pipeline for underrepresented groups by creating opportunities for participation and awareness before young people decide on a career path. Furthermore, we must not only expose and engage young minorities and women in science but strengthen our commitment to support them throughout their entire scientific careers. STEM programs aside, universities and departments across the country are finding creative ways to enhance scientific outreach to the public. For example, similar to many institutions, Ohio State now regularly hosts open forums to expose the public to the impact of research and technology on our everyday lives (e.g., "Science Sundays").

Outreach efforts such as these are important but likely not enough by themselves to drastically shift the public discourse. Beyond public outreach, scientists must increase involvement in advocacy efforts to help frame public policy. This means scientists across the country must ramp up efforts to meet routinely with state and national representatives on both sides of the aisle to discuss the value of transformative biomedical discoveries on public health.[2] The vast majority of scientists agree that they should be active participants in public policy debates. However, too often we hear from our colleagues that time for science advocacy is trumped by another faculty meeting, teaching obligation, grant application, or animal protocol resubmission. We contend that this attitude is inconsistent with the long-term future of science and biomedical research in our country. There are valid concerns in this arena regarding the appropriateness of scientists wading into activism or areas beyond our immediate sphere of expertise.[14] However, to avoid the public policy dialogue altogether for fear of stepping out of our comfort zone is not an option. It is imperative that we engage the public and policy makers. One avenue to pool our voices is to engage in advocacy efforts through our representative scholarly societies, which, through connections to Congress and events such as Capitol Hill Days, are able to organize to articulate the need for continued investment in science.

Finally, each of us must work on the simple task of better conveying the "what" and "why" of our research to our peers and the public. To maximize our impact, it is vital that we take measures to not only communicate but to *communicate well*.[6] Importantly, we must do so without overselling the immediate impact on health, disease, or wellness. Fortunately, there are plenty of resources at institutions and online (e.g., compassonline.org); such formal instruction may be necessary or helpful for many of us. One vital effort each of us can undertake is reflection and practice: by continuously asking ourselves the "what" and "why" of our own research programs and refining our

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"elevator pitch," we will be better prepared to answer the same questions from others.

In an election year, as we survey the state of the union, it is interesting to reflect on our roles as scientists. We have outlined a vision for the scientist as not just a professional researcher but also as an ambassador for our discipline. We have described some of the daunting obstacles that limit the reach of science in society. Finally, we have outlined possible solutions and ongoing efforts to help improve connections between scientists and the general public. Time will tell whether such efforts will increase scientific literacy for our citizenry and improve the state of the union. But with wide economic, political, and social differences right now in the United States, we are in dire need of forces that serve to equalize rather than to disenfranchise our populace. More than ever, our country and, more broadly, our global community need science. As spoken so eloquently by Louis Pasteur, "Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world. Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence."[15]

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