Science + Society: Closing the Gap

More than 1500 science educators from 34 states and 20 countries came to Boston on 19-21 January 2007 for a conference on "Science + Society: Closing the Gap," sponsored by Partners HealthCare's Office of New Ventures, with support from the National Science Foundation and Ortho-McNeil Neurologics.

As JoAnna Baldwin Mallory, Director of Partners HealthCare's Office of New Ventures, explained at the beginning of the conference, its purpose was threefold: 1) to better understand and appreciate science; 2) to take a critical look at how science is communicated; and 3) to create an event that crossed disciplines. In fact, the communication of science from a scientist to a nonscientist of necessity crossed disciplines, and it was the gap between scientific and nonscientific disciplines that the conference was intended to close.

The conference's two keynote speakers, Shirley Ann Jackson, President of Rensselaer Polytechnic Institute, and former Vice President Al Gore, were quick to address this gap. Ideally, Jackson said at the outset, there should be no gap between science and society. Her suggestion to close it was a president-day *agora*, a meeting place where people can exchange information. But, she added, when the agora is populated by self-proclaimed experts, the voice of truth is drowned out.

Gore picked up on Jackson's idea of an agora and continued to chronicle it through history. The agora's successor in Rome, Gore pointed out, was the forum. After a long hiatus (of the Dark Ages) a new substitute arose in the form of the printing press, which he said led to the rule of reason, from which the U.S. emerged. But he lamented that that ended 40 years ago with TV (which is also the outlet for most political advertising) -- and the Internet has yet to overcome this (many Internet users, Gore noted, are also watching TV). Gore was particularly concerned about the lack of public participation on the part of TV viewers. When the print media dominated, he said, people had more opportunity to be involved. And in the absence of public participation, policy makers feel that they can shut down programs that sample public opinion, because no one cares. Gore called for a restoration of reason to the political process and an end to the censorship of science being practiced by the current administration.

Engaging the Public

Both Jackson *and* Gore saw the need for participation by the scientific community in the setting of political policy. Subsequent speakers also expressed the need to involve people in setting science policy, thus citing a twofold need for science and society to have places to meet. The first of these was Alan Leshner of the American Association for the Advancement of Science, who felt that today's relationship between science and society is more intense than at any time in his lifetime. Leshner felt that this is because the relationship between science and society now involves more core values that affect people's lives more greatly, like embryonic stem cell research. Leshner added that public understanding is not enough; it must be replaced by public *engagement* – and this also requires a better understanding of the scientific enterprise.

A panel of speakers on "The Public's Role in the Scientific Enterprise" discussed venues for public participation on 20 January. Edna Einsiedel of the University of Calgary noted that it used to be that the public was able to evaluate a new product only once it reached the marketplace. In the future, Einsiedel sees public stakeholders involved at earlier stages and cited several deliberative models for the public to interact with the scientific community – consensus conferences, citizen juries, scenario workshops, and deliberative polls. In fact, she observed that the U.S. 21st Century Nanotechnology R&D Act (2003) requires consultations between scientists and citizens.

Consultations between scientists and citizens have been employed for issues ranging from local to global impact, Einsiedel went on, giving genetically modified food as an example in Europe. She felt that such public participation initiatives provided such benefits as foresight rather than hindsight, sustainability, accountability, and legitimacy.

Stef Steyaert of the Flemish Foundation of Science and Technology Assessment then described the process of a consensus conference (described by Richard Sclove, Director of the Loka Institute, at STS-13 and reported in our Spring 1998 issue). A consensus conference, Steyaert said, employs a lay panel of 15-30 citizens, which deliberates the societal aspects of a development in science or technology and issues a report. This panel is assembled on the basis of responses to between 4000 and 8000 invitations, with age, gender, motivation, and social class given proper balance, although the work required of a panel member typically leads to a greater representation of activist citizens. An information brochure (based on technical reports rewritten in plain language) is supplied to each panel member.

A first study weekend emphasizes team building among the panel members. On a second weekend, typically six weeks later, experts make presentations and key questions are formulated. This is followed by a public conference where "reference persons" make presentations, after which the final report is written. Steyaert said that the final recommendations are unanimous 95% of the time.

Public participation is important for pragmatic, moral, and content-based reasons, Steyaert said, although the impact is hard to quantify. He added that consensus conferences also set new items on the policy agenda.

Heather Mayfield, Director of Science Museum Live at the Science Museum, London, described the activities of the Dana Centre's innovative adults-only programs that seek to bring scientists and the public together to discuss topical issues at the Museum. The Dana Centre programs three nights per week for people over 18 to discuss brain science with neuroscientists. They can also see brain surgery performed at the museum cafe. Mayfield also described the European-wide DECIDE Project, which requires groups to come to a conclusion on a biotechnology project, with the assistance of tabulation on a website, and the Nanodialogues, which have brought people together to discuss nanotechnology at museums all over Europe.

Douglas Sarno of The Perspectives Group described how the lack of public participation killed efforts to build the now-defunct Superconducting Super Collider at FermiLab in Illinois and how the efforts of his group have turned things around with regard to building the future

International Linear Collider there. Public participation does not empower the public to say how science is to be done, Sarno said, but it does seek to get the public to buy into a policy decision about science and it does require the public to understand the science. It requires shared learning, relationship building, and dialogue. Sarno's approach is to build open, honest relationships, welcome all views, and involve all stakeholders at all stages.

Emmanuelle Schuler described the Science Café she directs in Houston, TX, a cultural event held once a month. A Science Café, she said, is a public discussion in a coffee shop. After a 10-minute presentation, the floor is opened to questions and comments from the audience. Topics are typically recent science issues in the news presented by opinion leaders or representatives from local organizations or institutions (but not necessarily scientists). There are about 200 Science Cafés worldwide, including about 40 in the US, all of them different. The work is all done by volunteers, and recruiting presenters is the most difficult -- Schuler reported having to cancel one meeting because of inability to get a scientist to speak about stem cells.

Gerritt Rauws of the King Baudouin Foundation, the last speaker on "The Public's Role in the Scientific Enterprise," described a Europe-wide public deliberation about neuroscience, which he described as being on the cusp of revolution. In the two-year pilot project which resulted from three years of preparation, elements of a consensus conference were included, although a larger number of people representing a larger area (speaking eight different languages) were involved. Rauws reported that nine national assessment reports resulted in 37 recommendations to the European Parliament. The result demonstrated the viability of a multilingual assessment of a scientific development, Rauws said, but the multiplicity of languages was a bigger barrier than the number of people involved.

A last venue for public participation is science was the theatre, as presented by Catherine Hughes on the final morning of the conference in a short play about the *Titanic*. The play depicted compartmentalization between radio communications and navigation as preventing communication that might have kept the ship from sinking. Hughes spoke about the interaction of science and theatre and how the latter could raise questions about the former as well as use it as a vehicle for theatrical expression. People remember better what stimulates their emotions, she said, so expressing science through the arts facilitates the learning of science. Theatre in science museums differs little from theatre in a playhouse, she added.

Assessing the Gap

In addition to discussing ways to close the gap between science and society, other sessions highlighted problems posed by the gap that still exists. One was a 20 January panel on "Science, Pseudoscience, and Belief," composed of Connie Bertka, program director of the American Association for the Advancement of Science (AAAS) Dialogue on Science, Ethics, and Religion; Lawrence Krauss, Professor of Physics and Astronomy and Director of the Center for Education and Research in Cosmology and Astrophysics at Case Western Reserve University; Eugenie Scott, Executive Director of the National Center for Science Education; and Gerald Wheeler, Executive Director of the National Science Teachers Association. The panel was hosted by Harvard University's Philip Sadler, who asked his panelists to respond to the following two questions: 1) How can the public distinguish between science and pseudoscience? 2) How

should science ask people to deal with conflicts between their personal belief systems and scientific evidence? The scientific community may view itself as a minority, but to the public we appear as a Goliath, he said.

To Sadler's first question, Bertka cited the 1995 definition of Beyerstein, who characterized pseudoscience as done in isolation, apart from recognized organizations, non-falsifiable, and using "special pleading." Krauss said that what makes Americans more susceptible to pseudoscience is the amount of it they are exposed to, and he pointedly noted that this includes catalogs for audiovisual materials for science teachers. He also faulted journalism's presentation of the science-pseudoscience distinction, criticizing journalists' belief that there are two sides to every story, while in science one side is often just wrong. Because of their discomfort with science, Krauss felt that many journalists are hesitant to make pronouncements, adding that at the same time they are more concerned about providing entertainment, and that while science is based on honesty, full disclosure, and anti-authoritarianism, it is also regarded as dull, hard, and unrelated to the world.

Scott saw science, in addition to personal insight and authority, as a way of knowing, but limited to the natural world using natural processes. Noted for her valiant efforts to combat pseudoscientific alternatives to evolution, Scott observed that the public finds it discomforting when scientists must retract a conclusion they have found to be wrong. And Wheeler maintained that, regardless of what Al Gore had said about TV viewing in his keynote address, most young people get most of their news from the Internet. Yet, recalling the solicitations for medical advice received by Marcus Welby (played by Robert Young in a 1970s TV series), Wheeler also felt that the American public has difficulty separating fact from fiction.

In responding to Sadler's second question, Bertka replied that in reaching out to others, the scientific community needs to be proactive for the long term. In dealing with evolution and religion, she said, we don't want to impart that science and religion are in conflict and we need to be clear about the limitations of science. Scientists cannot be deaf to concerns about the consequences of evolution, she added. *The Evolution Dialogues* is how the AAAS has sought to reach out with a sensitivity to these concerns. But it is not expected to obviate the need for the work Scott is doing, Bertka noted.

Krauss stated that one thing scientists can do in responding to conflict between personal belief systems and scientific evidence is to confront misconceptions. Without science, Krauss noted, everything is a miracle. Though science doesn't preclude belief in God, Steven Weinberg notes that it makes it possible *not* to believe in God. While Intelligent Design (ID) is marketed as open-minded, honest, and fair, Krauss said that scientists should market it as closed-minded, dishonest, and unfair. But, he added, scientists don't know how to market as well as the ID people. The purpose of education, Krauss went on, is not to validate ignorance but to overcome it. Neither science nor faith is the enemy, he said: *ignorance* is the enemy. Reinforcing Krauss, Scott said that science teachers have an obligation to impart to their students the nature and practices of science, not only at the beginning of the year but with continual reinforcement throughout the year. And Wheeler suggested looking at "truth" and "clarity" as complementary qualities in the communication of science.

Another 20 January panel which highlighted the gap between science and society was that on "Science in the Media," moderated by Jeffrey Brown of *The NewsHour* (PBS) and composed of Timothy Ferris of the University of California, Berkeley; Deborah Blum of the University of Wisconsin-Madison; Larry Klein of *NOVA*; and Jennifer Lawson of Howard University Television. Although Ferris did not regard TV as a medium for learning science (he felt it can appeal more to the emotions than the intellect), he agreed that TV could motivate people to learn on their own. Lawson observed that You Tube has enabled anyone to be a producer and get exposure. Blum noted that journalists have succeeded in engaging people to learn science by attracting them with an interesting story, then following it with information and repeating the cycle -- her *Sacramento Bee* story on "lying chickens" also taught her readers about animal behavior and the scientist who did the research. Klein reinforced Blum by noting the two rules which have enabled *Horizon* to be a popular series: everything takes a back seat to the story; and science is introduced as part of the story to the extent that it is needed. Klein said that while this may be considered to be "science lite," viewers are still being exposed to more science than if they had not watched the program at all. Yet, Klein, as the producer of *NOVA*'s "Why The Towers Fell," wondered why websites advocating other explanations got more hits than the PBS/*NOVA* website. Was this a case of science *vs.* pseudoscience, he asked.

Yet this gap is not unique to science, Klein said later. He reported finding equal ignorance about world affairs and political processes. The gap is one that covers all fields of education. In fact, Lawson added that research by the Corporation for Public Broadcasting consistently shows that *NOVA* and *Scientific American Frontiers* have high ratings, and Ferris noted that PBS polls showed science as the third favorite topic, behind only sports and news. Lawson said that this is why PBS has invited viewers to download pilots of three new science series from the PBS website and recommend which should be developed further.

The role of science in news coverage was also discussed by Blum and Brown. Brown wondered whether we are making science an accepted "normal" part of the news by highlighting it in the main part of a newspaper or newscast? Blum noted that science sections in newspapers were trendy a decade ago but that some newspapers have recently been pulling them back. Even *The New York Times* "Science Times" is more "news you can use " -- *e.g.*, personal health. On the other hand, science sections "ghettoize" science and make it appear more nerdy. Science stories as part of general news coverage make science appear to be a more acceptable thing to cover, Blum said.

The conference summation was given by Rita Colwell, Director of the National Science Foundation (NSF) from 1998 through 2004 and now at the Johns Hopkins Bloomberg School of Public Health and the University of Maryland. She saw the conference as an example of the agora cited by Jackson and Gore but wondered how we scale up the meeting of minds at the conference to the 300,000,000 people living in the U.S. She also opposed the transfer of $200 million for science education from NSF to the US Department of Education and attributed it to Lynn Cheney's distrust of discovery-based science education.