Reflections

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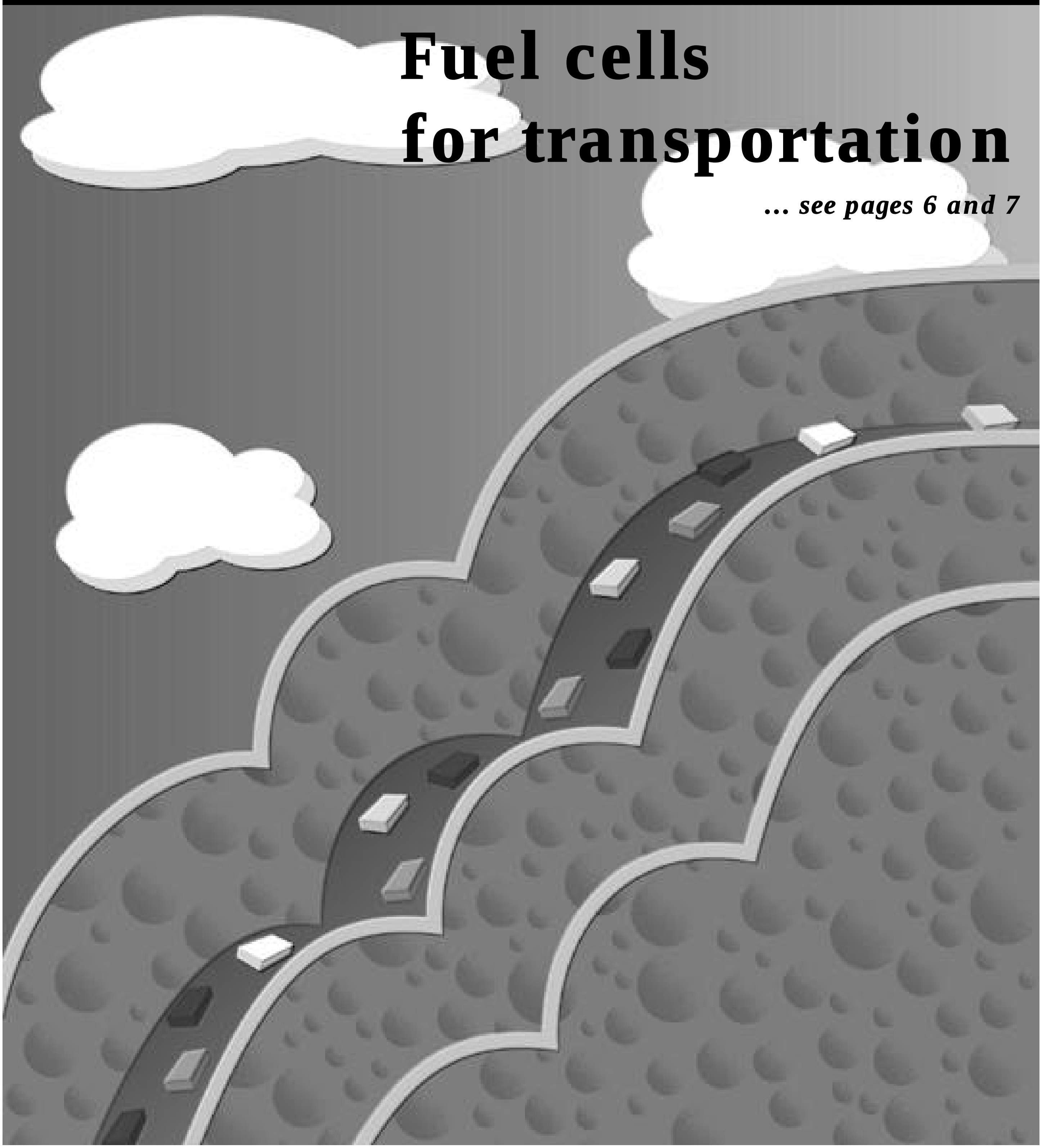
Fuel cells for transportation

... see pages 6 and 7



Inside this issue ...

Cover illustration by Edwin Vigil

Reflections

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editor's journal

Here's to successes

Heading into the homestretch year of the twentieth century, it's hard not to think about the new millennium and the challenges facing the Laboratory as it continues its core mission of enhancing global nuclear security and its ever-present goals of quality science and "safety first."

But rather than look ahead, I'd like to briefly look back at the past year and note what I think are some of the Lab's finest scientific accomplishments. There were numerous Laboratory achievements and awards during 1998, many of which were featured in the Jan. 4 Daily Newsbulletin (http://www.lanl.gov/newsbulletin). What I am noting here are only some of those achievements that caught my attention.

For instance, a recent attention-catching accomplishment was having the world's fastest computer with the world's most powerful advanced graphics system at the Lab. Last November, the Blue Mountain computer, which was developed with Silicon Graphics Inc., ran Linpack, one of the computer industry's standard speed tests for big computers, at 1.6 trillion operations per second. Blue Mountain is the latest advancement in the Department of Energy's stockpile stewardship program, which uses science-based methods to assess and certify the safety, security and reliability of nuclear weapons without underground nuclear testing.

And how about water being on the moon? Last March NASA announced there was evidence of the presence of frozen water on the moon from Lunar Prospector, a mission for which the Lab provided three scientific instruments — a neutron spectrometer, gamma ray spectrometer and alpha particle spectrometer. The data that pointed to the presence of water came from the neutron spectrometer.

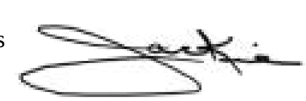
I also was fascinated with the multiton magnet powered by a billion-watt generator that was commissioned at the Laboratory last August. The 60-tesla magnet is capable of creating powerful, pulsed magnetic fields for a longer period of time than any other in the world. High magnetic fields offer scientists one of the most effective and noninvasive tools to explore basic and new materials critical to modern technology.

I always like to keep track of how the Lab's doing with R&D 100 awards, which are given for new technologies and scientific breakthroughs that have commercial potential. In 1998, we received four R&D 100 awards, bringing our total to 56. The awards were for Cyrax, a portable, three-dimensional laser mapping and imaging system; Low-Smoke Pyrotechnics, which combine an energetic nitrogen-rich fuel with nonmetallic oxidizers and extremely low levels of metal coloring agents to produce clean flames that generate virtually no smoke or ash; SOLVE, the first expert system that produces three-dimensional pictures of protein structure by automatically filling in missing information in X-ray crystallography; and Underground Radio, the first portable radio receiver able to support two-way voice communication through hundreds of yards of solid rock.

Another notable achievement, in my opinion, was the Laboratory's Influenza Sequence Database. Medical researchers around the world now can tap into the world's most comprehensive collection of genetic information about the influenza virus. The new database will help scientists understand how the flu bug mutates and will aid in the development of vaccines.

The Lab's scientific high points last year were not limited to research. We garnered a renowned scientist and Harvard professor as the new deputy for Science, Technology and Programs. Bill Press, who takes over as Director John Browne's principal deputy this month, is featured on Page 4 of this issue.

I wish I had more space to laud the many Laboratory accomplishments of the past year, both scientific and nontechnical, but I will say the Lab had its fair share of successes in 1998. And here's to even greater successes in the new year.



Doctor's office on wheels

Debrot Receconi, right, a licensed social worker, talks with two students inside the waiting area of the Healthy Tomorrows mobile medical unit at Cesar Chavez Elementary School in Santa Fe. The Santa Fe Public Schools used private funds and a Frost Foundation grant to retrofit a donated mobile home into the mobile medical vehicle. *Photo by Steve Sandoval*

by Steve Sandoval

Schools are a place where children go to learn. But they can't learn if they aren't in class because of illness.

Thanks to private resources and the assistance of the Laboratory, children at four of Santa Fe's public elementary schools are receiving the health care they need to stay in school without ever having to leave the campus.

The Healthy Tomorrows mobile medical unit is a retro-fitted motor home that was purchased by the Santa Fe Public Schools to serve as a sort of doctor's office on wheels, said Marcie Davis, director of student wellness for the 13,000-student school district. It was rolled out in November amid much fanfare during a public ceremony at southside Cesar Chavez Elementary School.

The motor home will travel to Salazar, Sweeney, Agua Fria and Cesar Chavez elementaries, spending one day a week at each school.

Davis said the four schools were selected based on family income levels of students in those schools. She explained that more than 60 percent of the students in the schools are from families whose annual income is less than $20,000.

"We want all the kids to come to school healthy and ready to learn," said Davis. "Healthy Tomorrows will be an onsite program that can provide medical assistance to these kids and their families."

The 36-foot, state-of-the-art medical mobile unit was sent to Specialty Vehicles and Equipment in Mesa, Ariz., a Phoenix suburb, where it was retrofitted. The private Frost Foundation donated $250,000 to help pay for the motor home, retrofitting and the health professionals who will staff the mobile-medical unit.

An anonymous donor gave $100,000 to purchase the motor home. St. Vincent Hospital is providing funds to pay for a registered nurse, while Presbyterian Medical Services is paying for a physician, said Davis. And the state Department of Education also provided a $100,000 grant to help fund a before-school and an after-school program for students at Cesar Chavez Elementary, which is part of the Healthy Tomorrows program, Davis said.

The city of Santa Fe provided $5,000 to pay a portion of a social worker's salary, while other agencies also provided some funding.

Walk inside the spacious mobile medical unit, and you find two fully equipped examination rooms, scales for weighing students, a waiting room where nurses can record health information, two refrigerators for storing foods and medicines, a microwave, a telephone and fax machine, three sinks, and a video cassette recorder and a television on which students can watch instructional health videos or videos to keep entertained while waiting to see the registered nurse or doctor, said Davis.

The Lab became involved in Healthy Tomorrows after Santa Fe Schools Superintendent Edward Lee Vargas spoke with Laboratory Director John Browne about the school district's plans, said Chuck Pacheco of the Lab's Community Relations Office (CRO).

The Laboratory provided several computers to store information and some educational software for young children, said Dennis Gill of the Lab's Science and Technology Base (STB) Program Office.

"This is part of the Lab's educational outreach program," said Gill. "It's important for us to help communities in any way that we can. And this is a way that we can. They came to us and asked for help."

The Lab's Science Education team in STB also developed a World Wide Web page for the Healthy Tomorrows program — it can be found at http://set.lanl.gov/healthy — according to Dolores Jacobs of Science Education. She noted that the web page also is linked to a University of California online education technology program called "UC Links." Science Education also provided some "Science at Home" books to the school district.

"The Lab is an integral part of the program," said Davis. "We're looking forward to a future partnership with the Lab."

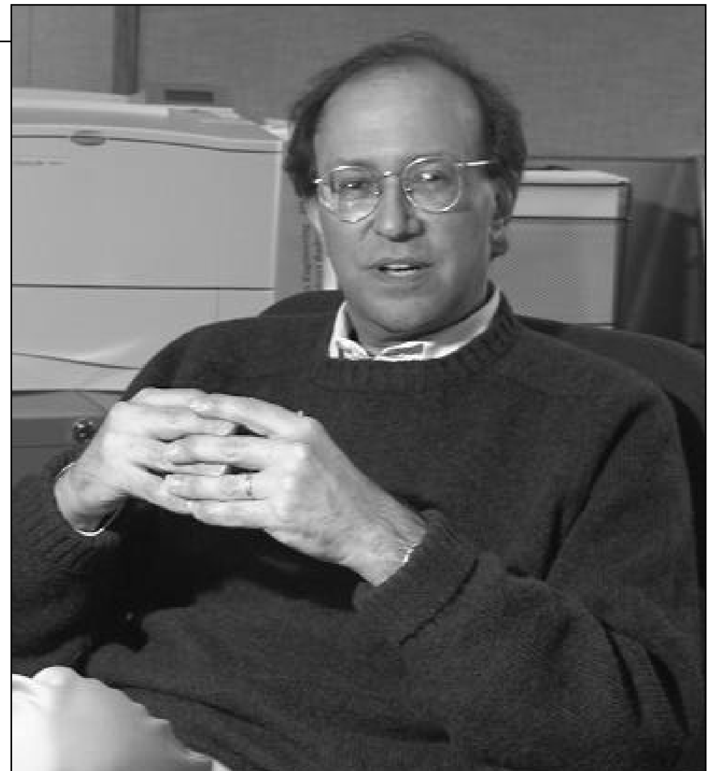
The Healthy Tomorrows staff includes Vida Tapia, an intake specialist; Debrot Receconi, a licensed social worker; Julie Salazar Fode, coordinator for the program; Jewel Cabeza de Vaca, parent outreach coordinator; and registered nurse Maureen Ramirez.

Other partners in the Healthy Tomorrows program include the city of Santa Fe, state Health and Education departments, the Santa Fe County Maternal and Child Health Planning Council and La Familia Medical Center in Santa Fe.

For more information about the Healthy Tomorrows program, call Davis at 954-2004.

William Press
New kid on the block

by Bill Heimbach



William H. Press

Like the typical new kid on the block, William H. Press spends much of his day absorbing new things until they become familiar.

He's permanently settled in as the Laboratory's No. 2, behind Director John Browne, after four months of gathering frequent-flier miles commuting from Cambridge, Mass., to Los Alamos.

The significance of an outsider running the sometimes insular Laboratory during the frequent on-the-road absences of Browne are not lost on the Harvard- and Caltech-educated Press.

"I think that John Browne has taken an unusual step in bringing someone in from outside to be his right-hand person," says Press, whose title is deputy Laboratory director for science, technology and programs. "I'm pleased and honored that it's me.

"My understanding with John is that I will learn to think as he thinks and make similar decisions to those he would make, when he is away on travel and I'm back here. In that sense, I'll be his shadow and alter ego as principal deputy director," Press explains.

> *"My first priority is to do a lot of listening. I am looking forward to getting out and hearing people's views, not just about this week's or today's challenge but about the long-range strategic view on where the Lab should go."*

"My first priority is to do a lot of listening. I am looking forward to getting out and hearing people's views, not just about this week's or today's challenge but about the long-range strategic view on where the Lab should go.

"I think the working scientists, engineers and technicians will in the end have more influence on the long-term direction of the Lab than the upper management will have, because it's these people who have the creative research ideas and generate the sparks that will move us in major strategic directions," he says. "My principal priority is to help that process and make sure good ideas filter up and get championed by management at all levels."

Press was the youngest tenured professor at Harvard at age 27. Now, more than than two decades after that honor, he brings to Los Alamos a solid reputation in scientific achievement and national-security expertise.

"I came here after a long time in academia, but at the same time I have served in advisory and consulting roles in the nuclear complex and a number of Department of Defense agencies," Press says. "Up to now, the main line of my career was astrophysics and computational physics, with a strong sideline of national security issues and advising governments. Now, the main line and sideline will be exactly reversed."

Press recently concluded his second term as chair of the JASON Study Group, an elite team of academicians from 45 universities that evaluate national defense technical initiatives. But, he will continue as a member of that board and other outside organizations, such as the Chief of Naval Operations Executive Panel and National Reconnaissance Office Advisory Board.

"Outside connections are part of what John Browne brought me here for. When it is beneficial to Los Alamos for me to serve on these outside boards as an ambassador for the Lab — and there is an intellectual connection with the organization and Los Alamos — then I'll continue serving," he says.

So why did Press trade the hallowed Harvard halls for the fourth-floor office across from Browne's? He hesitates for only a moment before responding.

"As I look at Los Alamos, I am attracted by the two parallel commitments of the technical staff. On the one hand, there is the commitment to programs of national

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Bluebirds of eco-happiness

Lab tracking bird health as indicator of environmental health

by Kathy DeLucas

The bluebird carries the sky on his back, says Henry David Thoreau, but what it carries in its body is what concerns Laboratory researchers.

Laboratory biologists are studying the health of bluebird adults and nestlings to track environmental pollution at Los Alamos. Laboratory biologists placed more than 400 nesting boxes on Laboratory property or near old research facilities to study how contaminants may be affecting the wildlife.

Western Bluebirds are easy to study, according to wildlife ecologist Orrin Myers of Environmental Science (EES-15), because they nest in cavities. The nest boxes are hinged for easy access and are easy to reach, involving no dangerous tree climbing or lengthy hikes. The study is nonlethal, no killing of the birds is necessary, says Myers.

Western Bluebirds can be found in the Southwest and all along the West Coast of the United States. This species is generally residential but moves to lower elevations for the winter months. Western Bluebirds breed in open habitats with scattered trees and on the edges of open coniferous and deciduous forests, such as those found in Los Alamos.

An adult Western Bluebird gets a wing check.

Western Bluebirds feast on a variety of invertebrates, including caterpillars, grasshoppers, beetles, ants and snails and may ingest as much as five percent of soil particles as a digestion aid for their stomachs, similar to a domestic chicken or turkey.

In winter, their diet includes wild berries. The breeding biology can begin from early April to early May. Females build their nests in the natural cavities of snags or rotting trees, in woodpecker holes or in nest boxes. The nest is a loose collection of grasses, weed stems and, sometimes, hair and feathers.

A researcher uses a caliper to measure wing web thickness to estimate immune response.

Myer's colleague Jeanne Fair opens the nest boxes and takes blood samples from the young, ranging from three to six birds per nest. The ecologists study the blood for parasites, antibodies and the amount of packed red blood cell volume in the blood. After their study is completed in a year or two, the researchers will study how contamination may weaken the immune system and how stress factors may influence populations.

The wildlife specialists also study how much food the birds consume, how they forage and how many contaminants are in the nesting areas. Studies include three factors: nesting success, growth rates and various physiological and structural responses.

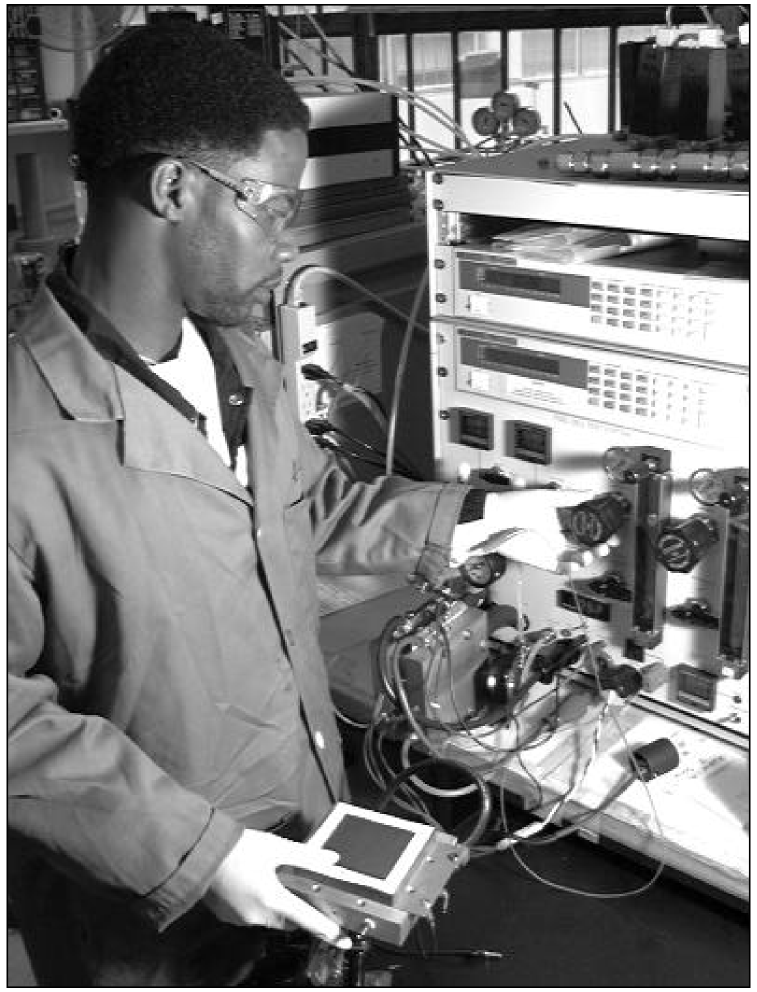
The researchers are developing a database to investigate an exposure response. After they accumulate the data, the wildlife biologists will develop a graph.

With fledgling success on one axis and the amount of contaminants on the other, there is a point where contaminants do affect the health of the young and success of the nest starts to drop.

If there are dead birds within a nest, the researchers may perform a necropsy — an animal-equivalent autopsy — to determine the cause of death.

Because this is the first year of the study, Myers and Fair have not accumulated the data yet, but they are hopeful that the bluebirds can be indicative of the overall health of Laboratory cleanup sites.

This initial data will be used by Myers and Fair to support Los Alamos environmental project cleanup decisions.



Tommy Rockward, a graduate research assistant in Electronic and Electrochemical Materials and Devices (MST-11), runs a test at a fuel cell testing station. He is collecting data to help determine the effects of impurities in the fuel stream on fuel-cell performance. Photo by LeRoy N. Sanchez

Electric vehicles — From pipe dream to practicality

by John A. Webster

The electric-vehicle scenario always has been attractive — autos, trucks and buses that are efficient, nonpolluting and free from dependence on imported petroleum — but it has faced major technical and economic obstacles.

In recent years, however, the possibility of putting significant numbers of electric vehicles on the road appears to be more likely, thanks to advances at the Laboratory and elsewhere in the development of fuel cells for transportation.

Fuel cells are battery-like devices that convert chemical energy to electrical energy. For nearly 20 years, they have been the focus of a vigorous research program at the Laboratory that has included a number of successful industrial partnerships.

"Efforts at Los Alamos, starting in the early 1980s, have been instrumental in making the [transportation] industry realize that what we're talking about has technical merit," said Shimshon Gottesfeld of Electronic and Electrochemical Materials and Devices (MST-11), project leader for fuel cells research and development.

"We were among those who led the early pioneering pathway for this technology, continuing to solve problems and show technical promise," said Nick Vanderborgh of Energy and Process Engineering (ESA-EPE), project leader for fuel-cell engineering. "Our Department of Energy sponsors have been critical in providing the long-term continuity to this endeavor."

Fuel cells were invented in 1839 by Sir William Grove of Great Britain, but they did not attract serious practical interest until the 1960s, when NASA selected them to power electrical systems aboard the Gemini and Apollo spacecraft.

Fuel cells operate like batteries, but they do not run down or require recharging and will produce electricity as long as fuel is supplied. In fuel-cell systems built so far for vehicles, the actual fuel is hydrogen, which can come from a variety of sources, including gaseous hydrogen and hydrogen generated on board from gasoline, methane, methanol, ethanol or natural gas.

The cells consist of two electrodes separated by an electrolyte. Hydrogen gas from the fuel reacts at one electrode, called the anode, producing protons and electrons. The protons move through the electrolyte to the other electrode, the cathode, while the electrons flow through an external circuit with a motor or other electrical device to the cathode, where they combine with the protons and oxygen from the air to form water vapor, the only emission. Catalysts are used at both electrodes to boost the reaction rates.

Much of the research at the Laboratory has focused on polymer electrolyte membrane, or PEM, fuel cells, which appear to be the most promising of various types of fuel cells for motor vehicles. They are highly efficient, stable and reliable. They can be packaged effectively into a small volume, and they operate at relatively low temperatures.

The success of fuel cells in the U.S. space program led industry to look at their commercial potential, but technical problems and high costs kept them from being economically competitive with other technologies until recently. Now, integrated fuel cell systems appear attractive for worldwide power needs.

Gottesfeld said there were three main technical obstacles to building practical PEM fuel cells: the cost of the platinum as a catalyst for the electrochemical reactions, effective control of the amount of water in the thin membrane used as the electrolyte and the intrusion of carbon monoxide, a "catalyst poison" that seriously degrades the efficiency of the electrolyte and is always found in hydrogen derived from methane, gasoline or alcohol.

Beginning in the mid-1980s, Los Alamos researchers began to develop ways to reduce the amount of platinum needed as the catalyst through a number of technical innovations.

"The earlier estimate of about $30,000 worth of platinum needed for a vehicle has been lowered to an estimate of $200 per vehicle," said Gottesfeld. "This has been perhaps the most important factor in making PEM technology practical."

The Laboratory helped solve the water-management problems by conducting some basic experiments in understanding the processes by which water moved in the electrolyte. "We found that thinner membranes of 50 to 100 microns worked much better than the earlier membranes of 175 microns thick," Gottesfeld said.

The third big problem, carbon monoxide contamination, was solved at Los Alamos by developing a way to bleed small amounts of air into the fuel stream, which removed the impurity, and by improving upstream fuel-processing technology to reduce the amount of carbon monoxide that enters the fuel cell.

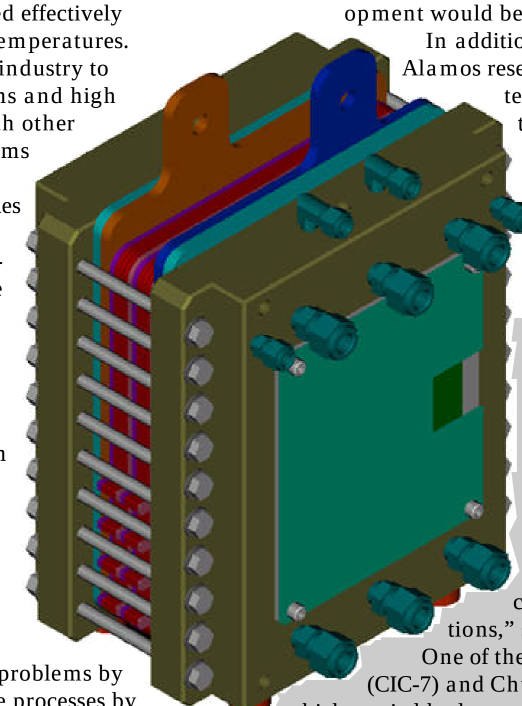
"It has been a combination of robust science — understanding and characterizing various processes — and a healthy, down-to-earth approach toward limits in time and cost," Gottesfeld said. "Our interactions with industry have been a valuable reality check, especially concerning costs."

Industry collaborations have been an important part of the Lab's work in fuel cells for many years. The approximately 20 industrial partners have included General Motors Corp. and Ford Motor Co., as well as chemical firms and automotive suppliers.

The Laboratory and GM formed a major engineering partnership in 1988 and worked for nearly eight years to develop a PEM fuel cell and improve fuel-processing systems. The partnership at Los Alamos resulted in a prototypical fuel-cell system and pioneered manufacturing technology for U.S. industry, as well as contributing to advanced component and system diagnostics and the development of models and system controls.

Today, hundreds of companies around the world are working on fuel-cell technology. Demonstration fuel-cell-powered buses are in operation in Chicago, while tests are being conducted across Europe and in Japan on automobiles that use fuel cells. The total worldwide investment in fuel-cell research and development has been estimated between $1.5 and $2 billion.

The U.S. government's Partnership for a New Generation of Vehicles, a collaboration of the private and public sectors created five years ago to strengthen U.S. competitiveness by developing advanced transportation technologies, announced this year that fuel-cell development would be one of its key focus areas.



In addition to working on the fuel cell itself, Los Alamos researchers are involved in developing technologies to process the fuel, manage the buildup and dispersion of heat, control the air supply and other systems required by electrically powered vehicles.

Vanderborgh's team has worked on such systems involving hydrogen and methanol as fuels. Recently, it has made significant progress with fuel-cell processing technology, demonstrating the feasibility of using gasoline as a fuel. The purpose is to use the existing fuels infrastructure in ways that are environmentally sound. The work earned the team, along with its collaborators at Arthur D. Little, Plug Power LLC, Argonne National Laboratory and GM, the 1998 PNGV Award for technical accomplishment. It also earned a 1998 Distinguished Performance Award from the Laboratory.

Vanderborgh agrees that using gasoline as fuel appears to conflict with an expected benefit of electric vehicles, reducing dependence on fossil fuels. However, he says the work is important in developing the necessary steps for a transition from current practices to a sustainable energy future.

The fuel-processing system presents a difficult engineering problem, he said, but the Laboratory's expertise in catalysis, heat transfer and control engineering offers real hope for continuing technological advances. The challenge is to combine design and improved catalysis to achieve the required goals in performance, size and cost.

The team continues to work to improve the preferential oxidizer, the primary device for carbon monoxide control. It also is learning more about processes that tend to limit the lifetime of catalysts and investigating a number of related fields such as heat management and alternate fuel-processing concepts.

Other current lines of fuel-cell research at the Laboratory include developing an infrastructure to deliver gaseous hydrogen to consumers, developing a system with methanol as the fuel rather than hydrogen and manufacturing components with stable, low-cost materials such as stainless steel or composites.

Los Alamos also is involved in research into applications of fuel-cell technology in areas other than transportation, including electricity generated by the utility sector and power generation for individual homes.

Fuel-cell research at Lab sparked by 1970s energy crunch

A 1977 workshop at the Laboratory jump-started research into the use of fuel cells to power electric vehicles, a field in which the Lab has continued to be a pioneer.

The workshop, which the Lab hosted with Brookhaven National Laboratory, was organized primarily by then staff member Byron McCormick, who later joined General Motors.

Mike Berger, program manager for solar energy and conservation at the time, recalls that he and McCormick sought funding for a fuel-cell program for quite a while, finally obtaining about $75,000 for the first year.

"Byron then put together a team of people to work on fuel cells, and he also formed an independent advisory committee with people from the auto industry, the oil industry and elsewhere to help us answer some basic questions," said Berger, now acting deputy director of the Environmental Management Program Office.

One of the first "products" of the team, which included David Lynn, now of General Motors, Ron Bobbett of Computing (CIC-7) and Chuck Derouin of Electronic and Electrochemical Materials and Devices (MST-11), was an electric golf cart. The cart, which carried hydrogen and oxygen in tanks strapped to the back, was the first vehicle anywhere to be powered by a phosphoric acid fuel cell.

Martin MacRoberts, who became leader of the group conducting fuel-cell research a short time after the team was formed, said the basic impetus for fuel-cell research was the energy crunch of the mid-1970s.

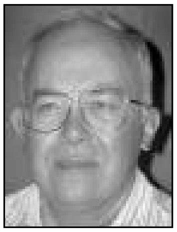
"In that era, energy was a large player," said MacRoberts, who now works in Facilities Management (ESA-FM). "Everybody was looking at alternate energy sources. We wondered how to increase efficiency in transportation by developing alternatives to the internal combustion engine."

The program eventually received additional funding — MacRoberts remembers receiving about $400,000 one year and recalling: "We felt like we were rich" — and other researchers were added to the team. They included Nick Vanderborgh of Energy and Process Engineering (ESA-EPE), Shimshon Gottesfeld MST-11, and Jim Huff and Supermanian Srinivasan, who have since left the Lab.

By the early 1980s, fuel-cell research at the Lab was receiving some $3 million a year, a level of funding that has grown slightly each year since.

"There was so much enthusiasm by those people," Berger said of the "golf cart team" of the late 1970s. "It was a neat program, and they were doing really good work."

Bruckner elected ASTM Fellow



Lawrence Bruckner

Lawrence Bruckner of Technology and Safety Assessment (TSA-1) recently was elected a fellow of the American Society for Testing and Materials (ASTM) organized in 1898.

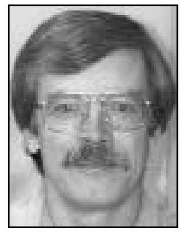
Bruckner was cited for outstanding contributions to the quality of numerous standards produced by ASTM standards writing Committee C-26 on Nuclear Fuel Cycle. He also is recognized for his effective leadership of the statistics subcommittee.

Bruckner received his doctorate in probability and statistics from the Catholic University of America, Washington, D.C., in 1968. He joined the Laboratory in 1974 as a member of the technical staff in the Statistics Group.

Bruckner recently retired but continues his association with the Laboratory as a consultant.

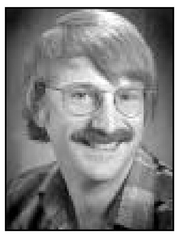
Lab geologists receive award for best poster

Three Laboratory geologists recently received the X-ray Fluorescence Poster Award for best poster during the 1998 Denver X-ray Conference held in Colorado Springs, Colo.



Dave Bish

Dave Bish, **Steve Chipera** and **Dave Vaniman**, all of Geology and Geochemistry (EES-1), received certificates for their poster titled "CHEMIN: A Miniaturized CCD-based Instrument for Simultaneous X-ray Diffraction and X-ray Fluorescence Analysis." CHEMIN is an acronym for chemistry/mineralogy. The geologists' poster beat out approximately 30 other posters presented during the five-day conference, spon-sored by the University of Denver and the International Centre for Diffraction Data.



Steve Chipera

Dave Vaniman

The poster details the collaborative efforts of researchers at the Lab, the NASA Ames Research Center in California and NASA's Jet Propulsion Laboratory to develop a miniature space instrument that uses a charge-coupled device and an X-ray source to determine the crystal structures and chemical compositions of soils, ice, rock powders and other samples. Los Alamos has been working about four years on the instrument, designed specifically for use on spacecraft that land on other planetary bodies.

Bish, the project leader at the Lab, is an 18-year Lab employee and native of Virginia who received his bachelor's degree in geology from Furman University and his doctorate in mineralogy from Pennsylvania State University.

Chipera has been at the Lab about 13 years. The North Dakota native received his bachelor's degree in geology from the University of Minnesota and his master's degree in geology from the University of North Dakota.

Vaniman is a 19-year Laboratory employee and California native who received his bachelor's degree from Pomona College in California and his master's degree and doctorate from the University of California, Santa Cruz.

In Memoriam

Theodore P. Cotter

Lab retiree Theodore P. Cotter died Sept. 13. He was 74. He received his doctorate in physical chemistry from Cornell University in 1953. Cotter came to the Lab in 1949, where he worked as a physical chemist in the former Design Engineering Division (GMX) group. He retired in 1986.

Paulina V. Ungade

Former Lab employee Paulina V. Ungade, 79, died Sept. 14. Ungnade graduated in 1936 from Godwin Secretarial College in Pittsburgh, Pa. She came to the Lab as an executive secretary for the former Medium Energy Physics (MP-DO) group in 1966. She also worked at the former Meson Physics Facility until 1982.

Robert L. Stockley

Laboratory retiree Robert L. Stockley died Oct. 7. He was 73. Stockley came to work at the Lab in 1983 with the former Systems Integration (AT-4) group as a technical specialist. In 1986 he taught Introductory Drafting to area schools and communities as a volunteer with the Los Alamos Science Student Program (LASSP). He retired from the Lab in 1992 while working with the former Accelerator Theory and Simulation (AT-7) group.

Harley Lane

Harley Lane died Oct. 12. He was 72. He served as a fire controlman on the Aircraft Carrier USS Wasp in World War II. Lane graduated from Clarkson College, N.Y., in 1955 where he received a bachelor of science in mechanical engineering. He came to work for the Lab with the former Glass Laser System (L-2) group in 1973. He left the Lab in 1990.

Lawrence Jones

Laboratory retiree Lawrence Jones died Oct. 13. He was 81. He joined the Lab in 1958 as a draftsman for the former Instrumentation and Design (CMB-7) group. Jones continued to work as senior designer until his retirement in 1980

Pereyra receives prestigious award

Laboratory employee **Ramiro Pereyra** of Nuclear Material Technology (NMT-11) has been awarded The Jacquet-Lucas Award for excellence in Metallography.

The Jacquet-Lucas Award is an international award

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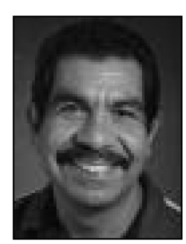


Ramiro Pereyra

November employee service anniversaries

35 years
Robert Hayden, AA-1
Thomas Marshall, NMT-1

30 years
Harvard Dye, NIS-5
John Gosling, NIS-1
C.F. Keller, EES-IGPP
Norman Magee Jr., T-4
Francisco Roybal, CIC-9
Phil Salazar, CIC-7
J.C. Skalski Jr., EES-4
Joe Vasquez, LANSCE-7

25 years
Martin Hughes, BUS-7
Elise Lee, CIC-8
A. Richard Martinez, DX-1
Anthony Sanchez, CST-9
Dennis Shampine, DX-1
Joan Thompson, LANSCE-DO
Senovio Torres, CIC-9
C. Trujillo-Neal, STB-DSTBP
Robert Zimmerman, ESA-MT

20 years
Thomas Baros, NMT-11
Ernesto Burciaga, NMT-7
Isaac Cordova, MST-6
Sandra Fletcher, CIC-DO
Stephen Fresquez, ESA-MT
Julian Garcia, LANSCE-7
Patricia Garcia, CIC-9
R.M. Gonzales-Nielsen, ESH-5
Linda Grimes, NMT-4
Bruce Hein, ESA-WMM
Robert Hermes, MST-7
Gary Langhorst, EES-15
Basil Lewis, NMT-7
Dorothy Lucero, HR-5
Molly MacKinnon, CIO-2
Thomas Marks Jr., NIS-5
Ann Mauzy, CIC-1
Alan Mitchell, EES-7
Dolores Salazar, CIC-10
Peter Sandoval, ESA-WE
Richard Sheffield, LANSCE-4
Walter Sondheim, P-25
Jeremy Trujillo, NMT-2
Margaret Trujillo, NMT-1
Alvin Vigil, NMT-1
Gilbert Villareal, BUS-2

15 years
Scott Allen, BUS-4
David Anderson, NMT-3
Stephen Blair, NIS-3
John DeVries, ESH-12
Steven Dinehart, NMT-5
Robert Ecke, MST-10
Deborah Ehler, CST-18
Gilbert Garcia, ESH-1
Joseph Gonzales, NMT-7
Patricia Haynie, ALDTR
Janey Headstream, CST-11
Roger Huchton, EM-ESO
Cindy Martinez, NMT-6
Deborah Martinez, QP
Rosabelle Martinez, CIC-10
Pamela Montoya, ESH-4
Mary Moore, CIC-1
David Nelson, ESA-EPE
Lisa Olivas, NIS-3
Tito Sanchez, ESA-WMM
Kimberly Sherwood, CIT-BS
Annabelle Torres, CIT-BS
Celina Vigil, BUS-8
Diane Weir, CIC-DO
William Zerwekh, DX-7

10 years
Benjamin Adams, TSA-10
Jeffrey Archuleta, ESH-1
E. Roxanne Calvert, BUS-5
Stephen Carroll, NMT-8
Ann Cernicek, NIS-8
Mary Cisper, CST-7
Stephen Eubank, TSA-DO-SA
John Faucett, LANSCE-6
Paul Gilna, STB-BER
K.M. Gruetzmacher, NMT-7
Lorraine Johnson, TSA-3
Victoria McCabe, HR-POLICY
Waits May, TSA-3
Daniel Martinez, NMT-4
Joseph Medina, LANSCE-7
Anthony Muscatello, EM-RF
Brent Newman, EES-15
Beverly Ortiz, FE-6
Nely Padial, T-3
Susan Ramsay, NMT-DO
Susan Ramsey, NMT-7
Nancy Sandoval, BUS-1
Kenna Theragood, BUS-1
Patricia Wing, CIC-1

5 years
Chris Adams, MST-7
Robert Beers, ESH-18
Josephine Caffrey, BUS-7
Fuming Chu, MST-8
Arthur Crawford, ESH-3
James Deininger, ESA-WE
Mark Gray, X-TM
Todd Haines, P-23
Kevin Kuhn, NMT-1
Shean Monahan, ESH-6
Cary Matthews, EM-PPC
John Morris, NMT-6
David Oro, P-22
Terry Sutton, EES-15
Loretta Weiss, NIS-8

Pereyra ...

continued from Page 8
co-sponsored by the International Metallographic Society and the American Society for Materials. The prestigious award honors the recipient with being the best in the field.

Pereyra has been a key figure in the research and development of Plutonium Metallurgy.

Pereyra worked for Lawrence Livermore National Laboratory in 1971 where he developed several metallographic techniques for the examination of plutonium. He came to work at the Lab in 1977 and currently works at Chemistry and Metallurgy Research (CMR) Building where he conducts R&D experiments and examinations on plutonium and its alloys. Pereyra has more than 60 publications and several awards. He received his associate degree in 1971 from San Joaquin Delta College in Stockton, Calif., majoring in mechanical engineering.

Lab physicist receives Francis M. Pipkin Award

Laboratory physicist **Steve Lamoreaux** recently was selected to receive the American Physical Society's Francis M. Pipkin Award for outstanding work in the field of precision measurement and fundamental constants.


Steve Lamoreaux

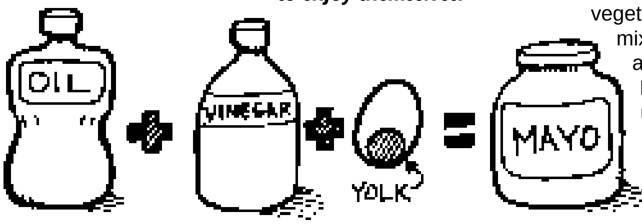
The two-year Laboratory employee and Fellow of the APS will receive a plaque and a check for $2,000 during APS' centennial meeting in Atlanta in March.

The award, created in 1997 by APS' Topical Group on Precision Measurement and Fundamental Constants, is named after the late Francis Pipkin, who was an active member of the group.

The award is given biennially to scientists who have made significant contributions in precision measurement and fundamental constants while having received their doctorates less than 15 years ago. Lamoreaux, who works in Neutron Science and Technology (P-23), received his doctorate in physics from the University of Washington in 1986.

Lamoreaux specifically was recognized for "searches for a permanent electric dipole moment of the neutron and atoms, measurements of atomic parity violation and tests of spatial symmetries and quantum mechanics, including observation of the vacuum Casimir Effect."

"Science at Home" is a publication developed by Science Education (STB-SE) to interest children, particularly those in grades four through eight, in science through hands-on activities. We are reprinting experiments from the book, along with other scientific activities, for employees to share with their families, or just to enjoy themselves.



Hold the Mayo — Together!

Could the chef in your favorite restaurant really be a chemist in disguise? After all, when a chef prepares something from a recipe, he or she is following a detailed formula! By changing some of the ingredients, a chef is performing a controlled experiment, manipulating variables, making hypotheses, and using observations to determine the outcome. Once a particular recipe has been worked out, it's then passed on to others who can repeat the same procedures and generally get the same results.

A tremendous amount of science goes into the preparation of food. Chemical changes such as acid-base reactions, changes of state by heating and cooling, and oxidation reactions from cooking all play a role in making our food taste better. One major area of kitchen chemistry involves trying to get different substances to mix and blend. Some things, like salt and water, mix quite easily, but anybody who has ever made Italian salad dressing knows that oil and vinegar just won't blend. Even after several minutes of shaking, the two components simply separate. By using a third type of chemical called an emulsifying agent, however, you can get these two liquids together.

In this activity you will observe and compare changes in oil and vinegar mixtures before and after adding an emulsifying agent.

The stuff you'll need

One and one-quarter cup vegetable oil, 1/2 cup vinegar, two empty 1-quart jars with lids, electric or hand mixer, small mixing bowl (glass is best so you can observe the emulsion), measuring spoons, measuring cups. spatula, two egg yolks separated from the egg white, 1/4 teaspoon dry mustard, 1/2 teaspoon salt

All ingredients must be at room temperature.

Here's the plan

1. Combine 1/4 cup vegetable oil and 1/4 cup vinegar in one jar.

2. Shake the jar and then set it down.

3. Observe what happens to the mixture. What happens to the oil droplets in the mixture? Why do you think this happens?

4. Set the mixture aside.

5. Measure and place the salt, dry mustard, 2 tablespoons vinegar, and the egg yolk into the mixing bowl.

6. Beat the ingredients at a medium speed until the yolks are sticky.

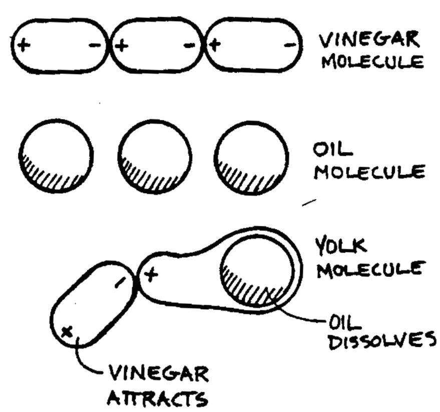
7. While one person continues beating, have another person slowly add one cup of vegetable oil, by teaspoonfuls, to the mixture. Watch as each teaspoonful is added. What changes do you see? Beat until the mixture is thick and then use the spatula to scrape it into a jar. Observe this mixture and compare it to the oil and vinegar mixture in the jar. How are they the same? How are they different? The yolk, which functions as an emulsifier, has mixed with the vinegar. How did the egg yolk, or emulsifier, change the oil and vinegar combination?

Wrap-up

The oil and vinegar mixture began to separate immediately after you stopped shaking the jar. Oil and vinegar do not mix unless some other type of chemical is present. The oil forms tiny droplets in the vinegar that stay separated from each other until they rise to the top. The mixture in the second jar looks more like a white paste than two liquids. Even after standing for several minutes, it doesn't separate. When the egg yolks were added to the mixture, it got the oil and vinegar to join together to form an emulsion called mayonnaise. Refrigerate the mayonnaise to use on salads and sandwiches.

What's going on here?

Oil and vinegar, like oil and water, do not mix because they have different physical and chemical properties. Physically, oil is less dense than either water or vinegar, so it naturally floats. Density alone does not explain the reason the two stay separate, though. Alcohol is also less dense than water, but when you stir the two together, they blend together. The molecules of water and alcohol mix together evenly because they are chemically similar. Oil and vinegar molecules are chemically different. Vinegar, like water, is made of polar molecules, which means they have two distinct ends with opposite electrical charges. The charged ends hook together because of the natural attraction between positive and negative charges. The positive end of one vinegar molecule links with the negative end of another vinegar molecule. Oil, on the other hand is made of nonpolar molecules, so there is no natural attraction between it and a molecule of vinegar. As a result, when they are shaken together, you get a cloudy suspension with the oil forming tiny droplets in the vinegar. In a suspension, one type of material is actually floating in the other. Nothing has actually dissolved. Because the oil is more strongly attracted to itself than to the vinegar and it is less dense, these drops eventually rise to he top, where they form a layer of oil.



To join the vinegar and oil molecules together, you need a third type of molecule that has the characteristics of both a polar and nonpolar molecule. This type of molecule is called an emulsifier because it helps to keep the two liquids from separating. Egg yolk contains a molecule with a polar head and a non-polar tail. When added to a mixture of vinegar and oil, the non-polar heads of the molecule dissolve in the oil and the polar tails bond with the vinegar. The bonds keep the oil molecules apart from each other, stabilizing the mixture as an emulsion.

Where does this happen in real life?

Milk is a natural emulsion of butterfat and water. In this case, a protein called casein serves as the emulsifying agent, keeping the butterfat in a near permanent suspension. Many ice creams and soft drinks are made using oil-based flavorings. To keep them evenly mixed, emulsifying agents like phosphoric acid are added.

Another place you find emulsifying agents is in the kitchen sink after a greasy meal. Because grease doesn't mix with water, it is next to impossible to clean dishes with water alone. Adding soap to the water disperses oil and grease molecules in the water so they rinse away. In this case, the soap molecules work the same way as the molecules in the egg yolk. The polar end bonds with water molecules, the nonpolar ends dissolve in the grease.

Now try this

An emulsion is a type of suspension. If you shine a strong flashlight through a suspension like milk, you will clearly see the path of the light beam as it reflects and scatters off of the fat molecules. This is known as the Tyndall Effect. If you shine a light through a solution of dissolved salt and water, you will see light but you will not see the path of the light beam. In true solutions, there is no Tyndall Effect.

Another experiment that you can do involving emulsions is making butter. Pour 1 cup of heavy whipping cream into a jar with a clean marble. Get a friend and take turns shaking the jar in a figure eight motion. The cream will become very thick, forming butter globs. Take the globs out of the jar, leaving the liquid, which is buttermilk, behind. Rinse the butter under cold water, remove the marble, add a bit of salt and pack it down into any shape you want.

This month in history

December

1620 — The Pilgrims land at Plymouth Rock

1853 — The Gadsden Purchase adds 45,000 square miles to the territory of New Mexico

1947 — The transistor is invented by Bardeen, Brattain and Shockley at Bell Labs

1971 — The first field tests of the Subterrene, a Lab-developed rock-melting boring device, are conducted

1991 — The Soviet Union is dissolved with the signing of an agreement creating the Commonwealth of Independent States

1993 — Energy Secretary Hazel O'Leary announces a new openness initiative for the Department of Energy

January

1610 — Galileo discovers the four major moons of Jupiter

1945 — Uranium-235 is separated at Oak Ridge for the first time

1950 — President Truman announces the decision to proceed with production of the hydrogen bomb

1975 — The Atomic Energy Commission is replaced by the Energy Research and Development Administration and the Nuclear Regulatory Commission

1986 — The Space Shuttle Challenger explodes 74 seconds after takeoff, killing all seven people on board

1995 — The Laboratory's Center for International Security Affairs is established

Syndicated material.

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November solution

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N	C	■	S	T	A	R	A	N	D	■	R	E	E	F
G	U	M	■	S	P	E	C	I	E	S	■	S	S	E
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New kid ...

continued from Page 4

importance, especially national security, and on the other hand, there is the commitment to excellent science. I think it's the ying and yang of the Lab," he says.

"For the shorter term, we are fulfilling our mission for the president and country, but longer term we will also produce exciting scientific advances," he explains. "I find this tremendously exhilarating and challenging. That's why I'm here. I want to be a part of that."

In addition to being the Lab's primary deputy director, Press also will be line manager for four organizations: Science and Technology Base Programs, Accelerator Production of Tritium, Quality and Policy, and the Delphi supercomputing modeling and simulation initiative.

He admits that a split personality will be required. "The biggest challenge will be to stay focused on long-term strategic issues but to keep those issues relevant to today's and this week's issues," he says. "On the one hand, someone in this position could be dragged too much into the important things that have to be done today, the operational things.

"The other extreme to be avoided is to be so far out in the future as to lose operational relevance," explains Press. "I want to spend a lot of time learning how operational things are done at the Lab, such as understanding the large physics experiments. I think these are flywheels to the future. These are abilities that we have that will guide us in strategic directions for the future."

Press is also interested in the future of biological sciences at the Lab. "Most of the pundits would say we are leaving the century of physics and entering the century of biology. Clearly, we have to understand where we are going to be positioned in the century of biology," he warns.

"I think that a pre-eminent physics lab can make major contributions to biological sciences in instrumentation, facilities, and in computation. At the same time, we have already developed significant biological capabilities, such as in the genome project, and I imagine we will find other purely biological areas in which to become stronger," Press says.

Meanwhile, Press and his wife, a management consultant specializing in executive searches for nonprofits, and their 11-year-old son, a Barranca Elementary School student, are settling into their newly purchased home on Los Alamos' North Mesa. A daughter, 24, is a photographer in New York City.

"The natural beauty of the land affects anyone who lives here," says Press. "We are very positive about living here, and we are very committed to being active in the community."

And he will not be a stranger to Pajarito Mountain. "I'm a perpetual low-intermediate skier," he says. "One of my goals it to get to high-intermediate."

His other pastimes include computing ("It is both part of my work and a hobby") and astronomy ("I have a 6-inch telescope that will do me a lot more good here than in Cambridge").

He also is co-author of a series of books on scientific computing and, in his spare time, he plans to add more of those to his already lengthy résumé.

Press is on an unpaid leave of absence from Harvard, where he is a professor of astronomy and physics. The

"My understanding with John Browne is very simple … If John remains satisfied with how I'm doing my job, then we are planning on staying in Los Alamos indefinitely."

university allows such two-year absences for only one purpose: national service.

"My understanding with John Browne is very simple," he explains. "If John remains satisfied with how I'm doing my job, then we are planning on staying in Los Alamos indefinitely. On the other hand, the two-year leave from Harvard makes it easy for John to send me packing if he decides that the Lab needs someone else in the job. It's his call — and it will keep me on my toes."

Reflections
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