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APS Centennial

March 20-26, 1999

www.aps.org/centennial

George Trilling Elected APS Vice-President

Members of The American Physical Society have elected George H. Trilling, a professor emeritus at University of California, Berkeley and senior faculty physicist at Lawrence Berkeley National Laboratory, to be the Society's next vice-president. Trilling's term begins on 1 January 1999, when he will succeed James Langer (University of California, Santa Barbara), who will become president-elect. Trilling will become APS president in 2001. The 1999 president is Jerome Friedman (Massachusetts Institute of Technology). [Look for our annual interview with the incoming APS president in the January 1999 *APS News*.]

In other election results, Michael S. Turner of the University of Chicago and Fermilab was elected chair-elect of the APS Nominating Committee, which will be chaired by Daniel Kleppner of MIT in 1999. The Nominating Committee selects the slate of candidates for vice president, general councillors, and its own chair-elect. Its choices are then voted on by the APS membership. Elected as new general councillors were Philip H. Bucksbaum of the University of Michigan; L. Craig Davis of the Ford Research Laboratory; Leon Lederman of the Illinois Institute of Technology and Fermilab; and James Trefil of George Mason University.

Several minor amendments to the APS Constitution were also approved by the membership in order to permit electronic ballots in future membership-wide elections and proposed Constitutional amendments. The Society hopes that electronic balloting will increase voter participation, lower expenses, and reduce the environmental impact generated by the mailing of paper ballots to each APS member. Confidentiality and accuracy of electronic ballots would be assured, although members preferring to vote on a paper ballot would retain that option for the foreseeable future.

George Trilling
APS Vice- President

Michael S. Turner
APS Chair-Elect,
Nominating Committee

Vice-President

Born in Poland, Trilling received his PhD in 1955 from the California Institute of Technology, joining the University of Michigan in 1957 as assistant professor of physics. Three years later he moved to the University of California at Berkeley, serving as Department Chair in 1968-72, and as Director of the Physics Division of the Lawrence Berkeley National Laboratory in 1984-87. His research is in experimental particle physics, and has included studies of hadron interactions and resonances, electron-positron annihilation at high energy, and colliding beam experiments and detectors. Within the APS, Trilling served on the Physics Planning Committee and as Chair of the Division of Particles and Fields. He is presently a DPF Divisional Councillor.

In his candidate's statement, Trilling identified the Society's general meetings, education and outreach, and communication with the membership as priorities for the APS. He supports emphasizing presentations by outstanding speakers on topics of general interest to help maintain interest in general meetings. Finding ways to make undergraduate physics education more valuable and attractive could help combat the reduced numbers of physics majors in many universities. With regard to outreach and research support, Trilling advocates working with other professional societies to play a leading role in informing the government and general public about the importance of R&D over a broad range of scientific fields, particularly em-

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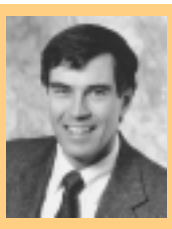
Inside...



Holt Elected

Rush Holt (D), an APS member, was elected to the US House of Representatives in the 12th Congressional District in New Jersey.

Physicists Win Nobel Prizes in Physics and Chemistry

In October, the 1998 Nobel Prize in Physics was awarded to Horst Stormer of Columbia University, and Dan Tsui of Princeton, University, for their discovery of the fractional quantum Hall effect at Bell Labs in 1982. They share the prize with Robert Laughlin of Stanford University, who explained the puzzling phenomenon in terms of quasiparticles a year later. The award will be officially presented at the Royal Swedish Academy of Sciences in Stockholm, Sweden later this month. Stormer and Tsui, both APS Fellows, shared the 1984 Oliver Buckley Prize, which Laughlin won two years later. The trio also shared the 1998 Medal of the Franklin Institute for their work associated with the fractional quantum Hall effect.

Born in 1950 in Visalia, California, Laughlin received his PhD in physics in 1979 at the Massachusetts Institute of Technology. He has been a professor of physics at Stanford since 1989. Stormer was born in 1949 in Frankfurt/Main, Germany, and earned his PhD in physics 1977 at Stuttgart University. He was a supervisor of the Physical Research Laboratory at Bell Laboratories from 1992-98, and is now a professor of physics at Columbia University. Born in 1939 in Henan, China, Tsui received his PhD in physics in 1967 at the University of Chicago, and has been a professor at Princeton University since 1982.

Curtis Hendrickson/National High Magnetic Field Laboratory

A non-superconducting, 33-tesla magnet that is used for continuing research into the quantum Hall effect.

Two other APS Fellows shared the 1998 Nobel Prize in Chemistry. Walter Kohn, a physicist at the University of California, Santa Barbara, and John Pople, a chemist at Northwestern University were cited for their contributions to the

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Elucidating the Hall Effect

The Hall effect is named after Edwin Hall, who in 1879 observed that electrons moving longitudinally along a metal strip (under the influence of an electric field) will, if also subject to a magnetic field perpendicular to the plane of the strip, be deflected toward the side of the strip. Because of this, an excess of charge will build up one side of the strip. This Hall voltage is proportional to the strength of the magnetic field. That is, a plot of Hall voltage (or equivalently the electrical resistance of the material to the sideways current flow) versus field strength would be linear. All of this can be explained in terms of classical physics.

Later, the Hall effect would be studied in a very different setting. This time the electrons are those moving in the two-dimensional world at the interface

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CRITICAL CENTENNIAL MEETING DEADLINES

Student Travel Grant Applications *(See Announcement, page 7)*	**12/15/98**	**Post Deadline Abstracts** *(Posters only)*	**2/19/99**
Early Registration	**1/15/99**	**Housing and Tours Deadline**	**2/20/99**

See Enclosed *APS Meeting Announcements* for complete Centennial Meeting Abstract and Registration Information

Rooney Tackles Range of S&T Issues as Congressional Fellow

Grappling with defense R&D issues, supporting efforts to restructure the R&D tax credit, and lobbying to double federal investment in R&D in the decade are just all in a day's work for Peter Rooney, the 1998 APS Congressional Fellow. Rooney spent the past year as a legislative assistant in the Congressional office of Senator Joseph Lieberman (D-CT), lending his technical expertise on a variety of science and technology issues.

Rooney received his PhD in physics from the University of California, San Diego, in 1995, where his research focused on studying the effect of deposition conditions on chemical order in single-crystal, thin-film binary-metal alloys. During graduate school, he obtained valuable experience as a research assistant with two industry-affiliated research centers, stimulating his interest in U.S. industrial competitiveness and its relation to technology-intensive industries. He also has prior experience as both an entrepreneur and pubic service advocate with his local school board, as well as lobbying organization in California on behalf of environmental issues.

Just prior to his fellowship year, Rooney was a program officer for the National Research Council (NRC), with primary responsibility for the management of the annual assessment of technical programs for areas of the National Institute of Standards and Technology that are engaged in physical science and information science research and development. He also served as study director for three different NRC panels: one on planetary protection issues surrounding a possible Mars sample return mission; another evaluating various NASA approaches to managing space science human exploration missions; and a third to examine the status of research and engineering directed toward developing alternative fire suppression agents to replace halons on naval platforms.

These experiences provided valuable background for Rooney as he tackled a broad range of science-related issues as a Congressional Fellow. A significant portion of his time was spent on innovation defense R&D issues related to Senator Lieberman's position as ranking member on the Acquisitions Technology Subcommittee of the Senate Armed Services Committee, which has jurisdiction over the defense R&D infrastructure.

Another critical thrust was civilian R&D funding, specifically the creation of a bipartisan bill that would double federal research funding over the next 12 years, currently known as S.2217, the Frist-Rockefeller Federal Research Investment Act. While "we did get a bill through the Senate," says Rooney, the effort must begin anew in the next Congress, since "there was no viable House companion bill." Still, he believes that this year's main accomplishment was the building of a coalition of interest groups around the issue. The APS played a crucial role in forming this coalition, along with other professional science and engineering societies (see *APS News*, January 1998, page 6). "The groundwork has been laid [for] increased R&D funding in the next Congress, and it is my expectation that there will be cooperation with both the House and the White House on this issue next year."

Another issue that cropped up during the year was the Research and Experimentation tax credit. Colloquially known as the R&D tax credit, the long-standing program is intended to create incentives for private sector investments; unfortunately, it tends to lapse every few years, according to Rooney. He aided the Lieberman office in lobbying for Senate support of a bill that seeks not only to make the tax credit permanent, but would restructure the program to make it more efficient and accessible. That effort was spearheaded by senator Jeff Bingaman (D-NM), the ranking member on the Senate Joint Economic Committee, and his committee staff. Rooney also briefly found himself involved in the debate on digital copyright issues for databases.

> [This fellowship is] a wonderful experience, even better than I could have anticipated.
>
> *Peter Rooney*
> *1998 APS Congressional Fellow*

Rooney was encouraged by his observation of both increased Congressional interest in science and technology issues, and increased levels of scientific literacy as a result of that growing interest. He sees "a growing recognition that the high- tech sector of the economy is in fact very important." As an example, he points to Texas, where employment in the high tech sector is currently almost 10 times that of the oil industry, as well as numerous other states that have traditionally been aligned with heavy manufacturing or agriculture and are moving into software and telecommunications. "Eventually that seeps into the Members' consciousness," he says, "So there's a perception that because of the way the economy is developing, science and technology issues are going to be very important in policy making."

Overall, Rooney pronounced his fellowship year "a wonderful experience, even better than I could have anticipated," and praised the experience, professionalism, effectiveness and strong involvement in science issues of Senator Lieberman and his Congressional staff. Rooney intends to remain involved in the science policy arena, preferably on Capitol Hill. "I love what I'm doing now and would love to remain in this arena," he said.

The APS Congressional Fellowship program is intended to provide a public service by making available individuals with scientific knowledge and skills to Members of Congress, few of whom have a technical background. This is deemed important because public policy increasingly is determined by technical considerations, and science is a major component of many issues with which Congress must grapple: global warming, energy policy, defense technologies, AIDS, pollution, communications technologies, to name a few. In turn, the program enables scientists to broaden their experience through direct involvement with the legislative and political processes, which ideally will enhance not only their own careers, but the physics community's ability to communicate more effectively with its representatives in Congress.

If you are interested in becoming a Congressional Fellow turn to the Announcement on page 7. **The application deadline is January 15, 1999.**

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Newswriter: **Jennifer Ouellette**
Production: **Elizabeth Buchan-Higgins**
Alicia Y. Chang
Coordinator: Amy Halsted

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Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, *APS News*, One Physics Ellipse, College Park, MD 20749-3844, E-mail: letters@aps.org.

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Distinguished Traveling Lecturer Program in Laser Science

The Division of Laser Science (DLS) of the American Physical Society announces the continuance of its sponsorship of a lecture program in Laser Science, and invites applications from host schools for the next round of awards. Lecturers will visit selected academic institutions for two days, during which time they will give a public lecture open to the entire academic community and meet informally with students and faculty. They may also give guest lectures in classes related to Laser Science. The purpose of the program is to bring distinguished scientists to predominantly undergraduate colleges and universities in order to convey the excitement of Laser Science to undergraduate students.

Lecturers for the 1997-1998 Academic Year:

- Geraldine Richmond, Univ. of Oregon, Dept. of Chemistry. *Surface Non-Linear Optics.*
- Jagdeep Shah, AT&T Bell Laboratories. *Quantum Optics, including semiconductors.*
- Philip Bucksbaum, Dept. of Physics, Univ. of Michigan. *High-Field Laser Physics.*
- Carlos Stroud, The Institute of Optics, University of Rochester. *Wave packets.*
- Lee W. Casperson, Department of Electrical Engineering, Portland State University. *Lasers and Optical Systems.*
- Wolfgang Ketterle, Dept. of Physics, MIT. *Atom cooling and trapping.*

DLS will be responsible for the travel expenses and honorarium of the lecturer. The host institution will be responsible for the local expenses of the lecturer and for advertising the public lecture. Recommendations to the DLS chair for host institutions will be made by the Selection Committee after consulting with the lecturers. Priority will be given to those institutions that are not located in major metropolitan centers and do not have extensive resources for similar programs. Applications should be submitted by members of DLS. Membership application can easily be made at the internet homepage for APS: http://www.aps.org/

Applications should be sent to Win Smith (winthrop@uconnvm.uconn.edu), the DLS Secretary-Treasurer, and also to DTL Committee Chair Rainer Grobe (grobe@phy.ilstu.edu). The extended deadline for this year's applications is **February 18,1999**.

Detailed and up-to-date information about the program and the application procedure is available on DLS homepage on the World Wide Web at http://www.physics.wm.edu/~cooke/dls/p_dtl.html

Centennial Travel Awards for NY State High School Teachers

The New York State Section of the APS will make up to two awards of as much as $1000 each for high school science teachers from New York state or contiguous states or provinces to attend the Centennial Meeting in Atlanta, Georgia, March 20-26, 1999. Individuals interested in applying should contact Carolyn MacDonald, Chair NYSS APS, Physics University at Albany, Albany, NY 12222 [c.macdonald@albany.edu] for more information. **The deadline for applications is January 15, 1999.**

Tenure Task Force Submits Final Report

The APS Task Force on Academic Tenure, chaired by John Poate (New Jersey Institute of Technology), presented its final report to the APS Executive Board in September, and to the APS Council in November. The task force concluded that no official statement from the APS is required at this time. The full report follows below.

The other members of the APS Task Force on Academic Tenure were Raymond Brock, Michigan State University; Jolie Cizewski, Rutgers University; Roger Falcone, University of California, Berkeley; Robert Gluckstern, University of Maryland; and Stephen Ralph, Georgia Institute of Technology. In addition, Jack Roach, executive assistant chief counsel to the Office of the President at the University of Maryland, College Park, served as legal consultant to the task force.

Final Report on Academic Tenure

After an extensive review the APS Task Force on Academic Tenure concluded that the academic community regards tenure as a privilege not an entitlement and if institutions, which combine both research and teaching, were to start from scratch they would probably come up with a system very similar to the existing tenure system.

There is little evidence that the professorial academic community, or physicists in industry and national labs, are overly concerned about tenure. The tensions that exist are between the tenured and the non-tenured stream teaching and research staff. These tensions could grow as university research enterprises expand. Junior physicists discern that problems with the tenure system lie primarily with such factors as lack of retirement age for senior faculty. They also perceive the increase of the non-tenured stream to be a problem. Institutions that expand their missions from a predominantly teaching role to include research frequently experience tensions between the existing teaching faculty and the newly-hired research faculty. This is especially true if the institution does not have the resources to hire an adequate number of research-oriented faculty.

The review process now spans the range from the usual annual salary review (and concomitant merit reviews) of junior and senior faculty to a periodic formal review of the person's tenure, a process which could ultimately lead to loss of same. Physics departments do not usually feature in tenure wars because of quantitative nature of discipline. However, a better job could be done articulating annually the criteria for tenure to tenure-track faculty. Realistic evaluations of the relative weights of teaching and research in the tenure decision process must be given; this implies an understanding of the institutional mission.

Finally, there is a lack of knowledge in the academic community as a whole regarding the legal basis and the very recent history of tenure. There is still not a body of law relating to tenure or academic freedom. Tenure is essentially a contractual agreement and academic freedom stems from the First Amendment right.

The Task Force recommended that the APS should not make a statement about the role or future of tenure in the physics community at this time. Such a statement could be harmful in the current environment where the tenure debate, which is not a uniquely physics phenomenon, appears to be largely driven by political or perceived financial imperatives. The Task Force feels that there are much bigger challenges facing the physics community such as more comprehensive undergraduate and graduate training, financial constraints, and the physics research infrastructure. If there are to be changes in the tenure process or structure of the physics community they will probably be driven by market and/or political forces. The time for a statement by the APS would be when these forces start to radically change the physics community.

The Task Force urged the APS to encourage all physics departments to articulate the requirements for tenure and promotion and mentor junior faculty at all stages. In addition, an APS sponsored article detailing the legal history of tenure and academic freedom in *Physics Today* or the *Chronicle of Higher Education* could be of general interest to the community.

A century of physics

1975-1985: Images

by Hans Christian von Baeyer, William and Mary University

On July 20, 1976, a couple of weeks after the two hundredth birthday of the United States, an automated spacecraft landed on Mars and beamed back images of its red soil. The world held its breath as a robot searched for extraterrestrial life (and found none). As significant as the experiment, was the manner in which the news was reported to the public. As a result of the universal spread of color TV, visual images began to supplant the written and spoken word which had been the principal carrier of news since antiquity.

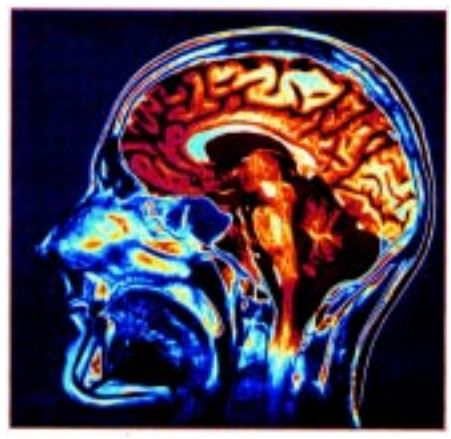


Photo from the A Century of Physics Time Line Wall Chart

Peering into the human body with a Magnetic Resonance Imaging (MRI)

Science itself has long recognized the value of human vision enhanced by technology. To the telescopes, microscopes, and cameras of classical physics the twentieth century has added television, holography, and, most importantly, the computer. The field of computer graphics, which builds upon discoveries in modern physics, has in turn become an indispensable tool for basic research.

In 1981 an ancient dream came true when the outlines of individual atoms were revealed to the human eye for the first time. The instrument that made this possible, called the Scanning Tunneling Microscope (STM), consists of a fine needle whose tip gently scans a surface the way a blind person's fingertip might scan an unfamiliar face. The digitized contours are fed into a computer which organizes them into a picture resembling the underside of an egg carton: each bump represents a single atom. Synthetic color coding adds to the contrast and helps to identify atoms of different species. The resulting map of the invisible atomic landscape we inhabit is imbued with a haunting beauty.

In medicine the combination of computers with different probes has yielded equally dramatic results. Views of the brain produced by pencil-thin beams of X-rays — useless when considered individually — are assembled by Computerized Tomography (CT) scanners into three-dimensional color coded images that have revolutionized neurosurgery. Ultrasound images of fetuses have benefited obstetrics. Other techniques for peering into the human body include Magnetic Resonance Imaging (MRI), which produced the picture and Positron Emission Tomography (PET scanning), which records the radiation emitted when positrons from radioactive materials administered to the body annihilate electrons in nearby cells.

Even pure mathematics, the queen of the sciences aloof from the material world, has embraced computer graphics. The Mandelbrot set, for example, a mathematical structure whose delicate beauty and complexity fascinates mathematicians, artists, and computer whizzes, owed its discovery in 1979 to the emerging image making capability of the computer.

The generations of physicists after 1975 will not look at the world through glass lenses, but at its image on a computer monitor. What will they see?

Editor's Note: A CENTURY OF PHYSICS, a dramatic illustrated timeline wallchart of over a hundred entries on eleven large posters is intended for high schools and colleges. Each poster covers about a decade and is introduced by a thumbnail essay to provide a glimpse of the historical and scientific context of the time. A CENTURY OF PHYSICS will be on display at the Atlanta Centennial Meeting in March.

In the January 1999 issue, APS News will feature the tenth and penultimate introductory essay: ***1985 - 1995: Taking a Second Look****.*

Executive Board Reaffirms 1995 EMF Statement

At its September meeting, the APS Executive Board reaffirmed the Society's 1995 statement [http://www.aps.org/statements] on power line fields and public health, triggered by public concern over the perceived potential cancer risks of extreme low frequency electromagnetic fields generated by said power lines. That statement concluded that "conjectures relating cancer to power line fields have not been scientifically substantiated." In fact, since then, additional scientific studies and exhaustive epidemiological surveys have uncovered no evidence of health effects from power line fields. The Executive Board was prompted by actions of a panel convened by the National Institute of Environmental Health Sciences, which voted to make EMF a "possible" carcinogen. Their claim contradicts a 3-year NRC review and monumental NCI epidemiological studies. In a second statement approved at the same meeting, the APS Executive Board of the American Physical Society affirmed its continuing support for the efforts of its officers and others to achieve science-content standards in the State of California that are consistent with those developed by the NAS and AAAS.

Senior/Retired Member Breakfast at Centennial

An APS Senior/Retired Member breakfast will be held Tuesday, March 23 from 7:30am to 9:00am Spouses and companions are welcome. This special breakfast will be hosted by the APS and Mid-Atlantic Seniors Group. Tickets can be purchased for $10 at the time you register for the meeting, either prior or on-site. Space is limited, and tickets will not be sold at the door. Information will be available about the activities of the newly-formed Mid-Atlantic Seniors Group and how other senior groups can get started.

Attend a Grand Reunion at the Centennial

In response to an invitation to all PhD-granting physics departments, the universities and research laboratories listed below have chosen to participate in our special "Grand Reunion" which is part of the APS Centennial Celebration. The Grand Reunion will be held on Tuesday, March 23, 1999 from 6:00-8:30 p.m. at the Georgia World Congress Center. All of these institutions cordially invite current and previous students, post docs and faculty, as well as friends to visit their reception and renew old acquaintances.

Because space is limited, we regret that we can no longer invite additional universities to participate in the Grand Reunion.

Arizona State University
Brookhaven National Laboratories
Brown University
California Institute of Technology
Case Western Reserve
Columbia University
Cornell University
CUNY, Brooklyn College
CUNY, City College of New York
CUNY, Hunter College
CUNY, Queens College
Drexel University
Duke University
Emory University
Florida Institute of Technology
Florida State University
George Washington University
Georgia Institute of Technology
Hampton University
Harvard University
Iowa State University
Jefferson Laboratories
Lawrence Livermore National Lab.
Lehigh University
Los Alamos National Laboratories
Louisiana State University
Massachusetts Institute of Technology
Michigan State University
Naval Postgraduate School
Norfolk State University
North Carolina State University
New York University
Northeastern University
Oak Ridge National Laboratories
Ohio State University
Ohio University
Old Dominion University
Penn State University
Purdue University
Rutgers University
Sandia National Laboratories
Southern Illinois University, Carbondale
State University of New York, Stoneybrook
Stevens Institute of Technology
Texas A & M
University of California, Berkeley
University of California, Davis
University of California, Riverside
University of California, San Diego
University of California, Santa Barbara
University of Connecticut
University of Florida
University of Illinois, Urbana Champaign
University of Maine
University of Maryland
University of Michigan
University of Minnesota
University of North Carolina, Chapel Hill
University of Pennsylvania
University of Pittsburgh
University of Rochester
University of Tennessee, Knoxville
University of Texas
University of Washington
University of Wisconsin, Madison
University of Virginia
Vanderbilt University
Virginia Polytechnic University
West Virginia University
William & Mary

OPINION

Science Policy and the Science Community

by William R. Brinkley, President FASEB (Federation at American Socities for Experimental Biology)

This is truly a great time to be a scientist. New tools and technologies are enabling us to perform more research and do it more rapidly then ever before. Startling and revolutionary discoveries are occurring at an unprecedented rate. Electronic communications allow us to work directly with colleagues around the world as through they were just down the hall. Public support is high, yet this is also a time of many serious challenges. Our system of graduate education and research training is experiencing strains, and many people are beginning to question the continued viability of a system that has produced such exceptional scientific and technical talent. There are ethical issues arising out of new discoveries and funding issues that grow more vexing as the cost of doing research increases.

As scientists, we must focus our critical attention on our own research enterprise as well as on the subjects of our various disciplines. Therefore, we were especially fortunate when the leadership in Congress chose a man of science, physicist Vernon Ehlers (R-MI), to chair a major review of U.S. science policy. We now have the report from this study (see "The Back Page", *APS News*, November 1998). As President of the Federation of American Societies for Experimental Biology (FASEB), I have asked our public affairs committee to take a careful look at this report and its recommendations.

Our initial review of the report, *Unlocking Our Future: Toward a New National Science Policy*, has revealed several points of strong agreement, two of which are especially important to the long-term future of American science. We agree wholeheartedly with the suggestion that scientists become involved early in the political decision making process. We also support the recommendation that the federal government fund basic research in a broad spectrum of scientific disciplines. The contributions of these fields are essential to the accomplishments of the U.S. science enterprise and any growth in future funding must reflect their importance.

Regarding political involvement, FASEB has been and will continue to be actively engaged. We believe that our past and future successes are consistent with — and not antagonistic to — growth in other fields. The increases in funding biomedical research do not come at the expense of the other fields of science. There is no single pool of science funds, from which one field's success is gained at the expense of others. FASEB's successful program of articulate, focused, and persistent advocacy can be a model for other groups. In addition, we stand ready to support those actions that are consistent with our programs and within our areas of expertise. Our efforts have been based on the view that strong and vocal support for research funding is our right as citizens and our responsibility as experts on the scientific opportunity.

We must not allow nay-sayers to define our agenda for us. The assumption that the federal budget cannot support growth in research funding has been proven false. Economic conditions change and budget caps can be raised, revised or surmounted. Success in science has always been characterized by a refusal to accept the limitations that others have set. Things once believed impossible are now so much a part of our everyday lives that we often forget how remarkable and revolutionary they are. We hold the same view in public policy and will continue to aggressively pursue the programs and policies that are in the best interests of the research community.

I can assure you that the community of biological scientists stands firmly behind the goal of funding in a broad spectrum of disciplines. For we truly believe that tremendous potential for progress in biological and medical research will only be achieved if there is a steady flow of new insights from the other fields of science. These discoveries have propelled much of our progress in the past and will undoubtedly guide our success in the future. FASEB is on record in support of broad, multidisciplinary funding. Last year, our annual funding conference recommendations included a 10% increase for NSF, including all of its directorates and programs.

For several years, we have invited the leaders of the American Physical Society (APS), the American Chemical Society (ACS), and the American Mathematical Society to join us in developing our recommendations for federal science funding. Last year, we testified jointly on the NSF appropriation with the Presidents of APS and ACS and look forward to continuing this cooperation in the coming year. We have also been active supporters of the Coalition for National Science Funding (CNSF), an umbrella organization working to raise the profile of the NSF and increase funding for research in science, engineering, and mathematics.

FASEB's testimony in support of the National Institutes of Health (NIH) was based upon our assessment of the tremendous opportunity for advancement in the health sciences. These recommendations, however, explicitly acknowledge the importance of physics, chemistry, mathematics, computer science, and other fields in medical research and call for funding increases to ensure that research in these fields is able to flourish. Our FY1999 funding conference report called upon NIH to establish more collaborative programs with physicists, mathematicians, and engineers.

Indeed, it is time to raise the funding levels of all areas of science in the name of improved health, quality of life and standard of living. Advances in mathematics, physics, chemistry and engineering are vital to progress in medical science. Therefore, FASEB fully endorses congressman Ehlers' proposal that the federal government increase funds for basic research in a broader spectrum of scientific disciplines. We look forward to the opportunity to work with the leaders of these disciplines to help make this happen.

zero gravity

Ig Nobel Prizes Awarded at Harvard

The 1998 Ig Nobel Prizes, presented for achievements that "cannot or should not be reproduced," were awarded at Harvard's Sanders Theatre in early October before 1200 spectators in a ceremony filled with hijinks, paper airplanes, and duct tape. The event was produced by the science humor magazine, *Annals of Improbable Research (AIR)*, and co-sponsored by the Harvard Computer Society, the Harvard-Radcliffe Science Fiction Association, and Manco, proud suppliers of Duck™ Tape.

The Prizes were physically handed to the winners by genuine Nobel Laureates William Lipscomb (Chemistry '76), Richard Roberts (Physiology or Medicine '93), Dudley Herschbach (Chemistry '86), and Sheldon Glashow (Physics '79). The evening also featured numerous tributes to duct tape, including a duct tape fashion show and a duct tape opera. Richard Roberts was the prize in the annual Win-a-Date-With-a-Nobel-Laureate Contest.

Recipients of the 1998 Ig Nobel Prizes are as follows:

Safety Engineering

Troy Hurtubise, of North Bay, Ontario, for developing, and personally testing a suit of armor that is impervious to grizzly bears.

Biology

Peter Fong of Gettysburg College, Gettysburg, Pennsylvania, for contributing to the happiness of clams by giving them Prozac.

Peace

Prime Minister Shri Atal Bihari Vajpayee of India and Prime Minister Nawaz Sharif of Pakistan for their aggressively peaceful explosions of atomic bombs.

Chemistry

Jacques Benveniste of France for his homeopathic discovery that not only does water have memory, but that the information can be transmitted over telephone lines and the Internet.

Science Education

Dolores Krieger, Professor Emerita, New York University, for demonstrating the merits of therapeutic touch, a method by which nurses manipulate the energy fields of ailing patients without physical contact.

Statistics

Jerald Bain of Mt. Sinai Hospital in Toronto and Kerry Siminoski of the University of Alberta for their carefully measured report, "The Relationship Among Height, Penile Length, and Foot Size."

Physics

Deepak Chopra of The Chopra Center for Well Being, La Jolla, California, for his unique interpretation of quantum physics as it applies to life, liberty, and the pursuit of economic happiness. Sheldon Glashow (Nobel 79) accepted on behalf of Chopra, citing Chopra's use of quantum mechanics in the pursuit of economic bliss. In his best-seller, "Quantum Healing," Chopra explained that, "We need to consult the quantum to understand how the mind pivots on the turning point of a molecule."

"It says 'you may already be a Nobel Prize winner'."

Brain Teaser Limerick Contest Submission deadline extended to January 31, 1999

We are looking for original brain teaser limericks on more advanced physical and mathematical concepts, as a challenge to readers and would-be limerickists alike. Winning entries will receive the usual fabulous prizes, plus publication in a future issue of APS News. The deadline for receipt of submissions is January 31, 1999. To view examples, see Zero Gravity in the August/September 1998 *APS News* (page 5) or online at http://www.aps.org/apsnews/.

Photo courtesy of Bill Frazer

APS Headquarters?

(It is actually a porta-pottie near Aspen, CO. The "APS" stands for "Affordable Portable Services")

How Duct Tape Sealed My Place in History

by Max Sherman

"Daddy is famous," declared my five-year-old. "Famous" is something Sabrina can relate to, unlike "scientist," which is what Daddy really is. While my daughter might have had some vague understanding of the purpose of my scientific work — "saving electricity" — she now thinks that Daddy's job is to have his name in the paper and on the radio.

I owe this to what appears to be one of the foundations of American society: duct tape. Yes, I am talking about that gray sticky roll of stuff you probably have in your house, car, boat, truck, or garage. You may have heard about me in September, or at least about my work, because I was credited with finding out that duct tape is really not very good for sealing ducts. The story of my findings spread globally, breaking through all the other news barriers, appearing in more places than I care to count. It was a duct tape feeding frenzy.

> "Yes, I really am a scientist, and yes, I really am 'doing science.'
>
> *Max Sherman*
> *APS Member, Professor of Physics and Senior Scientist*

Yes, I really am a scientist, and yes, I really am "doing science." I study energy efficiency in buildings. This task has involved testing the effectiveness of duct sealants. Anyone who has dealt with old ducts in an attic will not be surprised to hear about failing duct tape. Although I have always used duct tape, it was not part of my boyhood ambition to make a career out of it. While getting my PhD in physics from Berkeley, such dreams involved winning a Nobel Prize or discovering a new element, a new planet, a new particle or new energy sources, rather than finding flaws with duct tape.

I decided early in my career to work on the scientific aspects of energy and environmental issues. My colleagues and I have been working on the important, but hardly Einsteinian, problems of why so much energy is wasted in the heating and cooling ducts of houses. Over the past two years, we have used the resources of the Lawrence Berkeley National Laboratory to build an apparatus capable of doing accelerated testing of different kinds of duct sealants. We exposed the sealants to rapid changes in heat, cold and pressure in ranges typical of extremes found in houses. While most of the sealants passed our test, duct tape failed, often in just a few days.

The sound bite I provided for this, which was grabbed by the media, was that "it failed reliably, and often catastrophically." I admit to selecting those words for their impact. "Catastrophically" is technically quite accurate, but sounds like something more dramatic than tape falling off quickly.

Because our findings were so clearcut, we wanted to publish them promptly for the benefit of sponsors, so we chose the journal *Home Energy* (July/August 1998 issue), rather than the more hidebound scientific publications we usually pick. ["Can Duct Tape Take the Heat?" can be found online at www.homenergy.org/989ductape.title.] Almost as soon as our published results became available on the Web in July, my life took on a different character. It started quietly, with a call from *Better Homes and Gardens*, which was preparing a duct tape piece mentioning my research for its September issue.

Perversely, a July 27 story in *USA Today* indirectly triggered the frenzy that followed. *USA Today* gave credit for this research to the Lawrence Livermore Lab rather than the Lawrence Berkeley Lab. To the labs, this is like confusing a Republican from North Carolina with a Democrat from Massachusetts. [The Berkeley Lab is the older and more diverse, while Livermore Lab does the classified nuclear weapons work.] The Berkeley Lab public relations office sprang into action, taking a press release it had been preparing in a more leisurely fashion and expediting it — so that such a mistake would not happen again.

That's when the phones started ringing. I was a little taken aback when I got a call from a reporter who "covers duct tape for the Wall Street Journal." It occurred to me that this was a rather specialized position, until he informed me that he did other things as well. In the next week came the *Sacramento Bee* and *San Jose Mercury News*. I formed an appreciation for what good science editors and writers do at metropolitan papers. Most of the other coverage was derived from these two stories. Carrie Peyton of the Bee came to our lab to interview us and see the apparatus and the results. Glennda Chui of the Mercury News came down to the conference where I was presenting the results.

The few days which followed are still a blur. I was interviewed (by phone) by MSNBC, NPR, CBS, the Associated Press and several others that I can't remember. The Canadian Broadcasting Corporation's "As It Happens" radio program did a story with my Canadian co-author, Iain Walker, followed by a listener call-in on duct tape the following day.

Soon I was doing several interviews daily, answering questions like: "How did it get its name?" (I don't know.) "What can you use it for?" (Anything but ducts.) "Do you use duct tape?" (All the time, just not on ducts.) It gives one a bit of a swelled head to have two producers from NPR fighting over which show you should be on, or to put the Associated Press on hold while you talk to CBS.

Early one morning while I was at the conference, my wife Jan got a phone call asking for me. When the caller then asked for Iain Walker, who would not normally be at my home at that hour, she was a bit concerned. But when the called asked if she knew anything about duct tape, she realized what was going on. What Jan did not realize was that as soon as she said she knew a little of the results, she was on Alaskan radio — live. The Anchorage newspaper reported that a pillar of Alaskan culture was under attack; it appears that Alaskans take their duct tape quite seriously.

There is a sort of duct tape cult, which I became aware of when we started this research. Web sites and books abound, glorifying the many uses of duct tape. Few mention ducts at all. The cults appear harmless, but my wife is concerned over my notoriety. So she has forbidden me from opening any packages sealed with duct tape, meeting with duct tape manufacturers unchaperoned, or having anything to do with the state of Montana.

My friends and relatives have since called in from all over the country. There was a bit of, "You got a PhD in physics so you could what? Study duct tape?" Or, "Real scientists don't do duct tape." Or, "You wasted your 15 minutes of fame on duct tape?"

There is a serious side to this story. Millions of homes have their duct systems sealed with duct tape. Our results indicate that there could be a large number of premature failures, especially in the Sun Belt. Such failures would not usually be obvious. Rather, it would look as if the air conditioning (or heating) was simply not doing the job as well as it used to. The homeowner would call the repair guy, who would sell them a larger unit, and all would be fine again.

Fine, except for the fact that the homeowner was paying far too much money for energy and equipment, and that big chunks of carbon were being added to our atmosphere needlessly. This enormous potential savings is why the utility rate payer (through the California Institute for Energy Efficiency) and the American taxpayer (through the Department of Energy and the Environmental Protection Agency) are paying us to do duct research.

As a professional, the one line I should probably be the most proud of is the one in the soon-to-be-adopted energy code of the state of California that discourages the use of duct tape on ducts by builders. Using other sealants (of which there are plenty) is a win-win situation, saving the homeowner money and helping the environment. But as one-liners go, seeing yourself quoted in Time magazine is hard to beat.

Soon all of this duct tapery will be forgotten by the press. I will get back to my less exciting but still important research. Sabrina has already grown tired of hearing about duct tape and has ordered us to stop talking about it at dinner. She has declared, and rightly so, that her first week in kindergarten ought to be the subject of conversation.

I am, however, still a "duct tape hero" in the eyes of my seven- year-old, Alex. He read that duct tape is like the Force because it binds us and holds us together. Naturally, then, Daddy must be a Jedi knight. Thank you, duct tape.

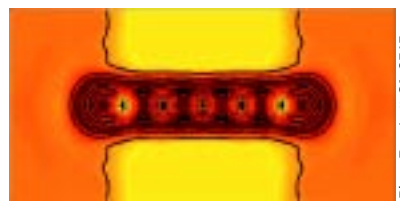
Max Sherman, an APS member, is professor of physics at the University of California, Berkeley, and a senior scientist at the Lawrence Berkeley National Laboratory. His Home Page is http://www-epb.lbl.gov/MHSherman. Further duct tape information is available from http://ducts.lbl.gov/ducttape

Reprinted, with permission, from The Washington Post, Sunday, September 13, 1998, page C01.

Physical Review Focus

PR Focus is a FREE APS electronic journal featuring highlights of selected *Physical Review Letters* accessible to all physicists. The editor is David Ehrenstein [see page 1, April 1998 *APS News*]. *PR Focus* is available at the web address: http://publish.aps.org/FOCUS/. *APS News* will print samplings from *PR Focus* over the next few issues to introduce the membership to this new journal. To receive one-paragraph introductions to *Focus* stories each week by e-mail, send the following message to majordomo@aps.org: subscribe focus [Leave the subject line blank].

Atom Wire Resists Conventions



Phys. Rev. Lett. **81**, 3515

World's smallest wire. Electron density contours show the six-atom chain and semi-infinite slabs of metal used for the calculation of atom wire conductivity.

As the electronic circuits on chips continue to be miniaturized, physicists have naturally looked ahead to the smallest wires possible: those made of only a few atoms or molecules. Researchers have made some rudimentary versions in the lab, but the electrical properties of atomic wires are not well understood. Calculations published in the 19 October *PRL* show that even in a simple example, those properties can be surprising. While a normal wire increases its resistance with increasing length, they found that the resistance of a chain of carbon atoms oscillates with length, becoming higher for an even number of atoms than for an odd number. The results show that the connections at either end of the atom wire have important effects on the wire's properties and must be studied in more detail before the technology can be implemented.

Atom wires are not only small; their lack of impurities should allow them to carry thousands of times the current density that normal copper wires can handle, according to Phaedon Avouris of the IBM Watson Research Center in Yorktown Heights, NY. He also sees atom wires as model systems for learning about carbon nanotubes, the molecular cousins of buckyballs that many researchers see as today's most practical nanoscale wires. To better understand the properties of these tiny conductors, Avouris and his IBM colleague Norton Lang analyzed a wire made of between three and seven carbon atoms attached to large chunks of metal at each end, which represented connections to a macroscopic circuit. Assuming 0.01 volts were applied across the wire, they calculated its conductance (inverse of resistance).

According to their calculations, the conductance of such a wire does not change continuously with length, but is higher for odd numbers of atoms than for even numbers. The reason, they found, is that for three, five, or seven carbon atoms, there are more available states for electrons to occupy as they traverse the wire. This pattern is determined not only by the structure of the free carbon chain, but also by the number of extra electrons that are permanently drawn onto the wire from the metal contacts. Lang and Avouris also looked at the wire's conductance as the two electrodes are moved apart, keeping the wire fixed in length and centered between them. Again, the result was surprising: The conductance drops, then increases to a maximum with increasing distance, even as the electrodes' contact with the wire worsens.

Both results point to the importance of the carbon-metal interactions, says Uzi Landman, of the Georgia Institute of Technology in Atlanta. "It's not enough anymore to just study the nanowire itself because everything can change when you make the contact." He says researchers have suspected the importance of metal contacts with carbon-based wires, but "nobody actually did a hard calculation." Landman says the work should inspire other theorists to perform more detailed calculations of these effects and experimentalists to test the predictions.

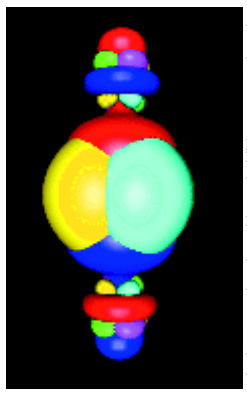
This PR Focus *article appeared in PR Focus vol. 2, story 20, posted October 23, 1998. Primary material: Oscillatory Conductance of Carbon-Atom Wires, N.D. Lang and Ph. Avouris, Phys. Rev. Lett.* ***81****, 3515 (19 October 1998).*

[Note: A line was dropped from the first paragraph of the November *PR Focus* article. The on-line version has the correction.]

Nobel Prizes, *continued from page 1*

establishment of computational quantum chemistry. Kohn, who headed the Institute of Theoretical Physics in Santa Barbara from 1979-1984, developed the density-function theory, which describes atomic and molecular bonding not by accounting for the motions of all the participating electrons, but rather by specifying the effective density of electrons, making the whole problem much more computationally tractable. Pople developed computational methods combining new quantum chemistry insights with the increasing power of computers.

Addition information on the research for which the 1998 Nobel Prizes in Physics and Chemistry were awarded can be obtained from two October 1998 *Physical Review Focus* articles [www.aps.org/FOCUS/] and the Nobel Prize website [www.nobel.se/foundation/press-prize98.html].



Nicola Marzari and David Vanderbilt/Rutgers University

Localized orbitals in the electronic structure of the $BaTiO_3$ crystal, calculated using density functional theory.

MEETING BRIEFS

Plasma Processing, Electron Swarms Highlight 1998 GEC

Plasma processing, electron swarms, and innovative plasma sources were among the featured topics at the joint meeting of the Gaseous Electronics Conference (a popular APS-sponsored topical conference) and the International Conference on Reactive Plasmas (ICRP), held October 19-22 in Maui, Hawaii. Plenary sessions included a presentation by the recipient of the 1998 APS Will Allis Prize, Ray Flannery of Georgia Tech, on three-body recombinations at thermal and ultra-low energies. Robert Compton of Australian National University reported on new results from electron swarm experiments, which he believes provide a valuable link between gaseous electronics and atomic physics. Hideo Sugai of Nagoya University in Japan described efforts to develop high- density large-diameter plasma sources to keep up with continuing progress in plasma-aided deposition and etching for the manufacture of semiconductor devices. Other speakers focused on the development and commercialization of large area color plasma displays, the role of plasma diagnostics in developing plasma processing tools for the semiconductor industry, and the development of new industrial plasma apparatus: an ozone generator, a CO_2 laser, and a plasma display panel excited by silent discharge.

DNP Holds 1998 Fall Meeting

The APS Division of Nuclear Physics (DNP) held its annual fall meeting, October 28-31 in Santa Fe, New Mexico, opening with a special evening session commemorating the life and science of David Schramm, a prominent cosmologist who was killed in an airplane crash earlier this year. A plenary session on frontiers in nuclear and particle astrophysics and cosmology was also featured, along with invited sessions on such topics as neutrino oscillations and neutrino mass, double beta decay, the search for exotic mesons, and hadron structure and nuclear force. The meeting also featured four mini-symposia on nuclear spectroscopy with gammaspheres, meson electroproduction, proton emitters, and Standard Model constraints from beta decay. Just prior to the meeting, the DNP sponsored three parallel workshops: physics with the Relativistic Heavy Ion Collider; the spin flavor structure of the nucleon; and new opportunities for nuclear physics with spallation neutron sources.

Organic, Polymer and VCSE Lasers Highlighted at ILS-XIV

Applications of ultrafast spectroscopy to biological problems and recent advances in vertical-cavity-surface-emitting (VCSE) lasers were among the technical highlights at the 14th Interdisciplinary Laser Science Conference (ILS-XIV), held 5-9 October 1998 in Baltimore, Maryland. Sponsored by the APS Division of Laser Science and held in conjunction with the annual meeting of the Optical Society of America, the conference combines fundamental studies of laser interactions with atoms, molecules, clusters, plasmas, and materials with research on emerging applications, such as environmental studies, atmospheric monitoring, and medicine.

The featured plenary speaker for 1998 was Philip Bucksbaum of the University Michigan, who spoke on quantum wave packet sculpting with shaped ultrafast radiation, highlighting exciting new developments in using lasers to create and control the evolution of quantum wave packets.

Four critical review talks were given by recognized experts on exciting new developments in the field of laser science. Ananth Dodabalapur of Bell Laboratories/Lucent Technologies summarized the history and latest progress on organic and polymer lasers. William Torruellas of Washington State University reviewed the "Golden Age" of optical solitons followed by a review of the "Golden Age" of spatial solitons by Grover Swartzlander, Jr., of Worcester Polytechnic Institute.

The final critical review session featured a talk on fiber gratings and ultraviolet photosensitivity in glass by Turan Erdogan of the University of Rochester. Opening with a summary of recent time-resolved studies of epidermal chromophores by Duke University's John Simon, a Monday afternoon invited session on applications of ultrafast spectroscopy to biological problems also featured a talk by Gilbert Walker of the University of Pittsburgh on ultrafast studies of nitric oxide, which plays many roles in intra- and inter-cellular signaling. And according to Warren Beck of the Vanderbilt University, the dynamics of biological charge transfer can be probed using dynamic absorption spectroscopy with impulsive excitation.

APS Election, *continued from page 1*

phasizing the need to recruit the active support of industrial leaders.

Finally, Trilling noted that there is too little awareness on the part of most APS members of many of the Society's activities, and improving awareness through *APS News*, divisional newsletters and electronic mailings could even increase membership in the Society. In summary, he praised the quality of the Society's present leadership, concluding, "It is moving effectively in response to financial, managerial, political and technical challenges, and it will be incumbent upon its future officers to maintain that momentum."

Chair-Elect of the Nominating Committee

Turner is the Bruce V. and Diana M. Rauner Distinguished Service Professor and Chair of the Department of Astronomy & Astrophysics at the University of Chicago. He also holds appointments in the Department of Physics at Enrico Fermi Institute at Chicago, and on the scientific staff at Fermilab. Turner received his PhD in Physics from Stanford University in 1978, and he joined the University of Chicago that same year. He has been honored with the APS Julius Edgar Lilienfeld Prize. His current research interests include inflationary cosmology, big-bang nucleosynthesis, dark matter and structure formation, and the cosmic microwave background radiation. Within the APS, Turner has served on the APS Council and Executive Board, the Publications Oversight Committee, the Committee on the Status of Women in Physics, and the Committee on Committees.

In his candidate's statement, Turner emphasized the importance of maintaining the Society's leadership role on behalf of the physics community, through its research journals, education and outreach programs, and meetings. "The engine of the APS is its membership," he said. "Physicists working in a variety of settings... on exciting forefront problems in dozens of subdisciplines."

General Councillors

Bucksbaum is the Otto LaPorte Professor of Physics at the University of Michigan, and Associate Director of the NSF Center for Ultrafast Optical Science. His research is in experimental atomic physics with emphasis on the behavior of atoms and molecules in intense laser fields, and on measurements of fundamental forces and symmetries in atoms. He received his PhD degree in physics from the University of California at Berkeley in 1980, joining the technical staff at Bell Labs in Murray Hill, NJ in 1982, where he remained until moving to the University of Michigan in 1990. He has served the APS on numerous committees, and is also a Distinguished Traveling Lecturer for the Division of Laser Science.

Davis is the Manager of the Physics Department, Ford Research Laboratory. His personal research has been in electro/magnetorheological fluids, composite materials, applications of superconductivity, magnetic levitation of high-speed ground transportation, electron tunneling, atomic spectra, electron spectroscopy, resonant photoemission, and the theory of alloy semiconductors. He received his PhD in physics from Iowa State University in 1966, and joined the Ford Motor Company in 1969. Davis served APS as Chair of the Forum on Industrial and Applied Physics (FIAP) in 1997-98.

Lederman served as Fermilab Director from 1979-1989. Before that he taught and did research in particle physics at Columbia University, where he also did his graduate work. While at Columbia, he did research at the 400 MeV Synchrocyclotron, at Brookhaven National Laboratory, at CERN's Intersecting Storage Rings, at the Berkeley Bevatron and the Rutherford Lab in the UK. He is the 1965 recipient of the National Medal of Science and the 1993 Fermi Prize. He received the Nobel Prize in Physics in 1988 for his work with Mel Schwartz and Jack Steinberger on neutrinos. He has co-authored *Quarks to the Cosmos* with David Schramm, and *The God Particle* with Dick Teresi.

Trefil received his PhD in theoretical physics from Stanford University. After postdocs at CERN and MIT and a junior faculty appointment at Illinois, he joined the faculty at the University of Virginia. He assumed his current position at George Mason in 1985. His current research, carried on in collaboration with the paleontology group at the University of Chicago, involves constructing mathematical models to interpret the fossil record. His main interest is in promoting scientific literacy both inside the university and among the general public. His writing has won numerous awards, including the AAAS Science Journalism Award. He is a Fellow of the World Economic Forum and a member of the AAAS Committee on Public Understanding of Science.

Elucidating the Hall Effect, *continued from page 1*

between two semiconductors. As with many other quantum phenomena the act of confinement (the two-dimensional electron gas, or 2DEG, stuck between the semiconductors) led to quantization. A plot of Hall resistance versus field strength was no longer linear: it had become a staircase. In other words, nature would not permit just any resistance, but only allowed certain resistances dictated by fundamental quantum principles. The specific choice of semiconductor did not play a part. Klaus von Klitzing discovered this "quantum Hall effect" in 1980 and won the physics Nobel Prize in 1985. So exacting is the quantization of resistance (better than a part in many millions) that von Klitzing's experiment has since been used to define the unit of resistance.

Stormer and Tsui carried this research further. At even colder temperatures and higher magnetic fields, they discovered steps within the steps. This "fractional quantum Hall effect" (FQH) was at first hard to explain. Robert Laughlin surmised that the electrons were combining with the flux quanta of the magnetic field. Electrons are fermions, spin-half particles, and normally do not like to condense into a shared quantum state, but in combination with the flux quanta they would become bosons, spin-zero or spin-one states, which are not averse to sharing a quantum state. This is analogous to what happens in low-temperature superconductors when, first, electrons pair up (into Cooper pairs, which are bosons) and then, second, condense into the shared superconducting quantum state in which all the electrons in the supercurrent act as an ensemble. One side effect of Laughlin's conjecture was that the FQH electron ensembles could have fractional charges. That is, the ensembles acted as if they were particles (quasiparticles) with an electrical charge which was a non-integral multiple of the basic electron charge. In 1997 this hypothesis was experimentally verified in Israel and France.

—Philip F. Schewe, AIP Public Information

Announcements

Matching Fund Grants for Students to Attend APS Centennial

Eligibility: All undergraduate and first-year graduate students enrolled in physics courses at any university or college in the U.S.

Nominating Letter: Physics departments should forward to the APS a brief statement of no more than 250 words concerning the rationale for selecting the student(s) it wishes to nominate. Nominating letters must include certification that at least $250 of matching support will be provided by the department to supplement the APS award, and a completed information sheet. Any questions or requests for information should be directed to Erika Ridgway, 301-209-3269; ridgway@aps.org.

Deadline: All letters must be received at the APS by **December 15, 1998**. Selected students and their departments will be notified in early January, 1999. All nominations must be mailed to:

Executive Office
The American Physical Society
ATTN: Matching Grants for Physics Students
One Physics Ellipse
College Park, MD 20740-3844

Special Note: Since the APS has limited funds to support the attendance of physics students at the APS Centennial Celebration, departments may elect to support the attendance of more students on their own, even if no travel grant from the APS is awarded. The APS asks that if a department does choose to fully support more students, that the APS be notified so that all students attending can be informed of the activities and events designed for them.

APS/AIP 1999-2000 CONGRESSIONAL SCIENCE FELLOWSHIP PROGRAM

The American Physical Society and the American Institute of Physics are currently accepting applications for their 1999-2000 Congressional Science Fellowship Programs. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmaker's perspective. In turn, Fellows may lend scientific and technical expertise to public policy issues.

Qualifications include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy, and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be U.S. citizens and, for the AIP Fellowship, members of one or more of the AIP Member Societies at time of application.
Term of Appointment for both fellowships is one year, beginning in September of 1999, with participation in a two-week orientation in Washington, organized by the American Association for the Advancement of Science. Choice of congressional assignment is reserved to Fellows.

A Stipend of up to $46,000 is offered, in addition to allowances for relocation, in-service travel, and health insurance premiums.

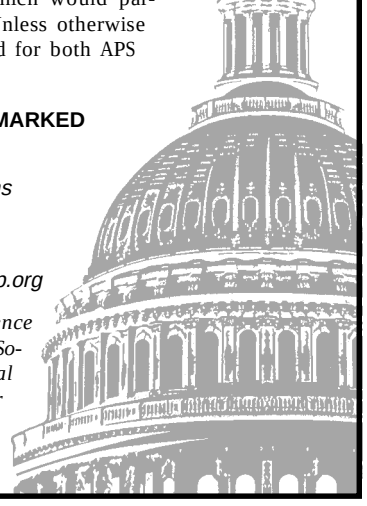
Applications should consist of a letter of intent, a 2-page resume, and three letters of reference, accompanied by a cover sheet indicating: name, address, phone, email, references, US citizenship, PhD status, society membership , and where you learned about the programs. All submissions should be on standard 8.5"x11" paper, single-sided and unstapled, and should be sent directly to the address below. Candidates should state in the letter why they are applying and briefly describe their public service experience. Letters of reference should discuss not just the candidate's competence as a physicist, but also the education, experience, and attributes which would particularly qualify the candidate to serve as a Fellow. Unless otherwise specified in the letter, the applicant will be considered for both APS and AIP fellowships.

ALL APPLICATION MATERIALS MUST BE POSTMARKED BY JANUARY 15, 1999.

APS/AIP Congressional Science Fellowship Programs
529 14th Street NW, Suite 1050
Washington, DC 20045

APS and AIP HomePages: www.aps.org and www.aip.org

Please note that other physics-related Congressional Science Fellowship opportunities are sponsored by AIP Member Societies. For information on the American Geophysical Union program, contact Daryl Tat/202-939-3222. For programs sponsored by the Optical Society of America, contact Liz Baldwin/202-416-1418.



Call for 1999 Awards and Nominations

Award for Outstanding Doctoral Thesis Research in Plasma Physics

Established in 1985 and endowed by General Atomic.

Purpose: To provide recognition to exceptional young scientists who have performed original doctoral thesis work of outstanding scientific quality and achievement in the area of plasma physics.

Nature: The annual award consists of $2,000, a certificate citing the accomplishments of the recipient, and an allowance of up to $500 for travel to attend the annual meeting of the Division of Plasma Physics at which the award will be presented.

Rules and Eligibility: Nominations will be accepted for any doctoral student (present or past) of a college or university in the United States or for a United States' student abroad. The work to be considered must have been performed as part of the requirements for a doctoral degree. Also, the nominee must not have passed his or her final doctoral examination or started regular employment more than 18 months before the nomination deadline for the selection cycle in which the nomination is to be considered. Each nominee will be considered in not more than two consecutive cycles.

Send name of proposed candidate and supporting information before **1 April 1999** to:

Amitava Bhattacharjee
Dept of Phys & Astron
Univ of Iowa
Iowa City IA 52242
Phone (319) 335-1686
Fax (319) 335-1753
Email amitava@physics.uiowa.edu

Nicholson Medal for Humanitarian Service

Established in 1994 by the Division of Plasma Physics and the Forum on Physics and Society by the friends of Dwight Nicholson.

Purpose: To recognize the humanitarian aspect of physics and physicists.

Nature: The honor consists of the Nicholson Medal and a certificate that includes the citation for which the recipient has been recognized.

Send name of proposed candidate and supporting information before **1 April 1999** to:

Barbara G Levi
1616 La Vista del Oceano
Santa Barbara CA 93109
Phone (805) 965-3483
Fax (805) 963-2574
Email bgl@worldnet.att.net

Excellence in Plasma Physics Research Award

Established in 1981 with support from Friends of the Division of Plasma Physics

Purpose: To recognize a particular recent outstanding achievement in plasma physics research.

Nature: The award consists of $5,000 to be divided equally in the case of multiple winners, and includes a certificate citing the contributions made by the recipient or recipients, to be presented at an award ceremony at the Division of Plasma Physics Annual Meeting Banquet.

Rules and Eligibility: Nominations are open to scientists of all nationalities regardless of the geographical site at which the work was done. It may be a given to a set of individuals as well as to individual scientists, as appropriate, to honor those who make essential contributions to the cited research achievement. Nominations are active for three years.

Send name of proposed candidate and supporting information by **1 April, 1999** to:

Charles F F Karney
Princeton Plasma Physics Laboratory
Princeton University
PO Box 451
Princeton NJ 08543-0451
Phone (609) 243-2607
Fax (609) 243-3438
Email karney@princeton.edu

James Clerk Maxwell Prize for Plasma Physics

Established in 1975 and funded by Maxwell Technologies, Inc.

Purpose: To recognize outstanding contributions to the field of plasma physics.

Nature: The prize consists of $5,000 and a certificate citing the contributions made by the recipient.

Rules and Eligibility: The prize shall be for outstanding contributions to the advancement and diffusion of the knowledge of properties of highly ionized gases of natural or laboratory origin. The prize shall ordinarily be awarded to one person but a prize may be shared when all the recipients have contributed to the same accomplishments. Nominations are active for three years.

Send name of proposed candidate and supporting information by **1 April, 1999** to:

Philip J Morrison
The University of Texas
Department of Physics
RLM 11.314, Mail Stop C1500
Austin, TX 78712
Phone (512) 471-1527
Fax (512) 471-6715
Email morrison@peaches.ph.utexas.edu

Call for Awards and Nomination Deadline: April 1, 1999

APS Mass Media Fellowship Program

Applications are now being accepted for the 1999 APS Mass Media Fellowships. In affiliation with the popular AAAS program, the APS is sponsoring two ten-week fellowships for physics students to work full-time over the summer as reporters, researchers, and production assistants in mass media organizations nationwide.

Purpose: The program is intended to improve public understanding and appreciation of science and technology, and to sharpen the ability of the fellows to communicate complex technical issues to non-specialists.

Eligibility: Priority will be given to graduate students in physics, or a closely related field, although applications will also be considered from outstanding undergraduates and postdoctoral researchers. Applicants should possess outstanding written and oral communication skills and a strong interest in learning about the media.

Term and Stipend: Following an intensive three-day orientation in early June 1999 at the AAAS in Washington, DC, winning candidates will work full-time through mid-August. Remuneration is $4,000, plus a travel allowance of approximately $1,000.

Mail application materials, which must be received by **January 15, 1999**, to:

APS Washington Office
ATTN: Mass Media Fellowship Program
529 14th Street NW, Suite 1050
Washington, DC 20045

Information on application requirements can be found at http://www.aps.org/public_affairs/Media.html

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The APS Web Server can be found at http://www.aps.org

Centennial
- Centennial Events updated—reunion information updated

Units
- DPB, TGPMFC pages updated
- New England Section Fall Newsletter

General
- Physics Internet Resources—Commercial Sites & Community Science Center sections added
- 1999 APS Prize and Award Recipient Announcements

centennial webpage: www.aps.org/centennial

THE BACK PAGE

How To Get Value from Industrial R&D

by Charles Duke, Xerox Corporation

The competitive environment for industry has been transformed over the past 10 years. Markets, suppliers and partners have become globalized. Information technology has resulted in new ways to work. The international scene has changed from one of military to economic competition. The net result has been an industrial pace of unprecedented tempo and intensity, with profound effects on the working lives of physicists, especially those in industry.

So how does R&D contribute to the success of individual firms? Two commonly held models describe the process: the "big bang model" and the "evolutionary universe model," named after analogous models that physicists know well. A third, the "big brother model," deals with the macroeconomic value of research to a nation or society as a whole.

In the big bang model, novel research discoveries or inventions spawn entire new industries. Familiar examples include nuclear power and nuclear weapons (1940-1960), xerography (1960s), the transition from vacuum tube to semiconductor electronics (1960-1980), the switch from propeller to jet aircraft (1950s), and the rise of the personal computer and the Internet (1980 to date). These new industries have a fragmented structure, containing many competing firms, particularly small ones. New products evolve rapidly, being generated in a highly creative but often relatively unstructured fashion.

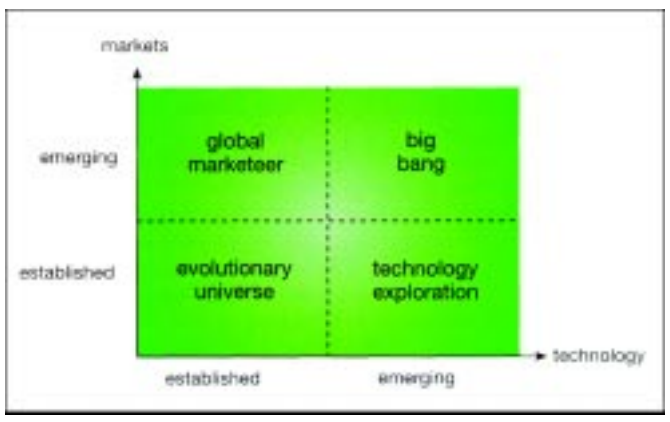
In the evolutionary universe model, existing technology is continually refined, driven by gradual changes in market, manufacturing and technology — particularly technology generated by R&D. Familiar examples include electric power, jet aircraft, cars with internal combustion engines, and xerographic copiers after their initial development. The model is characterized by mature markets and an established industry structure containing relatively few, mostly large firms. Personal computer software and hardware is evolving rapidly into this model. Waves of evolutionary technological change are interspersed with quiescent periods, during which only minor variants of existing products are launched. Marketing, manufacturing and product development are all highly structured.

The big brother model, however, is a macroeconomic construct, in which government investment in R&D is believed to drive macroeconomic growth on a national scale. The public investment supplies pre-competitive knowledge, technology and trained personnel as inputs to the big-bang and evolutionary-universe models. The big brother approach presumes that R&D investment and macroeconomic growth are correlated, without inquiring into the detailed mechanisms within firms and industries by which this correlation is generated. The model is characterized by publicly funded research at universities, government institutes, and private contractors. Examples include national military prowess enabled by R&D, especially during the Second World War and Cold War; and technology foresight programs like those in the United Kingdom, Australia and Japan. Research funds are provided by government agencies or by site funding mechanisms, such as overhead charges on military procurements. This is the environment in which most physicists have spent their professional careers.

Selecting the Right Model

So which model works? Well it depends. The way in which R&D contributes to a firm's success depends on which quadrant of the "market-technology" matrix, shown in the figure, that the company lies in. For example, the big bang model is most appropriate for those working with emerging technologies in emerging markets. For companies with established technologies in established markets, the evolutionary universe model is more relevant. The established technology/emerging market quadrant belongs to the "global marketeers" — firms like Coca-Cola and McDonald's, which take Coke and Big Macs to developing economies. For them, physical science research, as opposed to market research, is irrelevant to their success.

Meanwhile, the established markets/emerging technology quadrant is the province of technology explorers, who seek to satisfy recognized needs in new ways. This is difficult to do. History is replete with the wreckage of firms that were dominant when one technology held sway, but failed to make the change to another. (Remember when the now-defunct RCA dominated color TV production, or when General Electric was an important vacuum tube manufacturer?) Firms wishing to succeed in this quadrant must combine advanced technology with a keen insight into how to package it in order to satisfy an understood market need in a dramatically new fashion. This activity transcends physical science research in its conventional sense.



Array of hope — the way that R&D contributes to a firm's success depends on which quadrant of the "market-technology matrix" the company lies in.

However, when it comes to setting national macroeconomic policy, no clear answer suggests itself. The devil is in the details. A nation must span all four quadrants: One size does not fit all. The big brother model is an article of faith, based on military successes that were generated in large part by circumstances and policies beyond its purview. In today's global economy the validity of this thesis is being tested in real time, and we can no longer be sure that it will remain appropriate. Physicists cannot assume with confidence that the future will be like the immediate past.

New Industrial R&D Paradigm

What is a firm to do? A large diversified firm has no "right" model of R&D value. Instead, each individual segment of its businesses must embrace the model that describes it best. Large firms like Xerox seek to institutionalize the pursuit of value from R&D by adopting management and funding policies that encourage this process. In particular, management policies are designed to focus R&D activities on meeting customer needs. In Xerox, we do this through a structured market-technology-product development process which we call "time to market". This process encompasses all the steps from market and technology identification, through product definition, design and delivery to delighting the customer.

The time-to-market process is structured so that the process can be improved from year to year, the hallmark of any quality company. It ensures that new ideas and discoveries of researchers are quickly cast in the form of "technology investment options," which are "actionable" propositions for new Xerox businesses. Therefore when deciding which of the many good ideas to scale up and pursue, both the business and the technical aspects of the idea are considered in a balanced way.

To realize the benefits from its R&D investments, a firm must invest far more in its product design, delivery and manufacturing processes than in R&D. The rule of thumb is that for every $1 invested in R&D, a company should spend $10 in product design and $100 in product delivery and manufacturing. R&D investment per se is rarely the limiting factor in generating economic growth. More often, the product design, delivery and manufacturing costs form the bottleneck.

By using different funding mechanisms for different classes of R&D, Xerox incorporates the insight gleaned from the market-technology matrix into its own R&D funding process. The company also adopts specific R&D management practices to focus the attention of every employee on the fact that the primary goal of R&D is to create business value. The company's researchers co-develop business options; they do not "transfer technology" in the conventional sense. Researchers — working both on their own and in teams — are empowered to define and solve business problems, and are rewarded financially in proportion to the value of their solutions. Last, but by no means least, most "basic" (knowledge-oriented) research is done in partnership with universities, on topics such as materials research and control theory.

Impact on Physicists

The new paradigm I have described exerts a profound impact on the individual

Charlie Duke

players who practice it. There are three classes of players: those who make things happen, those who help things happen, and those who watch things happen.

Those who make things happen are the committed players, who work directly on industrial R&D as an employee or contractor. They play by the paradigm's rules, and they create value for modern industrial firms. Those who help things happen are the company's partners, be they universities, government institutes or contractors. They may have their own agendas, but they must nevertheless deliver their contribution to industrial value creation under the new paradigm in their role as suppliers. Those who watch things happen comprise the bulk of the physics profession. Supported generously by government largess for more than three decades until recently, they could — and often did — look with disdain at the supposedly mundane world of industry. Unfortunately, young physicists cannot enjoy this luxury because according to statistics collected by the American Institute of Physics, at best one in seven of them in the U.S. will find "traditional" physics employment.

For those who are or wish to be "players" in industrial R&D, you might consider three actions. First, the big bang value system is inappropriate in your new life; discard it. Second, commercial value rather than technical novelty or elegance is rewarded; so generate it by doing the right thing. Third, structured work processes that lead to continuous improvement are an essential vehicle for generating value at a competitive cost; embrace them by doing the right thing the right way. These may not be lessons you learned in college, but you ignore them at your peril.

The new global competitive environment has made firms take a more focused approach to their R&D investments, and the new industrial R&D paradigm described above has replaced the rather more comfortable one based on the big brother model of the past. The future, at least in industry, belongs to those who recognize this fact and exploit it.

Charles Duke is vice president and senior research fellow of corporate research and technology at Xerox Corporation in Webster, New York. Adapted from an article in PHYSICS WORLD, Volume 10, number 8, August 1997, pp. 17-18.

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