CHAPTER 8

Communicating with Public Audiences

8.1 Why Do Scientists Communicate with Public Audiences?

In Chapter 1 we noted that scientific disciplines are not only communities in themselves but also parts of the larger society in which these communities are situated and in which scientists work and live. This relationship between scientists and society is of great interest to the National Academy of Sciences and other national research associations, who together convened the Committee on Assessing Integrity in Research Environments (CAIRE). In a report issued in 2002, CAIRE et al. state:

> The pursuit and dissemination of knowledge enjoy a place of distinction in American culture, and the public expects to reap considerable benefit from the creative and innovative contributions of scientists. As science becomes increasingly intertwined with major social, philosophical, economic, and political issues, scientists become more accountable to the larger society of which they are a part. (p 33)

In previous chapters we have explored genres and conventions that professional scientists use to communicate with each other. In this chapter we will explore conventions used to communicate knowledge of science and scientific research to public audiences in the larger society.

The term *public audience* is a rather loose one and is meant here to imply a wide range of listeners and readers with a variety of interests, needs, and educational backgrounds. It may be a group or a professional person (even with a PhD in another field) in need of information about a particular scientific topic, or a general reader or listener simply curious about science. Public audiences for science thus can include, but are not limited to, those who regularly use the results of scientific research in the course of their daily work (such as agricultural

producers, fish and game managers, medical professionals); administrators, local government agencies, and other public officials who need scientific information to make decisions about issues such as waste management, industrial and environmental regulations, and road construction; clubs, classes, and other educational or special-interest groups that want to learn about science; private citizens who use natural resources for hiking, hunting, fishing, and other recreational purposes; and members of the public at large, who have a vested interest in science insofar as they support it financially through government funding and must live with its consequences.

Thus, public audiences are not monolithic, but rather quite diverse, and so no single, "rationalistic" formula will suffice to define them or their interests (see Locke 2001). In addition to addressing more general audiences *within* the scientific community (e.g., readers of journals such as *Science* and *Nature*, or the mixed audience of the research proposal), scientists may wish to write articles for the much broader audiences that read science-oriented journals such as *Scientific American* and *Discover*, general-interest publications such as *Time* and *Newsweek*, or the feature section of a newspaper. They also may be called on to make presentations to public audiences, participate in question-and-answer sessions, take part in public policy debates affected by developments in their research areas, and give press releases and radio, television, or online presentations and interviews on important discoveries or issues in their field.

There are three major reasons scientists communicate with the general public: moral, economic, and political. The National Academy of Sciences asserts that scientists have an ethical responsibility to understand and explain the effect of the work that they do on the society in which they live:

> The occurrence and consequences of discoveries in basic research are virtually impossible to foresee. Nevertheless, the scientific community must recognize the potential for such discoveries and be prepared to address the questions that they raise. If scientists do find that their discoveries have implications for some important aspect of public affairs, they have a responsibility to call attention to the public issues involved. (NAS 1995, p 20)

Genetic research—including genetically modified foods (GMFs), pharmacogenomics, stem cell research, cloning—are obvious cases in which scientific discoveries are morally controversial or have complicated, long-term implications for society. Other controversial areas of research include global climate change, nuclear power, environmental protection and wildlife preservation, the use of laboratory animals in medical research, the prescribing of psychiatric drugs, the unnecessary overuse of medical technology diagnosis and treatment (see Berenson 2008) and in artificially prolonging life, and biological studies of race and gender.

A second reason scientists communicate with the general public is economic and hinges on the practical question: Who funds science? In addition to private labs, corporations, and universities, it is the government, and therefore the public, that funds science through tax dollars and so indirectly chooses which projects to support. Public financial support of science takes two forms: the funding of governmental agencies that conduct scientific research and the funding of government grant programs that support research by scientists at other institutions. The federal government's proposed budget for 2008 included $6.065 billion for NSF (Mould and Cabbage 2008g), $17.6 billion for NASA (2008e), $95 billion for the USDA (2008), and approximately $28 billion for NIH (2008), with a request of $29.5 billion for year 2009. Increases in some areas of scientific research and education were undoubtedly spurred by the terrorist attack on the United States on September 11, 2001, notably research on biochemical and biological agents. But other government-run programs have either been scaled back because of budget cuts (e.g., NASA's Mars expeditions) or eliminated altogether (the Superconducting Super Collider). "Big science" projects in which the federal government plays a major role (such as the Hubble Telescope, the International Space Station, and the Human Genome Project) require costly equipment and the coordination of efforts of scientists around the world and can be prohibitively expensive. In times of renewed budget deficits and economic belt tightening, scientists must be able to convince not only their peers but also the public and its official representatives in government of the worthiness of scientific projects. Responsibility for garnering public understanding of, enthusiasm for, and goodwill toward science ultimately rests with scientists.

The third reason scientists should learn to communicate with the general public is related to the politics of a democracy. A democratic society requires that its citizens (both electorate and elected) be informed about the issues that confront it. Since science is a major cultural force in our democracy, many of the policy decisions we make are about or based on science. As the National Academy of Sciences states:

> [S]cience and technology have become such integral parts of society that scientists can no longer isolate themselves from societal concerns. Nearly half of the bills that come before Congress have a significant scientific or technological component. Scientists are increasingly called upon to contribute to public policy and to the public understanding of science. They play an important role in educating nonscientists about the content and processes of science. (NAS 1995, p 21)

Thus, a democracy such as ours needs a scientifically informed citizenry to arrive at good decisions about what research to support and how to interpret and apply its results (see O'Keefe 2001). In a 1996 survey of the American public, the National Science Foundation found only 25 percent performed well on a basic test in science and economics (Associated Press 1996). That same survey, however, found that 72 percent of the participants considered scientific research valuable. A later study by NSF found that "[M]ost Americans have a positive attitude about science and technology" (CAIRE et al. 2002, p 16), but also argues that scientists themselves have an important role to play in maintaining that positive relationship with the public. Citing a 2005 article by Michael Specter in the *New Yorker*, Donald Samson writes that the United States lags behind other countries in students' and the public's understanding of science. According to Specter, the high school seniors in the United States "'performed below the average of twenty-one countries on a test of general knowledge of mathematics and science—and in advanced courses, the U.S. was close the bottom (p 68)'" (Samson 2006, p 5). Significantly, Samson's article is not (only) an argument for increased education in science and math, but also an analysis of the role of ineffective and even damaging communication of science to students and to the public, and the need for improved reading and writing skills in scientific education. It is also an argument for the need to make science not only accessible and comprehensible to students and public, but more interesting and appealing to them as well. (Farmelo [2000] had made a similar argument but added that scientists also need to battle bungled science that gives scientists bad press.)

Scientists can help citizens understand and continue to appreciate science by becoming aware of the various media and genres through which the public gets its information and by learning to use the technologies of those media and the conventions of those genres to effectively communicate with the public. In 1990, John Wilkes, director of the Science Communication Program at the University of California–Santa Cruz, noted that "U.S. citizens get up to 90% of their information about science from newspapers, magazines, and, to a lesser extent, television. As producers of scientific knowledge, scientists are in the best position to use the media to teach the public what it wants—and needs—to know about developments in medicine, science, and technology" (1990 p 15). In 2006, Samson, a science communication expert, argued that despite the increasing prominence and importance of science via television and the Internet, most Americans still get the bulk of their news from print sources. Samson suggests that while television broadcasts by their very (technological?) nature tend to be superficial, and the credibility of Internet posts is always an issue, general public science journals like *Popular Science* and specialty public science journals like *Scientific American* can cater to specific sets of interests, explore issues in much more depth, and are more reliable. In addition, Samson (2006) states that: "We tend to associate science coverage with the specialty magazines, but far more readers get information about science from daily newspapers and more general weekly and monthly magazines," publications with enormous circulations (p 7).

While most scientists are not professionally trained in speaking or writing to general audiences, many scientists have recognized that the general public is an important audience to reach. As Bazerman demonstrates in *The Languages of Edison's Light* (1999), Thomas Edison was a master of public relations; it would not be far-fetched to say that the adoption of electric power and light was the result of his ability to employ various media (including the light bulb itself in spectacular displays of electric power) to persuasively communicate with a diversity of audiences: investors, businessmen, the U.S. Patent Office, international governments, the press, and the public.[1] Books and articles by such famous scientists as physicist Stephen Hawking, paleontologist Stephen Jay Gould, marine biologist Rachel Carson, research physician Lewis Thomas, and anthropologist Richard Leakey—just to name

[1]Lievrouw (1990) studied the Pons and Fleischmann debate as a modern-day example of the way "scientists strategically use popular media to make knowledge accessible to the public at large and to make themselves known" (p 1).

a few—as well as the current popularity of television programs about science (*National Geographic Explorer, Nature*, and *NOVA*), represent more traditional but effective means for scientists to reach outside their profession to wider audiences.

But earlier studies of the impact of technologies on audiences also suggest that technologies do change "the range of experiences and skills that audiences bring to media" (Nightingale 1986, p 31). Given Edison's achievement, it is perhaps also fitting that the explosion of communication technologies should make communicating with the public easy and more urgent. Popular websites like PubMed Central (www.pubmedcentral.nih.gov), "aims to fill the role of a world class library in the digital age" (PubMed Central 2008). The non-profit Public Library of Science (PLoS) (http://www.publiclibraryofscience.org/), or *SEED Magazine* (http://seedmagazine.com/) allow readers to view, listen to, read, research, and respond to science by blog. YouTube broadcasts and/or iTune podcasts of webcam, video, or 3D animation feature how-to astronomy demonstrations or physical explorations of space specifically designed by amateurs, companies, or agency-scientists themselves. These new forms of communication make use of newer low-cost as well as high-end technologies to appeal to younger viewers and shape the public's understanding and perception of science (see Shida and Gater 2007).

But the availability of powerful communication technology does not in itself guarantee successful communication. In Chapter 3 we explored how new communication technologies, as a potentially democratizing force, have both provided the means but also increased the need for scientists to communicate with the public. We also explored how it is a commonplace that because of the open, rapid, and anonymous sources of the public communication of science online, and the frequent lack of quality control mechanisms, not all the information found on the web is reliable. Given this technology, both the general reader *and the scientist* have the added responsibility to communicate directly and effectively with the public in a variety of media (see Shida and Gater 2007).

One solution to the inconsistency of online communication, then, may be the direct interaction of scientists with the public online. The interactive capabilities of the World Wide Web make the Internet a potential meeting place where scientists can interact not only with each other but also with other publics. In fact, the online journal *Issues in Science and Technology Online* (2007), "a forum for discussion of public policy related to science, engineering, and medicine" envisions itself as a public meeting place, focusing on social policy as well as policies designed to enhance specific research fields—and not only the communication of social policy, but also the interactive discussion of it. The journal's editors state their mission on their homepage:

> Although *Issues* is published by the scientific and technical communities, it is not just a platform for these communities to present their views to Congress and the public. Rather, it is a place where researchers, government officials, business leaders, and others with a stake in public policy can share ideas and offer specific suggestions.
>
> Unlike a popular magazine, in which journalists report on the work of experts, or a professional journal, in which experts communicate with colleagues, *Issues* offers authorities an opportunity to share their insights directly with a broad audience. And the expertise of the boardroom, the statehouse, and the federal agency is as important as that of the laboratory and the university. (http://www.issues.org/about.html)

All of these developments suggest that rather than heading to ivory-tower labs and leaving the communication of science to journalists, scientists are taking to public pages and airwaves and fiber-optic cables to explain their work. An understanding of the principles and techniques of audience adaptation, and of general audiences themselves, is essential for successfully communicating with the public in any medium.

EXERCISE 8.1

Choose a topic in your field (perhaps derived from a research report you have read), and identify some specific public audiences you might address on this topic. Who outside your field might read or listen to what you as an expert have to say about this topic? Why would they be reading or listening? What media would they likely use? How do the needs and interests of these groups differ from those of experts in your field? What do they want or need from your presentation, and how much would they already know? (Are there any public audiences with whom experts in your field might communicate but currently don't?)

EXERCISE 8.2

On the World Wide Web, search for information on a subject that you are interested in but don't know anything about. After reading the material, speculate on whether the information is reliable—whether you can trust this website. How do you know? List your specific observations about the author(s), the organization(s), the website design and graphics, the content, the terminology and style, and anything else that you are using to assess the validity and truthfulness of the information the site contains. What are some of the ways the public evaluates online information? What questions about the validity and truthfulness of the information remain unanswered for you? What else do you need to know before you can trust this site? How can online communication with the public be improved?

8.2 Understanding "General" Audiences

Some research indicates that human reasoning, even in sciences, is "proverbial"—based on human experience and common sense (e.g., Shapin 2001). But of course, human experience varies. Public audiences can be as diverse as the general population in their knowledge, interests, and needs. Listeners and readers in these audiences will possess varying types and degrees of scientific knowledge. What these general audiences have in common is a presumed lack of knowledge about *your* topic. Just as scientists must understand the conventions governing communication with their peers to be successful professionals, so too must they understand the conventions of communicating with public audiences in order to do so successfully. In this chapter we discuss some general strategies for adapting scientific information to meet the needs and interests of non-scientists in a wide range of situations. These strategies can then be applied to specific audiences, genres, and mediums as the occasion demands.

The basic principle of audience adaptation is that we build a discussion or argument on the knowledge, goals, values, and experience of the audience. This principle is the basis of *all* successful communication and teaching, including that between professional scientists. It is also essential for the scientist communicating with public audiences in any medium. In adapting scientific information for nonspecialists, the writer or speaker introduces new knowledge by trying to relate it to what the audience knows or values; this new knowledge, grounded in what the audience already knows, then becomes the foundation for more new knowledge and so forth.

When you write for other scientists in your area of specialization, such as in the research report, you can assume your readers have some degree of familiarity with the topic to begin with, as well as some degree of interest. When you write for public audiences, however, you need to be more cautious. Instead of assuming knowledge on the part of your readers, you must help them develop that knowledge; instead of assuming interest in the topic, you must generate interest. The way to begin is by assessing your audience's knowledge, needs, and goals.

In *The Rhetorical Act,* Karlyn Kohrs Campbell (1982) gives the following advice on assessing audience (p 149–150). Consider your subject *from the point of view of your readers or listeners.*

- What expectations does your audience have about the subject? About you?
- How is your audience likely to see and/or understand the topic or issue?
- Are there conflicting beliefs or concepts that will have to be dealt with, and how will you deal with them?
- Are familiar explanations trite or boring?
- Does the audience have firsthand experiences that you can draw on to illustrate points in your discussion?

To answer these questions, you will need to find out as much as possible about the background, areas of expertise, probable beliefs, values, and general interests of members of your audience. One way to learn about your audience is to ask the organization sponsoring your talk about who will be in attendance and why. Or read the magazine you are writing for and look at specific text features as described in Exercise 8.3; these features can often provide hints about how to interpret and adapt to a particular audience.

Consider the rhetorical situation in the following scenario.

Jane, a premed student working with lasers, wanted to show her friend, Mike, a zoology major, how a new laser in her lab worked: "Come on over to my lab and I'll give you a demonstration." Mike had never studied or worked with lasers, but