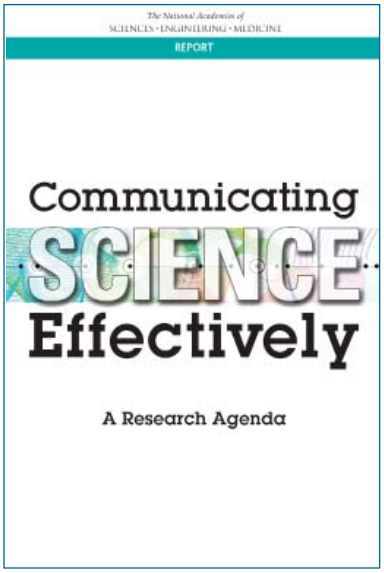
Report

December 2016

HIGHLIGHTS

Communicating Science Effectively: A Research Agenda



Science is integral to a range of decisions people must make in modern life—about vaccinating children, the safety of foods, what to do about climate change, and many other issues. Society's need for effective science communication has never been greater. But science communication is remarkably complex. The approaches to communicating science most effectively often are not obvious, especially when the science relates to important societal issues that have become the subject of public controversy—such as climate change, vaccines, hydraulic fracturing, and genetically modified organisms, among many others.

The National Academies of Sciences, Engineering, and Medicine convened a diverse panel of scientists and science communicators to offer a research agenda that can inform efforts to communicate about science effectively, particularly when the issues are contentious.

The committee's report points to cross-cutting themes for scientists and science communicators to consider in their work, as well as major challenges that should be studied to make science communication more effective. This research agenda should be pursued not only by researchers in academic settings but by researchers and practitioners embedded in various organizations that communicate science.

CROSS-CUTTING ISSUES

Aligning communication approaches with goals. Science communicators are diverse, and their goals for communicating are diverse as well. Science communicators include scientists, universities, the media, advocacy organizations, think tanks, corporations, nonprofit research organizations, health professionals, and government agencies, as well as amateur science enthusiasts and political commentators. Their goals may include:

- To simply share the findings and excitement of science
- To increase appreciation for science as a useful way of understanding and navigating the modern world
- To increase knowledge and understanding of the science related to a specific issue
- To influence people's opinions, behavior, and policy preferences
- To engage with diverse groups so that their perspectives about science related to important social issues needing a solution can be considered

A major research effort is needed to identify science communication approaches that best match particular goals.

One important ethical question is how far science communicators should go beyond simply communicating scientific facts and theories and either advocate for or actively try to influence people's opinions or actions. What science communicators should do in this regard is an ethical question as well as a question for research, and it will continue to be debated.

Moving beyond the "deficit model" of communication. A widespread assumption in the scientific and science communication communities has been that if only science communication were done "better"—that is, to better inform and increase people's knowledge of the relevant science—people would make choices more consistent with the scientific evidence. But this widely held, simple model of what people need from science communication—known as the deficit model—is wrong. Although people may indeed need more information or to have information presented more clearly, a focus on knowledge alone often is not sufficient for achieving communication goals.

Research shows that many audiences for scientific information may already understand generally what scientists are presenting but for diverse reasons do not agree or act consistently with that science.

People rarely make decisions based only on scientific information; they also take into account their own goals and needs, knowledge and skills, values and beliefs. Further, science by its very nature involves some degree of uncertainty with which people must cope when making a decision. Effective science communication is aimed at helping people to understand the science relevant to a decision and showing its relevance, while recognizing that other factors will also affect their actions.

MAJOR CHALLENGES FOR SCIENCE COMMUNICATORS AND RESEARCHERS

Research and practice in science communication face a number of challenges:

Understanding converging individual and social influences on science communication. A number of factors contribute to the complexity of communicating science effectively, including:

- *the scientific information itself*, which can be both complex and uncertain. People tend to have difficulty understanding scientific uncertainty and probability, for example.
- *the ways in which people process information.* In many circumstances, people automatically use mental shortcuts to make sense of complex scientific information, which could lead to inaccuracies in interpretation. For example, people tend to pay more attention to, or weight more heavily, information that is consistent with their pre-existing feelings about a subject. People also may perceive that information they encounter frequently is more true or important than information they have encountered less often, even when that inference is incorrect.
- *social influences,* such as social networks, communities, norms, group members, and loyalties. Individual and social factors—for example, political ideology, religiosity, and education—all can affect trust in science itself and in sources of information about it.

Further study is needed to determine how important each of these factors is in communicating with specific audiences and how the factors interact.

Communicating with policy-maker audiences. The use of science in policy making is not a straightforward process involving a simple, traceable relationship between the provision of information and a specific decision. Even when policy makers have access to and understand all of the relevant information, they will not necessarily weigh science heavily or use it to select among policy options. Overall, there is a shortage of evidence on effective practices for affecting policy makers' understanding, perception, and use of science. Important questions for research include

- How is scientific information accessed, encountered, understood, shared, or discussed by policy makers in formal policy processes? How can science communication affect these processes? How are these policy processes affected by science communication when science is involved in public controversy?
- Think tanks, scientific associations, evidence-based clearinghouses, government agencies, and nonprofit organizations all play an organized role in interpreting scientific information for use by policy makers, the media, and the broader public. Research is needed on the conditions for success in communicating science by diverse types of organizations, such as on the quality or outcomes of policy discussions.

Engaging formally with the public about science. Although some goals of science communication can be achieved through one-way transmission of the information, other goals—sharing information needed for a decision, for example, and finding common ground among diverse stakeholders—are best achieved by the dialog that happens through formal public engagement. But effective public participation is difficult. Some principles for success described

in the report can be gleaned from research, such as undertaking public engagement as early as possible in a public debate and having repeated deliberations over time in order to build trust among diverse participants. Still, additional important questions remain, such as:

- What are the particular structures and processes for public engagement that best enable science to be communicated effectively?
- To what degree do these approaches generalize or need to be tailored according to the diversity of the participants, the decisions to be made, and the nature of the topic?

Navigating science-related controversy. The involvement of science in public controversy makes the already complex task of science communication even more so. Science-related controversies have three key features about which more needs to be known:

- *Science-related controversies typically involve conflicts over beliefs, values, and interests that are central to the debate, rather than simply a need for knowledge from science.* For those reasons, across different science-related controversies, from GMOs to genetic testing, people who are demonstrably knowledgeable about the science may have opposite perceptions of or expressed support for the science. Research points to several strategies that can help engage those with competing beliefs, values, and interests on science communication—taking steps to establish trust and credibility, tailoring messages to offer accurate information while avoiding a direct challenge to strongly held beliefs, and engaging the public in formal processes for participating in decisions on such issues. However, more research is needed to determine how science can be communicated effectively in these contexts.
- *The public often perceives uncertainty either in the science itself or its implications or as a result of various communicators conveying different, and sometimes contradictory, messages.* In some science-related controversies, uncertainty can be mischaracterized, exploited, or exaggerated to serve particular interests. Research is needed to identify effective ways of communicating scientific consensus, as well as degrees or types of uncertainty and to understand audiences' responses to these communications on a large scale.
- *In science-related controversy, the voices of organized interests and influential individuals are amplified in public discourse and can impede clear communication about the state of the scientific evidence.* High stakes, conflicting interests, uncertainty, and concerns about risk and its consequences all can expand the number and diversity of people and organizations that are attempting to communicate about science. In this context, research is needed to determine how authoritative voices from science can be heard.

Communicating in a complex, dynamic, and competitive media environment. Communication about science takes place in a fast-changing environment, where familiar media sources are fading and new ones emerging. In 2014, nearly one-half of Americans reported that the Internet was their primary source of news and information about science and technology. Communicators have new ways to participate in public debates about science, and more scientists than ever are speaking directly to the public via blogs, podcasts, YouTube videos, and the like. But the widening channels for scientific information also mean that there are more actors in the media landscape who may provide inaccurate science information. Citizens are left to their own devices as they struggle to determine whom to trust and what to believe about science-related controversies. This is the new—and not entirely understood—media environment with which science communicators must cope.

Research needs to keep pace with these changes in media, in order to help communicators take advantage of new opportunities and find effective approaches given the many influences on people in this complex communication environment. Examples of important research questions include:

- How can accurate information about the state of the science be heard among many competing messages and sources of information?
- People's social networks are known to affect their beliefs, attitudes, and behaviors, and social media and blogs in particular are increasingly being used to spread both accurate and inaccurate scientific information. In light of this, what are effective approaches to communicating science through social media platforms, blogs and other networks?

A SYSTEMS APPROACH TO RESEARCH

The concept of science communication applies to a large variety of activities—a quick tweet, a conversation with a policy maker, a public hearing, or a long-planned and extensive media campaign. It is a complicated enterprise of many elements including the content and format of information; the diverse organizations and individuals involved; the channels of communication; the political, social, and cultural contexts in which communication takes place; and many (sometimes competing) voices that offer (sometimes conflicting) information. Each of these el-

ements itself is complex, and each interacts with the others in intricate and largely unknown ways.

An understanding of science communication as a complex system of many interrelated parts is the way forward for further research. Explanatory models of the influences on science communication need to be built and tested for a robust understanding of the individual elements of the system and how they interact.

Researchers and practitioners of science communication need to enter into partnerships to translate what is learned through research into practice and to develop detailed research agendas to test hypotheses that are realistic and pragmatic about how to communicate science.

ASSESSING THE EFFECTIVENESS OF SCIENCE COMMUNICATION

Far more research needs to be done to assess the effectiveness of various communication approaches in order to help science communicators select strategies that are likely to work. It would be particularly helpful to conduct

- randomized controlled field experiments to assess impact;
- research that simulates real-world communication environments as closely as possible; and
- analyses of large datasets, such as those derived from social media, to assess changes in people's responses to science communication.

Findings from effectiveness research should be aggregated, perhaps in registries, so that research approaches and results can be shared more easily, serving as a foundation for future work.

BUILDING THE SCIENCE COMMUNICATION RESEARCH ENTERPRISE

Efforts to enhance the infrastructure of science communication research should pay particular attention to four areas:

- Researchers and practitioners of science communication need to form partnerships to translate what is learned through research into practice.
- Researchers in the diverse disciplines that study science communication are currently disconnected and need opportunities to work together to develop more unified theories, concepts, and definitions of factors that matter to communicating science. Examples include new or refocused journals, professional meetings, and other forums to support interdisciplinary and practice-driven research collaborations.
- More scientists need to be recruited to this field from neighboring disciplines—particularly from the social and behavioral sciences, given that communicating science involves complex individual and social phenomena. Science communication researchers may need additional training to carry out the research agenda or to be encouraged to work in teams that include partners with the necessary expertise.
- Policy changes to enable rapid review and funding of certain science communication research, such as occurs in a public health crises, would help to make timely research on effective science communication possible.

EXAMPLES OF COMMUNICATION PRACTICES THAT NEED MORE RESEARCH

Using narrative. Science communicators frequently use narratives—information presented in the form of a story—to help explain complex issues. Narratives can increase audience engagement and attention, and they are easier to remember and process than traditional forms of science communication. Experts are often concerned, however, that narratives can sway people from using statistical information that is also presented. Using narrative to promote understanding in science communication needs further study.

Debunking misinformation. Many scientific communicators feel an urgent need to correct information that is inconsistent with the weight of scientific evidence. But under most circumstances, doing so is difficult: Repeating false information can reinforce belief in that information, even if it is followed by a correction. It is possible that debunking efforts may be more effective with the undecided majority of people than with the firmly entrenched minority. More study is needed to determine for whom and under what conditions current understandings about debunking apply.

Framing. Framing is presenting information in a certain light to influence what people think, believe, or do. Research is needed to determine the extent to which framing of an issue matters and when it is best done and to better understand its effects using national samples and studies that reflect complex, real-life communication environments.

COMMITTEE ON THE SCIENCE OF SCIENCE COMMUNICATION: A RESEARCH AGENDA

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For More Information . . . This Report Highlights was prepared by the Committee on the Science of Science Communication based on the report, *Communicating Science Effectively: A Research Agenda* (2016). The study was sponsored by the Burroughs Wellcome Fund, David and Lucile Packard Foundation, Gordon and Betty Moore Foundation, Rita Allen Foundation (via Climate Central), and William and Flora Hewlett Foundation. Any opinions, findings, conclusions, or recommendations expressed in this Report Highlights are those of the authors and do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the report are available from the National Academies Press, (800) 624-6242; http://www.nap.edu or via the DBASSE page at http://nas.edu/communicating-science.

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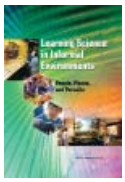

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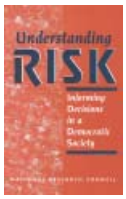

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