California Institute of Technology

The mission of the California Institute of Technology is to expand human knowledge and benefit society through research integrated with education.

We investigate the most challenging, fundamental problems in science and technology in a singularly collegial, interdisciplinary atmosphere, while educating outstanding students to become creative members of society.
LETTER FROM THE CHAIRMAN

It is likely that anyone who has come within the sphere of Caltech’s influence in the past 18 months or so knows about the great adventure we’ve embarked upon: raising $1.4 billion dollars to support our unique brand of scientific and technological research. At the end of September 2003—not quite a year into the campaign’s public phase—we were more than halfway to our goal, with $860 million in commitments on the books.

This progress has been possible thanks to the generosity of a circle of loyal friends, the leadership of our campaign committee, and the dedication of our development staff. Where do we go from here? As I see it, our next task is to expand that circle of support. There are still many people with an interest in furthering scientific progress who don’t know us as well as we would like.

President Baltimore and I spend considerable time trying to convey our enthusiasm for Caltech’s mission to these prospective friends, in part by answering questions about our current fund-raising effort. Why are we engaged in this campaign? And why now?

At first glance, this may seem like an inauspicious time to be conducting such an ambitious campaign, but there are several compelling reasons for doing so. First, in today’s competitive environment, a research institution of Caltech’s caliber simply can’t take a holiday from its work. Our highly productive faculty members are constantly generating ideas that must be acted upon while they are fresh. If we hesitate, we will soon be standing on the sidelines, watching the
rest of the scientific world pass us by. Raising the stakes is the fact that many of our peer institutions are also in the midst of major campaigns, or have just completed them. Without comparable resources, we risk losing the superlative faculty and students whose work keeps us at the forefront of discovery and invention.

Of course, it’s impossible to know exactly what sort of impact supporting Caltech research today might have tomorrow. But I think we can get a pretty good idea by looking at how the Institute’s past has shaped our present. Imagine how different today’s world would be if, say, Linus Pauling had not discovered the nature of the chemical bond, or Roger Sperry hadn’t mapped out the specialized functions of the left and right hemispheres of the brain, or Carver Mead hadn’t developed the high electron mobility transistor. Imagine how much poorer our understanding of the heavens would be without the spectacular images and data obtained by the Keck and Palomar telescopes and JPL’s missions to Venus, Mars, and Jupiter. And imagine what a different field seismology might be had Charles Richter not wandered into one of R.A. Millikan’s physics lectures some 80 years ago.

The money we raise through this campaign will be used to build new labs, to fund fellowships and professorships, and to buy the latest equipment. But ultimately it will do much more than that. It will allow Caltech investigators to keep doing what they do best: advancing human knowledge for the good of humankind. I can’t think of any worthier cause.

Benjamin M. Rosen
Chairman, Caltech Board of Trustees
In his 1852 work *The Idea of a University*, John Henry Newman wrote, “a University... is a place where inquiry is pushed forward, and discoveries verified and perfected, and rashness rendered innocuous, and error exposed, by the collision of mind with mind, and knowledge with knowledge.” Although the world is certainly very different from what it was 150 years ago, Newman’s attempt to define the nature and role of institutions of higher learning is still pertinent. **What, we might well ask ourselves, is *our idea of a university*? Is it reasonable for 21st-century institutions to aspire to the same high purpose as their 19th-century counterparts, given that they must function within the pragmatic framework of American capitalism? Contemporary universities are for the most part nonprofit organizations whose main concern is not the bottom line—yet they must be as fiscally savvy as any corporation if they want to survive to pursue their ideals. What is the proper balance between the **ideal and the real**, the exalted and the down-to-earth?

I am not alone in pondering these questions. I recently had occasion to review *Universities in the Marketplace: The Commercialization of Higher Education*, a book by Derek Bok, a former president of Harvard. Bok criticizes the extent to which some universities pursue revenue-generating activities—competitive athletics and technology transfer, to name two examples—because he feels it distorts or threatens what should be the schools’ primary mission: education and research. While I admire Bok’s vision, I don’t think it embraces the whole picture. **Experience has convinced me that successfully running a university today requires the ability to focus simultaneously on the pragmatic and the ideal.**
Caltech has been paying close attention to both these perspectives over the past year. Our most important pragmatic effort at the moment is, of course, the fund-raising campaign that was officially launched in October 2002. As of the end of the last fiscal year (September 30, 2003) we had raised about $860 million toward our $1.4 billion goal. The downturn in the stock market and other economic difficulties have made this an especially challenging time to launch such an ambitious campaign; yet it was absolutely necessary that we do so. Inaction, or even delay, could well have compromised our ability to pursue the kind of research that has benefited humankind so greatly over the past century and to compete with our peer institutions for the best faculty and students. Despite this initial challenge, there is much cause for optimism. The economy is showing signs of improvement, and our development staff—both on campus and in our recently established New York office—are hard at work. They have many funding proposals pending, and are continuously expanding the pool of prospective donors. I am confident that their efforts and the continued support of our many loyal friends will ultimately result in a successful campaign.

As for my own contribution to this effort, several months back I made the decision to devote the major part of my time to the campaign. Thus, even though I remained in close contact with what’s happening on campus, I delegated much of the day-to-day running of the Institute to Provost Steve Koonin. This arrangement allowed me to spend more time meeting with potential donors and communicating my excitement about our current activities and our plans for the future.
Fortunately, at Caltech there’s no lack of exciting scientific and technological feats to talk about. Some of the most spectacular achievements of the past year came from collaborations between campus investigators and their colleagues at the Jet Propulsion Laboratory (which Caltech manages for NASA).

→ One such project, the **Spitzer Space Telescope** (formerly known as the Space Infrared Telescope Facility), was launched in August 2003, beginning a two-and-a-half-year (or hopefully longer) mission to detect infrared energy radiated by objects in space. Its highly sensitive instruments will give us a view of the universe that Earth’s atmosphere prevents us from obtaining from the ground. Similarly, **GALEX**, the **Galaxy Evolution Explorer**, launched in April 2003, will observe galaxies in ultraviolet light across 10 billion years of cosmic history. What’s more, JPL’s **Mars Exploration Rover** was launched last summer and landed successfully on January 3, 2004, providing a welcome bit of good news after the heartbreaking loss of the space shuttle **Columbia** in February. These successes demonstrate that—despite difficulties in some divisions of NASA—JPL, under Charles Elachi’s strong leadership, still excels at robotic space exploration.

→ Another project that promises to reveal a wealth of new data about our universe is **TMT**, the **Thirty-Meter Telescope** (formerly known as CELT, the California Extremely Large Telescope), which Caltech is developing in partnership with the University of California and others. One of the funding priorities of our current campaign, TMT will be a powerful new tool for doing astronomy at visible and infrared wavelengths, and will build on Caltech’s existing strength in space study and exploration. The TMT project will also be one of the first activities of CIT², the Center for Innovative Technologies at the California Institute of Technology. CIT² will be housed in the former St. Luke Medical Center in northeast Pasadena, a facility Caltech purchased from Tenet Healthcare Corporation last summer. After the buildings undergo some necessary remodeling, other research groups will join the TMT team in the Institute’s latest “satellite” facility.
Collaborations like the Spitzer Space Telescope, GALEX, and TMT are particularly impressive examples of how Caltech conducts **cross-disciplinary investigation**—but they’re not the only ones. I had another insight into our preferred modus operandi last fall, when I met the four new members of our biology division faculty. Three of the four had studied physics or engineering, rather than biology—and the fourth, although first trained as a biologist, had later returned to school to become an engineer. (He realized that what he wanted to investigate—insect flight—was actually a fluid-dynamics problem!) At another institution it might seem odd for a biology department to hire so many non-biologists—but at Caltech it makes good sense. These faculty appointments hark back to the vision of Nobel Laureate Thomas Hunt Morgan, who founded our biology division in 1928. Though a classically trained biologist himself, Morgan believed—as he once told Albert Einstein—that “the future of biology rests in the application of the methods and ideas of physics, chemistry, and mathematics.” (Einstein reportedly scoffed at Morgan’s notion, but it appears history has vindicated it.)

Besides the increasingly common practice of cross-disciplinary training, there’s another educational trend that is affecting the way research institutions operate: **the lengthening of postdoctoral appointments**. Biology postdoc appointments in particular have increased markedly in length, from two or three years to as many as seven, but longer tenures are showing up in other fields as well. While this trend offers postdoctoral scholars a practical benefit—more time to complete substantive work, and thus better preparation for a competitive job market—it also subtly changes the culture at their host institutions. When postdocs work at a university for only a year or two, they tend to identify primarily with their own lab group or department. Double or triple that stay, however, and their relationships with the larger campus community have time to grow.
and deepen. This became clear to me last year, when Caltech’s sizeable postdoc community organized into a formal association for the first time. I think this is a very positive step, both toward meeting the particular needs of the postdocs themselves, and toward making the rest of us more aware of their substantial contributions to our research and teaching efforts.

As I mentioned earlier, my main reason for delegating some of my administrative responsibilities to the Provost was to give me more time to focus on the campaign. But this reorganization also gave me more time to think about how best to keep Caltech in a stable fiscal position while simultaneously keeping us at the forefront of research and education. So far, we’ve managed to pull off this balancing act rather well—thanks in large part to the invaluable support of Gordon and Betty Moore, whose extraordinary lead gift started our campaign off on a strong footing. Continuing success in our fund-raising efforts is essential, however, if we are to keep Caltech healthy in the years to come.

Our finances, for better or worse, are actually extremely simple. Our research in effect pays for itself, thanks to our faculty’s impressive talent for attracting sponsored-research dollars (two to three times the money investigators at most other institutions raise). All the Institute’s other expenses, however—for instruction, academic support, infrastructure maintenance, and so forth—are funded from two main sources: endowment income and gifts. [Tuition accounts for only about three percent of our revenues.] Moreover, the income from our endowment is based on a three-year rolling average; thus, even if this year the economy appears to be strengthening, this year’s endowment income will still reflect the weakness of last year and the year before. When endowment income goes down, we rely even more heavily on support from our friends.
Lest all this talk about our financial condition send the wrong message, I want to emphasize that Caltech is as fiscally sound as ever. Our budget was balanced last year, and will be again this year, thanks to the vigilance of our financial administrators. When it became apparent more than a year ago that the economy’s downturn was beginning to affect the Institute’s bottom line, they immediately began looking for ways to cut costs without compromising the core mission of Caltech. One result of their foresight was the installation on campus of a new cogeneration plant, which will generate 80 to 90 percent of the power we need, reduce overall emissions by 66 percent— and save us $2.5 million per year. Another was the careful review of health-insurance providers that was conducted by our benefits staff to obtain the best possible coverage at the lowest possible cost. Caltech staff, faculty, and students deserve commendation, too, for supporting our efforts to economize, even when it required some degree of personal sacrifice.

Even though these challenging economic times have required us to behave somewhat more “corporately” than in the past, I’m happy to say that we haven’t lost sight of our true identity. Caltech exists to conduct scientific and technological research and education with peerless style and uncompromising quality. (As our campaign slogan points out, “there’s only one” place like this in the world.) We succeed at these ventures because of the coordinated efforts of our highly productive faculty, our extraordinary students, our dedicated staff, and our generous friends. It is their continued dedication and support that allow us to realize our ideal of what a university should be.

David Baltimore
President
STUDENT AWARDS

(members of the class of 2003, unless otherwise noted)

Amasa Bishop Fellowships:
Rachel Medwood (class of 2004)
Kirsten Welge (class of 2004)

Hertz Fellowships:
Kimberly Beatty (graduate student)
Paul Choi

Marshall Scholarship:
Vikram Mittal

National Science Foundation Fellowships:
Michelle Allis    Geoffrey Irving
Paul Choi        David Moore
Helen Chuang     Mark Rudner
Kevin Costello   Eino-Ville Talvala
Justin Fox

alumni:
Daniel Abrams    Julie Norville
Kristen Cook     Dana Vukajlovich
Emma Goldberg    Zhen Zhou

Rotary Scholarship:
Laura Elliott

Strauss Scholarship:
Kristin Shantz (class of 2004)
the year in review
**OCTOBER 2002** → The Voices of Vision speaker series is inaugurated to bring to campus poets, writers, cartoonists, and other creative thinkers with unique ways of seeing the world. Speakers for the first season include Seamus Deane, a poet and professor of Irish studies at Notre Dame; “The Boondocks” cartoonist Aaron McGruder; Lawrence Krauss, a physicist at Case Western Reserve University, who speaks on “The Physics of Star Trek”; and composer John Adams, conductor Esa-Pekka Salonen, and director Peter Sellars, who discuss their opera *El Niño*. 10.25.02 — Caltech publicly announces its campaign to raise $1.4 billion dollars. 10.26.02 — Television talk-show host Charlie Rose moderates a public lecture and panel discussion, “A Celebration of Caltech Science,” from 9 a.m. to noon in Beckman Auditorium.

**JANUARY 2003** 01.14.03 — A festival celebrating the films of Frank Capra (BS ’18) kicks off with a showing of *Mr. Deeds Goes to Town*. 01.17.03 — Author Michael Crichton visits campus to give the Michelin Distinguished Visitor lecture. 01.28.03 — Paul Brest, president of the William and Flora Hewlett Foundation, is named to Caltech’s Board of Trustees.

**FEBRUARY 2003** 02.07.03 — Tommy Lasorda, the former manager and a current senior vice president of the Los Angeles Dodgers, visits Caltech for an evening of conversation with Tommy Hawkins, the Dodgers’ vice president of external affairs; former general manager Buzzy Bavasi; former Brooklyn Dodger Rod Dedeaux; and former Dodgers president Peter O’Malley. 02.12.03 — The Leakey Speaker Series on Human Origins returns to Caltech after an 18-year hiatus. The first speaker is Jean Clottes, a prehistorian and rock-art specialist, lecturing on “The Chauvet Cave Now: The Oldest Rock Art Site in the World.”
10.10.02  Robotic B.I.O.-Bugs swarm Pasadena
10.15.02  Caltech astronomers unveil powerful new infrared camera for the 200-Inch Hale Telescope
11.12.02  Cellular choreography, not molecular prepattern, creates repeated segments of vertebrate embryo
11.20.02  Rupture of Denali fault responsible for 7.9-mag Alaskan earthquake of November 3
11.28.02  New study describes workings of deep ocean during the Last Glacial Maximum
12.03.02  Caltech professor to explore abrupt climate changes
12.06.02  Earthbound experiment confirms theory accounting for sun’s scarcity of neutrinos
12.13.02  New theory accounts for existence of binaries in Kuiper Belt
12.18.02  Clouds discovered on Saturn’s moon Titan
12.23.02  Caltech, UCLA researchers create a new gene therapy for treatment of HIV
01.09.03  Research shows that shear force of blood flow is crucial to embryonic heart development
01.27.03  Caltech partners with local high schools to measure subatomic shrapnel
01.29.03  Nanodevice breaks 1-GHz barrier
MARCH 2003  ➔ All 200 of Caltech’s varsity athletes are named Sports Ethics Fellows by the Institute for International Sport in 2003 for being (in the words of IIS director Daniel Doyle) “a group of young people who face formidable academic pressure and who value their sports experience for reasons that transcend winning….Their lessons are learned…from teamwork, developing friendships, managing time, and turning the disappointment of frequent losses into a resolve to do better the next game.” ➔ Caltech’s newly formed women’s figure skating team places first in the Pacific Regional Collegiate Figure Skating Competition. (They go on to finish sixth in the nationals.) 03.02.03 — Caltech’s student chess team, founded at the beginning of the 2002–03 academic year, wins the U.S. Amateur Team Chess Championship. 03.17.03 — Physician and author Oliver Sacks comes to Beckman Auditorium as the William and Myrtle Harris Distinguished Lecturer, speaking on “Creativity and the Brain.” 03.29.03 — Former astronaut and Caltech trustee Sally Ride brings her L.A. Science Festival to campus for girls in grades 5–8. The program’s theme is “Reach for the Stars.”

APRIL 2003  ➔ The first of at least three magnetic resonance imaging instruments, a 3 Tesla large-bore scanner, is installed in the Broad Center for the Biological Sciences. The scanner—one of the priorities of the “one.caltech” campaign—will be used by investigators in the Center for Analysis of Higher Brain Function, a new facility established through a grant from the Gordon and Betty Moore Foundation. 04.02.03 — As part of the Caltech Y’s Social Activism Speaker Series, MIT professor Theodore Postol lectures on “Science and Technology Issues in the National Missile Defense Program.” 04.15.03 — NEURO, an art exhibit that is the result of a yearlong collaboration between Caltech engineers and Los Angeles–based artists, opens at Caltech and Art Center College of Design. The show runs through June 29.
02.12.03  Caltech, Italian scientists find human longevity marker

02.13.03  The Martian polar caps are almost entirely water ice, Caltech research shows

03.03.03  Caltech applied physicists create ultra-high-Q microcavity on a silicon chip

03.18.03  Caltech computer scientists develop FAST protocol to speed up Internet

03.19.03  Quick action by astronomers worldwide leads to new insights on mysterious gamma-ray bursts

03.19.03  Caltech applied physicists invent waveguide to bypass diffraction limits for new optical devices

04.07.03  Science begins for LIGO in quest to detect gravitational waves

04.14.03  Discovery of giant planar Hall effect could herald a generation of “spintronics” devices

04.16.03  Astronomers find new evidence about universe’s heaviest phase of star formation

04.17.03  New insight into how flies fly

05.07.03  Scientists gain insights into why fearful animals flee—or freeze

05.14.03  Caltech planetary scientist has “modest proposal” for sending probe to Earth’s core

06.12.03  Hydrogen economy might impact Earth’s stratosphere, study shows

06.26.03  International teams set new long-range speed record with next-generation Internet protocol

06.27.03  Scientists propose global HIV vaccine enterprise

Top to bottom:
04.17.03
03.03.03
03.19.03
MAY 2003 → Caltech announces that it will purchase the former St. Luke Medical Center in northeast Pasadena for use as a research facility. → Construction begins on Caltech’s new power cogeneration system. After its completion in summer 2003, the new system is expected to significantly reduce emissions and to save the Institute some $2.5 million annually in energy costs.

05.05.03 — President David Baltimore conducts “A Conversation with James Watson,” the corecipient of the Nobel Prize for discovering the structure of the DNA molecule, in Beckman Auditorium. 05.08.03 — Richard Tapia, a professor of computational and applied mathematics at Rice University, speaks on “Post-Affirmative Action Challenges to Diversity in Higher Education” under the auspices of the President’s Lecture Series on Achieving Diversity in Science, Mathematics, and Engineering.

JUNE 2003  06.13.03 — Caltech’s 109th annual commencement takes place. The speaker is Harold Varmus, president of Memorial Sloan-Kettering Cancer Center and former director of the National Institutes of Health. 490 degrees are granted: 242 BS (124 with honor); 111 MS; 137 PhD.

JULY 2003  07.29.03 — Community leader G. Patricia Beckman is elected to the Caltech Board of Trustees.

SEPTEMBER 2003 → The renovation of Dabney Hall begins, and a second MRI instrument (a 4.7 Tesla vertical-bore scanner) is installed in the Broad Center. Both projects are funded by donations to the “one.caltech” campaign.

OCTOBER 2003  10.02.03 — “A Conversation with Jack Valenti” is the fourth DuBridge Distinguished Lecture to be presented at Caltech. As in the past, the lecture format is an open-ended conversation between the guest speaker and an area journalist, this time Los Angeles Times entertainment reporter James Bates.
A detailed map of dark matter in a galactic cluster reveals how giant cosmic structures formed

New sky survey begins at Palomar Observatory

Gravity variations predict earthquake behavior

Atmospheric researchers present new findings on the natural hydrogen cycle

“Bubloy” the latest invention from Caltech materials scientists

JPL HIGHLIGHTS

The Jet Propulsion Laboratory said both hellos and goodbyes to major missions in 2003 as it managed a complex and varied agenda of space and Earth science missions.

One of the most exciting introductions was that of the long-awaited Spitzer Space Telescope, the fourth and final of NASA’s Great Observatories. With science activities managed out of a center located on campus, the mission is capturing images of targets ranging from distant galaxies to the dusty planetary construction zones around stars and a variety of other space objects. Also launched during the year was the Galaxy Evolution Explorer (GALEX), an ultraviolet telescope led by a principal investigator on the Caltech faculty.

The laboratory said goodbye to the Galileo spacecraft, which orbited the solar system’s largest planet, Jupiter, for nearly eight years. Galileo ended its highly productive mission—which delivered such important findings as evidence of subsurface oceans on jovian moons—with a dramatic plunge into Jupiter’s atmosphere, to avoid the possibility of ever contaminating any of the moons.

In the summer, JPL launched twin Mars Exploration Rovers that will reach the red planet in January 2004. Significant science results were achieved with several Earth science missions launched the previous year, including the Atmospheric Infrared Sounder on NASA’s Aqua satellite and the Gravity Recovery and Climate Experiment, or Grace.
DEVELOPMENT HIGHLIGHTS

Caltech received a total of $124,443,376* in cash and securities in fiscal year 2003, including more than $10 million from the estates of 33 individuals, nearly $34 million from foundation donors, and more than $5 million from corporations. Twenty-six percent of all alumni gave gifts totaling $2,544,258 to the Alumni Fund in support of current-use projects. Members of the Caltech Associates made contributions, which are also included in some of the previously listed categories, that totaled more than $72 million in restricted and unrestricted gifts.

Caltech gratefully acknowledges the following individuals and organizations for their generous support.

*This figure is based on the effective date of cash/securities received, per the Council for the Advancement and Support of Education (CASE) reporting standards, and may differ slightly from audited financials.

The Ahmanson Foundation
_to support the renovation and restoration of Dabney Hall_

Francis Bacon Foundation
_to create the Francis Bacon Prize in the History and Philosophy of Science and Technology_

Arnold and Mabel Beckman Foundation
_in support of the Beckman Foundation Fund for the Beckman Institute_

The Carl F Braun Trust
_to endow the John G Braun Professorship_

ChevronTexaco Corporation
_for equipment to support the Power, Energy, and Environmental Research (PEER) Center_

The Estate of Mr. Sidney Coolidge
_to provide unrestricted, current-use support to the Institute_

The Ellison Medical Foundation
_for the Ellison Senior Scholar Award in support of research by Dr. Seymour Benzer_

Mr. Martin D. Gray (BS ’71)
_to support the renovation and restoration of Dabney Hall_

The Estate of Mr. Lawrence A. Hanson Jr. (BS ’42)
_to establish the Lawrence A. Hanson Jr. Professorship_

Dr. Richard N. Lane (BS ’65, PhD ’68) and Mrs. Supathra Boonpikum Lane
_to endow a full undergraduate scholarship_

The McKnight Foundation
_to recognize research by Dr. Paul Patterson through the McKnight Neuroscience of Brain Disorders Award_

The Estate of Otto E. Osthoff
_to provide unrestricted, current-use support to the Institute_

The David and Lucile Packard Foundation
_to fund a Packard Fellowship in support of Dr. Dianne K. Newman_

The Estate of Mr. Frank J. Roshek
_to augment the Altair Fund to support a professorial chair in physics_

Warren and Katharine Schllinger Foundation
_to endow the Schllinger Discovery Fund_

Mr. Warren C. Shinn
_to fund a gift annuity to support the Warren C. Shinn Undergraduate Scholarship Fund and other charitable and educational purposes_

Dr. Thomas J. Tyson (BS ’54, PhD ’67)
_to endow the Howell Tyson Sr. Professorship_
AWARDS AND HONORS

National awards and honors

American Academy of Arts and Sciences, Fellow:
Fred C. Anson, Elizabeth W. Gilloon Professor of Chemistry, Emeritus
Colin F. Camerer, Rea A. and Lela G. Axline Professor of Business Economics
Joseph L. Kirschvink, Professor of Geobiology

American Association for the Advancement of Science, Fellow:
Barry C. Barish, Ronald and Maxine Linde Professor of Physics, and Director, Laser Interferometer Gravitational-Wave Observatory Laboratory

National Academy of Engineering, Founders Award:
Carver A. Mead, Gordon and Betty Moore Professor of Engineering and Applied Science, Emeritus

National Academy of Sciences, Award in Chemical Sciences:
Harry B. Gray, Arnold O. Beckman Professor of Chemistry
Member:
Shrinivas R. Kulkarni, John D. and Catherine T. MacArthur Professor of Astronomy and Planetary Science

National Medal of Technology, Recipient:
Carver A. Mead, Gordon and Betty Moore Professor of Engineering and Applied Science, Emeritus

International awards and honors

European Association for Geochemistry, 2003 Houtermans Medal:
Jess F. Adkins, Assistant Professor of Geochemistry and Global Environmental Science

European Association for Signal, Speech and Image Processing (EURASIP), 2003 Best Paper Award, Coreipient:
Emmanuel J. D. Candès, Associate Professor of Applied and Computational Mathematics

European Physical Society, 2003 High Energy and Particle Physics Prize, Coreipient:
H. David Politzer, Professor of Theoretical Physics

Alexander von Humboldt Foundation, Humboldt Research Award for Senior U.S. Scientists:
Axel Scherer, Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics

Israel Cancer Research Fund, Excellence in Clinical Research Award:
Alexander J. Varshavsky, Howard and Gwen Laurie Smits Professor of Cell Biology

Japanese Foundation of Fluids Machinery Research, Fluids Science Research Award:
Christopher E. Brennen, Professor of Mechanical Engineering

Max Planck Society, Max Planck Research Prize:
Pamela Bjorkman, Professor of and Executive Officer for Biology, and Full Investigator, Howard Hughes Medical Institute

Ninth International Conference on Photo-refractive Effects, Materials, and Devices, Best Application Award, Coreipient:
Demetri Psaltis, Thomas G. Myers Professor of Electrical Engineering

Particle Physics and Astronomy Research Council (PPARC), Member:
Anneila I. Sargent, Professor of Astronomy and Director, Owens Valley Radio Observatory

Royal Astronomical Society, 2003 George Darwin Lecturer:
Anneila I. Sargent, Professor of Astronomy and Director, Owens Valley Radio Observatory

Royal Society of Chemistry, 2003–04 Geoffrey Wilkinson Lecturer:
Harry B. Gray, Arnold O. Beckman Professor of Chemistry

Royal Swedish Academy of Sciences, Member:
Ahmed H. Zewail, Linus Pauling Professor of Chemical Physics and Professor of Physics

Russian Academy of Sciences, Foreign Member:
Ahmed H. Zewail, Linus Pauling Professor of Chemical Physics and Professor of Physics
Local awards

California Science Center, California Scientist of the Year:
Andrew E. Lange, Marvin L. Goldberger Professor of Physics

Awards and honors from professional societies

American Chemical Society, 2003 Frank H. Field and Joe L. Franklin Award for Outstanding Achievement in Mass Spectrometry:
Jesse L. Beauchamp, Mary and Charles Ferkel Professor of Chemistry

American Chemical Society, Oregon, Portland, and Puget Sound Sections, 2003 Pauling Award Medal:
Robert H. Grubbs, Victor and Elizabeth Atkins Professor of Chemistry

American Physical Society, 2004 Julius Edgar Lilienfeld Prize:
H. Jeff Kimble, William L. Valentine Professor and Professor of Physics

American Society of Civil Engineers, Coasts, Oceans, Ports, and Rivers Institute, 2003 International Coastal Engineering Award:
Fredric Raichlen, Professor of Civil and Mechanical Engineering, Emeritus

Association for Computing Machinery—Special Interest Group on Graphics and Interactive Technology (ACM SIGGRAPH), 2003 Computer Graphics Achievement Award:
Peter Schröder, Professor of Computer Science and Applied and Computational Mathematics

Association for Symbolic Logic, 2003 Carol Karp Prize, Corecipient:
Alexander S. Kechris, Professor of Mathematics

Geochemical Society, F. W. Clarke Award:
Paul D. Asimow, Assistant Professor of Geology and Geochemistry

Seismological Society of America, 2002 Medal of the Seismological Society of America:
Donald V. Helmberger, Smits Family Professor of Geophysics and Planetary Sciences

Society for Experimental Mechanics, Honorary Member:
Wolfgang G. Knauss, Theodore von Kármán Professor of Aeronautics and Applied Mechanics

Society for Experimental Mechanics Honors Committee, 2003 M. M. Frocht Award:
Ares J. Rosakis, Professor of Aeronautics and Mechanical Engineering

Foundation awards

Donald L. Bren Foundation, Bren Scholar:
Athanassios G. Siapas, Assistant Professor of Computation and Neural Systems

Chemical Heritage Foundation, 2003 Othmer Gold Medal, Corecipient:
John D. Baldeschwieler, J. Stanley Johnson Professor and Professor of Chemistry, Emeritus

Camille and Henry Dreyfus Foundation, 2003 Camille Dreyfus Teacher-Scholar Award:
David W. C. MacMillan, Professor of Chemistry

David and Lucile Packard Foundation, Fellowship in Science and Engineering:
Babak Hassibi, Assistant Professor of Electrical Engineering

Alfred P. Sloan Foundation, Research Fellow:
Paul D. Asimow, Assistant Professor of Geology and Geochemistry
Danny Calegari, Associate Professor of Mathematics
Linda C. Hsieh-Wilson, Assistant Professor of Chemistry
Jonas C. Peters, Assistant Professor of Chemistry
Athanassios G. Siapas, Assistant Professor of Computation and Neural Systems
Brian M. Stoltz, Assistant Professor of Chemistry

Corporate awards

Amgen, 2003 Amgen CR&D Young Investigator’s Award:
Brian M. Stoltz, Assistant Professor of Chemistry

Research Corporation, Cottrell Scholar:
Brian M. Stoltz, Assistant Professor of Chemistry
University honors

University of Alberta, Hiroomi Umezawa
Distinguished Visitor:
Barry C. Barish, Ronald and Maxine Linde Professor of Physics, and Director, Laser Interferometer Gravitational-Wave Observatory Laboratory

University of California, Berkeley, 2004 Alfred Tarski Lecturer:
Alexander S. Kechris, Professor of Mathematics

University of California, Irvine, Harold S. Johnston Lecturer:
Michael R. Hoffmann, James Irvine Professor of Environmental Science, and Dean of Graduate Studies

University of Chicago, G. W. Wheland Award:
Harry B. Gray, Arnold O. Beckman Professor of Chemistry

University of Maryland School of Pharmacy, 2003 Ellis S. Grollman Lecturer in Pharmaceutical Sciences:
Harry B. Gray, Arnold O. Beckman Professor of Chemistry

University of Newcastle upon Tyne, Robinson Prize in Cosmology:
Kip S. Thorne, Richard P. Feynman Professor of Theoretical Physics

Institute honors

Endowed Professorships:
Peter L. Bossaerts, William D. Hacker Professor of Economics and Management and Professor of Finance
John Brewer, Eli and Edye Broad Professor of Humanities and Social Sciences and Professor of History and Literature
Michael H. Dickinson, Esther M. and Abe M. Zarem Professor of Bioengineering
Kenneth A. Farley, W. M. Keck Foundation Professor of Geochemistry
James R. Heath, Elizabeth W. Gilloon Professor and Professor of Chemistry
Philip T. Hoffman, Richard and Barbara Rosenberg Professor of History and Social Science
Andrew P. Ingersoll, Earle C. Anthony Professor of Planetary Science
Matthew O. Jackson, Edie and Lew Wasserman Professor of Economics

Gilles J. Laurent, Lawrence A. Hanson Jr. Professor of Biology and Computation and Neural Systems
Jerrold E. Marsden, Carl F Braun Professor of Engineering and Control and Dynamical Systems
Elliot M. Meyerowitz, George W. Beadle Professor of Biology
Thomas R. Palfrey, Flintridge Foundation Professor of Economics and Political Science
Barbara J. Wold, Bren Professor of Molecular Biology

Associated Students of the California Institute of Technology (ASCIT), 2003 Teaching Awards:
Warren C. Brown, Associate Professor of History
Ada Chan, Harry Bateman Research Instructor in Mathematics
John M. Eiler, Associate Professor of Geochemistry
James P. Eisenstein, Professor of Physics
Ritsuko Hirai Toner, Lecturer in Japanese

Teaching Assistant Awards:
Katalin A. Grubits, Graduate Student in Physics
Robert B. Forster, Graduate Student in Physics
Brian J. Kwan, Graduate Student in Chemistry

Graduate Student Council, 2003 Teaching Award:
Mark B. Wise, John A. McCone Professor of High Energy Physics

Teaching Assistant Awards:
Kumar Manoj Bobba, Graduate Student in Aeronautics
Justin Bois, Graduate Student in Chemical Engineering

Mentoring Award:
Re’em Sari, Associate Professor of Astrophysics and Planetary Science

Richard P. Feynman Prize for Excellence in Teaching, Recipient:
Niles A. Pierce, Assistant Professor of Applied and Computational Mathematics
Introduction
Fiscal year 2003 presented both strategic opportunities and demanding financial challenges to Caltech. On one hand, we’ve been able to maintain our focus on the future and have taken some exciting steps forward. This progress, fueled in part by some early campaign gifts, includes the start of new research ventures, the acquisition of a new piece of property, and construction of important new facilities. On the other hand, we’ve dealt with very real budget constraints and economic pressure. Our disciplined and broad-based approach to these challenges enabled us to achieve a balanced budget and to channel resources to our core activities—research and teaching.

Assets and Liabilities
The Institute’s balance sheet continued to reflect long-term strength and to provide the foundation for our many ambitious goals. Total net assets increased by more than 10 percent over the prior year end to almost $2 billion; in fact, all three net asset classes grew over last year’s balances. Increases in the value of the Institute’s endowment and other investments (through a combination of new gifts/pledge payments and market appreciation) and an increase in contributions receivable strengthened an already robust balance sheet. In January 2003, Caltech was able to access the capital markets (through the California Educational Facilities Authority) for a new $70 million bond issue at extremely favorable interest rates. The proceeds from this bond issue are being used for campus improvement projects and strategic facilities investments. The Institute continues to maintain the most favorable debt ratings possible, Aaa from Moody’s Investors Service and AAA from Standard & Poor’s. Both ratings were reaffirmed during the issuance of the new debt.

Revenues
Total campus operating revenues (excluding JPL activity) increased by 4.4 percent over the prior year to $531 million, spurred by increases in technology transfer revenues and campaign-generated pledge payments. As has been the case historically, sponsored-research and gift revenues (including payout from the endowment) in fiscal year 2003 provided 85 percent of the support for campus activities.

Sponsored-research support, which provides 51 percent of the Institute’s operating revenues, increased by 3.2 percent to $268 million. The vast majority (more than 90 percent) of this revenue comes from various agencies of the federal government, most notably the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, and the Department of Defense. The strength of
this revenue component is a reflection of Caltech’s high-powered faculty, one of the most productive groups of researchers in all of higher education. Additionally, these dollars not only support specific research initiatives, but are important in providing opportunities for graduate students and, through the facilities and administrative cost recovery component of grants, the infrastructure that permits these activities to flourish.

In the midst of our ambitious campaign to raise $1.4 billion, the gift/endowment payout component of the revenue picture has grown as a percentage of total revenues over the past two years. In particular, this growth has been led by the generous support of Gordon and Betty Moore. Through their personal pledge and the commitment of the Gordon and Betty Moore Foundation (the Foundation), the initial payments on the commitment have advanced Caltech’s pursuit of several major initiatives. During fiscal year 2003, the Foundation provided significant funding for the Center for Analysis of Higher Brain Function in the Broad Center ($27 million over three years). The central project of this research center is to apply newly emerging computational techniques to in vivo optical and magnetic resonance imaging (MRI) of the developing brain. The Foundation grant has enabled acquisition of state-of-the-art equipment and the hiring of key research personnel. Additional proposals have been developed and submitted to the Foundation for approval in fiscal year 2004. The first to be approved, in early October 2003, was the funding of $17 million for the design study for the Thirty-Meter Telescope, a ground-based, optical/infrared facility that will be the largest in the world. As currently envisioned, the Thirty-Meter Telescope will have nine times the light-gathering capability of one of the ten-meter Keck Telescopes, and will yield images 12 times sharper than those from the Hubble Space Telescope. Ultimately, the Foundation will fund projects totaling $300 million over a 10-year period.

Revenues from technology transfer were particularly strong in fiscal year 2003 at $26.7 million. The initial public offering of LiquidMetal Technologies yielded $11 million for the Institute, and royalty income exceeded $14 million. While revenue generation is not the primary goal of our technology transfer operation, this activity has provided some significant financial support to the Institute over the past five years.

**Expenses**

Total operating expenses on the campus grew by 5.2 percent over the prior year to $477 million. The primary driver for this was an increase in instruction and academic support expenses, which rose by 7.5 percent. In large part this growth reflects the impact of campaign revenues on new academic programs and the resultant incremental costs.
Institutional support expenditures (the cost of central administrative functions) decreased by 4.3 percent, with savings across the board, but particularly in utilities and administrative computing. This fiscal discipline in the administrative units helped the Institute to achieve a balanced budget and to make progress on new research and academic initiatives.

Jet Propulsion Laboratory (JPL)
Caltech’s contract with NASA to manage JPL was renewed during fiscal year 2003 for another five-year period, extending the decades-old relationship through October 2008. The timeliness of this process, which was completed early in the year, allowed sufficient time to plan carefully for the transition to the new contract on October 1, 2003, and to implement any required changes. It also underscored the very positive relationship between the Lab, NASA, and the campus.

JPL is responsible for a broad spectrum of space science missions and instruments and is NASA’s Center of Excellence for the robotic exploration of space and deep space systems. A summary of JPL’s $1.4 billion fiscal year 2003 budget is provided below. Planetary flight projects and astronomy/physics programs account for the largest portion of JPL funding, followed by the earth science and technology, interplanetary network, and solar system exploration programs. Despite ever-increasing demands and pressures on the NASA budget, JPL’s portfolio of missions remains strong, reflecting NASA’s confidence in the quality of science and engineering conducted at the Lab.

Capital Activities
Capital investment and facilities renewal remained an important Institute priority during fiscal year 2003. Major projects completed included the $11 million expansion of the electricity cogeneration facility, completed in August. This project doubled the capacity of this facility, which will now meet 80 percent of total electricity demand on average. In addition, the new equipment is significantly cleaner and more environmentally friendly. Other major projects included the renovation of several floors of the Millikan Library to house Development staff and to provide more space-efficient book storage, along with a number of substantial laboratory renovations and upgrades to facilitate new or expanded faculty-driven research programs.

Of particular note was the acquisition in July of the 13-acre former St. Luke Medical Center facility in northeast Pasadena, just four miles from campus. The facility, dubbed the Center for Innovative Technologies at Caltech, or CIT², will house new research and technology programs that may not have been feasible within the limitations of the main campus. The facility has approximately 200,000 square feet of existing building space, including the historically significant main hospital building that was opened in 1936. This exciting new facility allows for broad thinking about the
Institute’s future and represents the first major move towards a new location since the creation of JPL. The purchase of the facility was funded with short-term debt that will be repaid by revenues generated at the facility. In January 2003, $70 million in California Educational Facilities Authority (CEFA) bonds were issued. The proceeds from this issue are being used to fund necessary infrastructure projects, prerequisites to future campaign-funded projects, and facilities renewal. Among the major projects the bonds will finance are the construction of a new 700-space underground parking facility (under the north athletic field), refurbishment of the south track and field area, energy conservation projects, and other deferred maintenance improvements. Debt service will be provided primarily through energy cost savings that will be achieved as a result of these strategic investments.

**Conclusion**

Even though the financial markets and the economy overall appear to be improving after a tough three-year period, the educational sector will continue to feel some intense residual pressure. The downstream effects of reduced endowment valuations will impact the amount of funding available for operations for some time to come. As a result, continued budgetary discipline and an ongoing search for administrative efficiencies is as important as ever. Caltech remains committed to its goal of pushing the greatest proportion of its resources to research and teaching and maintaining a lean, efficient administrative structure. Progress was made on this goal in fiscal year 2003 and will continue over the next few years.

We will also continue to look innovatively forward, seizing opportunities that are presented and, in fact, creating some along the way. As was the case in the past year, this view toward the future will be enabled by the continued successes of our fund-raising campaign, the new ideas of our faculty, and our research partnership with sponsors, particularly the federal government. The Institute will continue to evolve and grow in new ways, yet will always strive to ensure that it maintains its strengths in science and engineering.

Albert G. Horvath
Vice President for Business and Finance
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