APS NEWS
A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY
WWW.APS.ORG/PUBLICATIONS/APSNEWS

October 2012 • Vol. 21, No. 9

Why Communicate Science?
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APS Receives $3M NSF Grant to Help Minorities Pursue PhDs

By Bushraa Khatib

In September, the National Science Foundation awarded APS $3 million in funding over the next five years to launch the APS Bridge Program (APS-BP), a national effort designed to increase the number of underrepresented minority students who receive doctoral degrees in physics. The program plans to select its first funded site and accept student applications for fall 2013.

Underrepresented minority students, including African Americans, Hispanic Americans, and Native Americans, earn about 10% of US physics bachelors degrees, yet they comprise only about 5% to 6% of US citizens who receive physics PhDs at American institutions. The main goal of the APS-BP is to roughly double the number of PhDs awarded to these students within the next ten years by developing sustainable "bridging" models to provide these students with research opportunities, advanced coursework, and mentoring, and to facilitate these students' access to graduate programs. Also, the project will enable departments to enhance the culture of their physics graduate education so that all students have the best chance of success.

The program plans to select institutions to host bridging experiences through an NSF-style competitive proposal process, modeled on the one used by the Physics Teacher Education Coalition (PhysTEC), the APS flagship proj-

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Publishers See Pitfalls to Open Access

Open access. Two bland words that have obliged scholarly publishers, librarians, scientists, funders, and governments to rethink their most basic assumptions, and in some cases begin to tamper with a business model that has held up for more than a century.

Open access (OA) calls for scholarly publications to be available online at no cost and without barriers. Arguments in favor include a broader and more rapid distribution of research results, and the essential fairness of allowing taxpayers who paid in part for the research to access it without paying again.

But publishers worry that making manuscripts freely available would weaken the scientific peer review process, because libraries, the main source of revenue for most publishers, would no longer have to pay for subscriptions to the journals.

APS Treasurer/Publisher Joseph Serene said that if many libraries cancel their subscriptions to the journals, the lost revenue could adversely affect the Society's ability to evaluate new manuscripts.

Although reviewers of the papers do so voluntarily and without compensation, it takes a staff of about 50 full-time paid editors, most of them physics PhDs, to organize, edit and accept or reject the 35,000 manuscripts the APS receives a year.

"To do this well is a time-consuming process and it requires skilled and highly qualified people to run it." Serene said. "This is a nontrivial job.

"Public policy makers, science students, and the scientific community generally need to know what parts of the publicly available scientific information… is actually sound," Serene said. "The

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Letter Opposing Sequestration is Open for Signing

Led by APS student members, students across the physical sciences and engineering are signing a letter urging Congress to avoid devastating 8.2% cuts to science funding scheduled to occur on Jan 2nd 2013. These cuts will mean thousands fewer grants, resulting in reduced opportunities for students across the curricula. APS members are encouraged to share this information with fellow faculty and to have their students sign the letter at http://go.aps.org/sequestration2012 .

Capitol Hill Briefing Boosts Optics and Photonics

By Michael Lucibella

Leading scientists and policy makers participated in a briefing on Capitol Hill on September 12, asking the government to help improve the organization of research in optics and photonics. The briefing was based on a recent report, titled "Optics and Photonics: Essential Technologies for our Nation," that calls for a national strategic plan to focus public and private research in the field.

Photo Credit: Brian Jacobsmeyer

At the morning briefing in Washington, APS President Robert Byer (center) introduced Energy Secretary Steven Chu (left), who gave one of the two keynote presentations. Report co-chair Alan Willner (right) looks on, as does a member of the next Willner generation (extreme right).

Though not specific on what shape such an initiative would ultimately take, the speakers at the briefing highlighted a number of specific recommendations and goals in different subfields, including energy applications, communication, medicine, national defense and manufacturing.

"We need a concerted investment strategy that brings together private, public and academic institutions," said Tom Baer, executive director of the Stanford Photonics Research Center.

Advances in optics and photonics research have come from a large number of disparate institutions, and the report wants the federal government to help organize and foster more cooperation and collaboration to keep the United States competitive.

"We're not asking for more money," said Alan Willner, a professor at the University of Southern California, and co-chair of the committee that prepared the report. "The committee recommends the federal government develop an integrated initiative in photonics."

The report compared its vision for a strategic plan to the National Nanotechnology Initiative, established in 2000. "We don't have a roadmap. The semiconductor industry does, we don't," Willner said.

Presenters said that other parts of the world have developed such a strategic plan for their photonics industries. Taiwan, China and Germany have all invested significantly in research for new optics and photonics technology.

"In the E.U. there is a very strong and sustained focus on optics and photonics," said Eugene Arthurs, CEO of SPIE, an international society devoted to the science and applications of light.

One of the major recommendations of the report called for a national initiative to keep better track of the economic impact of the optics and photonic industries as a whole. The report identified specific areas where optics and photonics research could help address national issues. New optics and photonics technology would be central to speeding up the internet by a factor of 100, for making additive manufacturing, also known as 3-D printing, more economical and widespread, for improving

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Imperiled Funding Threatens Long-Baseline Neutrino Experiment

By Michael Lucibella

Physicists are fighting hard to save the country's proposed flagship neutrino experiment from a potential death of a thousand cuts. High energy physicists and the Department of Energy have deemed the Long Baseline Neutrino Experiment (LBNE) a top priority for the US science program, but looming budget cuts at the agency have prompted numerous reviews and reductions in scope for the project.

At the August High Energy Physics Advisory Panel meeting in Rockville, MD, advisors to the DOE presented three possibilities for the first phase of the proposed neutrino detector. They warned that the scope of the research could be severely undercut by inadequate funding. Scientists ideally want to locate the detector underground and 1300 miles away from the source of the neutrinos, but the budget may not be available to do both.

"It's a broad and very rich program of science that we want to do," said Milind Diwan a physicist at Brookhaven National Lab and spokesperson for LBNE. "We want to build a capable large detector and locate it deep."

The LBNE would make use of a new class of liquid argon neu-

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Ben-Naim is New Editor of PRE

On October 1, Eli Ben-Naim of Los Alamos National Laboratory became the new Senior Editor of APS's interdisciplinary journal *Physical Review E*. He is currently the deputy leader at Los Alamos's Physics of Condensed Matter and Complex Systems group and has both been a referee and served on the editorial board of *Physical Review E* for years. He has also served on the editorial boards of the *Journal of Physics A*, the *European Journal of Physics B* and the *Journal of Statistical Mechanics*.

Eli Ben-Naim

Ben-Naim succeeds Gary Grest of Sandia National Laboratories, who held the position since 2002.

"Eli definitely has the quali-

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Members in the Media

"What you get from classical general relativity, and also what everyone understands about a black hole, is that it can absorb anything that comes near, but it can't emit anything. But quantum mechanics doesn't allow such an object to exist."
Edward Witten*, Institute for Advanced Study,* The Christian Science Monitor*, August 3, 2012.*

"I haven't heard directly from him, but I assume I will soon, in some interesting way."
Gordon Kane*, University of Michigan, on whether Stephen Hawking has settled up after losing a bet over whether the Higgs boson exists,* The New York Times*, August 6, 2012.*

"I have not seen them, since they are carefully enclosed in their Styrofoam, but I trust they are in excellent shape!"
Janet Conrad*, MIT, on the condition of ten chocolate Nobel Prize coins she owes Frank Wilczek after the discovery of the Higgs boson,* The New York Times*, August 6, 2012.*

"I really enjoyed the film 'Armageddon' and up until recently never really considered the plausibility in the science behind the movie… But after watching it back, I found myself being more skeptical about the film in many areas."
Ben Hall*, University of Leicester, on his team's paper pointing out that it would take more nuclear weapons than exist worldwide to blow up an incoming, Texas-sized asteroid,* The Los Angeles Times*, August 7, 2012.*

"After eight years building the instrument, it's payoff time!"
Roger Wiens*, Los Alamos National Laboratory, on the Mars Curiosity rover's rock-melting laser,* The Christian Science Monitor*, August 20, 2012.*

"It's pretty amazing… It was the '60s. There was no Power Point. There was no (computer-assisted design), really, and a handful of people built this thing… And it's still useful today."
Mark Hogan*, SLAC, describing the particle accelerator,* The San Jose Mercury News*, August 24, 2012.*

"This is a phenomenal set of instruments… This is the best that's ever been flown in the radiation belts, and we'll make tremendous advances."
Craig Kletzing*, University of Iowa, on the launch of the Radiation Belt Storm Probes en route to Earth's Van Allen belts,* FoxNews.com*, August 30, 2012.*

"Think of it as a violin or a guitar string… If you put a little blob of solder on it, the weight would make the frequency change, ever so slightly.... That's what we're measuring."
Michael Roukes*, Caltech, describing his team's development of a nano-sized scale that can weigh large individual molecules,* Los Angeles Times*, August 31, 2012.*

"We know that the Standard Model of particle physics fits all the data we have here on Earth. On the other hand, it's not the final answer. It's inelegant in various ways, and it doesn't fit the data that we have from the sky. There's no dark matter in the Standard Model. We need to move beyond the Standard Model if we want to have a full understanding."
Sean Carroll*, Caltech,* NBC.com*, September 5, 2012.*

"This is a significant step toward a greater understanding of neutrinos… It represents many months of hard work on the part of the whole NOvA collaboration."
Marvin Marshak*, University of Minnesota, on the positioning of the first detector at the NOvA experiment in Ash River, Minnesota,* NBCNews.com*, September, 6, 2012.*

"The Leidenfrost state of a water drop is often used worldwide to gauge the temperature of a hot skillet while cooking."
Neelesh Patankar*, Northwestern University, on his team's research creating a material so smooth, bubbles won't form when water is boiled in a pot coated with it,* The Christian Science Monitor*, September 14, 2012.*

This Month in Physics History

October, 1644: Torricelli Demonstrates the Existence of a Vacuum

Elegant physics experiment; enduring practical invention

Ed. Note: *This month's column was written by guest author Richard Williams.*

Evangelista Torricelli, born of a humble family, eventually rose to the top of the Italian intellectual community. He led Italy, and then the world beyond, to resolve a two-thousand-year-old philosophical debate about vacuum and the nature of space. He did this by performing and understanding a single elegant physics experiment. The apparatus he used was also a practical invention–the mercury barometer.

Torricelli was born at Faenza, Italy on October 15, 1608. "Left fatherless at an early age" he was sent to Rome for his education. His achievements there brought him to the attention of Galileo in Florence. He came there and lived with Galileo. Galileo was preoccupied with a problem of Tuscan well diggers who were frustrated in their attempts to raise water more than about ten meters with lift pumps. When they tried to raise it higher, the water separated from the pump plunger and would go no farther. Could this be due to a vacuum forming under the plunger? They asked Galileo why the water could not be pumped higher. He considered the problem seriously, but died in 1642 with it still unresolved.


Evangelista Torricelli

Then, in 1644, Torricelli took up the problem. After some study of earlier experiments he did one of his own. The apparatus was a glass tube about a meter long, sealed at one end. He filled it with mercury, covered the open end, and inverted it over a dish of mercury. This was not as easy as it sounds today. Glass tubes at the time were fragile and hard to come by. They often broke when filled with a kilogram of mercury. But with the help of a skilled assistant the experiment was done. The mercury in the tube fell and stabilized at a level about 76 centimeters above the level in the dish. Torricelli surmised correctly that the mercury rose in the tube because the of the weight of the atmosphere pressing down on the mercury in the dish, and that the space above the mercury column was a vacuum. It was the first time that a vacuum had been created in the laboratory, and understood as such.

The concept of a vacuum had been contentious since antiquity. Both Plato and Aristotle thought the existence of a vacuum to be impossible, against Nature. In medieval Europe, this was summed up by the expression: "Nature abhors a vacuum." To discuss a vacuum became heretical and dangerous.

The word "vacuum" first appeared in the English language in 1550, introduced by Thomas Cranmer, the Archbishop of Canterbury, who composed the *Book of Common Prayer*, the central document of the Church of England. The phrase he used, as part of a theological argument, is cited in the *Oxford English Dictionary*: "Naturall reason abhorreth *vacuum*, that is to say, that there should be any emptye place, wherein no substance shoulde be." This was the sanctioned view, but, with the accession of the Catholic Queen Mary in 1553, the winds of orthodoxy shifted. Cranmer was convicted of heresy in 1555, and was burned at the stake the following year.

Torricelli's achievement brought the concept of vacuum from the dialectics of antiquity into experimental physics. Mindful of the contention around the idea of vacuum, he did not make his experiment public at first, but disclosed it only in letters to a friend, Michelangelo Ricci. In October, 1644, the French scientist Marin Mersenne visited Torricelli, who repeated the experiment for him and gave him copies of the letters to Ricci. Mersenne took these to Blaise Pascal and others in France, disclosing Torricelli's work publicly for the first time.

Pascal immediately understood the meaning of the experiment, and repeated it in 1646. He believed that the atmospheric pressure should decrease with altitude, and engaged a relative and some friends to carry a barometer up a mountain in the south of France. They found the anticipated decrease of pressure with altitude, laying the foundation for the science of meteorology.

Pascal understood the pressure to be equal to the weight of the atmosphere per unit area. He combined this with the surface area of the earth and calculated the total mass of the atmosphere. His result differed by less than 30% from the currently accepted value as cited in *The Handbook of Chemistry and Physics*. About the calculation, Pascal noted that "a child who knows addition and subtraction could do it," a strong endorsement of the French school system.

Torricelli's apparatus was the first mercury barometer. Minor improvements were later made to increase the precision of the readings, but the basic design remained unchanged. In meteorological stations around the world it served as the reference standard for measuring atmospheric pressure for more than three centuries, perhaps a record time for an instrument to be used with the same design. Finally, in 1977, the US National Weather Service announced that the mercury barometer would be replaced as the reference standard by a recently developed piezoelectric quartz crystal pressure transducer.

Torricelli stood at the nexus where, with a single elegant experiment, vacuum and the nature of space, defined in philosophical terms for two thousand years, gave way to the modern view, defined by experimental physics. In the twentieth century, physicists went far beyond this. They found, not an "emptye place, wherein no substance shoulde

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APSNEWS

Series II, Vol. 21, No. 9
October 2012
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Coden: ANWSEN ISSN: 1058-8132

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APS News (ISSN: 1058-8132) is published 11X yearly, monthly, except the August/September issue, by the American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, (301) 209-3200. It contains news of the Society and of its Divisions, Topical Groups, Sections, and Forums; advance information on meetings of the Society; and reports to the Society by its committees and task forces, as well as opinions.

Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, APS News, One Physics Ellipse, College Park, MD 20740-3844, E-mail: letters@aps.org.

Subscriptions: APS News is an on-membership publication delivered by Periodical Mail. Members residing abroad may receive airfreight delivery for a fee of $15. Nonmembers: Subscription rates are available at http://librarians.aps.org/institutional.html.

Subscription orders, renewals and address changes should be addressed as follows: For APS Members–Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org.

For Nonmembers–Circulation and Fulfillment Division, American Institute of Physics, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747-4502. Allow at least 6 weeks advance notice. For address changes, please send both the old and new addresses, and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing issues will be honored without charge only if received within 6 months of the issue's actual date of publication. Periodical Postage Paid at College Park, MD and at additional mailing offices. Postmaster: Send address changes to APS News, Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844.

Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

Leadership Agrees to a Continuing Resolution
Congressional leadership has agreed to a Continuing Resolution to keep the federal government funded through March 2013 at fiscal year 2012 levels. The agreement punts the issue of appropriation down the road and does not signify any change in the tone of hyper-partisanship that has dominated Washington recently. It merely leaves the appropriations issue for the next Congress to resolve. House Republicans, using the Ryan budget as a blueprint, and the President are still far from agreement on spending for defense and social programs.

The Romney/Ryan vs. Obama Budget Plans
For now the debate remains between the Romney/Ryan budget plans and the President's budget proposal. An analysis developed by the AAAS, which compares five-year outlooks for non-defense R&D spending based on the two plans, assumes the budgets for individual agencies, as a percentage of total spending, will remain relatively constant. Ignoring sequestrations (see below) the analysis finds that the overall R&D spending under the Ryan budget plan would be $39B (~5%) lower than the President's request through 2017. The Ryan plan would provide $1.8B (~6%) less for General Science (Function 250)–covering NASA, the Department of Energy Office of Science, and the National Science Foundation (NSF) – and $517M (~2%) less for Health (Function 550) with the National Institutes of Health's (NIH) share likely falling below the President's request by $30M (~1%). The Ryan plan would also provide $1.5B (55%) less for Energy programs (Function 270), among them ARPA-E and Energy Efficiency and Renewable Energy (EERE). By contrast, it would provide $514M (~1%) more for R&D within the Defense budget (Function 050).

The budget proposal put forth by Governor Romney poses additional uncertainties that at this time cannot be quantified.

Sequestrations
Current law (the Budget Control Act of 2011) mandates across-the-board reductions (sequestrations) for all discretionary programs beginning January 2, 2013. Defense programs would suffer reductions of approximately 10 percent, while non-defense programs would be cut approximately 8 percent. Absent bipartisan legislative action, NSF would be forced to reduce the number of grants it awards by at least 500 and perhaps by as many as 1500, and NIH would have to shrink its grant program 1,600 to 2,600 grants. Other science agencies would face comparable grant reductions, and the Department of Energy would confront the very real prospect of closing one or more scientific facilities.

Obama and Romney Science Policies
President Obama and Governor Romney recently responded to 14 questions regarding science and public policy posed by the "Science Debate." Their side-by-side answers appear at http://www.sciencedebate.org/debate12/.

ISSUE: Media Update
The Hill published an op-ed on Sept. 10 by APS President Robert Byer and ACS President Bassam Z. Shakhashiri regarding Office of Management and Budget travel regulations and Congressional legislation that reduce travel and meeting expenses by 30 percent for federal employees in fiscal year 2013. *Roll Call* printed an op-ed on Sept. 10 by Michael S. Lubell, APS Director of Public Affairs, who is a regular guest columnist for the paper. Lubell discussed the eroding support for large, US-based science projects and offered compelling reasons why science appeals to both political parties.

Log on to the APS Public Affairs website (http://www.aps.org/policy) for more information.

CSI: Physics
The Case of the Fabulous Career in Forensics

By Alaina G. Levine

Steve Compton doesn't interrogate suspects nor does he analyze chalk outlines of dead bodies. But he is a detective and does crack cases. Instead of a gun, his weapons are his knowledge of physics and an impressive arsenal of microscopes. He's a Senior Research Scientist with MVA Scientific Consultants, a Duluth, GA-based firm that uses science to solve problems for clients in insurance, pharmaceuticals, manufacturing, industrial hygiene and the environment, most of which have legal cases associated with them. It's forensics meets physics, so take that, CSI!

Compton serves on a squad of 16 employees, most of whom have a background in chemistry, geology, and environmental science. But he's the lone PhD physicist. You've probably heard of forensic accountants, and you might have heard of forensic meteorologists, who apply their know-how of the clouds to slip-and-falls and other weather-related cases. But a forensic physicist? You don't have to be looking at blood spatter, bullet trajectories, and other matters relevant to violent crimes to be a forensic physicist, Compton explains. "I think any physicist who performs scientific investigations that are used in legal cases, should be called a forensic physicist. In particular, I'm a forensic physicist who focuses on environmental, manufacturing, and pharmaceutical issues."

With an expertise in tiny materials, Compton's perps are airborne particles. "My background in physics helps me understand the nature of small particles in addition to the analytical tools I use everyday: microscopy, x-ray spectroscopy, diffraction pattern analysis, and infrared spectroscopy." He is often called to consult on situations involving asbestos contamination or product characterization in pharmaceuticals. For example, if a person worked within an asbestos-laden environment and became sick, Compton would help determine whether the asbestos from the job site was the cause. To do so, he would reconstruct the person's activities with asbestos products and use optical and electron microscopes to determine past exposures. In a hypothetical pharmaceutical case whereby a recurring stain is found on a panoply of pills, Compton might examine the pills with a polarized light microscope or a scanning electron microscope to figure out how the offending chemical got into the manufacturing process.


Steve Compton

He recently contributed to a dispute involving carbon black, or engineered carbon that is manufactured for various industrial purposes, such as a structural additive to tires. Residents of a community near a carbon black plant expressed concerns that their property was being dirtied by the factory. Compton scrutinized the engineered soot under a transmission electron microscope and compared it to dust particles found on homes nearby. He discovered that on many occasions, the dirt was something other than carbon black.

"Most of the cases I have worked, I am not at liberty to discuss," he says, in part because there are either legal or confidentiality considerations. "I don't typically do field work, but there was one case involving a famous athlete/actor in which I was asked to fly out to Utah to collect some gravel samples from the side of a highway, But I can't give you any more details than that!" On another case, MVA was asked "to analyze and perform a study on an asbestos-containing firesuit. I was the only one that could fit in the suit, so I volunteered to walk around inside a sealed chamber with the firesuit over my respirator and two protective full-body suits while a certified industrial hygienist collected air samples from within the chamber. Fiber release studies like this are always fascinating, but quite often the results cannot be discussed due to legal settlement conditions."

Sometimes, the truth is priceless to a client, says Compton. For example, one case centered around a young girl who had developed signs of lead poisoning with no obvious source. "Microscopic analysis of the dust in her home revealed particles of lead-containing fly ash," he explains. "Those particles were then traced to a nearby stockpile which ultimately had to be cleaned up by the Environmental Protection Agency."

Compton is proud to wear his firm's only badge from a physics department. As an undergraduate at the University of Georgia, Compton originally majored in chemistry. "But I was attracted to the power that the laws of physics provides in allowing one to understand the world around us," he says. "No other field, except perhaps mathematics, is so broad and all-encompassing in our daily life as physics. In my undergraduate courses, I started finding answers to questions that I hadn't even considered before."

Compton was convinced that physics was the way to go when his undergraduate adviser told him that, instead of preparing him for a specific track, "physics could provide me with an understanding of the world and an ability to solve problems that could take me anywhere," he recounts. "In my case, that's 100% true. There is a level of satisfaction that comes from listening to a client's problem and helping them find the solution. That relationship with the client and the ability to make an immediate impact on an individual after a hard day's work is something that physics typically doesn't provide. And not all of our cases are so emotionally charged, but there is an even deeper level of satisfaction that comes from helping a little girl track down the source of lead poisoning that makes her so sick."

Alaina G. Levine is a science writer and President of Quantum Success Solutions, a leadership and professional development consulting enterprise. She can be contacted through www.alainalevine.com.

New APS Webpage Hosts Statistical Graphics and Related Data

Physicists looking for presentation-ready graphics illustrating general statistics on physics degrees granted in the US, as well as the representation of women and minorities in physics, have a new tool in their repertory. The APS Education & Diversity Department has published a webpage devoted to physics data and statistics (www.aps.org/programs/education/statistics/). The webpage features more than 10 graphs available in both PDF and Powerpoint formats. In addition to the graphs, the raw data is provided allowing users to recreate or revise the graphs.

The demand for statistics on the number of physics degrees awarded annually has recently increased with the heightened pressure on physics departments to graduate at least five majors per year averaged over five years (see Theodore Hodapp's Back Page on "The Economics of Education" from the December 2011 *APS News* for more information on this crisis). The goal of this new webpage is not only to provide easily accessible graphics and data for professionals seeking to follow trends but also to generate discussion and bring attention to how the physics community compares to other disciplines in educating students in the US.

All data is collected from the National Science Foundation's WebCASPAR Integrated Science and Engineering Resources Data System (webcaspar.nsf.gov). The database contains a large body of statistical data resources for science and engineering at US academic institutions. Among those resources are the IPEDS Completions Survey and the NSF-NIH Survey of Graduate Students & Postdoctorates in Science and Engineering.

This new resource will supplement the information available

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Letters

Readers interested in submitting a letter to APS News ***should email letters@aps.org***

Israel's Rights Record Was Unfairly Attacked

I cannot remain silent at Bob Harvey's gratuitous criticism of Israel's human rights record, and unwarranted comparison to Iran's unfair trial of Omid Kokabee, in the Letters column of the August/September issue. The Palestinian terrorist organizations that Israel defends itself against are openly at war with Israel, and their attacks make no distinction between soldiers and civilians. To the extent that the Palestinian Authority is unable or unwilling to prevent these attacks from taking place, or is even abetting them, Israel has the right and responsibility, under the international laws of war, to defend itself. When possible, Israel sends troops into the PA areas and arrests these people. When that is not possible, Israel has the right to take military action against them–you are not required to give a fair trial to an enemy who is shooting at you, before shooting back. Collateral civilian casualties are allowed by the laws of war, providing they are not out of proportion to the military goals to be achieved. Israel makes every effort to avoid such civilian casualties, and many Israeli soldiers, including the son of a friend of mine, have died because they were sent into house to house combat, rather than bombing a building that was known to contain terrorists, in order to prevent civilian casualties. No other country has such a stringent policy for minimizing civilian casualties, and in similar situations in Afghanistan, the United States resorted to carpet bombing of buildings before sending in troops, resulting in thousands of civilian casualties.

Michael Gerver
Raanana, Israel

"BFY" Conference Focuses on Advanced Laboratory Instruction

Approximately 150 physics laboratory instructors gathered on the campuses of the University of Pennsylvania and Drexel University in Philadelphia in late July, to learn from one another how to set up environments that promote learning and skill development in the laboratory, and to share new experiments in hands-on workshops.

They were attending the Conference on Laboratory Instruction Beyond the First Year of College (or "BFY"), organized by the Advanced Laboratory Physics Association (ALPhA) as a follow-up to the 2009 Topical Conference on Advanced Laboratories that was held at the University of Michigan in Ann Arbor. One of the BFY participants, Ben Stottrup of Augsburg College, noted that "It was great to meet a community of educators who have a passion about experimental physics. I will use ideas I learned in the workshops in my courses this fall."

"The BFY Conference really illustrated the breadth of hands-on experiments that are being developed for undergraduate physics students. A number of the workshops demonstrated experiments that are well-suited to be offered as in-depth immersion experiences so that faculty and instructional staff can teach the experiments confidently to their own students," said Lowell McCann of the University of Wisconsin-River Falls. McCann has organized ALPhA's Laboratory Immersions program, which runs workshops several times a year that provide participants with two to three days of intensive hands-on experience with a single advanced laboratory experiment.

"This conference is an 'act of community' and the most efficient way for laboratory instructors to spend the time they devote to revitalizing their courses," said Conference Chair Gabe Spalding, of Illinois Wesleyan University. The conference was supported by the National Science Foundation, the American Association of Physics Teachers, and the APS Forum on Education. Many equipment vendors also lent their support.

More information about ALPhA can be found at www.advlab.org.

Photo by Elizabeth George

Tom Solomon of Bucknell University demonstrates the simple apparatus needed to create a "blinking vortex flow" used in undergraduate chaotic motion and mixing experiments.

Public Activism Makes a Difference

Nina Byers, in her interesting Back Page article in the July *APS News*, has described a course whose importance needs to be emphasized. Science is not an isolated activity, insulated from society. Scientific knowledge can contribute to the recognition and solution of wide-spread problems, but many scientists do not feel comfortable with entering into this public arena. Major current problems involve the environment, climate change and energy.

These problems will not go away by themselves. We need to expose our students to such topics, and a number of us have been offering courses like this for some years. Byers makes special mention of the reduction of nuclear weapon inventories and relates this to the atmospheric test-ban treaty of 1963. She notes, correctly, that the ratification followed "considerable public pressure from the scientific community and others, particularly following the 1961 publication of Louise Reiss's study of baby teeth." In fact, the public pressure started several years before Reiss's paper appeared, and the involvement of the scientific community constitutes an important lesson that is still relevant today.

The potential dangers to public health that could be posed by ingestion of radioactive fallout from weapons tests had received the attention of Adlai Stevenson in his 1956 presidential campaign. In 1957, Linus Pauling launched his petition against weapons testing that attracted the supporting signatures of many hundreds of major scientists.

The organized public involvement of knowledgeable scientists in this political arena started in 1958 with the formation of the Committee for Nuclear Information (CNI) in St. Louis. Among its founding members were Edward Condon and Barry Commoner, together with many scientists and physicians at Washington University and St. Louis University. CNI (and, even earlier, individual faculty) gave popular lectures on related subjects such as fallout, radioactivity, and the biological effects of radiation. Lecturers went to church groups, schools, civic groups such as Kiwanis–they were willing to speak to anyone who would listen. CNI published a newsletter *Nuclear Information*, and members testified before Congressional committees. CNI has been well described by Kelly Moore in *Disrupting Science*, (Princeton Univ. Press, 2008).

Reiss's study was a part of the Baby Tooth Survey, in which families were encouraged to donate baby teeth to the project; the Sr-90 content could then be related to the concentration of Sr-90 in domestic milk that was being monitored daily. The St. Louis area milk contained, at one time, the highest concentration in the entire country, due to the direction of prevailing winds that carried fallout from the Nevada testing site until brought down by rain, in Missouri. Children whose teeth were collected were rewarded with a lapel button that showed a drawing of a gap-toothed child and with the legend "I gave my tooth to science."

"Activism" was not a term used in those days. The activism of CNI was not universally appreciated and individual scientists and their universities were attacked with vigor. It was a strong tenure system and principled backing by many administrators that helped to preserve the academic freedom of faculty willing to speak out and criticize government agencies and their statements and reports.

Following CNI, information groups were formed in other parts of the country. Together, their activism laid the foundation for the "considerable public pressure" that Byers correctly identifies.

By now, the range of public scientific issues has broadened to include the debates over climate change, the environment and legislatively-imposed school curriculum content concerning evolution. There will always be a need for informed public debate, and a part of the professional obligation of the scientific community is to provide reliable, honest information in understandable form, to the non-experts who are, after all, the bulk of the voting public. College courses, such as those described so sympathetically by Byers, should be an essential offering of all colleges.

Michael Friedlander
St. Louis, MO

Electric, Internal Combustion Vehicles Compared

I read with interest the excellent Back Page article by Fred Schlachter in the August/September issue of *APS News*. The topic of the Electric Vehicle (EV) and its possible replacement of the current Internal Combustion Vehicle (ICV) may be important from the standpoints of cost and environmental impact.

We have made a study on the EV and ICV to compare the cost of operation and the relative consumption of fossil fuels. In this study we assumed that the electric power for the EV would be derived from the burning of coal, oil or natural gas. Some highlights of the study results may be of interest. The study was based on the following assumptions:

1. The vehicle is a family sized car weighing approximately 7000 pounds including passengers.
2. The gas mileage for the ICV is about 27 mpg.
3. The relative purchase prices are about $25,000 for the ICV and $40,000 for the EV.
4. The cost of electric energy is about 11 cents/kWh.
5. The price of gas is about $4.00/gallon.

Some of the study results that may be of interest are the following:

- The fossil fuel consumption for the EV is about 63% of the amount of gasoline used by the ICV.
- The cost of operation for the EV is about 22% that of the ICV.
- The investments in terms of purchase price and operating costs would be equal after 130,000 miles of operation.

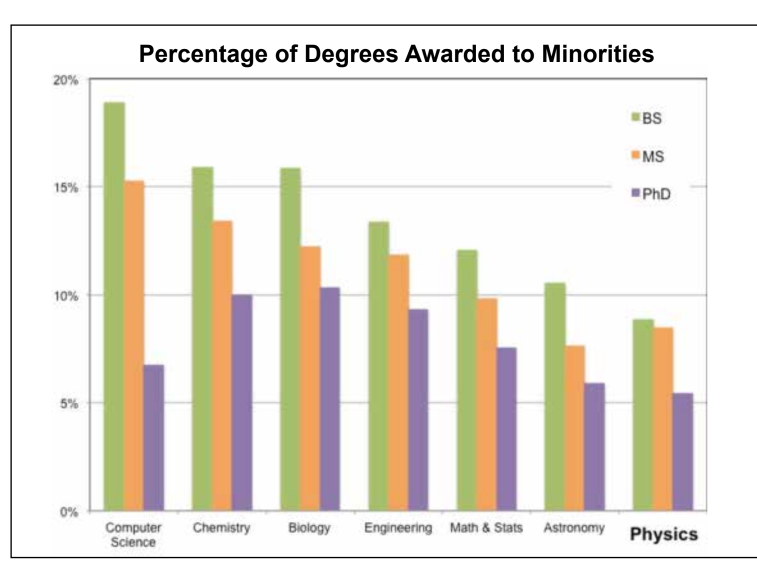
These results are subject to modification, as some important variables have not been included. For example, the overhead power for the EV to supply heat and air conditioning as needed were not taken into account. It is still unknown how many miles can be driven before an EV battery will need to be replaced. The study has meaning only for operating scenarios allowed by the limited range of the EV. As Fred Schlachter points out, this range limit will not increase in the foreseeable future.

James McDade
Janesville, WI

WEBPAGE continued from page 3

from the American Institute of Physics' Statistical Research Center (www.aip.org/statistics/) and provide additional views of data, as well as access to the raw data behind the graphs.

"We hope that this page will fill an important role in educating the community about the progress the US is making in educating students in physics," said Deanna Ratnikova of the APS Department of Education and Diversity. "The page also seeks to promote conversations amongst leaders in physics education on diversity and related issues," she added.



APS Awards Two Blewett Fellowships in 2012

This year's recipients of the M. Hildred Blewett Fellowship are Michelle Ntampaka of Carnegie Mellon University and Sujatha Sampath of the University of Wisconsin-Milwaukee. The recipients are chosen by the APS Committee on the Status of Women in Physics.

The Blewett Fellowship is dedicated to helping women who are returning to research careers that had been interrupted for family or other reasons. It is a one-year grant, which can be renewed, of up to $45,000 for use towards a wide range of necessities, including equipment procurement, stipend, travel, tuition, and dependent care. This is the eighth year the Fellowship has been awarded.

Michelle Ntampaka

Michelle Ntampaka says that she wants to be Neil deGrasse Tyson someday, and the Blewett Fellowship is helping her reach her goal of being a science communicator.

Ntampaka started out studying education and physics at Grove City College in western Pennsylvania. As part of her degree, she would help out at some of the local schools in the area.

"I knew I wanted to be a teacher and I happen to be good at physics," Ntampaka said.

After she graduated, she started working full time at one of the local schools, but then decided to return to school and get her master's degree. She wound up at Carnegie Mellon, and it turned out to be a perfect fit for her. She took one class a semester for about five years to finish her masters. To help put herself through the degree, she worked at the university as a laboratory demonstrator, the person in charge of the different experiments used in lectures.

"I was basically taking care of all the demonstrations for all of the faculty. It was a great way to learn because I was interacting with all the faculty," Ntampaka said. At the same time it took a lot to find the right balance between work and classes. "It really was a juggling act."

In 2010, just a few months after she graduated with her masters, her son Joseph was born. She decided to take a year off before starting her PhD.

"I found the juggling act, plus having a child was just too much," Ntampaka said.

When she returned to Carnegie Mellon to start her PhD, she enrolled in an astrophysics course because it was the only one that fit in with her schedule. From there, she was hooked.

"I love looking at the questions of the big universe. I just loved [the class]," Ntampaka said. "It was very serendipitous in how I ended up in astrophysics."

She said also that her advisor, Hy Trac, has been very supportive to her.

"Dark matter halos are sort of these knots of dark matter. We can simulate them very easily. We can detect them, but not directly. But we can detect galaxies," Ntampaka said. Her research compares astronomical observations of galaxies taken from the Sloan Digital Sky Survey with computer models of dark matter halos. "I will be doing simulations, and looking at data sets from astronomers and how to connect those two."

In addition to her research, she and her husband Bertin have been working to help train teachers in her husband's native Rwanda. They started out with a book drive and collected more than 5,000 textbooks for the country's disadvantaged school system.

They also traveled to Rwanda in 2011 at the request of the minister of education. There they trained teachers on how to do classroom demonstrations with few resources. She added they hope to continue working with students and teachers in Rwanda.

"I think we're going to work on developing a program if what we do at this one school works well," Ntampaka said. "We're going to take a step back and become a laser bean rather than a flood light."

For now, Ntampaka plans on using the Blewett Fellowship to go back to being a full time student so she can finish her research and PhD.

"The Blewett Fellowship was a game changer, it really was." Ntampaka said. "This has just given me the ability to put blinders on and focus on what I need to do."

It was while she was in high school in India that the wonder of the natural world around her grabbed Sujatha Sampath's attention and never let go.

"I was studying the natural phenomena around me, why natural things happen... [and] it resonated with what I was interested in." Sampath said. "I think I was more interested in what are the natural phenomena that surrounded us rather than making stuff at that point."

She went on to major in physics with a minor in chemistry at the University of Madras in Chennai, and completed her masters at Rani Durgavati University in Jabalpur. For her PhD, she did her research at the University Grants Commission-Department of Atomic Energy Consortium for Scientific Research in Indore. There she started focusing on research into condensed matter physics.

"When I started there, the institute was only a few years old," Sampath said. Together with her advisor, she helped build the lab to study the thermal conductivity of materials near absolute zero. She also studied heavy fermions, and helped make probes for amorphous materials. She found herself drawn to research on glass and amorphous materials.

For her postdoc work, Sampath landed a spot using high intensity X-rays to study the atomic struc-

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Media Fellows Train on the Job

***Ed. Note:** Each year, as part of a program run by the American Association for the Advancement of Science, APS sponsors two media fellows, who spend the summer at a media outlet, learning the craft of science writing. Sometimes this leads to a career in journalism; sometimes it produces a scientist with a more nuanced understanding of how the media operate. In the following two articles, 2012 media fellows Kerstin Nordstrom and Meeri Kim describe their summer experiences.*

Reporters Have to Tell the Story

By Kerstin Nordstrom

When I looked at the extensive agenda for the AAAS Mass Media Fellows orientation, this podcast addict only saw one thing: a field trip to NPR.

The trip was a blast, but strangely, an entirely forgettable quote is what stuck with me. After we all bragged about our innumerable scientific credentials to the NPR science desk, Nell Greenfieldboyce told us, "Remember, (this summer) you are a science REPORTER."

Greenfieldboyce meant that simply explaining the science in layman's terms isn't enough. Explaining the science is trivial if you have a copy of the paper and can Google arcane terms.

People need a story to care, replete with plot and characters.

As we filed away from the NPR science desk, I overheard Greenfieldboyce, only half-joking, wishing she could go to a local paper for the summer.

So I took her advice to heart when I went to my summer placement site, *The Raleigh News & Observer,* a local paper.

Before the fellowship, I had been focused on science writing. Of course, this fellowship gave me writing experience, but I've been writing for over two decades.

I did more reporting this summer than I ever have in my life, and I realize how important it is for good science stories. You may be the most brilliant wordsmith with the best grasp of the science, but if you don't have a story and quotes to back it up, it's worthless to your editor, because people won't read it. I agonized over plotlines, and introduced new characters as needed. I had in-person interviews as much as possible. Even when the plot isn't the strongest, a small sprinkle of a researcher's personality can take a piece out of introductory textbook territory.

Kerstin Nordstrom

After this fellowship, I am back on the academic track, though in the future I hope to write freelance about topics that interest me academically. I have always thought scientists should be engaged in public communication. Some colleagues may dismiss it as a waste of time, but the public has a right to know what it is funding.

This summer reminded me that the public needs and wants more science reporting.

Comments, phone calls, and emails about my stories tended to be of two flavors. Some readers who were simply happy to read science stories in the N&O hungered for more. After all, I was the only science reporter in the Research Triangle, an area with an abnormally high concentration of PhDs. Other readers either did not understand the scientific method itself or used their ideology to refute stories. More disclosure of science will not solve these problems, but it can't hurt, and is certainly beneficial if younger readers are exposed.

However, print media is declining, online advertising is less lucrative, and people don't want to pay for online content. It's too bad that science reporters also need to eat.

The problem is challenging, but needs to be solved.

Lastly, my reporting experience gave me another, admittedly selfish, reason to care about science communication.

I expected big-shot professors to be unreachable, or to be aloof or grumpy when talking to a "reporter." I know a few who might fit in one of those boxes. In reality, I mostly found the opposite: the more impressive the CV, the faster they called back. Their *willingness* to engage has attracted success in the form of students, collaborators, and grants. And it's a positive feedback loop–more students, collaborators, and grants mean even more opportunities to engage, spawning more research opportunities.

With no more than an attitude adjustment, all scientists can make their science better. I'll be taking this advice to heart for the rest of my career.

No Time to Rest on your Laurels

By Meeri Kim

My time spent at the *Philadelphia Inquirer* as a AAAS Mass Media Fellow proved to be a fantastic crash course in journalism and the world of breaking news.

From day one, I was thrown into the deep end. My editor called me during my fellowship orientation and asked if I could cover the American Diabetes Association conference. I felt slightly worried about my inexperience, given that I had never written a print article in my life (and no, academic manuscripts don't count). But I went along with it.

The morning of the first day, he told me to attend the sessions, find stories of interest, and write two pieces by the end of the day, each about four or five grafs. Revealing that I was still in physicist mode, I embarrassingly thought he meant "graphs" like figures or plots.

When I realized he meant paragraphs, more panic set in. Wait–I don't even know the difference between Type I and Type II, and I'm expected to find two compelling diabetes research topics to write articles on, all in the span of a day?

After the last talk wrapped up, around 5 p.m., I headed back to the office with frantically scribbled notes from the one session that I could actually understand, about ways to reduce one's risk of developing Type II diabetes. I started writing up whatever I had, and an hour later, my editor yelled out that I needed to "put the pedal to the metal" and start finishing up.

Meeri Kim

Heart racing, I realized, I could sit here and freak out or just get this done. And you really don't have a choice–you get it done because, in the news world, you HAVE to. So you panic at first, but then it dissipates because you become too preoccupied with finishing your piece to notice.

In the span of the next half-hour, my stories were checked over, edited, and posted online. As opposed to research, the news world has the ability to provide instant gratification. In the span of several hours, a story idea turns into a capsule of information released into the public sphere.

And just as quickly, you move onto the next. There's no resting on your laurels in journalism, said one editor. I ended up with a total of five posts from the conference and by the end of the third day, I was so deliriously hungry and tired, I couldn't find where I parked my bike for 15 minutes.

But that crazy first weekend gave my editor some faith in me, I think. Not to mention, I had a bit more faith in myself.

For the next ten weeks, I worked on a mix of breaking news stories and longer articles, with three ending up on the front page. I shot and edited three web videos, covered a Michelle Obama event complete with White House press pass, and interviewed Michael Moore, Ezekiel Emanuel, and Wendell Potter. I had a brief foray into investigative journalism. Oh, and a therapy dog took my socks off.

All in all, a wonderfully unpredictable summer. I learned something new every day and never had more fun–while working so hard–in my life.

BLEWETT continued from page 5

tures of different metal hydrides at Argonne National Lab, just outside Chicago. She found the materials interesting, because several could be used for rocket fuel and energy storage. She helped look for ways to substitute other materials for hazardous beryllium.

"As a basic physical scientist, I am excited about how things work at the atomic and subatomic levels," Sampath said. "I would definitely think that the next logical step in my mind is to use that information to apply it to some useful materials for society."

Sujatha Sampath

She got married while employed as a postdoc, and her husband took a job with General Electric Healthcare, located two hours north in Milwaukee. For a while she stayed in Chicago, then moved to Wisconsin to join him, and drove down to her lab for the week.

"Being an experimental scientist I had to be in the lab," Sampath said. Ultimately the hours spent in the car driving between the two cities took their toll. "The commute wore me out."

After her grant finished up, she started looking for jobs in Milwaukee, but had a hard time finding a full-time spot. She started working at a series of temporary and part-time positions. Her background working with high intensity X-rays helped her get involved with different research projects at Argonne again. One was studying protein folding, and another was collaborating with researchers at the University of Wyoming who are trying to understand and replicate spider silk.

"Spider silk is an amazing biological material. For the same length and diameter, it's stronger than steel and much more flexible than most manmade materials like Kevlar and nylon," Sampath said. "It all comes down to how the nanostructure in the spider silk is arranged… and that is still something that is not well understood, and that is why they came to us."

At the same time, she kept looking for a job in Milwaukee. Eventually in 2010 she was able to get a temporary position at the University of Wisconsin-Milwaukee working at their synchrotron for research using X-ray diffraction to study excess charge in layers of zinc oxide and magnesium oxide.

She still has a lot of leftover data from her work on spider silk, and she hopes that with the Fellowship, she can work to get some of that finished up.

"There is still a lot of work that needs to be analyzed and published," Sampath said. "I am hoping to publish all my data acquired so far."

She is also looking to keep expanding her skill set. The University of Wisconsin-Milwaukee is getting a new electron microscope soon, and Sampath is hoping to master another important piece of equipment.

GRANT continued from page 1

ect that focuses on physics teacher education, run collaboratively with the American Association of Physics Teachers. The APS-BP anticipates issuing a request for site proposals in October.

The APS-BP is also partnering with doctoral granting institutions to provide transitional support as bridge students begin doctoral studies. "Ideally, we would like to support students through a network of mentors, advisors, and graduate student peer-mentors from the start of their bridge years until they earn their PhDs," says Bridge Program Manager Peter Muhoro. "The program aims to strengthen mentoring and work with faculty to improve the graduate education environment."

Other components of the new program include: conferences with topics on graduate mentoring, improving students' graduate applications, and other topics relevant to students and faculty; building a national network of institutions committed to improving diversity in graduate education; and publicizing good practice in attracting and retaining underrepresented students in graduate programs. "APS is uniquely positioned to facilitate national conversations on improving diversity in graduate education and to connect institutions with others committed to the same goals," said Theodore Hodapp, Director of APS Education and Diversity, and project director of the Bridge Program.

Program management spent several years visiting minority-serving and doctoral-granting institutions to build relationships and assess the best methods of increasing the number of minorities who receive PhDs. The APS-BP decided to base its efforts on existing bridge programs, including those at Fisk-Vanderbilt, Columbia University, MIT, and University of Michigan.

Cherry Murray–Dean of Engineering and Applied Science at Harvard University, chair of the Bridge Program's National Advisory Board, and 2009 APS President-led discussions with APS and other leaders in STEM education that culminated in the successful NSF proposal. Murray says the program will create a network of institutions that can share best practices in mentoring URM students through the degree and beyond who may not have considered pursuing a PhD in physics.

"These best practices will raise the level of collegiality and mentoring of all students in these PhD programs, and the cadre of student recruits to this program will help to enhance our scientific workforce," Murray said.

More information is available on www.APSBridgeProgram.com.

FUNDING continued from page 1

trino detector located several hundred kilometers from a powerful neutrino beam originating at Fermilab. It would try to find the mass hierarchy in neutrinos, as well as look for evidence of charge parity (CP) violation. If the detectors are located underground, LBNE could also look for evidence of proton decay and neutrinos from a supernova.

The experiment has had a history of financial trouble. Initially, it was conceived as part of a large underground laboratory called DUSEL in the Homestake mine in South Dakota. In December of 2010, the National Science Foundation backed out of the project, and the research was pared to three major underground experiments at the mine, including a dark matter detector and one to look for neutrinoless double beta decay. The Department of Energy balked at the almost $2 billion price tag, and the other two experiments were dropped.

On August 6, the LBNE Reconfiguration Steering Committee issued its report, which recommended building a 10 kiloton argon surface detector in South Dakota, and a new beamline at Fermilab. The committee had been charged with evaluating different locations and configurations for the experiment.

The estimated cost for the committee's preferred option is about $789 million, with an additional $135 million for locating the detector underground. The other two major options, including a 30-kiloton surface detector at Ash River in Minnesota, and a 15-kiloton underground detector at the Soudan Mine in Minnesota, are both about $100 million cheaper, but have a more limited scientific scope.

"$700 million doesn't give you much physics at all [at Homestake]," said Young-Kee Kim, a physicist at the University of Chicago, and chair of the report committee. She noted that "a longer baseline allows complete separation between matter and CP effects."

Scientists are pushing hard for the Homestake site because it would produce the clearest final results of the three sites. Neutrinos change types as they fly at near the speed of light, a process called oscillation. Recent results from China's Daya Bay neutrino detectors indicate that Homestake's location would put it at an ideal spot for observing the most dramatic changes in neutrino composition. The 1300 kilometers between Fermilab and LBNE gives neutrinos enough time and distance to substantially change how many of each kind there are in the beam. The other two possible sites would still be able to detect some neutrino change, but at a lower confidence level.

Homestake would also be able to better differentiate differences in oscillation between neutrinos and anti-neutrinos. Scientists hope to use this information to look for evidence of CP violation, which would help explain why matter came to dominate antimatter in the early universe.

The DOE's final decision will come sometime in the fall. The representatives at the HEPAP meeting from the administration were non-committal about which plan they thought had the best chance of being funded.

"I see this LBNE thing as something we really want to do, but if we can pull it off is another story," said Bill Brinkman, head of the DOE Office of Science. He added that top priorities in the Department of Energy have been related to energy conservation and combating climate change. "When we, myself and [Secretary] Steve Chu and other management, start to think about budgets, we tend to start to think about this first."

Jim Siegrist, head of the DOE Office of High Energy Physics, said that in recent years, there was an unusually strong emphasis on research, and that was likely to change.

"We have under-invested in new facilities in the recent past. Correcting this will squeeze research for several years," Siegrist said.

Fermilab has been counting on the project to be its new flagship experiment. After the Tevatron was shuttered last year, the lab had hoped to upgrade the accelerator's old main injector for LBNE, using it to fire the 1300 kilometer beam of neutrinos at the distant detectors. Early plans had a new "near detector" at Fermilab to measure the beam at its source; however, this is now unlikely to be built until later in the project. The lab is in the process of gearing up to refocus itself more towards neutrino research.

"Neutrinos have surprised us in the past and I believe they will continue to surprise us," said Stephen Parke, a physicist at Fermilab.

Members of the steering committee said they were in talks with foreign nations that might be interested in contributing funds to the program. Kim said that they had been talking with India, Italy and the United Kingdom, but it was likely that the European nations would want to wait until the European Strategy for Particle Physics for the next several years is agreed to before deciding to contribute to any project. Kim said that they are hoping to hear from India's government before the end of the year.

OPTICS continued from page 1

the efficiency and lowering the costs of LEDs to replace traditional light bulbs, and for developing new defense technology for surveillance, space communication and laser weapons.

The speakers presenting the report at the briefing also highlighted the economic impact that optics and fundamental research have already had on society.

"Optics and photonics have become established as enabling technology for a multitude of industries vital to our nation's future," Willner said. "The internet as we know it wouldn't exist without photonics."

Paul McManamon, technical director for the Ladar and Optical Communications Institute at the University of Dayton and co-chair of the committee, elaborated on the point.

"If it wasn't for the [optic] fibers, you wouldn't be downloading music, because you couldn't get the bandwidth," McManamon said.

Baer emphasized the medical benefits of optics and photonics research.

"New procedures have the potential to lower costs and increase our life spans," Baer said. He pointed to scanners that can show detailed images of cancers and other disease. "With a CT scan, we now have a very accurate 3-D model… of the inner structure of the human body."

The committee has at least one member of Congress supporting their proposals. Rush Holt (D-N.J) spoke before the presentation, and emphasized the importance of investing in science.

"The reason we are discussing optics and photonics today…is to make the case, the policy case, that we should be investing more in research and development," Holt said. "Research and development can put people to work in the short term as well as provide benefits in the midterm and long term… It is money well spent."

The report was prepared by the National Research Council, an arm of the National Academies. Earlier in the day, a separate briefing was held in downtown Washington for members of government agencies and policy makers, at which the featured speakers were former Intel CEO Craig Barrett, and Secretary of Energy Steven Chu. Both events were cosponsored by the APS Division of Laser Science, in partnership with the Optical Society, SPIE, and IEEE-Photonics.

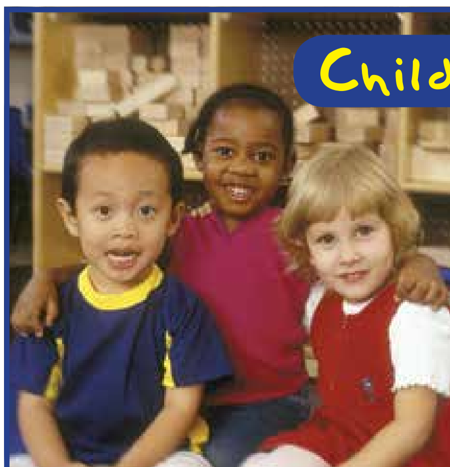
EDITOR continued from page 1

fications and broad research interests that the *PRE* editorship requires," said Gene Sprouse, APS Editor in Chief. "His prior involvement with *PRE* and his strong editorial experience with other journals were also very compelling."

Physical Review E is the APS journal covering statistical, nonlinear, and soft matter physics. Ben-Naim is a theoretical physicist whose own research has focused on the nonequilibrium statistical mechanics of interacting particle systems and its application to soft matter and complex systems.

ANNOUNCEMENTS

Childcare Grants Available



What: Small grants of up to $400

Who is eligible: parents/caregivers who plan to attend the APS March or April meeting with their small children or who incur extra costs to bring them along or leave them at home. Preference is given to early career applicants.

Deadline:
January 4, 2013 (for March)
February 1, 2013 (for April)

Details at www.womeninphysics.org

Reviews of Modern Physics

CODATA recommended values of the fundamental physical constants: 2010

Peter J. Mohr, Barry N. Taylor and David B. Newell

This review of the fundamental physical constants and conversion factors of physics and chemistry provides recommended values and their associated uncertainties. The set of values replaces the previous CODATA set of 2006. Since then new data became available which have led to important adjustments of former values. Furthermore, for future evaluations of the fundamental constants the authors emphasize by way of several examples the desirability of having from experiments not only multiple results with competitive uncertainties for a given quantity but also having one or more results obtained with a different method.

http://rmp.aps.org

4th Annual Colorado Learning Assistant Workshop

October 28-30, 2012

University of Colorado, Boulder

Registration is open

The Learning Assistant program is a highly supported peer teaching experience that has been shown to improve students' learning and attitudes toward science in undergraduate lecture classes and recruit talented science and math students into teaching careers.

Physics Teacher Education Coalition

www.ptec.org/conferences/CULA12/

Learning Assistant Model

Professional Skills Development Workshops FOR WOMEN PHYSICISTS

WHEN:
March 17, 2013 - Baltimore, MD
April 12, 2013 - Denver, CO

DEADLINES TO APPLY:
December 7, 2012 (for Baltimore)
January 11, 2013 (for Denver)

See http://www.aps.org/programs/women/workshops/skills/

PITFALLS continued from page 1

only proven way of providing that insurance both to ourselves and to the community is peer review."

He added that APS is not opposed to open access, and has enacted several policies allowing for greater public access to the journals. Procedures are in place for both public libraries and high school libraries to freely access the full content of APS journals, a benefit that many such libraries have taken advantage of. APS allows authors to post the published version of their articles either on their own websites or those of their institutions. In addition, authors can purchase open access for their papers, for a fee that reflects the costs of evaluation and publication.

In recent months, the British government announced a new policy requiring research conducted with government funds be made freely available to the public. In the US, the White House's "We the People" petition website has collected more than 30,000 signatures calling for federally funded research to be posted freely online.

"It's a very powerful…populist message," said Michael Lubell, APS's Director of Public Affairs. But he cautioned that there were possible unintended consequences, pointing out that the public itself is the ultimate beneficiary of the existing peer review system.

"We require the FDA to make sure drugs on the market are effective and not harmful," Lubell said. "The same kind of logic should apply to scientific publications. Peer review provides that public good."

Keeping the peer review system intact while making science more freely available has been a tricky issue to resolve. Serene pointed to *Physical Review D*, APS's journal covering particles, fields, gravitation and cosmology, as a sort of test case for what can happen to a journal when its content is widely available for free on the web. He estimated that nearly 98 percent of the papers in it are available in some form on the open access preprint server arXiv.org, hosted at Cornell University. Presumably as a result, downloads per paper from the journal website itself are roughly a third of those for the other *Physical Review* journals, a trend that started when the preprint server came online. Subscriptions to *Physical Review D* haven't declined significantly, however. Serene surmises this may be because libraries usually subscribe to the journals as part of a package, and wouldn't save much money by dropping a single title.

One frequently discussed business model is for journals to forego subscription revenue altogether and switch to an "author pays" model. Under such a system, the authors of every paper published would have to pay the additional fees to make their papers open access, and to cover the cost of processing, between $1700 and $2700 for APS journals.

However Lubell said that such a system would likely have a disproportionate impact on smaller research teams and theoretical physicists. A few thousand dollars for publishing costs would be a much bigger portion for a lone researcher with a grant in the tens of thousands of dollars rather than a giant research team with hundreds of thousands or millions of dollars.

"You're going to have less money in your grant to pay for other things," Lubell said. He estimated the physical sciences would need an infusion of two to three billion dollars to make up for these new publishing fees, an amount Congress is unlikely to appropriate in the near future. Lubell added that such a system would create an incentive for researchers to publish in less reputable or widely distributed journals, because they would be cheaper.

A consortium based at CERN known as SCOAP3 is working on an open access business model strictly for high-energy physics that would fundamentally alter how journals get their revenue. The consortium has been seeking agreements from research libraries to take the money that they currently spend on certain high-energy physics journals and pool it into a single fund. That fund would then be used to buy open access rights to all high-energy physics articles in those journals, making them free for anyone to read or reuse, without putting an undue burden on researchers or journals.

"It's a large scale worldwide collaboration to transform the publishing outfit of a particular discipline, in this case particle physics," said Ivy Anderson, the director of collections at the University of California's digital library and one of the organizers of SCOAP3's founding meeting at the University of California, Berkeley. She added that the goal of the organization is to ultimately bring the cost of journals and peer review down for libraries and for researchers who can't afford access. With a budget of about 10 million Euros worldwide, its organizers hope to bring the consortium online in January of 2014.

"I don't think that it should have negative effects on peer review," Anderson said. "There's certainly not any intention to disadvantage any of the players in the current ecosystem."

The plan is audacious, and many publishers are willing to give it a chance to work. However, there are reservations about how sustainable such a fund will be, or even if it will ever get off the ground.

"I have some supportive skepticism," Serene said. "I'm afraid there's an instability problem with it because there's no tangible cost to a library that withdraws."

He pointed to the classic "free rider" problem in economics. A university, if faced with a tight budget, could drop funding of the program, but still have access to all the same information. If enough institutions do this, the consortium wouldn't be able to pay for the open access costs of the journals, and the system would collapse.

Serene raised other concerns as well. He said that without knowing how concrete the agreements SCOAP3 has with its libraries are, it's unclear how much of the claimed 10 million Euros will actually materialize. In addition, with its current budget, SCOAP3 has not been able to include the more influential and expensive journals, such as *Physical Review Letters*.

The way libraries are funded in the US makes it difficult to follow the model that Britain recently announced. After recommendations by the government-appointed Finch Commission, the British government has pledged £10 million to researchers to buy open access rights for their journal articles.

It's not clear how much this will benefit libraries. Most papers are from researchers outside of Britain, meaning the libraries would still have to subscribe to the same journals in order to get access to all of the research from abroad. In the US, library funding and research funding sources are much more diversified, spanning different federal agencies, state and local governments as well as private institutional support, so rerouting money from libraries to researchers is logistically much more difficult.

"Our authors and subscribers are very international too," said Gene Sprouse, APS Editor in Chief. "We want everyone who needs our journals to be able to access them. We keep our prices low and strive to keep quality high. Open access is wonderful, provided that it doesn't compromise our ability to fund the peer review process."

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be," but rather a vacuum filled with wonders: electromagnetic radiation, including that from the last gasp of the Big Bang; a sea of virtual particle-antiparticle pairs; a space bent out of shape by gravitational warping–all unimaginable to earlier physicists.

Following his work on the barometer, Torricelli did research in mathematics and physics. His formula for the efflux of a liquid from a small orifice in a container is still known as Torricelli's Theorem. He died in Florence in 1647, at the age of thirty nine. A commemorative statue of him was erected in Faenza in 1864.

The Back Page

Why Communicate Science?

By Carl Safina

By "communicate science," I mean professional scientists explaining something about science to non-scientists. My question is, "Why?" But many scientists are still debating *whether* we should; many see why they should not.

Communicating science takes time away from research, from teaching, from being home; from something else we need to be doing. The time is not adequately compensated. Doing interviews with reporters, or visiting legislators, has no assigned "impact factor" that boosts vitae-value. Appearing on the radio or TV or in the news, giving talks to civic groups, writing op-eds or articles geared to "popular" audiences, or even a translational book for the general public; all count little, sometimes nothing, towards tenure. Sometimes they actually hurt. Communicating science can be seen as unprofessional. Peers may think less of you. It may seem absurd that many scientists would think it unprofessional to explain science, but that thinking is a fact in academia. And anyway, communicating is the job of communicators such as professional science writers.

All the above reasons not to communicate science are valid. Next question: Are those reasons sufficient? Charles Darwin and Albert Einstein apparently didn't think so. Granted, we're not them. We all juggle priorities and make compromises on how we can and must spend our time. But it's my conviction that scientists should elevate communicating science as something important and worthwhile. That brings us to "Why."

Some scientists believe we should communicate because public support is crucial for continued public funding. That's circular and self-serving. In the long run, it's likely self-defeating. Simply explaining that the space program resulted in such marvels as Tang and Teflon–two oft-cited benefits of science that, in fact, everyone can live without–doesn't adequately elevate the power of science above everything else vying for public money, such as military spending, bank-bailouts, infrastructure, etc., etc.

I believe it's important for people to get to know scientists as people, as members of civil society in their communities. And I believe the message is not one of facts, nor reports about the latest research, but of the overarching and deeply penetrating grandeur of science: how it uniquely has the power to unlock the secrets of life and the universe–and how scientific thinking can help people evaluate claims, think for themselves, and demand proof.

People Need What Scientists Have; Scientists Need People to Have it. Science is the human mind's greatest invention. It is the *only* endeavor designed to find out what is really going on in the world. It is the only system of thought and action capable of unlocking secrets of the universe.

Compared to the power of science, the workings of law, politics, and business are just so much fooling around. Take out the subjectivity and compromise in law and politics, remove the money from business; you're left with ideology and stuff to sell.

What passes for professional conduct in law, politics, business, and religion lets practitioners just cherry-pick the fragments of argument that support their narrow, often short-term, self interests, and–rather incredibly–to forcefully argue them!

> **"Compared to the power of science, the workings of law, politics, and business are just so much fooling around."**

To succeed, people in law, business, and politics must sometimes resist or hide the truth. In popular obsessions like sports, fashion, and celebrity, truth isn't even part of the equation

Science wields objectivity in an elevated search for truth. In every other endeavor, people of different genders, faiths, parties, ethnicities, or economic backgrounds are bound to differ. But in a science lab, if Palestinian and Israeli scientists do their work right, they will get the same result. If Democrats and Republicans repeat the procedure, they will get the same result. That is true power. There's nothing else like that.

Science teaches people to be skeptical of claims. In fact, a scientific approach–using information to sort through one's own biases, and demanding proof as a way of evaluating conflicting claims–is necessary for good citizenship. It is necessary for avoiding being preyed upon by people with ambitions, ideologies, and advertisements.

Scientific thinking requires us to consider all available information bearing on a question, to face the possibility that even our own best guess was wrong, and to advance what we know even when it's different than what we thought we knew. *Scientific thinking* is what everyone could use.

By being ferociously honest, science has given us real comprehension of our place in the universe, in time, and in the splendid pageant of life. Science has curiosity, self-motivation, and the quest for what's real. Science is often magnificent, and occasionally–let's face it–truly awesome.

But few people know any of this.

Scientific Thinking in Decision-making. Science–being the collective endeavor of scientists–isn't perfect. Scientists are people. People make mistakes. Scientists have egos, jealousies–science is human. But science is an attempt to avoid what's worst about being human and to bring out what's best. It doesn't have the hubris to think it knows everything. It holds no dogma. It is a system for working around bias and cutting through preconceived notions and prejudices.

As science progresses through time, it has a strong tendency toward correcting its misperceptions, accepting those corrections, and spiraling in on the truth. Indeed, science may already have found some absolute truths about major aspects of reality, such as laws of physics, chemical principles, geological history, and biological evolution. Perhaps best of all, science inhabits the frontiers of great mysteries and great questions: where did we come from, where are we going.

Science has limits. Science can't answer moral questions such as whether we should allow gay marriage or mandate racial equality, or when a "human life" begins. But it is uniquely able to factually inform those debates.

> **"Many scientists believe they should avoid 'advocacy.' But that in itself is advocacy, because the word 'should' implies that you're advocating something."**

Since science tries to honestly know what's going on, and good decisions require at least that, scientists are often those best-informed to advise society on what should be done. Academic scientists, particularly, are the closest thing civilization has to a non-biased reservoir of truth.

Many scientists believe they should avoid "advocacy." But that in itself is advocacy, because the word "should" implies that you're advocating something. If scientists decide not to engage, less-informed policy makers, pressured by less-objective advocates, will make decisions anyway. They'll often do so without the benefit of the best advice they might have gotten, or without anyone arguing on behalf of the facts.

Here's the problem: Virtually no one outside of science understands why and how any of this matters. Inside of science, hardly anyone gives it a thought, nor realizes the exceptional value that *scientific thinking*, not just scientific findings, would have in wider society.

If we choose not to communicate what we do, who we are, and the power of scientific thinking, then our work, and the value of scientific thinking, will be too easily ignored. Long-term results include a lack of societal support for science, and society suffering the consequences of bad decisions. As we see.

Inequalities of Perception. Science can seem the most simultaneously trusted yet feared profession–and the most ignored. Gallup annually polls people on their perceptions of various professions with the question, "How you would rate the honesty and ethical standards of people in these different fields?" The fields given include everything from nurses to business executives to telemarketers–but not scientists. Scientists seem to be off people's radar. But when the National Science Foundation asks specifically, the public accords scientists "a great deal of confidence" and "very great prestige."

Yet there's a chasm. Science is a factor in many things people use and do every day, yet virtually no one knows a living, working scientist–or can even name one. Search the Web for the phrase "can you name a scientist?" and in the sites that come up you'll discover: • about half of Americans can only muster Albert Einstein, a quarter can't name anyone, and respondents in the single digits mention Marie Curie, Louis Pasteur, and Thomas Edison. • When asked to name a living scientist, two-thirds of Americans can't name anyone at all, 15 percent name Stephen Hawking, and 19 percent name other people, mostly those who've been on TV a lot.

My impression of the problem, in two sentences, is that scientists ask: "Why don't people care about science?" Non-scientists ask, "Why don't scientists care about people?" When Pew looked into this issue, they discovered that, "Public Praises Science; Scientists Fault Public" and that "While the public holds scientists in high regard, many scientists harbor unfavorable assessments of the public's knowledge." This relationship between science and society is not a healthy one. And since the public seems to be expressing a certain amount of unrequited love, it behooves scientists to pay more attention.

> **"When asked to name a living scientist, two-thirds of Americans can't name anyone at all."**

Why Scientists Need to Engage. When I was in grad school working toward my PhD in ecology, I was told by a member of my own PhD committee that doing applied work toward solving problems in society, "is for people who aren't smart enough to get a PhD." Did they mean I was not smart enough? Should I prove how smart I am by not being concerned about the world's problems? Apparently so, because later, a professor at an ivy-league school told me–with apparent pride–"We solve puzzles, not problems." Well, that's the ivory tower for you. But even in the ivory tower, the rent comes due.

By estranging itself from people and problems, science suffers a perception of irrelevance–a perception science itself too often chooses. To the extent that scientists think they're above society's problems, and academic institutions give no credit to the communication activities of faculty members, and scientists cast aspersions upon colleagues who try to engage with decision-making in the wider world, that is the extent to which science helps facilitate dilemmas that it could help to solve. In practice, science cedes to less benevolent interests much of its own power to help guide society.

Good communication skills are learned, but talent and instinct are also involved. While I do think we have a responsibility to share what we know, it's not for everyone. On this, one has to be one's own judge. Some people are best as teachers, others add illumination to hotly debated issues such as climate science. The important thing is to find the right fit, and feel the right balance, for you. But the other important thing is: do something. Wield the knowledge, the value, or just the informed perspective that you have.

So What's the Message? So what messages should scientists "communicate?" Many scientists assume that to "communicate science" would be to translate scientific findings, putting journal articles into plain language in a press release, in case anyone's interested. And sometimes it is. But that's not what I'm getting at.

I'm getting at something less prescriptive, more amorphous, more persistent and more penetrating. I'm saying that scientists should be a much greater presence in society, should be brighter on the public's radar, and that how, exactly, we do it, is up to each of us.

Don't think you need to teach the public a lot of science facts. Instead, show what science is, what it means, why we need it. Find a way to have a *presence*. Choose what to comment on, how to be involved, and what actions and issues to engage in. Be a source of wisdom.

The public doesn't need to keep up-to-date on journal publications. What people do need to know is that scientists are people, that science is an honorable, trustworthy, and powerful endeavor that people should look to for answers, and as a way to help think through decisions. Every child asks, "Why is the sky blue?" People need to know that scientists are the ones among us who never stopped asking that question–and who found the answer.

I'd like to see more civics-minded scientists, because the society that we live in needs more science-minded civics. In my ideal world, I'd like the public to hold impressions as friendly as, "Science–there's nothing like it;" questions as persistent as, "Got science?;" and messages as simple as, "Science: it's what's real." It would help us all if people felt good about scientists and knew that they can look to science for answers and informed opinion. People can't do that without our help.

Mainly, people need to know we're here. And that we do have something pretty special to share.

Carl Safina is founder of Blue Ocean Institute at Stony Brook University, where he also co-chairs the Center for Communicating Science. He has won the National Academies' Science Communication Award, Lannan Literary Award, Orion Book Award, Pew and Guggenheim fellowships, the John Burroughs Medal, and a MacArthur prize. He is author of six books and will host the upcoming series Saving the Ocean on PBS television.