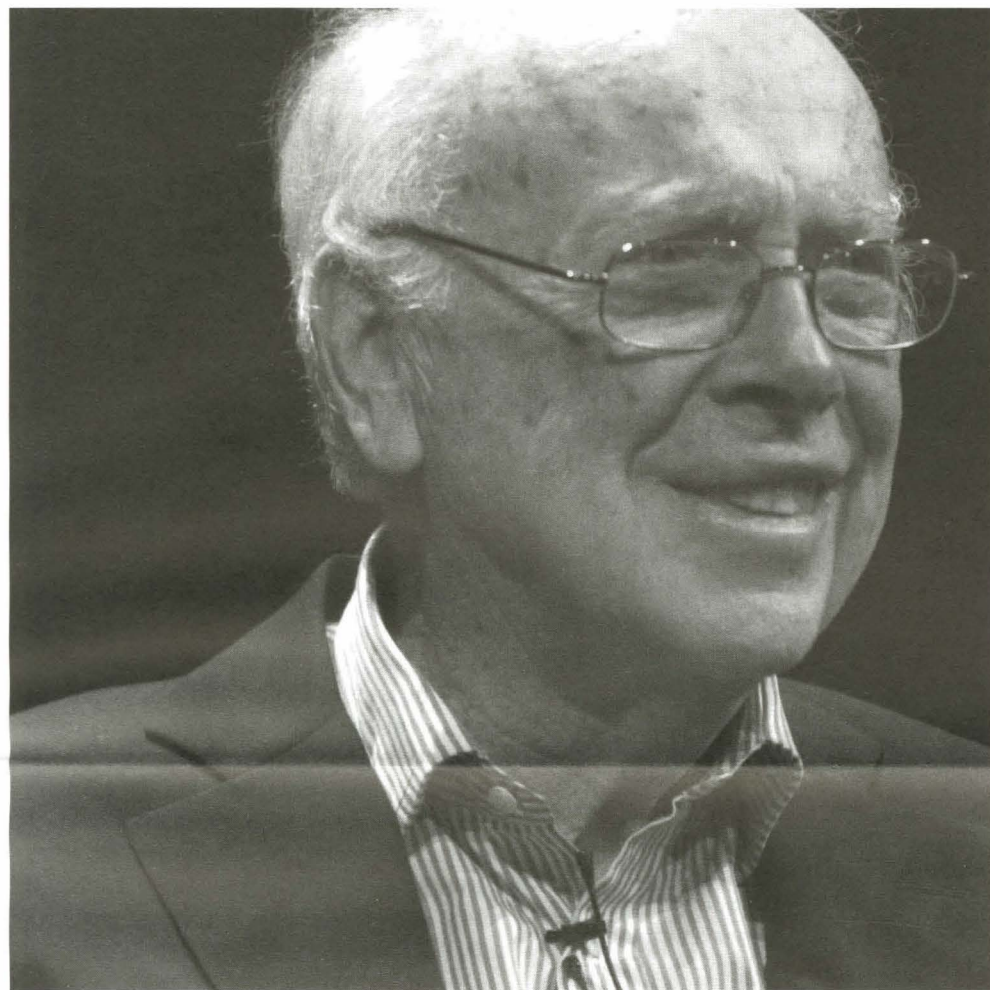


Caltech336

T F S S M T W T F S S M T W

The campus community biweekly
May 15, 2003, vol. 3, no. 10

Gene genie



"A Conversation With James Watson" featured the Nobel Prize-winning biologist and President David Baltimore in Beckman Auditorium on May 5. Watson, a former Caltech research fellow, and Francis Crick earned a Nobel Prize in 1962 for discovering the structure of the DNA molecule.

System gets the jump on quakes

Capitalizing on the low-energy waves that invariably precede major earthquakes, scientists have designed and demonstrated the feasibility of an early-warning system that promises Southern Californians as much as 40 seconds of advanced notice of major temblors.

The system, described in the May 2 issue of the journal *Science*, could help mitigate disaster by giving people a few moments to take shelter under furniture, evacuate buildings, divert aircraft, stop trains, and shut down pipelines and computer networks.

The system is based on TriNet, a dense network of modern seismic stations deployed in Southern California.

"An early warning system is the next generation of seismic information," says Professor Richard Allen of the University of Wisconsin-Madison's geology and geophysics department and the lead author of the paper that describes a prototype earthquake alarm. "There is a capability now of detecting earthquake parameters within a matter of seconds" and transmitting that information in a way that could provide some early warning.

The earthquake alarm system, developed by Allen in collaboration with Hiroo Kanamori of Caltech's Seismological Laboratory, uses a network of 155 seis-

mic stations now in place in Southern California. It utilizes what seismologists call P-waves, low-amplitude waves of energy that are the first to emanate from the underground source of an earthquake. These low-energy waves usually cause little damage, yet they travel at greater speeds than the ground-rollicking S-waves, which are the biggest threat to life and property.

Seismic stations can sense the P-wave and—given the advent of technology that permits near-instantaneous data processing and transmission—send signals to trigger alarms to warn the public, Allen says.

The system, known as ElarmS, is capable of quickly determining the location, origin, time, and magnitude of an earthquake before there is any significant ground motion. The amount of warning time people receive would depend on their proximity to the epicenter of the earthquake; the farther from the origin of the event, the more warning time would be available.

A few seconds would be enough time to take shelter under a desk or in another protected area. As the amount of warning time increased, people could take other steps to protect themselves and

see *Earthquake*, page 6

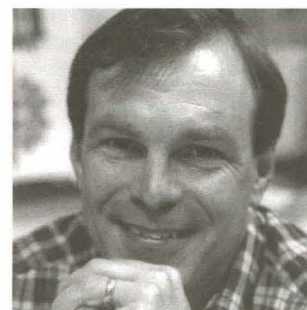
Lange named California Scientist of the Year

Goldberger Professor of Physics Andrew Lange and Saul Perlmutter of Lawrence Berkeley National Laboratory have been jointly honored as the 2003 California Scientist of the Year by the California Science Center.

Lange is the 14th Caltech researcher to receive the award. Established in recognition of the state's prominent role in scientific and technological development, the California Scientist of the Year Award is given to a nominee whose work is current and advances the boundaries in any field of science. Of past recipients, 11 have gone on to win Nobel Prizes.

Perlmutter, a senior scientist and group leader at Lawrence Berkeley, and Lange have used very different techniques to confirm a theory of how the universe expanded and evolved after the Big Bang, the explosion that gave birth to the universe. The award panel concluded that the two discoveries complement each other so well that both scientists should be recognized. They received the award on May 8 at the California Science Center in Exposition Park, Los Angeles.

Lange studies fluctuations in the cosmic microwave background (CMB) radiation, sometimes called the "afterglow" of the Big Bang. These signals, visible today at microwave frequencies, provide a clear snapshot of the embryonic universe at an epoch long before the first stars had formed. Using novel detectors developed at JPL and flown on a balloon-borne telescope above Antarctica, Lange's group was able to make the first detailed images of very faint patterns of fluctuations in the



CMB. These images demonstrate that the radiation fluctuates on an angular scale of one degree and are consistent with the current cosmological theory that we live in a mathematically flat universe—one in which, for example, parallel lines will never meet, and the angles of an astronomically sized triangle will add up to 180 degrees.

Perlmutter's group has found that, contrary to the widely held belief that the universe's rate of expansion is slowing, galaxies are actually moving away from each other at an increasing rate, as if pushed apart by a kind of negative gravitational pressure. This pressure may be what scientists call the cosmological constant, which Albert Einstein first hypothesized but later rejected. Perlmutter's estimates of the cosmological constant's magnitude are consistent with Lange's observations of a flat universe.



Kulkarni named to NAS

Shri Kulkarni, Caltech's MacArthur Professor of Astronomy and Planetary Science, is one of 72 researchers elected this year to the National Academy of Sciences. The 1,922 active NAS members now include 67 Caltech faculty and three trustees.

Kulkarni is a leading authority on exotic astrophysical phenomena such as gamma-ray bursts and brown dwarfs, and has been associated with many major advances in understanding the universe. In 1982, along with Don Backer of UC Berkeley, he discovered the first millisecond pulsar. These pulsars have turned out to be precise natural clocks with many applications.

In 1995, Kulkarni led a group that discovered the first brown dwarf, a "failed star" with a mass too low to shine like a

see *Kulkarni*, page 6

Caltech to purchase St. Luke site

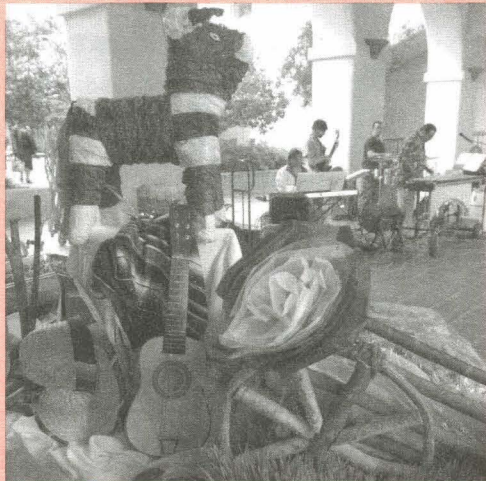
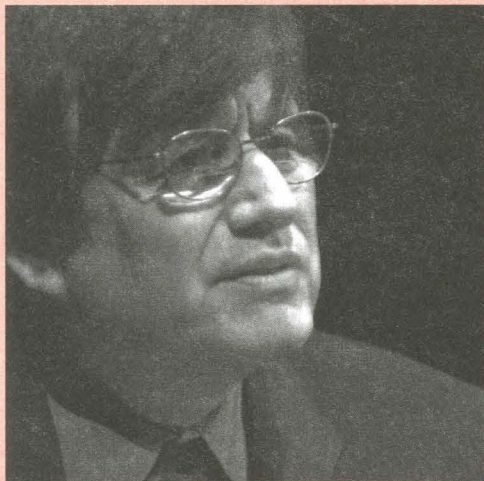
Caltech has entered into a binding agreement to purchase the former St. Luke Medical Center in northeast Pasadena from the facility's owner, Tenet Healthcare Corporation. Terms of the sale, scheduled to close in late June, have not been finalized.

Located four miles from the Caltech campus, the property will be used to augment Caltech's research and other related activities. It is not expected to be used for teaching purposes.

"Caltech is excited about the fact that we've been able to identify a substantial piece of property in Pasadena that gives us the opportunity to contemplate strategic research initiatives that otherwise

see *St. Luke*, page 2

NewsBriefs



(Left) Professor Richard Tapia of Rice University spoke on campus May 8 as part of the President's Lecture Series on Achieving Diversity in Science, Math, and Engineering; (Right) A lunchtime Cinco de Mayo fiesta in the Beckman Institute courtyard was one of several events kicking off Semana Latina, Caltech's celebration of Latino culture, last week.

Personals

Welcome to Caltech

April

Michael Bremner, visitor in physics; **Manuel Espinoza**, associate research engineer, observational cosmology group; **Victoria Hibbs**, administrative aide, planetary sciences; **Hua Hu**, scientist/data quality analyst, Space Infrared Telescope Facility Science Center; **Ben Johnson**, assistant engineer, Laser Interferometer Gravitational-Wave Observatory (LIGO); postdoctoral scholars in chemistry **Ezekiel Johnston-Halperin** and **Young Kim**; **Christophe Leruste**, visitor in physics; **Vanessa Maldonado**, assistant animal laboratory technician, Office of Laboratory Animal Resources; **Karen Nava Castro**, visitor in biology; **Laura Robinson**, postdoctoral scholar in environmental science and engineering.

May

Suzette Furbeyre has joined the Division of Chemistry and Chemical Engineering effective May 1 as administrative manager for faculty affairs and assistant to the chairman of the division.

June

Alex Sessions joins Caltech effective June 1 as assistant professor of geobiology. He is noted for his background combining microbiology and biochemistry, which, with his work in geology and geochemistry, may allow linkages between the more biological components of the geobiology program and programs in geology and isotope geochemistry. He received his BA from Williams College in 1991, his MSc from Dartmouth in 1996, and his PhD from Indiana University in 2001.

Jana Kunicova joins the Institute effective June 1 as assistant professor of political science. She received an MSc and MA in 1996 from Comenius University, in Slovakia, her BA from Whitman College in 1998, and her PhD from Yale University in 2003. Her work, which focuses on the modeling of political corruption, combines theory and empirical analysis in a way complementary to Caltech's approach to political economy, and she is noted for her mastery in the area of Eastern European and Russian studies.

Deaths

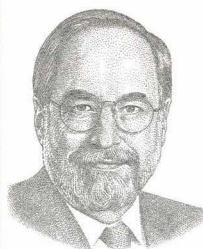
Gilbert McCann, professor of applied science, emeritus, died on April 9; he was 91. A Caltech alum (BS 1934, MS 1935, and PhD 1939, all in electrical engineering), he went to work for Westinghouse, becoming involved with the development of analog computers during World War II. He later returned to Caltech as an associate professor of electrical engineering, setting up a laboratory whose first task was to build an analog computer. A world-class instrument at the time, it solved aerospace engineering problems that no machine had been able to tackle before. Promoted to professor in 1947, McCann went on to investigate approaches to miniaturizing electronic components for computers as well as the application of computer technology to biology, particularly basic processes of vision, and how animals, especially houseflies and honeybees, can translate what they see into thought and action. In 1966, McCann was named professor of applied science and director of Caltech's new Willis H. Booth Computing Center, which he led until 1971. His later research involved applying combined X-ray and computer techniques to fields such as archaeology and locating brain tumors. He retired in 1980. A fellow of the Institute of Electrical and Electronics Engineers and a member of several other technical societies, McCann received the Eta Kappa Nu Award for Outstanding Engineer in 1942. He was also a member of the Caltech Associates, the Pasadena Rotary Club, and the Twilight Club. Predeceased last year by his wife, Betty, McCann is survived by a daughter, Janice; a son, Norman; and a brother, Louis.

Honors and awards

Michael Hoffmann, Irvine Professor of Environmental Science and dean of graduate studies, gave the third annual Harold S. Johnston Lecture at UC Berkeley on March 18; the title of his lecture was "Photochemistry in Ice: Nitric Acid Photolysis and the Production of NO₂ and NO." A research fellow at Caltech from 1973 to 1976 and a member of the professorial faculty since 1980, Hoffmann received his BA in chemistry from Northwestern University in 1968 and his PhD in chemical kinetics from Brown University in 1974.

Media minute

Caltech president and professor of biology **David Baltimore** and associate professor of history **Bill Deverell** have both spoken out on media coverage and public perception of the SARS (severe acute respiratory syndrome) epidemic in recent weeks. Deverell wrote a *Los Angeles Times* op-ed, "Epidemics of Fear and Mistrust," published April 24, relating SARS to a 1924 plague epidemic in Los Angeles. Baltimore's op-ed piece, "SAMS—Severe Acute Media Syndrome? The SARS Epidemic," appeared in the April 28 *Wall Street Journal*, and he was interviewed in a follow-up article by *Los Angeles Times* writer Tim Rutten on April 30. Baltimore also discussed the epidemic on ABC-TV's *Nightline* with Ted Koppel on May 7.



SARS will be eradicated

David Baltimore

We in the U.S. are lucky: somehow we have so far dodged the bullet of SARS. If an infected traveler from China had come here and silently initiated a chain of infection, we could have had the problem that faced Canada. As it is, we can safely go about our lives with much less danger from SARS than we face daily in our automobiles.

It is ironic that Americans and, even more, Europeans, worry about genetically engineered plants and animals, but it is the natural organisms from the wild that pose the greatest threat. We plan for a biowarfare attack, but our preparations serve us best to counter dangers that are a part of the normal microbial world. If it sounds like we are misjudging our enemies, that is a possibility worth pondering.

We still have no idea where SARS came from. It seems pretty clear that it is due to a member of the family of coronaviruses. Somewhere in nature, there must be a species that passes the SARS virus around, just as we pass around the common cold viruses among ourselves. We may never identify that species because such a virus generally causes mild symptoms. Imagine looking for a sneezing squirrel or a diarrhetic rabbit. Actually, you needn't spot the virus while it is spreading in its home population because an infection leaves telltale antibodies in the blood that can be assayed. Also, SARS virus may well be a recombinant, an agent created by joining parts of the genetic material of two different viruses, say, one from a bird and one from a mouse.

The spread of a virus from animal to humans is not a rare occurrence. One estimate I have seen is that it happens on average once a year. But when a virus is adapted to one species, it generally is transmitted poorly in a second species and even if it jumps across, it usually burns itself out. Ebola is such a virus that jumps frequently in Africa. It is daunting to realize that although we have known about Ebola for decades, we still do not know what species harbors it naturally.

The best-known virus to jump species and then be passed around is HIV, the virus that causes AIDS. It seems to have come from chimpanzees, where it causes no known disease. It is actually not transmitted all that efficiently in humans but we help by injecting ourselves or having unprotected sex. It is particularly diabolical because the initial symptoms of an HIV infection are mild and it generally takes years before the immunodeficiency becomes evident. Thus, the virus was able to take hold in the human population before we could establish barriers to its spread. Also, the unwillingness of officials in many countries to face up to the routes of transmission and counsel the population to take precautions allowed it to gain a foothold around the world.

Will SARS end up endemic, like HIV, or sporadic, like Ebola? I believe that we still have a chance to put the genie back in the box. In Vietnam, they seem to have eradicated it. Likewise in Canada. The

real problems are China, Hong Kong, and, recently, Taiwan. Hong Kong and Taiwan are small enough that I believe they can eradicate the virus, particularly if they can keep themselves isolated from mainland China. In China, the problem seems much worse because they allowed so much spread before they began serious countermeasures. But the virus is not easily transmitted: it is generally very close contacts who get infected. So there is a chance, even for China. In fact, if China does not want to end up isolated from the rest of the world, it must eradicate the virus.

My confident predictions assume that the virus will not fundamentally change by mutation—or perhaps recombine with a human coronavirus—and find a more effective route of transmission. This is not a common occurrence when a virus jumps species, so it is not something to expect, but it could happen.

Whatever happens, there is one lesson I hope we have learned: when a new agent starts spreading in the human population, our first response has to be openness, not secrecy. The spread of SARS could have been entirely avoided if the Chinese had been open with their own population and the world when the infection first became evident. Sure, openness can lead to overreaction. I believe that the press has a responsibility in such circumstances to warn the world but also to ameliorate the inevitable fear response by putting the danger in perspective. I wrote about the responsibility of the press in the *Wall Street Journal* in late April and received many letters of thanks from people who thought the epidemic of fear accompanying the outbreak of SARS was an overreaction.

This is not the first and will not be the last virus to jump from an animal reservoir to humans. These natural occurrences are as likely, and maybe more likely, to face us than a man-made epidemic generated by a terrorist. We need to be vigilant, then open and effective in our response if we are to avoid replays of the SARS events. It is hard to stay vigilant when years may pass without an incident but we need long memories and the political will to stay the course. The moment *will* come when we will be thankful.

St. Luke, from page 1

would be limited by our current facilities," says President David Baltimore. "This historically significant facility allows us to think very differently about the future of Caltech."

Trevor Fetter, president of Tenet Healthcare, says, "Tenet's goal has been to find a buyer that would preserve this important architectural landmark in the Pasadena community, and we're delighted that Caltech has made that commitment."

Opened in 1933 by the Sisters of St. Joseph of Orange, St. Luke was one of the San Gabriel Valley's first hospitals. The building's Spanish-style dome and facade look much the same today as when the hospital opened. St. Luke's manicured lawns, terrazzo floors, and winding stairways epitomize Pasadena's elegant architecture.

Tenet purchased the facility in 1997, but because of its age and lack of adaptability to modern hospital requirements, it had lost business in recent years and was closed last year.

May 19–25, 2003

M T W T F S S

Monday, May 19

Aeronautics Seminar
101 Guggenheim Lab, Lees-Kubota Lecture Hall, 1 p.m.—“Exploratory Hydrodynamic Studies,” Dr. Tom Lang, president, Semi-Submerged Ship Corporation. Information: www.galcit.caltech.edu/seminars.shtml.

Sloan Seminar
24 Beckman Labs, 2:30 p.m.—“Possible Mechanisms Underlying the Generation of Persistent Activity and Rapidly Changing Neuronal Responsiveness in the Cerebral Cortex,” David McCormick, professor of neurobiology, Yale University School of Medicine. Refreshments, 2:15 p.m.

Mechanical Engineering Seminar
206 Thomas, 3:30 p.m.—“Algorithms for Reaction Mechanism Reduction and Numerical Simulation of Detonations Initiated by Projectiles,” Patrick Hung, graduate student in mechanical engineering, Caltech.

Astronomy Tea Talk
106 Robinson, 4 p.m.—“Ultrahigh Photometric Precision and the Search for Extrasolar Planets,” Charles McGruder, professor of astronomy, Western Kentucky University. Information: www.astro.caltech.edu/~cc/tea_talks.

Bioengineering Seminar Series
142 Keck, 4 p.m.—“Design and Fabrication of a Micromechanical Flying Insect,” Professor Ron Fearing, department of electrical engineering and computer sciences, UC Berkeley. Refreshments, Keck lobby, 5 p.m.

Geological and Planetary Sciences Seminar
155 Arms, Robert Sharp Lecture Hall, 4 p.m.—“Intersonic Shear Ruptures and the Story of the Square Root of Two Times the S-Wave Speed,” Guust Nolet, professor of geosciences, Princeton University. Information: <http://www.gps.caltech.edu>.

Inorganic-Electrochemistry Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—“Nanoscale Patterning on Semiconductor Surfaces,” Jillian Buriak, associate professor, department of chemistry, Purdue University.

Solid State Sciences Seminar Series (S^5)
102 Steele, 4 p.m.—“From Science to Technology with Biophysics,” Stephen Quake, associate professor of applied physics and physics, Caltech. Refreshments, Watson lobby, 3:45 p.m. Information: www.its.caltech.edu/~yehgroup/s5.

Applied and Computational Mathematics Colloquium
101 Guggenheim Lab, Lees-Kubota Lecture Hall, 4:15 p.m.—“Convergence Rates for Fast Diffusion,” Professor Jochen Denzler, department of mathematics, University of Tennessee, Knoxville. Refreshments, 3:45 p.m. Information: www.acm.caltech.edu/colloq.shtml.

Tuesday, May 20

LIGO Science Seminar
351 West Bridge, LIGO Science Conference Room, 11 a.m.—“Search for Gravitational-Strength Forces at Short Distances,” Michael Varney, department of physics, University of Colorado at Boulder.

Institute for Quantum Information Seminar
74 Jorgensen, 3 p.m.—Topic to be announced. Professor Gerard Milburn, department of physics, University of Queensland, Australia.

Mechanical Engineering Seminar
206 Thomas, 3 p.m.—“Information Technology Approaches for Design and Manufacturing,” Maria Yang, instructor in mechanical engineering, Caltech.

Ulric B. and Evelyn L. Bray Seminar
25 Baxter, 4 p.m.—“Competition and Performance: The Different Roles of Capital and Labor,” Thijs ten Raa, associate professor of economics, Tilburg University, the Netherlands. Refreshments.

Carnegie Observatories Colloquium Series
William T. Golden Auditorium, 813 Santa Barbara Street, 4 p.m.—“The Evolution of z>6 Quasars and the End of Reionization,” Xiaohui Fan, assistant professor of astronomy, University of Arizona. Refreshments, 3:30 p.m.

Chemical Physics Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—Topic to be announced. Barbara Finlayson-Pitts, professor of chemistry, UC Irvine.

General Biology Seminar
119 Kerckhoff, 4 p.m.—“Nuclear Regulators of Transcription in Early B Cells,” James Hagman, assistant professor, department of immunology, National Jewish Medical and Research Center, Colorado.

Caltech/MIT Enterprise Forum
Baxter Lecture Hall, 5:30 to 9 p.m.—“Venturing in Fuel Cells: The Power in ‘Small.’” A panel of investors, entrepreneurs, technologists, and market analysts will examine venture opportunities for micro or portable power for homes, offices, and recreation. Registration: 395-3916 or entfor@caltech.edu. Information: www.entforum.caltech.edu.

Wednesday, May 21

Astronomy Colloquium
155 Arms, Robert Sharp Lecture Hall, 4 p.m.—“The Cepheid Distance to NGC 1637: A Direct Test of the EPM Distance to SN 1999em,” Dr. Douglas Leonard, University of Massachusetts. Information: www.astro.caltech.edu/~gma/colloquia.html.

Environmental Science and Engineering Seminar
142 Keck, 4 p.m.—“Microbial Control of the Oceanic Carbon Cycle and Implications for Ecosystem Response to Human-Induced Stresses,” Dr. Farooq Azam, professor of marine biology, Scripps Institution of Oceanography. Refreshments, Keck Labs lobby, 3:40 p.m.

Information Sciences Seminar Series
070 Moore, 4 p.m.—Topic to be announced. Sanjoy Mitter, professor of electrical engineering, MIT. Information: <http://netlab.caltech.edu/seminar>.

Organic Chemistry Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—“Cascades and Multicomponent Coupling Reactions for Total Synthesis,” Timothy Jamison, Paul M. Cook Career Development Assistant Professor of Chemistry, MIT.

Earnest C. Watson Lecture Series
Beckman Auditorium, 8 p.m.—“Quaoar and the Edge of the Solar System,” Michael Brown, associate professor of planetary astronomy, Caltech. Admission is free. Information: 395-4652, 1 (888) 2CALTECH, or events@caltech.edu. Individuals with a disability: 395-4688 (voice) or 395-3700 (TDD).

Thursday, May 22

Mechanical Engineering Seminar
206 Thomas, 2:30 p.m.—“Collisional Dynamics of Macroscopic Particles in a Viscous Fluid,” Gustavo Joseph, graduate student in mechanical engineering, Caltech.

Geoclub Seminar
151 Arms, Buwalda Room, 4 p.m.—“N Isotopes and the Terrestrial N Cycle,” Professor Ron Amundson, department of environmental science, policy, and management, UC Berkeley.

William Bennett Munro Memorial Seminar
237 Baxter, 4 p.m.—“Political Disagreements and Equal Opportunity,” Alex Voorhoeve, departments of philosophy and economics, University College London. Refreshments.

Physics Research Conference
201 E. Bridge, 4 p.m.—“What Is Information?”, Benjamin Schumacher, Moore Distinguished Scholar, Caltech. Refreshments, 114 E. Bridge, 3:45 p.m. Information: www.pma.caltech.edu/~physcoll/PhysColl.html.

Social and Information Sciences Laboratory Seminar Series
25 Baxter, 4 p.m.—“Distributed Algorithmic Mechanism Design: Recent Results and Future Directions,” Scott Shenker, UC Berkeley. Refreshments.

Friday, May 23

High Energy Theory Seminar
469 Lauritsen, 11 a.m.—Topic to be announced. Anton Kapustin, assistant professor of theoretical physics, Caltech.

Fluid Mechanics Seminar
101 Guggenheim Lab, Lees-Kubota Lecture Hall, 3 p.m.—Topic to be announced. Heinz Pitsch, assistant professor, department of mechanical engineering, Stanford University. Information: www.galcit.caltech.edu/Seminars/Fluids/CurrentFluids/index.html.

Inorganic-Organometallics Seminar
151 Crellin, 4 p.m.—“The Development of Functionalized N-Heterocyclic Carbene-Based Ligands for Transition Metal Catalyzed Ethylene Homo- and Copolymerization,” Andy Waltman, graduate student in chemistry, Caltech.

Kellogg Seminar
Lauritsen Library, 4 p.m.—Topic to be announced. Mike Snow, associate professor of experimental nuclear physics, Indiana University Cyclotron Facility.

Science, Ethics, and Public Policy Seminar
25 Baxter, 4 p.m.—“From Artificial Gold to Synthetic Humans: Alchemy and the Refashioning of Nature,” William Newman, professor of history and philosophy of science, Indiana University. Refreshments. Information: www.hss.caltech.edu/ses/index.html.

Swiss Film Series: A Koller Retrospective
Baxter Lecture Hall, 7:45 p.m.—Xavier Koller’s *Gripsholm*, 2000; with English subtitles. Admission is free.

May 26—June 1, 2003

M T W T F S S

Monday, May 26

Memorial Day holiday

Tuesday, May 27

Beckman Institute Seminar
Beckman Institute auditorium, 10:30 a.m. to noon—"Fluorescent Probes of Protein Structure and Dynamics," Harry Gray, Beckman Professor of Chemistry, Caltech. Refreshments, 10 a.m. Information: www.its.caltech.edu/~bi/seminars.html.

LIGO Science Seminar
351 West Bridge, LIGO Science Conference Room, 11 a.m.—Topic to be announced. Laura Cardonati, MIT/LIGO.

Information Sciences Seminar Series
070 Moore, 1 p.m.—"Making Cyclic Circuits Acyclic," Professor Stephen A. Edwards, computer science department, Columbia University. Information: <http://netlab.caltech.edu/seminar>.

Institute for Quantum Information Seminar
74 Jorgensen, 3 p.m.—Topic to be announced. Stephen Bartlett, research fellow, department of physics, Macquarie University, Australia.

Carnegie Observatories Colloquium Series
William T. Golden Auditorium, 813 Santa Barbara Street, 4 p.m.—"Optical Gravitational Lensing Experiment: Update," Bohdan Paczynski, Lyman Spitzer Jr. Professor of Astrophysics, Princeton University Observatory. Refreshments, 3:30 p.m.

Chemical Physics Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—"Helium Nanodroplets, a Unique Laboratory for Physics and Chemistry," Professor Andrey Vilesov, USC/UCLA.

Wednesday, May 28

Mathematical Physics Seminar
351 Sloan, noon—"Estimates for the Number of Bound States of the Schrödinger Operator," Mihai Stoiciu, graduate student in mathematics, Caltech. Information: www.math.caltech.edu/events/mathphys.html.

Astronomy Colloquium
155 Arms, Robert Sharp Lecture Hall, 4 p.m.—"Constraints on Galaxy Formation from the Milky Way and Its Satellites," Professor Rosemary Wyse, department of physics and astronomy, Johns Hopkins University. Information: www.astro.caltech.edu/~gma/colloquia.html.

Leakey Speaker Series
Beckman Auditorium, 8 p.m.—"Chimpanzees, Bonobos, and the Problem of Human Violence," Professor Richard Wrangham, department of anthropology, Harvard. This talk will explore the mystery of why we are temperamentally like chimpanzees in some ways, and like bonobos in others. Tickets and information: 395-4652, 1 (888) 2CALTECH, or events@caltech.edu. Individuals with a disability: 395-4688 (voice) or 395-3700 (TDD). Visit Public Events at www.events.caltech.edu.

Thursday, May 29

Chemical Engineering Seminar
106 Spalding Lab, Hartley Memorial Seminar Room, 4 p.m.—"Acid and Redox Catalysis on Small Oxide Structures," Professor Enrique Iglesia, chemical engineering department, UC Berkeley. Refreshments, 113 Spalding Lab, 3:30 p.m. Information: www.che.caltech.edu/calendar/seminars.html.

Geoclub Seminar
151 Arms, Buwalda Room, 4 p.m.—"Did Bacteria Form Precambrian Banded Iron Formations?," Kurt Konhauser, professor of geomicrobiology, University of Alberta.

Physics Research Conference
201 E. Bridge, 4 p.m.—"QCD, Strings, and Black Holes: The Large N Limit of Field Theories and Gravity," Professor Juan Maldacena, Institute of Advanced Study, Princeton. Refreshments, 114 E. Bridge, 3:45 p.m. Information: www.pma.caltech.edu/~physcoll/PhysColl.html.

Friday, May 30

High Energy Theory Seminar
469 Lauritsen, 11 a.m.—"Nonlocal Effects on D-Branes in Plane-Wave Backgrounds," Ori Ganor, department of physics, UC Berkeley.

Fluid Mechanics Seminar
101 Guggenheim Lab, Lees-Kubota Lecture Hall, 3 p.m.—"Urban Fluid Mechanics: Air Circulation and Pollutant Dispersion in Cities," Joseph Fernando, college of engineering and applied sciences, Arizona State University. Information: www.galcit.caltech.edu/Seminars/Fluids/CurrentFluids/index.html.

Inorganic-Organometallics Seminar
151 Crellin, 4 p.m.—"An *Endless* Route to Cyclic Polymers," Diego Benitez, graduate student in chemistry, Caltech.

CampusEvents

Monday, May 19

Child Educational Center Summer Camp Sign-Up

Enrollment is open through June 20 for the CEC's Summer Camp Program for children completing kindergarten through 6th grade. Caltech and JPL families have priority enrollment. Information: (818) 354-3418 or www.ceconline.org.

NEURO: An Art and Science Collaboration

This display of works by six contemporary artists, who drew on the technology resources of Caltech and the knowledge of the Center for Neuromorphic Systems Engineering (CNSE) scientists, will be on display in the Athenaeum lobby and at the Art Center College of Design's Williamson Gallery through June 29. Admission is free. Information: www.artandscience.us.

Flash for Animated Research

NewMedia Classroom, 363 S. Hill Avenue, 9 a.m. to 4 p.m.—Gain a general base of knowledge of Flash and create an animated movie that can be used in a PowerPoint presentation or on a website. Fee: \$150. Reservations: 395-3420 or wenyee@caltech.edu. Information: <http://muri.caltech.edu/nmc/index.htm>.

Baby Furniture and Household Equipment Pool

234 S. Catalina, 10 a.m. to 12:30 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Ceroc Dance Lessons

Winnett Lounge, 7:30 p.m.—Ceroc is a hip, international dance club sensation. The series began March 31. No experience is required. Fee: \$1; free for freshmen, first-year graduate students, and those taking the class for PE credit.

Tuesday, May 20

Excel Fundamentals Class

120 ATC Building, 263 S. Chester, 8:30 a.m. to noon—Learn the basic skills necessary to create and work with databases and spreadsheets. This two-morning class will continue on Thursday. Fee: \$80. Registration: 395-3500 or ATC.helpdesk@caltech.

Premiere Video Editing Class

NewMedia Classroom, 363 S. Hill Avenue, 10 a.m. to noon—Learn about digitizing video for use on your computer, including basic editing techniques, adding titles, and using effects and transitions. Output your final project to tape or to file. This two-day class will continue on Thursday. Fee: \$100. Registration: 395-3420 or wenyee@caltech.edu. Information: <http://muri.caltech.edu/nmc/index.htm>.

Preschool Playgroup

Tournament Park, 10 a.m. to noon—Song and storytime, crafts and free play for toddlers and preschoolers (from walking to age 4). Information: 792-7808 or julia@astro.caltech.edu.

Caltech Tai Chi Club

Winnett Lounge, 7 p.m.—Meets Tuesdays and Fridays weekly. Sessions are free. Information: www.its.caltech.edu/~taichi.

Intermediate Jazz Dance Class

Braun Gym, multipurpose room, 9:30 p.m.—Intermediate jazz dance, taught by a professional instructor. Open to everyone with a valid gym membership. No special clothing or shoes are required. The trial class costs \$5; fee for the full term is \$30 for Caltech students, \$40 for non-students. Sponsored by the GSC, ASCIT, and the Alumni Fund.

Wednesday, May 21

Baby Furniture and Household Equipment Pool

234 S. Catalina, 10 a.m. to 12:30 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Wednesdays in the Park

Tournament Park, 10 a.m. to noon—Conversation and coffee for parents and caregivers, and playtime for children. Information: 355-3874 or lcklavins@hotmail.com.

Excel Macros

120 ATC Building, 263 S. Chester, 2 to 4:30 p.m.—Learn the basics of creating macros, which are user-created instructions for common tasks, repetitive tasks, and calculations. Fee: \$40. Registration: 395-3500 or atc.helpdesk@caltech.edu.

American Smooth-Style Dance Lessons

Winnett Lounge, 7:30 p.m.—An assortment of popular American smooth-style dances, including the fox-trot, tango, and waltz, taught by a professional instructor. The series began April 9. No previous experience is necessary. Fee: \$6 per class for Caltech students, \$8 per class for others.

Dance Team Quickstep Classes

Winnett Lounge, 9:30 p.m.—Four weeks of quickstep, taught by a professional instructor. No experience is required.

Hip-Hop Dance Class for Advanced Beginners

Braun Gym, multipurpose room, 9:30 p.m.—This hip-hop class offers beginners a more challenging experience. Open to everyone with a valid gym membership. No special clothing or shoes are required. The trial class costs \$5; fee for the full term is \$30 for Caltech students and \$40 for nonstudents. Sponsored by the GSC, ASCIT, and the Alumni Fund.

Thursday, May 22

Excel Fundamentals Class

120 ATC Building, 263 S. Chester, 8:30 a.m. to noon—A continuation of Tuesday's class.

Premiere Video Editing Class

NewMedia Classroom, 363 S. Hill Avenue, 10 a.m. to noon—A continuation of Tuesday's class. Information: <http://muri.caltech.edu/nmc/index.htm>.

Caltech Architectural Tours

Athenaeum, 11 a.m. to 12:30 p.m.—Meet in the entry hall of the Athenaeum. Led by members of the Caltech Architectural Tour Service. Reservations: Susan Lee, 395-6327 or suze@caltech.edu.

Women's Wellness Series: Springtime Stretch

Steele House (carriage house pool area), noon—Using stretches from tai chi chuan, yoga, dance, and body education, this workshop will teach useful skills to carry over into daily life. Bring a mat or towel for floor stretches, and wear comfortable clothes for freedom of movement. Bag lunches will be provided, but participants may want to have a midmorning snack before attending and to eat lunch at the end of the workshop. Reservations: emery@studaff.caltech.edu.

Amnesty International Monthly Meeting

Caltech Y lounge, 7:30 p.m.—Caltech/Pasadena AI Group 22 holds its monthly meeting to discuss current activities and plans. All are welcome. Refreshments. Information: (818) 354-4461 or lkamp@lively.jpl.nasa.gov.

Friday, May 23

Making the Most of Your Presentation

Beckman Institute auditorium, 2 to 3:30 p.m.—Control and Dynamical Systems and the Caltech Library System present a seminar on presentation skills by Jean-luc Doumont, an expert on professional communication. A five-step methodology addressing delivery, design, and visual presentation questions will be discussed. Refreshments. Registration: <http://library.caltech.edu/learning/form.htm>.

An Evening of Odissi: Traditional Indian Dance

Ramo Auditorium, 6:30 p.m.—Possibly the oldest classical dance in India, odissi has been mentioned in inscriptions and depicted in sculptures in temples. Six dancers, including Caltech researcher Deepshikha Datta, who studied the dance form for 20 years in her native India, bring this rarely displayed form of dance to Caltech as the final event in the campus's annual Asia-Pacific Heritage Week.

Caltech Tai Chi Club

Winnett Lounge, 7 p.m.—Meets Tuesdays and Fridays weekly. Sessions are free. Information: www.its.caltech.edu/~taichi.

Caltech Chess Club

Page House kitchen, 8 to 10:30 p.m.—Be you master or novice, you are welcome to play chess with us. Bring board, set, and clock if you have them, or come empty-handed if you don't. Information: <http://www.its.caltech.edu/~citchess>.

Piano Recital by James Boyk

Dabney Lounge, 8 p.m.—James Boyk, Caltech's pianist in residence, will give a free recital. Works to be performed include Bach's *Italian Concerto*, Chopin's Fantasy in F minor, Schumann's *Scenes from Childhood*, and Schubert's "little" Sonata in A Major.

Sunday, May 25

Piano Recital by James Boyk

Dabney Lounge, 2:30 p.m.—James Boyk, Caltech's pianist in residence, will give a free recital. Works to be performed include Bach's *Italian Concerto*, Chopin's Fantasy in F minor, Schumann's *Scenes from Childhood*, and Schubert's "little" Sonata in A Major.

Monday, May 26

Memorial Day holiday

Credit Union Closure

All branches of the Caltech Employees Federal Credit Union will be closed in observance of the Memorial Day holiday.

Ceroc Dance Lessons

Winnett Lounge, 7:30 p.m.—Ceroc is a hip, international dance club sensation. The series began March 31. No experience is required. Fee: \$1; free for freshmen, first-year graduate students, and those taking the class for PE credit.

Tuesday, May 27

Preschool Playgroup

Tournament Park, 10 a.m. to noon—Song and storytime, crafts and free play for toddlers and preschoolers (from walking to age 4). Information: 792-7808 or julia@astro.caltech.edu.

Caltech Tai Chi Club

Winnett Lounge, 7 p.m.—Meets Tuesdays and Fridays weekly. Sessions are free. Information: www.its.caltech.edu/~taichi.

NEURO Art Exhibit: Public Lecture and Artists' Presentations

Beckman Institute auditorium, 7:30 p.m.—Three *NEURO* artists, whose works are on display until June 29, will discuss their work in this free public lecture. Jennifer Steinkamp's art is installed in Caltech's Athenaeum. Christian Möller's and Jessica Bronson's art is installed in the Art Center College of Design's Williamson Gallery. Information: www.artandscience.us.

Intermediate Jazz Dance Class

Braun Gym, multipurpose room, 9:30 p.m.—Intermediate jazz dance, taught by a professional instructor. Open to everyone with a valid gym membership. No special clothing or shoes are required. The trial class costs \$5; fee for the full term is \$30 for Caltech students, \$40 for non-students. Sponsored by the GSC, ASCIT, and the Alumni Fund.

Wednesday, May 28

Baby Furniture and Household Equipment Pool

234 S. Catalina, 10 a.m. to 12:30 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Wednesdays in the Park

Tournament Park, 10 a.m. to noon—Conversation and coffee for parents and caregivers, and playtime for children. Information: 355-3874 or lcklavins@hotmail.com.

Bloodborne Pathogen Training

118 Keith Spalding Building, 3 p.m.—This course, designed for individuals who are exposed to blood or other potentially infectious agents, presents information on preventing exposure to bloodborne pathogens, including hepatitis B and human immunodeficiency viruses. Requires registration; call 395-6727 or e-mail safety.training@caltech.edu.

American Smooth-Style Dance Lessons

Winnett Lounge, 7:30 p.m.—An assortment of popular American smooth-style dances, including the fox-trot, tango, and waltz, taught by a professional instructor. The series began April 9. No previous experience is necessary. Fee: \$6 per class for Caltech students, \$8 per class for others.

Dance Team Quickstep Classes

Winnett Lounge, 9:30 p.m.—Four weeks of quickstep, taught by a professional instructor. No experience is required.

Hip-Hop Dance Class for Advanced Beginners

Braun Gym, multipurpose room, 9:30 p.m.—This hip-hop class offers beginners a more challenging experience. Open to everyone with a valid gym membership. No special clothing or shoes are required. The trial class costs \$5; fee for the full term fee is \$30 for Caltech students and \$40 for nonstudents. Sponsored by the GSC, ASCIT, and the Alumni Fund.

Thursday, May 29

Video Compression for Presentations, Web, and CD/DVD

NewMedia Classroom, 363 S. Hill Avenue, 10 a.m. to noon—Learn why and how video is compressed for playback on a computer. There will be hands-on exercises with Cleaner 5 software, and demonstrations of other compression software such as Premiere and Sorenson Squeeze. Fee: \$50. Reservations: wenyee@caltech.edu. Information: <http://muri.caltech.edu/nmc/index.htm>.

Friday, May 30

Caltech Tai Chi Club

Winnett Lounge, 7 p.m.—Meets Tuesdays and Fridays weekly. Sessions are free. Information: www.its.caltech.edu/~taichi.

Saturday, May 31

Intermediate Ballet Class

Braun Gym, multipurpose room, 1 p.m.—Free class taught by experienced members of the Caltech Dance Troupe. No special clothing or shoes are required.

Folk Music Society Presents Priscilla Herdman

Winnett Lounge, 8 p.m.—Since her first landmark album, *The Water Lily*, in 1976, Priscilla Herdman has recorded seven solo albums, with a new one due out soon. Tickets and information: 395-4652, 1 (888) 2CALTECH, or events@caltech.edu. Individuals with a disability: 395-4688 (voice) or 395-3700 (TDD). Visit Public Events at www.events.caltech.edu. Visit the Folk Music Society at www.folkmusic.caltech.edu.

What lies beyond our solar system?

Astronomers are busily scanning the heavens to redefine the outer edges of our solar system. The move is due in part to the discovery in the past decade that the outermost planet Pluto may not be a planet at all. Instead, it has been identified as a member—albeit a very large one—of a swarm of planetesimals known as the Kuiper belt.

This band of ice and rock hovers outside the orbit of Uranus and is the home to Quaoar, another celestial body nearly as large as Pluto that was discovered by Michael Brown, associate professor of planetary astronomy, and Chad Trujillo, a postdoctoral researcher.

In his Watson lecture, “Quaoar and the Edge of the Solar System,” Brown will address some of the pertinent questions that arise from these discoveries: What makes a body a planet? Where does the true edge of the solar system lie? And what lies beyond the known solar system? The lecture takes place on Wednesday, May 21, at 8 p.m., in Beckman Auditorium.

The Kuiper belt is the region where comets originate and also where planetary scientists have long expected to eventually find larger planet-shaped objects. Quaoar, named after the creation force of the Tongva tribe, who were the original inhabitants of the Los Angeles basin, is a spherical body that circles the sun every 288 years. Its discovery last year has spurred researchers to employ other telescopes to study Quaoar, including the Hubble Space Telescope and the Keck Observatory on Mauna Kea, Hawaii, and to search for other objects like it.

The Watson Lecture Series was conceived by the late Caltech physicist Earnest Watson as a way to explain science to the local community. This event is free, and tickets are not required.



Earthquake, from page 1

mitigate property damage.

One concern, however, is the relative infrequency of large earthquakes. Given this fact, people might not respond to an early warning, says Kanamori, Caltech's Smits Professor of Geophysics: "The most exciting and effective applications of early-warning systems would be to include them in automated control systems for buildings and structures."

With ElarmS, the warning time would be about 40 seconds for people at some distance from the epicenter. For some large earthquake events there might be even more warning time available, since these tend to occur deeper within the earth.

For the "Big One," the anticipated major earthquake that would rupture a significant portion of a big fault, the new system would continually update its estimate of earthquake magnitude, perhaps initially suggesting a smaller earthquake, but increasing the magnitude and hazard estimate as the event evolved, Allen says.

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GALEX: A mission to the stars

NASA's Galaxy Evolution Explorer spacecraft was successfully launched on Monday, April 28, on a rocket released by an aircraft off the coast of Florida's Cape Canaveral Air Station. After the space observatory separated from the rocket's third stage, it began circling Earth at an altitude of 429 miles. Led by principal investigator and Caltech professor of physics Christopher Martin and managed by JPL, the mission features an orbiting telescope that will observe millions of galaxies across 10 billion years of cosmic history. Its findings may help astronomers determine when the chemical elements originated and the stars seen today first blossomed.

After one month of in-orbit checkout, the science mission will begin, lasting up to 28 months. The mission's ultraviolet detectors will home in on galaxies containing young, hot stars, helping scientists learn more about star formation.

The GALEX mission was developed under NASA's Explorers Program, managed by the Goddard Space Flight Center, Greenbelt, Maryland. Orbital Sciences Corporation in Dulles, Virginia, is responsible for the spacecraft, integration and testing, ground data system and mission operations, and launch vehicle. Other partners include UC Berkeley, Johns Hopkins University, France's Laboratoire d'Astrophysique de Marseille, and Yonsei University in Seoul, South Korea.

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Kulkarni, from page 1

star but too high to be a planet. Two years later, he and his colleagues showed gamma-ray bursts to be extragalactic in origin, and he has since led many further investigations into the phenomenon.

Kulkarni has been a leader in the quest to improve the resolution of optical instruments with interferometry, a technique that combines light from two or more mirrors for a superior image. Working with JPL engineers, his research team used the testbed interferometer at Caltech's Palomar Observatory in 2000 to obtain the most precise distance to date for a Cepheid variable, a type of pulsating star that is a standard reference for gauging astronomical distances. Heavily involved with the Keck Interferometer, Kulkarni is also the interdisciplinary scientist for NASA's Space Interferometry Mission, set to launch in 2009 and with which astronomers hope to catalog planets around nearby stars.

After receiving a master's degree from the Indian Institute of Technology and a PhD from UC Berkeley, Kulkarni came to Caltech in 1985 as a research fellow, joining the professorial faculty in 1987. He is a former Presidential Young Investigator, Sloan Research Fellow, and Waterman Prize winner.

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Boyk to give recitals

Celebrating his 30th year as Caltech's pianist in residence, James Boyk will give a pair of free public recitals, to take place on Friday, May 23, at 8 p.m. and Sunday, May 25, at 2:30 p.m. in Dabney Lounge. Works to be performed include Bach's *Italian Concerto*, Chopin's *Fantasy in F Minor*, Schumann's *Scenes from Childhood*, and Schubert's *Sonata in A Major*.

Since 1979, Boyk has taught "Projects in Music and Science," a class investigating the connections between music and the sciences, and has directed Caltech's Music Lab. He received an AB in mathematics from Harvard College and an MFA in piano from the California Institute of the Arts. Boyk also facilitates "Alive! with Music," a weekly music and discussion session open to all, with students especially welcome. Meetings are Wednesdays at 4:30 p.m. in Dabney Lounge during each academic term.

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Take Our Children to Work Day



In order to introduce children to the various career opportunities available at Caltech, the Institute once again opened its doors to the children of Caltech students and staff members during Take Our Children to Work Day on Thursday, April 24.

Clockwise from top: Children and their parents assemble in the Beckman Institute courtyard before moving on to the Caltech Precollege Science Initiative activity, which consisted of building a handheld catapult out of common household materials. Magnolia Ycasas from Human Resources welcomes Beth Larranaga from the Bursar's Office and daughter Amanda during registration. Teams of kids made use of the grassy meadow between the Beckman Institute and the Broad Center to play soccer; staff members from Caltech Athletics were on hand to lead the kids in games of volleyball and relay races as well. At noon, the children replenished their energy with a pizza lunch, which they ate while relaxing in the Beckman Institute's courtyard and around the Gene Pool. Rudy Arvizu and daughter Andrea display a medal made for her during the Aero shop tour.

In addition to visiting laboratories run by top Caltech scientists, the kids took in a Frank Capra short and learned about savings accounts during a presentation by the Caltech Employees Federal Credit Union. Human Resources and the Public Relations Office sponsored Caltech's version of the national Take Our Daughters to Work Day.

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