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APS Aids Efforts on Behalf of New DOE Legislation

The APS Office of Public Affairs (OPA) spent much of this summer working with the office of Rep. Judy Biggert (R-IL) and others in Congress and the scientific community to introduce new legislation that seeks to set the Department of Energy's Office of Science (DOE-OS) on a course to substantially increase its budget over the next four years.

The bill would also create a new undersecretary position to centralize DOE's basic and applied research programs.

Funding for the DOE/OS has remained at the same level as that of 1990 (constant dollars.) While budgets for the National Institutes of Health and the National Science Foundation have dramatically increased over the last few years, that of the DOE/OS has been at or below the rate of inflation during the last decade.

Congress hopes to enact sweeping energy legislation before it goes home this fall. The energy bill, H.R. 4, serves as a vehicle for those supporting a larger budget for the Office of Science.

When the House of Representatives passed H.R. 4 one year ago, it authorized a single 15% increase in the FY 2002 Office of Science budget. The more recent Senate version of this legislation authorized increases ranging from 9 to 15% in FY 2003 through FY 2006. Conferees will be working this fall on a compromise version of the energy bill acceptable to both chambers and President Bush.

In order to demonstrate House support for the kind of authorization levels that are in the Senate version of the bill, Biggert introduced H.R. 5270. Biggert's bill authorizes an 8% increase in the budget for the DOE/OS in FY 2003.

FY 2004 through FY 2006 would receive authorization increases of 15% per year. H.R. 5270 and the Senate energy bill would provide a roughly comparable increase in the authorization levels by FY 2006. (Authorization legislation guides, but does not set, actual funding levels.)

At press time, H.R. 5270 had 17 cosponsors: Robert Andrews (D-NJ), Leonard Boswell (D-IA), Ken Calvert (R-CA), Michael Capuano (D-MA), Vernon Ehlers (R-MI), Felix Grucci (R-NY), Doc Hastings (R-WA), Rush Holt (D-NJ), Michael Honda (D-CA), Amo Houghton (R-NY), Timothy Johnson (R-IL), Jim McDermott (D-WA), Lynn Rivers (D-MI), Bobby Rush (D-IL), Ellen Tausher (D-CA), Zach Wamp (R-TN), and Lynn Woolsey (D-CA).

See OPA AID *on page 3*

Senate Bill to Double NSF Budget

Shortly before Congress departed for August recess, Senator Ted Kennedy (D-MA) introduced an authorization bill to more than double the National Science Foundation budget over five years. This bill, S. 2817, is the Senate's answer to H.R. 4664, an NSF reauthorization bill that passed the House by a wide margin on June 5. (Authorization bills provide spending guidelines, but actual budgets are determined by annual appropriations bills.)

The House bill would reauthorize NSF for fiscal years 2003 to 2005, putting the foundation's budget on track to double in five years by calling for 15% increases in each of the years authorized. The Senate bill, known as the "National Science Foundation Doubling Act," is co-sponsored by Senators Ernest Hollings (D-SC), Barbara Mikulski (D-MD), and Christopher Bond (R-MO). The Senate bill would reauthorize NSF through FY 2007 and recommends annual increases of approximately 15.5% in each of these years, more than doubling the foundation's budget by FY 2007.

NSF's current budget is $4,789.2 million, with $3,598.6 million for Research and Related Activities (R&RA), and the Administration is seeking $5,036.0 million for FY 2003. The Senate bill would authorize $5,536.4 million for the foundation in FY 2003. By comparison, the House bill would authorize $5,515.3 million for FY 2003. By FY 2007, the authorization level in the Senate bill would increase to $9,839.3 million (with $7,559.1 million for R&RA), which would represent a 105.5% increase over current funding, not considering inflation.

The Senate and House bills contain nearly identical provisions addressing NSF's prioritization of proposed

See NSF BUDGET *on page 7*

APS Outreach Programs Exhibited at the AAPT Summer Meeting

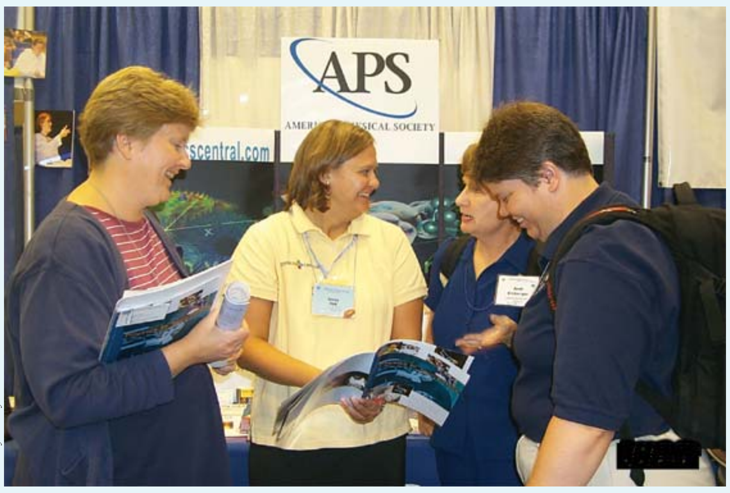


Photo by: Evelyn Hitchcock

APS Public Outreach Specialist Jessica Clark (second from the left) discusses the newly updated Physics in Your Future brochure [See page 7] with attendees at the summer meeting of the American Association of Physics Teachers in Boise, Idaho: (from the left) Patricia Sievert of Northern Illinois University, Andi Erzberger of Lawrence Berkeley Laboratory, and Beth Beiersdorf of the University of Notre Dame. Other APS educationand outreach programs exhibited at the meeting included PhysicsCentral.com and PhysTEC [see page 1], along with the debut of the new APS Committee on Minorities poster.

APS-Led Education Program Revamps Teacher-Prep Courses

By Desirée Scorcia

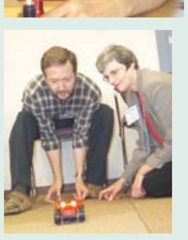
This fall, six universities participating in a pioneering education initiative will launch major course changes in an attempt to better prepare future K-12 science teachers. The universities will redesign both introductory physics courses and teacher preparation classes to train future elementary science teachers and high school physics teachers to replace the standard lecture model of teaching with more engaging, hands-on methods.

The initiative is called the Physics Teacher Education Coalition (PhysTEC). It was created by the APS, in partnership with the American Institute of Physics (AIP) and the American Association of Physics Teachers (AAPT), in response to national reports that decried the inadequate preparation of K-12 science teachers, many of who have little formal science training.

"Our governing philosophy is that teachers teach the way they were taught in the discipline," says Fred Stein, APS Director of Education . "If they were lectured to, then they tend to become lecturers. PhysTEC aims to break that cycle."

Stein says poor physics teacher preparation is partly responsible

See REVAMPS *on page 3*



In the top right photo,Ingrid Novodvorsky, who works in physics department in physics education research at the University of Arizona, is investigating the position of a reflection by placing one light source at the position of the reflection of another.

At the bottom right, Lin Oliver (left), of the University of Arkansas, and Susan Wyckoff of Arizona State University, investigating the motion of an electric car. Both activities were part of the Third Annual Physics Teacher Education Coalition (PhysTEC) Conference, held at Western Michigan University on June 28-29 of this year.

Report Takes First Look at Careers of Physics Bachelors

By Desirée Scorcia

Brian White and Mark Wilkins earned their bachelor's degrees in physics back in 1992. After graduation, Brian took a job teaching high school physics and chemistry in Illinois, and Mark found work as an animator for Disney. Neither went on to earn any further degrees, but according to a recent survey published by the American Institute for Physics (AIP), both are representative of a group of people whose highest degrees are their physics bachelors.

The AIP report, released in July, marks the first time the institute has collected data about the careers of physics bachelors several years after graduation. The institute surveyed a total of 1200 people who had earned their degrees between 1991 and 1993. Of these, approximately 400 did not have additional degrees beyond their physics bachelors.

The report says that five to eight years after graduation, about 60% of this group have the same title as their first career path job, which the AIP described to respondents as "a job that will help you in your future career or a job in the field in which you want to make your career." The report stresses that physics departments should be aware of the potentially vital role they play in preparing undergraduate majors for their first "real job."

Like the majority of physics bachelors, White has stayed with his first career path job. As a 10, 11, and 12 grade physics and chemistry teacher at Lawrence North High School in Indianapolis, Indiana, White uses his physics education every day, to plan lessons and teach students essential problem-solving skills.

Wilkins, like the other 40% of physics bachelors, has changed job titles several times since he graduated. Right now, he is a technical director at PDI/Dreamworks animation studio — the company that put out the movie *Shrek* — in California. Wilkins finds technical approaches to computer graphics problems to help animators do their work.

Though their career paths are quite different, both Wilkins and White feel equally well prepared by their undergraduate physics education, and both use physics in some different, and some remarkably similar, ways.

White teaches mechanics, electric-

See BACHELORS *on page 7*

Highlights

Members in the Media

"If there were no other energy sources, you could have a fusion reactor in 10 years' time."
—John Perkins, Lawrence Livermore National Laboratory, Contra Costa Times, July 3, 2002.

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"I'm completely snowed by the cosmic background radiation. The signal was so weak it wasn't even detected until 1965, and now they're measuring fluctuations of one part in 100,000."
—Alan Guth, Massachusetts Institute of Technology, New York Times, July 23, 2002.

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"To someone who's interested in new sources for power stations, it would be very boring."
—Seth Putterman, UCLA, on possible fusion inside a sonoluminescent bubble, Chicago Tribune, July 25, 2002.

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"When you send your credit card number off to Amazon, the reason that it is safe is that nobody can figure out how to factor really big numbers."
—David Kielpinski, Massachusetts Institute of Technology, Dallas Morning News, July 9, 2002.

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Two comments on Stephen Wolfram's book "A New Kind of Science", from the Los Angeles Times, July 9, 2002:

"Wolfram's naivete about biological complexity is stunning.We call this 'crackpot science.' "
—Chris Adami, Caltech

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"The modern approach in much of science has been reductionist: You take a complicated thing and split it up into units that are less complicated. Wolfram's approach is the direct opposite: Start with simplicity instead of complexity. If he's right, this could be a huge step forward in the way we approach scientific problems — and maybe most complicated issues in life as a whole."
—Raymond Jeanloz, University of California at Berkeley

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"In a different life, I could have been a farmer instead of a physicist."
—Bruce Barnett, The Johns Hopkins University, Baltimore Sun, July 15, 2002.

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"This is the strongest material that will ever be made."
—David Luzzi, University of Pennsylvania, on carbon nanotubes, New York Times, July 16, 2002.

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"We're not designing 'dirty bombs. It also does not involve weapon 'pits' manufacturing."
—Bruce Goodwin, Lawrence Livermore National Laboratory, on renewed plans to purify plutonium, San Jose Mercury News, July 17, 2002.

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Three comments on the apparent fraud in data reporting the discovery of elements 118 and 116:

"Why would somebody put his or her life's reputation at stake and make a data fabrication? It's just crazy, because such things are brought to light sooner or later. There are very few cases like this, but they give us (nuclear scientists) a black eye."
—Witek Nazarevicz, Oak Ridge National Laboratory, San Francisco Chronicle, July 21, 2002.

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"There was extreme reliance on one individual because he was considered to be the world's greatest expert in this area. He was the heart and soul of putting the experiment together. [Fraud] was the last thing anyone would have expected."
—Pier Oddone, Lawrence Berkeley National Laboratory, Los Angeles Times, July 22, 2002.

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"So far I wasn't able to discover a mistake from my side and I disagree with the laboratory that I fabricated the data because I just simply didn't have a motivation for this. I mean, what was my profit or would have been my profit? "
—Victor Ninov, formerly of Lawrence Berkeley National Laboratory, National Public Radio, September 5, 2002. [Ninov is not an APS member—Ed.]

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"The Chinese are three to five years ahead of us on this. I don't know why we're not doing it here."
—Larry Crum, University of Washington, on using intense ultrasound to treat cancer, Seattle Post-Intelligencer, July 30, 2002.

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"We're telling them, 'Look, you guys, get the damn answer on the table'. "
—Thomas Kirk, Brookhaven National Laboratory, on the lack of a good theoretical number to compare with the g-2 experiment, New York Times, July 31, 2002.

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"Folks trying to catalyze political action need to have some

See **MEMBERS** *on page 3*

This Month in Physics History

October 1900: Planck's Formula for Black Body Radiation

When one thinks of the pioneers of quantum physics, names such as Dirac, Einstein, Bohr, Heisenberg and Schroedinger invariably spring to mind. However, it was Max Planck's profound insight into thermodynamics culled from his work on black body radiation that set the stage for the revolution to come. While Planck's radiation law was readily accepted, the importance of its conceptual novelty — its basis in energy quantization — took several more years to gain notice. And once it did, physics would never be the same.

Born in 1858, Planck hailed from a long line of academics. Both his grandfather and great-grandfather had been professors of theology at the University of Goettingen and his father was a professor of law at Kiel. Planck entered the University of Munich at age 16, opting to study physics. He received his doctorate at age 21 with a thesis on the second law of thermodynamics and was appointed to a teaching post at Munich, which he held until 1885, when he was appointed to a chair in Kiel. Four years later, he became chair of theoretical physics at the University of Berlin, a position he held for 38 years until his retirement in 1927.

His thesis work on the second law of thermodynamics ultimately became the basis of the research that led Planck to discover the quantum of action — now known as Planck's constant — in 1900. In late 1859, Kirchhoff had defined a black body as an object that is a perfect emitter and absorber of radiation. By the 1890s, various experimental and theoretical attempts had been made to determine its spectral distribution — the curve displaying how much radiant energy is emitted at different frequencies for a given temperature of the black body.

Planck was especially intrigued by the formula found in 1896 by his colleague Wilhelm Wien, and he made a series of attempts to derive

Max Planck

"Wien's law" on the basis of the second law of thermodynamics. By October 1900, however, other colleagues had conducted additional experiments and found definite indications that Wien's law, while valid at high frequencies, broke down completely at low frequencies. So Planck went back to work. He knew that the entropy of the radiation had to depend mathematically upon its energy in the high-frequency region if Wien's law held there. He also saw what this dependence had to be in the low-frequency region in order to reproduce the experimental results there. He guessed, therefore, that he should recombine these two expressions in the simplest possible way, and thus transform the result into a formula relating the energy of the radiation to its frequency.

Planck presented this latest formulation at a meeting of the German Physical Society on October 19, 1900, which was hailed as indisputably correct. But to Planck, it was simply a "lucky guess," and he set about deriving the formulation from first principles. By December 14, 1900, he had succeeded in doing so, but only by introducing what was to prove a revolutionary concept in physics: the oscillators comprising the black body and re-emitting the radiant energy incident upon them could not absorb this energy continuously, but only in discrete amounts, or quanta of energy.

This concept of energy quanta conflicted fundamentally with all past physical theory, and its importance was not fully appreciated at first, even by Planck himself, who was something of a reluctant revolutionary. However, the evidence for its validity gradually became overwhelming as its application accounted for many discrepancies between observed phenomena and classical theory, among them Einstein's explanation of the photoelectric effect. And in 1918 Planck's fundamental contribution was recognized with the awarding of the Nobel Prize in Physics, "for the discovery of energy quanta."

Planck made no other significant discoveries of comparable importance to his 1900 work, but remained a vital figure within the scientific community, becoming one of the first prominent scientists to endorse Einstein's special theory of relativity. In his later years, Planck devoted more of his writings to philosophical, aesthetic and religious questions. He became permanent secretary of the mathematics and physics sections of the Prussian Academy of Sciences in 1912 and was also president of the Kaiser Wilhelm Society (now the Max Planck Society) from 1930-1937. Alas, his professional success was not mirrored in his personal life. His first wife died in 1909 after 22 years of marriage, and three of his four children had also died by 1919.

During World War II, Planck chose to remain in Germany to try to preserve what he could of German physics, but it proved to be a costly decision. His house in Berlin was completely destroyed by bombs, and his one remaining son was implicated in the assassination attempt on Hitler on July 20, 1944 and executed by the Gestapo in early 1945. Planck died on October 4, 1947 at the age of 89, survived by his second wife and one remaining son from that marriage.

Further Reading:

Kragh, Helge. "Max Planck: The Reluctant Revolutionary," *Physics World*, December 2000.

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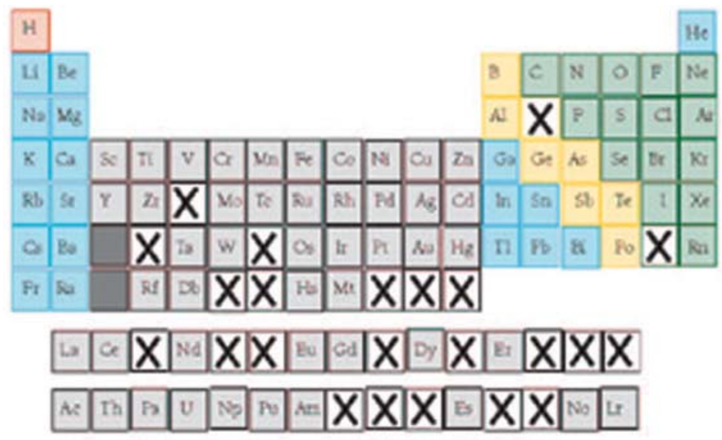
zero gravity
The Lighter Side of Science

Investigation Pokes Holes in the Periodic Table

By Martin Bridge



In a stunning series of revelations that spread through the periodic table like a wildfire through Colorado, several chemical elements have been withdrawn as evidence mounts that the experiments reporting their discovery had been faked.

It started last spring with elements 118 and 116, whose "discovery" in 1998 at Berkeley had been reported in *Physical Review Letters*. But when other labs could not reproduce the results, internal investigation revealed that the lead author on the paper might have manufactured the evidence, and the paper was withdrawn, taking the two elements with it. Subsequently, it was alleged that the same person had faked earlier experiments reporting the discovery of elements 110 and 112 at the GSI laboratory in Germany.

That was just the beginning. For years the Particle Data Group at Lawrence Berkeley Laboratory has been keeping close tabs on the properties of elementary particles, but stimulated by these events they turned their attention to the chemical elements. In a report issued last week, they conclude that there is no basis for believing in seven of the transuranic elements, which have atomic numbers beyond 92, and fully 18 of the so-called naturally occurring elements probably don't exist either.

"It's amazing that these results haven't been questioned over all this time," said a spokesperson for the group who declined to be identified. "Physicists, and chemists too, are such trusting souls that fraud can be committed right under their noses and they'll never notice it."

Particularly hard hit have been the rare earth elements. "They don't fit very well into the periodic table anyway," said the anonymous spokesperson. "Nobody will really miss them." He added that it should have been a clue when two elements were given closely related names. "Things like holmium (Ho) and hafnium (Hf). Or yttrium (Y) and ytterbium (Yb). What are the odds of two such crazy names arising independently? The second was just a 'copycat' discovery by someone trying to cash in on the glory. When you look at the data, they're all faked, but no one thought to investigate before. Yb or not Yb? That is the question. And now we have the answer."

Even some well-known elements are threatened with extinction. Potentially the most serious is silicon, only recently thought to be the most abundant of all the elements on Earth. "Imagine what this will do to the semiconductor industry when they find out that they named their valley after a fictional element. Silicon comes from silly con, which just means ridiculous fraud."

But if silicon and the other elements don't exist, what is the true composition of all the materials thought to contain them? The Berkeley group believes it knows. "Most likely they're all different forms of carbon," the spokesperson said. "Everybody has heard about buckyballs and nanotubes. Carbon can be made to take on an entire array of different forms. A lot of what we thought of as different elements are probably just more and more intricate forms of carbon. And carbon is one element that we're sure exists… at least that's what they told me this morning."

OPA AIDS, *from page 1*

Supporters of a larger budget for the DOE-OS in coming years are focusing their attention on increasing the number of cosponsors of H.R. 5270 before this section of the energy bill comes before House and Senate conferees.

"We're hoping to get at least 125 House members on record as supporting its provisions," says OPA Director Michael Lubell, who is working with APS policy fellows Susan Ginsberg and Steve Pierson to garner even more support for the bill.

Those representing the House when this section of the bill is considered are Sherwood Boehlert (R-NY), Ralph Hall (D-TX), Roscoe Bartlett (R-MD), Lynn Woolsey (D-CA), and Jerry Costello (D-IL). All of these members of the House Science Committee are strong supporters of science, but they will need to be able to point to the list of cosponsors on H.R. 5270 to strengthen their case.

The House Science Committee's Energy Subcommittee held a hearing on the Office of Science budget on July 25.

Office of Science Director Raymond Orbach, APS former President Jerome Friedman (Massachusetts Institute of Technology), and Richard Smalley (Rice University) testified at this hearing, all of them noting the many research opportunities that would be afforded through higher levels of funding.

With an FY02 budget of $3.2807 billion, the DOE's Office of Science is the principal sponsor of scientific facilities in the U.S., and the leading federal agency in terms of support for the physical sciences, including the materials and chemical sciences.

Unfortunately, the stagnant budget has forced the Office of Science to reduce the number of research grants and cut back operations at a number of major research facilities, at a time when demand for access to these facilities is higher than ever.

It currently funds only about 10% of the unsolicited, peer-reviewed proposals it receives annually, compared to 33% of proposals funded by the NSF.

"The consequences have rippled through the entire research enterprise," Friedman testified during the July 25 hearing. "Reductions in the operating and construction budgets for DOE facilities have put extraordinary strains on the R&D enterprise that reach far beyond the Department's own research programs."

Furthermore, the reductions in university support have prompted students to seek other career options, causing the country to become increasingly reliant on an uncertain flow of foreign-born scientists.

The DOE predicts that within ten years, 50% of its own managers will be eligible for retirement, so the stage is set for a significant workforce shortage. "You've got a serious mismatch between the demand for operations at the facilities and the ability to operate, and you've also got a serious mismatch between the projected manpower needs and the number of students entering the physical sciences," said Lubell.

The other major provision of H.R. 5270 is the creation of a new under-secretary of Energy Research and Science, with authority over all civilian science programs that support activities at DOE national laboratories and U.S. research universities.

"An undersecretary, properly credentialed in science and engineering, would be better able to integrate DOE's basic and applied research programs, provide the vital visibility for DOE's science enterprise, and allow the remaining undersecretary to concentrate on DOE's important environmental management mission," said Lubell.

REVAMPS, *from page 1*

for the low number of students who take physics in high school. A recent report from the National Science Foundation found that while 90% of high schoolers study biology, fewer than 30% study physics. Stein notes that in schools where teachers are known for using the hands-on methods PhysTEC promotes, as many as 80% of students take physics classes.

"What teachers want to know," says Stein, "is how to set up experiments in a physics classroom, and how to manage a class full of kids out of their seats doing science. Basically, PhysTEC will show them how to teach a science class."

Recently, PhysTEC held its third annual conference. All six participating universities—Ball State, Oregon State, Western Michigan, the University of Arizona, the University of Arkansas and Xavier University of Louisiana—attended the June meeting at Western Michigan University in Kalamazoo.

The theme of the conference was "Course Transformation." There, 41 participants observed a reformed physics class, in which students experimented with software that modeled electrostatic charges. They also held several panel discussions on physics and education department course reform and heard presentations from several PhysTEC facilty members.

The conference came before PhysTEC officially initiated a central part of its program—the Teachers in Residence (TIRs). Outstanding K-12 teachers from nearby schools, who already use hands-on methods in their classrooms, are each spending a year at one of the six universities. There, they are helping physics departments integrate hands-on methods into introductory physics classes, and helping education departments design better classes for students learning to teach.

Ball State University ran ahead of schedule and brought its first TIRs onto campus last spring. Ruth Howes, a physics professor and PhysTEC principal investigator there, said her group started by redesigning the undergraduate labs.

"We just threw away the old lab manual," Howes said. "It takes a lot of guts to do that. We walked into it cold turkey, but we survived and did some good work."

Jim Bogan and George Hill are retired high school physics teachers from Indiana who were TIRs at Ball State. Both taught the kind of hands-on physics throughout their careers that PhysTEC is trying to spread.

Bogan said it's important that physics professors learn to involve their students in lessons by asking questions, such as what students think will happen in certain situations or what formula to use when solving a problem, instead of simply lecturing.

"With inquiry-based lessons," Bogan said, "students find out things for themselves rather than having someone stand up in front telling them things. As a teacher, you can still be there to guide your students, but you don't have to tell them everything.

"One of the most important things I try to remember is that I don't know everything," Bogan said. "If I don't know the answer, I tell them where they can find it themselves. You can't always be the so-called 'sage on the stage.' It's much more important to teach students how to learn."

Success will be difficult to measure, but an external group called The Momentum Group will independently evaluate the program.

"Twenty years of research has shown that students learn better by doing," Stein said. "So we'll judge success by how well teachers use hands-on methods in their classroom."

Stein hopes that over the next ten years, ten more universities will join PhysTEC, which will be possible if incremental funding can be obtained.

Last year, the NSF awarded a five-year, $5.76 million grant and the Fund for the Improvement of Postsecon-dary Education (FIPSE), in the US Department of Education, awarded a three-year, nearly half-million dollar grant to the APS.

MEMBERS, *from page 2*

visible symptom to get peoples' attention. So if you have a really hot summer, forest fires, hurricanes, the temptation is to use these things to get the political support you need. It's not really scientific, but it's understandable."

—Steve Fetter, University of Maryland, Baltimore Sun, July 28, 2002.

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"Independent development of efficient and compact fission weapons, or thermonuclear weapons of any kind, could not be accomplished by countries new to nuclear weapons without nuclear testing highly likely to be detected."

—John Holdren, Harvard University, on the feasibility of a comprehensive test-ban treaty, San Francisco Chronicle, August 1, 2002.

***

"In principle, one ought to be able to build a device that would register balls and strikes. You don't even need the umpire to call them. But the question is whether one should do that, and that's a sociological-entertainment-baseball-history problem."

—Robert K. Adair, Yale University, Wired Magazine, August 8, 2002.

***

"Why did [Wimmer] pick a human disease which conjures up terrifying images? It's being done more for effect and less for the advancement of science."

—Steven Block, Stanford University, on the construction of a polio virus in the laboratory, Time Magazine, July 22, 2002.

***

"We will be able to contribute not only for our research, but for the cause as well."

—Hongxing Jiang, Kansas State University, on using ultraviolet light sources to detect biological weapons, Wichita Eagle, August 19, 2002.

LETTERS

Wen Ho Lee, Dreyfus Cases Eerily Similar

James Riordon's excellent article on Wen Ho Lee in the July 2002 *APS News* issue rightly emphasizes ethnic profiling. To this I would add national hysteria. From beginning to end, this case bears a remarkable resemblance to another episode of national hysteria, the notorious Dreyfus case, which rocked France a century earlier.

There, in 1894, at a time of widespread anti-Semitism, Alfred Dreyfus, a Jewish army officer, was accused of passing military secrets to a member of the German general staff, and imprisoned after a secret military trial. Here, Wen Ho Lee, a Chinese-American scientist, was suspected of passing nuclear secrets to Chinese agents, charged with improperly downloading computer files, and held without bail or trial.

There, Dreyfus was imprisoned under heavy armed guard on Devil's Island and chained to his bed at night. Here, Lee was kept in solitary confinement 23 hours a day, and shackled hand and foot when he left his cell.

There, an army colonel admitted that he had forged the principal documentary evidence against Dreyfus. Here, an FBI agent admitted that the evidence he gave against Lee was incorrect.

Richard Williams
Princeton, NJ

Wen Ho Lee is no Mahatma Ghandi

During Wen Ho Lee's incarceration, I participated in the petitions, etc. protesting his obvious mistreatment and the probable ethnic prejudice against him. Never, though, was I more aware of the admonition (usually attributed to Justice Brandeis) that those who would stand up for civil liberties will often find themselves defending some truly despicable characters. Such is Wen Ho Lee, who has made his living inventing nuclear bombs to exterminate cities, or even whole nations, of human beings. And he did this for a country already possessing a nuclear arsenal orders of magnitude in excess of any plausible need for deterrence, defense, or even aggression. While it was our duty to protest the violation of Lee's rights, let's not delude ourselves. This guy is no Mahatma Ghandi.

Jonathan Allen
Titusville, NJ

Article Presents Impression of Bias

As a regular reader and admirer of *APS News*, I was dismayed by the shoddy journalism in the article about the Wen Ho Lee Case in the July 2002 issue.

For example, "But one spy suspect on the CNN list stands out: *Wen Ho Lee is an Asian-American, a former Los Alamos National Laboratory hydrodynamics expert, and, it now seems, probably innocent*."

In the phrase I have italicized the author speculates without presenting any justifying evidence that Lee is probably innocent. Unfounded speculation on a suspect's guilt or innocence has no business in a news article — least of all should it be part of a newspaper sponsored by an organization of high scientific standards.

Compounding the impression of bias this article presents is the final reference to a web site where one can find "further information on Lee's case and a petition drive for his presidential pardon ..".

William R. Frazer
Aspen, Colorado

Wen Ho Lee Violated Trust

I am puzzled as to why Wen Ho Lee would be looking for a job [*APS News* interview, July 2002]. He is, after all, receiving full retirement benefits from the Los Alamos National Laboratory. Imagine any company giving a wayward employee full retirement benefits!

If I were an employer, I know why I would not hire this guy: he violated workplace rules, then tried to justify his actions by the lamest excuses. By downloading an enormous amount of classified material, Wen Ho Lee has violated the trust of his friends, colleagues, and in his case, the country that provided him with opportunities to succeed.

It's high time for Wen Ho Lee to come clean. I want to know where the "missing tapes" are. I want an apology from Wen Ho Lee for the trouble he has imposed on his former friends and colleagues at Los Alamos National Laboratory.

Karen Pao
Los Alamos, New Mexico

Climate Change Needs Stronger Effort

I'd like to respond to J.C. Watts' comments in the "Viewpoints" column of May 2002 *APS News*. The damage-mitigation policy he advocates for dealing with climate change is certainly necessary, but without an accompanying stronger effort to reduce greenhouse gases (especially CO_2), it is like sending in a bucket brigade to bail out a rapidly submerging Holland, without sending in a task force to identify and plug leaks in the dike.

The Bush administration has NOT announced a policy of carbon reduction—on the contrary, under their plan for what they call greenhouse gas "intensity" reduction, the actual carbon emissions would rise!

They have refused to sign on to the Kyoto accords, a small step, but at least one in the right direction. Watts' "climate change policy for America" ignores the root causes of all the extreme weather phenomena it is trying to deal with.

Eric Nelson-Melby
Lausanne, Switzerland

Land mines & US Policy

Having been a teacher and research physicist for more than forty years, I was conditioned to not being surprised at the way the great majority of physicists feel about ethical issues, *i.e.* that such soft talk is irrelevant to physics and should also be to physicists. But even then I was not prepared for the article by Richard Craig on land mines in the August 2002 issue of *APS News*. A few remarks will make clear why:

- 133 countries have signed the treaty known colloquially as APM or the Ottawa Convention concerning "the use, stockpiling, production, and transfer of Anti-Personnel mines, and on their destruction".
- The U.S., however, has not signed, together with Iran, Iraq, North Korea, Libya, Syria, China and Russia. Does this list of seven countries ring a bell somewhere in the memory of the reader?
- The U.S. has refused to give agencies trying to clear mine fields technical information on mines that would make mine clearing easier and safer.

Does anyone really doubt that the original refusal of Clinton to sign the treaty had a lot more to do with protecting the profits of companies making mines than with protecting American military personnel? American companies continue to design, produce, and sell to anyone the land mines that Richard Craig wants physicists to help clear. Isn't that like mopping the floor with the faucet open? Why doesn't Craig ask physicists to help in a more effective way against the scourge of land mines by asking the elected representatives from their districts and states to put pressure on the government to sign the treaty, *now*? More than 120 congressmen have already done this. [See http://www.fcnl.org/issues/arm/sup/lan_chron.htm]

I know, of course, what the answer will be: physicists shouldn't engage in politics. In answer I would close with a thought that may wake up some dormant moral qualms: Not engaging in politics is a political act — you can't get off the hook by doing as Pontius Pilate.

Philip Smith
Groningen, The Netherlands

Richard Craig's Reply

As noted on the Back Page I am not an expert in land mines. I am even less an expert in the politics of land mines.

However, within my very limited knowledge, Smith's assertions cannot be supported; the US government is in the process of fabricating land mines that are very unlikely to injure noncombatants and that will be destroyed, made inert, or retrieved instead of being abandoned in-place.

Furthermore, it is my understanding that, despite the failure of some nations to sign the Ottawa treaty, there is a moratorium on the manufacture and sale of antipersonnel land mines.

Finally, I cannot imagine technical information about U. S. or other nations' land mines that cannot be obtained simply by testing one of the many contaminating the landscapes of Cambodia, Angola, Bosnia, etc.

Richard A. Craig
West Richland, WA

Alpher and Herman's Work Often Forgotten

The Physics History story, "June 1963: Discovery of the Cosmic Microwave Background" in your July, 2002 *APS News* issue fails to give a proper historical background for the prediction of the CMB.

Ralph Alpher and Robert Herman, in 1948, predicted a present temperature for it of about 5 Kelvin (*Nature*, vol.162. pg.774 (1948)).

Robert Dicke, credited in your story, was unaware of Alpher and Herman's prediction when, 17 years later, he predicted a CMB of about 3 Kelvin (R.H. Dicke, P.J.E.Peebles, P.G.Roll, I.D. Wilkinson, *Astrophys. J.* vol.142, pg. 414 (1965)).

Alpher and Herman have published informative histories of the Big Bang in "Reflections on Early Work on 'Big Bang' Cosmology" (*Physics Today*, vol.41, pg.24 (August, 1988)) and "Genesis of the Big Bang", *Oxford University Press, 2001*.

A quote from the *Physics Today* article, "But we have derived enormous pleasure from the creative process, considerable pain from lack of appreciation of our work, and some measure of satisfaction and pleasure from realizing that at long last some scientific colleagues view our contributions as meritorious," gives some indication of their feelings about their early work being so often ignored or misrepresented.

Ralph de Blois
Schenectady, New York

***

I liked your feature "This Month in Physics History" [*APS NEWS*, July 2002] on the discovery of the cosmic background radiation. It's a wonderful story, but there's more to it than you told. The missing bit is that a cosmic thermal background at about 5 K was predicted by Alpher and Herman in 1948. That prediction was then forgotten or ignored. Even now the origin of the idea is commonly overshadowed, as in your story, by its rediscovery 15 years later by Dicke. He was instrumental in communicating the significance of Penzias and Wilson's work, but priority ought to be priority. The question of why experts were unaware of significant existing work is one that is probably still relevant.

Charles Kaufman
Kingston, Rhode Island

Signatures Sought for Quantum Physics Topical Group

We are trying to start a topical group of the APS on quantum physics. Those of us who work on quantum information, including cryptography, and classifying entangled states in varying ways, and quantum computation, and all sorts of fundamental problems in quantum theory-measurement theory, superposition, Bell Theorems, etc., have no natural home in the APS. Many of the current APS units are relevant for some of our interests, but none are devoted specifically to our primary interests.

This move is at least 20 years overdue. Therefore we are petitioning the APS to start such a group. We would appreciate the signatures of everyone who works in these areas, and hope that everyone will publicize this to their friends in the field. The whole petition, which spells out the complete rationale, can be read and signed at the website: http://www.sci.ccny.cuny.edu/~greenbgr/

Daniel Greenberger,
New York, NY
Anton Zeilinger,
Vienna, Austria

Typo Understates Age of Universe

There was an obvious typo in the July 2002 (Vol. 11, No. 7) *APS News* in "This Month in Physics History." The first paragraph mentioned the CMB originating from 16-million years ago. I believe 16-billion years was the intended figure.

Daniel Fromowitz,
Niskayuna, NY

Motivation of Penzias and Wilson Clarified

It is my understanding that Penzias and Wilson were decidedly NOT trying to "measure radio signals from the spaces between galaxies" [This Month in Physics History, *APS News*, July 2002].

Rather, they were assuming there would be no signal in that region and were seeking to use that "fact" to enable measurement of the intrinsic noise in their amplifiers.

Terry Goldman
Los Alamos, New Mexico

Can't Have it Both Ways

In the July 2002 *APS News*, in an article entitled 'Panel Probes Possibilities in Particle Physics', Raymond L. Orbach is said to have "stressed that the next big accelerator must be an international effort from the start, regardless of where the machine is built", an opinion with which I agree.

Two paragraphs further on, in referring to the Japanese computer 'Earth Simulator', which is 50 times faster than any US machine, he is quoted as saying, "To find ourselves second on an international scale is a national disaster".

It is precisely this attitude that contributed to the failure of the SSC, and will need to be overcome if his first expressed wish regarding the NLC is to be met.

Len Bugel
Fermilab

Viewpoint...

LAPTAG—A Physics Outreach Program at UCLA

By Walter Gekelman

I have taught undergraduate physics courses at UCLA since the late 1970's. As the years rolled by it seemed, to me, that the incoming students' mathematical background and general science preparation eroded little by little. The natural thing to do was to blame the high schools that sent them to us on a wave of grade inflation.

In 1993, at the urging of one of my colleagues, I attended a meeting sponsored by the AAPT on encouraging the formation of alliances between universities and high schools. I went to the meeting under the assumption that it would lead nowhere and give me a perpetual right to gripe. There were several presentations about alliances (mostly involving several high schools and not universities), but what struck me was the great number of high school teachers present who were very interested in their craft: teaching. It was obvious that those present were dedicated and loved their work. In the afternoon we broke into groups based on physical proximity of schools and the group I was in decided to form an alliance which exists to this day. We called it LAPTAG (Los Angeles Physics Teachers Alliance Group).

At the outset most of our activities consisted of going on tours of many fascinating laboratories at UCLA and then expanding this with tours at USC, JPL, General Atomics fusion laboratory, and the Mount Wilson observatory. We also met on Saturdays and discussed education reform and classroom demonstrations. About ten other alliances formed the day of the meeting and we are the only one that survived. I believe the reason for this is the introduction of projects to our venue. We used one of the computers in my plasma physics laboratory as a web server and hosted a website for every school. In those days this meant teaching the high school teachers and their students how to write HTML and download pictures. Now most of the schools have servers of their own and some have sophisticated websites. We still host websites for about a dozen schools as well as the LAPTAG home page (http://coke.physics.ucla.edu/laptag).

The first substantial project was funded by the University of California Office of the President. It involved earthquake study (we have small temblors in Southern California nearly every day). We secured funding to buy 10 seismometers that interfaced with PC's and gave them to schools that were interested. Two of the LAPTAGer's were geologists and gave us lectures on what earthquakes were and how to bury the seismometers. We also had a series of lectures on ways to complement what they were learning in school. At this time we wrote a proposal to the NSF education division to substantially expand the project (we also had several hundred thousand dollars in matching equipment and software) but met with a great deal of frustration. We did not neatly fit into any of their programs and gave up after trying twice. Although several schools are still using the seismometers, a high point of that project was a presentation of six posters at the 1998 APS March meeting in Los Angeles. We brought a schoolbus full of high school students to the meeting and they had a wonderful and exciting time presenting the results.

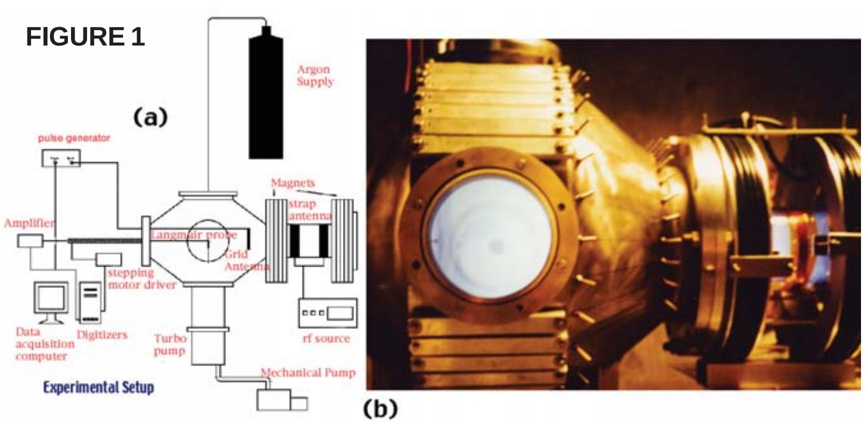


FIGURE 1

Our next project was the construction of a plasma physics laboratory, which would be for the exclusive use of LAPTAG. I am a plasma physicist by trade and the Department of Energy (DOE) has now supplemented one of my grants three times in the past three years to help with the project. We used a surplus vacuum chamber and bought some refurbished pumps, gauges and so on. This was supplemented with "spare" equipment from my lab. The machine features a helicon source, which is safe and very easily run. The high school teachers and their students designed the antenna, solenoidal magnets, as well as the vacuum flanges with some help from one of my colleagues, Pat Pribyl, and myself. Ten additional LAPTAG students and teachers built the machine over the course of a summer. It has now been running for about three years. **Figure 1** shows the experiment and plasma.

In the past three years we have, with financial support from the DOE, added a computerized stepping motor control system (built and programmed by the students), 4 channels of 100 MHz digitizers, and soon an optical fiber based spectrum analyzer. Data is acquired using Labview software, and Visual Numerics has donated a copy of PVwave for data analysis. The high school students and their teachers use equipment and software similar to what we use in our research laboratory.

One of the experiments is on ion acoustic waves. The waves are launched by a grid antenna and detected by a Langmuir probe, which is moved with respect to the grid.

The propagation velocity of a tone-burst is used to determine the plasma electron temperature (**Figure 2**). In a parallel experiment on sound waves in air the students measure the sound speed and air temperature. The speed of the two waves is compared. This is complemented by lectures and a lab manual (both on the website).

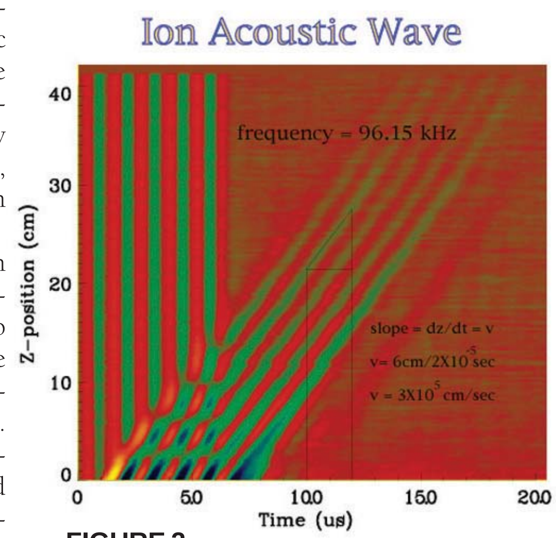


FIGURE 2

In some sense the tide of science education has turned towards large programs, sometimes involving many universities and still more high schools. It is a way to try and solve the problems that seem to plague our secondary school system, in one fell swoop. It is also heartening to see that other scientists working with middle and high schools. Perhaps one of these programs will work; time will tell. LAPTAG has not set out with any such ambition. It is a purely local attempt to have high schools benefit from the resources of a nearby University. Although the LAPTAG teachers have had many discussions about what a high school syllabus should be, and have followed and debated the content of the California and national standards with interest, we are savvy enough to know we can't change any of this. These are political decisions. From our experience with the NSF Division of Education we also realized that programs such as ours are not fundable from their point of view. We have no close connection to graduate schools of education and the vocabulary necessary to write a successful grant proposal, and from what we know now, no desire to administer

See VIEWPOINT *on page 7*

We can summarize what we learned so far with the following points.

- Universities have a great deal to offer high schools.
- For an alliance to be successful it must have projects.
- The involved faculty in both high schools and universities must be committed.
- Expect no monetary resources — you must get them yourself.
- National aspiration will get in the way — it's all local.
- Don't expect quantitative outcomes.

LETTERS, *from page 4*

We Don't Mess Around in Texas

Last November *Physics Today* published a book review written by Hans Bethe — "*Edward Teller: A Long Look Back*," about the Teller "*Memoirs: A 20th Century Journey in Science and Politics*."

This review is just about what one would expect to see in *Physics Today*. It opens with the phrase "In his fascinating Memoirs..." and ends with "I strongly recommend the book."

A somewhat different review of "*Memoirs*" appears in a recent issue of *The Texas Observer* (7/5/02), by Anna Mayo. Its title is "And the Shark Has Pretty Teeth, Dear."

Since most APS members 1) have probably read Bethe's *Physics Today* review and 2) probably don't subscribe to *The Texas Observer*, I'll quote a bit more from the latter review. She begins as follows: "When the review copy arrived, I couldn't bring myself to touch it; a horrid thing, it gave off poisonous vapors — like an alchemist's toad. Finally, using tongs, I managed to get it up on the shelf alongside the autobiographies of Judas Iscariot, Dr. Strangelove, and Faust."

It goes on: "The toad-like book is the memoirs of Bohr's sometime pupil, the Hungarian-born physicist Edward Teller, who achieved worldwide fame as 1) Betrayer of J. Robert Oppenheimer, and 2) Father of the Hydrogen Bomb.

"Since our Dr. Faustus is ninety-something and in failing health, his book may be seen as a last effort to prove that he's not a heel."

Near the end: "But he is to be condemned not only for having played Judas to Oppenheimer, but for adhering to the belief, in the face of unchallengeable evidence to the contrary, that low-level radiation is a beneficial agent of evolution, that it weeds out the weak to produce a super race.

"Together with his sponsors in the military and industry, he is to be condemned for the deaths of uranium miners, of victims of the atomic tests in the Marshall Islands and Nevada and of persons living in the vicinity of nuclear power reactors; for promoting the Star Wars anti-missile system so favored by the present administration; for promulgating false studies to cover up these deeds against humanity; for having sanctioned the persecution of scientists such as Linus Pauling, Ernest Sternglass, and Teller's ultimate nemesis, John Gofman."

Obviously there are differences of opinion regarding Teller, his "*Memoirs*", and his work. As I said at the beginning, we don't mess around in Texas.

Robert A. Levy
Austin, Texas

Machines Can't Defy Entropy Either

In the August/September 2002 *APS News* I read that the APS Executive Board approved a resolution that calls claims of perpetual motion machines fraudulent. While I applaud the resolution, I believe that there is a more important need to also include "entropy-defying machines" into the ranks of fraudulent claims. Many proposers of such devices do not deny the existence of the second law of thermodynamics. They argue that entropy-decreasing systems are energetically possible, just unlikely. Then they argue that a clever scheme (machine) could be fabricated that would make it possible to overcome the thermodynamic ( ) T/T) efficiency limit.

In my area of expertise, solar cells, the unfortunate situation has developed that solar cell device schemes have been proposed that promise unbelievably high conversion efficiencies (>70%) for two-terminal solar cell device structures converting the solar radiation spectrum into electricity. The high conversion efficiencies arise from concepts where it is suggested that the energy in excess of that required to excite an electron-hole pair to the "collection energy level" (*i.e.*, the semi- conductor band edges in a conventional semiconductor solar cell) would not be necessarily lost to thermalization. Such arguments, I believe, artificially separate the generation of carriers (electron-hole pairs) and the collection of such at the terminals of the device, thereby leading to the illusion that the thermodynamic limit could be overcome. Such schemes come from authors that are well respected in the field, and papers proposing such solar cell schemes have passed the muster of the review process in AIP journals.

Bolko Von Roedern
Golden, Colorado

Focus on Committees

Careers Committee Provides Crucial Services

Physics isn't just a way of life – it's also a career. And just like other careers, it's a lot easier to find the right path or switch between fields with some guidance. Until recently, however, the APS didn't have an organized way to pass job advice between members and on to physics students.

Then came the Committee on Careers and Professional Development (CCPD), established in 1998. Committee chair Heather Galloway says that providing career services is crucial for the APS.

"The future of physics depends on it," says Galloway, who is also an associate physics professor at Southwest Texas State University. "If students don't believe that they can have careers with degrees in physics, then I believe physics will cease to exist as a discipline. This may sound extreme, but successful departments generally have worked to inform their students and expand those students' options with respect to careers."

CCPD's first initiative was to form the Careers and Professional Development Liaison Program. More than 200 colleges, universities and government labs are members of this program, which provides tools for physics departments to develop their own in-house career programs for students and faculty.

The liaison program works simply. Each participating lab or university joins by filling out a form on the APS website. The institution names its liaison — a member of the faculty who has volunteered to act as a key link between the APS and the participating lab or university. The liaison gets periodic mailings with activity updates, is invited to nationwide workshops where he or she can network, discuss employment trends with other liaisons and learn about other programs, and can download a presentation package to help communicate all of this information to the students.

Heather Galloway

Galloway thinks the program has had some success. Still, she says, with approximately 600 universities not involved in it, the committee still has a long way to go.

"We, as physicists, should put a higher priority on providing career information," she says. "And we on the CCPD need to publicize more what the liaisons are doing. I would definitely still like to see the number of liaisons grow."

To reach more physicists, the committee is working on several changes. They're planning to open up the passworded portions of their website so that anyone can access career information at any time. They're planning career sessions for the March or April meetings. And they're getting ready to better extend their services to established physicists who are considering career changes.

"There's very little information out there right now for physicists who want help or advice in making career transitions," says Arlene Modeste Knowles, the APS staff liaison for CCPD. "We don't even have anything out there yet. We've got a lot of work to do."

But both Galloway and Knowles agree that of all the challenges facing the CCPD, the biggest is keeping their information up-to-date in a job market and economy that is continually changing.

"We haven't figured out the best way of keeping our career advice current yet," says Knowles. "Right now, we get quite a lot of our statistics from the AIP, but statistics can take a long time to gather and analyze. By the time we see them and pass them along, the trends may already be shifting, especially in years like the past two."

Pat Mulvey concurs. He collects statistics for the AIP, and says that while the physics job market is affected by the economy like any other field, it is difficult to gather current information.

"It's hard to read the economy today," Mulvey says. "Economists don't even know what it's doing until six months after it's done it."

Some factors that influence the job market, Mulvey says, are the amount of available funding, how fast positions at universities open, how receptive employers in research and development are to hiring physicists, and the number of foreign physicists applying for jobs in the U.S. The market is also different for physicists looking for initial employment than it is for those who have been working and are changing jobs.

"There's just a whole lot going on, and it's such a small group of people," Mulvey says.

Because of the complexity of understanding the physics job market from statistics alone, CCPD hopes to begin asking the liaisons to report back their real-world observations of the job market.

"We would like to get information from them on what's happening where they work, what kinds of trends they're seeing, and pass that along to other departments," says Knowles.

In such a complex area, finding an effective balance will doubtless remain a challenge for the committee.

"We haven't figured out yet how to best stay on top of everything," says Knowles. "It has taken a little while for this committee to really get going."

—Desirée Scorcia

Hearing Details Concerns Over Future of NASA's S&T Workforce

As the August congressional recess approached, subcommittees of the House Science Committee were active, holding oversight hearings on a number of programs and agencies under their jurisdiction. On July 18, the Space and Aeronautics Subcommittee investigated concerns that, in the future, NASA will not have the S&T workforce it needs to fulfill its mission.

U.S. Comptroller General David Walker testified that NASA "is finding it particularly difficult to hire people with engineering, science, and information technology skills." Within five years, he stated, about a quarter of NASA's scientists and engineers will be eligible for retirement, while "the pipeline of people with science and engineering skills is shrinking."

NASA Administrator Sean O'Keefe reported on "an alarming attrition pattern" among recent employees. "Even utilizing all the tools at hand," his testimony stated, "we are at a disadvantage when competing with the private sector."

"NASA is not alone in its search for enthusiastic and qualified employees," O'Keefe's testimony continued. "Throughout the Federal government, as well as the private sector, the challenge faced by a lack of scientists and engineers is real and is growing by the day."

He cited NSF statistics showing that graduate enrollment in engineering, physical and earth sciences, and math showed declines between 1993 and 2000, and from the mid-1990s to 2000, engineering and physics doctorates declined by 15% and 22%, respectively.

O'Keefe presented to the subcommittee a proposal to give NASA enhanced flexibility in hiring, retaining and rewarding highly skilled employees. The provisions include scholarships to help U.S. students pursue careers in engineering and physical, biological or life sciences (with a year-for-year service requirement); expansion of federal employee personnel exchanges; establishment of similar personnel exchanges with industry; authority to provide higher pay and larger bonuses; and streamlined hiring processes.

Mark Roth, General Counsel of the American Federation of Government Employees, took issue with provisions to expand personnel exchanges and to hire "without regard to existing competitive procedures." His testimony concludes, "No federal agency, including NASA, should have a human resources plan that explicitly encourages constant turnover and puts no value on continuity, dedication, or career development for the incumbent workforce."

"One thing I want to see this committee do this year is to move forward with some proposals that would ensure that NASA has the people it needs," said Committee on Science Chairman Sherwood Boehlert (R-NY). However, the hearing charter notes that several other pieces of legislation to reform federal hiring practices and increase flexibility have been the subject of Senate hearings this spring, but are unlikely to go any further this year.

Detailed data on physics and astronomy degree production is available in the latest "Enrollments and Degrees Report" put out by AIP's Statistical Research Center in July.

The number of physics doctorates granted in 2000 dropped four percent from the previous year, continuing a steep decline since the early 1990s that is expected to continue for several more years.

First-year physics graduate student enrollments have shown a slight increase in the last few years, mostly due to an increase in foreign students, who make up 51% of the total students currently enrolled in graduate physics programs.

— Audrey T. Leath

Editor's Note: *The most recent workforce and degree information for the physics community can be found at http://www.aip.org/statistics.*

Student Interns Summarize Their Summers

By Desirée Scorcia

Last summer, the Society of Physics Students (SPS) began a summer internship program with just one student. This summer, the organization, which is run by the American Institute of Physics and describes itself as "the professional society for physics students and their mentors", expanded its efforts and placed five undergraduates in eight-week internships at the National Institute of Standards and Technology (NIST), NASA's Goddard Space Flight Center, and in the SPS office at the American Center for Physics (ACP) in College Park, MD. The ACP is also the headquarters of the APS.

On August 13, the SPS held a closing ceremony for their interns at the ACP. There, the students gave 20-minute presentations on their summer's work to their family members, coworkers, and fellow physicists. Though the students all had very different jobs, they agreed that the internships were a worthwhile educational experience.

Brent Janus interned at the Goddard Space Flight Center's laboratory for extraterrestrial physics. There, under Dr. Larry Evans, he analyzed gamma ray spectrometer readings from the Near Earth Rendezvous mission.

"One thing I really appreciated about the internship," Janus said, "was the opportunity to work with an actual space mission — something that prior to June, I had only learned about by watching 30 second clips on CNN. Then I found myself the first week in July accessing the data from the mission. I went from being a college student to a NASA employee."

Janus is a double major in physics and political science at Fort Lewis College in Colorado. He will graduate in 2003.

Katie Peek graduated from Mount Holyoke College in Massachusetts this spring, with a double major in physics and astronomy. Katie also interned with NASA at the Space Flight Center.

"I spent the summer looking at dust in the solar corona," Peek said. "My goal was to look at populations of dust near the sun, and to explore possible problems with sending a probe there."

Eva Wilcox graduated this spring from Brigham Young University in Utah with a major in physics teaching. She interned for the summer at NIST, where she studied spectroscopic ellipso-metry repeatability and the Hafnium Dielectric.

"I interned with NIST for three years through the SURF [Summer Undergraduate Research Fellowship] program," Wilcox said, "and their internships are at NIST. Going through the SPS, I got to be in the central location for physics. It was so interesting to meet all of these people and see who's behind the scenes."

See INTERNS *on page 7*

The 2002 SPS summer interns

Photo by: Desirée Scorcia

The 2002 SPS summer interns at their closing session on August 13. The group is modeling the light diffracting glasses and holding equipment that is part of the educational SPS Outreach Catalyst Kit (SOCK) Tabeling and Glas put together. From left to right: Jason Tabeling, Lauren Glas, Eva Wilcox, Katie Peek, and Brent Janus.

BACHELORS *from page 1*

ity and magnetism, thermodynamics, and the other basics of physics to his students. He uses the equations of motion, light, and sound to design problems, experiments and demonstrations for his classes.

In one lab that White teaches, students watch a videotape of a NASCAR race. They use the speed of the car, given in the "in-car telemetry" on the tape, and the time it takes to reach the finish line to graph the motion of the car. White then has the students calculate the average acceleration from their graph, and determine the length of the straightway.

White has also developed a digital library of short physics video clips for his students. They include shots of skateboard crashes, skiing accidents, car wrecks, and bungee jumps, that he uses to spark class discussions on physics in real life.

"Students love them," says White. "Most of them are either amazing or funny, but they all demonstrate some concept in physics. This summer I carried a video camera around with me pretty much everywhere, and captured everything from rainbows to the inside of my lawnmower engine when I was working on it. It's a great way to get students interested in learning physics."

Wilkins uses the same equations of physics as an animator. It can be a lot more realistic to simulate the way dust swirls, a bridge sways, or clothing moves, using a computer than drawing it by hand, he says. The same equations of motion that govern how a ball falls and bounces in reality are used to create the effect on screen. The real challenge, according to Wilkins, is simplifying the equations without compromising the appearance of reality.

"The question is, how can we take a complex simulation that would take forever and pull out the time-consuming pieces that don't add to visual impression of accuracy? Sometimes, that can involve pushing things too far in that direction and then fixing them."

Wilkins says that the first few weeks of a shot are spent experimentally figuring out what parts of the simulation must stay, and what can go. "We constantly get funny results," he says, "like things interpenetrating each other. In *Shrek*, there were a lot of instances where the characters would walk away and leave clothing behind for an instant, before it caught up with them."

Both men agree that while some of the skills they use in their jobs, such as teaching techniques and computer programming, were gleaned outside of their physics education, studying physics gave them both a serious advantage.

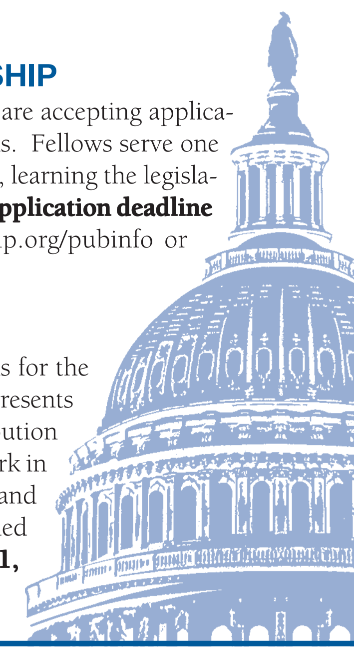
"Majoring in physics has absolutely given me advantages far beyond just learning the equations," says Wilkins. "It taught me analytical problem-solving skills – how to see each piece of the problem, and then rule out the part that troubles me to get to the solution."

White says for him, one of the best things about studying physics as an undergraduate was that it taught him how to be a student.

"I think that to teach effectively, I have to put myself in my students' shoes," says White, "and anticipate prior misconceptions about the subject. My physics major laid the foundation for me to be able to learn physics to a point beyond merely passing the exams and other requirements as an undergraduate; it gave me the ability to learn on my own to the point that I can always strive to be a more effective teacher by learning more about my subject."

ANNOUNCEMENTS

FELLOWSHIP PROGRAMS



APS/AIP CONGRESSIONAL SCIENCE FELLOWSHIP

The American Physical Society and the American Institute of Physics are accepting applications for their 2003-2004 Congressional Science Fellowship programs. Fellows serve one year on the staff of a Member of Congress or congressional committee, learning the legislative process while lending scientific expertise to public policy issues. **Application deadline is January 15, 2003.** For more information, visit: http://www.aip.org/pubinfo or http://www.aps.org/public_affairs/fellow/index.shtml

AIP STATE DEPARTMENT SCIENCE FELLOWSHIP

The American Institute of Physics (AIP) is now accepting applications for the AIP State Department Science Fellowship. This fellowship program represents an opportunity for scientists to make a unique and substantial contribution to the nation's foreign policy. Each year, AIP sponsors one fellow to work in a bureau or office of the US State Department, becoming actively and directly involved in the foreign policy process by providing much-needed scientific and technical expertise. **Application deadline is November 1, 2002.** For more information, visit: http://www.aip.org/mgr/sdf.html

INTERNS *from page 6*

Wilcox is teaching English this semester in Hefei, China. She will start studying for her master's degree in physics at Brigham Young University when she returns.

Lauren Glas worked for the SPS national office at the American Center for Physics.

"I didn't have a typical science internship," Glas said, "but I had one that really fit my education. Coming here and getting a chance to go to the hill was amazing. I thought that there weren't a lot of people interested in changing science policy before I got here, but I realized that it's not that policy doesn't change and people don't care, but that the system is huge, and it takes a long time to change."

Glas worked on a project called the SPS Outreach Catalyst Kit (SOCK). The SOCK looks like a denim Christmas stocking and is filled with materials that can be used for SPS physics outreach programs. The SOCK Glas designed is called "Dimensions in Physics," and contains foam shapes that can be used for scaling exercises and rainbow glasses that demonstrate how light bends. They will be used by students of all ages.

The fifth intern, Jason Tabeling, also interned at the SPS national office. There, he created a website to help publicize the William F. and Edith R. Meggers Project Award, which has gotten few applicants over the past few years. He also helped Glas prepare the SOCK kit.

"I got pretty good at using a turkey carver to cut mattress foam for the shapes," he joked.

"There are a lot of people who think physics is hard to understand," Tabeling said. "The public perception isn't always positive. One question I tried to answer was, 'educating people about physics is difficult, so how can we make it easier?' "

Tabeling graduates this year with a double major in physics and math, and minors in astronomy and Spanish from Virginia Tech.

The interns' advisors were very excited about what the students accomplished over the summer.

"Katie's report will be required reading for engineers that are going back into solar mission research," said Fred Herrero, her advisor at NASA. "I'm very enthusiastic about the work that she has done."

The internship program began last summer with Mark Lentz, a physics major from the Northwestern State University SPS chapter. The internship, which pays a $2,500 stipend in addition to living and travel expenses, is accepting applications for next summer.

SPS members interested in applying should visit the SPS website at http://www.spsnational.org/programs/interns.htm to download the application form, or contact Liz Dart Caron at (301) 209-3034 for more information.

VIEWPOINT *from page 5*

and assess it, although we fully understand why program assessment is important to the NSF. Our tactic has been to utilize resources available at UCLA, spare equipment and small grants, to do what we can. Since UCLA is a large university and the **La**rge **P**lasma **D**evice (affectionately called the LAPD) Plasma Lab has resources as well, building the high school plasma lab was possible. One can't be as ambitious at a smaller college, but something always can be done. It all depends on a resource more precious, the dedication of a group of people[1].

Is LAPTAG a success? The participating teachers have certainly benefited and had a good time. They are involved in designing and teaching laboratory experiments using sophisticated equipment not available in their schools. In addition they and their students can relate measurements in the LAPTAG plasma lab to the physics and math they are teaching. I have had a good time working with the teachers and students and am happy to donate the necessary hours. As for the high school students it's hard to say. There was a tremendous variation in the students that have come through the plasma lab. Some were, in my opinion, good enough to skip whatever they had left in high school and directly come to UCLA or any other university. Others were there for the ride, sometimes accompanying friends. None of them seemed bored, some were downright enthusiastic. At the very least they completed the lab with a feeling about how science is done. Who knows, one or two one day may be first-class scientists. So is LAPTAG a success? Maybe.

Walter Gekelman is Professor of Physics at the University of California, Los Angeles. This article is based on his presentation at the Physics Department Chairs Conference at APS headquarters in June 2002.

1. When asked what the most valuable thing in the world was, a Chinese philosopher answered "The head of a dead cat, because no one can name the price." Perhaps our group is of equal value.

NSF BUDGET *from page 1*

major research equipment and facilities construction. How prospective projects under this account are evaluated and prioritized for funding has been the subject of congressional concern and several hearings.

In general, the National Science Board approves a list of projects for inclusion in future NSF budget requests, but those projects are not ranked in any priority order. However, both reauthorization bills would require the NSF Director to develop, for the Board's approval, "a list indicating by number the relative priority for funding under the Major Research Equipment and Facilities Construction account that the Director assigns to each project the Board has approved for inclusion in a future budget request."

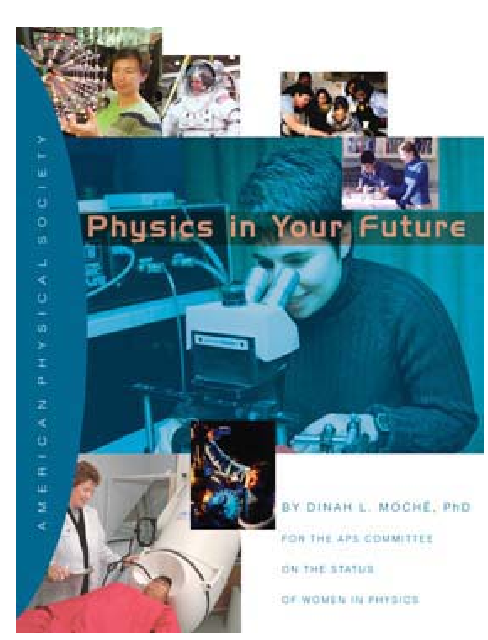
The Director would be required to report annually to Congress on the latest Board-approved priority list, the criteria used to develop the list, and "a description of the major factors" that determined each project's ranking on the list.

Among other provisions, the Senate bill would require the Board to "explicitly approve any project to be funded out of the major research equipment and facilities construction account before any funds may be obligated from such account for such project." It also calls for the Director to conduct an assessment of the needs for major research instrumentation by field of science and engineering and by type of institution.

The full text of both bills (S. 2817 and H.R. 4664) can be found on the Library of Congress web site at http://thomas.loc.gov.

—*Audrey T. Leath*

Physics In Your Future



At right is the redesigned cover of the booklet *Physics in Your Future*, which profiles seven young, female physicists, who have careers in industry, government labs, and academia. It was written by Dinah L. Moché, author of "Astronomy Today," and "Amazing Rockets," and produced with support from the APS, Bell Labs-Lucent Technologies, IBM, the Xerox Foundation, NEC, and GM.

The booklet is an updated version of one with the same title published in 1983. It is designed to show middle and high school girls the kinds of careers open to them if they study math and science before college.

The booklet is free to students, educators, guidance counselors and groups who work with young women. To order copies, please visit http://www.aps.org/educ/cswp/index.html.

THE BACK PAGE

Exploring the Role of Science in Foreign Policy

By Colin L. Powell

The strong partnership between American science and American statecraft is more critical than ever in meeting the challenges of the 21st century, and that our decision-makers and diplomats should work closely with our finest scientists is not a novel idea; it goes back to the earliest days of our republic.

Indeed, the concept was personified by our first Secretary of State, Thomas Jefferson, and our first Minister to France, Benjamin Franklin. Both made vital contributions, as you all know, to scientific study in America and to our young nation's success in the world.

To my knowledge, after Thomas Jefferson, the first Secretary of State, there has been only one other Secretary of State with a background in science— moi.

I happen to hold a Bachelor of Science Degree in Geology from The City College of New York, and my great contribution to the field of science is that I never entered it. But you don't have to have a geology degree or to be Secretary of State to survey the 21st-century terrain and see that science and technology must inform and support our foreign policymaking in this challenging world that we live in.

Whether the mission is supporting the President's campaign against terrorism, implementing arms agreements, creating conditions for sustainable development, or stemming the global HIV/AIDS pandemic, the formulation of our foreign policy must proceed from a solid scientific foundation.

Since September 11th, all of us have been acutely aware of the dangers from terrorist threats and anthrax scares, cyber-threats and weapons of mass destruction. But we must not let the perils of our age blind us to the great promise that exists in this 21st century. Despite worrying about the Middle East, despite all of our concerns in places like Kosovo and Bosnia, we can step back and see that there are opportunities to be seized.

There is no major war taking place today between the great powers. Communism is dead, fascism is dead, the Cold War is over. Yes, there are tensions in the world, but the reality is that the major powers are now cooperating in ways that were unimaginable just a few years ago.

A lot of my time is spent on the Middle East, of course, but a lot of time is also spent working with Russia, a new partner that has made a strategic choice to move forward with us in the campaign against terrorism, and beyond that, to cement a strategic relationship with the U.S. that will lower the number of nuclear weapons that both sides will hold.

We are also working with China, still a Communist nation of 1.3 billion people, but its leaders nevertheless understand that wealth and success doesn't come out of the barrel of a gun. It comes out of trade, it comes out of liberalization, it comes out of opening up your society to the wonderful forces related to democratization, liberalization, and market economics.

Forty percent of Chinese products come to the U.S. We press the Chinese on human rights, proliferation activities, and other issues of concern to us, but at the same time, we cooperate with them.

With these two great powers, Russia and China, we are creating a new stable relationship, not moving away from any of the values that we hold dearly, but at the same time recognizing that these former adversaries can be partners and friends as we move forward.

We are doing the same thing with other great nations such as India and Pakistan, creating a new relationship with these two countries so that we can move forward together and defuse tensions in that very tense part of the world and move forward and benefit both nations and both peoples in those nations.

We have seen great progress as a result of our engagement, and in all of these areas, science and technology has played an important role.

Since September 11th, we have cooperated with Russia on the technical aspects of counter-terrorism. We continue our programs that encourage Russian researchers to channel their know-how in a positive direction and keep that know-how out of dangerous hands. And we are reinvigorating our civil science and technology cooperation with Russia in the areas of basic research, health, environmental protection, and resource conservation.

> *"These opportunities have been created by globalization, a process that is largely propelled by science and technology."*

President Bush's meeting with Indian Prime Minister Vajpayee last November launched a new era in our bilateral relationship, and a new pillar of that partnership is a global issues forum, of which science and technology cooperation will be a major component. Nothing is of greater interest to Delhi than expanding science and technology cooperation.

No discussion of our science and technology cooperation around the world would be complete without mention of our extensive and intensive collaboration with Europe and Japan. Our staunchest allies are also our closest partners in a vast range of science and technology efforts from biotechnology to fusion energy.

I see great potential for enduring peace and stability in this unprecedented level of international cooperation. On economic and political fronts we see a growing number of market economies and democracies around the world. Country after country has embraced private enterprise, and country after country has embraced democracy because they understand that political and economic freedoms are the foundation for lasting prosperity.

To support the efforts of developing countries committed to the domestic reforms that are necessary for sustained growth, President Bush has announced an increase in the U.S. economic development assistance over the next three years that will rise to $5 billion a year every year, on top of all other foreign aid that we have been providing, beginning in Fiscal Year 2006.

In our assistance activities, we will continue to bring computer instruction to young professionals in developing nations; we will continue to provide textbooks and training to students in Islamic and African countries, to apply the power of science and technology to increase harvests where hunger is greatest. And we plan to expand our fight against HIV/AIDS and other infectious diseases.

You also saw our new approach to development at the World Summit on Sustainable Development in Johannesburg, South Africa this past summer. We stressed that good governance, including solid science and technology policies, is fundamental to sustainable development. We also emphasized that as important as government-to-government cooperation is to development, governments alone cannot do the job. Public-private partnerships will be crucial to find the money needed to help nations address the daunting problems that they face in developing.

One of the public-private initiatives we showcased is the Geographic Information for Sustainable Development Project, which makes satellite imagery available to people around the world via laptops, to policy-makers, to users, to scientists so that they can get instant access to satellite photography.

These pictures will help them map watersheds, plan agricultural crop strategies, and trace urbanization trends. Linking that to GPS technology gives us new avenues to increase productivity and to bring the power of technology to the most distant corner of the world. Poor regions in Africa are the project's initial areas of study for this satellite imagery availability.

The U.S. and the world community have before us unprecedented opportunities we must seize, opportunities to help millions of people on every continent escape misery and build a better future for themselves and for their children. These opportunities have been created by globalization, a process that is largely propelled by science and technology. It is fashionable to talk about the dark side of globalization, just as people have always seen a dark side even to science.

Like scientific knowledge, globalization in and of itself isn't a force for darkness or a force for light; the issue is how we respond to this powerful force, how we use it to create hope for ordinary men, women and children around the world.

We are convinced that with good governance, solid economic policies, and with the responsible application of science and technical knowledge, globalization will be a positive force for the overwhelming majority of people on this planet.

We must work very closely with the scientific community to make sure that we have the best knowledge, that we are at the leading edge of the state of the art. Science and statecraft can and must work together for a safer, healthier, better world in many areas: missile defense, climate change, and energy, among others.

Even as science and technology help us tackle these complicated problems, other developments in science and technology will open up new challenges and opportunities that today we can only dimly imagine. Indeed, new avenues of scientific research may produce technologies as revolutionary in their security, economic and social implications as information technology has been since the mid-1980s.

One area of research alone, nanotechnology, could have enormous implications — some thrilling, others chilling — on terrorism, defense, health, development and the world economy.

In the months and years to come, the Department of State will continue to need the help of the scientific community in bringing your collective knowledge, experience and expert judgment to bear as we seek to understand complex issues and to work within the international community to address them.

Help keep us abreast of breakthroughs like genetically modified foods that can help fulfill the promise of a prosperous, healthy, stable world. Help us also to comprehend, to anticipate, and to guard against the dangers that can befall us should technologies fall into the hands of those who would use them to do harm.

Do all that you can to inspire young scientists to devote themselves to tackling the great challenges of feeding, housing, and educating, and meeting the energy, water and health needs of the 9 billion people expected to be on Earth by the year 2050.

Help us to share know-how and promote science education all around the world. I urge you in particular to volunteer as mentors, set up mentoring programs with math, science and technology.

Get young people turned on to the challenges and opportunities that math, science and technology provide to them. It is often said that science shapes the future, but it is the rising generation of young people who will shape the future of science.

Last but not least, help us build scientific and technological capacity right here in the State Department and across our foreign affairs community. Scientists have graciously put their own research on hold, stopped their own work, their own life, and volunteered to perform tours of duty in many of the State Department's bureaus. They are making a real difference, and we look forward to welcoming more scientists on to our State Department team, either as fellows or as career Foreign Service Officers or Civil Service Officers.

The American people can be proud that the U.S. is the world's leader in science and technology. That does not mean we have a monopoly on brains or wisdom, or that we don't have much to learn from others. Far from it. But I think that we have been enormously successful because our scientists, engineers and medical experts live and work within an open democratic society that values the freest possible flow of ideas, information and people.

As the American scientific community and the U.S. Government work in partnership to safeguard against those who would turn tools of science into instruments of terror, to guard us against those, we in government also want to work with you to preserve the freedoms that make America and American science so great.

Colin Powell is the U.S. Secretary of State.

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.