

History of Physics Newsletter

October 1995 Volume VI, No 3

FROM THE EDITOR

Membership in the Forum will no longer continue automatically from year to year, but must be renewed with each annual APS dues bill. Alternatively, contact the APS Membership Department (301-209-3280), or join the Forum or renew membership via the World Wide Web: [../memb/unitapp.cfm](http://memb/unitapp.cfm).

As was the case in October 1994, two innovations are being introduced with this edition of the Newsletter, one immediately visible, the other virtual. The first innovation concerns content. Because Associate Editor Stephen G. Brush is now compiling his extensive Recent Publications on the History of Physics annually, much of the space previously devoted to publications in the body of the Newsletter has been replaced with an experimental "Opinions" section which, in this issue, includes comments provided by Forum Vice-Chair Stanley Goldberg, in addition to excerpts from editorials that have appeared in other publications. Readers of the Newsletter are invited to submit their own "opinions" for possible use in future editions, as well as suggested editorial excerpt from other publications. My coordinates appear in the box at the top of the next page.

The second, virtual innovation has already become obvious to anyone who has gotten this far: namely, the Newsletter is now available electronically and can be accessed through the Forum's home page on the World Wide Web: [../FHP/index.cfm](http://FHP/index.cfm). Timely notices of meetings, Forum elections, and other relevant events will be accessible at this same website beginning early in 1996. David Cassidy, the Forum's Secretary-Treasurer (e-mail: chmdcc@vaxc.hofstra.edu), devised the Home Page, and will oversee the addition of other features from time to time. Either or both of us welcome suggestions from Forum members about appropriate additions and improvements, including information about other relevant websites.

The printed edition of the Newsletter, like the October 1994 edition, consists of two parts, Part II being Steve Brush's latest Recent Publications in the History of Physics compilation. Although Steve intends to continue to prepare these annual compilations, they will not be included with future printed editions of the Forum's Newsletter, on the grounds that they are also being included with the Newsletter of the AIP Center for History of Physics. Readers who wish to receive hard copies of future compilations may do so by requesting that their names be added to the Center's mailing list: FAX (301) 209-0882; Internet: nbl@aip.org. Starting next year, Steve's compilations should also be available electronically and accessible from the Forum's home page.

Most readers will be aware by now that 1999 marks the centenary year of the American Physical Society. A description of the status of centenary planning appears below in the "APS and AIP News" section. The Forum's officers and executive committee strongly urge members to volunteer to participate in centenary events to help assure adequate historical content. Information on how to volunteer is included with the status report. Forum members may also submit comments on the Centenary for possible publication in the Newsletter directly to the editor.

William A. Blanpied
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FORUM NEWS

Nominations for Officers

The Nominating Committee would appreciate receiving the names of Forum members who are willing to serve on various committees of the Forum or of the American Physical Society. The Forum needs to elect a Vice-chair who in succeeding years will become Chair-elect and then Chair, and two members of the Executive Committee who will serve for three years. The By-laws require that we have at least two nominees for each position. Submit suggestions for candidates by December 31 to Gloria Lubkin, Chair of the Forum Nominating Committee, Physics Today, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; e-mail: gbl2@aip.org.

Election Results

Gordon A. Baym of the Physics Department at the University of Illinois, Urbana became Chair-Elect in April 1995 and will succeed John S. Rigden, of the American Institute of Physics, as Chair in April 1996. Stanley Goldberg, a consultant to the Smithsonian Institution, was elected Vice-Chair and will succeed as Chair-Elect in April 1996. David Cassidy of the Natural Science Program at Hofstra University was elected Secretary-Treasurer and will serve in that capacity until April 1998. Peggy Kidwell of the Smithsonian Institution and K.C. Wali of the Physics Department at Syracuse University were elected Members at Large of the Executive Committee and will serve until April 1998. The remaining Members at Large are William Blanpied of the National Science Foundation's Division of International Programs and Caroline Herzenberg of Argonne National Laboratory, whose terms will expire in April 1996, and George L. Trigg, retired Editor of the Physical Review Letters, and Virginia Trimble of the Physics Department at the University of California, Irvine, whose terms will expire in April 1997. Albert Wattenberg of the Physics Department at the University of Illinois, Urbana, who was elected Forum Councillor in April 1994, will continue to serve in that capacity until December 1988. Spencer R. Weart, Director of the AIP Center for History of Physics, continues to serve as Ex Officio member of the Executive Committee.

Forum Committees

Forum committees for 1995-96 are:

- Program Committee: William Evenson (chair), Virginia Trimble
- Nominating Committee: Gloria Lubkin (chair), Albert Wattenberg
- Fellowship Committee: Gordon A. Baym (chair)
- Membership Committee: Elizabeth Garber (chair), Richard Olenick
- Publications Committee/Editorial Board: Stephen Brush (chair), William Blanpied.

Forum Sessions at APS Meetings

Forum members interested in organizing invited sessions for either the March 18-22, 1996, APS meeting in St. Louis or the May 2-5, 1996, "April" meeting in Indianapolis, are invited to contact William Evenson, who chairs the program committee, at: Department of Physics, Brigham Young University, Provo, Utah 84602; phone: (801) 378-6078; FAX: (801) 378-2265; Internet: EVENSON@PHYSICI.BYU.EDU. Members who

propose such invited sessions should consider preparing abstracts and/or summaries for publication in this Newsletter and the Forum's home page.

APS Fellowship Election

Allan A. Needell, of the Smithsonian Institution's National Air and Space Museum, has been elected a Fellow of the American Physical Society. Forum members desiring to nominate APS members for Fellowship through the Forum should contact Gordon A. Baym, Chair of the Fellowship Committee for details on eligibility requirements and nomination procedures: Dept. of Physics, Univ. of Illinois, Urbana, IL 61801; FAX: (217) 3339819; e-mail: gbaym@uiuc.edu. Deadline for receipt of nominations material is December 31, 1995.

Executive Committee

The annual meeting of the Executive Committee, held on April 17, 1995, in conjunction with the Washington, DC, meeting of the American Physical Society, was chaired by Elizabeth Garber, outgoing Chair of the Forum. APS Executive Officer Judith Franz reported that attendance at the annual April meeting has continued to decline, while the average age of attendees has increased. A special task force has proposed numerous changes in the April meeting. Starting next year, the meeting will convene in a different location each year. Next year's "April meeting" will be held in Indianapolis, May 2-5, 1996. Stephen Brush, the Forum's representative on the Planning Committee for the Centenary of the APS, summarized the current state of planning of activities, in addition to the scheduled March 20-26, 1999, meeting in Atlanta. These include: a series of short books on 20th century physics for the general public; a wall chart modeled after the well-known "men of physics" chart; and a speakers bureau whose members will present talks on topics in 20th century to general audiences throughout the country. Volunteer speakers and authors are needed for each of these endeavors. Incoming Forum Chair John Rigden plans to establish a committee to work with Brush to assure that historical components are integrated into centenary events. [NB: A summary of plans for the Centenary as they now stand appears below under APS & AIP News.]

Forum Officers Contributions to August 1995 Physics Today

The August 1995 edition of Physics Today featured contributions by two officers of the Forum:

Secretary-Treasurer David Cassidy provided an introduction to "A Lecture on Bomb Physics: February 1942," which features a translation of a non-technical lecture entitled "The Theoretical Foundations for Obtaining Energy from fission of Uranium," which was delivered by Werner Heisenberg to a group of senior German research officials on February 26, 1942,. Cassidy also was co-editor, with Jeremy Bernstein, of "Bomb Apologetics: Farm Hall, August 1945." (Bernstein, until recently Professor of Physics at Stevens Institute of Technology, is a staff writer for The New Yorker .) The article consists of excerpts from the reactions, on August 6-7, 1945, of 10 German physicists, including Heisenberg, to the news that the United States had dropped an atomic bomb on Hiroshima. The German physicists, who had been interred at Farm Hall, an English manor house, since July 3, 1945, were unaware that their conversations were being recorded by British intelligence agents. [NB: the complete Farm Hall transcripts, with detailed annotations and an introduction by Bernstein, will be published by the American Institute of Physics in October with the title, Hitler's Uranium Club: the Secret Recordings at Farm Hall.]

Vice-Chair Stanley Goldberg's article, "Groves and the Scientists: Compartmentalization and the Building of the Bomb," presents a sympathetic portrait of General Leslie R. Groves, the administrative head of the Manhattan Project. Goldberg suggests that a good deal of the tension and conflict between Groves and many of the scientists who worked on the project derived from their very differing perspectives regarding its scope. Most significantly, the general understood that although the contributions of the scientists were crucial, their work was only one of a host of critical components that made up the totality of the project.

Five Forum Coordination

There are now five APS Forums: History of Physics, Physics and Society, Education, International Physics, and Industrial and Applied Physics. Although they were established to serve, in the words of Anthony Nero, outgoing Chair of the Forum on Physics and Society, as "'glue' for an APS that is becoming increasingly fragmented, . . . their proliferation makes it difficult to address broad APS issues." In an attempt to address if not resolve this dilemma, Nero and Ruth Howe, outgoing Chair of the Forum on Education, organized a meeting of the elected officers of the five Forums in conjunction with the April 1995 APS meeting in Washington, DC. Among the items discussed were organization of joint symposia at general as well as divisional and topical APS meetings, including new types of open forum sessions that aim to involve members actively on issues of broad importance.

Nero offered some thoughts on the matter of coordination among the fora in the July 1995 issue of the Newsletter of the Forum on Physics and Society:

- . . . specific efforts taken among the officers of the five forums [i.e., follow-up of the April 1995 meeting] will serve to alleviate some of the difficulties of fragmentation. But a larger vision is needed, one that bears on the broad issues of the future of physics. The question for the forums is not only how we can cooperate on our particular forum interests such as, say, radiation protection, which relate to the specific interests of two or more forums. The bigger question is how we can assist the APS membership in understanding the broadest and most difficult issues facing physics.

The APS has worked best at focusing on the content of physics, not the context. Yet the societal context determines how the content will develop and be supported both culturally and financially. . . . The five forums are the APS entities that are organized to serve as forums for these, as well as narrower issues. And they can serve both as inward and outward forums; inward in encouraging members to discuss things within the APS, and outward in reaching out to nonphysicists and thus serving as an open forum in the fullest sense.

Unfortunately, it is becoming increasingly difficult for the forums to serve this broader role for the APS, at the same time as it is becoming increasingly important. . . . Yet this consciousness of the broadest issues facing the physics community as the APS's and joint forums' most fundamental responsibility needs to be raised, examined, and, I believe, taken on as the most compelling mission of the forums. Making progress on this scale, though important to the entire APS and to society, will not be easy Yet if we don't act together, we make noise instead of music.

The July 1995 Newsletter of the Forum on Physics and Society includes a detailed report of the five-fora meeting and the complete text of Nero's remarks. The Newsletter is available on-line via the APS Forum Home Page on the World Wide Web ([../forums.cfm](http://forums.cfm)).

APS and AIP NEWS

Web Sites

A significant amount of information about the APS and the AIP is now available electronically and may be accessed through the home pages of the two organizations, whose respective addresses on the World Wide Web are [../forums.cfm](http://forums.cfm). Newsletters of the AIP's Center for History of Physics are accessible via <http://aip.org/history/newsletters.cfm>.

APS Council Meeting

The principal actions taken at the April 23, 1995, meeting of the APS Council of direct concern to members of the Forum involve membership and funding. Henceforth, members of APS Divisions and Forums must indicate on their annual APS dues bill that they wish to renew their membership; otherwise, those memberships will be canceled. There is no charge for membership in any two forums, but a charge of \$6.00 for membership in each additional forum. APS funding for forums will consist of a \$1,000 base, plus an additional \$4.00 per each member up to 3 percent of total APS membership. The Forum on History of Physics would receive more funds than in previous years under this new scheme, provided its membership does not decrease. However, since membership renewal will no longer be automatic, such a decrease is likely.

Brian Schwartz, chair of the APS Centenary Planning Committee, reported on plans for the event, which will take place in conjunction with a combined annual March and Spring APS meeting in Atlanta, from Saturday March 20 - Friday March 26, 1999. [NB: a summary of current plans for the Centenary appears in the next article.]

APS Centenary

The APS Centenary Planning Committee was established by the APS Executive Board immediately following its February 1995 meeting. Two meetings have been held to date: on March 9 and June 1, 1995. Current plans for the Centenary can be broken into two parts: 1) events planned in conjunction with the Atlanta meeting and (2) year-long events.

The first two days of the Atlanta meeting will be celebratory. An outline of the currently envisioned program is as follows: Saturday Afternoon, 20 March, International Session: Focus on government, science and economic development in collaboration with various local universities. Saturday, Early Evening, Pre-banquet Celebration: Display of celebratory objects for the APS from foreign physical societies, dignitaries, US sister societies. Display of flags of nations participating. Saturday Evening: Formal Banquet; single multimedia entertaining presentation on a physics topic. Sunday Afternoon, 21 March (and perhaps Late Morning): Moment of Discovery Session: attending Nobel prize recipients in physics from various nations briefly discuss one or two events in their lives of scientific importance. (About 20 to 25 Nobel prize recipients seem likely to attend.). Sunday, Late Afternoon: Opening of Nobel Prize Recipient Exhibit using the AIP Meggers Collection of prizewinner photographs, plus descriptive material of the Nobel Foundation. Nobel prize recipients in attendance will be available to meet with physicists (and public) on the opening day of the exhibit. Sunday Evening: Gala Reception Buffet at Fernbank Museum with the opening of the museum exhibit on physics; the showing of IMAX films, tour of museum. Monday, Late Afternoon: Plenary Session of two hours, three speakers covering the accomplishments of various subfields of physics in the 20th century. Monday Evening: Reception with light food for all attendees at the Centenary Meeting. Tuesday, Late Afternoon: Plenary Session of two hours, three speakers covering the accomplishments of various subfields of physics in the 20th century.

Other events during the meeting will include displays such as: history of women in physics in the 20th Century; comparison of physics course work and texts in 1899 with similar material in 1999; where possible, and in conjunction with various corporations, the role of physics in technological developments such as transistors, lasers, nuclear energy, medical physics, etc; display and final judging of a national Rube Goldberg contest by college physics students, based on at least 10 principals or discoveries of 20th century physics. In view of the commemorative nature of the APS Centenary, the Forum on History of Physics expects to plan special sessions and also to play a role in planning and implementing year-long events.

Year-long events identified to date are: Centenary Speakers Bureau: the Centenary Committee, working with the APS units, will identify members willing to give colloquia, seminars and general talks on physics and history of physics topics. A Centenary Speaker's Booklet will be prepared, listing the speakers, topics, geographical location, level, etc., for each speaker. It will be widely distributed to colleges, universities, laboratories, high school teachers groups, encouraging the recipients to schedule one or more talks at their

institution to celebrate the Centenary. Wall Chart: a time-line "wall chart" will be produced and distributed for the Centenary. It will be designed to present a history of physics, with an emphasis on the 20th century. The context for physics might emphasize its role in culture and technology. The wall chart will be distributed free of charge to physics departments, high school physics teachers, libraries and laboratories. Centenary Stamp: a proposal will be submitted to the U.S. Postal Service in 1996 requesting a series of four stamps to celebrate the Centenary.

Stephen G. Brush, associate editor of The History of Physics Newsletter and a member of the Centenary Planning Committee, will welcome suggestions on those events from Forum members, as well as volunteer speakers and writers. (Department of History and Institute for Physical Sciences and Technology, University of Maryland, College Park, MD 20742; e-mail: brush@ipst.umd.edu). Information on the status of planning for the Centenary will also be available electronically early in 1996 and accessible from the APS home page: <http://www.aps.org>.

Letter from APS President Richter to Secretary of the Smithsonian Institution

There follows the text of a November 9, 1994, letter from Burton Richter, then President of the APS (and Director of the Stanford Linear Accelerator Center) to I. Michael Heyman, Secretary of the Smithsonian Institution, concerning the APS Council's position on the Smithsonian's controversial "Science in American Life" exhibition. (NB: excerpts from a commentary on this exhibition from the editor of Science Communication appears below in the Opinion section of this newsletter.)

- Dear Mr. Heyman:

As President of the American Physical Society, I have been asked by the elected Council of the Society to convey its profound dismay over the exhibit "Science in American Life" at the Smithsonian Museum of American History and to offer our cooperation in developing a more balanced portrayal of the impact of science and technology on American life.

The American Physical Society is the principal organization of physicists in the United States, with 43,000 members in industry, government and universities. APS members who have visited "Science in American Life" found a portrayal of science that trivializes its accomplishments and exaggerates any negative consequences. We are concerned that the presentation is seriously misleading, and will inhibit the American public's ability to make informed decisions on the future use of science and technology.

Of course science can be misused, and examples of that misuse belong in the exhibit. What is missing is balance. In the 118 years covered by the exhibit, science has helped to more than double the life expectancy of Americans and has enhanced the quality of our lives; the enrichment of the human spirit as the secrets of the universe unfold cannot be measured. None of this has been captured. Indeed, the scientific discoveries that underlie the "information revolution" are not included at all.

The American Physical Society would like to work with the Smithsonian and with other scientific societies to develop an appropriate exhibition of science in American life. I would welcome an opportunity to meet with you to discuss the steps that might be taken. I will call your office shortly to arrange an appointment.

[Editor's note: In February 1996, the APS's officers, Executive Director, and Treasurer met with Robert Hoffman, Provost of the Smithsonian, and provided suggestions for improving the exhibition. Discussions with the museum are continuing.]

Letter From APS President Patel to Congressman Walker

There follows the text of a June 16, 1995, letter from Kumar Patel, President of the APS (and Vice Chancellor for Research at UCLA), to Congressman Robert Walker, Chair of the House Science Committee and Vice-Chair of the House Budget Committee. A copy was also sent to Congressman George Brown, Ranking Minority Member of the Science Committee. Kumar wrote his letter at the suggestion of the Executive Committee of the Forum on History of Physics.

- Dear Representative Walker:

I have been informed that the House Science Committee is considering removal of all NSF funding in the areas of social science research. As president of The American Physical Society I would like to raise some issues which should be considered before such a drastic action is taken. The American Physical Society's membership includes over 42,000 active researchers in the fields of physics.

We have seen increasing importance of research that is truly multidisciplinary. Many new advances in understanding as well as many new discoveries are made at the interface of different disciplines. As a result, researchers in physical sciences and engineering are beginning to recognize the value-added quality of social science research. Prudent use of federal monies, including regulatory approaches, can be improved by a better understanding of those areas studied by the social sciences. Further, the societal implications including economic implications of research in other fields can be better understood through social science research.

Research of poor quality or that is inconsistent with the long term goals and needs of the society should not be supported, no matter what field is involved. Work of high quality and that is central to the long term needs and goals of the society should not be eliminated solely because of its field.

[Editor's Note: the NSF Authorization Bill reported out of the House Science Committee omitted language that would have deleted all funding for social science research.]

AIP Study of Large Collaborations in Space Science and Geophysics Issues

Final reports of a study of multi-institutional collaborations in space science and geophysics, conducted by the AIP's Center for History of Physics, are now available for the asking. The reports give the findings of the first extensive study ever conducted of a variety of these organizations, based on numerous site visits and analysis of over 200 interviews plus questionnaires and documents. These collaborations are huge -- bringing together three or more institutions and dozens, hundreds, even thousands of investigators. They are very costly but are often crucial to the advance of scientific understanding in their field. And they are transient, liable to leave only fragmentary traces for those who need to understand them for purposes of administration, science policy studies, and history.

The AIP reports are based on historical-sociological essays that offer a preliminary sketch of the social patterns and changes over time of collaboration in the space science and geophysics communities. Special attention is given to information that will be useful to archivists, whose work increasingly requires them to understand the structures and functions of collaborations. The reports continue with archival essays describing the records that space science and geophysics collaborations create and retain (or destroy) as they work across institutional lines. There are also appraisal guidelines to help archivists identify and preserve core sets of records relating to their institutions. Support for the project has come from the American Institute of Physics, the National Science Foundation, the National Historical Preservation and Records Commission, and the Andrew Mellon Foundation.

Report No. 1 includes summaries of all the findings, followed by recommendations for actions that institutions in space science and geophysics should take to improve the documentation of their work for the sake of both

current administration and posterity. It appears that a few simple changes would greatly improve the chances that records will be preserved. The longer Report No. 2 gives the complete historical-sociological and archival essays. There are also two appendices: a quantitative sociological report on basic issues of trust in collaboration, and a case study of the importance of a collaboration and a high-technology company to each other. For a free copy of either or both reports, contact the AIP Center for History of Physics, One Physics Ellipse, College Park, MD 20740; phone (301) 209-3174, Fax (301) 209-0882, e-mail nbl@aip.org

AIP Niels Bohr Library's Guide to its Archival Collections

Rich and diverse collections of unpublished materials relating to modern physics and allied sciences have now been cataloged in a Guide to the Archival Collections of the Niels Bohr Library. The Niels Bohr Library, dedicated in 1962, is part of the Center for History of Physics of the American Institute of Physics. Its catalog will be an indispensable aid to historians of science, pointing to a wide variety of source materials -- not only in the Niels Bohr Library itself but extending beyond through its listing of finding aids relating to collections world-wide. A comprehensive index of personal and institutional names and topics gives ready access to materials that will benefit research into many areas of modern science.

The Niels Bohr Library is the official repository for the permanent records of the American Institute of Physics, for many of the AIP Member Societies such as the American Physical Society and the American Astronomical Society, and also for numerous collections of personal and professional papers of individuals for which a more appropriate repository has not been found. Another outstanding and heavily used feature of the Library is its collection of oral history interviews with eminent scientists, containing over 3,000 hours of interviews. The Guide includes thorough descriptions of these collections, and also of items in its Miscellaneous Physics Collection (originals and photocopies of many significant letters, manuscripts, and research and student notebooks), its Manuscript Biography Collection, and its Institutional History Collection. The Library's extensive holdings in papers and correspondence on microfilm are also described in the Guide as well as descriptions of audio visual holdings including the Emilio Segr Visual Archives, video tapes, film footage, and tape recordings of public reminiscences.

Ordering information: 1995 574pp. ISBN 1-56396-379-5 cloth \$135.00, ISBN 1-56396-435-X paper \$75.00. To order call 800-809- 2247 or mail check, MO or PO (plus \$3 shipping) to: American Institute of Physics, c/o AIDC, P.O. Box 20, Williston, VT 05495, Fax (802) 864-7626. Outside the US and Canada contact Oxford University Press, Saxon Way West, Corby Northants NN18 9ES, England; phone +44(0)536-45434, Fax +44(0)536-746337.

ANNOUNCEMENTS

Center for History of Physics Grants-in Aid

The Center for History of Physics of the American Institute of Physics has a program of grants-in-aid for research in the history of modern physics and allied sciences and their social interactions. Grants can be up to \$2,500 each, and they can be used only to reimburse direct expenses connected with the work. Preference will be given to those who need part of the funds for travel and subsistence to use the resources of the Center's Niels Bohr Library in College Park, Maryland, in suburban Washington, DC, or to microfilm papers or to tape-record oral history interviews with a copy deposited in the library. Applicants should either be working toward a graduate degree in the history of science, or show a record of publication in the field. Applicants should send a vitae plus a letter of no more than two pages describing their proposed research, with a brief budget showing the expenses for which support is requested; graduate students should also include a letter of reference from their thesis adviser. Send application materials to Spencer Weart, Center for History of Physics, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; Phone: (301) 209-3174, Fax (301) 209-0882; e-mail:

sweart@aip.org.

Government Agency Home Pages

Substantial amounts of information about U.S. government agencies pertinent to historian of physics, including program descriptions, publications, current news, and recent speeches of top administrators, is now available on the Internet and may be accessed through the respective agency home pages. The respective World Wide Web addresses for the National Science Foundation and National Endowment for the Humanities are <http://www.nsf.gov> and <http://www.neh.fed.us>. The web address of NASA's History Office is <http://www.gsfc.nasa.gov/hqpao/history.html>. Home pages of cabinet-level agencies of the executive branch and of White House Offices, including the Office of Management and Budget and the Office of Science and Technology Policy, may be accessed through <http://www.gov.mci.net/fed/exec/exec.html>.

NSF Programs

NSF's Science and Technology Studies Program (publication NSF 95-92) supports research on the nature and processes of development in science and technology (past and present) and the differences in the nature of theory and evidence in various scientific and technological fields. It supports research on the interactions between science and technology and their impact on society, and the interactions of social and intellectual forces that influence science or technology. Also supported are examinations of topics like the social construction of scientific knowledge and institutions; relations among science, government, and other social institutions and groups; and processes of scientific innovation and change. The Research on Science and Technology Program (publication NSF 92-37) supports a small number of research projects that develop and improve approaches, methods, techniques, data, information, and knowledge needed to address research and technology questions and issues. It also supports analyses of significant research and technology issues of interest to users and decision makers, especially in the U.S. Government but also in academia, industry, State and local government, and the general public. Projects supported by the program include studies of the processes and impacts of scientific and engineering research and technological change (in the United States and elsewhere); studies of science and engineering human resources issues; improvement of methods, data, and information; and assessments of the state of knowledge of and future needs for research on science and technology. The Ethics and Values Studies Program (publication NSF 95-86) supports research and educational projects that contribute to developing and transmitting knowledge about ethics, values, and the conduct of science and engineering. The program supports research that examines the intellectual, ethical, value, and policy contexts that influence and that are influenced by the development, use, and effects of science and technology. Projects are expected to contribute to understanding the ethical and social values, policies, and obligations and responsibilities that arise in these interactions. The above- referenced announcements may be obtained from NSF's Forms and Publications Unit, 4201 Wilson Blvd., Arlington, VA 22230, phone: (703) 306-1130, internet pubs@nsf.gov. General information about NSF programs and publications may be obtained by calling the NSF Information Center: (703) 306-1234, or via e-mail: info@nsf.gov. Refer also to information accessible via NSF's home page: <http://www.nsf.gov>.

Overmann Retirement

Ronald J. Overmann who, among his other duties at the National Science Foundation serves as Program Manager for the History and Philosophy of Science, plans to retire from federal service at the end of 1995. His successor has not yet been selected. Ron came to NSF in 1973 as an "ABD" from the University of Indiana, and completed his dissertation in the area of the history of 17th century science the following year. He has been a valued colleague and good friend since my arrival two years later. An

individual with wide-ranging interests and talents in addition to history, Ron intends to pursue some of those options seriously beginning in January 1996.

NEH Programs

The National Endowment for the Humanities (NEH) has several research grant programs of potential interest to historians of physics: Fellowships for University Teachers (Application deadline May 1; Phone: (202) 606-8466); Fellowships for College Teachers and Independent Scholars (Application deadline May 1, Phone (202) 606-8467); and Dissertation Grants (Application deadline November 1, Phone: (202) 606-8465.) NEH's Libraries and Archives grants support the planning and implementation of projects that enhance public understanding of the humanities through the use of books, new technologies, and other resources in the collections of libraries and archives (Application deadlines July 15 and November 1, Phone (202) 606-8271) The Endowment's Science and Humanities Education grants support the development of undergraduate courses and curricula that integrate the study of the sciences and the humanities Application deadline February 1, Phone: (202) 606-8380). Current information on NEH grants is also available by e-mail: info@neh.fed.us. A list of NEH publications and complimentary copies of the Endowment's Humanities and Overview magazines may be requested from nehopa@gwuvm.gwu.edu. Refer also to information accessible via NEH's home page: <http://www.neh.fed.us>.

ACLS Travel Grants

The American Council of Learned Societies, in cooperation with its constituent societies, administers a program of travel grants to assist scholars in all fields of the humanities to participate in international meetings held outside the United States. Applicants must hold a PhD degree, must be citizens or permanent residents of the United States, and must be scheduled to have some major role in the meeting. The deadline for applications for the year beginning June 1, 1996, is February 1, 1996. For further information contact the American Council of Learned Societies, 228 East 45th Street, New York, NY 10017-3398.

Dibner Institute Awards

The Dibner Institute for the History of Science and Technology in Cambridge, Massachusetts, has announced the recipients of its Resident Fellowship and Graduate Fellowship awards for 1995-1996.

Seven of the 19 Resident Fellows are pursuing research of potential interest to historians of physics. Leo Corry, Tel Aviv University, has recently completed a work, *Modern Algebra and the Rise of Mathematical Structures, 1870-1945*, now in press. At the Dibner Institute, he will work on a project entitled "Hilbert and Relativity." Robert Friedel, University of Maryland, has published several works on the history of technology. He plans to explore how the concepts of "invention" and "novelty" have been understood in the West and what their links are to technological applications. Ole Knudsen, University of Aarhus, Denmark, will study the interplay between thermodynamics and electromagnetism in the latter half of the nineteenth century, beginning with the exchanges between Helmholtz and Clausius. Michael S. Mahoney, Princeton University, is the author of *The Mathematical Career of Pierre de Fermat, 1601-1665*, whose second edition was published by the Princeton University Press in 1994. At the Dibner Institute, he will complete a book, tentatively entitled, *No Royal Road: Programming, Productivity, and the Origins of Software Engineering*. Ulrich Majer, The Technical University, Hanover, Germany, will work on his manuscript, *The Emergence of Structuralism in Nineteenth Century Mathematics and Science*. David E. Rowe, Johannes Gutenberg University, Mainz, Germany, has two major projects planned for his stay at the Dibner Institute. The first is "Noether's Theorem," focusing on the prehistory of Emmy Noether's theorem in the calculus of variations, and the second, a

biography of Dirk Jan Struik. George E. Smith, Tufts University, will continue his study of the writings of J.J. Thomson between 1897 and 1913 on the composition of cathode rays, and also complete the compilation of his lecture notes for a volume, Companion to Newton's Principia.

Two of the Dibner's three Visiting Fellows for the current academic year are also pursuing research in the history of physics. Arthur Fine is the John Evans Professor of Philosophy at Northwestern University. He is the co-editor with J. Cushing and S. Goldstein of *Bohmian Mechanics and Quantum Theory: An Appraisal* and the author of *The Shaky Game: Einstein, Realism and the Quantum Theory*. At the Dibner Institute, he will pursue his studies on the role of gauge symmetry as a tool for theory construction in modern physics. Heinz-Jürgen Schmidt, Professor in the Department of Physics, Osnabrück University, Germany, is the co-editor with Ulrich Majer of *Semantical Aspects of Spacetime Theories* and with W. Balzer and D.A. Pearce of *Reduction in Science*. At the Dibner Institute, he will continue studies for a work entitled *Understanding Hertz's Principles of Mechanics*.

Two of the five Dibner Graduate Fellows from the institute's consortium member institutions are pursuing research in the history of physics. Karl P. Hall is a Ph.D. candidate in the Department of the History of Science at Harvard University. His dissertation is entitled *Schools for Scandal: Theoretical Physics in Stalin's Russia*. Babak Razzaghe-Ashrafi was graduated in 1986 from MIT with an S.B. in Physics and Mathematics and received a Ph.D. in Physics from the State University of New York at Stony Brook in 1993. He is now enrolled in MIT's Ph.D. Program in Science, Technology and Society where his area of concentration is the history of nineteenth and twentieth century physics.

The deadline for receipt of applications for the institute's Resident, Visiting Fellows, and Graduate Fellowships for the 1995-1996 academic year is January 1, 1996. Fellowship recipients will be announced in March, 1996.

Requests for further information and application forms should be sent to:

Trudy Kontoff, Program Coordinator
Dibner Building, MIT E56-100
38 Memorial Drive
Cambridge, MA 02139
e-mail: DIBNER@MIT.EDU

Aeronautical R&D History Papers.

Original essays on the history of aviation are requested for a projected book in the NASA History Series on the development of aeronautical technology in the United States. The collected work will consist of case studies in aeronautical research and development. For further information contact Dr. Roger D. Launius, NASA History Office, Code ZH, NASA Headquarters, Washington, DC 20546; Phone: (202) 358-0384; Fax: (202) 358-2866; e-mail: rlaunius@codei.hq.nasa.gov.

How to Collect Hard to Find NASA Histories

More than 60 books have been published in NASA's History Series throughout the history of the agency. A complete list may be obtained from the NASA History Office, Code ICH, NASA Headquarters, Washington, DC 20546, e-mail: history@codei.hq.nasa.gov. The majority of these books is out of print and available from NASA only in photocopy form.

MEETINGS

International Symposium on Technology and Society

The International Symposium on Technology and Society 1996 has issued a call for papers for its June 21-22, 1996, meeting at Princeton New Jersey. The theme is, "Technical Expertise and Public Decisions." Proposals should consist of a one page abstract of a paper or poster, or a proposal for a paper session or panel discussion. Deadline for receipt of proposals is December 15, 1995. Contact Clinton J. Andrews, Program in Science, Technology, and Public Policy, Woodrow Wilson School, Princeton University, Princeton New Jersey 08544-1013. Fax: (609) 258-1985; e-mail: istas@wvs.princeton.edu.

British-North American Joint Meeting for History and Philosophy of Science

The Third British-North American Joint Meeting of the Canadian Society for History and Philosophy of Science, the History of Science society, and the British Society for History of Science will be held in Edinburgh, Scotland, from July 23-26, 1996, a week preceding the international meeting of the Society for the History of Technology in London, August 1-4. The theme of the Edinburgh meeting will be, "Crossing Boundaries," broadly interpreted to include the historical study of science across, for example, national, regional, community, disciplinary, public-private and professional-lay boundaries. For additional information, including instructions for submitting papers, contact representatives from the respective societies: Robert Hatch, History Department, University of Florida, Gainesville, FL 32611, e-mail: ufhatch@nervm.nerdc.ufl.edu; Hannah Gay, History Department, Simon Fraser University, Burnaby, BC. V5A 1S6 Canada: Fax: (604) 291-5387, e-mail: hgay@sfu.ca; Stephen Pumfrey, History Department, Lancaster University, Lancaster LA1 4YG, UK, FAX: (44-524) 846-102, e-mail: hia004@lancaster.ac.uk.

Society for the Social Studies of Science (4S Society): 1996

The Society for the Social Studies of Science will hold its 1996 meeting jointly with the European Association for the Social Study of Science and Technology from October 10-13, 1996, in Bielefeld, Germany. The theme of the meeting will be: "Signatures of Knowledge Societies." Individuals interested in organizing a session or submitting a paper are invited to contact Wolf Krohn, University of Bielefeld, Faculty of Sociology, C 33501 Bielefeld, PF 100131, Germany; Fax: (49-521) 106-5844, e-mail: wkrohn@argo.hrz.uni-gielefeld.de.

Archives of the Scientific Revolution

A conference on Archives of the Scientific Revolution will be held at the Royal Society, London, from April 10-12, 1996. The conference will consider existing archives from the Scientific Revolution as artifacts which reveal much about the individuals and institutions who created them. Archives to be dealt with include the Collezione Galileiana; the papers of Robert Boyle, Christiaan Huygens, G.W. Leibnitz, Isaac Newton, and the collections of the Acad mie des Sciences and the Royal Society. For additional information contact:

Michal Hunter, History Department, Birbeck College, Malet Street, London WC1E 7HX, United Kingdom.

International Congress of History of Science

The 20th International Congress of History of Science will be held at the University of Li. The Congress will be "Science, Technology and Industry." The program will include plenary lectures on themes of general interest, symposia on the theme of the conference as well as other topics, traditional sections and business meetings, and poster sessions. For detailed information contact the Congress Office, Centre d'Histoire des Sciences et des Techniques, Universit de Li 15, B-4000 Li

Diesel Engine Centenary Conference

A conference marking the first successful operation of a Diesel engine will be held in the United Kingdom in May 1997 at a venue yet to be announced. For additional information contact Denis Griffiths, School of Engineering and Technology Management, Liverpool John Moores University, Byrom Street, Liverpool, L3 3AF, United Kingdom.

REPORTS

New Studies of Isaac Newton's Work: APS Meeting in San Jose

An invited session sponsored by the Forum on New Studies of Isaac Newton's Work was held on March 20, 1995, at the APS meeting in San Jose, California.

Alan Shapiro, University of Minnesota, presented a paper entitled, "Artists' Colors and Newton's Colors." He demonstrated that placing Newton's theory of color in the context of the artists' tradition helps to explain why it took until the mid-19th century to develop the distinction between the additive mixing of light and the subtractive mixing of pigments. During the Renaissance, artists rejected the Aristotelian idea that a mixture of white and black, or light and darkness, could generate chromatic colors. Color mixing became a common practice, culminating in the discovery of the three painters' primaries in the early 17th century: red, yellow, and blue. Newton's discovery that sunlight is not simple and pure but a mixture of spectral colors revealed new physical properties of sunlight. But he and his contemporaries also understood his theory to be one about color mixing. That theory took its start from the artists' rejection of black and white as chromatic colors, and in turn it supported the artists' position by further distinguishing them from the chromatic colors. Newton also attempted to bring the painters' three primaries into agreement with the infinite number of "primary" colors that he discovered in sunlight. His synthesis of the two fundamentally different concepts of primary color affected the reception and understanding of his theory in the 18th century.

Subrahmanyam Chandrasekhar*, University of Chicago, spoke about, "Some Propositions of Newton's Principia," based on a book he is completing. Working through all of Newton's propositions in detail has, according to Chandrasekhar, provided him with substantial insight into how Newton thought and worked.: "For me, reading the Principia is like discovering a whole array of gems. The fact that he [Newton] existed is something that I just don't understand."

Michael Nauenberg, University of California, Santa Cruz, who organized the session, presented a paper entitled, "Newton's Early Computational Method for Dynamics." He began by observing that despite considerable historical research, very little is known about how Newton developed the mathematical theory of orbital dynamics which culminated in the Principia. A letter from Newton to Hooke, written on Dec. 13, 1679, reveals that Newton had made considerable more progress in understanding central force motion than had been previously realized. In particular a careful analysis of the original diagram which appears in this letter reveals

that by then Newton understood by the fundamental symmetries of orbital motion for central forces. Moreover, the text of the letter indicates that he had developed a computational method to evaluate orbital motion for arbitrary central forces. Nauenberg went on to show that the early mathematical method Newton used to solve orbital motion for general central forces in his letter to Hooke was based on the calculus of curvature which he developed in the late 1660's. In correspondence with Newton in late 1679, Hooke suggested an alternative physical approach to which Newton gave a mathematical formulation without acknowledging Hooke (later in 1686 he wrote to Halley emphatically denying that Hooke had made any important contributions). This approach led Newton immediately to the discovery of the physical basis of Kepler's area law, which remained hidden in his earlier curvature method. The new approach is described in Proposition I, Theorem I of the Principia, and constitutes the cornerstone for the geometric methods in the book.

**Professor Chandrasekhar, who shared the 1983 Nobel Prize in Physics with William Fowler, died in Chicago on August 21, 1995, following a heart attack. Chandrasekhar, who was 84 at the time of his death, was a nephew of C.V. Raman, the 1931 Nobel Laureate in Physics.*

The Centennial of X-Rays: A Celebration.: APS Meeting in Washington

The session was organized and chaired by Elizabeth Garber of the State University of New York at Stony Brook. In her introductory remarks, she noted that the 1890s marked a turning point in the history of modern physics. Within five years new phenomena were uncovered that could not be encompassed within the available principles governing explanations of physical phenomena. Radioactivity (1896), x-rays (1895) and the electron (1897) mark the importance of experiment for the development of modern physics. X-rays are now essential tools in industry, medicine and the sciences and it is fitting that we examine their disclosure the early history, and impact on physics and other sciences.

Spencer Weart cast new light on "Wilhelm Conrad Roentgen" and his work on x-rays. Rather than being a plodding experimentalist whose only significant work was in 1895 Roentgen emerged as a meticulous "measurement physicist" whose career built steadily--not an insignificant achievement given the conditions in German academia in the late nineteenth century. He trained under August Kundt, and worked on specific heats and other phenomena that seemed to offer insights into the structure of matter through the careful measurement of the physical properties of specific heats of gases, elasticity and heat conduction in solids. His work on cathode rays was a continuation of this search for probes to the structure of matter. Roentgen also had some near misses in the discovery of important phenomena, notably the Kerr effect. He was primed and sensitive to any unusual occurrences in his laboratory work. His exploration of the existence and properties of x-rays was thorough and systematic. While they may have been produced by others before him, Roentgen investigated the established their fundamental properties.

While the impact of x-rays on medicine are taken as very significant Albert Wattenberg, "Physics Experiments with X-Rays, 1895--1913," detailed some of the experiments that were done with and on x-rays in the twenty years after their discovery. Some of the earliest were done by Henri Becquerel who began to examine the fluorescent crystals he was working on for x-ray emissions. This led, in 1896, to his discovery of radioactivity in uranium salts. It did not decide the nature of x-rays themselves. One of the major impediments to the close examination of the properties of x-rays was the lack of an efficient and effective vacuum pump. The mercury pumps available in the 1890s were a "disaster" and it took four days to obtain a decent vacuum. Better equipment allowed Charles Barkla in 1912 to establish the electromagnetic nature of x-rays. Barkla had already used x-rays to establish some fundamental atomic properties of the chemical elements. Also in 1915 William Duane and F. L. Hunt used x-rays to measure Planck's constant. However, this measurement, using a method the reverse of the photoelectric effect confused the issue of the nature of x-rays further.

In the years immediately following the discovery of x-rays theories about their nature multiplied. Nahum Kipnis, "Early Theories of X-Rays," demonstrated that early attempts to understand x-rays were a continuation of theories about the ether that originated in the early nineteenth century. The early theorists assumed x-rays

were some kind of wave motion in the ether. Roentgen favored the idea that they were longitudinal ether waves, a idea shared by Lord Kelvin and George Francis FitzGerald. However, x-rays did not behave as other electromagnetic waves. They did not reflect or refract as other electromagnetic waves, nor were they polarizable. George Gabriel Stokes saw them as non-periodic transverse electromagnetic waves. J. J. Thomson viewed them as pulses of electromagnetic radiation. None of these theories was wholly convincing and adherence seems to follow national boundaries rather than significant physical arguments for one theory rather than any other. While x-rays were accepted as electromagnetic waves their precise nature was left unresolved and some experimental results suggested that they were wave packets, rather than continuous trains of wave motions.

While some physicists argued over the nature of x-rays and others tried to uncover experimentally their precise nature, physicians exploited their medical potential revealed in Roentgen's first paper with the x-ray of his wife's hand. J. S. Laughlin, "Development of X-Rays, Electrons, and Other Radiations for Treatment and Diagnosis," explored some of the aspects of this early research done by physicists rather than physicians and sketched the broadening role of x-rays especially as a diagnostic medical tool. Physicists investigated the dosages and the intensities necessary for seeing bone versus soft tissue and other medical uses. It was not until the development of the Coolidge tube that standards were established for radiology. Van der Graff developed his high voltage generator for both physical research and for use in radiotherapy for the treatment of tumors in the 1930s. The use of x-rays particularly as diagnostic tools and in metabolic studies especially of the brain have expanded their medical usefulness.

Radioactivity and Health: The Cold War Legacy APS Meeting in Washington

An invited session on, Radioactivity and Health: The Cold War Legacy, co-sponsored by the Forum on History of Physics and the Forum on Physics and Society, was held at the APS meeting in Washington, DC, on April 18, 1995. The following summary of the session is excerpted from the texts of the presentations reproduced in the July 1995 Newsletter of the Forum on Physics and Society. The Newsletter is available on-line via the American Physical Society's Forum home page ([../forums.cfm](#))

Lois Joellenbeck of the Office of Technology Assessment presided at the session. In her introduction she suggested that:

- Traditionally, wars have driven technology development. They have also provided motivation and means for major research efforts and innovation. The result of one of the most famous U.S. wartime research efforts, the Manhattan Project, was a powerful weapon that led to both an intensification of old societal challenges and a host of new ones. . . During the Cold War, the novelty and limited understanding of radioactivity and its health effects provided another challenge to decision-making about radiation and its uses in research and industry. The effects of the Cold War have a long half-life. The three presentations at the session illustrate how, in the 1990's, scientists and society at large must still strive to address and learn from past problems. The questions raised are big ones, bigger than the topic of radioactivity alone, and not readily answered.

Mark Goodman, a research analyst with the Advisory Committee on Human Radiation Experiments, presented a paper entitled, "Human Radiation Experiments." He addressed some of the difficult ethical issues raised by human experimentation. Even under ideal circumstances, experiments carried out on human beings require vigilant attention to ethical issues. In the special circumstances of the Cold War, secrecy and the concern for national security provided additional potential for compromising the rights of study participants. "Scientific and technical training alone do not equip investigators with the tools to handle these questions, and under conditions of secrecy there is little opportunity to consider other perspectives."

Barton Hacker, Lawrence Livermore Laboratory, presented a paper entitled, "Setting Radiation Protection Standards: Science, Politics, and Public Attitudes in Historical Perspective." He considered the continuing

scientific discussions about the health effects of low-level doses of radiation, the role of this controversy in setting radiation protection standards, and the evolution of public concern about radiation health effects. "Science is a process; increased understanding in a discipline requires open dialogue between researchers about the interpretation of data. This can prove frustrating to a public seeking unequivocal answers about issues of health and safety."

Marvin Goldman, University of California, Davis, and Health Physics Society, presented a paper entitled, "Radiation Lessons from Russia." Cold War research, development, and production of nuclear weapons has had a significant legacy in the former Soviet Union. Best known are the considerable releases of radionuclides from the Mayak weapons production site near Chelyabinsk in the Southern Ural Mountains. Data have also become available about high exposures to workers at this site. Goldman reviewed the findings to date from studies of health effects from both the environmental and occupational exposures in Russia, considering them in the context of other findings about health effects of radiation.

The Emergence of Modern Physics

An international conference on The Emergence of Modern Physics was held in Berlin, Germany, March 22-24, 1995, organized by Fabio Bevilacqua (University of Pavia), Dieter Hoffmann (University of Berlin), and Roger Stuewer (University of Minnesota). The event was held in conjunction with the 15th Anniversary Meeting of the Deutsche Physikalische Gesellschaft, and was co-sponsored by the Commission on the History of Modern Physics of the Division of History of Science of the International Union of History and Philosophy of Science, the Interdivisional Group on the History of Physics of the European Physical Society, and the Fachverbandes Geschichte der Physik of the Deutsche Physikalische Gesellschaft. Papers were delivered by 47 scholars from 17 countries, with total attendance being approximately 100. Most of the papers dealt with the central theme of the conference and focused on the nature and influence of the seminal discoveries in physics a century ago, namely: x-rays, radioactivity, the electron, the Zeeman effect, and Planck's constant. The organizers believe that the conference was most successful in offering a splendid venue for international scholarly collaboration and for the exchange of ideas on topics of critical significance in the history of modern physics. The possibility of publishing the proceedings is currently being explored. Additional information can be obtained from Roger Stuewer: rstuewer@physics.spa.umn.edu.

OPINION

The World of Science: Hard and Soft

[Editor's Note: the following essay by Forum Vice-Chair Stanley Goldberg is intended as the first of a series of short opinions by this author for publication in the Newsletter. Comments -- as well as candidate "opinions" for publication in this section are welcomed.]

- A feature of the common parlance of most scientists is the separation of the sciences into two major categories: "hard" and "soft." There is such universal acceptance of these two categories that no one ever seems to see the need to further characterize or define the distinguishing features of each. Disciplines such as physics, chemistry, geology and their subcategories--e.g. astrophysics, psychophysics, biophysics, biochemistry, geophysics, physical anthropology --are almost universally accepted as being very hard. Most social science disciplines which fall within the broad domains of sociology and psychology are "soft." If there is any uncertainty within such a classification scheme, it is about how to categorize such specialties as cosmology, paleoastronomy, or paleogeophysics.

The dictionary does not quite capture what is meant by "hard" and "soft" in this context. Of the twenty-three definitions of "hard" in the American Heritage Dictionary of the English Language, the one that

comes closest is number four: "rigorous, stringent and demanding." For soft, using the same dictionary, we have to settle for number six (of twelve): "not sharply drawn or delineated."

A better sense of how "hard" and "soft" are used by scientists can be gleaned from the behavior of social scientists who describe their own work as being "hard." Generally, what characterizes and separates their work from the work of their soft colleagues is their use of abstract mathematics of one kind or another in their analyses. (Such practitioners often explicitly acknowledge that they model their work on the physical sciences.) The implication is clear. At one level "hard" means being able to employ a rigorous mathematical argument to interpret the data being gathered. At a more fundamental level, "hard" and "soft" are used to symbolize what are believed to be differing epistemological and ontological characteristics of various disciplines. "Hard," is meant to communicate the belief that results are certain, rock-solid and immutable -- that the theory (i.e. explanation) and evidence (i.e. measurements) are tied together in ways that provide both understanding and predictability, in short, that results so obtained are "scientific." Contrarily, "soft" is a euphemism, not just for vague and uncertain. It also implies lack of reproducibility of results -- results which can only be arrived at by making a number of untestable assumptions. All of this makes soft studies "unscientific."

Most scientists would shy away from claiming that hard studies result in learning the truth about the basic laws governing the way the natural world works. Many have and do claim, however, that the history of science shows that as one theory replaces another with better predictions covering a wider range of phenomena, we get closer and closer to knowing what those laws are.

How do they know that? If we can't know anything about the physical world directly, without the mediation of our senses, how is it possible to know that we are getting closer to knowledge of how the universe really works? There is only one answer to that question: we can't. This doesn't mean that a person should not believe that we are closing in on the true laws of nature. But such people should also recognize that such a belief is as untestable an assumption as one can make. It is very, very soft, which long-ago suggested to me that the hard/soft categorization of various disciplines is neither meaningful or useful in understanding how the various sciences relate to each other or to the social sciences and the humanities.

Wielding History Like a Hammer

In an editorial entitled "Wielding History Like a Hammer" in the March 1995 edition of *Science Communication*, Marcel C. LaFollette of the Center for International Science & Technology Policy at the George Washington University, reflected on the special and often conflicting responsibilities that historians of science assume when they address a mass audience. She took as her point of departure the controversies that have centered on two exhibitions at the Smithsonian Institution: "The Last Act," which was to have focused on the atomic bombings of Japan, and the less well publicized "Science in American Life" exhibition which opened in April 1994 and for which the American Chemical Society (ACS) raised \$5.3 million. The following excerpt, in which LaFollette's refers to her own observations as a member of the external advisory committee for this exhibition, is particularly provocative:

- . . . the ACS gift was targeted for an exhibit that would use history and computer interactives (or similar "hands-on" activities) to tell about 20th-century U.S. science; the ACS also wanted the exhibit to encourage young people, especially girls and children from ethnic and racial minority groups, to become interested in science. Given the background to this donation, it is even more remarkable than that the ACS itself became the target of so much internal hostility from museum staff. Several historians assigned to the curatorial team made no secret of their disdain for "Big Science" and of everything they believed it represented. Their political ideology opposed industry, and dismissed chemical manufacturers as "polluters." Eventually, the lead curators seemed so fearful of building a "pro-science" exhibit (which would have antagonized some of their colleagues) that they wound up creating a largely negative one. As a member of the project's external advisory committee, I watched ACS

scientists attend the early advisory meetings full of optimism and respect for the Smithsonian; after several years of contentious debate, the overwhelming majority of the advisors grew disillusioned with both process and outcome. During one meeting's lunch break, there was a blatant example of the deterioration of civility, and of the "power, politics, and ideology" problem: an ACS advisor struggled to maintain his composure while a Smithsonian historian harangued him about the horrors of agricultural chemicals. The curator, determined to press a political argument, seemed smugly unconcerned about the effects of his rudeness. He knew that, ultimately, he would write the labels, he would shape the choice of artifact and image - and, thus, audience reaction.

The Danger of Voodoo Science

The Smithsonian's "Science in American Life" exhibition was also the subject of a review essay in the December 1994 edition of *Science Communication* by Robert L. Park, Director of Public Information of the American Physical Society and Professor of Physics at the University of Maryland. The essence of Park's review is best summarized by his conclusion that: "The message, delivered over and over, is that Western civilization is heavily burdened with guilt, and science, as a servant of the power structure, must bear a large share of that guilt."

Park explored other variants of this message in a July 9, 1995, *New York Times* editorial entitled, "The Danger of Voodoo Science," noting that the current ". . . romantic [anti-science] rebellion [is] led not by the religious fundamentalists who are the traditional foes of science, but by serious academics and writers who regard themselves as intellectuals."

- They range from the environmental extremist Jeremy Rifkin, who sees disaster in every new technology, to a University of Delaware philosophy professor, Sandra Harding, who argues that the laws of physics were constructed to maintain white male dominance. An Afrocentric writer, Hunter Adams, contends that the African people were "the well spring of creativity and knowledge on which the foundations of all science, technology and engineering rest." Researchers in the Office of Alternative Medicine at the National Institutes of Health espouse psychic healing and homeopathic medicine.

"Why," Park asked, "have the scientists themselves, who are forever bemoaning the general scientific illiteracy, been so timid about publicly condemning this nincompoopery? Perhaps they fear being cast as intolerant, even of foolishness."

- Progress is never smooth. Each new application begets new problems. But it is science that uncovers the problems and it is to science that we turn to solve them. This is not because scientists have any claim to greater intellect or virtue, but because science is the only means we have to sort out the truth from ideology or fraud or mere foolishness.