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APS Task Force Calls for Website on Ethics Education

The APS should create and maintain a web site to serve as a resource for ethics education, according to a report of the APS Task Force on Ethics Education, presented to the APS Council at its April Meeting. Appointed last year, the task force was charged with examining how the Society might encourage physics departments around the country to do a better job of educating students, postdocs and faculty alike about scientific ethics.

A handful of cases of scientific misconduct in various fields (including physics) over the past several years have cast a shadow on the entire research enterprise. According to task force chair Allen Goldman (University of Minnesota), there is a very real need to develop resources and materials to educate the community about the various ethical dilemmas they may encounter in the course of their careers.

While certain cases of gross misconduct are easy to identify, there are plenty of murky gray areas where the boundaries between acceptable and unacceptable behavior are not as clearly drawn. Many physicists may be confused or unaware of what constitutes misconduct. Incoming physics graduate students in particular are in need of a little guidance in this area, on their way to becoming practicing scientists.

"Ethics education is essential to the intrinsic health of the enterprise, as well as for the need to assure public trust," the task force said in the introduction to its report. "The community cannot take for granted that all of its members will behave ethically."

There are some scattered existing resources. For instance, the APS has an official statement on the issue (http://www.aps.org/statements/02_4.cfm), while the National Academy Press published *On Being a Scientist* in 1995. And there has been the occasional workshop or introductory course on scientific ethics, as well as an Online Ethics Center for Engineering and Science. Task force member Marshall Thomsen, a professor at Eastern Michigan University, also maintains an extensive online collection of ethics resources, gleaned from two NAS-funded workshops he organized in the late 1990s, plus materials from his own course on the subject.

The APS task force reviewed all these ongoing efforts and existing resources. The report recommended that the Society regularly remind its members of the existence of its "Guidelines for Professional Conduct" (http://www.aps.org/statements/02_2.cfm). However, the task force members decided what was really needed was a central Web site devoted to ethics education, featuring not just links to useful

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The Truth, The Whole Truth....

Photo credit: US Department of Energy

On May 26th, Raymond Orbach was confirmed by the US Senate as Undersecretary for Science in the Department of Energy. On June 1, Energy Secretary Samuel W. Bodman (right) administered the oath of office to Orbach, as Orbach's wife Eva looked on. President Bush nominated Orbach for the new position, created by the Energy Policy Act of 2005, in December 2005. He will continue to serve as the Director of the DOE Office of Science, a position he has held since March 2002.

Practice Makes Perfect

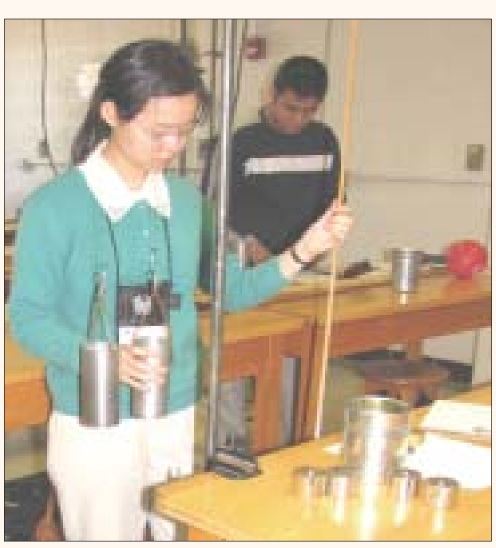

Photo credit: Ernie Tretkoff

Sophie Cai, one of the 24 members of the 2006 US Physics Olympic Team, investigates the mysteries of nature at the training camp held at the University of Maryland in May. Cai is a junior at Ridgefield High School in Ridgefield, Connecticut. For more details about this year's Physics Olympiad, see the story on page 4.

Atomic Clocks, Fast Lasers Highlight DAMOP Meeting

The latest research in atomic clocks, attosecond laser experiments, and ultracold neutral plasmas were among the featured topics at the 2006 annual meeting of the APS Division of Atomic, Molecular and Optical Physics. The DAMOP meeting took place May 16-20 in Knoxville, Tennessee.

In addition to the technical program, the meeting featured a Wednesday evening public lecture by the University of Nebraska's Timothy Gay, and banquet keynote address by Patricia Dehmer, associate director of the DOE's Office of Basic Energy Sciences, on the new "American Competitiveness Initiative." Conference attendees were also given the opportunity to tour the Spallation Neutron Source and Center for Nanophase materials at Oak Ridge National Laboratory.

Keeping Time with Atoms. Kurt Gibble (Penn State University) reviewed some recent advances in the use of laser-cooled atoms in atomic clocks that have resulted in significant improvements in accuracy. This requires finding creative solutions to the frequency shifts that occur in cold collisions. Those solutions include using adiabatic fast passage to accurately evaluate the cold collision frequency shift, as well as "fountains" based on rubidium atoms.

NIST scientists have built similar fountain atomic clocks using cesium atoms, although the focus of NIST's John Kitching's paper at the DAMOP meeting was on recent efforts to develop millimeter-sized devices based on atomic spectroscopy for highly precise timing and sensing applications. Such structures rely on miniature alkali vapor cells–fabricated using standard MEMS techniques–that allow atoms to be confined along with a buffer gas. The atoms in the cell are excited using laser light, as well as magnetic fields generated by microfabricated current loops. Potential applications for such units–which are about the size of a grain of rice and require less than 200 mW of power to operate–include GPS receivers, wireless communication devices, remote monitoring, and explosives detection.

For all the advances in atomic clocks, most commercial atomic frequency standards (AFS) still rely on conventional technology developed in the 1950s. Symmetricom Technology Realization Center has developed specialized laser sources

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Global Nuclear Plan Shares Key Elements with APS Report

A key component of the Bush Administration Advanced Energy Initiative, announced during the 2006 State of the Union Address, is the Global Nuclear Energy Partnership (GNEP), intended to enable the expansion worldwide of nuclear energy. The current GNEP proposal before Congress shares key elements with the recommendations of a May 2005 report issued by the APS Panel on Public Affairs (POPA).

Nuclear energy has long been viewed with suspicion by the general public because of various health and safety concerns, but over the last decade, there has been a noticeable shift in public perception, according to Roger Hagengruber (University of New Mexico), who chaired the POPA subcommittee responsible for drafting the APS report. Nuclear energy is becoming an attractive alternative to petroleum-based energy sources, particularly in light of mounting concern about global warming and US dependence on foreign sources of oil. Other countries are also reconsidering the potential of nuclear energy.

"The intent [of the POPA report] is to provide an informative, educational document to help Congress by clarifying the technical details supporting the issue, independent of any political agendas," said Hagengruber, emphasizing that the report is "a consensus document," although there were some dissenting voices during discussions. The report made several recommendations. The issue that provoked the most discussion, and which is most relevant for the debate in Congress, had to do with reprocessing of nuclear fuel. In this area, the

GNEP continued on page 5

Women Who Choose Physics Love It, AIP Survey Discovers

Women in physics around the world say they face negative attitudes towards women in science, but they are also passionate and excited about physics, according to a recent AIP Statistical Research Center report, titled *Women Physicists Speak Again.*

More than 1350 women from over 70 countries answered the survey, which was a follow-up to a similar survey conducted in 2002 in conjunction with the first IUPAP International Conference of Women in Physics.

While not a representative sample of women in physics, the survey responses give a picture of the challenges women face in physics and their attitudes about their chosen field.

The survey asked women about their education and careers, and about issues that concern women physicists, such as discrimination, marriage and childcare, and funding.

The study compared responses from women in developed and developing countries. Unsurprisingly, women in developing countries were much more likely to say they lacked adequate funding and travel money. Sixty percent of women in developing countries said they did not have adequate funding, compared with 33% of women in developed countries. 63% of women in developing countries lacked travel money, compared with 32% in developed countries.

"I am not given a single cent for traveling. It's very sad," wrote one woman from Tanzania. "Right now I have a collaborator in the US but no funding to support me. It is frustrating somehow," wrote a woman from Nigeria.

Worldwide, women reported both positive and negative effects of marriage on their career

Women continued on page 3

Members in the Media

"As president, I'm responsible for them. Personally, I walked into a set of practices and lack of knowledge of the policies and as such, I feel that I got some bad advice. And I will fix it."

–Robert Dynes, University of California president, on executive pay scandals at the University of California, Los Angeles Times, May 14, 2006

"This is a good example of something which is very counterintuitive that the laws of nature permit."

–Robert Boyd, University of Rochester, on a method of making light travel backwards, The New York Times, May 16, 2006

"We were all scientists and therefore really understood and appreciated the value this would bring to our colleagues in Iraq,"

–Barrett Ripin, on the Iraqi Virtual Science Library, Washington Times, May 22, 2006

"No matter how zoomed in or out you are, you still see the same pattern."

–Peter Pfeifer, University of Missouri, on fractals, St. Louis Post Dispatch, May 23, 2006

"The cage structures were not expected, because metal clusters tend to be more compact."

–Lai-Sheng Wang, Washington State University, on a new cagelike configuration of 16 gold atoms, The New York Times, May 23, 2006

"The things I made, like nitroglycerin, took a fair amount of lab technique. I specialized in explosives because they were fun, and I liked doing things that got results in a hurry"

–Gordon Moore, on his childhood science experiments, Wired, June 2006

"There's no question that stinks and bangs and crystals and colors are what drew kids – particularly boys – to science."

–Roald Hoffmann, Cornell University, Wired, June 2006

"It's a quarry worth hunting."

–Daniel Akerib, Case Western Reserve University, on dark matter, Knight Ridder Newspapers, June 5, 2006

"Golf club heads made of metallic glasses, for example, can make golf balls fly farther. While our research could be utilized by industry, it can actually help us understand any 'glassy' multi-particle system, such as the early universe–which cosmologists have described as a glass."

–Sal Torquato, Princeton University, on glasses, United Press International, June 6, 2006

"Bringing DAMOP to Knoxville and to UT is a significant event. It is the top meeting in the field, and the opportunities available to the general public are outstanding."

–Joe Macek, University of Tennessee, the Oak Ridger, May 15, 2006

"I resolved that if I ever came back to Boston, I'd study its acoustics."

–William Hartmann, Michigan State University, on his visit to the Mapparium, a whispering gallery in Boston, Christian Science Monitor, June 5, 2006

"A lot of times this stuff is presented as beautiful mathematics and all that. It can seem disconnected from reality. I wanted to make it clear that the speculation is drawn from experimental evidence, from observations. I want people to understand where these ideas come from, in a way that's entertaining and readable. I think many people enjoy the notion that there's more out there ... that we are still learning new things."

–Lisa Randall, Harvard University, on why she wrote a popular book, Seattle Post-Intelligencer, May 29, 2006

"If their proposed test yields a positive result (finding small black holes), that would be fantastic. If it finds something, a new world opens up."

–Raman Sundrum, Johns Hopkins University, on a proposal by Charles Keeton and Arlie Petters for detecting very small black holes, the San Francisco Chronicle, June 9, 2006

"Is it science fiction? Well, it's theory and that already is not science fiction. It's theoretically possible to do all these Harry Potter things, but what's standing in the way is our engineering capabilities."

–John Pendry, Imperial College London, on a theoretically possible invisibility cloak, Associated Press, May 26, 2006

This Month in Physics History

July, 1977: MRI Uses Fundamental Physics for Clinical Diagnosis

On July 3, 1977, the first magnetic resonance imaging (MRI) exam on a live human patient was performed. MRI, which identifies atoms by how they behave in a magnetic field, has become an extremely useful non-invasive method for imagining internal bodily structures and diagnosing disease. The life-saving medical technique has its foundations in the work of physicist I. I. Rabi, who during the 1930s developed a method of measuring magnetic properties of atomic nuclei.

I. I. Rabi

Isidor Isaac Rabi was born on July 29, 1898 in Rymanow, Austria. In 1899 his family moved to New York, where they lived in poverty in the Lower East Side before moving to Brooklyn in 1907. Rabi's parents were Orthodox Jews, and though Rabi never practiced religion as an adult, he was always influenced by his religious upbringing. He felt that doing good physics was "walking the path of God."

Rabi graduated from Cornell University in 1919 with a degree in chemistry. But he wasn't really captivated by chemistry, and spent three years not doing much of anything before deciding to go to graduate school in physics at Cornell. After finishing his PhD in 1927, Rabi went to Europe, where he spent time working with the giants of quantum mechanics, including Sommerfeld, Bohr, Pauli, Stern, and Heisenberg.

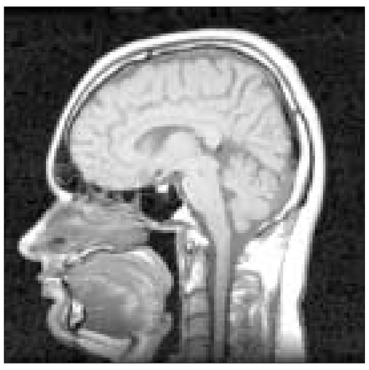
Rabi was fascinated by quantum ideas, especially the Stern–Gerlach experiment. Otto Stern and Walther Gerlach had sent a thin beam of silver atoms through a non-uniform strong magnetic field, and observed that the beam separated into two distinct sub-beams, the atoms in the beam having been deflected slightly according to the direction of their magnetic moments.

When Rabi returned to the United States in 1929, he took a teaching position at Columbia University. After spending two years searching for a problem that interested him, in 1931 Rabi set up his molecular beam lab and took up the problem of determining the nuclear spin and associated magnetic moment of sodium. The nuclear magnetic moment, much smaller than that of the electron, was difficult to determine precisely. Rabi and Gregory Breit figured out how to modify the classic Stern-Gerlach apparatus to find the nuclear spin of sodium.

Rabi, who was often viewed as lazy, was always impatient with routine experimental techniques and data analysis. He liked to say he wanted an answer at the end of the day, and was driven to design clever, clean experimental methods, methods that brought him "nearer to God."

Throughout the 1930s, Rabi improved the molecular beam method and used it to gather increasingly accurate values for the nuclear spin of atoms, including hydrogen and deuterium. The work culminated in the magnetic resonance method which is the basis for magnetic resonance imaging.

Magnetic moments tend to align either parallel or antiparallel to an external magnetic field, and tend to behave somewhat like tops, precessing about the direction of the magnetic field, with a frequency that depends on the magnetic field strength and the atom's nuclear magnetic moment. In 1937 Rabi predicted that the magnetic moments of nuclei in these experiments could be induced to flip their orientation if they absorbed energy from an electromagnetic wave



MRI Image

of the right frequency. They would also emit this amount of energy in falling back to the lower energy orientation. Rabi would be able to detect this transition from one state to the other. He called his method molecular beam magnetic resonance.

Rabi and his team modified the molecular beam apparatus so the beam was also exposed to a radio frequency signal as it traveled through the magnetic field. Tuning either the external magnetic field or the radio frequency can produce resonance. They observed the first magnetic resonance absorption in 1938, with beam of lithium chloride molecules. Rabi was enthralled by the flopping of the magnetic moment, and the group held a party to celebrate the achievement.

Each atom or molecule has a characteristic pattern of resonance frequencies. Rabi detected a series of resonances in different molecules that could be used to identify the type of atom or molecule and give more detail into molecular structure.

After World War II broke out, Rabi left his molecular beam laboratory and went on to become Associate Director of the MIT Radiation Laboratory. He was awarded the Nobel Prize in 1944, "for his resonance method for recording the magnetic properties of atomic nuclei."

In 1946 Edward Purcell and Felix Bloch independently found a way to study the magnetic resonance properties of atoms and molecules in solids and liquids, instead of individual atoms or molecules as in Rabi's molecular beam method. Later, nuclear magnetic resonance was further developed into the imaging technique that is now commonly used for medical diagnosis. The first images were produced in the early 1970s, and the first live human subject was imaged in 1977. MRI machines became commercially available in the 1980s, and are now commonly used for imaging internal body structures, especially soft tissues like the brain.

Shortly before he died in January of 1988, Rabi was imaged in an MRI machine. "It was eerie. I saw myself in that machine," he said. "I never thought my work would come to this."

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Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: SCIENCE RESEARCH BUDGETS

The House of Representatives voted to provide full funding for the President's ACI (American Competitiveness Initiative) request for the Department of Energy's Office of Science, the largest federal supporter of physics research. The Energy and Water Appropriations Subcommittee, led by Chairman David Hobson (R-Ohio) and Ranking Member Peter Visclosky (D-IN), funded the Office of Science at $4.132 billion, which includes the 14.1% increase requested by the President and an additional $30 million for Congressionally directed projects. Senate action on the spending bill is not expected before July but early indications suggest that the Senate will follow the House lead. House action on the funding bills that include NSF, NIST, NASA and DOD are expected in June. For details of the FY07 budget process, go to http://www.aaas.org/spp/rd/fy07.htm

To express your views to Congress on the President's ACI requests, go to http://www.congressweb.com/cweb4/index.cfm?orgcode=apspa&hotissue=61.

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ISSUE: INTERIM NUCLEAR WASTE STORAGE STUDY

At its May 12th meeting, the Panel on Public Affairs (POPA) authorized the formation of a study committee to look at technical issues associated with the centralized interim storage of spent nuclear fuel. The committee is a continuation of the previously formed Nuclear Energy Study Group (NESG) and is co-chaired by Roger Hagengruber of the University of New Mexico and John Ahearne of Sigma Xi. The membership of the study group will be similar to the NESG with new members added, who will expand the expertise of the group in the areas of safety, cost, security and transportation associated with consolidated interim storage of spent nuclear fuel.

The study is intended to educate congressional staff and clarify the technical issues associated with interim storage to help Congress decide how to treat and dispose of the nation's nuclear waste.

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ISSUE: POPA ELECTRICAL ENERGY STORAGE STUDY

At its May 12th meeting, the Panel on Public Affairs (POPA) authorized the formation of a study committee to draft a report that will look at technical issues associated with electricity storage. The report will identify the relevant parameters of the electricity storage problem, as well as areas where research might have a high payoff in improving technology, paying specific attention to DOE's current interest in developing an R&D program that will lead to economical large-scale centralized or distributed storage. The study group will be co-chaired by Ruth Howes of Marquette University and Sekazi Mtingwa of Harvard.

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ISSUE: EDUCATION LEGISLATION UPDATE

On May 11th, the House Science Committee introduced three bills to strengthen and enhance federal support of science, technology, engineering and math (STEM) education and research. The Science and Mathematics Education for Competitiveness Act (H.R. 5358), sponsored by Rep. John Schwarz (R-MI), primarily focuses on the expansion of preexisting NSF programs to improve math and science education and to attract more undergraduates to STEM careers and K-12 teaching. The other two bills, the Early Career Research Act (H.R. 5356) and the Research for Competitiveness Act (H.R. 5357), both sponsored by Rep. Michael McCaul (R-TX), would authorize or increase grant programs at NSF and DOE to assist early-career researchers. Because the bills are in line with APS statements on science education, APS President John Hopfield sent a letter of endorsement to House Science Committee Chairman Sherwood Boehlert (R-NY).

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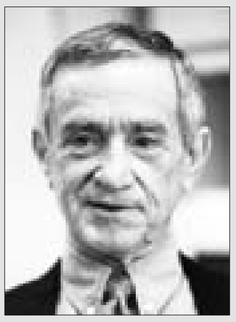
Log on to the APS Public Affairs web site (http://www.aps.org/public_affairs) **for more information**.

What's New

July 2006

1. END OF AN ERA: PARK STEPS DOWN AS DIRECTOR OF PUBLIC INFORMATION.



Robert Park

Bob Park, long-time faculty member at the University of Maryland and former physics department chair, is stepping down as Director of Public Information of the American Physical Society. Park established the APS Washington Office in 1983 and has been a DC fixture since, holding politicians, policy makers, administrators, quacks, buffoons and miscreants accountable for their deeds and misdeeds. Shy, timid and retiring only in his dreams, Park has been a candid, caustic critic in real life. Over two decades he helped convert the Washington Office from a one-man show into a strong, six-person professional advocacy operation. Although he will end his role as an APS spokesperson, Park will continue in his role as a part-time APS consultant. "I'm not really going anywhere," Park advises friend and foe alike, "I just won't have the title anymore."

2. VOODOO VAMPIRES BEWARE !! PARK BOOK RELEASED IN ROMANIAN.

Park will continue to write his weekly "What's New" column, begun in 1987 and now available in unexpurgated form at http://www.bobpark.org . And his 2000 book, "Voodoo Science," has just been released in Romanian, having been translated into nine other languages since its publication.

3. MORE TREES TO FALL: PARK INKS BOOK DEAL.

Park recently signed a contract for two new books. But that's not all. He will still keep busy with his op-ed pieces and his occasional TV and radio appearances, debunking pseudo-science, expressing his strong views on manned space exploration and keeping Puff Panegyric and General Persiflage of the Missile Defense Agency shuddering in their silos.

4. PRAISE FROM ON HIGH: APS LEADERS OFFER PLAUDITS.

WN hasn't yet heard from Pat Robertson and probably won't, but in the meantime APS President John Hopfield told us that "Bob Park's years of service to APS have been invaluable both in dealing with the media and in keeping the APS membership informed about Washington affairs." If that's not enough to bring tears to the eyes of WN readers, APS Executive Officer Judy Franz added, "We owe Bob tremendous thanks for initiating and helping to maintain an APS presence in Washington."

These opinions may not be shared by Park, but they should be.

APS TASK FORCE CONTINUED FROM PAGE 1

materials and other resources, but also a series of case studies, which the task force developed, illustrating some of the more likely ethical scenarios encountered by scientists.

Some of the hypothetical case studies stem from real incidents (with names and details altered to protect identities), while others are entirely fictional. The topics run the gamut from publication practices, conflict of interest, data acquisition, mentoring, issues of bias, and health and safety, among others.

For example, publication practices relating to authorship can be an especially knotty problem. A hypothetical case study provided in the report describes a graduate student who has worked closely with a professor and a postdoc on a project studying experimental techniques in microfluidics.

The adviser then writes a subsequent paper with another colleague, developing a theory that accounts for the graduate student's results. Yet the advisor fails to list the graduate student as one of the authors on the paper, even though the paper is directly based on the student's work, and includes a new experimental plot created by said student, in addition to the theoretical calculations.

In this instance, the APS guidelines are clear: "All those who have made significant contributions should be offered the opportunity to be listed as authors." The case study template also allows for discussion and advice as to how one might handle this type of situation.

The web site model that the APS task force proposes is intended to be dynamic, even interactive: users would be able to contribute their own case studies, and provide comments and suggestions, although these would be vetted by an oversight committee, which would also be responsible for planning ethics-related sessions and activities at APS meetings.

"The case studies have been selected to illustrate various ethical issues that are not necessarily easily resolved," explains Goldman. "But these aren't all-inclusive, hence the need to open the site to external contributions."

The next step is to implement the task force's recommendations. Goldman has developed a mock-up design for a web site, and hopes to work with APS staff over the next several months to get such a site up and running.

Goldman acknowledges that the planned web site probably won't stop extreme cases of outright data falsification and fraud. But it may heighten awareness of ethical dilemmas, and help physicists at every stage of their careers navigate the murky gray areas. "Lying, cheating and stealing are obvious violations of behavior, although some people do it anyway," he said. "But there are many cases where people are simply not aware that what they're doing may not be ethical. Maybe we can help raise their consciousness a little."

The other members of the task force were Beverly Karplus Hartline (Delaware State University); Jean P. Krisch (University of Michigan); Brian Utter (James Madison University); and Simon Woodruff (University of Washington).

WOMEN CONTINUED FROM PAGE 1

progress. Some said their husbands had been very supportive, while others said that family and household duties were not shared evenly, or that their husband's careers had taken precedence over their own.

In the 2002 survey, many women mentioned a lack of affordable childcare as a factor that influenced their careers. The recent survey therefore included a number of questions about childcare in order to further probe the issue, said Rachel Ivie, one of the study's authors. However, many women responding to the 2005 survey pointed out that childcare is an issue for all working women, not just physicists, and furthermore, while childcare is a problem, negative attitudes towards women in science were a much bigger problem. Eighty percent of women agreed that attitudes about women in physics need improvement, while 55% said daycare cost needs improvement.

Women in developed countries were more likely than women in developing countries to say that childcare was a problem. One Brazilian woman wrote "I think that in my country, the main problem for women in science is not the family. We have maids."

During their education and early careers, most women reported that they had some support from at least one other person, though they also said they relied on their own hard work, perseverance, and determination. Most women reported a good or excellent relationship with their graduate advisors.

Many women (60%) had chosen physics as a career while they were in high school. While most (85%) cited their interest in the subject as the reason for their career choice, many (50%) also said that a teacher had influenced their decision. Ivie said that other studies have found that men in physics also report interest in the subject as the main reason for their career choice, but they are less likely than women to say they had been influenced by a teacher.

Though generally happy with their chosen careers, 71% of women in physics said they were sometimes discouraged, especially by discrimination and lack of funding.

In some countries women receive a greater percentage of physics bachelor's and PhD degrees than others. Turkey is at the top of the list, with 39% of bachelor's degrees and 28% of PhDs going to women. Many factors contribute to the representation of women in physics in a given country, explained Ivie. In some countries, especially in the developing world, education is a class issue, so upper class women are often given a good education and encouraged to study subjects like physics. However, those women are often expected to give up their career when they get married. In developed countries, factors such as childcare may make the difference in whether women can pursue a career in physics. For instance, in France, which awards 24% of physics PhDs to women, childcare is available and affordable, whereas in Germany, which gives only 10% of its physics PhDs to women, childcare is much less easily available.

Despite the difficulties for women in physics, women who answered the survey were enthusiastic about their careers, and 86% said they would choose physics again. Many women expressed their love of the subject.

"I feel that physics chose me, not the other way around. I was born a physicist," wrote a woman from the Netherlands. Another woman, from Egypt, expressed a similar sentiment: "Physics is in my mind and blood.

Letters

Scientists Need More Insight Into the Religious Community

As a member of both the scientific and Christian communities, I am frequently exasperated at the manner in which persons who purport to speak for one community portray the other. The latest example is The Back Page article by Lawrence Krauss in the April *APS News*.

I am not a fan of Intelligent Design and agree with Krauss' discussion of the operation of good science. However, his portrayal of the motives of ID proponents and religious persons is distorted. He greatly exaggerates the threat they pose to science.

Krauss describes the Taliban's destruction of Buddhist statues. Connecting one's opponent to the most extreme example one can imagine is a commonly used polemic technique, but it is terribly unfair and ultimately ineffective. This polarizing tactic just ratchets up the emotions on both sides.

For personal reasons I was particularly offended by his mischaracterization of James Dobson as a "televangelist." I attended the same church as Dobson in the 1970s and admire his character, convictions, and efforts for the well-being of children and families. He is not an ordained minister (his degree is in psychology), does not pastor a church, and has no television ministry. It would have taken very little research to discover Dobson's true background,

Religious continued on page 6

Rutherford's Whereabouts Clarified

Because of his immense contribution to the study of radioactivity and the understanding of the atomic structure, Ernest Rutherford is well deserving of the excellent article that appeared in "This Month in Physics History" [*APS News*, May 2006]. I would like, however, to correct a small error in the article about the discovery of the heterogeneous nature of the uranium radiation first observed by Henri Becquerel in 1896. This discovery was not done at McGill but rather when Rutherford was still at the Cavendish Laboratory. In the only paper on radioactivity that Rutherford wrote before joining McGill one finds the sentence, "These experiments show that the uranium radiation is complex, and that there are present at least two distinct types of radiation-one that is very readily absorbed, which will be termed for convenience the alpha radiation, and the other of a more penetrative character, which will be termed the beta radiation", names still in use today. This article entitled "Uranium Radiation and the Electrical Conduction Produced by It" communicated by J.J. Thomson to the *Philosophical Magazine* is dated September 1st 1998, a week before Rutherford boarded the Canada-bound ship that brought him to Montreal and McGill University, where he performed most of the work that led to his 1908 Nobel Prize.

Jean Barrette
Montréal, Québec

French Ship First to Deploy Radar

Having read about the work of Robert Watson-Watt in "This Month in Physics History" in the April issue of *APS News*, we would like to point out that the first commercial ship equipped with a radar system was the French transatlantic liner Normandie; this radar had been built by the French company CSF, and its purpose was to detect icebergs by night or in foggy weather. However, it had no echo chamber and one could not know if the absence of a signal indicated that there were no icebergs or that the system was not working, so the commander of the ship did not dare to use it.

Michel Soutif and Pierre Averbuch
Grenoble, France

Viewpoint...

Iran's Quest for Nuclear Science and Technology

By Hamid Javadi

The quest of the Iranian government to acquire nuclear science and technology is heading toward an international crisis, albeit a manufactured one. The subject has many dimensions. Iran has been a party to the Treaty on the Nuclear Non-Proliferation since 1970 and had a safeguards agreement with the UN nuclear watchdog, the International Atomic Energy Agency (IAEA), since 1974.

The roots of Iran's drive to become a nuclear player go back to events following the 1978-1979 Iranian Revolution when a young Republic trying to stand on her own feet had to go through a 8 year-long bloody conflict with Iraq. The state and the Iranian people found themselves alone in the fight against Iraq's invasion, which was backed by numerous world powers, including the US [1].

Even the most adamant critic of the Iranian government gives it credit for fending off aggression that could have split and destroyed the country. This difficult task was accomplished in part by intricate use of the nationalistic and religious drive and fervor of the Iranian people. Iranians are very proud people (mainly because of a glorious past and vibrant culture, even in the face of recent centuries of neglect and stagnation). Irrespective of their cultural, religious, or ethnic backgrounds, Iranians hold their country very dear to their heart.

Among the worst experiences of the war was Iraq's use of chemical weapons against Iranian troops and civilians, and later, against Kurdish Iraqi civilians [2]. By the end of the war, it had become the norm for Iraqis to start an offensive against Iran by first gassing the front line in order to demoralize the defending forces. The bitter challenge of the Iranian government was to convince the world that Iraq was guilty of starting the invasion, engaging in terror attacks on civilian population centers, and its flagrant violation of the 1925 Geneva Protocol and international customary law.

What Iran learned in the halls of the United Nations was her most valuable lesson of survival. It is based on this psyche that Iran is maneuvering the negotiations around the new nuclear dispute [3]. Alas Iran's poor and lower class paid the price of the war and will pay for any future political blunder of their government under foreign imposed rules and constraints.

In this article, I inadvertently crossed the line into politics in which I am neither a student nor a player. The reader is encouraged to consult multiple sources to obtain an accurate understanding of the situation. My most genuine reaction as a physicist is to share with you (as it seems to me) the forthcoming and courageous expressions of sound scientific minds by the Physics Society of Iran under the prospect of most uncertain consequences.

On October 2003, the Physics Society of Iran issued a declaration regarding the internal political drive toward the nuclear science and technology, which was issued about a year prior to when it aquired international dimensions.

The declaration called for "modern rationality" in the procedures governing scientific decision making, as well as "serious scrutiny" of claims concerning Iran's achievement of nuclear technology and its potential consequences–specifically the possibility of international sanctions. "Our concern is the possible future blockage of all international roads to our scientific development," the declaration stated. "National security relies on scientific development and on maintenance of international interactions." ***(Editor's Note:*** *The complete text of this declaration can be found at http://www.aps.org/apsnews/0706/070619.cfm)*

It is the desire of all concerned physicists that technologies (in general) be used for the well-being of humans all around the world. It is heartbreaking to see that new technologies (for example superconductivity, silicon micromachining, nanotechnology, nano-biology, genetic engineering, hydrogen fuel, plasma reactor) can't transfer the poor countries of the North-South divide out of their cycle of poverty.

The extreme plight of the human race will remain unmanageable unless more international institutions of the caliber of the Abdus Salam International Center for Theoretical Physics in Italy (founded in 1964 by Abdus Salam; the ICTP operates under a tripartite agreement among the Italian Government, UNESCO, and IAEA), and Jordan's SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East; SESAME is an international center for research and advanced technology) will operate under direct supervision of the scientists who live and work in the poor and third-world countries.

To be frank, what is in the best interest of the Islamic Republic of Iran is to wake up from the stupor of religious self-righteousness to join the rest of the world in the technological race for the well-being of its citizens.

Hamid Javadi is in the Submillimeter Wave Advanced Technology Group of the Jet Propulsion Laboratory in Pasadena.

References:

1."Iran's Nuclear Posture and the Scars of War," Joost R. Hiltermann, Middle East Report Online Jan. 18th 2005. http://www.merip.org/mero/mero011805.html

2."Preventing the further proliferation of weapons of mass destruction. The importance of on-site inspection in Iraq," Lecture by Dr. Hans Blix, Executive Chairman of UNMOVIC at the Third Training Course of UNMOVIC. Vienna, 19 February 2001. http://www.un.org/Depts/unmovic/ExecChair/BlixVienna.htm.

3."Iran's Nuclear File: The Uncertain Engame," Farideh Farhi, Middle East Report Online Oct. 24th 2005. http://www.merip.org/mero/mero102405.html

Odom Wins DAMOP Thesis Award

The APS Division of Atomic, Molecular and Optical Physics (DAMOP) awarded its 2006 Thesis Award to Brian Odom, for his thesis entitled "Measurement of the Electron g-Factor in a Sub-Kelvin Cylindrical Cavity." The selection was made during the DAMOP annual meeting, held May 16-20 in Knoxville, Tennessee. (See story, page 1.)

Odom earned his B.S. in physics from Stanford University in 1995, and did his graduate work at Harvard University under Gerald Gabrielse. He had made a previous measurement of the electron's magnetic moment, but then discovered a serious flaw in the design of the apparatus used to perform the experiment. As a result, the effects of nuclear magnetism turned out to be too strong for the level of accuracy required in measuring the electron's magnetic moment.

So Odom redesigned the experiment, building a completely new apparatus (featuring silver electrodes and a titanium vacuum enclosure), which reduced the effect of nuclear magnetism by a factor of 20. He achieved a much improved measurement of the electron magnetic moment, and the best determination of the fine structure constant to date. Gabrielse, for one, believes that in the long-term, Odom's work will lead to an improved measurement of the proton-to-electron mass ratio as well.

Following the awarding of his PhD in 2004, Odom accepted a postdoctoral fellowship at the Kavli Institute for Cosmological Physics at the University of Chicago.

Students Train Hard for Physics Olympiad

Twenty four high school students spent nine long, intense days at the end of May doing physics, including classes every day, seven exams, two practice labs and four mystery labs. And they had fun doing it.

Members of the United States Physics team, they attended training camp May 19-29 at the University of Maryland. Five members of the team will travel to Singapore in July to compete in the International Physics Olympiad.

The US Physics Team training camp is organized by the American Association of Physics Teachers. The team is sponsored by all ten member societies of the American Institute of Physics, including the APS.

The 24 team members were selected through two rounds of qualifying tests that were taken by students from all around the country.

Robert Shurtz, the Physics Team head coach, is a teacher at Hawken School, a small private school in Gates Mills, Ohio. He said that the US Physics Team members have usually already taken an AP physics course at their high schools. Classes during the training camp focus on topics not typically covered in high school classes, including relativity, thermodynamics, waves, and some quantum mechanics, said Shurtz. These topics do show up on the International Olympiad exams.

These students are already very good at solving problems, said Shurtz. The training camp especially emphasizes lab skills, which some students don't have the opportunity to learn in school. It's a lot of material for the students to learn in a week, he said. "The students are bright, and they tend to absorb information quickly."

Many of the team members were interested in math and science at a young age, and had already taken advanced science and math classes. Many have also participated in numerous science and math competitions. Some are on the US Physics team for the second year. Though clearly excelling in math and science, they do have hobbies other than studying–several are also accomplished musicians, athletes, and computer experts.

Henry Tung, a quiet teenager from San Diego who enjoys programming and assembling computers and playing the saxophone, said he was having fun at the training camp, and learning a lot. "I'm learning about all the physics I want to know, and didn't want to know," he said laughingly. The best part of the camp, he said, was getting to

Olympiad continued on page 6

GNEP CONTINUED FROM PAGE 1

subcommittee focused on three main points.

First, the POPA study asserted that there is still adequate time to properly evaluate promising technologies to enable Congress to make the most prudent decision with regard to reprocessing.

Second, the APS report emphasized that making a policy decision about reprocessing should not outpace the science, urging the Department of Energy to take sufficient time to identify the most cost-effective technology that would also be the most resistant to threats of proliferation.

"It is in the best interests of the US to maintain a reprocessing research program and seek a proliferation-resistant and cost-effective reprocessing technology," Hagengruber emphasized in his testimony before Congress in June 2005. "We do not oppose eventual reprocessing, but believe an early decision could threaten future growth in the use of nuclear energy."

Third, the members of the POPA study group urged Congress to "do no harm" and refrain from forcing a decision on reprocessing before the issues of safety, proliferation and cost are fully understood. Doing so could backfire, diminishing the growing momentum for nuclear power among the general public.

GNEP's primary focus is on the development and deployment of new technologies to recycle nuclear fuel, minimize waste, and improve our ability to keep nuclear technologies and materials out of terrorist hands. In addition to building a new generation of nuclear power plants in the US, the US will work with other partner nations to achieve these lofty goals, in the process providing nuclear fuel to developing nations so they, too, can reap the benefits of nuclear energy in exchange for an agreement to forego enrichment and reprocessing activities on their own.

When GNEP was first announced, Secretary of Energy Samuel Bodman declared that the program "brings the promise of virtually limitless energy to emerging economies around the globe, in an environmentally friendly manner while reducing the threat of nuclear proliferation. If we can make GNEP a reality, we can make the world a better, cleaner, safer place to live."

But GNEP's progress through Congress thus far has been less than smooth. Many members support nuclear energy, but there are concerns that GNEP "as presently formulated" might not be the best approach. Chief among the naysayers is David Hobson (R-OH), chair of the House Energy and Water Development Appropriations Subcommittee. That body's FY2007 report contained language sharply critical of GNEP, and Hobson has publicly expressed "serious policy, technical and financial reservations" about the project.

The Hobson committee "strongly endorses the concept of recycling spent nuclear fuel," but finds GNEP lacking in its strategic plan for achieving this. For instance, GNEP favors an alternate recycling process using fast burner reactors, which might be technologically desirable, but which Hobson and his cohorts feel "adds significant cost, time and risk to the recycling effort."

Other concerns center on the lack of a requirement for interim storage for hosting GNEP facilities, particularly in light of delays and mounting costs of the planned high-level nuclear waste facility at Yucca Mountain. The Hobson committee objected to the decision to place GNEP before Yucca Mountain in priority, particularly since there is a pressing need to begin licensing new reactors in the coming decade, before GNEP is ready for commercial-scale implementation.

Nonproliferation and national security issues round out the Hobson committee's list of objections, particularly with regard to the need to integrate spent fuel recycling, "keeping sensitive materials and facilities within a secure perimeter and minimizing offsite transportation of special nuclear materials." GNEP makes no mention of this requirement, or of the need for interim storage.

In his Congressional testimony, Hagengruber acknowledged the validity of proliferation concerns, but stressed, "The ultimate assessment should not be based on whether it is theoretically possible to make a weapon from the waste," but on evaluating the numerous practical factors associated with producing weapons for a national stockpile, many of which can be difficult to evaluate.

"In the end, technology alone can't stop the risk of an increase in proliferation, in such an international climate, so some sort of long-term institutional changes will be needed," said Hagengruber. "That was part of the rationale for GNEP. Nuclear energy will go forward whether the US pursues it or not. Perhaps if we take a leadership role, we can shape that agenda."

ON THE WEB

- ***GNEP*** http://www.gnep.energy.gov
- ***POPA Report*** http://www.aps.org/public_affairs/proliferation-resistance
- ***Hagengruber Congressional testimony*** http://www.house.gov/science/hearings/energy05/june15/Hagengruber.pdf
- ***House Report 109-474*** http://thomas.loc.gov

Hey! Where Did My Office Go?

Photo credit: Robert A. Kelly

It may appear from the photo that APS Editor in Chief Martin Blume arrived at work to find an empty space where his office used to be. But, actually, no. The space shown in the picture is not his office; it had held the hard copy files of manuscripts submitted to the Physical Review. The new electronic editorial process has made the paper files obsolete, so the banks of rolling shelves were dismantled and removed in May, freeing up the 25 x 25 foot space. Staff at the Editorial Office had a number of creative suggestions: A café? A boxing ring? A dance floor? But in the end the space was swiftly converted into offices to accommodate four employees.

Congress Still Questions Scientific Information Policies

Members of Congress continue to express concern about the Administration's policies regarding the dissemination of scientific findings involving research in areas such as climate change. In May, the National Science Board (NSB) provided its views on the dissemination of research findings in response to a February 8 letter from Senator John McCain (R-AZ).

In his letter, McCain asked the NSB to examine existing policies of Federal science agencies concerning the suppression and distortion of research findings and the impact these actions could have on the quality and credibility of future Government-sponsored scientific research results.

A May 12 NSB memorandum contains as an attachment a five-page letter to Senator McCain signed by then NSB Chairman Warren Washington. The Washington letter comments favorably on NASA's newly instituted employee policy, citing it as "one way to effectively articulate an agency's goals of scientific openness." The letter continues, "The survey of the agencies' IG [in-house Inspectors General] indicated that no reports were issued to indicate scientific information was suppressed or distorted at the agencies involved with the Board's reviews."

In his letter, Washington found "no consistent Federal policy regarding the dissemination of research results by Federal employees," and called for the development of "an overarching set of principles for the communication of scientific information by Government scientists, policy makers, and managers."

Washington believes that "a need exists for all Federal agencies that conduct research to establish policies and procedures to encourage open exchange of data and results of research conducted by agency scientists, while preventing the intentional or unintentional suppression or distortion of research findings and accommodating appropriate agency review."

Furthermore, "A clear distinction should be made between communicating professional research results and data versus the interpretation of data and results in a context that seeks to influence, through the injection of personal viewpoints, public opinion or the formulation of public policy. Delay in taking these actions may contribute to a potential loss of confidence by the American public and broader research community regarding the quality and credibility of Government sponsored scientific research results."

The full text of Washington's NSB letter may be read at http://www.nsf.gov/nsb/meetings/2006/0509/major_actions.pdf

Early this year, controversy erupted over attempts to restrict NASA researcher James Hansen from discussing climate change. House Science Committee Chairman Sherwood Boehlert (R-NY), Senator Susan Collins (R-ME), and Senator Joseph Lieberman (D-CT) wrote letters expressing their concern to NASA Administrator Michael Griffin. Griffin quickly issued an eight-page information dissemination policy, winning praise from Boehlert and Science Committee Ranking Member Bart Gordon (D-TN).

Less than a month after the resolution of this matter, Boehlert wrote to Vice Admiral Conrad Lautenbacher, Administrator of the National Oceanic and Atmospheric Administration (NOAA). In this April 7 letter, Boehlert wrote that he appreciated Lautenbacher's expressed support for "open and unfettered scientific communication." However, Boehlert went on to express concern that " at least some scientists at NOAA continue to feel that the agency is not encouraging open communication. " He recommended NOAA take corrective steps similar to those instituted by NASA.

Courtesy of FYI, the American Institute of Physics Bulletin of Science Policy News (http://aip.org/fyi).

MEETING BRIEFS

• The APS Texas Section held its annual spring meeting March 23-25 at Angelo State University in San Angelo, Texas. Among the highlights was a lecture during Saturday morning's plenary session by David Bixler (ASU), on stellar archaeology–specifically, what white dwarf stars can tell scientists about the age and history of star formation in our galaxy. Other speakers covered such topics as baryon spectroscopy, supersymmetry, new measurements of the proton's spin, spectral shapes in helium gas, optical properties of bovine ocular tissues, and a scientific explanation for a legendary local optical phenomenon: the "Marfa lights."

• The New England Section held its annual spring meeting March 31 through April 1 at Boston University in Massachusetts, on the theme "Physics and Cosmology at the Interface." Several prominent scientists discussed their research on the cosmological constant, the accelerating universe, different means of probing dark matter, measuring and predicting cosmological parameters, and cold dark matter halos. Friday evening's banquet featured bestselling author Lawrence Krauss (*The Physics of Star Trek, Hiding in the Mirror*) as the after-dinner speaker. The program also featured a showcase of physics demonstrations, as well as an education workshop designed to help new physics teachers integrate effective methods and new technologies to better meet the challenge of reaching students.

• That same weekend, the APS Ohio Section held its annual meeting at Wayne State University in Detroit, Michigan. The theme of the meeting was the physics of the early universe, featuring such topics as cosmology, Big Bang physics, general relativity, microwave background radiation and quasars, along with selected topics in particle and nuclear physics, including "B" quark physics, symmetry breaking, and the search for the Higgs boson. The invited speakers included Fred C. Adams (University of Michigan), who explored how the early universe may have impacted the formation and long-term evolution of galaxies, and Paul Stankus (Oak Ridge National Lab), on the quark-gluon plasma and the early universe.

• From May 19-20, the APS Northwest Section held its annual spring meeting in Tacoma, Washington. Program highlights included plenary talks on probing the existence of extra dimensions with gravitational-wave observations; building robust qubits for quantum computing; the search for missing baryons at Jefferson Lab; the latest results from Fermilab's Tevatron; relativistic binary pulsar systems; testing symmetry by trapping antihydrogen atoms; and transverse coherence at short wavelengths. Friday evening's banquet featured an after-dinner lecture by Mott Greene (University of Puget Sound) on atmospheric physics and continental drift: "The True Story of How Alfred Wegener Made His Discovery."

DAMOP CONTINUED FROM PAGE 1

for commercial applications. For example, the Chip-Scale Atomic Clock is smaller and uses less power than other commercial AFS devices, enabling atomic timing accuracy in portable battery-powered applications. The optically pumped cesium beam frequency standard is being developed for deployment onboard the GPS-III satellite constellation.

Combing Optical Frequencies. Femtosecond laser frequency combs (FLFCs) have found widespread use in optical atomic clocks, as well as in optical frequency metrology. Now, these broadband, evenly-spaced arrays of optical frequencies–produced by femtosecond mode-locked lasers–are beginning to play a vital role in other precision measurements, according to NIST's Scott Didams. These include using optical frequency combs for direct atomic spectroscopy and in more transportable instruments. There are also new possibilities in arbitrary waveform generation, spectroscopic sensing, and secure optical communications, thanks to the development of highly dispersive elements that permit the spatial separation of the frequency comb elements while maintaining high resolution.

Just an Attosecond. Attosecond pulses of light can be generated via the nonlinear interactions between an intense, ultrashort laser pulse and a gas of atoms, via the process of high harmonic generation. According to Joachim Burgdorfer of Vienna University of Technology in Austria, the process has sufficiently advanced to the point where scientists can now generate attosecond electromagnetic pulses of sufficiently short duration to approach the orbital period of a classical atomic electron. This means we may be able to map out the electronic dynamics inside atoms in real time.

At the same session, Gerhard Paulus (Texas A&M University) reported on a novel application of intense few-cycle laser pulses: an attosecond version of the famous double-slit experiment first conducted by Thomas Young in the 19th century. In this instance, the double slit is realized in the time-energy domain (rather than position-momentum), and the "slits" can be opened or closed by changing the temporal evolution of the field of a few-cycle laser pulse.

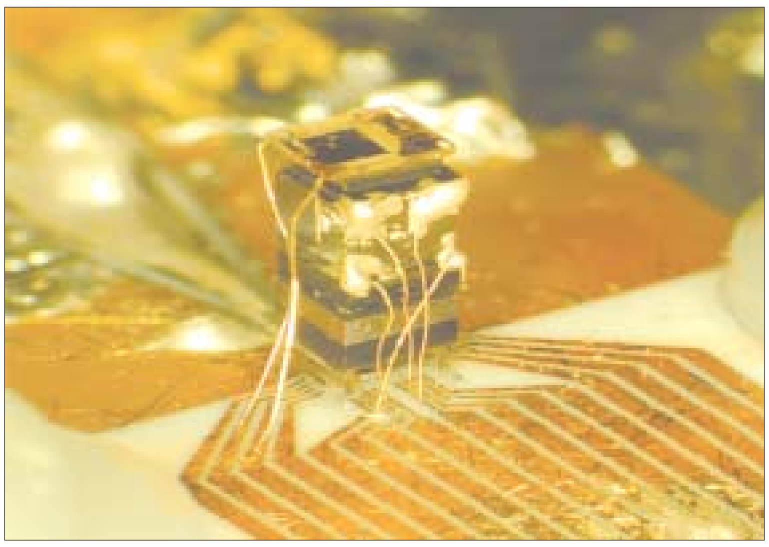


Photo credit: NIST Public Affairs

NIST's chip-scale atomic clock includes (from the bottom) a laser, a lens, an optical attenuator to reduce the laser power, a waveplate that changes the polarization of the light, a cell containing a vapor of cesium atoms, and (on top) a photodiode to detect the laser light transmitted through the cell. The tiny gold wires provide electrical connections to the electronics for the clock.

Interstellar Bio-Building Blocks. Currently, more than 125 different chemical compounds have been detected in the interstellar medium, many of which are unusual, such as metal cyanide species, or organic molecules like acetone or the simple sugar, glycolaldehyde. The common appearance of organic molecules and simple species with a metal center suggests that the building blocks of life may have originated in interstellar space, according to Lucy Ziurys of the University of Arizona. She and her colleagues have developed an effective combination of techniques for studying such elements in the laboratory, with an eye towards evaluating the limits of chemical synthesis in interstellar gas.

Strongly Coupled Plasmas. Ultracold neutral plasmas are produced by photoionization of laser-cooled neutral atoms. Physicists find them of interest for many reasons, most notably the prospect of creating–in a tabletop experiment–a strongly coupled two-component plasma, in which the electrostatic potential energy greatly exceeds the thermal kinetic energy of the particles that comprise the plasma.

Thomas Pattard of the Max Planck Institute for the Physics of Complex Systems in Dresden, Germany, reported on recent work showing that the addition of Rydberg atoms to a plasma allows one to significantly control the electronic temperature in order to achieve both cooling and heating of the plasma electrons. Numerous experiments have also demonstrated a "dipole blockade" effect, in which the disorder-induced heating of the ions is suppressed. Not only is this effect important to the creation of strongly coupled plasmas, it also plays a vital role in certain proposed schemes for quantum information processing.

OLYMPIAD CONTINUED FROM PAGE 4

know the other students.

Ariella Kirsh, a senior at Hawken School in Ohio, also said she liked meeting the other team members. "It's a really neat atmosphere. There are a lot of really high-powered people here," she said.

It is a busy week for the team members, though the students do have a little free time for playing card games and Frisbee, and just hanging out.

During the nine day camp, the team took one day off from training to visit nearby Washington, DC, where they met with their Senators and Representatives, toured the National Air and Space museum, and attended a special reception with the two physicists in Congress, Vernon Ehlers and Rush Holt. Ehlers inserted a statement in the congressional record honoring the team.

At the end of the training camp, five students and one alternate were selected to the traveling team, which will travel to Singapore to compete in the International Physics Olympiad July 8-17. The students were selected based on their scores on the exams and labs during the training camp, which are similar to what they will encounter in the international contest.

The students selected for the traveling team are:

Men Young Lee, a senior at Thomas Jefferson High School for Science and Technology, Alexandria, VA. Last year Lee brought home a gold medal from the competition, held that year in Salamanca, Spain.

William Throwe, a senior at Shoreham-Wading River High School, Shoreham, NY. Last year Throwe served as an alternate to the team.

Sherry Gong, a junior at Phillips Exeter Academy in Exeter, NH.

Henry Tung, a junior at Torrey Pines High School in San Diego.

Otis Chodosh, a senior at the Oklahoma School of Science and Mathematics in Oklahoma City.

The alternate to this year's team is Ingmar Saberi, a junior at Pullman High School in Pullman, WA.

RELIGIOUS CONTINUED FROM PAGE 4

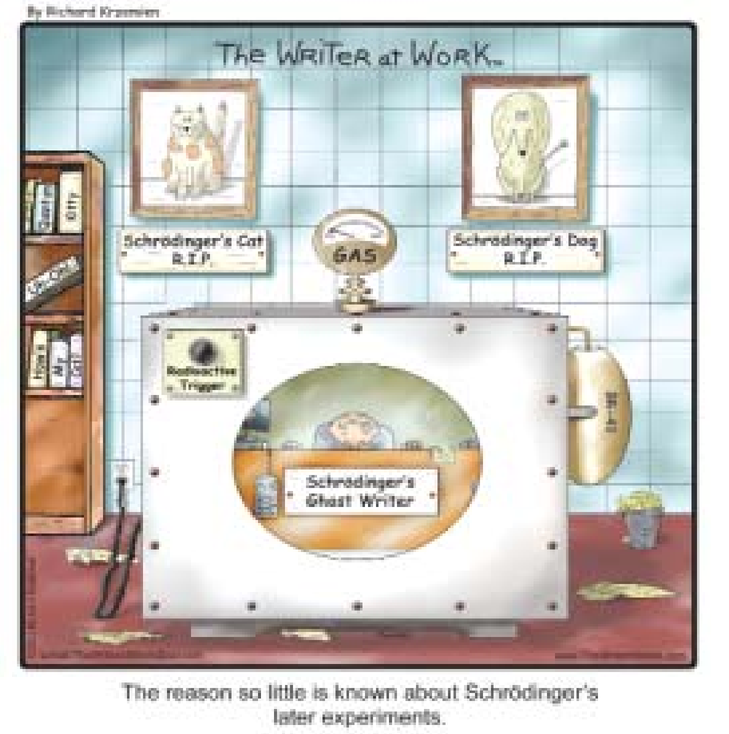
education, and organization.

Many religious persons do not accept the scientific description of origins, because they perceive the scientific establishment to be hostile to religion, and therefore biased and not to be trusted in this area. The only way to reverse the numbers that Krauss deplores is for the scientific community to gain the trust of the public. This will not be accomplished by scientists loudly attacking "scientific creationism" as nonsense, even though such attacks are correct. It will be accomplished by the scientific community loudly disassociating itself from the philosophical (as opposed to methodological) naturalism of Richard Dawkins and his ilk. I am not optimistic that this will happen.

The American Scientific Affiliation (http://www.asa3.org/) is a good resource to provide some insight for scientists into the religious community.

Ronald Hodges
Palo Alto, CA

zero gravity
The Lighter Side of Science



The reason so little is known about Schrödinger's later experiments.

To see more comics by Richard Krzemien, please visit his website at www.TheWriterAtWork.com

ANNOUNCEMENTS

Estate Planning Handouts Now Available

In addition to the many research talks at the 2006 March Meeting in Baltimore, an estate planning session was once again offered for attendees and local members. Led by Jerry McCoy, an attorney from the DC area well-known for expertise in estate tax law, the session provided APS members with tips and tax savings ideas for use in planning for the long term distribution of their property to family, friends and charitable interests. Handouts from the session, including informational brochures on a broad range of estate planning topics, are available to all interested members from Darlene Logan at logan@aps.org.

Now Appearing in RMP: Recently Posted Reviews and Colloquia

You will find the following in the online edition of *Reviews of Modern Physics* at http://rmp.aps.org

String Gas Cosmology
Thorsten Battefeld and Scott Watson

In recent years the study of string-theory-based approaches to cosmology has become a very active field. This paper reviews one of these approaches, called string gas cosmology. It concerns the role of a gas of extended strings in the very early Universe. These strings can wrap compact dimensions and influence their expansion.

Attention is also turned to late time cosmology and it is found that string gases even provide a framework to explore dark matter.

48th Annual American Physical Society Division of Plasma Physics (APS/DPP) Job Fair

Philadelphia Marriott Downtown Hotel October 30 through November 1, 2006

Whether you are looking for a job or recruiting, the American Physical Society Division of Plasma Physics (APS/DPP) Job Fair is the place to be! The Job Fair will provide job seekers and hiring managers with unsurpassed recruitment and networking opportunities. Last year, more than 50 companies met with hundreds of job seekers.

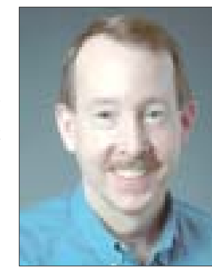
The Job Fair is free of charge to all job seekers. There is a nominal fee for employers. The pre-registration deadline for both employers and job seekers is October 16, 2006. Register today at http://www.physicstoday.org/jobs/jobfairs.html.

For additional information, please contact Alix Brice at:
American Physical Society
Career Network Division
One Physics Ellipse
College Park, MD 20740
Phone: 301-209-3187
E-mail: jobfairs@aps.org

2006 GENERAL ELECTION PREVIEW

It's that time of year again, when APS members have the opportunity to elect next year's leadership from a slate of candidates selected by the APS Nominating Committee. Brief biographical descriptions for each candidate can be found below. Those elected will begin their terms on 1 January 2007. Members will elect a Vice President, Chair-Elect of the Nominating Committee, and two General Councillors. All votes must be entered by Noon, Central Daylight Time, September 1, 2006. Full biographical information and candidates' statements can be found at www.aps.org/exec/election2006.

FOR VICE PRESIDENT



WICK HAXTON
University of Washington

Haxton received his PhD from Stanford in 1976. After a year as a researcher in Germany, he joined the Theory Division in Los Alamos in 1977. In 1984 he joined the University of Washington, where he is Professor of Physics and Adjunct Professor of Astronomy. In 1990, with Ernest Henley, he helped found the Institute for Nuclear Theory, a Department of Energy visitor center. He has been the Institute's director since 1991. Haxton chaired the APS Division of Astrophysics in 1997 and the Division of Nuclear Physics in 1993, served as Councillor-at-large during the years 1991-95, and chaired the Nominations Committee in 1997-98. He was elected to the National Academy of Sciences in 1999. He was awarded the APS Hans Bethe Prize in 2004 for contributions to neutrino astrophysics. He currently serves on the National Academy's Board on Physics and Astronomy.

Haxton's research focuses on theoretical aspects of neutrino and nuclear astrophysics, low-energy tests of symmetries and conservation laws, and many-body techniques. His work includes the description of nuclear reactions in the high-temperature plasmas found in stellar cores and supernovae; the detection of astrophysical neutrinos and their importance as a probe of neutrino mass and mixing; tests of CP violation and hadronic parity violation through atomic electric dipole and anapole moment measurements; modeling the core-collapse supernova mechanism; and the adaptation of effective field theory methods for the solution of nonrelativistic many-body problems. He has dabbled, somewhat unsuccessfully, in the area of deep underground science facilities, discovering in the process that experimental physics is more complicated than theory.

CHERRY A. MURRAY
Lawrence Livermore National Laboratory

Murray has been Deputy Director for Science and Technology at Lawrence Livermore National Laboratory since December, 2004, leading the Laboratory's science and technology activities. She received her PhD in physics in 1978 from the Massachusetts Institute of Technology. Formerly Senior Vice President for Physical Sciences and Wireless Research at Bell Labs, Lucent Technologies, she first joined Bell Labs in 1978 as a member of the technical staff. She held a number of management positions over the years, including department head for low temperature physics, department head for condensed matter physics, department head for semiconductor physics and director of Bell Lab's physical research lab. In 2000, Murray became vice president for physical sciences and then senior vice president in 2001.

Murray is an experimental condensed matter physicist who has worked in surface and low temperature physics, light scattering and phase transitions in complex fluids. *Discover* Magazine named her one of the "50 Most Important Women in Science" in 2002. She served on the APS Executive Board and Council from 2001-2004, and has been an active member of many APS taskforces, divisions and forums. In 1989, she won the APS Maria Goeppert-Mayer Award, and in 2005, the APS George E. Pake Prize. She was a member of the 2005 National Academies Committee on Prospering in the Global Economy of the 21st Century, which was responsible for the NRC report *"Rising Above the Gathering Storm–Energizing and Employing America for a Brighter Economic Future."*

FOR CHAIR-ELECT, NOMINATING COMMITTEE

CHARLES CLARK
National Institute of Standards and Technology

Clark is Chief of the Electron and Optical Physics Division, Physics Laboratory, National Institute of Standards and Technology (NIST), in Gaithersburg, MD. He serves as acting Program Manager for Atomic and Molecular Physics, U.S. Office of Naval Research, and is active as an Adjunct Professor in the Institute for Physical Science and Technology, University of Maryland at College Park. His previous service to APS includes: Chair, Division of Atomic, Molecular and Optical Physics (DAMOP); member, Fellowship Committee, Physics Policy Committee, and Davisson-Germer Prize Committee. Clark received a PhD in physics from the University of Chicago. He spent two years as a postdoc at Daresbury Laboratory in the U.K., then joined the National Bureau of Standards (now NIST), where he is now a member of the U.S. Senior Executive Service. He is an advisor to the production team of the forthcoming movie, Absolute Zero and the Conquest of Cold.

PHILIP W. PHILLIPS
University of Illinois

Phillips is a professor of Physics and a Bliss Faculty Scholar in the College of Engineering at the University of Illinois at Urbana-Champaign. A theoretical condensed matter physicist, Phillips studies quantum phase transitions and strongly correlated electrons. In particular, he focuses on novel metallic phases in two dimensions and high-temperature superconductivity. Phillips is a recipient of the Society's Edward A. Bouchet Award (2000). He was an APS general councilor (2000–2002) and executive councilor (2002–2004). He also served on the APS Committee on Committees for the APS (2002–2004). Phillips received his PhD from the University of Washington in 1982. After a Miller Fellowship at Berkeley, he joined the faculty at Massachusetts Institute of Technology (1984-1993). He came to the University of Illinois in 1993.

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Austin received his PhD in physics from the University of Illinois Champaign-Urbana in 1976. He did a post-doc at the Max Planck Institute for Biophysical Chemistry from 1976-1979 and has been at Princeton University since 1979, achieving the rank of Professor of Physics in 1989. He has chaired the APS Division of Biological Physics, and has served as the biological physics editor for *Physical Review Letters*. He won the 2005 APS Edgar Lilienfeld Prize. He has a wide-ranging set of interests in the field of biological physics. He remains interested in the subject of the conformational dynamics of proteins, particularly in the mid and far infrared range, and has carried out an extensive set of experiments probing picosecond protein dynamics at free electron lasers around the world. He also is interested in time-resolved conformational dynamics of proteins using ultra-fast mixing techniques and has carried out ultra-fast mixing experiments at accelerator light sources, using a technology based upon a microfabricated diffusional mixer he invented.

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Beise is a professor of physics at the University of Maryland. She received her PhD in physics from MIT in 1988. She worked as a research fellow in the Kellogg Laboratory at Caltech from 1988-1992 prior to coming to the University of Maryland. Her research is on the use of electron scattering to study aspects of nucleon structure and light nuclear systems, particularly in kinematic regions where the strong interaction cannot be described using perturbative methods. In 1998 she received the APS Maria Goeppert-Mayer award for her research in this area. She is presently on partial leave from the University of Maryland while completing a two-year appointment as a Program Director for Nuclear Physics at the National Science Foundation. Beise has served on the APS Division of Nuclear Physics executive, program, and nominating committees, and on the APS Committee on the Status of Women in Physics. She also currently serves on the editorial board for *Physical Review C*, and as an associate editor for *Nuclear Physics A*.

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Jin is a NIST Fellow working at JILA in Boulder, Colorado. In addition to her position in the Quantum Physics Division of NIST, she serves as an adjoint associate professor of physics at the University of Colorado. She received her PhD in Physics in 1995 at the University of Chicago. Jin is an experimental atomic, molecular, and optical physicist whose research has focused on ultracold Fermi gases of atoms. She received the Maria-Goeppert Mayer Award in 2002 and the I.I. Rabi Prize in 2005. Jin is a member of the executive committee of the APS Division of Atomic, Molecular, and Optical Physics.

TREVOR A. TYSON
New Jersey Institute of Technology

Tyson received his PhD from Stanford University in 1991. He worked as a postdoctoral researcher at the INFN national research laboratory, in Frascati, Italy, and then as a postdoctoral fellow at Los Alamos National Laboratory. In 1996, he became an assistant professor at the New Jersey Institute of Technology (NJIT). He currently serves as a professor of physics and as the director of the Materials Science and Engineering Program. His basic research focuses on understanding materials in which the spin, charge and atomic parameters are strongly coupled. In addition, he is involved in the development of novel spectrometers and detector systems. He is committed to the application of methods developed for basic science to the solution of real-world applied problems. This includes, for example, the application of spectroscopic techniques to complex metal hydrides for hydrogen storage and to understanding corrosion and developing protective coatings to inhibit it.

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Charting the Course for Elementary Particle Physics

By Harold T. Shapiro

Over the past 18 months I have been engaged in a very stimulating—and rewarding—intellectual adventure. I chaired the National Academies' Committee on Elementary Particle Physics in the 21st Century that was convened in response to an informal request from DOE and NSF. The committee was charged to identify the compelling science questions that currently define the elementary particle physics scientific agenda and to recommend a 15-year implementation plan with realistic, ordered priorities to address them. The committee that was assembled included quite a few individuals from outside the field of particle physics; in fact, half the committee members were not experts in particle physics, and yet each one had an important perspective to contribute. As an economist with a long-time interest in science policy and as a former university president, I undertook this challenge seriously but with a commitment to ensure that our recommendations would represent responsible stewardship of public resources.

The final report of the committee, *Revealing the Hidden Nature of Space and Time*, was publicly released on April 26, 2006. The committee strongly recommended an aggressive, direct exploration of the physics of the Terascale, where "tera" refers to the trillions of electron-volts that the world's most powerful accelerators can impart to fundamental particles. The strong attraction of Terascale physics is underscored by the convergence of interests from distinct scientific areas. From cosmology, there is growing interest in dark matter and dark energy. From particle physics, there is great interest in supersymmetry, in the origins of mass, and in Einstein's dream that all the forces can be unified. This convergence is what makes the Terascale so persuasive. The intersection of scientific interests is often a signal that major new discoveries are on the horizon, and thus, the committee felt that explorations of the Terascale have enormous scientific potential.

Let me assume for the moment some general familiarity with the report (please see the excellent discussion in last month's *APS News* for details), and use this space to briefly expand on three themes: (1) the role of particle physics in the physical sciences (as seen by an outsider), (2) leadership in an international arena, and (3) the medium-term challenge facing US particle physics.

In the committee's judgment, the US program in particle physics, despite a long tradition of distinction, is now at a decisive crossroads. Not only has this program (like many others in the physical sciences) experienced a decade of stagnating support when programs elsewhere in the world were expanding, but also the most important experiments at SLAC and Fermilab are reaching the end of their useful scientific lives without a clear follow-on strategy in place. As a result, the intellectual center of gravity is moving abroad just when the scientific agenda is especially promising. In these circumstances it was the committee's view that a failure to adopt a refreshed and compelling strategic vision and associated set of priorities would imply a decision to forgo leadership and commit ourselves to a much smaller effort in this critical scientific arena.

An outsider to particle physics (or even to the physical sciences in general) might naturally question the consequences of forgoing America's tradition of leadership in particle physics. In my view, and one echoed by the committee throughout its report, there is a strong relationship between the health of US particle physics and the vitality of the nation's overall science and technology portfolio. Consider these two observations. First, scientific discovery is an unpredictable process whose impacts are only fully recognized ten or twenty, sometimes even thirty, years down the road. In such an environment, the best investment strategies rely on a mixed or diversified portfolio. Indeed it was the committee's view that a strong particle physics program not only would enable us to explore some of the most exciting issues on the scientific frontier, but was essential to the long-term vitality of the physical sciences. Historically certain important scientific and technological advances arose because of a synergy among particle physics and other developments in science and technology, but the committee does not claim that particle physics is the best or only path to drive such innovations. Rather, the committee argued that a strong program in particle physics is an essential element of an overall strategy to foster such breakthroughs.

Second, it seems to me that particle physics has several key attributes that give it a distinctive role in the physical sciences. For example, particle physics incorporates both imagination and technological and computing prowess at an unusual scale in order to address several of the most exciting questions of our time: What is the nature of space and time? What are the origins of mass? How did the universe begin? How will it evolve in the future? The quests and the techniques of particle physics, therefore, attract some of the best and brightest minds to futures in science, technology, engineering, or mathematics.

Thus, I would posit that the future of the US program in particle physics has consequences that extend far beyond the field itself. Particle physics is not elite, nor special, nor exclusive in this regard. However, the US program currently faces a set of strategic decisions that will determine, to a large degree, its future for a generation. These decisions will require the support of physics in general, if not all of the physical sciences together. Perhaps this is one of the reasons the National Academies saw fit to include such a diverse set of individuals on the committee. The committee recommended, unanimously, that the United States should not abandon its leadership role in particle physics, especially at a time when the scientific agenda is richer than it has been for a generation.

Let me say something further about leadership and the international arena. As the field of particle physics took shape in the middle of the century, America's scientists focused on experiments designed to measure and explain the properties and forces governing the ultimate constituents of matter. Since then, even as the field became increasingly internationalized with very distinguished centers abroad, the United States has been home to some of the world's most accomplished theorists, the most diverse array of experiments, and some of the largest particle accelerators. Moreover the United States has welcomed and greatly benefited from the intellectual and financial input of scientists from around the world. US leadership in particle physics both anchored and symbolized the growing distinction and reach of the overall American scientific enterprise.

Photo credit: Jane Scherr

Harold T. Shapiro

The committee felt strongly that because of the increasing cost and complexity of particle physics experiments, and the need to deploy public funds in the most effective and responsible manner, it is more important than ever for all the major programs in particle physics to leverage their resources by working together internationally. The community of particle physicists has a strong tradition in this area, but that tradition needs to be enhanced. Moreover, the key sponsors of national and multinational programs need to allow for the serious consideration of new and imaginative arrangements. Such arrangements would not only serve the cause of scientific progress; they also may be the only way to provide scientists and their students in each region of the world with the opportunity to address those areas of particle physics to which they can make the greatest scientific contribution. This type of transformation cannot be accomplished by a single country or region: it requires the mutual collaboration of all major partners. Such transformations would strengthen the knowledge base of the entire US scientific enterprise.

If we are to take the current discussions about globalization, "the flat world," and the growing interdependence of national efforts around the world, what does scientific leadership mean for the United States? After some thought, the answer becomes relatively clear for a field like particle physics. Leadership does not mean dominance, but rather taking initiative at the frontiers, accepting appropriate risks, and catalyzing partnerships both at home and abroad. That is, in articulating a strategy for the United States, we must find a path that leverages US strengths for the benefit of the not only the domestic program but also the global enterprise. We must move from a paradigm of "We're going to build this, will you help us?" to one of "What can we build together that will benefit us all?" US leadership, together with that of our colleagues abroad, is important because it is critical to reaping the scientific, technological, economic, and cultural dividends that come from advancing the scientific frontier.

With these considerations in mind, the committee saw a critical role for the United States in fostering this new era of international partnership and coordination. Even as the Europeans have been finishing the Large Hadron Collider (LHC), particle physicists worldwide have been designing the next generation of particle accelerators. Known as the International Linear Collider (ILC), this new tool would consist of two accelerators that fire electrons and positrons at each other head-on, re-creating conditions that existed just a fraction of a second after the universe's birth. The ILC would be of such a scale and complexity, similar to the LHC, that only a global, cooperative effort could make it possible. It was the committee's judgment (echoing many others) that the ILC was a necessary tool to fully exploit the scientific opportunities of the Terascale. The committee believed that the potential role of the United States in building, supporting, and perhaps hosting the ILC was key to the continued distinction of the US program. In order to participate in such a global effort, the United States must surrender some degree of control—but this shift is precisely the form of leadership that I believe will be essential to shepherding in a new era of global scientific cooperation.

The committee's report identifies a set of priorities that we believe will propel the United States to leadership in a way that adds value to the international effort. The committee's strategy aims for a pivotal role in the ILC but is not without risks. Nature might not reveal its secrets so easily at the LHC, the necessary level of international cooperation and agreement might not coalesce, or fiscal and technical realities might make a linear collider untenable. The committee advocated for a firm step forward, however, in the face of these longer-term uncertainties. The committee recommended that the program invest some risk capital that would enable the United States to become the leading center for R&D relating to the ILC and prepare to mount a compelling bid to host the ILC if that still seems desirable down the road. While this path contains obvious risks the committee felt that the prospective benefits more than justified such actions. Indeed we could not identify an alternative program that could sustain our leadership position with a better risk-adjusted rate of return: the riskiest path is to simply maintain our current course.

The task of crafting a meaningful program that moves forward is a challenge that requires courageous decisions, but such courage and determination are some of the unavoidable prerequisites for leadership. In its strategic principles, the committee offers some general guidance to the US particle physics program and its sponsors. A key element of these principles is the discussion of the role that a so-called national program committee might play in helping to frame a national program that not only addresses the most compelling science but also best deploys US resources and talents. Implicit in this principle is the committee's judgment that structuring the near- and mid-term program, within the recommended framework, is work best left to the physicists and their immediate sponsors.

Today, our nation faces some decisions about its future role in particle physics. The United States can choose to sacrifice its historical leadership in particle physics. Or we can make a strong commitment to current and future global efforts. The United States has an unprecedented opportunity, as a leader of nations, to undertake this profound scientific challenge.

Finally, I must express my thanks and gratitude to the members of the committee and indeed to everyone who contributed to the work of this committee. I am pleased with our final report and I hope that it continues to be of value to this important field of science for years to come.

Harold Shapiro is president emeritus and professor of economic and public affairs at Princeton University. His broad interests and experience range from chairing the board of trustees of the Alfred P. Sloan Foundation and the National Bioethics Advisory Committee to membership on the U.S. Olympic Committee.

APS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org