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# C a l t e c h N e w s

## In This Issue

A President's Appearance

An Alum's Ecoexploits

An Archive's Attractions

and

A Good Year for Gifts



# CALTECH

# Caltech News



**ON THE COVER**  
President Clinton takes  
the stand in support of  
science and technology.

- 3 **Clinton Speaks, Campus Responds**  
The president comes to Caltech.
- 4 **It's Thunder, Lightning! The Giant Planet Keeps Exciting**  
The Galileo spacecraft alights on new finds at Jupiter.
- 7 **Science Through the Ages: An Archival Odyssey**  
Embark on a visual voyage of discovery.
- II Earthly Passions**  
Supercharged biology alum Steve Green finds his niche in conservation.

#### Also in this issue

Prestigious plaudits; generous gifts; summit celebrations; and (on our back page poster) awakening astronomy.

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U p  
F r o n t

## DID A PRIMEVAL GLOBAL FREEZEOUT HELP HEAT UP MODERN INDUSTRY?

For the primitive organisms unlucky enough to be around 2.4 billion years ago, the first global freeze was a real wipeout, likely the worst in the history of life on Earth. Few of the organisms escaped extinction, and those that did were forced into an evolutionary bottleneck that altered the diversity of life for eons.

But 2.4 billion years later, an unlikely winner has emerged from that first planetary deep-freeze, and it's none other than us modern industrial humans. New research at Caltech reveals that the world's largest deposit of manganese (a component of steel) was formed by the cascade of chemical reactions caused when the planet got so cold that even the equators were icy—a condition now known as "Snowball Earth."

In a special issue of the *Proceedings of the National Academy of Sciences* on global climatic change published February 14, Caltech geobiology professor Joe Kirschvink '75, MS '75, and his team show that the huge Kalahari Manganese Field in southern Africa was a consequence of a long Snowball Earth

episode. Kirschvink, who originated the Snowball Earth concept more than a decade ago, says the new study explains how the drastic climatic changes in a Snowball Earth episode can alter the course of biological evolution, and can also account for a huge economic resource. (A detailed article on the Snowball Earth phenomenon was published in the January 2000 issue of *Scientific American*.)

According to Kirschvink and his team, the planet froze over for tens of millions of years, but eventually thawed when a greenhouse-induced effect kicked in. This warming episode led to the deposit of iron formations and carbonates, providing nutrients to the blue-green algae that were waiting in the wings for a good feeding.

The algae bloom during the melting period resulted in an oxygen spike, which in turn led to a "rusting" of the iron and manganese. This caused the manganese to be laid down in a huge 45-meter-thick deposit in the Kalahari to await future human mining and metallurgy. Today, about 80 percent of the entire world's known manganese

reserves are found in that one field, and it is a major economic resource for the Republic of South Africa.

The Snowball Earth's cascade of climatic chemical reactions also probably forced the living organisms of the time to mutate in such a way that they were protected from the excess oxygen. Because free radicals can cause DNA damage, the organisms adapted an enzyme known as the superoxide dismutase to compensate.

Kirschvink points out that the enzyme and its evolutionary history are well known to biologists, but that a global climate change apparently has never been suggested as a cause of the enzyme's diversification.

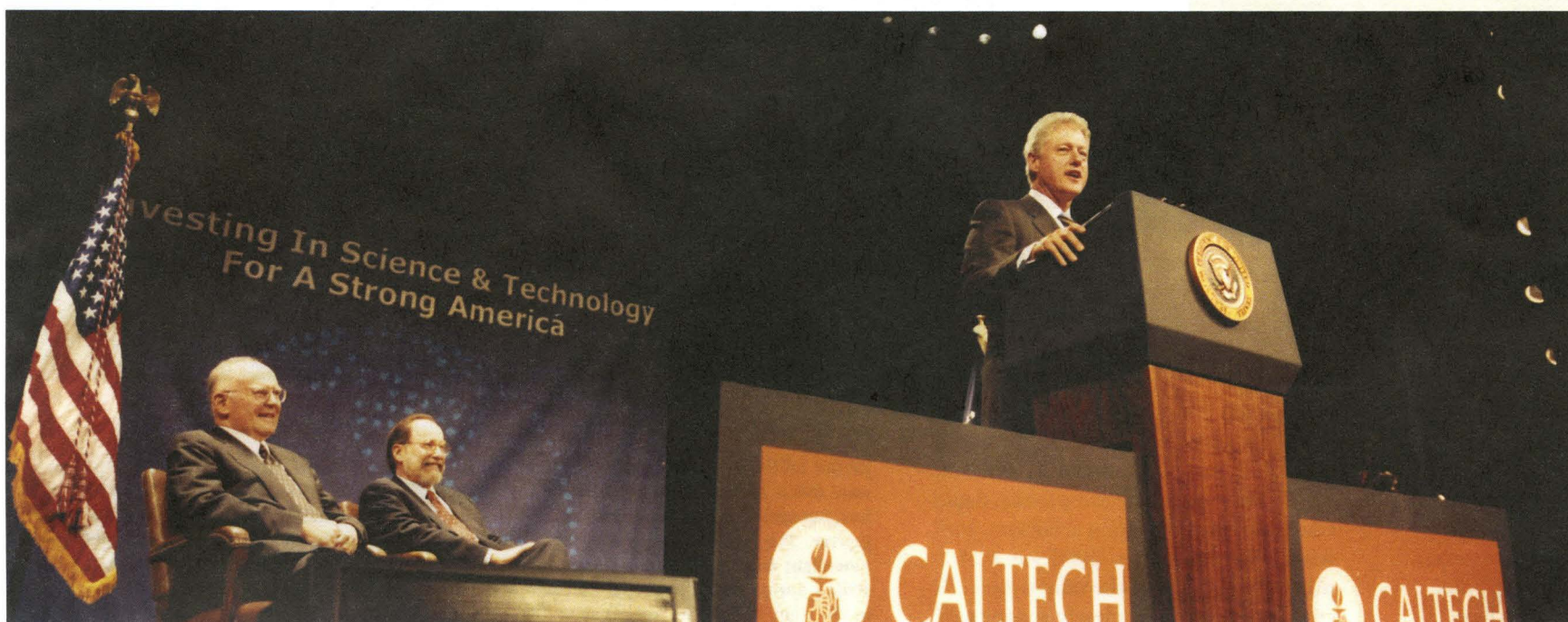
"To our knowledge, this is the first biochemical evidence for this adaptation," says Kirschvink, adding that the data show that the adaptation can be traced back to the Snowball Earth episode 2.4 billion years ago.

Kirschvink and his former doctoral student Dave Evans (now at the Uni-

*Continued on page 17 . . .*



Surrounding the aptly named South African town of Hotazel, the Kalahari Manganese Field (outlined area above) supplies a key product to the modern steel industry. Research by a Caltech-led team suggests the manganese deposits were laid down 2.4 billion years ago in the aftermath of a Snowball Earth episode, during which our planet became cold as . . . well, you get the picture.



## Clinton Speaks

Caltech got an early look at the last science budget of Bill Clinton's administration and a sneak preview of portions of his final State of the Union address, when the president came to campus on January 21. Saying that American scientists have a unique role to play—and special responsibilities to fulfill—in shaping the course of the 21st century, Clinton unveiled comprehensive new budget proposals for boosting federal support of science and technology to unprecedented levels.

The president spoke to an enthusiastic capacity crowd in Beckman Auditorium and to an overflow throng that packed Baxter and Ramo to watch his appearance on simulcast. Clinton opened his remarks by thanking his Caltech audience “for all you have done to advance the march of human knowledge.” He noted humorously that while his technically tuned-in vice president—a well-timed reference to the campaigning Al Gore—might have seemed a better choice to deliver that message (“When we took office together, it was a standing joke between us that I was scientifically challenged”), his two terms in the White House have brought home to him in countless ways the long-term benefits that flow from scientific research, in areas ranging from biomedicine, to energy research, to economic growth. Said the president, “A strong America needs a strong investment in science and technology.”

The budget that Clinton went on to submit to Congress included an increase of \$1 billion for the National Institutes of Health to support research into cancer, AIDS, diabetes, brain disorders, disease prevention, genetic therapies, and the causes and disorders of aging. He requested an additional

\$675 million for the National Science Foundation—more than twice any previous increase—to be applied in particular to new ventures in fundamental and interdisciplinary research. Another \$1 billion was allocated to support research in the burgeoning and highly promising field of nanotechnology—the manipulation of matter at the atomic and molecular level to create entirely new classes of devices—and in information science.

“Big ideas in science matter,” Clinton said. “Once you make a big breakthrough, thousands and thousands of things follow that have immense practical significance.” The president said that both government officials and the scientific community need to do a better job of explaining this crucial connection to the American people. He called for intensified efforts to raise public awareness about how federal support for basic research and its spinoffs has fueled national prosperity, has contributed greatly to our current climate of opportunity, and, “broadly stated, will allow us to lead longer and healthier lives.”

“Far too many of our citizens think science is

*Continued on page 14...*

## Campus Responds

*Reactions to President Clinton's speech on campus were as wide-ranging as the talk itself. Here is a representative sampling of comments by Caltech audience members.*

“His comments about the Institute were quite insightful and made the speech more personal. I think it touched each person in a different way.”  
—Stacey Scoville, assistant to the provost

“A politician with as much experience as Clinton knows how to deal with a diverse group. By saying that he doesn't know anything about a field, he convinces us that he's a normal person. It's a technique we all have to master. Every time I face a new group of students, I have to find my own way of making contact, and that's what the president was doing in the first minutes of his speech—making contact. [Humility aside,] he seemed to understand that students are a big part of things here, that education and research—at least at Caltech—are not two different things.”

—Tom Tombrello, division chair of physics, mathematics and astronomy

*Continued on page 14...*



The crowd gathers, at right, to welcome President Clinton. Backed by a beaming Board of Trustees Chair Gordon Moore, PhD '54, and Caltech President David Baltimore (from left in above photo), Clinton proudly exhibits his grasp of Moore's Law.

## IT'S THUNDER, LIGHTNING! THE GIANT PLANET KEEPS EXCITING

THUNDERSTORMS ARE IDENTIFIED AS  
ENERGY SOURCE ON JUPITER

The ancient Romans credited their chief deity, Jupiter, with numerous protean abilities, including the power to hurl thunder and lightning bolts. Now, new space-age findings have revealed that, once again, the denizens of the ancient world were on to something. Scientists using data from the Galileo spacecraft currently in orbit around Jupiter, the sun's largest planet, have discovered that thunder and lightning storms beneath the upper cloud cover are supplying energy to the planet's colorful large-scale weather patterns, including the 300-year-old Great Red Spot.

In two articles in the February 10 issue of the British journal *Nature*, and an article in the current issue of the journal *Icarus*, Caltech planetary science professor Andy Ingersoll and his colleagues from Cornell, NASA, and UCLA write that lightning storms on the giant planet are clearly associated with the eddies that supply energy to the large-scale weather patterns.

Their conclusion is possible because

the Galileo spacecraft can provide daytime photos of the cloud structure when lightning is not visible, and nighttime photos of the same area a couple of hours later clearly showing the lightning.

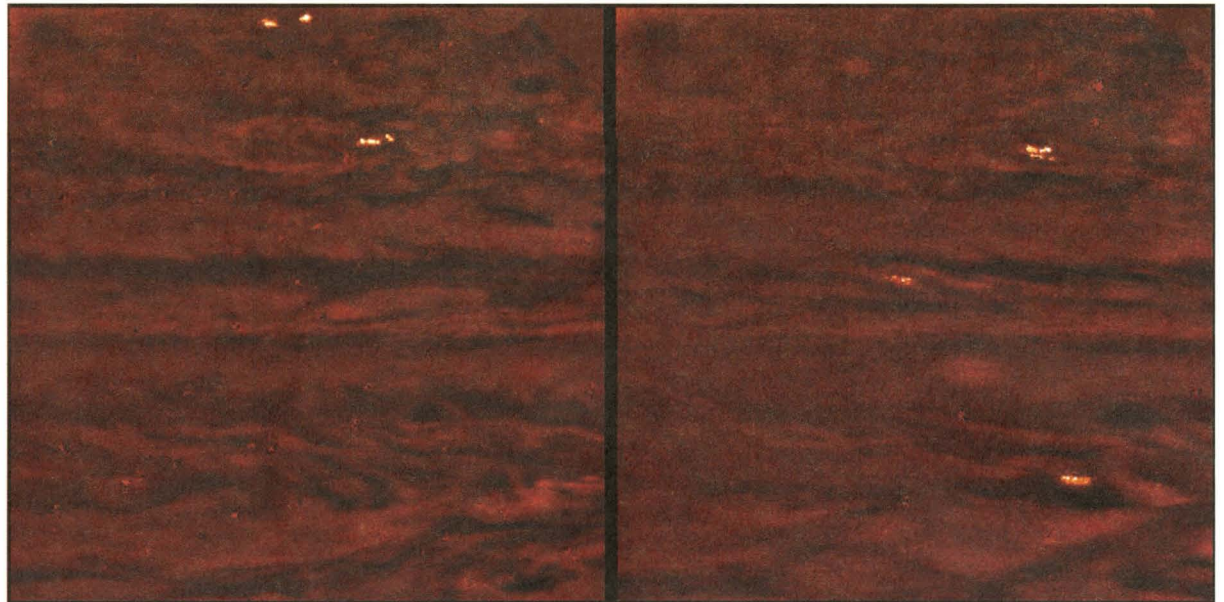
"You don't usually see the thunderstorms or the lightning strikes because the ammonia clouds in the upper atmosphere obscure them," says Ingersoll.

"But when Galileo passes over the night side, you can see bright flashes that let you infer the depth and the intensity of the lightning bolts."

Especially fortuitous are the Jovian nights when there is a bit of moonshine from one of the large moons such as Io, says Ingersoll. When there is no moonshine, the Galileo images show small blobs of glow from the lightning flashes, but nothing else. But when the upper cloud covers are illuminated at night by moonshine, the pictures show both the glow from the lightning some 100 kilometers below, as well as eddies being roiled by the turbulence of the thunderclouds.



The classical myths that identified the Greek god Zeus and the Roman god Jupiter with tumultuous weather, particularly thunder and lightning, have inspired artists down the centuries. This engraving, "Tornado (Zeus Hurling Lightning Bolts)," by the poet and artist William Blake, is based on a drawing, which has since disappeared, by his friend, the painter Henry Fuseli. The engraving was printed in the third edition (1795) of *The Botanic Garden* by Erasmus Darwin, now in the collection of Caltech Professor of Literature Jenijoy La Belle.



**JOVIAN LIGHTNING AND MOONLIT CLOUDS.** These two images (north is at the top of the picture) were taken 75 minutes apart at visible wavelengths on October 5–6, 1997 by the Solid State Imaging system of NASA's Galileo spacecraft, at a range of 6.6 million kilometers from the planet Jupiter. They show lightning storms on the night side of Jupiter, along with clouds dimly lit by moonlight from Io, Jupiter's closest moon. Bright storms, illuminated by multiple lightning strikes during the exposure, are present at two latitudes in the left image, and at three latitudes in the right image. The images show that Jovian and terrestrial lightning storms have similar flash rates, but that Jovian lightning strikes are a few orders of magnitude brighter in visible light. The moonlight from Io allows the lightning storms to be correlated with visible cloud features. The latitude bands where the storms are seen seem to coincide with the "disturbed regions" in daylight images, where short-lived chaotic motions push clouds to high altitudes, much like thunderstorms on Earth. The storms in these images are roughly 1000–2000 kilometers across, while individual flashes appear to be hundreds of kilometers across. The lightning probably originates from the deep water cloud layer and illuminates a large region of the visible ammonia cloud layer from 100 kilometers below it. This image and other Galileo images and data are posted on the Galileo mission home page on the Web at <http://galileo.jpl.nasa.gov>.

The association of the eddies with lightning is especially noteworthy, Ingersoll says. Planetary scientists have known for some years that Jupiter had lightning; and in fact they have known since the Voyager flyby in the 1980s that the zonal jets and long-lived storms are kept alive by soaking up the energy of smaller eddies. But they did not know until now that the eddies themselves were fed by thunderstorms below.

"The lightning indicates that there's water down there, because nothing else can condense at a depth of 80 or 100 kilometers," he says. "So we can use lightning as a beacon that points to the place where there are rapidly falling raindrops and rapidly rising air columns—a source of energy for the eddies."

"The eddies, in turn, get pulled apart by shear flow and give up their energy to these large-scale features. So ultimately, the Great Red Spot gets its energy and stays alive by eating these eddies."

Adding credence to the interpretation is the fact that the anticyclonic rotation (clockwise in the northern hemisphere and counterclockwise in the southern) of the eddies is consistent with the outflow from a convective thunderstorm. Their poleward drift is consistent with anticyclones being sucked into Jupiter's powerful westward jets.

Ingersoll is lead author of the *Nature* paper that interprets the new Galileo data. The other authors are Peter

Gierasch and Don Banfield of Cornell University; and Ashwin Vasavada of UCLA. (Banfield and Vasavada were both doctoral students of Ingersoll's at Caltech.)

Gierasch is lead author of the other *Nature* paper, which announces the discovery of moist convection on Jupiter. The other authors are Ingersoll; Banfield; Vasavada; Shawn Ewald of Caltech; Paul Helfenstein and Amy Simon-Miller, both of Cornell; and Herb Breneman and David Senske, both of JPL. The authors of the *Icarus* paper are Ingersoll; Vasavada; Senske; Breneman; William Borucki of NASA Ames Research Center; Blane Little and Clifford Anger, both of ITRES Research in Calgary, Alberta; and the Galileo SSI Team.

The Galileo spacecraft has been orbiting Jupiter and its moons for the past four years, and the mission has begun a one-year extension.

ROBERT TINDOL

## FRANCES ARNOLD NAMED TO NAE

Frances Arnold, professor of chemical engineering and biochemistry, has been elected to the National Academy of Engineering, one of the highest honors that can be bestowed on an American scientist or engineer.

NAE membership recognizes those who have made "important contributions to engineering theory and practice, including significant contributions to the literature of engineering theory and practice," and those who have demonstrated "unusual accomplishment in the pioneering of new and developing fields of technology."

Arnold was elected, according to the academy announcement on February 17, "for integration of fundamentals in molecular biology, genetics, and bioengineering to the benefit of life science and industry."

A graduate of Princeton and UC Berkeley, Arnold came to Caltech as a visiting associate in 1986 and joined the faculty as assistant professor of chemical engineering in 1987. She was named associate professor in 1992, professor in 1996, and added "biochemistry" to her faculty title last year.

Arnold's research interests include biocatalysis, protein design, and directed evolution. She has authored or coauthored more than 120 publications and has numerous patents issued or pending. Her awards include an Office of Naval Research Young Investigator Award, a National Science Foundation Presidential Young Investigator Award, and a David and Lucile Packard Fellowship for Science and Engineering.

For Arnold's own take on her recent research, check out her *Engineering & Science* article "Unnatural Selection—Molecular Sex for Fun and Profit," which can be found on the @Caltech Web site through the Caltech home page, or accessed directly at <http://caltech.edu/EngineeringAndScience/articles/arnold/arnold1.html>

Also elected to the NAE this year is alumnus Stuart Savage '61, MS '62, emeritus professor of civil engineering and applied mechanics at McGill University in Montreal. Savage was recognized "for contributions to the mechanics of granular flows that have laid the foundation for wide-ranging applications of particle technology."



Frances Arnold

## DIANNE NEWMAN AWARDED LUCE PROFESSORSHIP

Caltech has received a grant of \$498,427, in support of a five-year Clare Boothe Luce Professorship in Geobiology from the Henry Luce Foundation. Dianne Newman, who recently joined Caltech as an assistant professor of geobiology and environmental science, has been appointed to the position.



Dianne Newman

Newman's expertise in microbiology and geochemistry will allow her to explore a wide range of problems, as well as collaborate with a variety of faculty members.

Newman received her bachelor's degree in German studies from Stanford in 1993, and her PhD in envi-

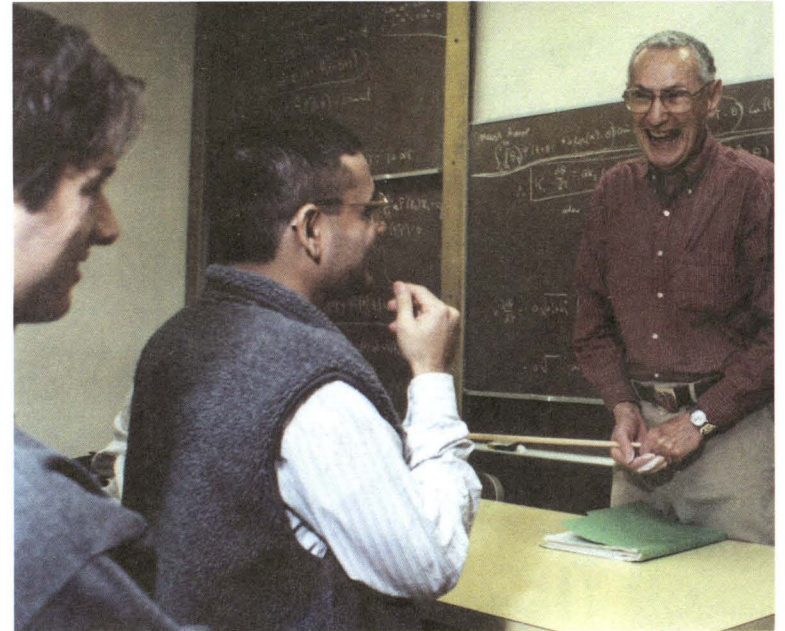
ronmental engineering from MIT in 1997. Before coming to Caltech, she was a postdoctoral fellow at Harvard. She has received a number of awards, including the W. B. Dickman Writing Prize in Engineering, the American Chemical Society Award, and the NASA Planetary Biology Internship Grant.

The Clare Boothe Luce Program is administered by the Henry Luce Foundation, which was established by Mrs. Luce's husband, Henry R. Luce. The program was created "to encourage women to enter, study, graduate, and teach" in scientific and technological fields in which they are underrepresented. Luce established the program "in recognition that women have already entered the fields of medicine, law, business, and the arts, and in order to encourage more women to enter the field of science."

## DAVID BALTIMORE RECEIVES NATIONAL MEDAL OF SCIENCE

Caltech president David Baltimore was presented with the 1999 National Medal of Science by President Clinton in a White House ceremony on March 14. Baltimore was among 11 individuals to receive the nation's highest scientific honor this year, and his selection brings to 45 the number of Caltech faculty and alumni who are medal recipients. Baltimore was honored for his Nobel Prize-winning work showing that the flow of biological information is reversed, allowing cancer-inducing viruses to become genes in cells. He was also recognized for his leadership in academic and public policy.

From left, grad students Valentin Stredie and Sanjay Kumar approach their infinitely approachable professor, Don Cohen, making sure he keeps working hard to explain applied mathematics, even after winning the Feynman teaching prize.



## COHEN WINS FEYNMAN PRIZE, JOINS DIALOGUE ON "WHAT MAKES A GOOD TEACHER?"

"I can recognize one, and the students can recognize one, but I can't define what makes a good teacher," says Don Cohen, the Charles Lee Powell Professor of Applied Mathematics and Caltech's seventh winner of the Richard P. Feynman Prize for Excellence in Teaching.

But those who nominated and selected Cohen for the annual award sought to explain why he "exemplifies the best of teaching at Caltech." His assignments "challenge the students to apply their accumulated knowledge in a creative and non-obvious way," read the committee citation, which praised Cohen's "method of presentation and his commitment to ensuring that the students understand the material."

Saying "Don, please come up and accept the check," Provost Steve Koonin '72 presented Cohen with the award of \$3,000, which is matched by an equivalent raise in annual salary—all made possible by a gift from Caltech Associates Ione and Robert Paradise. Koonin quoted students who found Cohen to be "always in 'hyper-teach' mode; probably the most energetic prof I've met at Caltech" and "fast-talking, wisecracking . . . a most lucid lecturer and a superb motivator."

"Having myself taken AMa95 from Don about 30 years ago, I can tell you that all of this rings true," the provost said, referring to the Introductory Methods of Applied Mathematics course, which Cohen created two years after joining Caltech in 1965. His teaching of AMa95 has also garnered him three awards from ASCIT (the Associated Students of Caltech).

"What I try to do," says Cohen, "is to expose students to what an equation is trying to say and how to extract information about applications by manipulating equations—something that's now called modeling. [But] I've never thought actively about what I do when I teach. I just do it.

"I talk too fast in class," Cohen adds. "But the speed is made up for by saying things many times and hopefully in different ways." Of the many teachers Cohen admires, he notes that Hans Liepmann, the Theodore von Kármán Professor of Aeronautics, Emeritus, "strives to make students understand

what it's all about. He also cares for the students; he understands that students

*Continued on page 17 . . .*

Caltech News invites readers to share their thoughts on what makes a good teacher; who was your favorite Caltech teacher and why; and how do the twin responsibilities of teaching and research conflict with or complement each other. Send letters to Editor, Caltech News 1-71, Pasadena, CA, 91125 or e-mail to [billary@caltech.edu](mailto:billary@caltech.edu).

## HONORS AND AWARDS

Professor of Electrical Engineering and Computer Science Yaser Abu-Mostafa, PhD '83, has received the Kuwait State Award in Applied Science, for his pioneering work on neural networks, learning from hints, and computational finance. The November 29 award ceremony was televised live in a number of countries, and a reception by the emir of Kuwait followed at the royal palace. Abu-Mostafa is the youngest person to have received this award since its establishment in 1979.

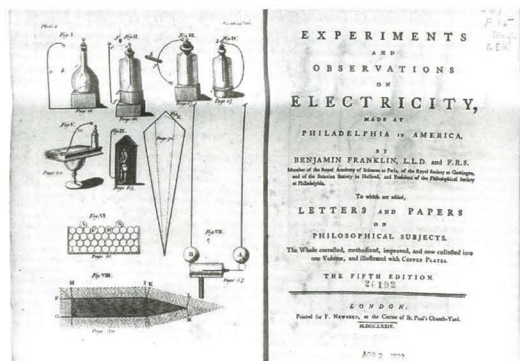
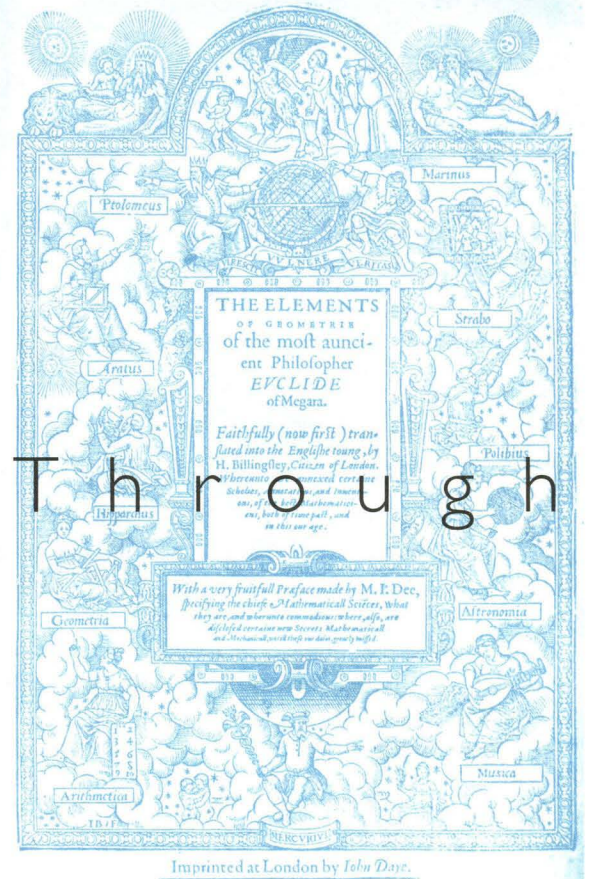
Giuseppe Attardi, the Grace C. Steele Professor of Molecular Biology, has been named Doctor Honoris Causa by the University of Zaragoza, in Spain. The degree was conferred in a November 5 ceremony at the university.

Caltech president and Nobel Laureate David Baltimore, who is also a professor of biology at the Institute, and Crafoord Laureate Seymour Benzer, who is the James G. Boswell Professor of Neuroscience, Emeritus, at Caltech and a recipient of the National Medal of Science, have received honorary Doctor of Science degrees from Cold Spring Harbor Laboratory (CSHL), which recently celebrated "its 109-year history of science education." The degrees were awarded on November 5 at the inaugural convocation of the CSHL Watson School of Biological Sciences. A private, nonprofit basic research and

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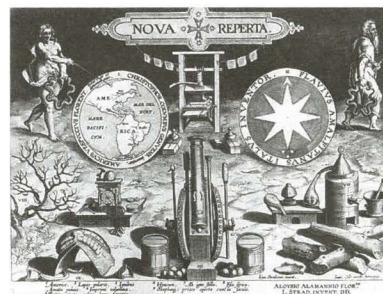
# Science Through



*“Turning over the great book of nature is the way to elevate one’s gaze.”  
—Galileo, from the dedication to his Dialogue Concerning the Two Chief World Systems*

Science, a most forward-looking enterprise, has generated a wealth of artifacts, seminal writings, and artistic prints. Take, for example, the history of science collection in the Caltech Archives, a good portion of which was acquired for the Institute by Earnest

Kepler, Copernicus, Newton, and Galileo. Paging through works of the 16th and 17th centuries, one is immersed in a period of great exploration and discovery. Partnerships between science and hands-on craftsmanship were key to such advances, says associate archivist Charlotte Erwin. “The desire to know and the means to find out” went hand in hand.



The intricately illustrated *Nova Reperta*, or *New Discoveries*, at left, compiled in 1590, depicts on its title page the invention of gunpowder, printing, clocks, stirrups, and distillation techniques. Also featured are the magnet, silk worms, a remedy for syphilis, and the discovery of America.

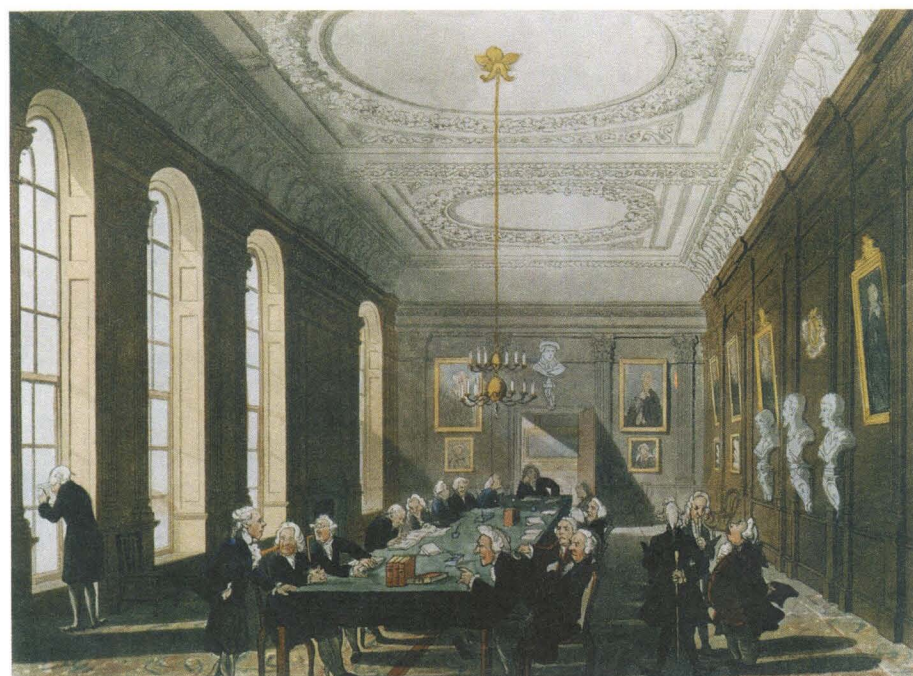
Watson, an early Caltech physics professor and administrator.

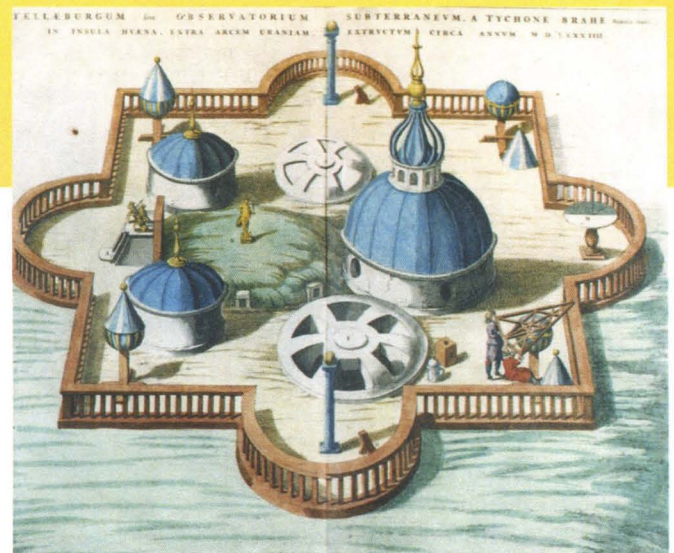
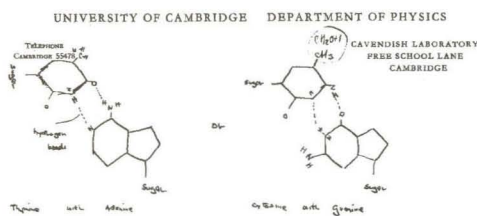
On the walls of the Archives, one finds colorful large-leaf signatures from *Atlas Maior* (1662) depicting the elaborate Uraniborg Observatory (top right) and instruments built and operated by Tycho Brahe, “the greatest observational genius in astronomy before the age of the telescope,” notes Erwin. The prints were copied from Brahe’s 1598 *Astronomiae instauratae mechanica*. Erwin adds that Brahe chose the title “awakened astronomy” to recognize a new era in which “the Ptolemaic concept of a static, hierarchical universe, long accepted as truth, was dying.” Ultimately the Copernican revolution would usher in the scientific revolution.

Perusing the collection, either by personal or virtual visit, is akin to traveling back in time. An ancient Egyptian plumb bob represents a design used since as early as 1500 B.C. to determine a straight line. It is the Archives’ oldest scientific artifact. A traveler’s timepiece brings the visitor into the millennium just past (or still present, depending on how you count it). Crafted in Munich in 1586, the gilt brass timepiece is a pocket sundial with a compass, adjustable for elevation and local latitudes and engraved on the cover with the latitudes of European cities. (Both artifacts are pictured at far right.)

An imaginative portrait of Aristotle, Ptolemy, and Copernicus debating geocentric and heliocentric theories serves as the frontispiece to Galileo’s *Dialogo*, or *Dialogue Concerning the Two Chief World Systems*, 1632. The engraving by Stefano della Bella (top left) shows Ptolemy holding an armillary

In the Archives’ rare book room, one can find first editions bound to withstand centuries of use. A first English edition of Euclid’s *The Elements* dates from 1570. The world-class collection also includes first editions of works by





# the Ages AN ARCHIVAL ODYSSEY

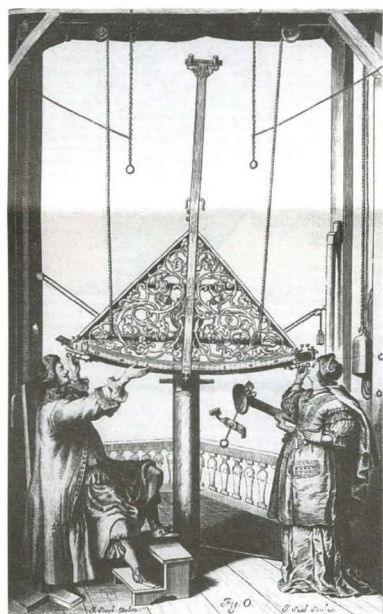
sphere while Copernicus carries a representation of the new heliocentric system by his side. An assortment of rocks at the latter's feet appears to represent the new system, and an arrow on the ground on the opposite side of the publisher's seal points to Copernicus, as if to convey a subtle endorsement of Galileo's views.

A 1673 illustration from *Machinae Coelestis Pars Prior, or Machines of the Heavens Part One*, at right, depicts husband and wife Johannes and Elisabetha Hevelius making observations with their six-foot brass sextant at the Danzig observatory that Elisabetha helped Johannes operate.

Instruments of a later time helped Benjamin Franklin conduct his famous experiments on electricity. The fifth English edition of *Experiments and Observations on Electricity* (1774), at far left, includes letters written to Royal Society fellow Peter Collinson. Erwin points out that letters and manuscripts by famous scientists are the most frequently used resources in the Archives.

Some of the most visually striking collections are bound volumes of colored prints. One book, entitled *Campi Phlegraei: Observations of the Volcanos of the Two Sicilies*, includes hand-colored

drawings of Mount Vesuvius before the eruption of 1767 (at bottom of page). The 54 plates by Peter Fabris illustrated the observations of Sir William



Hamilton, writing for the Royal Society of London. Another three-volume set called *The Microcosm of London*, compiled by Rudolph Ackermann in 1808, captures scenes of London as designed and engraved by Thomas Rowlandson

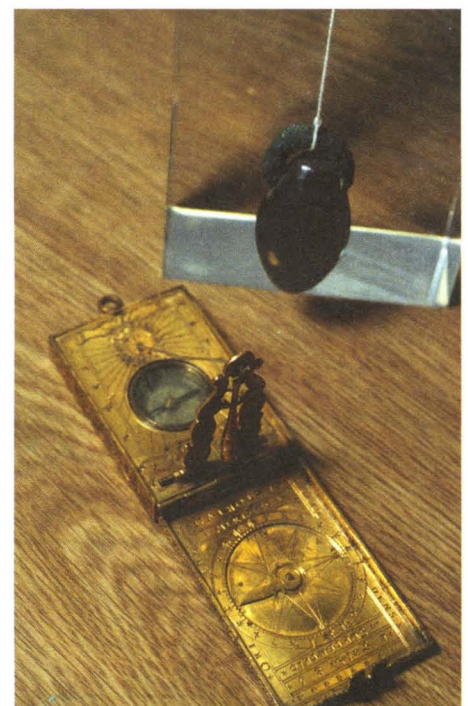
and Augustus Pugin. A print of the College of Physicians (bottom left) is one of many used by Alison Winter, associate professor of history, to illustrate a soon-to-be-online searchable map that tracks scientific activity in London during the industrial revolution. Winter says the watercolored engraving depicts an examination in the hall of the college, the body that "ostensibly governed doctors but whose authority was fraying in the nineteenth century."

Traveling forward in time, visitors will find a wealth of firsthand information about more recent scientific endeavors. An original letter from James Watson to Caltech's Max Delbrück tentatively announces Watson and Francis Crick's discovery of the double helix structure of DNA, complete with a sketch (above). Watson writes in March 1953 that, even if he and Crick are wrong, the model "provides a concrete example of a structure composed of complementary chains. If by chance, it is right then I suspect we may be making a slight dent into the manner in which DNA can reproduce itself. . . . P.S. We would prefer your not mentioning this letter to [Caltech's Linus] Pauling. When our letter to *Nature* is

completed we shall send him a copy." (Delbrück mentioned it to Pauling almost immediately.)

Much of the Archives' collection has been photographed and referenced for the Web and can be accessed at <http://www.caltech.edu/~archives/>. Appointments to visit the Archives, which is located in the subbasement of the Beckman Institute, can be made by calling 626/395-2704. (Recently, President Clinton's speech writers placed a call to gather details on Einstein's association with Caltech.) Once on site, visitors can access film footage of Einstein's visits and of the construction of Palomar Observatory. Likewise, the Archives has maps (see the back page poster), portraits, books, and Institute memorabilia to keep the dedicated time traveler occupied well into the new millennium.

HILLARY BHASKARAN



THE INSTITUTE RECORDS A BANNER GIFT-GIVING YEAR

Caltech celebrated the end of the 20th century with a record fund-raising year. For the fiscal year ending last September 30, gifts to Caltech totaled \$128.4 million in cash and stock, 51 percent over the amount raised the previous year.

Caltech achieved its banner year with the help of numerous friends and supporters. But its fund-raising efforts were propelled by one of the largest-ever gifts in higher education for direct student support—a bequest to the Institute from the estate of Rea Axline '31 and his wife, Lela, who were both members of the Associates. Distributions received in 1999 from the estate totaled more than \$60 million, and it is expected that the bequest, which will be used for student financial aid, could eventually total about \$70 million. But the record total could not have been reached without the support of many other individuals, foundations, and corporations.

"This outstanding year is due to the generosity of our alumni, trustees, Associates, and friends (including corporations and foundations) of the Institute, along with the hard work of our staff," said Vice President for Institute Relations Jerry Nunnally. "We've also been helped by a healthy economy and a robust stock market. All of these factors converged to spell success."

Besides the Axline gift, Caltech also received other bequests totaling more than \$5 million, including more than \$2.6 million from the estate of Albert "Al" Atwood, Jr. '32, MS '33, one of the first life members of the Alumni Association and a member of the Associates' President's Circle. This gift will support research in the field of electrical engineering. An additional 43 gifts in the form of charitable trusts and other life income arrangements totaled more than \$9.6 million.

Caltech is in the middle of a three-

year-long fund-raising campaign for the biological sciences—"Beyond the Genome: The Biological Sciences Initiative at Caltech"—and about \$18 million of the total cash raised last year was earmarked for this fund-raising effort. The campaign, which is scheduled to be completed in May 2001, has reached 82 percent of its \$100 million goal.

The remaining funds needed for the campaign will support new faculty, graduate students, and facilities in the biological sciences and completion of the Broad Center for the Biological Sciences, the new building that will contain the labs of 10 new faculty members. Groundbreaking for the building—named for Eli Broad, the Caltech trustee and Los Angeles business and civic leader who provided the lead gift—is slated for September.

Other major gifts last year included \$11.6 million donated by the David and Ellen Lee Family Foundation to establish the Lee Center for Advanced Networking, a program that will improve computer networking through innovations such as wireless links. David Lee, president and chief operating officer at Global Crossing, received his PhD from Caltech in 1974.

Other Caltech alumni made major commitments during last fiscal year. Denny Ko, PhD '69, chairman and CEO of Dynamics Technology, Inc., made a \$1 million pledge through his company for the Guggenheim Aeronautical Laboratory's new lecture hall, to be named the Lees-Kubota Lecture Hall in honor of the late Caltech professors Lester Lees and Toshi Kubota. This gift is part of a current \$14 million renovation of Guggenheim.

Through the Alumni Fund, 5,416 alumni gave more than \$3.1 million last year. Including alumni Associates and alumni major gift donors, alumni contributions totaled \$5.6 million

(major gifts were capped at \$25,000 for Fund reporting purposes). Alumni were particularly supportive of the Linde Challenge, as 1,384 alumni donated \$363,753, excluding pledges. This challenge, established in January 1999 by Caltech trustee and alumnus Ronald Linde, PhD '64, and his wife, Maxine, will match gifts donated by alumni up to a total of \$1.25 million. Funds will be used to name the Ronald and

The Intel Corporation continued its strong support for the Institute by donating equipment to the computer science, electrical engineering, and physics departments. General Motors, AlliedSignal, and TRW supported selected research projects and student organizations. And Southern California Edison signed up to participate in the TriNet Project, a seismic measuring network that will expedite power resto-

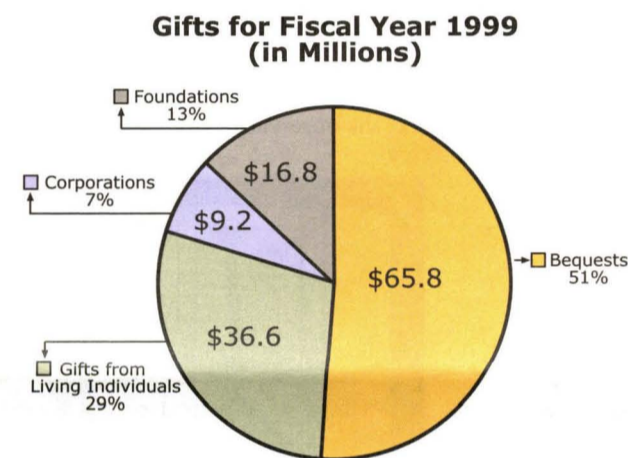
ration and emergency response after a major earthquake in the Southland. Corporations were also major supporters of the annual Mechanical Engineering Design Contest, as well as the Earthquake Research Affiliates program.

Adding to the total raised last year, members of the Caltech Associates contributed \$7.4 million in restricted and unrestricted gifts. These contributions, when added to gifts of more than \$1

million and the present value of trusts, resulted in total Associates' donations of more than \$9.5 million for the same period. (Bequests are not included in this figure.) Individual members of the Associates generously supported a variety of fund-raising projects on campus, including the Biological Sciences Initiative, the SURF program, scholarship aid, and the Linde Challenge.

Expectations for the current year are high and got a big boost in November, when Caltech Board of Trustees Chair Gordon Moore, PhD '54, and his wife, Betty, donated \$8.2 million for the President's Discovery Fund. Then in December, Caltech trustee Patrick Nettles, Jr. and his wife, Selma, made a gift of approximately \$10 million to establish a charitable remainder unitrust.

"The Development Office is committed to having Caltech well-positioned in the new century," said Robert Hawkins, assistant vice president for development. "The pace of activity and discoveries by our faculty and students demand it. Our fantastic alumni, the trustees of Caltech, the members of the Associates, and our corporate and foundation partners all expect it, and with their continued support, we will have what we need to excel. The fund-raising numbers for the first quarter of this year are looking great and bear out our feeling that the Caltech constituency is more supportive than ever."



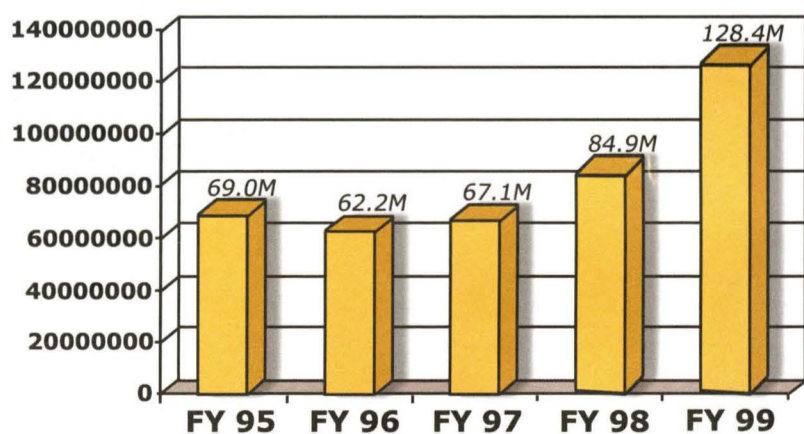
Maxine Linde/Alumni Laboratories on the ground floor of the Broad Center for the Biological Sciences.

A group of alumni and other individuals also joined together to establish the Sunney I. Chan Endowed Undergraduate Scholarship. The scholarship honors Chan, the George Grant Hoag Professor of Biophysical Chemistry, an honorary alumnus, and former master of Caltech student houses.

Several foundations contributed generously to Caltech last year, including the Kenneth T. and Eileen L. Norris Foundation, which pledged \$1.5 million to fund the Owens Valley Radio Observatory site relocation. The L. K. Whittier Foundation pledged more than \$1.4 million to establish the L. K. Whittier Gene Expression Center, which is expected to produce wide-ranging discoveries in both the medical and biological sciences. The Charles Lee Powell Foundation donated \$1 million to establish the Herbert Kunzel Endowed Fellowship Fund, honoring the foundation's long-time chairman and executive director, and pledged \$1.3 million for bundle grants for faculty start-up, equipment, and research in the Division of Engineering and Applied Science.

Among corporate donors, Amgen Inc. funded the creation of the Norman Davidson/Amgen Endowed Graduate Fellowship, honoring Norman Davidson, the Norman Chandler Professor of Chemical Biology, Emeritus.

The Past Five Years...







### AHMED AND THE ASSOCIATES

From Egypt's highest and most ancient honor, the Grand Collar of the Nile, to the Associates Black Tie Dinner, pictured here, the Institute's most recent recipient of the "Swedish Prize," chemical physicist Ahmed Zewail, has been up to his Nobelists' neck in awards and celebrations. About 275 Associates attended the Institute support group's annual gala at Pasadena's Ritz-Carlton Huntington Hotel, to dine, dance, and hear the guest of honor (who is also Caltech's Linus Pauling Professor of Chemical Physics and professor of physics) talk about science and life before and after The Prize. Above, Zewail gets a warm round of applause, and, at left, is joined by (from left) Nancy Glanville; his wife, Dema Zewail; Egypt's consul general, Hager Islambouly; and Associates president John Glanville. Among those also enjoying the evening (above left, from left) are Ann and Malcolm Cloyd and J. C. and Shi-Ping Hsu, PhD '80.



The Caltech Associates elected its executive committee and board for 2000-01 in January. The new executive committee members (left-hand photo, from left) are Peter Cross '68, ex officio; Alice Steere Coulombe, secretary; John Glanville, president; Carel Otte, PhD '54, past president; Margaret Richards, vice president; and Gordon McClure '47, treasurer. Not pictured is vice president Tom Tyson '54, PhD '67. Newly elected to this year's board (right-hand photo, from left) are Marlene Konnar, John Glanville, Malcolm Cloyd, Richard Mgrdechian '88, Robert Marshall, and Mark Sturza '77.



### ANNUAL FUND CALL MOVES TO FALL

Alumni volunteer calling will move to the fall season for the 2000-01 fund year. Caltech alumni will be contacting their classmates during the months of October and November 2000 to ask for their support of the Alumni Fund. Preparations will begin soon. The fund is looking for alumni who received their bachelor's and/or graduate degree from Caltech to serve as coordinators and callers. If you are interested in being a volunteer or would like more information, please contact the Alumni Fund office at 626/395-6323.

### ALUMNI FUND HONORS FREWING, SHACKLETT

Kent Frewing '61 and Bob Shacklett, PhD '56, were honored for their volunteer work with the Alumni Fund at a Fund Council dinner on January 22. The two were recognized for their invaluable work over the years as dedicated Alumni Fund volunteers. Frewing was recognized for having served two successful terms as the Alumni Fund chair before taking up his current post as president of the Alumni Association (see his letter on page 12). Shacklett was honored with the Alumni Fund staff appreciation award for his unwavering

commitment to both the Alumni Fund and the Institute in the face of personal challenges.

More than 460 alumni volunteer callers worked with the fund during the 1998-99 year. The fund wishes to acknowledge each of them for all their hard work.

## Gifts by Will

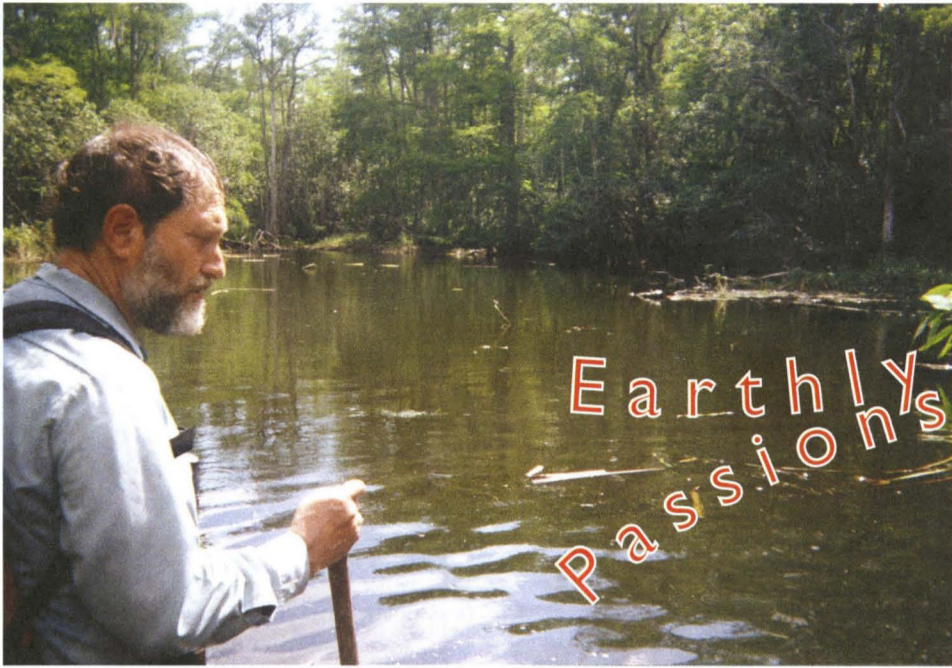
In 1991, Ted Combs, who died on March 15, 1999, established the Theodore C. Combs Scholarship Fund with a founding gift of \$4,000. Much has already been written about Combs's lifelong devotion to Caltech. What has gone largely unsung is his commitment to providing young people with the same opportunity for a first-class education that was afforded him. What inspired him to initiate the fund?

"More than 60 years ago I decided that, circumstances permitting, I would support deserving students who might otherwise be restricted in achieving full potential scholastically and in student activities," Combs once said. "Although I didn't feel handicapped, I well remember the struggle to make ends meet and having to forego some interests so as to make a few dollars."

Combs originally intended the scholarship to be fully funded over a period of years, at which time awards would be made until the fund was expended. It was also his wish that recipients be notified of his hope that, when circumstances permit, awardees "repay" their scholarships by making their own contributions to Caltech.

Later on, Combs made a commitment to fully endow the scholarship fund, with the balance of the pledge commitment to be paid out of his estate. This pledge ultimately brought the total fund to \$400,000—more than ten times his initial gift! Now, thanks to Combs's generosity and foresight, as well as the generosity of those who have contributed to the fund in his name, the Theodore C. Combs Scholarship Fund actually exceeds the minimum requirement for a fully endowed scholarship fund and will benefit many students for years to come.

*For more information regarding bequests, please contact the Office of Gift and Estate Planning, Mail Code 105-40, Pasadena, CA 91125; (626) 395-2927; e-mail, [planned\\_gifts@caltech.edu](mailto:planned_gifts@caltech.edu); Web site, [www.gep.caltech.edu](http://www.gep.caltech.edu).*



BY RYAN POQUETTE

"Don't worry, it doesn't want to chase us," says Jennifer Sheridan to her fellow biology grad students, all of whom are gathered around a startled, highly poisonous cottonmouth snake coiled at the base of a cypress tree stump.

"I wouldn't always count on that," counters Steve Green '64, one of three University of Miami biology professors who are accompanying the students on an exploratory trip into Big Cypress National Preserve, a national park located on the western margins of the Florida Everglades. "Some venomous snakes are territorial and will attack large mammals that can compete for or disturb their prey. Although most snakes won't strike unless you accidentally step on them or do something foolish like try to catch them, you can never be sure that just being close won't provoke a response."

Heeding Green's advice, the large mammals *slowly* back up and give the surly reptile some space. By now, though, the snake has explored its options, hissed a few times to remove any doubt that it is in fact a cottonmouth (so named because of the white inside its mouth), and ultimately decided that the group of biology folks is not worth its effort. It slithers lightning-fast back into its tree stump, annoyed that this inquisitive group of scientists has interrupted its morning sunning session.

For the students on this trip, Green has just imparted some potentially life-saving advice. Over the course of the three-day excursion, he will share many more insights into the behavior of various animals, especially in the wetlands environment of Big Cypress. In the process, the students will learn about the natural history of the area and about

wetland areas in general, including vegetation sampling techniques. They will design and execute a field project in animal behavior and work on a volunteer project for an education center on the border of Everglades National Park and Big Cypress. But the students aren't the only ones who benefit from the instruction. Green himself is glad that he has the opportunity to turn another group of biologists onto conservation.

"Most of us have strong conservation interests," says Green. "The idea behind this course in Advanced Field Ecology is to get students to appreciate the biological areas; to get them interested in the kind of exploration that they did when they were six or seven years old."

While he did a lot of exploring in his own early years, the aptly named Green did not always aspire to be a conservationist. In fact, when he came to Caltech, he had every intention of being a chemical engineer. But two things made him switch. First, Green, a native Californian, realized he had always been a "SoCal would-be naturalist." More importantly, he had a very influential conversation with Linus Pauling. "He basically gave me his view that all of the interesting problems in chemistry were in biological chemistry, so I started taking biology courses."

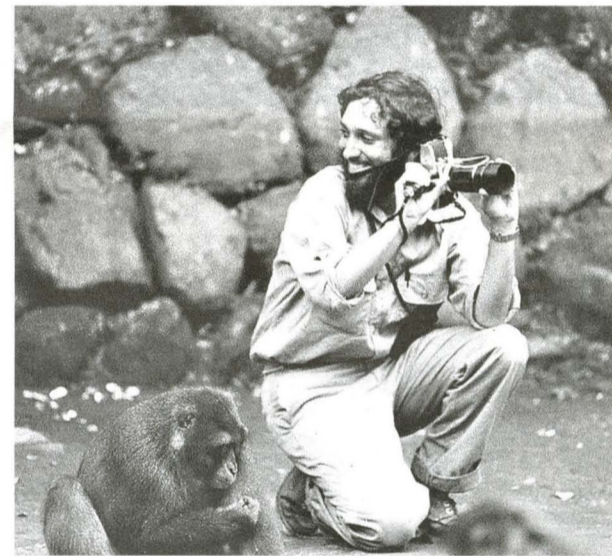
But it wasn't until two years after Green graduated from Caltech with his biology degree that he decided to devote his research efforts to conservation in particular.

He was doing his graduate studies at Rockefeller University at the time, specializing in developmental neurobiology, when new faculty members in the field of animal behavior arrived. After his first course with one of them,

Green took off for the East African nation of Uganda with some other grad students. But first he started out in Cameroon (in West Africa) by visiting a professor who was in the field studying forest monkeys, about which virtually nothing was known. Green then joined up with the other students at a campsite along the Nile River in

tents," says Green. "One night, one of them shoved its trunk inside our tent and started rummaging around for food. We tried to get out the other side, but another elephant was there. So since we figured the food was all they were after, we just huddled in the middle of the tent as they took it apart, got what they wanted, and left. We

**Top: Animal behaviorist and conservationist Steve Green '64 contemplates a possible encounter with denizens of an alligator hole in Big Cypress National Preserve, in the western Florida Everglades. Right: Monkey business—er, research—became part of Green's career early on, as attested to by this photo, taken in 1968 in Koshima, Japan. There, his study of primate behavior and conservation focused on the structure of vocal communication systems in Japanese macaques.**



Uganda, where biologists had been cropping hippos and elephants—a process that selectively removes entire animal groups for population reduction. While learning the ropes for tropical field work, Green had his first run-in with the wild kingdom.

"Because our campsite was only a day's walk from a tourist campsite, the elephants in the area had gotten accustomed to getting food out of tourists'

didn't want to yell for help or try to scare them off, because they would most likely have reacted by stomping on us. We were also hoping nobody from the other tents would realize what was going on and inadvertently scare the elephants into stomping."

Green had other exotic adventures on his African trip, all of which gave him the opportunity to see that he could professionally pursue the activities that he



had previously enjoyed doing for recreation. Says Green, "Walking through natural areas, examining closely the plants and animals, and spending lots of time looking at just what an animal does: I realized that these are all part of an interesting, fun, and socially relevant scientific discipline—ethology and its applications to conservation planning."

In fact, conservation is one of the main reasons Green chose to come to the University of Miami. "Some of the other places were not comfortable with my conservation interests," says Green. "Whereas here it was accepted and valued."

Like every ecology professor at Miami, Green (because he is both an ethologist and behavioral ecologist) leads an Advanced Field Ecology trip about once every four years. (The class is offered every other year.) This time he is team-teaching with one of his colleagues, Ron Hofstetter, a wetlands vegetarian. (The reference is not to his eating habits but to the type of vegetation he studies.)

"Ron and I have taught together before, and have learned to merge the animal point of view with vegetation communities," says Green. "That merger turns out to be critical for conservation purposes. People studying animals without attention to habitat generally don't get into the conservation issues."

On the first night of the Big Cypress trip, Hofstetter suggests to Green that this may be the time for one of Green's "exercises." Green agrees, and has the entire group stop what they're doing and flop flat on their backs on the ground for five minutes and quietly observe. Sure enough, what was a quiet forest only moments before now becomes truly wild. The forest's residents—who had been hiding from the tromping humans—start calling back and forth to each other, and it is back to animal business as usual.

Hofstetter notes that Green has let this batch of grad students off easy.

"You should be thankful that the ground's not wet," he says. "Steve will usually make people lie down in the water and do this."

Green himself has been put in some uncompromising positions while doing this particular observation exercise. Says Green, "One time in India, I got too relaxed and fell asleep, and when I woke up there was a pack of dholes, the Indian wolf or wild dog, who were interested in what I was doing."

If Green's exploits make him sound a little like Indiana Jones, the fictional archaeologist of *Raiders of the Lost Ark* (and two sequels), this comparison is not so far off the mark. Like Jones, Green has been taken around the world by his work, and he's had his share of hair-raising adventures.

Green's research—which has mainly focused on primate behavior and conservation—has taken him to India, Japan, and Africa, and he has published extensively on Asian and African primate species. Although his work originally centered on vocal communication systems among Japanese macaques, Green has since branched out into comparative field work with other species and habitats, including rain-forest monkeys in West Africa, blind cave fish in Mexico, and whales and dolphins in the Caribbean. Along the way, he's had plenty of up-close and personal encounters with his subjects.

"For protection, I have carried rifles, but there was only one time I came close to using one," says Green. "I came across an elephant that began to behave like it

was going to attack. I had a bolt-action rifle and chambered a round, getting ready to fire it into the air to scare the elephant off. But the elephant understood what the noisy action of the rifle meant, and took off before I even fired a shot."

On other occasions when Green has been caught by surprise, he's used his knowledge of animal behavior to outfox his antagonists.

"I remember coming across a line of African buffalo coming off a riverbank," says Green. "I was startled and they were startled, and they started stamping the ground like they were going to charge. So I started doing jumping jacks, and scared them away." Green knew that to the buffalo he would appear to make himself larger by doing jumping jacks, and they would most likely not attack.

Jumping jacks were not an option in 1973, when Green was one of the first Americans to travel to India after the India-Pakistan war over Bangladesh. The United States had supported Pakistan, and anti-American sentiment in India was high. Green and his research team had walkie-talkies, and they were working close to a rocket-launching site. Since Green's Indian collaborators were

also taking part in a big Smithsonian-sponsored ornithology project—one that involved tracking birds from China with radar—local officials concluded that the scientists were part of a conspiracy to set the stage for an airborne, biological war.

"The police came and dragged us out of bed in the middle of the night," says Green. "They held us at gunpoint and confiscated our walkie-talkies." After being interrogated for several hours, Green and his assistant, Karen Minkowski (now Karen Minkowski Green), were ordered to appear at the regional governmental headquarters the next day and then let go. The local head official served them tea the next day and apologized for "overzealous" police. But he made them give up the walkie-talkies.

But even though Green has lived an adventurous research life, there are times when he has been totally unaware of the dangers that surrounded him. He laughs as he recalls one such occasion in the African nation of Sierra Leone, where he had gone to observe forest monkeys with some grad students. After telling one student "there are only a few snakes



**Above: Green's students follow their leader, not without trepidation, into an alligator hole in the western Everglades. Bottom: The group conducts a prototype animal behavior study on water beetles. After dividing the pond in half, the team will unceremoniously move the hapless insects all to one side with Saran-wrapped cardboard paddles, in order to investigate their motives for clustering in the first place. If the clustering results from social attraction, the beetles will tend to stay put; if the causes are environmental, they will likely beat it back to their original locale.**



*Continued on page 13 . . .*

### NASA HEAD TO LAND ON CAMPUS FOR 63RD ANNUAL SEMINAR DAY

NASA administrator Daniel Goldin will speak on "Science and Technology in the 21st Century" at the General Session of Caltech's 63rd Annual Seminar Day, which will take place May 20 on the Caltech campus.

Appointed NASA's administrator in 1992, Goldin has revolutionized America's space program. His "faster, better, cheaper" approach to developing high-value programs without sacrificing safety has resulted in both productivity gains and cost reductions for the agency.

Goldin's space-exploration strategy includes the Origins Program, which seeks to understand the beginnings of life on Earth and to search for life elsewhere; the first scientific census of the solar system; and increased exploration of Mars through biennial robotic missions over the next decade.



Dan Goldin

Goldin has also expanded opportunities for public participation in space exploration by incorporating the Internet into mission outreach plans. *Internet Life* magazine has

rated NASA's site Best Astronomy Internet Site for two consecutive years.

Named one of the government's 100 most influential people by the *National Journal*, Goldin is a member of the National Academy of Engineers, a fellow of the American Institute of Aeronautics and Astronautics, and a recipient of a 1998 Laurel Award "for outstanding achievement in aviation and aerospace."

After beginning his career at NASA's Lewis Research Center in 1962, Goldin went on to a 25-year career with TRW, where he was vice president and general manager of the Space and Technology Group.

### FLEMING HOVSE ALUMNI!

In order to preserve the link between past and present, we, the current members of Caltech's Fleming Hovse, are establishing a database of alumni to foster relations between students and graduated Flems. If you are interested in being added to the database, please go to the Web site [www.ugcs.caltech.edu/~fleming/alumni](http://www.ugcs.caltech.edu/~fleming/alumni) to fill out the relevant information. Or you can e-mail us at [fleming-info@ugcs.caltech.edu](mailto:fleming-info@ugcs.caltech.edu), or write to us at Caltech 3-57, Pasadena, CA 91125. However you contact us, please provide us with your name, mailing address, e-mail, and telephone number. And, if you would like to speak to a live person, please contact our current president, Dan Daly at 626/395-1612.

We greatly appreciate your continued interest in Fleming Hovse!

**GO BIG RED!**

### ASSOCIATION MAKES BOARD NOMINATIONS

In January, the Alumni Association board of directors accepted the proposals of the nominating committee for new board officers and board members. The term of office for directors and officers will begin at the close of the annual meeting in June 1999.

Also on the annual meeting agenda is the proposal to convert the corporation to a public benefit corporation.

The election will take place at the annual meeting of the Association, to be held at 6:15 p.m., June 9, in the Card Room of the Caltech Athenaeum, 551 S. Hill Avenue, Pasadena, California.

Nominations for officers are as follows: president, Blair Folsom, PhD '74; vice president, Ted Jenkins '65, MS '66; treasurer, Debra Dison Hall '74; and secretary, Tom Tisch '61. Association president for 1999-2000, Kent Frewing '61, will become official past president for 2000-2001 when the new terms begin this summer.

The following were nominated to serve on the board for three-year terms that will run through 2003: Christopher Ho '92; Julie Kornfield '83, MS '85 (who is commencing her second three-year term as faculty representative); Debra Tuttle '93; Richmond Wolf, PhD '97; and Joe Yang '86, PhD '91. Keith Karasek '74 will serve a one-year term as chapter representative.

Section 5.01 of the Association bylaws provides that members of the Alumni Association may make additional nominations for directors or officers by petition, signed by at least 50 members in good standing, providing the petition is received by the secretary no later than April 15. In accordance with section 5.02 of the bylaws, if no additional nominations are received by April 15, the secretary casts a unanimous vote of all regular members of the Association for the election of the candidates nominated by the board. Otherwise a letter ballot is required.



With his brother Jack (right), Kent Frewing '61 enjoys his own rocky-mountain high at the summit of Caltech Peak, which he climbed in 1997 to celebrate the Alumni Association centennial and to see if the plaque commemorating Caltech's hundredth year was still there.

### CELEBRATING THE ALUMNI ASSOCIATION—A PEAK EXPERIENCE

My involvement in the Caltech Alumni Association has provided me with many opportunities to enjoy people and experiences that I would otherwise not have found. Three years ago then-Association president Ed Lambert was instrumental in arranging a celebration of the Association's centennial, and, in a very personal and very unofficial celebration, I was one of three who climbed Caltech Peak early in August 1997 and found all the memorabilia left in the summit ammunition can by previous alumni climbers. Come to think of it, the climb wasn't only unofficial, it was completely unofficial, since it took two Harvard alums (Jack Frewing '62 and Scott Frewing '90) to urge on one Caltech Alumni Association board member to the summit.

The Frewing-family climb was inspired by several conversations in the Braun Athletic Center with former Caltech Registrar, Honorary Alumnus, and Senior Research Associate in Chemistry, Emeritus, Bill Schaefer, who has climbed the peak more than once. We were also motivated by *Engineering & Science* articles (published in 1962) by Bill and by Dick Jali '55, and by a long and enthusiastic narrative that Caltech Vice President for Student Affairs Chris Brennen had placed on the Web (<http://www.galcit.caltech.edu/~mikek/hiking/peak/brennen.html>) describing how he and Doug Hart, PhD '93, summited Caltech Peak in 1991 in honor of the Institute's centennial.

We were apprehensive about starting our adventure at the 5,600-foot elevation of the Symmes Creek trailhead in the Owens Valley, since it was 115°F in La Cañada the day we left. Luckily, the usual afternoon Sierra thunderstorms completely shaded us and kept us cool with a constant drizzle during the entire long hike up the Symmes Creek and Shepherd Creek drainages to our camp at Anvil Camp at 10,000 feet. The next day was an easy walk over Shepherd Pass to a spectacular camp at 12,100 feet next to a lake on the southeast flank of Caltech Peak. The easy rock scramble to the 13,832-foot summit only took two hours the next morning, but the shiny centennial plaque placed by Brennen and Hart was, nevertheless, a welcome

sight. Clouds were already forming overhead, and we didn't want to be on the summit during a lightning storm.

The plaque also served as a signal to my brother and son to stop below the summit so I could catch up and be the first to the top. We signed the register, took some pictures, and read the now-obsolete "Facts about Caltech" (an early 1970s photo showed Harry Gray with sideburns to his chin). And then, thanks to Men's Glee Club Director Don Caldwell, who had carried the music to the summit on an earlier climb, we sang a verse of the Caltech Alma Mater—well, hummed it after I figured out that former Caltech Music Director Olaf Frodsham had put the melody in the second tenor part—and headed back down over Shepherd Pass to another night at Anvil Camp. The 4,400-foot descent back to the car the next morning was a short, toe-crunching ordeal, but most of the open blisters were healed within a week.

I encourage other Caltech hikers and climbers to try their namesake peak for exceptional views of the highest part of the Sierra crest, from University and Junction peaks to the northeast, to Mounts Williamson, Tyndall, Whitney, and all of the Great Western Divide (dividing the Kings and Kern drainages) to the west of the spectacular Kern River canyon. Just be sure to replace the manufacturer's insoles of your boots with orthotic insoles if you graduated before I did.

*Kent Frewing*

### MOUNTAIN HIGHS?

*Caltech News* would like to hear from other alums who have tall tales (so to speak) to tell about their mountaineering and summiting experiences. Please address correspondence and/or photos with captioning material to the Editor, *Caltech News*, Caltech 1-71, Pasadena, CA 91125.

## Alumni Activities

APRIL 30  
Senior Barbecue.

MAY 18  
Alumni Reunions for classes of '35, '40, '45, and '50.

MAY 19  
Alumni Reunions for classes of '55, '60, '65, '70, '75, '80, '85, '90, and '95.

The Division of Physics, Mathematics and Astronomy will host its first reunion of graduate students and postdocs on May 18-19. The event kicks off with a Thursday evening cocktail reception hosted by the Alumni Association. Scientific presentations and a poster session will be the order of the day Friday, followed by a second cocktail reception and dinner. For more information, contact Helene Seibly at 626/395-6323.

MAY 20  
Alumni Association's 63rd Annual Seminar Day.

JUNE 9  
Honorary Alumni Dinner.

JUNE 9  
Alumni Association board meeting, 6:15 p.m., Athenaeum. (See article, facing page.)

JUNE 23-24  
Alumni College—"New Horizons: Economics and Politics in the Information Age," led by Institute faculty, Caltech campus.

JULY 9-22  
La Belle France—Travel/Study Program to France, led by Caltech Associate Professor of History Diana Barkan and Jeb Buchwald, director, Dibner Institute, MIT.

SEPTEMBER 18-27  
Indian Country—Travel/Study Program led by Lee Silver, PhD '55, the W. M. Keck Professor for Resource Geology, Emeritus.

JANUARY 14-29, 2001  
Antarctica—Travel/Study Program led by Professor of Geology and Geophysics Joann Stock.

Green . . . from page 11

here, so we should be okay," Green finally brought his gaze down from all the monkeys in the trees long enough to see the student staring fixedly at the many cobras that dominated the forest floor. Says Green, "I had worked there on and off for years and had never seen them, because I was always too busy looking up."

India and Sierra Leone are two places where Green has helped to set up working game reserves, in an attempt to protect endangered species. But plenty of less distant areas are also in need of such conservation strategies—including Green's home base in South Florida.

On this warm spring day, as Green leads his flock of biology grad students through Big Cypress, he explains that the swampy area is dry even for the dry season. At one point, Green directs the students' attention to some claw marks in the moist mud.

"Gator tracks," he says. "You almost never see these. Normally they would swim to their hole when they hear us coming. But now, it's so dry that it's hard for them to find water in which to hide, so they have to crawl."

At the mention of alligators, the students' expressions reflect everything from excitement to fear. Then Green announces their next move. "Now we're going to do something that most people would consider foolhardy. We're going to follow the tracks to the gator hole." All of the students—who up until this point had trusted their fearless leader's advice—look at him as if he has lost his ecological marbles. (And they haven't even heard the cobra story!) But they follow anyway.

Minutes later, the tracks disappear as the students enter the waterway to the gator hole. After carefully plunging through watery muck knee to thigh deep, they finally reach the hole, a large pond that contains about 12 baby gators and one adult gator (about eight feet long) on the far side.

Alligator infants are timid creatures, but some of the babies swim to within a mere 15 feet or so of Green and check out the strange intruders for a while, before getting spooked and moving out to a safer distance. Green explains that this is the non-mating season and therefore a good time to safely observe alligators, because the male is not defending a breeding site and the mother will not attack unless her young are threatened.

The abnormally dry season that Green and the students are encountering this year in Big Cypress is one more indication of the impact that human



Web search: Steve Green (left) points out a spider in its delicate domicile, good potential subjects for a field experiment, to student Doug Scofield.

habitation is having on South Florida's ecosystem. Says Green, "The natural flow of water has been modified in order to reclaim wetlands for urban development as well as farming and in order to prevent flooding of those areas." These alterations in the water's natural levels and flow (together called the hydro-period) have so greatly modified the habitat as to virtually wipe out elements of the food chain essential for some species of plants and animals. Tampering with the ecosystem has also made the area more congenial to rare and previously unknown communities, including some "exotic pest species."

Green's role in examining this process is primarily educational. "I supervise graduate student projects and dissertations on both native and exotic animals in relation to the changed habitats, and I teach the principles and practice of using quantitative field biology (ecology and behavior) to assess environmental impacts and to provide the basis for conservation recommendations."

*When he makes up syllabi for his Animal Behavior class, Green always fills in the class dates for the students' spring break with topics like "hormones and behavior" and "animal recreation." Says Green, "I'm just trying to get them to think."*

Whenever possible, Green teaches these principles in a natural setting such as Monkey Jungle, a private zoo south of Miami. These days he's also using it as a base for studying cooperative foraging strategies among primates, but he first learned about the facility in 1965, about a year after he graduated from the Institute. One of his friends was working on termites, and Green was one of a group that drove down to the Florida Keys to collect some termite samples. On their way they stopped off and talked to the people at Monkey Jungle.

Green recognized the name of the owner, Frank DuMond, because a relative of Frank's—Jesse DuMond—had been one of Green's physics professors at Caltech. When Green moved to the University of Miami in 1978, he reestablished the connection by bringing students over to Monkey Jungle. Eventually, both DuMond and his wife

passed away, and their children inherited the zoo.

Since the DuMond children didn't know a lot about primates, Green offered advice. The son, an MIT grad, got the idea for the DuMond Conservancy (DC), because he wanted to do more primate conservation.

So Green helped him out and in the process became one of the founders of the conservancy—located on the grounds of Monkey Jungle—which is devoted to research and education. Impressed by what they saw as Green's skill at managing meetings, they also saw to it that Green was elected chairman of the DC board.

Green has a different take on this, though. "What some people regard as skill, I regard as my panic about keeping things on schedule. It's nothing to do with skill or attributes, I just can't afford to get any more behind, so I damn well better run the meetings on time."

Green claims that it is also this desperate need for efficiency that led to his election as chair of U of Miami's Faculty Senate. In this role, he functions as the link between the faculty and the Board of Trustees—and in the process gets to observe higher primates in a somewhat more administrative setting.

With the many hats that Green wears both inside and outside U of Miami, following him on a typical day is a multifaceted exercise—a level of activity that his fellow Caltech alums can surely relate to. "When I got to Caltech," says Green, "I quickly realized that I wasn't going to coast through, and that I had to adopt an insane schedule."

But out of all his responsibilities, Green enjoys his educational role the most. At times, this can take the form of a practical (yet educational) joke upon his students. For example, when he makes up syllabi for his Animal Behavior class, Green always fills in the class dates for the students' spring break with topics like "hormones and behavior" and "animal recreation."

"I'm just trying to get them to think," says Green. "The students are always concerned when they see I have something scheduled for their vacation, but once they think it over, they realize what it's all about."



Of Clinton's speech, Professor Bill Johnson, PhD '75, said the president "covered a lot of ground." Clinton would continue to do so as he shook hands with students after the speech (above) and as he headed to the golf course later in the day. In the lower right-hand photo, President Baltimore presents Clinton with a set of Liquidmetal golf clubs, which were made from a metallic glass developed in Johnson's lab. Johnson, the Ruben F. and Donna Mettler Professor of Engineering and Applied Science, said Clinton was looking forward to trying out the gift.

*Clinton Speaks...from page 3*

something done by men and women in white lab coats behind closed doors that somehow leads to satellite TV and Dolly the sheep," the president said. "It is our responsibility to open the world of science to more of our fellow citizens—to help them understand the great questions science is seeking to answer and to help them see how those answers will actually affect their lives and their children's lives in profoundly important ways."

Clinton also stressed the need to recruit more minority students in science and technology and to help them graduate, and reiterated his support for student loans and tax deductions for college tuition, which he had announced the previous day. And the president received a round of applause when he noted the benefits gained from scientists and engineers born in other countries, whom "we should continue to welcome to our shores."

For his campus appearance, Clinton, living up to his reputation as a quick study, came well primed with local lore. He paid tribute to "the brilliant Caltech community that first located the genes on chromosomes, unlocked the secrets of chemical bonding and quarks, and took us on our first guided tour of Mars."

Envisioning the revolutionary products that may one day flow from nanotechnology—among them "molecular computers that could store the library of Congress in a device the size of a sugar cube" and microdevices capable of "detecting cancerous tumors that are only a few cells in size"—the president acknowledged the primal role of Caltech physicist Richard Feynman, who first outlined the field's possibilities in a 1960 talk entitled "There's Plenty of Room at the Bottom."

And he recalled Albert Einstein's visits to campus in the 1930s as he shared a joke that he said "one of the wags back at the White House" had told him after Clinton confessed to feeling a wee bit apprehensive about speaking at Caltech. Miraculously returned to Earth for a day to get a look at the dawning millennium, *Time's* Man

of the Century genially reassures a fellow who admits to low-IQ anxiety "not to worry, you can always go into politics."

In his closing remarks, Clinton once again invoked Einstein as he spoke about the uses and abuses to which science can be put and sounded a cautionary note about "the responsibilities that all these advances and discoveries will clearly impose."

Said the president, "Just because we can do something doesn't mean we should. It is incumbent upon both scientists and public servants to involve the public in a great debate to ensure that science serves humanity—always—and never the other way around. On this campus nearly 70 years ago, Einstein said, 'Never forget this in the midst of your diagrams and equations. Concern for man and his fate must always form the chief interest of all technical endeavors.'"

Just the other night, said Clinton, a leading genome researcher had told him that as far as genetic makeup goes, humans appear to be about 99.9 percent identical to one another. In an era marked by "almost unfathomable advances" on the one hand and outbursts of the most primitive ethnic, racial, and religious strife on the other, might not this newfound knowledge play a part in eradicating what Clinton called humanity's most ancient and deadly fear—that of people who seem different from ourselves?

Sounding a theme he would invoke a week later in his State of the Union address, the president's parting words were optimistic. Said Clinton, "I leave you with this thought. You have the power to put science and technology to work advancing the human condition as never before. Always remember to keep your values at the core of what you do. And tell every one of your fellow citizens, and indeed people with whom you come in contact all across the world, that every single scientific advance confirms over and over our common humanity."

The complete text of Clinton's speech can be found at <http://www.caltech.edu/events/pspeech.html>.

*Campus Responds...from page 3*

"I've never seen a speaker who had his kind of poise and elegance. I intend to be a scientist and will have to give all kinds of presentations. I can only hope to present things near to the way he did."

—Agedi Boto, sophomore in chemical engineering

"This is the first time, and I think it will be the last time, for me to be that close to a president. It was like a dream. I told my older daughter, and she told her teacher."

—Luis Cardenas, custodian

"I always like it when people tell you they're going to give you more money for doing things you like to do. But, seriously, I, like most scientists, agree on several key points. First, we do need to broadly support science as a basis for economic growth. Second, we, the media, the entertainment industry, and government need to better communicate how important science is to sustained economic growth and to bettering lives. Third, with an NSF budget that has remained flat in constant dollars, even the best people have to scramble frantically to fund their research, and they don't get the rewards of being able to think a significant amount of the time. We lose people. Less than a billion dollars to NSF represents an enormous increment."

—Nate Lewis '77, MS '77, professor of chemistry

"I was very pleasantly surprised. I'm not a big supporter of his policies, but I really liked what he said about how people of different races should learn to live together—to admire our differences rather than hate them." But, on another note, "I think it's dangerous to sell science. I think the BBC approach is better—the British government mandates programming that illuminates what basic science is doing, rather than explaining how much money it brings. The latter is sort of like promising we can predict earthquakes. Ultimately we'd like to do that, but we can't do it on a short time scale."

—Leo Eisner, graduate student in geophysics

"It was mesmerizing. I didn't close my eyes once. He finished every thought. He speaks in complete sentences. He has smart speech writers who had done their homework before they called the Caltech Archives to check up on

historical details."

—Judith Goodstein, university archivist, registrar, and faculty associate in history

"We're always told that Reagan was 'The Great Communicator,' but I was really impressed with Clinton's presentation. He was not just funny. He was also very adroit at exploring a topic that was clearly not in his area. From the point of view of an economist, he comes across as having a pretty sophisticated understanding of economic forces, such as the importance of trade as a check on inflation. His plan to increase spending on science and technology could really make a serious impact on the economy. It's not just pork for university faculty."

—Caroline Foblin, assistant professor of economics

"It was wonderful. I expected it to be, and it was. I liked the way he dealt with hate crimes at the end, stressing the need to solve the problem of hate in our society."

—Ed Lewis, PhD '42, Nobel laureate and Thomas Hunt Morgan Professor of Biology, Emeritus.



"I got the feeling that he knew his story when he got here and that he knew who his audience was. I certainly could understand why people are drawn to him. I also liked that he was able to wrap the whole speech up with a humanitarian view."

—Jean Grinols, division administrator for geological and planetary sciences

## Classes Notes

1949

Hugh Carter  
555 San Antonio Avenue  
San Diego, California 92106-3467  
Fax 619/225-9968  
hcarte1@home.com

The class of 1949 continues to retire, only to renegade in fruitful activities. **Rolf Sinclair**, **Bill Muehlberger**, and **Art Bruington** are three examples. Rolf has retired from the National Science Foundation and is now a part-time consultant to Centro de Estudio Cientifical de Santiago (Chile), while Art "interrupted retirement in the fall of 1998 for a six-month task as interim general manager for the Irvine Ranch Water District." Art and his wife are in good health, and travels include Arguilla, Belize, Alaska, and a "leafer" trip to New England. Bill is retired from the University of Texas at Austin but is still grading exams from the last class he taught and "working on a backlog of projects." He recently was awarded the National Service Medal by NASA and continues to be involved in training astronauts. His other medals resulted from work on Apollo missions 16 and 17.

**Robert Pilling** is "just spending the kids' inheritance taking cruises." **Joe Curray**, professor emeritus of geology at Scripps Institution of Oceanography at UCSD, writes, "I am continuing my research on tectonics and the geological history of Southeast Asia and the northeast Indian Ocean on a part-time basis." **Bob Darrow** and his wife "are celebrating our 50th anniversary all year long—and we spent the \$47.00 cash the men of Ricketts gave us for our honeymoon."

**R. W. Kermeen**, **Don Six**, and **Ronald Greene** send e-mail addresses of rkermeen@aol.com, desix@airmail.net, and ronaldgreen@duke.edu. **Roger Johnson** says the 50th class reunion was well organized, and notes that *U.S. News & World Report* rates Caltech ahead of MIT and as number one in the USA. Roger is still employed full time and his plant has received a top OSHA Star Site award. **Stan Barnes** writes expressing thanks to "all the guys who write in with their news." He is still protecting the drinking water of the state of California. Good going, Stan.

**Donald Morrison** has retired after 33 years. He has nine grandchildren and his hobbies include traveling, golf, bowling, investing in stocks, the computer, reading, and gardening. **Dick King** has "given up a house of 38 years, but our move to a single-floor house in a slower paced community has been just what our aging bones needed. I'm playing in a senior citizen band and arranging music for them. With three grandchildren close by, life is not bad." Amen. **Will Webster** writes, "Helen and I really enjoyed the reunion. Some of us were hard to recognize, as it had been 50 years since the last meeting. I'm still working full time, more or less, in the company I founded 30 years ago, but it sure is different not having to make all the decisions." He has acquired a Paso Robles ranch, now planted in vineyards and orchards. "We might retire there."

**Dick Morgan** continues with his book on Apollo moon flights. He would like input from classmates. Please call him at 818/704-5662. **Naomi Kashiwabara** and his wife traveled to Italy, Greece, and Waikiki in 1999, and he wishes everybody a Happy Y2K that is bug free. **Blouke Carus** enjoys *Caltech News*, with the opportunity to hear about his classmates. He is saddened by the death of **Paul Saltman**. **Forrest Allinder** and his wife have both retired from Sinclair Oil and are

now consulting. He saw his grandson play football recently at left guard, Forrest's position, but says, "He is better than I was." **Art Spaulding** and **David Liberman** have new e-mail addresses: bamimi@webtv.net and liberman@west.llnl.gov. Finally, I, **Hugh Carter**, had breakfast with **Carlos Beeck** in December. Carlos continues his intellectual search in all matters of science and philosophy, takes a daily swim, and is super grandpa to all the neighborhood kids. He had a ball at the 50th reunion.

1950

Dwight Schroeder  
2332 North Old Grand Street  
Santa Ana, California 92705-6963  
dwightcsch@aol.com

A note from your class agent: Don't forget to reserve May 18, 19, and 20 for our 50th-year reunion on campus.

**Harvey Amster** reports that, after graduating from Caltech, he went to MIT, where he received a PhD in physics. He then worked at the Westinghouse Bettis Atomic Power Laboratory near Pittsburgh, Pennsylvania, before becoming a professor of nuclear engineering at UC Berkeley. He is now retired and married, with two children aged 13 and 17.

**Wilson Bradley** spent several years helping manage technology-oriented companies such as Beckman, Endevco, and Becton Dickinson, and also helped several new ventures. In 1982 he moved to Santa Barbara County to continue consulting and to grow lemons and avocados. He recently spent considerable time in Europe, settling the estate of a longtime friend.

**Ralf Erickson** joined General Electric a week after graduation and retired on January 1, 1990, nearly making the 40-year mark. He worked in Los Angeles; Schenectady, New York; and Sunnyvale and San Jose, California. All his work was in the electrical power field. Highlights include development of the Nike missile electrical system and working as a system engineer for the electrical propulsion system of the submarine *Glenard P. Lipscomb*, SSN 685 and as principal engineer for the power supply of a 15,000-GPM liquid-metal electromagnetic pump and a 4,000-kW diesel generator set for cooling a nuclear reactor. He and Margy Nichols married a week after graduation, and they now live in Sunnyvale, with two sons living close by. Ralf's time is spent working around the house, annoying the airways with amateur radio, and playing golf two or three times per month as a grand duffer. He and Margy have traveled in Asia, Europe, the Mediterranean, and South America, as well as the 50 states.

**James Gerhart** reports that in the last 50 years he changed from callow youth to paterfamilias, with wife, son, daughter, and five grandchildren—all this while involved in experimental nuclear physics, including 25 years of national physics committees and offices. During 43 years at the University of Washington, he has received a distinguished teaching award, the Millikan Medal, and finally promotion to professor emeritus.

**Bill Higgins** is looking forward to his 60th-year high school reunion, as well as the 50th-year get-together at Caltech. He still enjoys flying, skiing, and a little business. However, he claims to be learning about entropy from some of his projects that do not get completed.

**Jerome Jacobs** joined Hughes Aircraft when he received his BSEE, and worked on missile electronics and systems analysis. Moving

up through levels of management, he became chief scientist, missile systems group. During this time, he also managed to earn an MSEE at Tech and an MS from UCLA. He retired in 1974 but continued consulting until the '90s. He now keeps a database and Web site for a local neighborhood association. He and his wife have enjoyed some travel, but now mainly stay near home and visit their two children and six grandchildren.

**Walter John** received his PhD in nuclear physics at UC Berkeley in 1955. He then was an instructor at the University of Illinois for three years before becoming a group leader at Livermore National Laboratory in nuclear physics research. In 1971 he was department chairman at California State College, Stanislaus, doing research on aerosols and air pollution, and in 1974 he joined the California Department of Health, retiring in 1992. He now does part-time consulting, travels, and visits his four children and four grandchildren.

**Peter Knoepfler** is in the process of retiring from his practice of psychiatry. He is a volunteer in an international school teaching French, calculus, and special education. His four grandchildren keep him amused.

**Ralph Lovberg** went to Minnesota for a PhD in physics in 1955. He then was at Los Alamos in plasma physics and controlled fusion until 1961, when he joined General Atomic. From 1964 to 1991 he was at UC San Diego as a professor of physics, involved with plasma physics applied to fusion and to electric space propulsion. He also collaborated with TRW on propulsion projects from 1964 to 1994. He is proud of his eight children, among them **John '81**.

**David Mackenzie** came to Pasadena from British Columbia and hasn't made it back to Canada to live. After graduation, he went to Princeton for a PhD in geology and then married Jan and lived in Europe for several years. They settled in Denver in 1957 and have stayed, except for a short term abroad. His career is in oil and gas research and exploration, and he continues to be involved with earth science organizations. Children and grandchildren live nearby, keeping the grandparents happy and busy.

**David Oakley** spent his career in explosives—high and nuclear. He retired in '91 when that field went out of fashion. He is now involved in gardening, volunteering, and serving on the board of a senior residence for low-income persons. He cannot find time to just sit and read.

Your class agent, **Dwight Schroeder**, spent a 30-year career as a civil and structural engineer with Boyle Engineering Corporation (**J. R. L. Boyle '30**). In 1963, he received an MS in environmental health engineering from Tech, perhaps showing that he is a slow learner. He retired in 1984, and now grows a few oranges and avocados, but finds time for golf and for salmon fishing each year in Alaska with **Cecil Drinkward**.

**Ed Reinecke** has had a varied career. First, he worked in engineering and sales in his own company. In 1964, he was elected to the United States Congress, and in 1969 was appointed lieutenant governor of California by then-governor Ronald Reagan. From 1975, he raised purebred Charolais cattle and did real estate. He now claims to be tired and retired.

**David Warren** spent most of his career consulting on risk management. In 1968 he started a two-man consulting firm, and in 1974 he produced a handbook, *Practical Risk Management*. The firm had grown to 11 consultants in 1979, when he sold it. He continued publishing and consulting until he retired in 1998. From 1979 to

1996, he wrote and published a monthly risk-management commentary, notoriously known as *The Warren Report*. He now lives the life of Riley, enjoying three daughters and three grandchildren.

1971

Philip Lowry  
4323 Woodhill Road  
Minnetonka, MN 55345-2958  
612/938-7678  
plowry1176@aol.com

**Stephen Elliott** (stephen\_h\_elliott@yahoo.com) writes that "after one year as an associate in the Harvard Program of U.S.-Japan Relations, I have stayed in Boston, working alternately at Harvard and at two Internet startups and volunteering at Emerson Hospital in Concord. My oldest son will enter Yale College next year! Job hunting after an Internet startup failed."

**Ken Hanson** (Ken\_Hanson@compuserve.com) sends word that he "completed this summer a seven-day, 50-mile backpacking trip with **Steve Fershtut** (BS, '70), from Onion Valley to Whitney Portal, via the John Muir Trail. Highlight was standing on top of Mount Whitney, savoring the view from all directions. Steve's two children and my oldest child, Christine (17), accompanied us."

**Steve Shuler** (sdbudde@yahoo.com) is working for Bridge Medical in Solana Beach, California, as a systems analyst, developing hospital medication management software. **John Cronin** writes from Fairbanks, "After 21 years in the Alaska environmental consulting business, Laurel and I have decided to retire. Have not yet decided where to live, perhaps Owens Valley."

**Michael Lamanna** (streak@nacs.net) reports that he is "back on campus, but as a parent. My son James is a member of the class of 2002!" **Paul Wegener** (paul@epitomepherm.com) sends word that "my startup got some funding. We are developing new medications."

**Eric Schiff** (Schiff@suhep.phy.syr.edu) is currently chairman of the department of physics at Syracuse University, where he has been on the faculty since 1981, after receiving his PhD from Cornell and doing a postdoc at the University of Chicago. "My research has centered on amorphous silicon, a thin-film semiconductor. My wife, Nancy, is a professor of social work, also here at Syracuse. We have two teenage sons: one studying economics at the University of Pennsylvania, and the other in high school aspiring to a career in TV and film production."

**Wes Munsil** (wmunsil@dmwgroup.com) writes that he "finally decided to do that 'PhD thing' only 25 years after my original target date for achieving the PhD. Actually, this is not a bad schedule slip as far as software is concerned. I figure I took 'time out' to raise a family. Midlife crisis time: it was cheaper than a Porsche! Got first computer science PhD ever awarded by the Colorado Springs campus of the University of Colorado. Continue to practice computer software consulting along Colorado's beautiful Front Range, as president of my business, the Cantabrigian Operation (TCO). I program computers between acting gigs: I have been involved with KCME Radio Theatre, Star Bar Players, and Fine Arts Center Repertory Theatre. My favorite roles have been Elwood in *Harvey* and the first torchee in *War of the Worlds*. My daughter Angie married a couple of years ago; she is now a computer science student at Colorado State. My son Josh married this year. He is in advertising."

**Larry Westerman** (law@sharplabs.com) writes, "Working at Sharp Labs of America in

Camas, Washington, for three years, and have finally hit my creative stride, winning the corporate R&D invention award each of the past two years. This past year I had 17 patent disclosures filed, 10 patent applications, and one issued patent. Working mainly in digital video. This year I became senior member of the technical staff, the first person in the four-year-old lab to receive that designation. My wife, Jody, and I serve together as Neighborhood Tree Liaisons for the Portland Urban Forestry Office. I also work on the Land Use and Planning Committee for our neighborhood association. With our kids grown up and gone from home, we're focusing our energies more on the community around us and on our friends."

**John Waugh** (jixix@aol.com) reports that "I have a 1966-vintage Airstream. Does that mean I'm getting old? Doing science teaching and writing for some time, but have now moved into computer programming, primarily Visual Basic. Have two daughters in college and a son in high school. Have written some science fiction, some science articles, and published a few alien cartoons in *Terra Incognita* magazine. Recently I've enjoyed the joys and troubles of Land Rover maintenance, too emotional for the Zen crowd."

**Mark Noble** (mjn@shadow.org) writes, "I left the University of Kansas Medical Center, where I was professor of urologic surgery, and now work as staff urologist at Cleveland Clinic. Perhaps I will make it to our 30th Reunion in 2001; I made it to the 15th. My original major, physics, is still useful. I mentally calculate the optimal forces and angles for our new hobby, sailing on Lake Erie."

**Alan Barclay** (aabarcly@aol.com) says that "after joining SDA as their 100th employee in 1987 and negotiating the hard work, mergers, and political intrigues that grew SDA into a nearly \$1 billion company, now known as Cadence Design Systems, my luck finally ran out and I was laid off along with 600 others in 1998. Now working again in the trenches of electronic design automation at Tera Systems in Campbell, California. Happily remarried to April Kelley in 1996, and living with our sons Colin, Adam, and Jonathan."

**Steve Menkus** (SideOutX@aol.com) sends word that "I work for a small company named ARCO, which is known for marketing hot dogs, fountain drinks, and a little gasoline on the side! We are being merged into British Petroleum, although that verb might be a little generous. After 20 years with the same company/house/wife, it was time for some changes, so we'll see what happens. At a later date, I will contribute some dynamite stuff about awards, professional recognition, successful kid, extramarital flings, stock market coups, etc."

**David Turner** (DLTurner@aol.com) recalls how he "spent freshman and sophomore years at Ruddock House; junior and senior years at the Caltech Coffeehouse." **Joshua Foreman** (foreman@lawfirm.com) is senior partner at Foreman and Zwicker, Attorneys-at-Law, in Seattle, specializing in representing fathers in child support and custody cases.

**Gary Demos** (gary@alumni.caltech.edu) writes that "my Santa Monica, California, company, Demografx, celebrated our 10-year anniversary in 1998. Elected as associate member of American Society of Cinematographers."

As for your class agent, **Phil Lowry**—our family lives in Hopkins, Minnesota. My wife works for a personnel agency as a staffing manager. Our son is a junior in high school; our daughter is in sixth grade. I work as director of operations communications for Northwest

Airlines. Have had two books published: one on all major league baseball parks, entitled *Green Cathedrals*; and one on all pro football stadia, entitled *Green Gridirons*. I run marathons to stay in shape, but I'm much closer to the back of the pack than to the front!

The following class members have also sent in e-mail addresses:

**Michael Arenton**, arenton@uvahee.phys.virginia.edu; **Chuck Barber**, cubarber@jps.net; **David Bauer**, dbauer3@ford.com; **James Beck**, james\_beck@computer.org; **Bill Criss**, billcriss@aol.com; **Dennis DiBartolomeo**, dldibart@lbl.gov; **Barry Fitzgerald**, barryf@netins.net; **Larry Gagliani**, lgaglian@hmsi.com; **Jim Justiss**, jejustiss@mindspring.com; **David Mikkelsen**, mikk@pppl.gov; **Leonard Moss**, ljm@slac.stanford.edu; **Fred Prindaville**, prindaville@dustdevil.com; **Doug Richstone**, dor@umich.edu; **Tim Tardiff**, Timothy.Tardiff@nera.com; **Kenneth Trabold**, kentra@gte.net; **John Victor**, victorjg@rochester.rr.com; **Larry Watkins**, lwatkins@dmci.net; and **Avi Wrobel**, wavi@aol.com.

#### 1986

**Scott Karlin**  
80 Hampshire Drive  
Plainsboro, New Jersey 08536-4313  
karlin@alumni.caltech.edu

**Jim Kennedy** writes from Madison, Alabama, "Last year my wife, Tracey, and I finally bought a house after three years of renting. One of our first acquisitions was a long-awaited dog, an English springer spaniel pup." **Lisa Skrumeda** reports that she is "happily living in the Seattle area and working at a small medical device company."

From Bethlehem, Pennsylvania, **Paul Gillespie** informs us that he's gone back to school. He writes, "While at Caltech I developed a real interest in history, thanks to outstanding professors like David Elliot and Martin Ridge, and ended up double-majoring in E&AS and history. As a communications-computer systems officer in the Air Force for the past 11 years, I've always considered myself an engineer first, but did complete a master's degree in history at the University of Colorado so I could teach at the Air Force Academy 1997-99. Last year I began a doctoral program in the history of science and technology at Lehigh University. Although this is an Air Force-sponsored program, my family (wife, Yvonne, and four children) and I are enjoying living like civilians for three years."

**Alex Yu** (aka Hsiu-Tung Yu) is living in Palo Alto, California, and works in the corporate development group of Liberate Technologies (previously Network Computer, Inc.) doing merger, acquisition, and strategic alliance. "We produce software for information appliances. After three years of struggling in start-up mode, we went public last year. As you can imagine, I am pretty happy about that," writes Alex.

When not skiing, playing racquetball, or competing in chess tournaments (including last year's National Open in Las Vegas), **Matt Compton** '87 designs high-speed data acquisition hardware at the Vexcel Corporation. He and his wife, Lynne, live in Boulder, Colorado, with their children, Robert and Jenny.

"I received my MBA from USC a few years back," writes **Nate Hurvitz**. He is director of engineering at Plexus Medical in San Dimas, California.

In Milan, Italy, **Mario Montessori** is working in the petrochemical industry for a German company that makes large reciprocating compressors. He frequently visits customer

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NEWS \_\_\_\_\_

sites in Egypt, the United Arab Emirates, Iran, and Spain. **Mario** writes, "Italy is very hot and humid in the summer, so every year my wife and I take a vacation in the cooler mountains of South Tyrol (near Austria). We don't have any kids, but we do have a small poodle (Pepsi) who can't speak, but communicates by expressions of his ears and eyebrows. Every evening around midnight he tells us that it's time to turn off the TV and go to bed."

**Taylor Lawrence** reports that he works as vice president of products and technology for Northrop Grumman's Electronic Sensors and Systems Sector, where he oversees advanced programs in tactical, surveillance, maritime, and space-based radars, as well as electronic combat systems, electro-optical countermeasures, intelligence systems, and supporting research activities. Previously, he served as staff director of the Senate Select Committee on Intelligence, chaired by Senator Richard Shelby (R-Alabama). The responsibilities of the committee included drafting legislation that authorized the expenditure of funds by the intelligence community (including the CIA, NSA, NRO, DIA, and NIMA), and consideration of appointed positions, including the president's nominees for director of central intelligence.

More news comes from **Simon Goldstein** in Canada, who writes, "I have been in practice as a pediatric orthopedic surgeon in Calgary for the last four years." After spending 10 years furthering his education after Caltech, "it's good to finally have a real job." He divides his time at the Alberta Children's Hospital (affiliated with the University of Calgary) between clinical work (80 percent) and teaching and research (20 percent). He and his wife, Allison, have two daughters, Genevieve (nearly 3) and Allison (9 months). "Parenthood is certainly an education in itself and makes Caltech look not so difficult, although this may be a bit of a distorted perspective as the years have passed."

"I am still in the Philadelphia area doing work in mathematical finance," writes **Dan Loeb**. "Last spring, Helen and I added to our collection of children with Benjamin Zelig Loeb, born April 28, 1999. Gabby (9) and Jonathan (6) are crazy about him." Last summer, the Loebes hosted a local alumni barbecue. "A

good time was had by all."

**Dave Gallup** writes, "Kyu [Kyuson Yun '89] and I are enjoying our sons Andy (3) and Tom (1) and are both very busy with work. Kyu is going to apply for tenure track faculty positions at the end of 2000." His family business continues to grow. "I have so far failed in my attempts to help my mom retire, due to the volume of work; however, we are feeling optimistic (again) about having her retire at year's end." Dave climbed the Matterhorn in Switzerland last summer and has plans for more adventures this year.

**Lisa Baxter** and her husband **Steve Baxter** '84 writes, "We are celebrating the birth of our second son, Liam, born November 23, 1999. Our 7-year-old, Colin, dotes on the baby." Lisa quit her job as software engineer at UGM Medical Systems and is enjoying being home with her boys, learning karate, playing in a bell choir, and teaching Sunday school.

"I'm *very* happily married to Mayumi Arai, a fellow volleyball player and travel hound I met in Japan," writes **Rod Van Meter**. "The biggest news is that our first child, Sophia Fumi, was born November 1, 1998." After his network-attached storage project at Quantum was canceled, Rod moved to Network Alchemy in Santa Cruz, where he works with **Ken Adelman** and **Hod Greeley** as the team leader of a virtual private networking gateway project. "We've settled into a nice house in Half Moon Bay, and love company—come visit. E-mail gratefully accepted at [rdv@alumni.caltech.edu](mailto:rdv@alumni.caltech.edu)."

We hear that 1999 was quite a year for **Frank Kragh**. He writes, "Mark Stephen Kragh was born on December 28, 1999. Also in December, we bought our first house (in a San Diego suburb) since getting married. With two other boys (15 and 4 years old), we are very much into the 'family phase' of life. Back in February 1999, I started work at a San Diego Navy lab as a civilian communications engineer. I like the work very much. Year 2000 will be a good year for us to enjoy finally having a house that fits our family!"



Cohen . . . from page 5

are our most important product.”

In his research, Cohen studies perturbation theory and bifurcation theory in differential equations, chemical reactor and reaction theory, and problems in diffusive transport. Do the two worlds of teaching and research conflict with or complement each other?

“Some look upon teaching as drudgery, as an imposition. I can’t understand that,” says Cohen, who will spend hours preparing for one lecture. “My research is enhanced by teaching. There are things I want to learn, and sometimes I learn them to teach the students.” On the flip side, he has more success getting a basic mathematical concept across to students when he can apply it to a current example from research rather than a “horse and buggy” example.

A physics graduate of Brown University in 1956, with a master’s degree from Cornell and a PhD from the Courant Institute of Mathematical Sciences at NYU, Cohen was a postdoctoral preceptor at Columbia University in 1962 and an assistant professor at Rensselaer Polytechnic Institute before joining Caltech. He has served as executive officer for applied mathematics, chairman of the faculty, and chairman of the faculty committee that selected past president Tom Everhart.

Cohen joins company with past Feynman Prize recipients Tom Tombrello, Erik Antonsson, Yaser Abu-Mostafa, David Middlebrook, Barbara

Imperiali, and Emlyn Hughes—all professorial faculty honored for their “unusual ability, creativity, and innovation in undergraduate and graduate classroom and laboratory teaching.”

Snowball . . . from page 2

versity of Western Australia in Perth) proposed the Snowball Earth episode in a 1997 paper in *Nature*.

Their evidence for the freeze of 2.4 billion years ago was based on their finding evidence of glacial deposits in a place in southern Africa that in ancient times was within 11 degrees of the equator, according to magnetic samples also gathered there.

The other authors of the PNAS paper are Eric Gaidos of JPL, who also holds an appointment in geobiology at Caltech; Elizabeth Bertani and Rachel Steinberger, both of the Institute’s biology division; and Nicholas Beukes and Jans Gutzmer, both of Rand Afrikaans University in Johannesburg.

The work was supported by the NASA National Astrobiology Institute.



Snowball Earther  
Joe Kirschvink '75

Honors . . . from page 5

educational institution with programs focusing on cancer, neurobiology, and plant biology, as well as molecular and cellular biology, genetics, structural biology, and bio-informatics, CSHL is located in Cold Spring Harbor, New York. Baltimore and Benzer, both of whom are members of the National Academy of Sciences, were recognized for “their long associations with educational activities at the Laboratory.”

Colin Camerer, the Rea A. and Lela G. Axline Professor of Business Economics, has been elected a fellow of the Econometric Society, an international organization for “the advancement of economic theory in its relation to statistics and mathematics.”

The Economic History Network has selected the book *Institutional Change and American Economic Growth*, by the Mary Stillman Harkness Professor of Social Science Lance Davis and Douglass North, as one of the 12 most significant works in economic history published during the 20th century.

Professor of Geochemistry Ken Farley has been selected to receive the 2000 National Academy of Sciences Award for Initiatives in Research, which “recognizes innovative young scientists and encourages research likely to lead to new capabilities for human benefit.” The award will be presented at a May 1 ceremony in Washington, D.C.

Robert Grubbs, the Victor and Elizabeth Atkins Professor of Chemistry, has been awarded the Franklin Institute’s Benjamin Franklin Medal in Chemistry, for his “discovery of a method to significantly improve” the chemical reaction olefin metathesis. His work, the institute adds, has led to a broad range of new drugs, and improved materials for laboratory and commercial applications.

Professor of Civil Engineering and Applied Mechanics Paul Jennings, PhD '63, has had his paper, “Enduring Lessons and Opportunities Lost from the San Fernando Earthquake of February 9, 1971,” selected by the board of directors of the Earthquake Engineering Research Institute (EERI) as the 1997 Outstanding *Earthquake Spectra* Paper. *Earthquake Spectra* is published by EERI, and the paper appeared in the February 1997 (Vol. 13, No. 1) issue. Formal recognition took place at EERI’s 1999 annual meeting, on February 3–6 in San Diego. The EERI board “considers recognition of outstanding contributions to the field of earthquake engineering to be one of its most important responsibilities.”

Dan Kevles, the J. O. and Juliette Koepfli Professor of the Humanities, has been selected to receive the History of Science Society’s 1999 Watson Davis and Helen Miles Davis Prize for his book *The Baltimore Case*. The prize is

awarded annually “for an outstanding book that promotes public understanding of the history of science.”

Professor of Astronomy and Planetary Science and Executive Officer for Astronomy Shrinivas Kulkarni has been invited by MIT’s physics department to give the David Harris Lectures for the year 2000.

Assistant Professor of Physics Hideo Mabuchi, PhD '98, Luce Assistant Professor of Geobiology and Assistant Professor of Environmental Engineering Science Dianne Newman, and Assistant Professor of Computer Science and Computation and Neural Systems Erik Winfree, PhD '98, have been selected by MIT’s *Technology Review* for its TR100 list of “100 young innovators who exemplify the spirit of innovation in science, technology, business and the arts.” The list appeared in the magazine’s November/December issue.

Professor of Biology and Executive Officer for Biology Elliott Meyerowitz has received the Lounsbery Award from the National Academy of Sciences.

Associate Professor of Applied Physics Stephen Quake has been selected as a 1999 Packard Fellow for Science and Engineering and will receive a \$625,000 grant over five years from the David and Lucile Packard Foundation. The grant will support his interdisciplinary research in biophysics, biotechnology, biochemistry, and polymer physics.

Professor of Electrical Engineering P. P. Vaidyanathan has been awarded a Golden Jubilee Medal by the Circuits and Systems Society of the Institute of Electrical and Electronics Engineers.

Alexander Varshavsky, the Howard and Gwen Laurie Smits Professor of Cell Biology, and Avram Hershko, of the Technion—Israel Institute of Technology, are corecipients of the 1999 Gairdner Foundation International Award. Given by the Gairdner Foundation (Canada), the award is for “the discovery of the ubiquitin system of intracellular protein degradation and the crucial functions of this system in cellular regulation.” The award ceremony took place in Toronto last October. Varshavsky has also been selected by the University of Chicago to receive the 2000 Shubitz Cancer Research Prize, and by the German Biochemical Society to receive the 2000 Hoppe-Seyler Award.

Associate Professor of History Alison Winter has been selected to receive the North American Council on British Studies’ 1999 British Council Prize for her book *Mesmerized: Powers of Mind in Victorian Britain*. The award is presented each year “for the best book published anywhere by a North American scholar in any aspect of British studies dealing with the nineteenth and twentieth centuries.”

### KEEP US INFORMED THROUGH THE CALTECH PERSONALS!

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1928

KENNETH R. CROSER, Ex, of Santa Rosa, California, on October 18; he was 93. In 1929 he joined the Army Air Corps because, according to him, "they said they would teach me to fly." He flew the airmail in the early 1930s, then was assigned to the Civilian Conservation Corps when it was organized under the Roosevelt administration. During World War II he served in the Pacific and was part of the occupation force in Japan following the war. Returning to the United States in 1947, he helped introduce ejection seats into jet fighter aircraft. In 1954, he was assigned as senior advisor to the California Air National Guard's 146th Fighter Wing, retiring in 1958 with the rank of colonel. Following his retirement, he became a substitute teacher in the Santa Rosa school system, then accepted a position teaching math and electronics at Santa Rosa Junior College. A ham radio operator (W6BCC), he was also an amateur geologist, jewelry maker, and potter. Predeceased in 1981 by his first wife, Jane, he is survived by his second wife, Gladys; his daughters, Eveline French, Betsy Estes, and Carol Nelson; his son, Fred; and 15 grandchildren and 20 great-grandchildren.

1930

ROLLIN P. ECKIS, MS, of La Jolla, California, on November 12; he was 94. A pioneering geologist and an oil-company executive, he helped discover oil fields from Kern County to Alaska's Prudhoe Bay. After receiving his geology MS from Caltech, he went to work for the Texas Oil Company, then joined the Richfield Oil Company in 1937 as a field geologist. The following year he discovered the Kern County field near Bakersfield, and by 1946 he had risen to chief geologist. Appointed manager of foreign exploration in 1954, he became vice president at Richfield, then president in 1962, and finally executive vice president of ARCO after the 1966 merger of Richfield with the Atlantic Refining Company. Active in the Geological Society of America and the American Association of Petroleum Geologists, Eckis helped organize and served as president of the Petroleum Club. Concerned as well with education and community affairs, he also helped organize the city of Bradbury and was elected its first mayor in 1957. He served as a trustee of Pomona College, and in 1986 he and his first wife, Caroline, contributed \$50,000 with a matching amount from ARCO to help establish the Eckis Chair in Seismology at San Diego State, his first school. After the death of his wife, Caroline, he married Ellen Revelle, who survives him. He is also survived by his daughters, Nancy Eckis and Ellen Schmitt; his son, Rollin Jr.; five grandchildren and seven great-grandchildren; and the four children of the Revelles.

1932

CHARLES F. "FRED" HAMLIN, of San Luis Obispo, California, on October 8; he was 89. After graduating from Caltech, he worked for Union Oil, the city of Pasadena, the San Francisco Bay Bridge, and the California State Bridge Department. During World War II he served as a lieutenant commander in the U.S. Navy Seabees. In 1946 he founded Bailey Bridges Inc., and he began a gradual retirement in 1981, retiring permanently in 1995. Involved in his community, he served on the school board and grand jury, and he was a Rotary Club president and a member of the Antique Car Club. He is survived by Lee, his

wife of 53 years; his son, Charles Frederick "Rick" Jr.; his daughters, Valerie Ramsey, Robin Hamlin, and Betsy Amato; nine grandchildren and three great-grandchildren; and a brother, Homer.

ROBERT C. WHERRITT, of Walnut Creek, California, on June 17, 1999; he was 90. After graduating from Caltech, he went to work for Santa Fe Railroad's ice department. When World War II came, he joined Goodyear Tire & Rubber in South Gate, California, as a mechanical engineer, where he worked on self-sealing gas tanks for aircraft. After the war he specialized in refrigeration, moving in 1948 to Salinas, California, where he worked for the Liquid Ice Company. He served as a member of both the Salinas city council and the Salinas City Airport Commission and, after moving to Walnut Creek, was a Boys' Ranch counselor. His enthusiasms included snow and water skiing, speedboats, cars, flying small planes, wood carving, and joining his wife in golf and bridge. He is survived by his wife, Oleta; a daughter, Irene; a son, Robert; and three grandchildren.

1933

SYLVESTER N. GIDDINGS, Ex, of Stockton, California, on February 10, 1999; he was 89. After serving in the U.S. Navy during World War II, he worked for Ladd's Home Service and Supply in downtown Eureka, California. He later began his 27-year career with the Humboldt Division of Pacific Gas and Electric. Preceded in death by Kathrine, his wife of 60 years, he is survived by his son, Peter, and by a granddaughter.

1934

JAMES N. GREGORY, of Sonoma, California, on October 18; he was 86. He worked as a mechanical engineer for Shell Oil, then independently as a water drilling consultant for major oil companies, cities, and other clients. He and his family lived in Fullerton and Long Beach, in California, where they were avid sailors. Following several years in Pasadena, they retired to Solvang, California. Predeceased by Helen, his wife of 62 years, and by his brother Carter '31, PhD '35, and his brother Theodore, who also attended Caltech, he is survived by two daughters, Carol Moore and Kristin Mikkelsen, and by four grandchildren. His brother-in-law, William McFadden '34, is also an alum.

1936

THOMAS E. BROWNE JR., PhD, of Monroeville, Pennsylvania, on October 17; he was 91. He had joined Westinghouse in 1928, and he spent the next 45 years working in the field of electrical arc interruption. The holder of 21 U.S. patents and the recipient in 1966 of a Westinghouse Special Patent Award for his work with circuit breakers, Browne authored or coauthored over 30 papers and articles. In 1971 he served on the guest editorial committee for the *Special Issue on Atomic and Electrical Plasmas* in the *Proceedings of the IEEE*, and in 1984 he edited the basic reference book *Circuit Interruption: Theory and Techniques*. A fellow of the Institute of Electrical and Electronic Engineers and a founding member of the Current Zero Club, an international group of scientists dedicated to furthering understanding of high-power circuit interruption, Browne retired from Westinghouse in 1973 but continued as a consultant for the next decade. He is survived by his wife, Edna; three sons, Thomas III, Joseph, and Charles; a daughter, Mary Ann Porrata; five grandchildren; and a brother, Micou.

1938

RALPH W. JONES, of San Marino, California, on June 22, 1999; he was 83. A member of the Associates of Caltech, he is survived by his wife, Bobbie.

1939

LEO S. LAVATELLI, of Spring Hope, North Carolina, on May 17, 1998; he was 80. He earned an MA in physics from Princeton in 1943 and was recruited for the Manhattan Project to work on Robert Wilson's isotron project to separate U-235 at Los Alamos. After World War II, he enrolled at Harvard, earning an MS in physics in 1949. He joined the physics department at the University of Illinois in 1950 and received his PhD from Harvard in 1951. At Illinois, he became involved with the new Control Systems Laboratory (now the Coordinated Science Laboratory), where he worked on novel controls for aircraft and for an electric delay line. He retired in 1979 as a professor emeritus of physics—"His enthusiasm for physics was infectious, and he thrived on the interactions with beginning students." He is survived by his wife, Olwen; a daughter, Shana; a son, Mark; two stepdaughters, Alice Cone and Caroline Williamson; two stepsons, Thomas and Hugh Williamson; and five grandchildren.

1940

RAYMOND C. BAIRD, MS, BS '42, of Santa Monica, California, on July 10; he was 82. After receiving his MS he earned a degree in meteorology from Caltech under the Townsend Act, and he served as a meteorologist during World War II. After the war he worked as a research engineer, becoming a self-employed mechanical engineer in 1955, working with power plants, oil refineries, and propulsion systems. He is survived by Myrtle, his wife of 58 years; his son, Raymond Jr.; two daughters, Christine Topham and Sheila Baird; five grandchildren and a great-grandchild; a sister, Jane Goodman; and a brother, Ted.

1943

WILLIAM INNES JR., Ex, in Carmichael, California, on April 19, 1999; he was 82. During World War II he served in the U.S. Army Air Forces, then remained in the Air Force reserves after the war, retiring in 1976 as a lieutenant colonel. He earned a master's degree in meteorology from Caltech following the war, then went to work for United Airlines, remaining with them for 16 years. He then joined the state of California's Division of Forestry, retiring in 1982. He was a member of the Masonic Lodge for over 60 years. He is survived by Margaret, his wife of 46 years, and by his daughter Jane and her family.

GEORGE A. KENDALL, of Rancho Santa Fe, California, on June 25, 1999; he was 78. A Professional Engineer and the CEO of Kendall Golf Products, he spent most of his adult life as an inventor, working with the movie and golf industries. He retired in 1980 and then was head of George Kendall Associates. He is survived by his wife, Nancy; three sons, Robert, James, and Norman; and a daughter, Beverly Thompson.

C. MEADE PATTERSON, MS, of Silver Spring, Maryland, on July 4, 1998; he was 79. After receiving his master's in meteorology from Caltech, he went on to earn master's and doctoral degrees in geology from Columbia University, and he served with the U.S. Army Air Forces during World War II. After the war he worked as a geologist with Gulf Research and Development in Pittsburgh, then was a staff

editor for the National Rifle Association. He joined the Bureau of Mines in 1957 as a commodities specialist and later served as a science editor and physical scientist. He was a marine geologist with the Naval Oceanographic Office from 1967 to 1978, then returned briefly to the Bureau of Mines, from which he retired that same year. He was a fellow of the Company of Military Collectors and Historians, and a member of the Geological Society of America. His marriage to Florence Leach Patterson ended in divorce. He is survived by his wife, Anna; a stepmother, Gertrude; and two brothers and two sisters.

1944

JOSEPH S. "STEWART" MARTIN, MS '47, of Midland, Texas, in March 1998; he was 75. During World War II he served in the U.S. Navy as a lieutenant, j.g., then worked for Tidewater Associated, Intex Oil, Superior Oil, Enron Oil, and HNG Oil as an exploration geologist. He was best known for his discovery of the Pitchfork Ranch field in 1982. He retired in 1988. A life member of the Alumni Association and the West Texas Geological Society, he was in addition a member of the Society of Independent Professional Earth Scientists, the U.S. Naval Reserve and Midshipmen School, the Roswell Geological Society, the Dirty Dozen, the American Association of Petroleum Geologists, and the American Independent Petroleum Geologists. He was also involved with Little League, the Boy Scouts, and the Indian Guides. He is survived by Carmen, his wife of 41 years; five sons, J. Stewart Jr., J. Edwin, Frederick, Stephen, and David; two brothers, John and Carmel; a sister, Anne; and three grandchildren.

1946

RICHARD A. BERNATIS, of Topeka, Kansas, on May 23, 1999; he was 76. He worked for Kansas Power & Light for 39 years, retiring in 1986 as assistant vice president and chief engineer of electrical operations, and he was a member of the Crestview United Methodist Church, Capitol Post No. 1 of the American Legion, the Shawnee Country Club, and the Topeka Fellowship Group. Predeceased in 1979 by his first wife, Regina, and in 1994 by a stepdaughter, Linda Meeker, he is survived by his wife, Dorothy; three sons, Bob, Richard, and Bill; a daughter, Chris; two stepdaughters, Shirley Newcomer and Carol Knott; and 11 grandchildren and three great-grandchildren.

TECK A. WILSON, of Osprey, Florida, on August 9; he was 74. After graduating from Caltech, he joined Hughes Aircraft as one of the first "postwar" electronics people to be hired. In addition to various air-defense design projects, he worked on, in his words, "weird special projects for Howard Hughes personally." Among the memorabilia of such projects was a cast of Hughes's ear, taken to facilitate a telephone design. The first engineer hired by Litton Industries, Teck worked for that company from 1954 to 1960, becoming director of Litton's airborne early warning and control systems department. He later formed and directed Litton's department for advanced systems design. In 1962 he moved to Teledyne, serving as corporate vice president until 1980 and heading up work in advanced systems and the integrated helicopter avionics system. He became managing director of Teledyne's Belgium operation in 1972, and he was a member of NATO's industry advisor group from 1973 to 1976 and headed the U.S. delegation to the group in 1977. That same year he returned to the United States as president of Teledyne Ryan

Aeronautical and Electronics, Ryan being at that time the major producer of unmanned military aircraft. His final position at Teledyne, from 1980 to 1992, was that of director of technology. He is survived by his wife, Eleanor; his daughter, Natalma McKnew; his son, Mark; and a granddaughter, Bronwyn McKnew.

**1948**  
**WILLIAM J. DIXON**, MS '49, PhD '52, of Manhattan Beach, California, on November 2; he was 73. A space-technology engineer who worked for TRW for 19 years, he was best known for his design contributions to the Pioneer spacecraft. After retiring in 1982 he taught spacecraft design for UCLA Extension and at the Naval Postgraduate School at Monterey and was a visiting professor at the Israel Institute of Technology in Haifa (1991–92). He was a member of the American Institute of Aeronautics and Astronautics and the Institute of Electrical and Electronic Engineers. A Boy Scout leader and a musician with the Palos Verdes Symphonic Band, he was also an avid amateur painter, a world traveler, an airplane pilot, a bicyclist, a badminton enthusiast, and a skilled sailor. He is survived by Jean, his wife of 39 years; three sons, Lance '82, Roy, and Alan; a daughter, Wendy; and two grandchildren.

**WALTER P. EATHERLY**, MS '49, of Oak Ridge, Tennessee, on September 8; he was 76. A physicist in the field of carbon materials, he was considered an authority on nuclear graphite. He originally came to Caltech in 1941, but left in 1942 to join the U.S. Army, and during World War II he worked for the Manhattan Project at both Columbia University and in Oak Ridge. After receiving his master's degree from Caltech, he worked for five years with Atomic International as a group leader responsible for research on graphite radiation damage. In 1954 he joined the doctoral program at the University of Illinois, where he worked under Nobel Laureate J. Bardeen, and in 1956 he went to work for Union Carbide's Carbon Products Division as a staff physicist. In 1959 he became an assistant director, and in 1962 Carbon Products Division general manager of nuclear products. In 1967, while it was managed by the Union Carbide Nuclear Division, he went to work at Oak Ridge National Laboratory. He joined the graphite research group, of which he became leader in 1970. From 1977 until his retirement in 1988, he was program manager for graphite R&D. Active in professional societies, he served the American Society for Testing and Materials for 14 years as a member and chairman of the C5 Committee on Carbons and Graphite, and the American Carbon Society as an advisory committee member from 1971 to 1975. In 1973 he served as conference chairman for that society's 11th Biennial Conference on Carbon. A fellow of the society, his many awards included its George Skakel Memorial Award and two U.S. Department of Energy Outstanding Achievement awards for the NASA Galileo and Ulysses missions. Predeceased by a son, Charles; a brother, Scott; and a granddaughter, Amy; he is survived by Emily, his wife of 55 years; his sons, W. Scott and Richard; and six grandchildren, three step-grandchildren, and two great-grandchildren.

**TOM TRACY**, of Fremont, California, on February 17, 1999. His career in sales and marketing took him from employment with Honeywell Semiconductors to serving as vice president, marketing, at Noble Packaging, Inc., which produces vacuum cryogenic packaging systems. The permanent secretary of his class

for over 50 years, he kept in close contact with many of his classmates, and he is survived by many friends.

**1949**  
**FRANK H. BEARDSLEY**, on November 17, in Redding, California; he was 78. Throughout his career he specialized in motor design, a field in which he worked continuously up until his death, and during the mid-1960s he was a team leader in the Apollo program. He was also a lifelong amateur radio operator (KD6W and W6RAX). He is survived by a son, Robert; a daughter, Barbara; and two grandchildren.

**1950**  
**ALBERT M. SOLDATE**, PhD, of Arcadia, California, on September 25; he was 78. After receiving his doctorate from Caltech, he pursued a career in research at Standard Oil of California, Skagit Steel Corporation, National Engineering Science Corporation, and Tetratex. He was a past president of the Arcadia Rotary Club and the Monrovia Tennis Club. Predeceased by his son Mark, he is survived by Mary, his wife of 55 years; two sons, Mills and Stuart; and two grandsons.

**1952**  
**ALAN G. FLETCHER**, MS, of Bella Vista, Arkansas, on December 22; he was 74. He received his doctorate from Northwestern University in 1963, and during his career he was a professional civil engineer with BC Hydroelectric in British Columbia, and professor of engineering and dean of the School of Engineering and Mines at the University of North Dakota, from which he retired in 1989, moving to Bella Vista. He was an honorary member of the student chapter of the Society of Women Engineers at the University of North Dakota, as well as a member of Sigma Xi and various engineering societies, and he had recently received a Leadership Award from the National Society of Women Engineers, and an Engineer of the Year award in North Dakota. A member of the Rotary Club, the YMCA, and the Presbyterian Church, his interests included photography, travel, and snow and water skiing. He is survived by Agnes, his wife of 50 years; a son, Christopher; three daughters, Lynn Fletcher, Elizabeth Lamb, and Anne Fletcher; two brothers, Ray and Herbert; a sister, Rita Mcleod; and three grandchildren.

**LLOYD D. JOHNSON**, MS, of Sacramento, California, on July 9; he was 76. One of a group of students during World War II who received certification after completing an accelerated training program in meteorology—and who referred to their group as Ceiling and Visibility Unlimited, or CAVU—he went on to serve in the Army Air Forces during World War II, including in the Pacific theater, where he flew over Japan as a weather observer. In following years he attended several CAVU reunions, and in 1998 Caltech awarded him a retroactive master's in meteorology, dated 1952. After the war he received his BS in civil engineering from UC Berkeley, then went to work for the East Bay Municipal Utilities District. A member of the Air Force Reserve, he was recalled to active service during the Korean War. After his discharge, Johnson joined Leeds, Hill & Jewett, a prominent Los Angeles water-engineering firm, and participated in many international projects. In 1959 he became a member of the California civil service, working in Sacramento with the Water Resources Control Board, Water Rights Division, for nearly 30 years. During his final years of work he headed the Bay Delta project, part of the ongoing attempt

## VITO VANONI 1904–1999

Vito Vanoni '26, PhD '40, professor of hydraulics, emeritus, died on December 27, 1999, of congestive heart failure. He was 95 years old.

Vanoni was an internationally recognized authority on the mechanics of transport of sediments by streams and rivers. He taught courses and did research on hydrodynamics of sediment transport, advanced hydraulics, hydraulic structures, and coastal engineering.

After receiving his Caltech PhD in 1940, Vanoni became assistant professor of hydraulics at the Institute in 1942. He was promoted to associate professor in 1949, and served as professor from 1955 until his retirement as professor emeritus in 1974.

From 1935 to 1947 he supervised the cooperative Sedimentation Laboratory of the Soil Conservation Service and Caltech. The SCS sponsorship stopped in 1947, but research on sediment transport in open channel flumes and turbulent diffusion in a low-speed water tunnel continued until 1960, when the W. M. Keck Laboratories became the permanent home for this program.

During World War II, Vanoni did defense-related research for the National Defense Research Committee and the U.S. Navy, primarily related to the investigation and control of wave action in harbors, using hydraulic models in outdoor space on the campus and later in a large off-campus facility in Azusa. He was also active in the design and testing of hydraulic structures such as energy dissipaters and high velocity channels.

After retiring from Caltech, Vanoni served as an expert individual consultant on river channel and sedimentation problems for many consulting firms and government agencies, including several boards for the U.S. Army Corps of Engineers.

Elected to the National Academy of Engineering in 1977, Vanoni was named an Honorary Member of the American Society of Civil Engineers (ASCE) in 1980. The ASCE also named him to be the Hunter Rouse Hydraulic Engineering Lecturer in 1983. In 1989 he became the first recipient of the ASCE Hans Albert Einstein Award, awarded annually for a "significant contribution to the engineering profession in the areas of erosion control, sedimentation and/or waterway development."

His wife of 61 years, Edith Vanoni, died in 1995. Although they had no children, he is survived by many relatives in his extended family in his native Ventura County and in Santa Barbara.

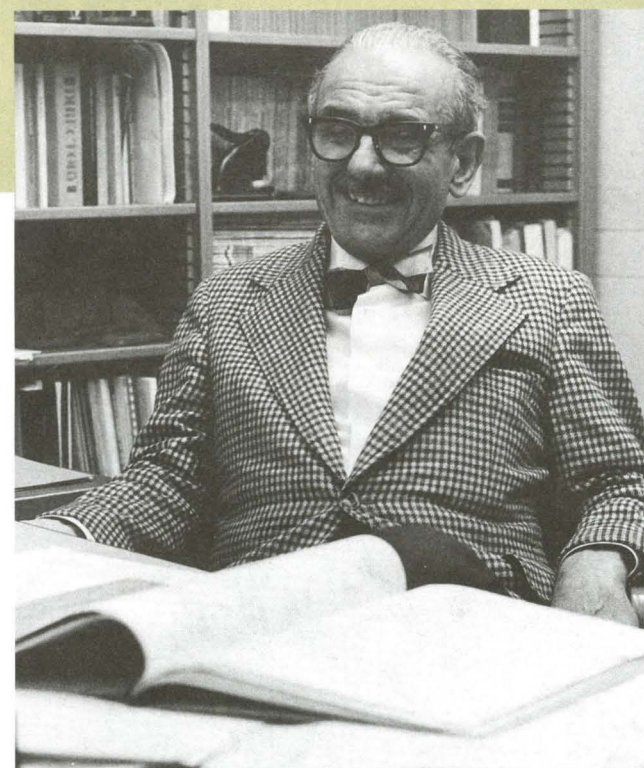
to manage California's water resources fairly. He is survived by Edith, his wife of 50 years; a daughter, Nicole Napp; three sons, Mark, Bruce, and David; a sister, Ellen Howard; and four grandchildren.

**1956**  
**TOM PLAMBECK**, MS '57, of Santa Barbara, California, on November 26; he was 64. A computer programmer who during his career worked for Raytheon, General Research Corporation, GeoDynamics, and Toyon, he devoted more of his energy to personal interests, including leading men's retreats and participating in the Fatherhood Coalition of Santa Barbara and the Ojai Valley Youth Foundation Mentoring Program. The recent owner of a house built around a 100-year-old oak tree, Plambeck took pleasure in nature, taking white-water rafting trips and organizing 22 annual Memorial Day hikes through Davy Brown Canyon in the Santa Ynez Mountains. He is survived by his wife, Wini; a daughter, Teri Brown; a son, Kevin; a stepdaughter, Denise Musil; two brothers, Chuck and Dan; and eight grandchildren.

**RICHARD S. VAN DE HOUTEN**, of Maitland, Florida, on June 9, 1999; he was 64. He was the owner of Swim-N-Stuff, Horizons.

He is survived by his wife, Mimi; three sons, S. Scott, Richard, and David; two daughters, Debra Latter and Vicki Huchette; two brothers, John and Edward; two sisters, Caryl Saunders and Joan Hannas; and 11 grandchildren.

**1957**  
**CHARLES H. MOSHER**, on May 1, 1999; he was 63. After graduating from Caltech he served in the U.S. Army from 1957 to 1959, then earned his MS (1961) and PhD (1963) from Cornell University. He was a senior engineer with Varian Associates, and then manager of product development at Nuclear Equipment until 1978, when he moved to Computervision Corporation. Since 1989 he had been writing and serving actively in the community, teaching classes and holding offices in a variety of local organizations, including the Bay Area Amphibian and Reptile Society, the East Palo Alto Area Drug Task Force, the Palo Alto Junior Museum, Parents Without Partners, and the Little House Computer Club. Formerly married to Naidia Woolf, he is survived by a son, Alexander; a daughter, Vivi; and a brother, Lanning.



Vito Vanoni in his Caltech office, in the 1970s.



**“New Mirror of the Heavens”**

Or as the original Dutch has it, “Nieuwe Hemels Spiegel.” The dawn of modern astronomy is beautifully reflected in this hand-colored celestial map, printed and engraved in Rotterdam, Holland, at the close of the 17th century. Centered on the north pole, the map shows all of the constellations of the northern hemisphere, with Earth’s four winds at the four corners. The upper left-hand drawing depicts a heliocentric solar system, with the then-seven known planets circling the sun, while the drawing at the upper right pictures the north pole’s orientation to the sun during each of the four seasons. Now in the Caltech Archives, the map is one of many treasures relating to the history of science acquired by Caltech physicist Earnest C. Watson and donated upon his death to the Institute.