Caltech336

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The campus community biweekly
May 17, 2001, vol. 1, no. 10

A guerrilla parking strategy

John Sutherland

I have been parking by permission of the Caltech yellow sticker for 18 years. I can't remember anything about the first 15, because it was so uncomplicated. It was one of the things that made Caltech such an efficient workplace. You just sort of wished yourself into work.

Parking has become memorable, on a daily basis, the last two years. The reasons are obvious. The master plan is covering up more and more flat-lot area, most recently the space south of Luria. Undergraduates are better off now, and more of them bring cars to campus.

Pasadena City College and the Polytechnic School have become increasingly competitive for street parking. And street parking has become tougher. The Pasadena municipal authorities have switched from chalk-marking car tires to registering vehicles (license number and time) by handheld computer. This means that you can't just shift your street-parked car a few yards every two hours; you have to rezone it, or pay the price. Caltech has many more administrative personnel than it had 20 years ago. These colleagues are eight-to-fivers. Hence the Holliston structure nowadays fills up by 7:45 a.m.

Faculty and students use Caltech around the clock. I frequently work till 11 p.m. or midnight (strange life forms emerge on the campus, and in Millikan Library, at this witching hour). One of the

see Parking, page 6

Harmony in the early universe

Caltech cosmologists and their international collaborators have discovered the presence of acoustic "notes" in the sound waves that rippled through the early universe.

The existence of these harmonic peaks, discovered in an analysis of images from the BOOMERANG experiment, strengthens results last year showing that the universe is flat. The new results also bolster the theory of "inflation"—which states that the universe grew from a tiny subatomic region in a period of violent expansion a split second after the Big Bang—and show promise that the Cosmic

see BOOMERANG, page 6

The BOOMERANG telescope, here being readied for its 1998 launch, was carried by a 28-million-cubic-foot balloon to an altitude of 120,000 feet—above 99 percent of the atmosphere—in order to make its highly sensitive measurements.

Baltimore research leads to cancer drug

Many media outlets reported last week that a powerful new anticancer drug is among the first results of almost 30 years of research into the basic biology of cancer. Caltech president David Baltimore was one of the pioneers of such work in the mid-1980s.

The drug, known as STI571, or Gleevec, has generated excitement among cancer researchers for its ability to target cancerous cells in chronic myelogenous leukemia (CML)—a form of cancer characterized by an overabundance of white blood cells—while leaving healthy cells alone. It was approved by the Food and Drug Administration on May 10 after a two-and-a-half-month review, "an all-time record for a cancer drug," according to Tommy Thompson, secretary of health and human services. CML affects about 5,000 Americans annually. Researchers also reported at a May 13 meeting of the American Society of Clinical Oncology that Gleevec has shown extremely promising results in treating another form of cancer, gastrointestinal stromal tumors (GISTs), that usually kills within a year of diagnosis.

Gleevec was created because researchers now understand the basic mechanism by which CML occurs: a genetic anomaly triggered by the rearrangement of chromosomes 9 and 22, forming what is called the Philadelphia chromosome. A molecular consequence of this anomalous chromosome is the *bcr-abl* gene, present in 95 percent of CML patients.

In experiments with mice, Baltimore and Owen Witte, now a professor of microbiology and molecular genetics at UCLA, discovered that the *abl* portion of the gene encodes a tyrosine-specific protein kinase, an enzyme that adds phosphate to tyrosine in proteins. They also showed that *abl* can cause cancer in mice, and that the tyrosine kinase activity played a central part. Baltimore said, "Although another lab discovered the reaction at about the same time, this was the first time it had been described, and thus it generated the idea that the reaction could be at the heart of cancer induction."

The reaction was later associated with the *bcr-abl* gene and human cancer, and inspired Alex Matter, of the Swiss drug company Novartis Pharma AG, who thought that making a drug against the *abl* kinase reaction might stop the growth of CML cells. His work, along with that of Nicholas Lydon, of Amgen, Inc., and Brian Druker, of the Oregon Health Sciences University, led to the development of Gleevec. The three researchers, together with Baltimore and Witte, received the Harvard Medical School's Alpert Founda-

see Cancer, page 2

Courtesy of Caltech Archives

The story of a seal

Judith Goodstein

When the class of '51 returns to campus this week for their half-century reunion, it won't just be buildings that have upped and gone away; so has the Caltech seal they knew. And therein hangs a tale.

In 1923, soon after physicist Robert Millikan became head of Caltech, the school commissioned Belgian artist Godfroid Devreese to create a work of art "which will for a thousand years to come, we hope, be the symbol by which the California Institute will be most widely known." Devreese completed the design in 1925 (figure 1). In his charge to the artist, Millikan stipulated that the seal show an older man passing the torch to a younger one, both of them in the clouds. He wanted the figures to symbolize the spirit of research being passed from one generation to the next, from maturity to youth.

The motto "The truth shall make you free," also chosen by Millikan, comes from the New Testament and appears above the

see Seal, page 6

Alums gather for reunion weekend

What do you call an extensive get-together, a field trip to JPL, plus a leisurely day of lectures all rolled up together into one weekend package? If you guessed Caltech's Alumni Weekend and 64th Annual Seminar Day, you'd be right.

The big weekend begins today, May 17, and culminates with Seminar Day on Saturday. In preparation, the campus has been cranking with activity for weeks in advance. The lawns have been manicured, the greenery groomed, and the lecture halls tidied up. The Athenaeum's 28 guest rooms were booked months in advance, and the Institute's catering crews have stocked up for the back-to-back feasts scheduled to take place on campus and at JPL. Even a stretch of California Boulevard got a new layer of blacktop.

see Reunion, page 2

NewsBriefs

A weeklong celebration of culture—Caltech's Semana Latina, which took place May 7 to 12, included a noon concert by Caribbean band Johnny Polanco y su Conjunto Amistad (above). At right, Elias Gonzalez and Rodolfo Mendes, both of Custodial Services, enjoy the festivities on the Winnett quad.

Personals

New positions

Dlorah Gonzales has accepted the position of director of employment in Human Resources. The move comes after two months in which she and Sharon Patterson from Finance filled that position on a part-time basis. Formerly the deputy director of Campus Auxiliary and Business Services, Gonzales will begin her new position at the beginning of June. In her new post, she will also oversee the operations of HR's Shared Customer Services Unit.

Also in Human Resources, **Tony Kinslow** will take on the responsibilities of director of employee relations beginning on June 18. Kinslow comes to Caltech from Metropolitan Nashville General Hospital, where he served as director of human resources.

Trustees approve key administrative changes

President David Baltimore announced that on May 8, Caltech's Board of Trustees approved title changes for two senior administrators and promotions for two key business and finance managers.

To recognize the provost's unique role in the Institute, the Board has elevated the office and simplified Vice President and Provost **Steven Koonin's** title to provost. The change reflects the provost's key responsibilities of overseeing research and academic programs, infusing academic insight into the Institute's decision making, and acting as president in the president's absence. Baltimore said, "Steve is more than a vice president, he is my partner, bringing the academic perspective to every decision made at Caltech."

Vice President for Business and Finance **William Jenkins** is now the executive vice president for administration. "Since his arrival, Dr. Jenkins has assumed corporate oversight of JPL's business operations, contributed enormous managerial skill and administrative insight, and has developed an increasingly external focus," said Baltimore. "This title change acknowledges the broader sweep of Dr. Jenkins' duties beyond the scope of business and finance operations."

Associate Vice President for Finance and Controller **Albert Horvath** has been promoted to vice president for business and finance. "With this promotion, we acknowledge the remarkable changes in Caltech's financial operations that Mr. Horvath has brought about in his relatively brief tenure here," Baltimore said. Horvath will assume additional responsibility for budget, sponsored research, auxiliary enterprises, facilities operations, and security.

Associate Controller **Sharon Patterson** has been promoted to associate vice president for finance and controller. Her duties will expand to include responsibility for all financial activities, including reporting, project accounting, indirect cost studies, property services, purchasing, and accounts payable.

Baltimore said, "The Jenkins-Horvath-Patterson team has been so effective that each person has proved able to handle a much larger role than originally envisaged. We are excited to have a group so dedicated to the smooth functioning of Caltech's administration."

Honors and awards

Roger Blandford, Tolman Professor of Theoretical Astrophysics, was named the Tetelman Fellow at Yale for 2001; he delivered the Tetelman lecture in mid-February. In June, he will travel to Munich to give the Siemens Lecture.

Alan Hajek, associate professor of philosophy, has received a $10,000 grant from the Center for Theology and the Natural Sciences. He will develop a new course entitled Probability, the Philosophy of Religion, and the Philosophy of Science.

Maya Tokman, postdoctoral scholar in applied and computational mathematics, has been selected to receive a 2001 Frederick A. Howes Scholars in Computational Science award, which will include a substantial cash award and a plaque. Tokman will receive her PhD in applied and computational mathematics at Caltech's 2001 commencement ceremony in June.

For the record

But do they card her? In the May 3 issue of *336*, Human Resources staff member **Monica Sierra** was mistakenly included in "a group of kids" in the photo caption for Take Our Children to Work Day. Also, the day's musical performance included not only Scott Van Essen and Joe Cook, as mentioned, but their entire vocal group, known as **Ecphonema**.

Grant supports campus art space

The Pasadena Art Alliance, an independent, nonprofit organization, has awarded $2,000 to Caltech for the support of its outdoor art space. The site, located behind the campus recycling center, just north of the Holliston parking structure, allows emerging artists to display large-scale sculptures; environmental, site-specific work; and other projects. The current show, *Crylawn*, was produced by Artlab, an alternative art program at Imperial College of Science, Technology, and Medicine in London.

Four Techers named Goldwater scholars

The Goldwater Foundation has awarded four Caltech undergraduates Barry M. Goldwater Scholarships for the 2001–02 academic year. The students are junior **Agedi Boto** (chemical engineering), sophomore **Paul Choi** (chemistry), junior **Betty Hong** (biology), and sophomore **Benjamin Mathews** (physics).

The four are among 302 sophomores and juniors from the 50 states and Puerto Rico who received Goldwater Scholarships this year. Sophomores receive $7,500 per year in their junior and senior years, while juniors receive $7,500 in their senior year. The scholars, selected on the basis of academic merit, were chosen from 1,164 science, mathematics, and engineering students nominated by the faculties of their universities and colleges.

Created to honor the late Senator Barry M. Goldwater, the scholarship program is now in its 13th year and has awarded 3,323 scholarships worth approximately $33 million.

Market evolution examined

Cambridge University Press has published *Evolving Financial Markets and International Capital Flows: Britain, the Americas, and Australia, 1865–1914*, by **Lance Davis**, Harkness Professor of Social Science at Caltech, and the late Robert Gallman, Kenan Professor at the University of North Carolina, Chapel Hill. A study examining the impact of British capital flows on the evolution of capital markets in Argentina, Australia, Canada, and the United States, the book offers parallel histories of each country's financial infrastructure—commercial banks, nonbank intermediaries, primary security markets, formal secondary security markets—and the institutions that provided international financial links with the British capital market.

Researchers sing the body electric on PBS

Advances in technology are beginning to blur the line between what is strictly human and what is machine. This ironic development is explored in *Beyond Human*, a two-part PBS special.

The first installment, "Body Electric," features interviews with **Richard Andersen**, Caltech's Boswell Professor of Neuroscience, and **Steven Potter**, a senior research assistant in biology. Their independent work focuses on technology that allows communication between neurons and electronic circuits.

The show airs on May 23 at 8 p.m. on KCET, channel 28. It is followed by "Living Machines," an exploration of the possibilities and consequences of a brave new world run by robots and smart machines.

Jerry Nunnally, vice president for institute relations, presents an award to Romy Wyllie, cofounder of the Caltech Architectural Tour Service, at a special reception on May 10. The ceremony honored volunteers who have led monthly campus tours for the past 16 years.

Cancer, *from page 1*

tion Scientific Prize on May 1 for each of their contributions to CML research.

Baltimore noted that the prize explicitly recognizes the direct connection between basic research and new treatments. "By honoring our work of 20 years ago," he said, "Harvard is reminding the world that new drugs, especially for treating cancers, come from the insights provided by those of us whose interest is in the underlying processes driving cancer cells to continual multiplication." He added, "Of course, there was no way to know that our particular discovery would be the one that led to a first-in-class designer drug that kills cancer cells."

Francis Collins, director of the National Human Genome Research Institute, cited Gleevec as an early example of the kind of rational drug design that will stem from human genome studies. At a recent lecture at Harvard Medical School, he stated that the drug's clinical trials have shown "pretty dramatic results, and ones which we hope will be repeated in other disorders as we get this kind of molecular understanding of what's gone awry in disease."

Gleevec has shown remarkable effectiveness against CML in clinical trials, and few side effects. (Other currently approved treatments for the disease have side effects that are difficult for patients to tolerate.) Typically, a person with CML can expect to live for five years. Although there is no evidence that Gleevec prolongs this life expectancy, so far, 51 out of the 53 patients who received the highest dose of the treatment in a controlled study have gone into remission. In the study of patients with GIST, "a cancer that always has been completely resistant to chemotherapy and radiation," noted Charles Blanke of the Oregon Health and Science University, 51 out of 86 patients who took Gleevec for three months or more achieved total remission.

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Reunion, *from page 1*

Second only to graduation in terms of size and prominence, the reunion weekend entices hundreds of visitors to fly in or drive to Pasadena every year. A homecoming of sorts, it is the perfect opportunity for Caltech grads to catch up with former classmates and professors alike.

It's also an opportunity to take in a variety of seminars and lectures that feature the latest research efforts and their exciting results. Among the many seminars are those with intriguing titles like "Birth of the Universe" and "A 3-D Map of the World," as well as "Congestion Control on the Internet" and "Designing a Neural Prosthesis to Convert Thoughts to Action." Participants of the Summer Undergraduate and Research Fellowships will also make oral presentations regarding their summer research projects.

In addition to these seminars, Kip Thorne, Feynman Professor of Theoretical Physics, will present the lunchtime General Session talk. His afternoon chat goes by the title "Space-Time Warps and the Quantum: A Glimpse of the Future."

The weekend includes a special program for alumni who graduated 50, 55, 60, and 65 years ago. In addition to attending sundry fetes in their honor, these hardy individuals are invited to join a Thursday tour of JPL and an evening reception at President Baltimore's residence.

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May 21–27, 2001

M T W T F S S

Events in roman type are open to the public
Events in italic type are open to the Caltech community only

Monday, May 21

Aeronautics Seminar
101 Guggenheim Laboratory, Lees-Kubota Lecture Hall, 1 p.m.—Topic to be announced. Jack Ryan, senior controls engineer, propulsion performance branch, NASA Dryden Flight Research Center.

Geological and Planetary Sciences Seminar
155 Arms, Robert Sharp Lecture Hall, 4 p.m.—"The Haiyuan Fault in Northeastern Tibet: Geological History, Kinematics, and Seismic Behavior," Cecile Lasserre, postdoctoral student, department of earth and space sciences, UCLA, and JPL. Refreshments, 151 Arms, 3:45 p.m.

Solid State Sciences Seminar Series (S^5)
102 Steele, 4 p.m.—"(Electrically) Shocking Observations about DNA," Professor Lydia Sohn, department of physics, Princeton University. Refreshments, Watson foyer, 3:45 p.m. Information: www.its.caltech.edu/~s5.

Special Biophysics Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—"The Kinetics of Fast-Folding Proteins: A Twist on Transition-State Theory," Professor Ken A. Dill, department of pharmaceutical chemistry, School of Pharmacy, UC San Francisco.

Applied and Computational Mathematics Colloquium
306 Firestone, 4:15 p.m.—"The Infinite Dimensional Space of Shapes," University Professor David Mumford, division of applied mathematics, Brown University. Refreshments, 204 Firestone, 3:45 p.m.

Astronomy Tea Talk
106 Robinson, 4:15 p.m.—"Galactic Winds: The View from FUSE and Chandra," Crystal Martin, postdoctoral scholar in astronomy, Caltech.

Tuesday, May 22

Caltech Library System Presents
Sherman Fairchild Library, multimedia conference room, noon to 1:30 p.m.—"Copyright for Researchers in Academia." Learn about the rights and responsibilities of scholars as they are governed by copyright law. Issues of photocopying, digital scanning, fair use, and scholarly publisher copyright agreements will be covered. Registration: http://library.caltech.edu/learning/form.htm.

Thesis Seminar
03 Beckman Labs, 2:30 p.m.—"Negative Regulation of Transcription Factors by Srb10 Cyclin-Dependent Kinase," Yong Chi, graduate student in biology, Caltech.

Carnegie Observatories Colloquium
William T. Golden Auditorium, 813 Santa Barbara Street, 4 p.m.— "What Fuels AGN Activity in Seyferts? Clues in the Central Kiloparsec," Dr. Paul Martini, Carnegie Observatories. Information: 577-1122.

Chemical Physics Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—"Charge Flow and Solvent Dynamics in the Photodissociation of Molecular Cluster Ions," Associate Professor Robert P. Parson, department of chemistry and biochemistry, University of Colorado, Boulder.

Immunology Seminar
119 Kerckhoff, 4 p.m.—"Cytokines and Thymic Injury," Kenneth Weinberg, associate professor of pediatrics and molecular microbiology and immunology, Keck School of Medicine, USC, and Division of Research Immunology/Bone Marrow Transplantation, Childrens Hospital, Los Angeles.

Wednesday, May 23

Biolunch Seminar
24 Beckman Labs, noon—"Antigen Specificity and Fate of Autoreactive CD4+ T Cell," Lili Yang, graduate student in biology, Caltech; and "Expression Cloning of Signaling Molecules," Joel Pomerantz, postdoctoral scholar in biology, Caltech.

Mathematical Physics Seminar
351 Sloan, noon—"A Geometrical Version of Hardy's Inequality," Ari Laptev, Royal Institute of Technology (KTH), Sweden. Information: www.math.caltech.edu/events/mathphys.html.

Astronomy Colloquium
155 Arms, Robert Sharp Lecture Hall, 4 p.m.— "Diversity Among Young Neutron Stars," Vicki Kaspi, associate professor, department of physics, McGill University.

Environmental Engineering Science and Global Environmental Science Seminar
142 Keck, 4 p.m.—"New Views on the Isotopic Composition of Atmospheric Oxygen," Professor Boaz Luz, Institute of Earth Sciences, Hebrew University. Refreshments, lobby, 3:45 p.m.

General Biology Seminar
119 Kerckhoff, 4 p.m.—"Combinatorial Control: Implications for Structure and Mechanisms of Transcriptional Regulatory Complexes," Keith Yamamoto, professor and chairman, department of cellular and molecular pharmacology, UC San Francisco.

Earnest C. Watson Lecture Series
Beckman Auditorium, 8 p.m.—"The Coming Revolution in Photography," Carver Mead, Gordon and Betty Moore Professor of Engineering and Applied Science, Emeritus, Caltech. 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 http://www.events.caltech.edu.

Thursday, May 24

Thesis Seminar
151 Crellin, 2 p.m.—"Ancillary Ligand Effects at Electrophilic Zirconium (IV) and Platinum (II) Metal Centers," Hong Zhong, graduate student in chemistry, Caltech.

Civil Engineering Seminar
206 Thomas, 4 p.m.—"Seismic Performance of Transportation Structures," Joseph Penzien, International Civil Engineering Consultants, Inc. Refreshments, 210 Thomas, 3:45 p.m.

Physics Research Conference
201 E. Bridge, 4 p.m.—"From the Big Bang to the Cosmic Hum: Listening to the Music of the Early Universe," Marc Kamionkowski, professor of theoretical physics and astrophysics, Caltech, and Andrew Lange, Marvin L. Goldberger Professor of Physics, Caltech. Refreshments, 108 East Bridge, 3:45 p.m.

Science, Ethics, and Public Policy Lecture
25 Baxter, 4 p.m.—"Is it a Crime to Belong to a Reference Class?", Dr. Mark Colyvan, lecturer in philosophy, University of Tasmania, Australia. Refreshments. Information: www.hss.caltech.edu/ ses/SEPP.html.

Friday, May 25

Thesis Seminar
106 Spalding Lab, Hartley Memorial Seminar Room, 8:30 a.m.—"Cell-Responsive Synthetic Biomaterials Which Are Formed *in situ*," Alison Pratt, graduate student in chemical engineering, Caltech.

Thesis Seminar
151 Crellin, 2 p.m.—"Polymerization of Functionalized Olefins with Neutral Group X Catalysts," Todd Ross Younkin, graduate student in chemistry, Caltech.

Institute for Quantum Information Seminar
102 Steele, 3:30 to 5 p.m.—"Some Results about Parallel Quantum Computation," Alexei Kitaev, T. J. Watson Research Center, IBM.

Caltech/JPL Association for Gravitational-Wave Research Seminar Series
von Karman Auditorium, JPL, 4 p.m.—"The Virgo Gravitational-Wave Detector: Status and Plans," Benoit Mours, Virgo Project, LAPP/Annecy; visitor, LIGO Laboratory, Caltech.

Inorganic-Organometallics Seminar
151 Crellin, 4 p.m.—"Investigation of DNA-Mediated Electron Transfer Reactions with New Ru-Photooxidants," Alexander Schnyder, postdoctoral scholar in chemistry, Caltech.

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May 28–June 3, 2001

M T W T F S S

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Monday, May 28

Memorial Day
Institute Holiday

Tuesday, May 29

Thesis Seminar
151 Crellin, 2 p.m.—"Reactions of Platinum (II) Complexes with Dioxygen: Progress Toward Alkane Functionalization," Vsevolod V. Rostovtsev, graduate student in chemistry, Caltech.

Carnegie Observatories Colloquium
William T. Golden Auditorium, 813 Santa Barbara Street, 4 p.m.—"The Velocity Dispersion Profile of the cD Galaxy NGC 6166 and Its Implications for the Mass Profile of Abell 2199, or Why This Was Not Easy to Do on a 10m Telescope," Dr. Dan Kelson, Carnegie Observatories. Refreshments, 3:30 p.m. Information: 577-1122.

Chemical Physics Seminar
147 Noyes, Sturdivant Lecture Hall, 4 p.m.—"The Uphills and Downhills of Protein Folding: Measuring Structural Evolution, Reaction Coordinate(s), Transition State(s), and the Free Energy Surface," Martin Gruebele, professor of chemistry and biophysics, and full-time faculty member in the Beckman Institute photonic systems group, University of Illinois, Urbana-Champaign.

General Biology Seminar
119 Kerckhoff, 4 p.m.—"Global Studies of Gene Expression in *C. elegans*," Stuart Kim, associate professor of developmental biology and medicine, Stanford University.

Yuen Fellow Speakers Seminar Series
Judy Library, 110 Baxter, 4 p.m.—"Digital Democracy: Why Louis XIV Would Have Loved the Internet," Karl Auberbach, North American at-large delegate for the Internet Corporation for Assigned Names and Numbers (ICANN). Refreshments.

Wednesday, May 30

Caltech Library System Presents
Sherman Fairchild Library, multimedia conference room, noon to 1:30 p.m.—"Business Resources." Learn business research strategies and methods for finding information on companies and industries. Registration: http://library.caltech.edu/learning/form.htm.

Astronomy Colloquium
155 Arms, Robert Sharp Lecture Hall, 4 p.m.— "The Structure and Evolution of Molecular Clouds: Insights from Numerical Simulations," Eve Ostriker, associate professor of astronomy, University of Maryland, College Park.

Environmental Engineering Science and Global Environmental Science Seminar
142 Keck, 4 p.m.—"Mechanisms in the Formation of Allergen-Loaded Respirable Aerosols from Flowers, and the Link with Asthma," Dr. Philip Taylor, visiting associate, Caltech. Refreshments, 3:45 p.m.

Thursday, May 31

Thesis Seminar
151 Crellin, 11 a.m.—"Force-Detected Nuclear Magnetic Resonance Independent of Field Gradients," Garett Michael Leskowitz, graduate student in chemistry, Caltech.

Arnold O. Beckman Lecture
22 Gates Annex, 4 p.m.—"New Ring-Forming Methods: Development and Use in the Synthesis of Polycyclic Natural Products," Larry E. Overman, Distinguished Professor of Chemistry, UC Irvine. Refreshments.

Civil Engineering Seminar
206 Thomas, 4 p.m.—"El Salvador Earthquakes, Utility Lifeline Performance," LeVal Lund, member, El Salvador Earthquake Reconnaissance Team. Refreshments, 210 Thomas, 3:45 p.m.

Physics Research Conference
201 E. Bridge, 4 p.m.—"Force Inhomogeneities in Granular Materials," Susan Coppersmith, professor of physics, University of Chicago. Refreshments, 108 East Bridge, 3:45 p.m. Information: www.pma.caltech.edu/~physcoll/PhysColl.html.

Friday, June 1

Fluid Mechanics Seminar
101 Guggenheim Laboratory, Lees-Kubota Lecture Hall, 3 p.m.—"Vortical Flow Past Axisymmetric Bluff Bodies," Professor Hiroshi Higuchi, department of mechanical, aerospace and manufacturing engineering, Syracuse University. Information: www. galcit.caltech.edu/Seminars/Fluids/CurrentFluids/index.html.

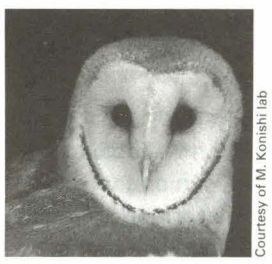
General Biology Seminar
119 Kerckhoff, 4 p.m.—Topic to be announced. Mu-Ming Poo, professor of neurobiology, UC Berkeley.

Inorganic-Organometallics Seminar
151 Crellin, 4 p.m.—"Kinetic Resolution of Chiral Olefins Using Enantiopure C_1-Symmetric Polymerization Metallocene Catalyst," Endy Min, graduate student in chemistry, Caltech.

Institute for Quantum Information Seminar
102 Steele, 3:30 to 5 p.m.—Topic to be announced. Michael Nielsen, department of physics, University of Queensland, Australia.

LIGO Seminar
155 Arms, Robert Sharp Lecture Hall, 4 p.m.—"A Comparison of Spherical, Resonant-Mass Gravitational-Wave Antennas with Narrowband Interferometers," Gregg Harry, LIGO, MIT. Information: www.ligo.caltech.edu.

Science, Ethics, and Public Policy Seminar
25 Baxter, 4 p.m.—"Science and Security before the Atomic Bomb: The Loyalty Case of Oceanographer Harald U. Sverdrup," Dr. Naomi Oreskes, associate professor of history, UC San Diego. Refreshments. Information: www.hss.caltech.edu/ses/SEPP.html.



Courtesy of M. Konishi lab

Multiply and conquer

Owls have long been known for their stunning ability to swoop down in total darkness and grab unsuspecting prey.

In the April 13 issue of the journal *Science*, Caltech neuroscientists report that an owl locates prey in the dark by processing two auditory signal cues to "compute" the position of the prey. This computation takes place in the midbrain and involves about a thousand specialized neurons.

"An owl can catch stuff in the dark because its brain determines the location of sound sources by using differences in arrival time and intensity between its two ears," says Mark Konishi, the Bing Professor of Behavioral Biology and coauthor of the *Science* paper with lead author José Luis Peña, a senior researcher in biology.

For example, if a mouse on the ground is slightly to the right of a flying owl, the owl first hears the sound the mouse makes in its right ear, and a fraction of a second later, in its left ear. This information is transmitted to the specialized neurons in the midbrain. Simultaneously, the owl's ears also pick up slight differences in the intensity of the sound. This information is transmitted to the same neurons of the midbrain, where the two cues are multiplied to provide a precise two-dimensional location of the prey.

"What we did not know was how the neural signals for time and intensity differences were combined in single neurons in the map of auditory space in the midbrain," Konishi says. "These neurons respond to specific combination of time and intensity differences. The question our paper answers is how this combination sensitivity is established. The answer is that these neurons multiply the time and intensity signals."

Thus, the neurons act like switches. The neurons do not respond to time or intensity alone, but to particular combinations of them. The reason the neural signals are multiplied rather than added is that, in an addition, a big input from the time pathway alone might drive the neuron to the firing level. In a multiplication, however, this possibility is less likely, because a multiplication reduces the effects of a big input on one side.

It's not clear how the owl perceives the location of the mouse in the third dimension, Konishi says, but it could be that the owl simply remembers how far it is to the ground or how much noise a mouse generally makes, and somehow adds this information into the computation.

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CampusEvents

Monday, May 21

Badminton
Brown Gymnasium, 9:30 a.m. to noon—Bring your own racket. Information: 355-6158.

Baby Furniture and Household Equipment Pool
234 S. Catalina, 10 a.m. to 1 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Ballroom Dance Club
Winnett lounge, 7:30 to 9:30 p.m.—Argentine tango for beginners. Third of five weekly lessons taught by a professional instructor. No partner or experience is required. $4 per class for Caltech undergraduates, $6 for others. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Ballroom Mini Dance Party
Winnett lounge, 9 to 11 p.m.—Open dancing; make requests or bring your own music. No admission charge and no partner needed. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Wednesday, May 23

Baby Furniture and Household Equipment Pool
234 S. Catalina, 10 a.m. to 1 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Ballroom Dance Club
Winnett lounge, 7:30 to 9:30 p.m.—West Coast swing for beginners, the third of four lessons. No partner or experience is required. Free for Caltech freshmen, $1 per class for others. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Thursday, May 24

Campus Architectural Tour
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: 395-6327 or suze@caltech.edu.

Amnesty International Monthly Meeting
1052 E. Del Mar Blvd. (top floor, GSC Penthouse), 7:30 to 9 p.m.—The Caltech/Pasadena chapter of Amnesty International will discuss new and ongoing activities. Information: lkamp@lively.jpl.nasa.gov, (818) 354-4461, or www.its.caltech.edu/~aigp22/home.shtml.

Introduction to Modern Dance
Braun Athletic Center, aerobics room, 9 to 10:30 p.m.—A free modern dance class for beginners, taught by a professional instructor. Sponsored by the Caltech Dance Troupe. No experience, special clothing, or shoes are required. Open to all adult members of the Caltech community.

Friday, May 25

Badminton
Brown Gymnasium, 9:30 a.m. to noon—Bring your own racket. Information: 355-6158.

James Boyk's 27th Anniversary Piano Recital
Dabney Lounge, 8 p.m.—James Boyk celebrates his 27th year as Caltech's pianist in residence with a program consisting of Victor Steinhardt's "18 Pieces in the Form of a Limerick," the four pieces of Brahms's Opus 119, and Prokofiev's Piano Sonata no. 8. Information: www.cco.caltech.edu/~boyk/perform.htm.

Six Characters in Search of an Author
Ramo Auditorium, 8 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Saturday, May 26

Ballet Dance Class
Braun Athletic Center, aerobics room, 1 to 4 p.m.—A free ballet class, sponsored by the Caltech Dance Troupe. Beginners: 1 to 2 p.m. Intermediate: 2 to 3 p.m. Advanced: 3 to 4 p.m. No special clothing or shoes are required for the beginners' class. Open to all adult members of the Caltech community.

Six Characters in Search of an Author
Ramo Auditorium, 8 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Sunday, May 27

James Boyk's 27th Anniversary Piano Recital
Dabney Lounge, 2:30 to 4:15 p.m.—James Boyk celebrates his 27th year as Caltech's pianist in residence with a program consisting of Victor Steinhardt's "18 Pieces in the Form of a Limerick," the four pieces of Brahms's Opus 119, and Prokofiev's Piano Sonata no. 8. Information: www.cco.caltech.edu/~boyk/perform.htm.

Six Characters in Search of an Author
Ramo Auditorium, 8 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Monday, May 28

Memorial Day Holiday
Institute Holiday

Six Characters in Search of an Author
Ramo Auditorium, 2 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Ballroom Dance Club
Winnett lounge, 7:30 to 9:30 p.m.—Argentine tango for beginners. Fourth of five weekly lessons taught by a professional instructor. No partner or experience is required. $4 per class for Caltech undergraduates, $6 for others. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Ballroom Mini Dance Party
Winnett lounge, 9 to 11 p.m.—Open dancing; make requests or bring your own music. No admission charge and no partner needed. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Tuesday, May 29

Social with Ray Choto and AIGP22
1052 E. Del Mar Blvd. (top floor, GSC Penthouse), 6 to 7:15 p.m.—Have refreshments and informal discussion with members of Amnesty International Group 22 and tonight's featured speaker, Ray Choto, noted journalist from Zimbabwe.

African Press Freedom: Journalist Speaks about Government Repression
119 Kerckhoff, 7:30 to 9 p.m.—Ray Choto, award-winning Zimbabwean author and journalist, will speak about repression of journalists in southern Africa. Information: (818) 354-4461 or lkamp@lively.jpl.nasa.gov. Sponsored by Amnesty International Group 22.

Wednesday, May 30

Baby Furniture and Household Equipment Pool
234 S. Catalina, 10 a.m. to 1 p.m.—Loans of kitchen and household necessities and baby furniture are made to members of the Caltech community. Information: 584-9773.

Ballroom Dance Club
Winnett lounge, 7:30 to 9:30 p.m.—West Coast swing for beginners, the last of four lessons. No partner or experience is required. Free for Caltech freshmen, $1 per class for others. Refreshments. Information: 791-3103 or www.its.caltech.edu/~ballroom/index.html.

Thursday, May 31

FOCAL Members-Only Book-Sale Preview
Dabney Garden, 6:30 to 9 p.m.—Members of the Friends of Caltech Libraries are invited to this members-only annual event. Browse the books while enjoying a wine and cheese tasting. Membership is available at the event for a fee of $50.

Introduction to Modern Dance
Braun Athletic Center, aerobics room, 9 to 10:30 p.m.—A free modern dance class for beginners, taught by a professional instructor. Sponsored by the Caltech Dance Troupe. No experience, special clothing, or shoes are required. Open to all adult members of the Caltech community.

Friday, June 1

Friends of Caltech Libraries Book Sale
Dabney Garden, 8 a.m. to 5 p.m.; continues until 2 p.m., Saturday, June 2—A bonanza of books at bargain prices.

Caltech Y Noon Concert
Winnett quad, noon—The Cathedral Brass Ensemble, one of the West Coast's most versatile brass ensembles, will present a variety of musical styles. Visit the Caltech Y at www.y.caltech.edu.

Six Characters in Search of an Author
Ramo Auditorium, 8 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Saturday, June 2

Friends of Caltech Libraries Book Sale
Dabney Gardens, 9 a.m. to 2 p.m.—A bonanza of books at bargain prices.

Ballet Dance Class
Braun Athletic Center, aerobics room, 1 to 4 p.m.—A free ballet class, sponsored by the Caltech Dance Troupe. Beginners: 1 to 2 p.m. Intermediate: 2 to 3 p.m. Advanced: 3 to 4 p.m. No special clothing or shoes are required for the beginners' class. Open to all adult members of the Caltech community.

Six Characters in Search of an Author
Ramo Auditorium, 8 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Sunday, June 3

Six Characters in Search of an Author
Ramo Auditorium, 2 p.m.—Theater Arts at Caltech presents the classic play by Nobel Laureate Luigi Pirandello in a modern adaptation by Robert Brustein. 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.

Two to tango in "Six Characters"

Caltech sophomore Panu Trivej dips JPL staffer Marjorie Schmeltz during a rehearsal of TACIT's production of "Six Characters in Search of an Author," opening Friday, May 25.

BOOMERANG, *from page 1*

Background Imager (CBI), a Caltech-based detector in Chile, will soon detect even finer detail in the cosmic microwave background (CMB). Analysis of this detail is thought to be the means of determining how slight fluctuations billions of years ago eventually resulted in the galaxies and stars we see today.

"We were waiting for the other shoe to drop, and this is it," says Andrew Lange, Goldberger Professor of Physics and the U.S. team leader. Lange was one of a group of cosmologists who revealed new results on the CMB at an American Physical Society meeting on April 29.

The new results are from a detailed analysis of high-resolution images obtained by BOOMERANG (Balloon Observations of Millimetric Extragalactic Radiation and Geophysics)—a highly sensitive microwave telescope suspended from a balloon that circled Antarctica for 10 days in 1998. Lange says that BOOMERANG's ability to obtain the new images is due to combining a powerful detector technology developed at Caltech and JPL with a microwave telescope and cryogenic systems developed in Italy.

Cosmologists believe the universe was created approximately 12 to 15 billion years ago in an enormous explosion called the Big Bang. The intense heat that filled the embryonic universe is still detectable today as a faint glow of microwave radiation, known as the cosmic microwave background (CMB). Whatever structures were present in the early universe would be imprinted as a faint pattern of variations in the CMB's brightness.

The CMB was first discovered in 1965. Within a few years, theorists had predicted that the size and amplitude of structures in the early universe would form a "harmonic series" of structures imprinted on the CMB, which would allow understanding of the universe's detailed nature. It was not until 1991, however, that technology was able to confirm that prediction, as NASA's Cosmic Background Explorer satellite discovered the first evidence for such structures. The BOOMERANG images are the first to bring the CMB into sharp focus, and the new results show the first evidence for a harmonic series of angular scales on which structure is most pronounced.

The 36 BOOMERANG team members come from 16 universities and organizations in Canada, Italy, the United Kingdom, and the United States. Primary support for BOOMERANG comes from the Italian Space Agency, Italian Antarctic Research Programme, and the University of Rome "La Sapienza"; from the United Kingdom's Particle Physics and Astronomy Research Council; and from the NSF and NASA in the United States.

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Seal, *from page 1*

two figures. Taken in the context of the emblem, the passing on of knowledge, Millikan seemed to be endorsing scientific truth. Still, the motto is ambiguous as it appears on the seal, and perhaps he wanted it that way—a message that would strike a responsive chord both with the faculty and with Caltech's financial supporters, who tended to be more religious.

The line alongside the seal in small type, "Founded by A. H. Fleming," goes back to a 1920 Board of Trustees resolution. Arthur Fleming had agreed to leave the bulk of his fortune to Caltech and, in consideration of his gesture, the board supported having his name appear on the seal.

Millikan apparently liked the emblem, referring to it as Caltech's official seal. The executive council (Millikan's cabinet) authorized its use on diplomas, where it appears to this day. For the next 40 years, the Devreese design was considered the official seal.

In the 1960s there were calls to update the seal, and in 1969, with Harold Brown's inauguration as president and the pending admission of female undergraduates, Caltech's administration eyed two "new and improved" renderings. Apparently they couldn't decide which one to use; both versions (figures 2 and 3) appeared on Brown's inauguration publications.

Brown thought the Devreese seal didn't help Caltech's public image or its fundraising efforts. He suggested that school officials get the opinion of trustee Henry Dreyfuss, a well-known industrial designer. In reply, Dreyfuss provided a sketch (figure 4), just after Caltech started admitting undergraduate women, and wrote, "Instead of boys chasing one another, we have a boy chasing a girl, or vice versa."

Meanwhile, the trustees officially adopted another seal, a torch held by one hand, with little discussion. The students, however, took exception, and suddenly everyone on campus had an opinion about it. Should there be one hand or two holding the torch? To make matters worse, when in 1970 the board started delving into history, it discovered that the Devreese seal had never been officially approved by either the board or Millikan's executive council. It had merely served as the de facto official seal for those many decades.

In 1984, the issue of the seal came to a head. The board rescinded its 1969 action adopting an official seal. The Devreese design was adopted as the official seal retroactively to 1925, but was taken out of use except on diplomas. And the logo in figure 5 was approved for publications, events, and all the mugs, T-shirts, and other souvenirs now sold in the bookstore. Millikan may yet have the final word.

Judith Goodstein is Caltech's archivist and registrar, and a faculty associate in history.

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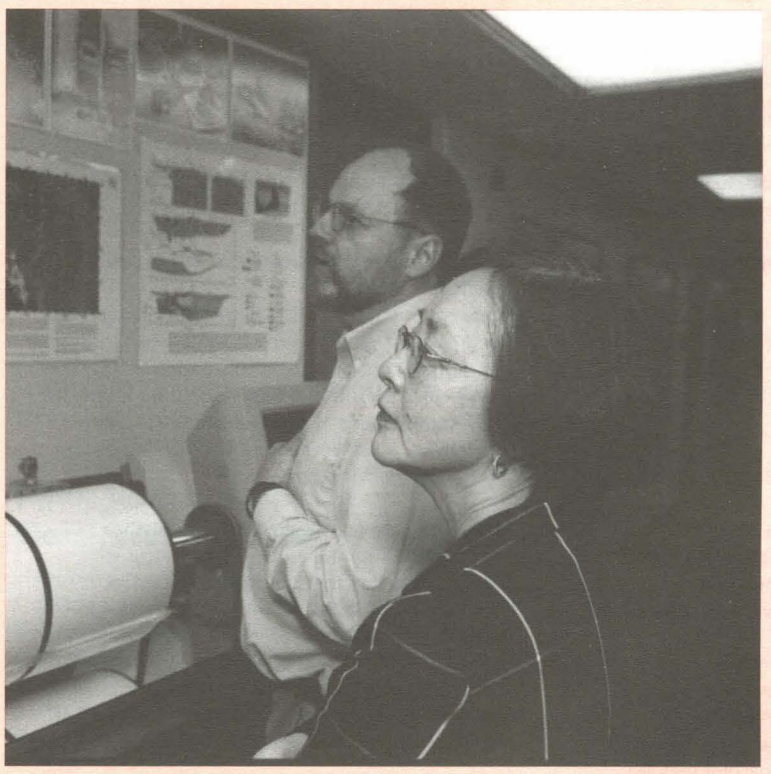
NewsExtras



California State Assembly member Carol Liu, 44th district, learns about the California Integrated Seismic Network from seismologist Egill Hauksson during a recent campus visit.

Parking, *from page 1*

pleasures of life here is to walk through the cool campus, by the lily ponds, late at night, conscious that one is safe, and that all around people are quietly working, expanding the frontiers of knowledge. But after such a stint, one doesn't feel like coming in with the lark next morning.

If you do turn up after 9 a.m., chances are you will be met by "Lot Full" signs. It makes people ratty, it makes them late, and it palpably reduces the efficiency of the place.

The Institute should, I think, consider abolishing designated parking privileges after 11 a.m. There are few more vexing experiences than cruising around an otherwise jam-packed lot or structure, with gaping holes that you know will never be filled because the designated parker is either (1) on leave, (2) retired and only comes in once a week for mail, or (3) deceased.

If all the reserved parking spaces turned into pumpkins at 11, it would enable colleagues to move from the street when the 9 a.m. to 11 a.m. grace period elapses.

In the interim, I would suggest some guerilla parking tactics. First, of course, is to talk to your division administrator, find out who is on leave, and snaffle their place (a paint-pot at midnight and some pirate redesignating, for the more adventurous guerilla). Carpooling is never going to work at Caltech, where people have such different modi operandi. But it would be socially responsible for colleagues to inform their division or department when they will not be coming in and when their designated space is up for grabs—to be distributed, perhaps, by divisional lottery or by auction.

There are some frankly antisocial tactics. Come in at 10 a.m., park on the street, then slip into one of the spots that falls vacant at noon, when colleagues drive off to lunch. Of course, when the poor sods come back, they must do the circuit, looking vainly for what is no longer there. I've done it, I'm sorry to say. War of all against all.

Oddly, the Caltech community seems averse to parking south of California. When, as increasingly happens, I can find nothing on campus, I go a couple of hundred yards to Holladay Road, and park (appropriately, as I like to think) outside George Ellery Hale's house. It's a big, empty San Marino street with, as far as I can see, no restrictions. You can walk, pleasantly, down leafy Lombardy and up Arden, use the Ped Xing, and come up into campus by its nicest entrance, the Bridge colonnade, Throop Site, and Millikan Pond. Don't tell anyone, though. We don't want everyone to start going there.

Sutherland was a professor of literature at Caltech from 1983 to 1992, and has been an annual one-quarter visitor since 1993.

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Caltech 336

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