



# Setting the Stage

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**ISE Summit 2010** | Surrounded by Science  
Washington, D.C. March 3-5

**caise** | center for advancement of  
informal science education

This document is intended to be a faithful synthesis of a session that took place at the Informal Science Education Summit 2010 in Washington, D.C. March 3-5. It is meant to serve as a resource for those who attended and for others in the field.

Participant comments have been paraphrased and reordered. These are not exact quotes, rather they are an attempt to capture the content and meaning of the ideas presented. The contents of this document do not necessarily reflect the views of CAISE, the National Science Foundation, or individual meeting participants.

This is one of a series of documents covering the ISE Summit 2010. For more visit [insci.org](http://insci.org).

### Community Timeline

Summit participants posted memories, sketches and snapshots of key events that helped to shape the informal science education field and tagged the time when they entered the field. See the timeline at [insci.org](http://insci.org).

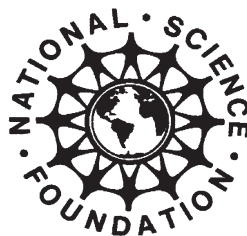
### Sparks!

These illustrated, online posts about informal science education projects appear on the CAISE Web site, contributing to a picture of the field.

<http://insci.org/sparks>

### Documentation

Catherine McEver  
The Bureau of Common Sense



<http://www.nsf.gov>

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# Setting the Stage

## Opening Remarks

### CAISE and ISE

Wendy Pollock

Principal Investigator/Director, Center for Advancement of Informal Science Education

Welcome to the Informal Science Education Summit. There are almost 450 of us here today. We work in television and radio, zoos and botanical gardens, science centers and natural history museums, children's museums, planetariums, youth and community programs, with after-school, environmental education, and cyber-enabled learning. Among us are people from federal agencies and private funders that support our field and researchers and evaluators who study learning in informal environments. We come from at least 38 states and several Native nations, from Puerto Rico and the District of Columbia—and from Canada and China.

Together we are reaching millions of people every year with an extraordinary array of opportunities to discover, to explore and to learn. This is an opportunity for us to celebrate the work we do and to strengthen our connections across this field.

The Center for the Advancement of Informal Science Education (CAISE) was founded three years ago with support from the National Science Foundation. The original idea was that we would serve primarily as a technical assistance

center for people working as principal investigators for grants from the NSF Informal Science Education program. When we had our first summit two years ago, we realized (and evaluation suggested) that by working more broadly to strengthen and connect the field, we would also be better serving NSF and its grantees. We decided to open the summit to wider participation, and with NSF's generous agreement, that's what we've done—and here we are today.

At CAISE, our vision is of a field that is recognized for its fundamental contribution to STEM education and to society as a whole. We want you to go away from this meeting better able to

Wendy Pollock

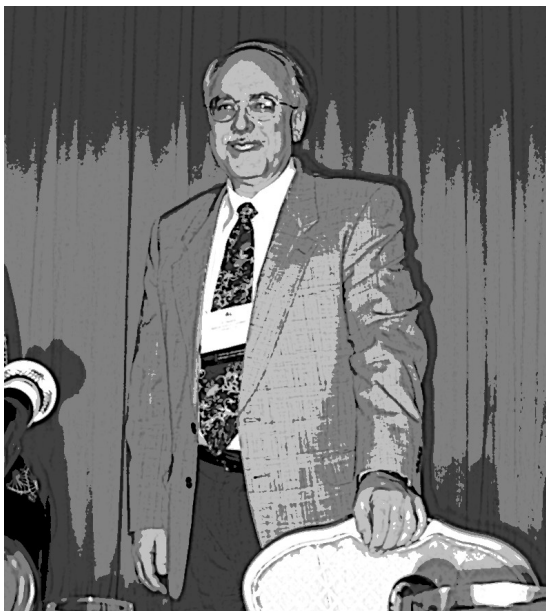


### CAISE Partners

Founded in 2007 with support from the National Science Foundation (NSF), CAISE is a partnership among the Association of Science-Technology Centers (ASTC), Oregon State University (OSU), the University of Pittsburgh Center for Learning in Out-of-School Environments (UPCLOSE), and the Visitor Studies Association (VSA).

- Wendy Pollock, PI and Director
- John Falk, Co-PI, Free-Choice Learning Program, OSU
- Kevin Crowley, Co-PI, UPCLOSE, University of Pittsburgh
- Alan Friedman, Co-PI, VSA
- External evaluator: Inverness Research
- Multimedia designer: Ideum





Al DeSena

make the case for this field and the value of the work that we do. We also want you to go away having connected with people you don't already know because, by working together, we can be much stronger.

I would like to acknowledge how grateful we are to the National Science Foundation for supporting our work, and will turn it over to Al DeSena.

### NSF and ISE

**Al DeSena**  
**Program Director, Informal Science Education,**  
**Division of Research on Learning in Formal and**  
**Informal Settings, National Science Foundation**

What I would like to do is offer a transition from the comments that Wendy just made about CAISE to the speakers that will follow. Part of this perspective is personal and part is

that of the National Science Foundation. What I would like to do is link what you are doing today to what the 2006 solicitation said when the Informal Science Education Resource Center from which CAISE evolved was first announced in competition. There were three major sections. One had to do with what we then called ISERC, the Informal Science Education Resource Center, which would help develop the field and provide support to principal investigators as well as support to the NSF program itself. There are a couple of items I would like to point out to you in order to continue the discussion.

One of the things that we asked for was that this organization would build capacity across the field and support continued professionalization of the field. It would also foster a community of practice that bridges the many varied forms in which informal STEM learning experiences are developed and delivered. As Wendy noted, that variation is represented in this room.

The center would also help with the knowledge transfer between research and practice, and the bringing together of researchers and practitioners of all sorts is part of that objective. The center would serve both existing PIs and prospective PIs, expanding the PI pool that existed in July of 2008 into one that is broader than that, drawing in a number of other professionals and increasing the diversity of the field. The center should also increase the communication among ISE awardees through PI meetings and other methods that encourage sharing of

### CAISE Steering Committee

- Julie I. Johnson, Co-Chair, Science Museum of Minnesota, St. Paul
- Barry A. Van Deman, Co-Chair, Museum of Life and Science, Durham, North Carolina
- Preeti Gupta, Chair of Leadership & Diversity Task Force, New York Hall of Science, Queens
- Diane Carlson, Giant Screen Cinema Association, Pacific Science Center, Seattle, Washington
- Tinsley Davis, National Association of Science Writers, Berkeley, California
- James Gee, Arizona State University, Tempe,
- Yolanda George, AAAS, Washington, D.C.
- Harry Helling, Crystal Cove State Park, Laguna Beach, California
- Richard Hudson, Twin Cities Public Television, St. Paul, Minnesota
- Bruce Lewenstein, Cornell University, Ithaca, New York
- Ellen Wahl, Independent Consultant, New York City
- Wendy Wheeler, The Innovation Center for Community and Youth Development, Takoma Park, Maryland

deliverables, practices and findings across projects. The ISERC should assist the ISE program in gathering and assessing evidence of impact across the portfolio. This notion of impact and evidence is something that is going to be on your plates for the next day or two.

Now I would like to take those ideas and transition them to NSF because I think there are some interesting parallels here. If I had a theme it would be that in our Informal Science Education program, NSF has historically both reflected the field and what is going on and also prodded the field to do new and better things, to have a stronger impact, to innovate and to collaborate.

For those of you who are not familiar with the structure of the National Science Foundation, the NSF has several directorates and offices. One of those directorates is Education and Human Resources. That directorate has four divisions: the Division of Undergraduate Education (DUE), Division of Graduate Education (DGE), Division of Human Resource Development (HRD), and the Division of Research on Learning in Formal and Informal Settings (DRL). That is where the Informal Science Education program resides. In DRL there are three clusters. One is the Knowledge Building Cluster, which is education research oriented. There is the Resources, Models and Tools Cluster, which is primarily K-12 formal education. Then there is the cluster called Lifelong Learning, and it is in that cluster that the Informal Science Education program sits.

Regarding the expertise of the staff in the ISE program, many of us wear several hats. There

isn't a one-to-one correspondence between the skills or expertise that we represent and any one individual, but we do include representation from the exhibit field; from broadcast media including films and television; from community involvement including Citizen Science; from lifelong learning; education research and evaluation; science research; technology; science museums; children's museums; and those from formal education backgrounds. NSF, and particularly our program, reflects the field, but we also broaden the field, and in many respects the kinds of things that CAISE is doing are things that we are grappling with every day: What business are we in? Who should be at the table? How do we foster improvement, innovation, collaboration and impact?

Those of us working in ISE at NSF represent different professional frames of reference. I can tell you that while we are very collegial, we also have a lot of arguments among ourselves and I think they represent the kinds of conversations that you in the field often have, so we are part of the field, we reflect the field. In many ways, CAISE is undertaking a major effort to try to move the collaborations, conversations and kinds of impacts that we have beyond any of the things that we have been able to accomplish up to this point in time.

*Wendy Pollock and Al DeSena*



David Ucko



## NSF Influence on Informal Science Education

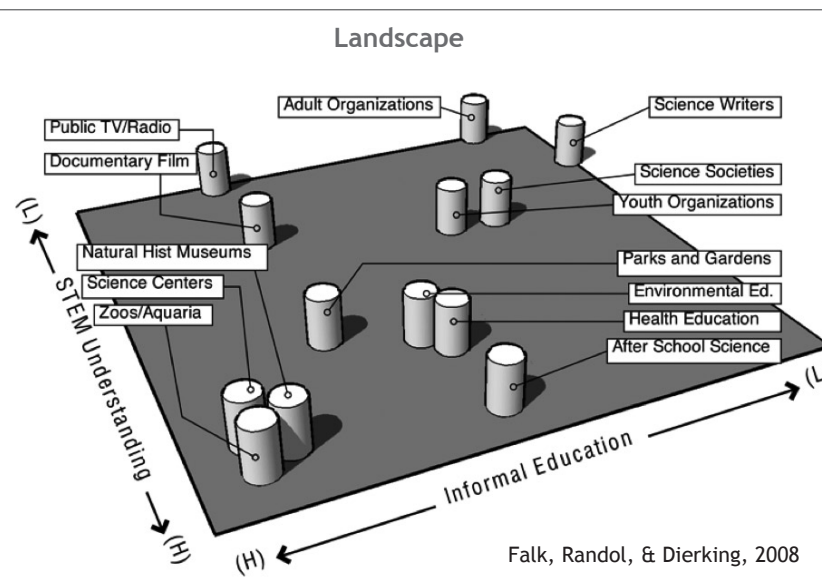
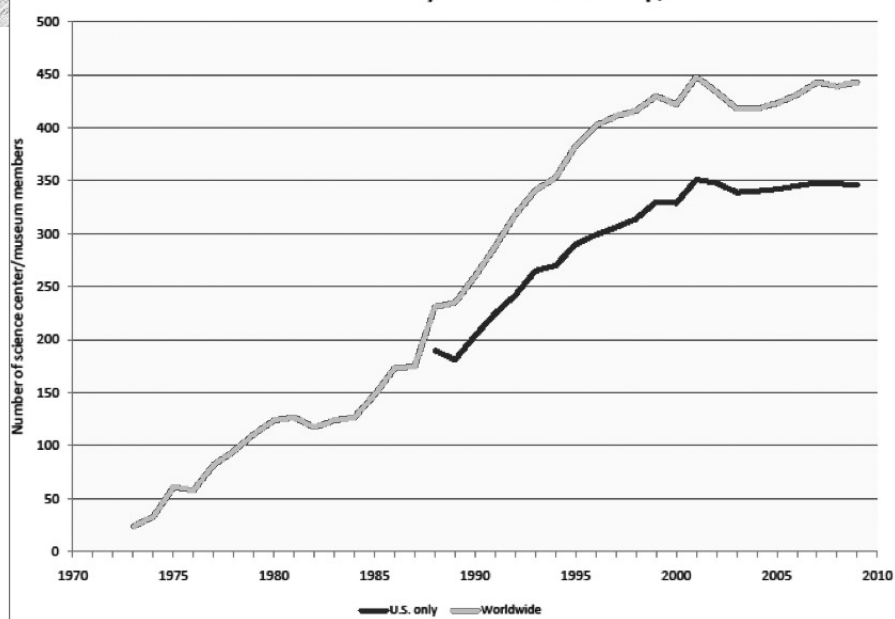
**David A. Ucko**  
 Division Director (Acting), Division of Research on Learning in Formal and Informal Settings, National Science Foundation

I'd like to welcome you on behalf of NSF in this, our sixtieth anniversary year. It's great to see so many informal science education professionals here, and the best part is that I don't know many of you! When I entered the field thirty years ago and went to an ASTC national meeting at the Exploratorium, there were about fifty people in one room. At that time you could literally know almost everybody who was active in the field. That's no longer possible, and the graph below gives you one indicator of what has

happened since then.

ASTC started in 1971 with sixteen organizations. Today there are 583 member organizations from 45 countries. In addition, the field has become increasingly diverse. The second figure below is from a landscape study that was done through CAISE. It shows the distribution of the various communities in the field along two axes. One is promoting STEM understanding and the other is practicing informal education. Some reflect a commitment to both of those dimensions, such as science centers, natural history museums, and zoos and aquaria. Others place greater emphasis on one or the other. Over the past sixty years, NSF has invested in most of these communities, along with academic institutions, to support the work that is going on at the intersection of these two dimensions.

**Growth of ASTC science center/museum membership, 1973–2009**





The NSF Act of 1950, which authorized the new agency, directed it to develop and encourage pursuit of a national policy for the promotion of basic research and education in the sciences. The initial focus was scholarships and graduate fellowships. The launch of Sputnik in 1957 brought significant budget increases for teacher institutes and curriculum development. That same year the Public Understanding of Science program was created.

#### Education at NSF

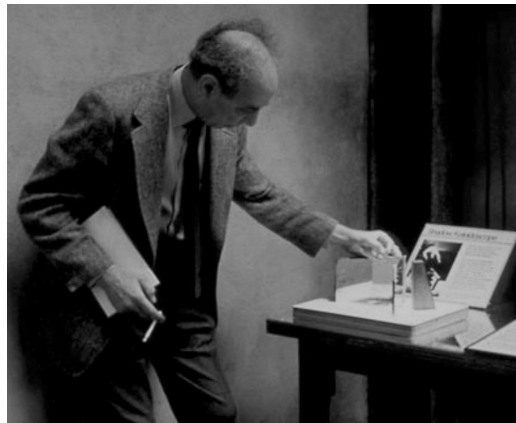
- National Science Foundation Act of 1950
- Public Understanding of Science (1957)
- Informal Science Education (1983)
- Directorate for Education & Human Resources

Informal Science Education, its successor, was formed in 1983 and as you heard from Al DeSena, is the primary program within the Division of Research on Learning in the Directorate for Education and Human Resources that promotes the public understanding of science and advancement of STEM literacy. It does so by investing in projects that advance knowledge and practice and build capacity.

NSF has supported the growth and development of science museums by funding both permanent and traveling exhibitions. The first one was a traveling exhibition in 1959 from the Maryland Science Center. In 1972 NSF invested in exhibits being developed by the Exploratorium. Frank

#### Exhibitions

- Maryland Science Center (1959)
- Exploratorium (1972)
- Global Climate Change (1990)
- Whodunit? (1992)
- ~50% of exhibitions toured by ASTC
- Lion's Mane (2003)
- Extreme Zone (2004)
- Children's Library Discovery Center (2005)



Oppenheimer, shown here, was the PI and as you know, these exhibits became the model for science museums around the world.

In 1990 we funded an exhibition on global warming, a traveling exhibition on the scientific basis for understanding global climate change, long before the issue became popular (or unpopular depending on your political point of view).

Over the years, NSF has funded approximately half of the exhibitions circulated by ASTC.

These are projects not funded by NSF, courtesy of *The Onion*.

#### Least-visited Science Museum Exhibitions

- Sheep Diseases of the World (Houston Museum of Natural Science)
- The Slide-Through Urinary Tract (Boston Museum of Science)
- Armour Presents: Hands-On Historic Sausage-Filling (Boise Children's Museum)
- "Sounds of the Prairie" Locked Isolation Chamber (Oklahoma Museum of Science and Industry)
- Tooth Decay: An IMAX Presentation (New York Hall of Science)



Source: *The Onion*

### Media

- NOVA (1974)
- 3-2-1 Contact (1977)
- NPR Science Desk, Star Date (1978)
- Square One TV (1987)
- Walking on Water (1987)
- Bill Nye the Science Guy (1992)
- Cosmic Voyage, Tropical Rainforest



I've included the *Lion's Mane* here, which you probably haven't heard of, because it shows what can be done with a low budget. This exhibit, which focuses on the role of a mane, cost \$75,000 and featured a full-size plush lion made by a toy factory. It was used by researchers to study the actions of lions in the wild and became the featured item of the exhibition along with a video.

The final two exhibitions listed are opening this year. The Extreme Zone at the California Science Center integrates live animal habitats on a large scale with science center exhibits. The Children's Library Discovery Center in Queens integrates science center exhibits within a children's library.

NSF has played a key role in stimulating and establishing media as a vehicle for STEM education. It invested in the first *NOVA* programs, now the longest-running science television show. *3-2-1 Contact*, funded in 1977, was the first daily children's science program. Later, *Square One TV* offered a daily series on math for children. NSF initiated the *NPR Science Desk* along with *Star Date*, the longest running national radio science feature, which was followed by *Earth and Sky* and many others. It helped to transform the IMAX film into educational media with *Tropical Rainforest*, *Cosmic Voyage*, *Storm Chasers* and many others. It funded a PBS program called *Walking on Water* that featured an unknown high school math teacher in Los Angeles, Jaime Escalante, which became widely distributed as *Stand and*

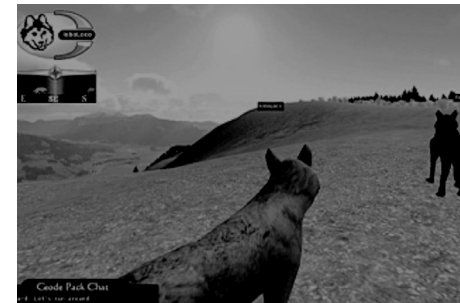
*Deliver*. It funded *Bill Nye the Science Guy* and today such programs as *PEEP and the Big Wide World* for preschool-age children.

In addition to exhibit technologies, NSF encouraged the development and application of digital technologies. I included *Demystifying Science* because I was familiar with it as the PI. The exhibition used Texas Instruments 99/4A computers, which were pretty innovative at the time with 16k of RAM.

*Hands-On Universe* allowed science centers to gain access to professional telescopes via the Internet. The *Electronic Guidebook* connected networked, hand-held computers to Exploratorium exhibits. It was followed up more recently by *Science Now Science Everywhere* at

### Technology

- Demystifying Science (1981)
- Hands-On Universe (1995)
- Electronic Guidebook (1999)
- Accidental Scientist (2001)
- Science Now Science Everywhere (2006)
- WolfQuest (2006)





the Liberty Science Center, connecting to the exhibits using cell phones. *Accidental Scientist* focuses on the science behind topics that capture the public interest, such as cooking, music and gardening, and cultivates links with Web sites commonly visited by followers of those avocations. *WolfQuest* is an online, multi-player video game featuring role playing as a gray wolf avatar to learn about ecology. Now nearly every project involves technology applications, including mobile and Web 2.0.

NSF has invested heavily in educational program development in museums, after-school programs and community settings, often focusing on underrepresented groups, parents and linkages to schools. An early example was the Integrated Community Science/Arts Program in New York City's Roosevelt Island, which was new at that time. It funded a play about the science of glass, which didn't quite achieve the success of *Copenhagen*.

Early support was provided to the AAAS Mass Media Science Fellows program and to many

#### Programs

- Integrated Community Science/Arts Program (1975)
- Glass (1977)
- Mass Media Science Fellows (1980)
- Girl Scout Leader Training Program (1987)
- Playtime is Science (1992)
- Community Science Workshops (1995)
- MAPPS (1999)

community organizations such as through the Girl Scout Leader Training Program. Support was also given to early childhood education such as Playtime is Science, an inquiry-based science program. Many investments were made in out-of-school science programs such as the Community Science Workshops, which started a national network providing after-school, family and summer science programs in underserved communities. There were also many parent-focused programs such as the Math and Parent Partnerships in the Southwest, which still helps Hispanic parents promote math learning for their kids. More recently, an NSF-funded conference led to formation of The Coalition for Science After School.

Citizen science in its current form was stimulated by a grant in 1992 to the Cornell Lab of Ornithology for Public Participation in Ornithology: An Introduction to Environmental Research, followed by funding for some twenty other citizen science projects. *Citizen Science Central* now includes many subjects for investigation beyond ornithology.

NSF encouraged evaluation for understanding the audience, developing prototypes and pilot



#### Public Participation in Science

- Public Participation in Ornithology (1992)
- ~20 "citizen science" projects
- Citizen Science Central (2006)
  - Birds, mammals, invertebrates, plants, invasive species, water & air quality, weather, climate change, astronomy



### Evaluation

- Formative evaluation (early 1990s)
- Summative evaluations (late 1990s)
- Informalscience.org (2002)
- Framework for Evaluating Impacts of Informal Science Education Projects (2008)



testing, and learning from completed projects. As a result of NSF grant requirements, front-end, formative and summative evaluation are now widely used. The evaluation section of *Informalscience.org* became a natural home for posting those evaluations. The *Framework for Evaluating Impacts of Informal Science Education Projects* was the product of a workshop that we organized for evaluation experts to bring greater coherence to summative evaluations based on impact categories for public and professional audiences.

NSF has been funding educational research for a long time. Early projects include *Investigation of the Effect of Field Trips on Science Learning* in 1977 by John Falk, and *A Longitudinal Study of the Development of Adolescent and Young Adult Attitudes Toward and Knowledge about Science and Technology* in 1986 by Jon Miller, among others. In 1992 NSF funded Valerie Crane to do a synthesis which was published as *Informal Science Learning: What the Research Says about Television, Science Museums, and*

### Community-based Projects.

The Museum Learning Collaborative was created in 1996 to support NSF and other agencies in generating a research base. By the time funding ended five years later, it had 2,300 citations. *Informalscience.org* now has over 5,000. More recently, we funded a synthesis by the National Research Council of the growing body of diverse research literature—*Learning Science in Informal Environments*—to provide a foundation for future research by making prior work more widely known and making recommendations for further study. This study enables practitioners to build on that body of research as they design and implement their informal science experiences. It became the basis for a companion publication, which is being officially released during this summit, called *Surrounded by Science: Learning Science in Informal Environments*.

Significantly, that report broadened the definition of learning beyond the four strands and the science proficiencies that were previously identified in *Taking Science to School: Learning and Teaching in Grades K-8*, to look at interest and identity. The report noted that informal environments can be particularly important for developing and validating learners' positive, science-specific interests, skills, emotions and identities. This finding isn't going to surprise anyone in this room, but coming from the NRC based on an extensive literature review, it provides external validation.

### Research

- Early projects
- Informal Science Learning: What Research Says... (1992)
- Museum Learning Collaborative (1996)
- Informalscience.org (2002)
- Learning Science in Informal Environments (2009)



### Learning Strands

1. Developing interest in science
2. Understanding science knowledge
3. Engaging in scientific reasoning
4. Reflecting on science
5. Engaging in scientific practice
6. Identifying with the scientific enterprise

National Research Council, 2009



NSF has encouraged many forms of collaboration to build capacity and attain outcomes not possible by a single organization. The Science Museum Exhibit Collaborative got early support in 1983 and continues today. The Science Carnival Consortia combined exhibits with training for new science centers. The Magic School Bus Collaborative developed programs, activities and exhibits based on the book and TV show. The Traveling Exhibits at Museums of Science (TEAMS) Collaborative developed traveling exhibits that increased capacity and research among small museums. The PIE (Playful Invention and Exploration) Network brought together the hands-on inquiry

approach of science museums with digital technology from the MIT Media Lab.

Today, KQED Quest is a large-scale, cross-platform collaboration involving research institutions, science and nature centers and community-based organizations. It continues Web, television and radio production, community engagement, and educational resource development, and offers a promising future direction for public media. In addition, the new Climate Change Collaborative brings together twelve science centers and twelve ecological research centers.

NSF has also encouraged formation of communities of practice to share knowledge and build capacity. For example, *Informalscience.org* is an online community as well as a resource. The Nanoscale Informal Science Education Network, which was created by the Museum of Science, the Exploratorium, and the Science Museum of Minnesota, is now in its fifth year and has fourteen organizational partners and activities at over 100 sites across the nation. They are developing and

### Collaboration

- Science Museum Exhibit Collaborative (1983)
- Science Carnival Consortia (1991)
- Magic School Bus Collaborative (1993)
- TEAMS [Traveling Exhibits at Museums of Science] Collaborative (1996)
- PIE Network (2001)
- KQED Quest (2009)



### Communities of Practice

- Informalscience.org (2002)
- Nanoscale Informal Science Education Network (2005)
- ExhibitFiles (2006)
- Center for Advancement of Informal Science Education (2007)



### Tipping Point

- Professional journals
- Professional organizations
- Private foundations
- Federal government



David Ucko (left) and Tom Kalil



sharing open-source resources and creating a community of practice among professionals from museums, universities and research institutions, with over 700 registered on their Web site.

*ExhibitFiles* is a community of exhibit developers as well as an online database. And finally there is CAISE, which was designed to foster a community of practice across this diverse field, building on the broad body of knowledge of research and practice. All of you are here today as part of that effort.

As a result of these and other investments, it is my opinion that the field is reaching a tipping point in terms of recognition of its educational impact on public understanding, awareness and engagement with STEM. Professional journals such as *Science Education* have featured special editions and ongoing series. Professional organizations like NSTA have an Informal Science Day. Private funders such as the Noyce Foundation have focused on informal learning. In the federal government, the Academic Competitiveness Council had Informal Education and Outreach as one of its three working groups. A House subcommittee hearing last year was held on “Beyond the Classroom: Informal STEM Education.” And of course, the turnout at this CAISE summit is another indicator.

NSF, and its Informal Science Education program in particular, continue to invest in R & D to build a knowledge base and to foster effective

practice, strengthening the informal learning infrastructure and capacity. I encourage you to build on the investments made by Public Understanding of Science and Informal Science Education programs. I also encourage you to think about integrating learning environments—at home, at school, and at “third places,” such as museums, libraries and the other settings represented here—to create a lifelong learning ecosystem both community-based and digital and taking advantage of mobile technology that makes learning possible at any time, any place by anyone. Perhaps we need a “grand unified theory” of learning.

### Looking Forward

- Build on growing base of research + practice
- Strengthen informal learning infrastructure
- Lifelong learning ecosystem
- Any time, any place, anyone
- Continued transformation of field

I thank you for participating in this summit and hope that your work will continue to transform the field. And finally, I look forward to getting to know many more of you during this meeting.

## Word from the White House

Tom Kalil

Deputy Director for Policy, Office of Science and Technology Policy, The White House

One of the things that I work on for President Obama is his strong commitment to improving STEM education in the United States. This is a real priority for a number of reasons. One is that he thinks that improved U.S. performance in STEM is important for our long-term economic fitness. As he says, the nations that out-educate us are going to out-compete us. Second is that he believes that science, technology and innovation have a critical role to play in virtually every challenge we face as a nation, whether it's accelerating the transition to a low-carbon economy or developing new biomedical technologies that allow Americans to live longer healthier lives. Facing these challenges requires advances in science and technology.

He also believes that the increased importance of science and technology means that STEM education is important for a better educated, more vibrant democracy. If citizens don't understand these issues, it's difficult for them to make informed decisions.

Finally, given that jobs that require science and technology skills often pay more—jobs in the technology sector, for example, may pay 80% more than the average private sector wage—then widening the circle of opportunity and increasing participation by women and men from underrepresented minorities in STEM fields

is very important for creating more economic and social opportunities for all Americans.

Those are some of the reasons that the President is committed to improving STEM education. One of the things that the President has made very clear is that although there is a lot that the federal government can do, and there is a lot that he is committed to doing, he really believes that we need all hands on deck. That is, this is not a problem that is going to be solved in Washington alone. In a major policy presentation he gave at the National Academy of Sciences, he issued a call to action to foundations, to companies, to governors, to science and engineering societies and to non-profit organizations to get more involved in improving STEM education.

In November we launched an initiative called “Educate to Innovate,” which has at its core the notion of improving U.S. performance in STEM and moving internationally from the middle of the pack to the top of the pack over the next decade, and getting more young boys and girls excited about and motivated to excel in STEM. A number of companies, private foundations and non-profit organizations have stepped forward and are beginning to make concrete commitments that I think are going to have a significant impact. Just in the last couple of months over a half-a-billion dollars worth of commitments have been made.

Time Warner Cable has decided to make this their number one corporate philanthropic issue and are working with the Coalition for

### An ISE end-user

I am the father of a seven-year-old and a ten-year-old. We have lived in the Bay Area and are big fans of informal science institutions in the Bay Area—the Lawrence Hall of Science, the Exploratorium, the Monterey Bay Aquarium, Chabot Space and Science Center, the California Academy of Science and others that we've had the opportunity to enjoy. So I have a first-hand appreciation for the work that you do.

Tom Kalil



Science After School. Their goal is to use their media properties to get a million kids interested in after-school science activities. Intel has committed to significantly expand their professional development activities, using technology and Web-based instruction to offer math and science training for classroom teachers.

The MacArthur Foundation is teaming up with Sony Computer Entertainment America (SCEA), in cooperation with the Entertainment Software Association and the Information Technology & Innovation Foundation to support a competition for the creation of compelling new digital games that offer learning experiences in science, technology, engineering and math.

The Association of Public and Land-grant Universities has made a commitment to address the shortage of math and science teachers by substantially increasing the number and diversity of high-quality math and science teachers that they graduate every year.

Dell Computers, Texas Instruments and a number of other companies are joining together to increase the scale of a program called UTeach, a national science and math initiative that started as a program at the University of Texas at Austin. It allows undergraduate college

students to earn a STEM-related teaching certificate over a four-year period while pursuing math and science majors.

There is also something called National Lab Day, which I encourage all of you to google. This allows a teacher to identify a hands-on science project that they are excited about bringing into the classroom and ask for volunteers to help support that project. Our goal is to try to create rich communities of learners comprised of teachers, scientists, engineers and other skilled volunteers, who help bring these hands-on activities into the schools.

One of my reasons for coming here is to challenge this community to identify ways you might get involved in this initiative by trying to figure out a goal that this community could rally behind in the way that a number of companies, foundations and non-profit organizations have done. That is something that you can use as a focus for your conversations. There will be an event sometime early this summer in which the President will highlight commitments to new and expanded activities related to STEM.

I'd like you to think about how you might get involved and also what role informal science institutions might play in making sure that there are really strong, well-organized networks at the state level on these issues. One of the things that we have discovered is that in some states you have a really strong coalition that includes the governor, the business community, higher education, informal science educators and philanthropists, and there is a clear set

<http://www.nationallabday.org>  
A National Barn-Raising for Hands-On Learning

**National Lab Day** BETA  
A National Barn-Raising for Hands-On Learning

HOME ABOUT NLD PROJECTS RESOURCES TESTIMONIALS

*Bring Exciting Hands-On Learning to Your Area*

It's more than just a day. We're building a community.

**TEACHERS**  
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WE'LL MATCH YOU TO PROJECTS NEEDING YOUR HELP. SIGN UP NOW.

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of goals concerning what needs to be done to improve STEM education, both inside and outside the classroom. A really strong coalition is required to take advantage of all of the assets of a state and mobilize the additional resources that are required. Given the geographic breadth and the depth of this ISE community, I think you can play a productive role in making sure that is happening in all of these states and not just some of them.

Let me bring up a few things that I think are particularly interesting and may lead to further interesting dialog. One is whether we now have the opportunity to put the tools of design, invention and fabrication at the fingertips of all children. One of the things that I've been very interested in is the emergence of the maker and do-it-yourself culture that you are beginning to see in things like *Make* magazine and Web sites like *Instructables*, and new technologies such as a 3D printer that makes

it possible to give kids the opportunity to know that in science you can actually see the physical substantiation of something important. Yesterday we had the opportunity to meet with some kids from a school in Los Angeles. None of their parents had gone to college, but all of them were planning to go to college and that, in large part, was because of their participation in hands-on learning activities like participation in the First Robotics Competition. Those types of experiences are very powerful and we should be thinking about how to take fuller advantage of them.

As the previous speaker noted, mobile technology has not only become ubiquitous but is also becoming increasingly powerful. NSF has been supporting a Science & Technology Center called the Center for Embedded Network Sensing (CENS), which is looking at the notion of participatory sensing systems. If you think of combining that with augmented reality and notions of citizen science, that is another rich area to support.

There have been questions regarding how we can use online video more effectively as a way of communicating about science. One

**Make:** <http://makezine.com>  
technology on your time

Blog MAKE Magazine Videos/Podcasts Projects



**MAKE, Volume 21**  
Build this 3-string instrument that requires a minimum of tools and parts, yet sounds great.

Make: Online



**instructables**

<http://www.instructables.com>

Tom Kalil (right) fielding questions from participants



### Boston Dynamics Big Dog



9, 712,333 views as of 3/10/10

<http://www.youtube.com/watch?v=W1czBcnX1Ww>

“ I hope that you will seriously consider getting involved in National Lab Day and think about what goal this community can identify for itself as part of the President’s ‘Educate to Innovate’ initiative. If you were collectively writing a letter to President Obama... what is the goal that this community could sign up for and be excited about pursuing? ”

of the things that I’ve been struck by is that every once in a while a video of a science and technology project is so compelling that it will get millions of views on *YouTube*. How many of you have seen *Boston Dynamics Big Dog*, the four-legged robot by Boston Dynamics? When you see that it changes your mind about what’s possible with technology. The question is, how do we do a better job of identifying some of those things that are so compelling? This involves not just getting kids and adults to watch the video, but then getting them interested in learning more about that technology and broadening their appreciation and understanding of where science and technology is headed.

Finally there is the interaction between games and STEM learning. I think this is another really powerful area that deserves more attention. The fact that 60 million people are playing *Farmville* and *Mafia Wars* should teach us something about how to grab the attention of kids and adults. It would be nice if we were able to use some of these technologies for a broader set of national purposes, rather than searching for a secret treasure. I think it’s worth having a discussion about what sorts of public-private partnerships we in the government could help facilitate using the tools that are available in agencies like the National Science Foundation, but also the President’s bully pulpit and ability to convene and to challenge people to do things.

One of the things I ask people is, if you were

President Obama and you could call and ask people to do anything, who would you call and what would you ask for?

I hope that you will seriously consider getting involved in National Lab Day and think about what goal this community can identify for itself as part of the President’s “Educate to Innovate” initiative. If you were collectively writing a letter to President Obama, as seventy-nine university presidents did regarding math and science teacher preparation, what is the goal that this community could sign up for and be excited about pursuing?

Tom Kalil (right) with Bruce Lewenstein



## Who Are We and How Did We Get Here?

Bruce V. Lewenstein  
 Professor, Departments of Communication and of  
 Science & Technology Studies, Cornell University



Bruce Lewenstein

I, too, am happy to see so many of you here, and I am especially glad to be here on a panel with Tom Kalil because he introduced the issue of politics and the connections that we have with political issues.

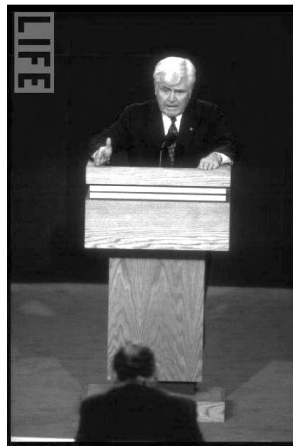
Let me ask whether anyone recognizes this person? This is Vice Admiral James Stockdale, who was vice-presidential candidate in 1992 and is most remembered for his words during a vice-presidential debate: “Who am I? Why

am I here?” It’s unfortunate that is how he is remembered because he is also an example of how much a person can accomplish and was both a POW in Vietnam and a highly-decorated Navy officer. I used those words because many of us may be wondering why we are here. What is it that this incredible diversity of people has in common? What is it that brought us all together, and what is it that we can achieve?

We come from so many different places. We have already heard about some of these programs and activities, such as *WolfQuest*. I happen to like it because one of my former students works there. These images reflect just a sampling of our diversity.

We have heard about NSF, but we are funded

“Who am I? Why am I here?”



Credit: A1



Credit: A2

Also 8-year POW in Vietnam, president of Naval War College, one of the most highly-decorated American Navy officers in history



Credit B1

Credit B2

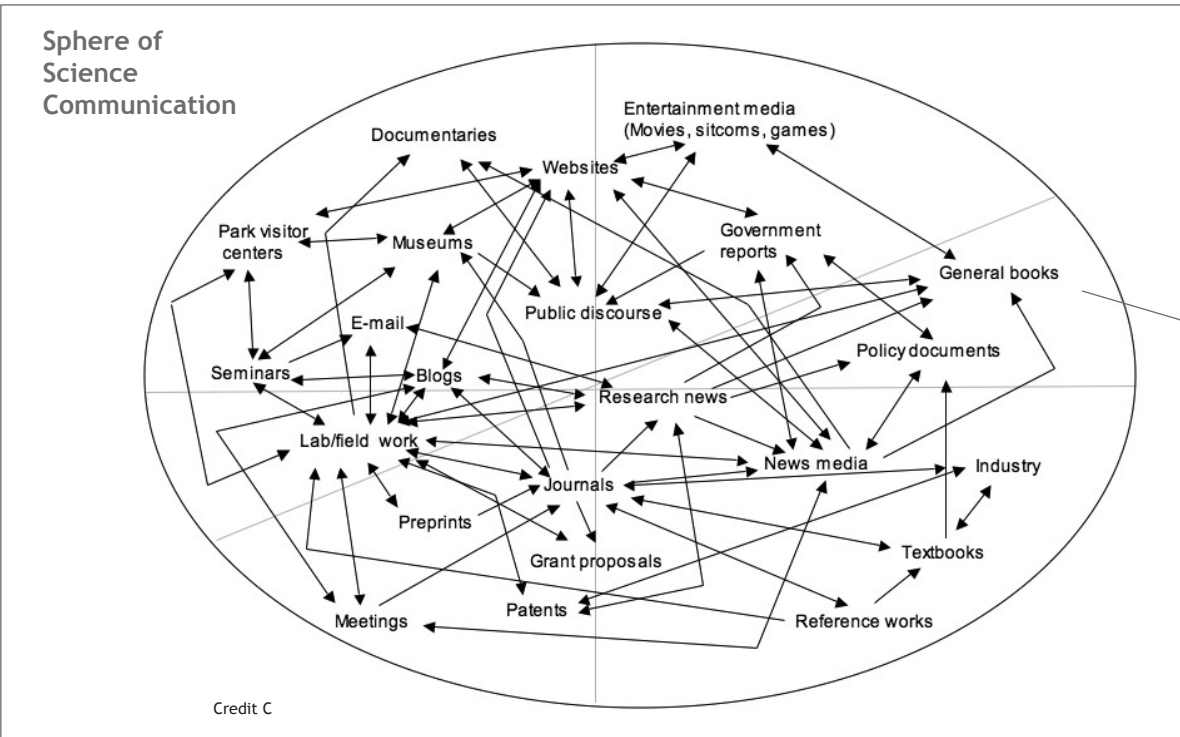
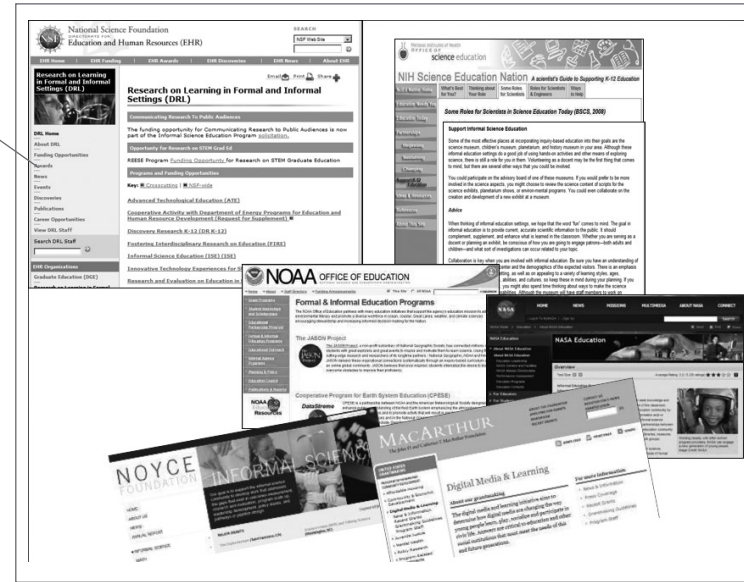
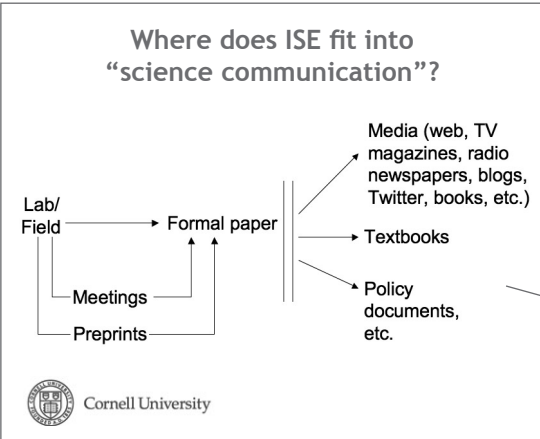
Credit B3

Image: Science Museum of Minnesota



by other places as well: NOAA, NIH, NASA and other organizations. I want you to think about who is not on that list. Who is not funding us? What other activities are out there that we might identify with, but for which we are not seeking funding from a government agency or private foundation?

I want to look at how we as a community fit into a broader context of science communication. In particular, I want to look at this historically. Often when we think about science communication

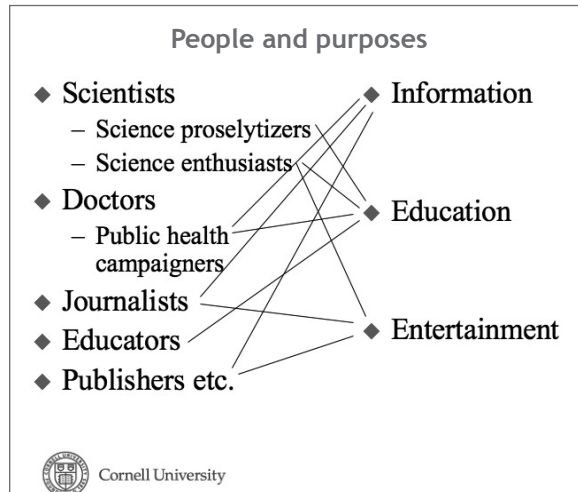


or science education, we think of science as happening in the lab or field and then going through a process of meetings and preprints, and finally getting published as a formal paper. Only then is it "SCIENCE." Only after that does it go out to museums, to the media, to Twitter, to policy conferences and so forth.

From a historical point of view, it turns out to look a little more like this. You still have lab and field work in there, you still have journals, you still have news media and so forth, but a lot of the connections are two-way rather than one-way. I first drew this in 1992, and first published it in 1995. This is the 2009 version; each time I show this I add something new to it. I hope all of you see yourselves in some of these categories. We all connect in different ways. We're not just connecting directly to science but to other institutions. We don't connect

only through the formal journal system but also through lab and field work and so on.

So how did that come about? How is it that we have this sphere of science communication and not a simple linear process?



There are a lot of people involved. There are scientists involved in outreach. Some of them are proselytizers who think science is the best thing in the world and want to make sure you know it. Others are enthusiasts—they love science and they want you to love it too. There are people with various specific, concrete goals like doctors and public health campaigners. There are people whose job it is to communicate science in one way or another, like journalists and educators. There are people who are hoping to make money doing this such as publishers, producers and so forth. A lot of people are involved and they have multiple goals. Some of them are just trying to provide

information. But if you tell journalists that they are involved in education they will strangle you. Then again, if you tell teachers that all they are doing is providing information they will probably get just as angry. A lot of television or movie producers will tell you their primary goal is entertainment. However, there is not a simple one-to-one correlation between the people and the purposes, thus the multiple connection lines.

How did this current communication network develop? If we can go back 200 years, we can explain some of our origins and perhaps some of the features that led to the characteristics that we have today.

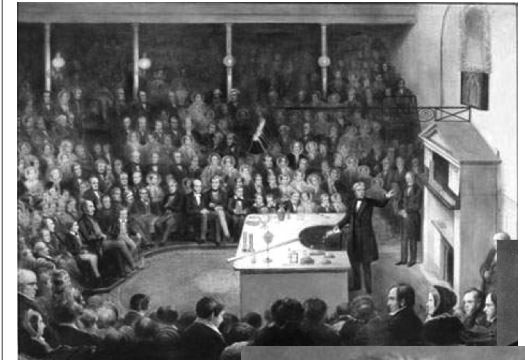
#### Public communication of S&T, 1

The 19th Century

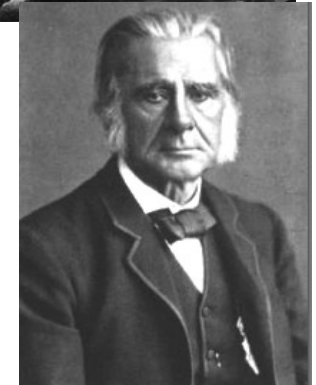
- The “great men”
- Education for the masses
  - Adult schools
  - Itinerant lecturers
- Natural history museums
- Exhibitions
- Science in magazines and newspapers

During the 19th century, most of what we now call informal science education or public communication of science revolved around what were then called the “great men of science.” We were moving from an agrarian society to an industrial one in which more education was necessary. It was the beginning of the great

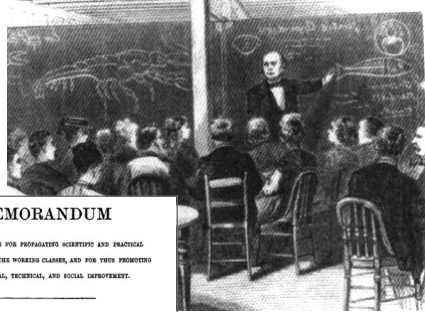
Michael Faraday, Christmas Lecture, Royal Institution, 1856



Credit D

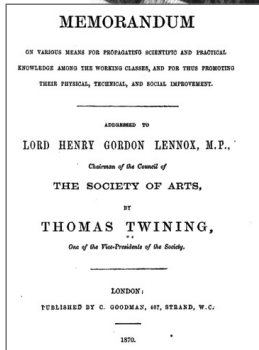


Thomas Huxley, “Darwin’s bulldog”



Credit E

Louis Agassiz lecturing to Anderson School of Natural History



natural history museums and large national science institutions, and we began to have science in newspapers and magazines.

Examples include Michael Faraday giving the Christmas Lectures at the Royal Institution in 1856. This was one of a series of lectures presenting science to the public. The litany of great men—and they were almost all men—includes defenders of evolutionary theory such as Thomas Huxley, who was “Darwin’s bulldog” and gave lectures on this topic in England and in this country as well, trying to proselytize. Another example: Louis Agassiz was teaching in adult schools in Connecticut and Massachusetts.

A lot of these speakers were motivated by class issues. A memorandum from 1870 addresses “various means for propagating scientific and practical knowledge among the working classes, and for thus promoting their physical, technical, and social improvement.” There was an ideological goal here, a statement about the way in which to view different people in society and what the goal for them should be. That motivated a lot of those who undertook this work.

forth. There were also the great natural history museums, which in those days were cabinets of curiosities, with rows and rows of cases, some of which are still present today (though not so much in this country), such as those depicted below in Vienna.

Credit F3: INhM Naturhistorisches Museum



The 19th century also brought the beginning of science journalism, with magazines like *Scientific American*, which was initially a magazine for inventors to provide them

information. By the end of the century

Credit G1



Credit G2



Credit F1: The Book of the Fair (1894)



Credit F2: Ball Pettigrew Museum, Univ. of St Andrews

Promotion was a big part of what was happening. There were national and world’s fairs and exhibitions. At middle left is a picture of the Montana Mining exhibit from the Centennial Exhibition in Philadelphia in 1876, which featured various states and their natural resource issues and so



science began to appear in the newspapers, with articles about cures and discoveries that were “a boon to mankind.” Science information began to circulate to a broader audience.

### Public communication of S&T, 2

#### The 20th Century

- Scientific societies and health associations
- Specialization in science, journalism, and education
- New media: radio, TV, movies, industrial museums, science centers ... the WWW
- Public interest and concern about implications of science progress

In the 20th century a new set of institutions become involved, such as scientific societies and “voluntary” health associations (what today we would call nonprofits or advocacy organizations). Specialization begins, with people focusing on being scientists (instead of natural philosophers), journalists, and educators. Throughout the century new types of media emerge: radio in the 1920s, television in the 1940s and 1950s, the great investment in science museums and science centers in the 1970s and 1980s, and the Web towards the end of the century. Beginning about the middle of the century, the public increasingly voiced concerns about the implications of science and technology and the interaction of science and technology with other social issues.

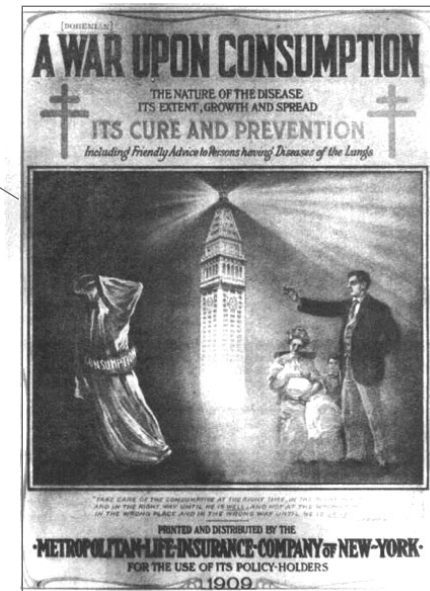
The practical implications of science and technology had a big impact on public

communication and the need for scientific information. Modern medicine began late in the 19th century. By the beginning of the 20th century there was clearly a need to spread that information. For example, the Metropolitan Life Insurance Company produced a pamphlet about the war on consumption (what we now call tuberculosis). The pamphlet shows the tower of the Metropolitan Life Insurance Company, a building that still exists in New York, standing as a sentinel, shining a light that banishes tuberculosis. The pamphlet and related materials originated with a social worker who had the idea to use the commercial insurance system as a way to distribute science information.

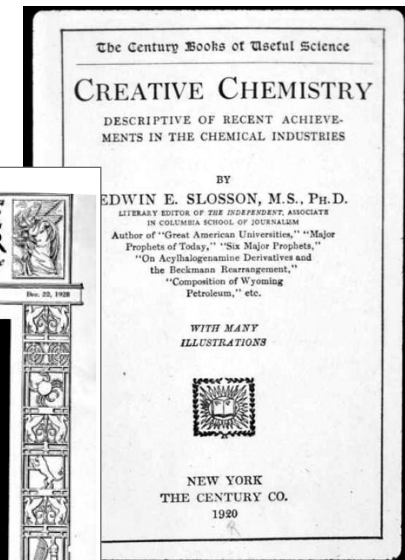
Popular books on science began to be published. One author was Edwin Slosson, a well-known science journalist and book author. His book *Creative Chemistry*, published in the 1920s, was circulated to every high school in the country by the Chemical Foundation. About that same time, Slosson became the founding editor of what was then called Science Service and is now called Society for Science and the Public, which published the *Science News*.

*Science News* was founded as a collaboration between the National Academy of Sciences, the Smithsonian, and the American Association for the Advancement of Science, reflecting the commitment

Credit H



Credit I1





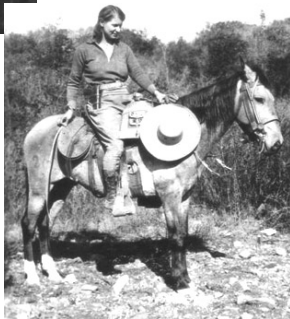
Credit I2

Science Service Staffers



Jane Stafford, 1937

Credit J1

Emma Reh  
Stevenson, 1935

Credit J2

of the scientific community to public communication—and also reflecting the ideals that underlie public communication. Funding came from the newspaper industry initially, from E.W. Scripps. The offices were actually in the National Academy's building. In a photo taken on the top of the building, you can see Slosson standing and pointing.

The seated woman center right in the photo may be Jane Stafford. She reflects the kind of deep intertwining of the scientific community and the public communication community. She majored in chemistry, became a hospital technician in Chicago, worked as a technical editor and then editorial assistant for the American Medical Association, and then went to Washington as a reporter for Science Service. She ended her career as a public information officer for NIH and lived well into her nineties.

Another Science Service reporter was Emma Reh Stevenson. After working for a few years there she continued her archeological work in Mexico and then spent the rest of her career as a freelance writer.

The other man on the scene was Watson Davis. After Slosson died Davis became the director of Science Service. He was an engineer and when he completed college he worked for what was

then the Bureau of National Standards. Then he became interested in science journalism, especially in the new medium of radio, and began talking about science on the radio. Once he became Director of Science Service he extended its activities to include science clubs and science fairs and *Things of Science*. (*Things of Science* were little boxes that came through the mail with experiments that kids could do.) Davis expanded Science Service so that it wasn't just a news service, it was about science outreach, about communicating science. He also remained connected to the research world. Many people attribute the word



Credit K2

Credit K3

Watson Davis  
Credit K1

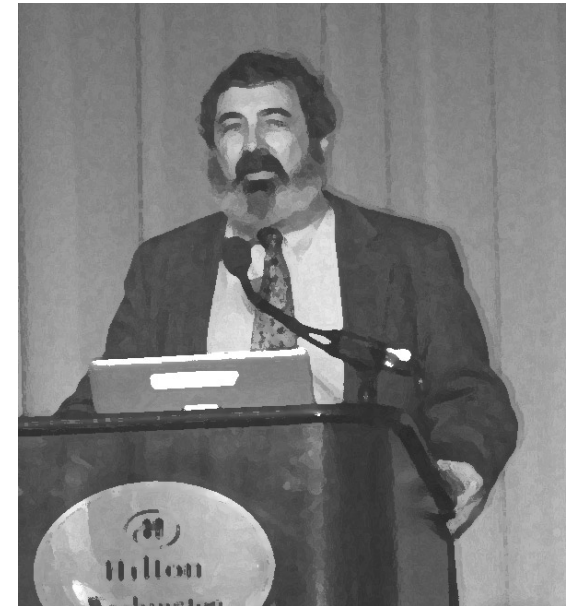


“microfilm” to Watson Davis. He was one of the founders of what was then called the American Documentation Institute and is now known as the American Society for Information Science and Technology.

Also in mid-century come changes in museums. They go from rows and rows of cases to dioramas with their great art, often showing “nature red in tooth and claw.”



This period also brings the growth of the great science and technology museums, some of them modeled on the Deutsches Museum in Munich. Some were based on older organizations or institutes, but the one that is pointed to the most is the Museum of Science and Industry in Chicago, which opened in 1933. Its initial director was Waldemar Kaempffert. Kaempffert was a journalist who worked for *Scientific American* early in his career and then for *Popular Science Monthly*. He went on to work for the *New York Times* as their Science Editor and was then asked to be the founding Director of the Museum of Science and Industry, creating many of the exhibits the museum was famous for. Kaempffert is emblematic, moving from *Scientific American*, a more specialized publication for those within the community, to these broader publications like *Popular Science*



Bruce Lewenstein

Deutsches Museum, Munich



Chicago Museum of Science & Industry

Franklin Institute, Philadelphia



Waldemar Kaempffert



The New York Times Studio  
New York Times, 28 November 1956





Credit L1



Dr. Gerald Wendt  
Credit L2

Monthly and the *New York Times* and then into the museum world. People were moving around among these different organizations.

Similarly, there was Gerald Wendt, who was a chemist and then became a writer. In the 1930s he became Director of the American Institute, an organization in New York that ran science clubs. He became the Scientific Director for the 1939 Worlds Fair in New York, featuring the Trylon and the Perisphere.

Another example is Warren Weaver, a mathematician, who became head of the natural sciences division of the Rockefeller Foundation. He funded much of the work that led to modern molecular biology. During World War II he organized scientists' speeches and science talks during intermissions of broadcasts at the New York Philharmonic, and became key in communicating science via radio and other kinds of outreach. His interests were eclectic. He wrote in *Scientific American* on Lewis

Carroll. He made significant contributions to the field of communication, both electronic and social communications. He was a champion of the

new *Scientific American*, originally established in the 1840s. In fact, that old inventors' publication died

in 1947, and its name was bought and used for a new magazine, the one known today as *Scientific American*.

The editor of the new *Scientific American* was Gerard Piel, a Harvard-educated journalist who had taken a lot of sociology of science courses and remained very close to the science community. The *Scientific American* created in 1948 was never intended for the public, it was intended for the "scientist who is a layman outside his own field," according to Piel and his colleagues. At the same time there was another magazine created right after the war,



Credit M2

Credit M3



Credit M1



Credit N1

Credit N2



Gerard Piel



Barry Commoner

*Science Illustrated*. Gerald Wendt appears again in the story. After the World's Fair he returned to being a writer and then became the first editor of *Science Illustrated*. Barry Commoner, who later became a well-known biologist, was an editorial assistant there early in his career before going on to become an environmental activist. As with so many others, these people stayed connected to both public communication and to the scientific community. For example, Gerard Piel near the end of his career was President of the AAAS.

### Origins of field of "PUS/ISE/ PCST/PEST/PLUS"

- 1930s: First academic publications about science literacy and public communication of science
- 1945: "Public understanding of science"
- 1982: "Informal Science Education" (NSF)
- 1989: "Public communication of S&T"
- Late 1990s: "Public engagement in S&T"
- Mid-2000s: "Public Learning and Understanding of Science"

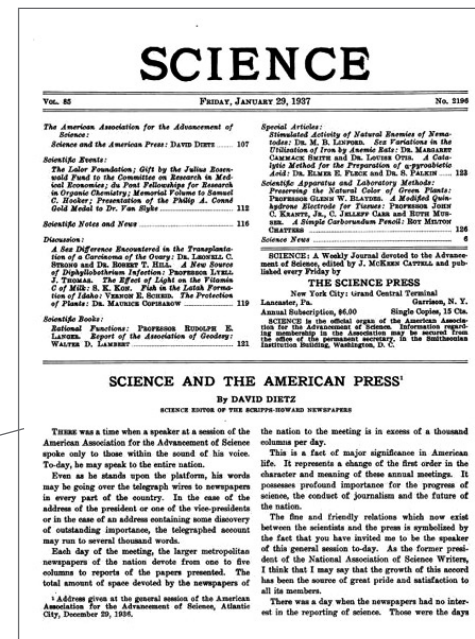
Thus, by the 1930s this field that we call Informal Science Education had begun to stir. A few publications appear, beginning to connect various public communication activities. Debates begin about what to call the field—"Science and the media" (such as an article by David Dietz in *Science* about science and the American press). "Public understanding of science," which has the unfortunate acronym of "PUS"? "Public engagement in science and

technology," with an acronym that isn't much better: "PEST"? "Informal science education," which has the acronym "ISE," which is OK until you try to say it out loud. "Science literacy"—at last, no acronym! My colleague Ilan Chabay now calls the field "Public learning and understanding of science" (PLUS, which at least is a good acronym). Today, 80 years later, there is still no common name for the field.

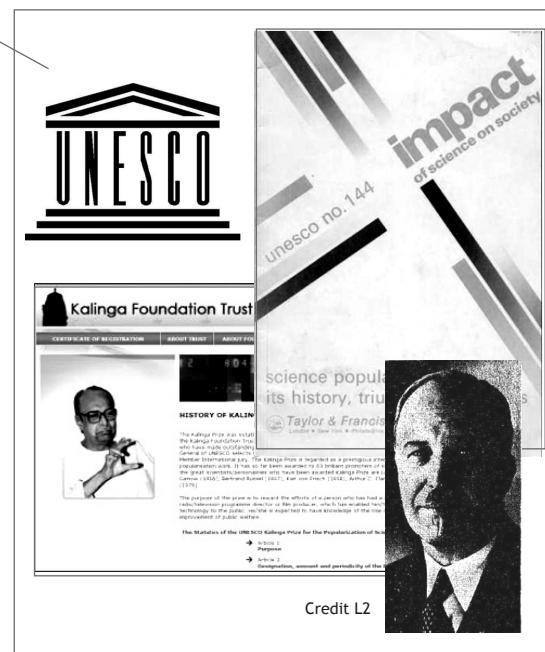
All of these names came from publications, all of these came from attempts to pull together who we are. So by the 1930s we had science editor David Dietz giving a talk about science and the press to the AAAS.

The new field was, and is, international in scope. In the 1950s UNESCO early in its existence became involved in publication and outreach; in the early 1950s, it created the Kalinga Prize for public understanding of science and a division for teaching and dissemination of science. And lo and behold Gerald Wendt pops up again as director there.

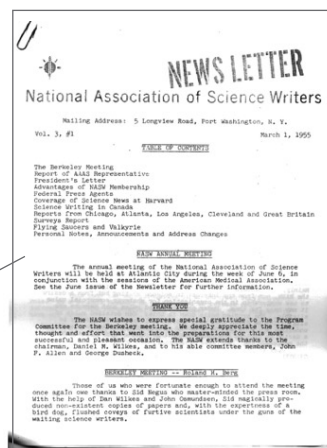
By the 1950s and 1960s people are trying to actively pull these threads together. The National Association of Science Writers became very active in trying to promote science. AAAS



Credit O



Credit L2







was the home for an NSF-funded newsletter called *Understanding* that was published under a grant for a number of years in the mid-1960s, covering things like telelectures and science clubs and trying to pull that knowledge together.

As David Ucko mentioned, NSF funded some of the early big activities such as *NOVA*, which was initiated in collaboration with AAAS. AAAS was a central player in trying to create centers for public understanding, which may be seen as precursors to CAISE.

By the 1970s and 1980s activities were flourishing. Popular science books become best-sellers, such as those by Carl Sagan, Jacob Bronowski, and Stephen Hawking. Popular

science magazines go through a boom in the early 1980s. New museums, most famously the Exploratorium in San Francisco, open up. Science and technology are everywhere, as are “visible scientists,” both great men and, as with Margaret Mead, great women taking leadership in public communication of science and technology.

The research literature that David Ucko referred to also begins. Valerie Crane published *Informal Science Learning* with NSF support; the NSF itself collected reports from its grantees. Two journals focused on the field, *Public Understanding of Science* and *Science Communication*, and other journals in the science education community began devoting special sections to informal science education.

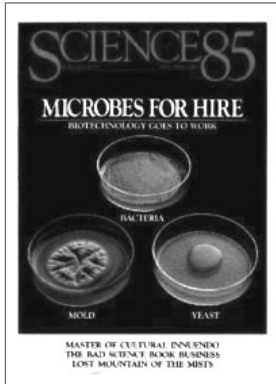
Credit P3



Credit P1



Credit P2



Credit P4





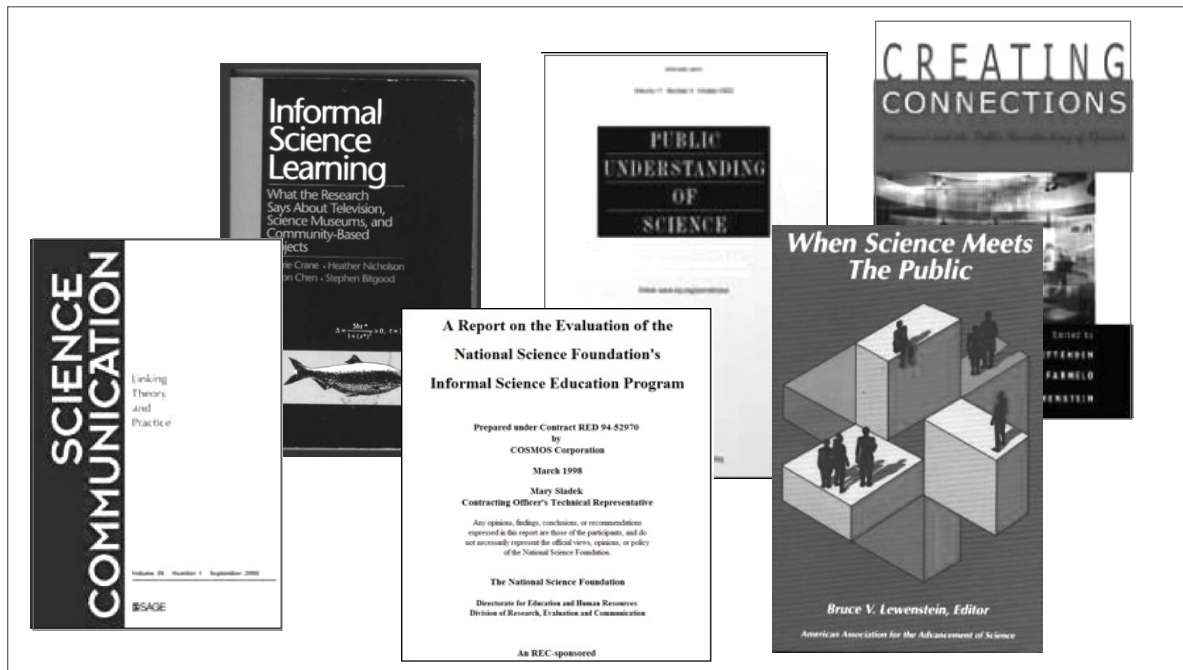
*Public Understanding of Science* was created by John Durant, who is now the Director of the MIT Museum, specifically because as people were starting to conduct scholarly studies on this field they couldn't find any place to publish them. AAAS sponsored a session organized by former ASTC leader Sheila Grinell, *When Science Meets the Public*, and those proceedings were published and continue to be cited. NSF funded public understanding of research activities in the 1990s, documented in *Creating Connections*.

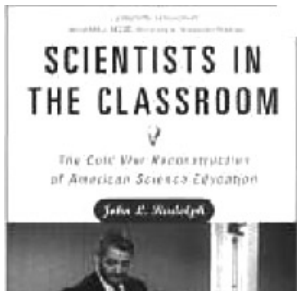
A lot of this literature built on work that was done in the United Kingdom and Europe. That work can be summed up in a quote from the 2004 volume *See-through Science*: "The task is to make visible the invisible, to expose to

public scrutiny the assumptions, values and visions that drive science." The new literature from across the Atlantic is talking about the social context of science, which is not something we do so much in this country.

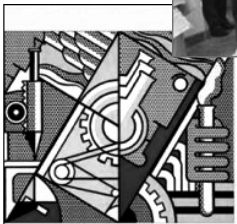
But...

There is something that has been missing from the story that I have been telling you. We have not talked about protests against science. We have not talked about "Kellogg's Genetically Modified Frosted Flakes." We have





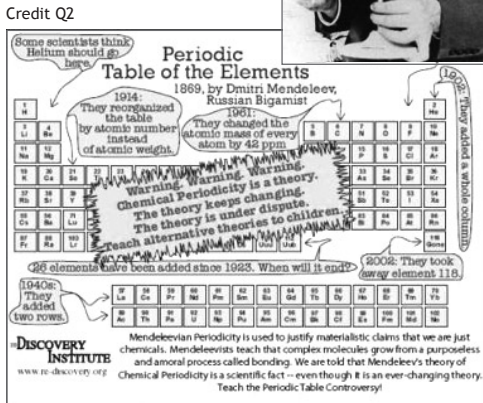
Credit Q1



Credit Q4



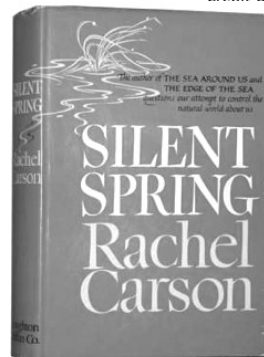
Credit Q3



Credit Q2



Credit O5



not talked about Rachel Carson's *Silent Spring*, which was on of the great achievements in public communication of science but was also the object of scorn by many in the scientific community. It was a science journalist at the American Chemical Society who said that there ought to be an investigation into that work. A lot of science is tied to military goals and a lot of science education is tied to military goals, but we haven't talked about that. We haven't talked about social protests for creationism and against stem cell research.

Instead, we come back to those Christmas Lectures. Bassam Shakhshiri, from the University of Wisconsin, has just given his 40th annual talk (available at scifun.org). He's got television cameras there, he's got bright and cheery colors—it's back to "science is great."

There are meetings that support this new pro-science movement. I have T-shirts from ISE meetings, including Public Understanding of Research (PUR) and the 7th International

### The Christmas Lecture on scifun.org



### ONCE UPON A CHRISTMAS CHEERY IN THE LAB OF SHAKHASHIRI

Credit R



Conference on Public Communication of Science and Technology in South Africa. (In another marker of the field, I have a collection of museum and science center refrigerator magnets.)

So...

- Lots of ISE activities for a long time
- Real growth in many areas in last 50 years
- Leads to growing scholarship about ISE
- Leads to self-identity within field
- SE people find each other and each other's work interesting...so people move around



What does this history tell us? There have been a lot of ISE activities for a long time, and there has been real growth, we've seen evidence of that. With growth there comes inquiry and review and scholarship about ISE, which helps lead to some sense of self-identity and understanding of who we are, where we come from and what we want to do.

Those of us who are in this field are often alike. We like science but don't necessarily want to be scientists. We want to be involved in education and want more people to be thinking about science. And so we look for opportunities in this field and we as individuals move around.

There are some questions that we should ponder. There is a gender issue in this field. If you look around, I think you'll see that this is a

predominantly female gathering. When I teach science communication classes I sometimes have up to ninety percent females in those classes.

What is our relationship to science? How do we define what science is? How do we define whether it's about economics and jobs or the joy of discovery, or whether it's about controversies like genetically modified cereal?

What is our relation to education? One of the major challenges that we faced in the *Learning Science in Informal Environments* report was to learn what we know about the connections between formal and informal.

What do we mean by "informal"? The very fact that we are here as a formal organization means that we have formalized the informal.

And think about that movement of individuals: What will your next job in Informal Science Education be?

Some questions to ponder

- What's the gender balance of ISE people... and does that matter?
- What's the relation of ISE to "Science"?
- What's the relation of ISE to "Education"?
- What's the relation of ISE to "Informal"?
- And: In what part of ISE will your next job be?





## Lewenstein Presentation Image Sources

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### Credit E:

Louis Agassiz lecturing to Anderson School of Natural History, Leslie's Illustrated Newspaper, 1873 [from Burnham, J. (1987). *How Superstition Won and Science Lost: Popularizing Science and Health in the United States*. New Brunswick, NJ: Rutgers University Press, p. 117, where it was reprinted courtesy of Carnegie Library of Pittsburgh]

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### David A. Ucko

Division Director (acting), Division of Research on Learning in Formal and Informal Settings, National Science Foundation

David A. Ucko, Ph.D., is Division Director (acting) for the Division of Research on Learning in Formal and Informal Settings at the National Science Foundation, where he earlier served as Deputy Division Director, Section Head for Science Literacy, and Program Director for Informal Science Education. Formerly, he was Executive Director of the Koshland Science Museum at the National Academy of Sciences; Founding President of Science City at Union Station and President of the Kansas City Museum; Chief Deputy Director of the California Museum of Science & Industry in Los Angeles; Vice President for Programs at the Museum of Science & Industry in Chicago; and a member of the faculty of Antioch College in Ohio and the City University of New York. Dr. Ucko was a presidential appointee confirmed by the U.S. Senate to the National Museum Services Board. He is a Fellow of the American Association for the Advancement of Science and a Woodrow Wilson Fellow.

### Tom Kalil

Deputy Director for Policy, Office of Science and Technology Policy, The White House, Washington, D.C.

Tom Kalil is Deputy Director for Policy in the White House Office of Science and Technology Policy (OSTP), which was established in 1976 with a broad mandate to advise the President and others within the Executive Office of the President on the effects of science and technology on domestic and international affairs. OSTP also leads interagency efforts to develop sound science and technology policies and budgets and to work with the private sector, state and local governments, the science and higher education communities, and other nations toward this end. Before his return to the White House, where he had served an earlier term as Deputy Assistant to the President for Technology and Economic Policy, Mr. Kalil was Special Assistant to the Chancellor for Science and Technology at the University of California, Berkeley, where he helped develop multidisciplinary research and education initiatives in such fields as nanotechnology, information technology, clean energy, and life sciences. Earlier, he was Senior Fellow at the Center for American Progress and the National Economic Council's "point person" on a wide range of science, technology, and innovation issues, including the National Nanotechnology Initiative, the Next Generation Internet, liberalization of computer export controls, and education technology.

### Bruce V. Lewenstein

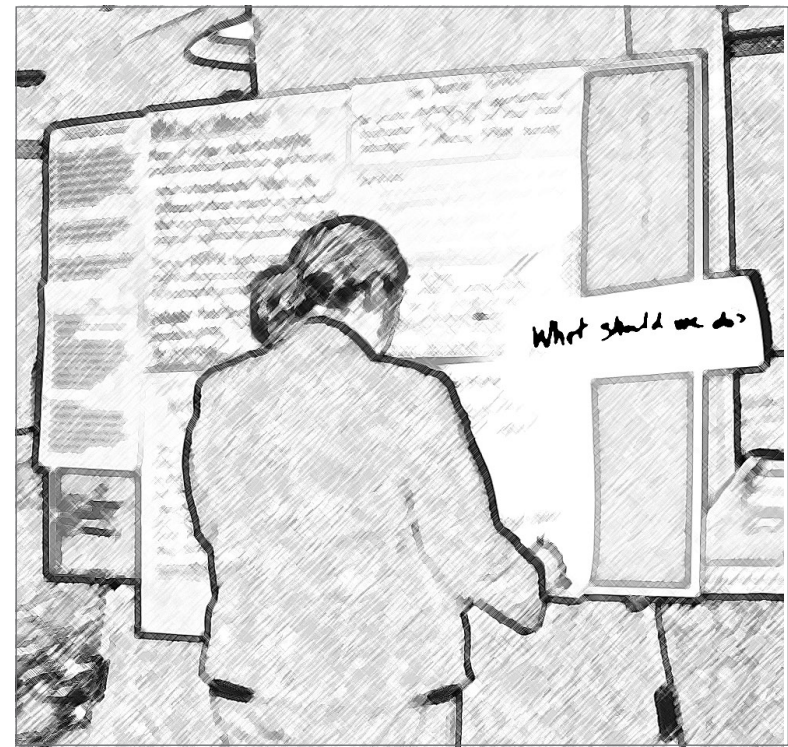
Professor of Science Communication, Cornell University

Bruce V. Lewenstein, Ph.D., is Professor of Science Communication in the Departments of Communication and of Science and Technology Studies at Cornell University. He works primarily on the history of public communication of science, with excursions into other areas of science communication, such as emerging issues in open-access publishing. He was Co-chair of a National Research Council study, *Learning Science in Informal Environments: People, Places, and Pursuits*, edited by Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder (2009). Dr. Lewenstein is also co-author of *The Establishment of American Science: 150 Years of the AAAS*, editor of *When Science Meets the Public* (1992), and co-editor of *Creating Connections: Museums and the Public Understanding of Research* (2004). From 1998 to 2003, he was editor of the journal *Public Understanding of Science*. He is a Fellow of the American Association for the Advancement of Science, and in 2010 Chair of the AAAS Section on Societal Impacts of Science and Engineering. He is also a member of the CAISE Steering Committee.

## intermission



*Browsing and discussing posters and project materials*



*Posting proposed discussion topics on the Connections Lounge boards*