



The California Tech

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Stud. Aff. Cans Resident Pianist for 'Inadequacy'

By JAAP WEEL

After 30 years as Caltech's Pianist in Residence, and 25 teaching the Projects in Music and Science course, James Boyk has been given the pink slip. The dismissal occurred when Boyk's old appointment as Pianist in Residence expired on June 30. Although formally Boyk was not given any motivation for his dismissal, Student Affairs has informally cited "inadequate student participation."

"I was startled," said Boyk about the loss of his position as Pianist in Residence. "I learned [about it] on the day the old appointment expired (June 30), and only because I happened to ask." When only two weeks later he heard that the music lab was evicted from the Winnett building by Student Affairs, "it was surprising to learn that a non-academic Department could kill an academic course." He will stay on

as a Lecturer in Music in Electrical Engineering for another year, but lacking a lab he will no longer be able to actually teach.

His students are equally baffled. Jared Updike called it "ironic" that they would fire him after 30 years. Kyle Bradley found it to be his most valuable class, and stresses that projects in Boyk's class have inspired many students' careers. "Projects in Music and Science is exactly the sort of thing Caltech humanities should be like," he says.

Boyk's teaching included the "Alive with Music!" public sessions as well as the more in-depth Music Lab courses. He brought to his work a unique multi-disciplinary viewpoint. As a respected concert pianist with a Harvard math degree and a tremendous amount of experience in the fields of recording technology, instrument technology and acoustics, his message to students has always been that "music is unique among the arts in the number and significance of its connections with the sciences."

In Projects in Music and Science, students have investigated the connections between music

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Courtesy of caltech.edu

Pianist in Residence James Boyk, shown here with students from his "Alive With Music!" class last year, was fired last week for attracting "inadequate student participation."



L. Tran/The California Tech

An incoming freshman chats with an upperclassman over a Rotation dinner last week. Designed to match new students with houses complementing their personalities, the annual ritual culminated last Sunday as a committee of house leaders issued final membership assignments.

Houses Win Freshmen's Hearts Through Annual Rotation Week

By CHRISTINE CHANG

Name tags, rapid hellos and dinnertime dramatics underlined a week that saw Caltech's newest crop of incoming freshmen roam the seven houses in search of a home, enjoying first tastes of student culture in a fun albeit frenzied annual Rotation ritual designed to match each student with one of the seven on-campus undergraduate houses.

"It was an excellent experience. I got to know all the upperclassmen," said Thomas Mainiero '08.

Through eating dinner and attending receptions at each of the

seven houses, Rotation offered the incoming freshmen the opportunity to mingle with the upperclassmen, receive advice and refine their choice of a home among the seven houses.

Typically, freshmen cite the opportunity to meet and speak with upperclassmen as one of the most popular, and informative, aspects of Rotation.

"Most of the upperclassmen were very forthcoming and willing to talk," said Derek Chan '08.

Many freshmen also enjoyed the festivities and unique traditions that accompanied each house dinner. Dinners offer the

new students a glimpse of the differences between the cultures of each house.

"Dinners were pretty awesome," said Stephen Cheng '08.

Furthermore, some freshmen find Rotation a welcome diversion from the rigors of classes and homework.

"I got to meet a lot of cool people. It's also a good stress reliever right after classes," said Helen Lee '08.

Many freshmen agree that Rotation provides them with the opportunity to become acquainted with the houses, but they point out that the houses seem to over-

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P. JENNINGS OPENS TERM AS PROVOST

KOONIN ON LEAVE OF ABSENCE

Returns With Finance Experience to Office He Left in '95

By KLIMKA KLEMENTY

Stepping in for departing Provost Steve Koonin, ex-Provost Paul Jennings is poised to retake the office he last held from 1989 to 1995 while Koonin takes a leave of absence from his faculty position at Caltech to work as chief scientist at BP Amco Chemical Company in London.

Asked why he accepted the position for a second—and this time, shorter—term, Jennings replied that his good health and his caring feelings towards Caltech were key factors in bringing him back. Besides, he said, his life as an emeritus was fairly busy to begin with—so no harm in making it a little busier.

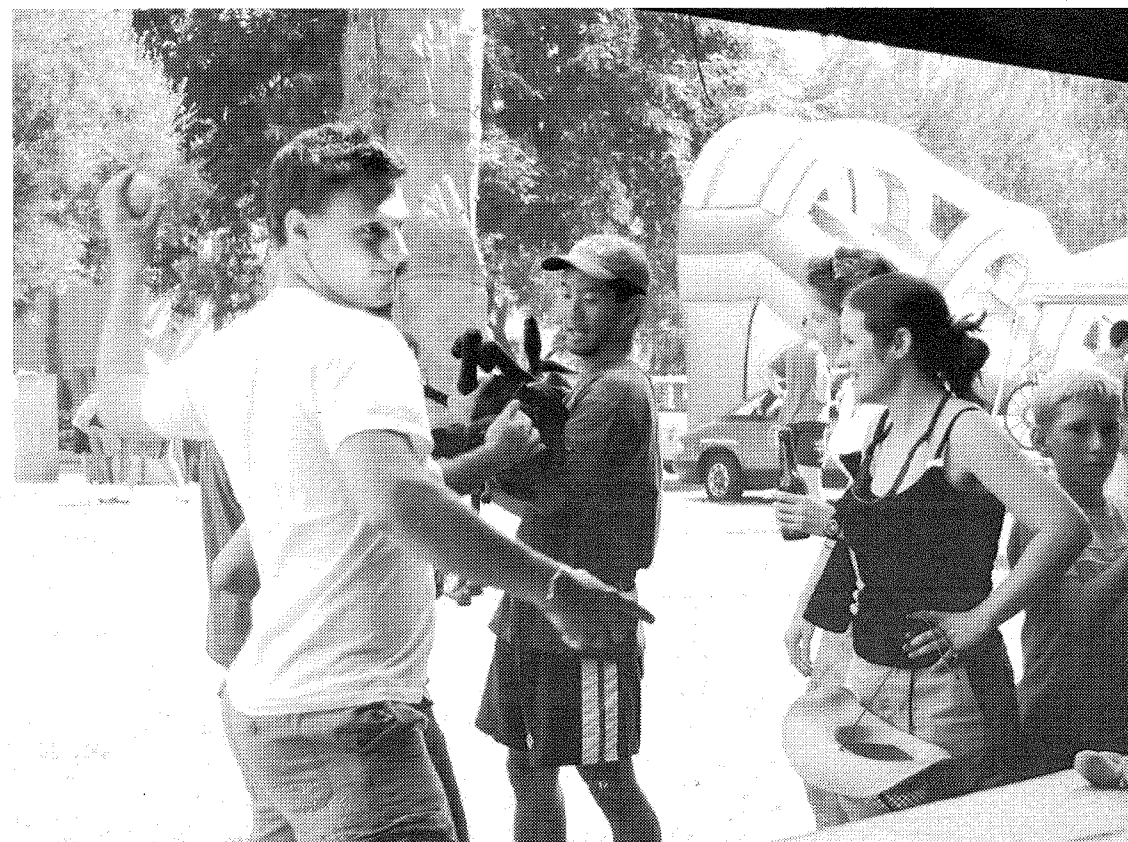
Indeed, during the nine-year interim to his provostship, Jennings served as acting vice president for business and finance in 1995 and from 1998 to 1999, as chairman of the California Council on Science and Technology in 1996-2002, as member of CCST's Executive Committee and as chair of Pasadena's City Hall Restoration Oversight Committee. His energy and leadership are widely acknowledged and admired, and most say they will be great assets to his office.

Also to his advantage is Jennings' previous experience with the position of provost. Knowing what to expect and how to deal with different problems that come up is important; "it's all about problem-solving," said Jennings of his new job.

And with the ongoing capital

Continued on Page 7, Column 1

READY, AIM...



L. Tran/The California Tech

An incoming freshman shares in the carefree fun of Student Life Director Tom Mannion's annual pre-term carnival. In its second year, the festival featured games, bouncy castles a dunking booth and its signature fireworks show.

CAIB MEMBER ASSAYS SPACE CATASTROPHE

SAYS 'FOAM' CRASHED COLUMBIA

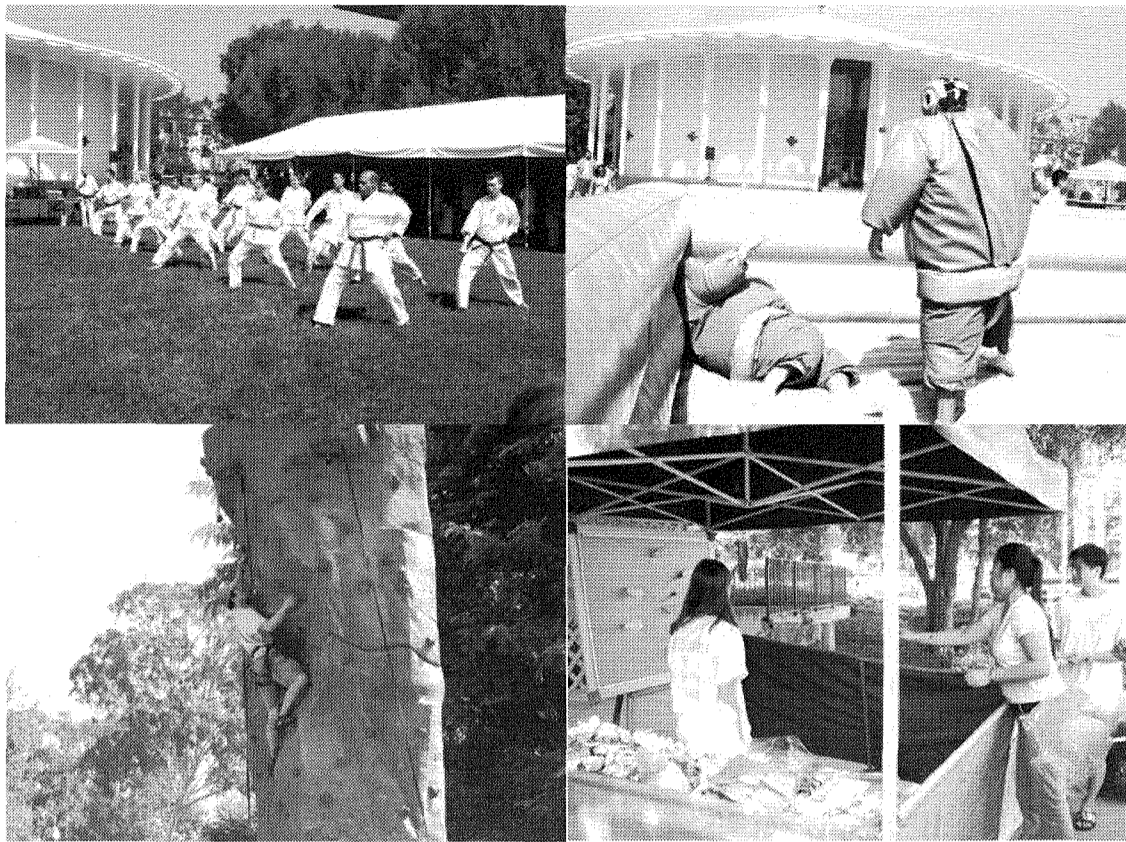
Explains Bush Move To Land Men On Moon, Mars

By MARK POLINKOVSKY

February 1, 2003 marked a tragic turn in the US space program. The space shuttle Columbia was destroyed upon re-entry. Last Thursday, Douglas Osheroff of Stanford University gave a Physics Research Conference lecture titled "Understanding the Columbia Shuttle Accident." Dr. Osheroff, a 1996 winner of the Nobel Prize in Physics, served on the Columbia Accident Investigation Board (CAIB). In his lecture, Dr. Osheroff described the findings of the CAIB and offered a detailed analysis of the Columbia accident.

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PHOTO OF THE WEEK



L. Tran/The California Tech

The second annual carnival and club fair spotlights student groups and culture, with setups ranging from a karate formation and a sumo bout to rock climbing and balloon popping. Though Caltech has always hosted a pre-year club fair, it was only recently that the event grew from a humble array of club tables with homemade sign-up sheets to a festival with performances, games and fireworks.

Though Repetitious, 'Tedious' To Some, Rotation Again Memorable

Continued from Page 1, Column 5
play their personalities to make the week more exciting and to recruit the freshmen. Many common strategies include dinner games and house movies.

"Each house was more extravagant than they generally are, but it was a fun way to meet people. It's hard to get a good impression of the houses from one week, especially since this was a party week," said Cheng.

Though many found Rotation to be enjoyable at the beginning of the week, some freshmen admit to growing tired of the excitement of Rotation. They were eager to move into permanent rooms and settle into their lives at Caltech.

"At the beginning, Rotation was fun, but at the end, it got a little tedious," Chan said.

Originally, Rotation was designed to introduce the freshmen to each house so they could rank which houses they prefer to live in, but some freshmen felt that Rotation made the decision more difficult to make.

"All the houses have cool people, and going through Rotation made it harder for me to choose because I realized there were cool people in each house," said Lee.

At the week's end, freshmen submitted rankings of their choices for a home among the seven on-campus undergraduate houses. Meeting all night Saturday, a committee of house leaders used the freshmen's preferences along with their own to match freshmen into houses.

Even though they enjoyed Rotation, many freshmen believe

that some improvements could be made.

"Lunches were too short," said Cheng. "People just eat and go to class."

Classes not only hinder Rotation by limiting lunchtime, but they also conflict directly with Rotation receptions.

"They should make classes not conflict with Rotation," said Mainiero.

Upperclassmen, though also admitting that Rotation has its limitations, stress its importance in introducing the incoming class to the house system.

"While it's impossible for the Houses and the freshmen to truly get to know one another in only a matter of days, I think that Rotation provides an effective means of introducing the freshmen to the different kinds of people they'll be interacting with during their time here at Caltech as well as the House system in general," said Michael Chang '06.

For the sophomores, this year brought back memories of going through Rotation last year. Many believe that being an upperclassman is much less draining than being a freshman.

"This year wasn't nearly as tiring because I got to be on the other side, and it wasn't too hard to talk to the frosh because I was just there a year ago," said Chris Yu '07.

Even though many sophomores enjoyed Rotation better as an upperclassman, some found it more interesting and stimulating as a freshman last year.

"In addition to getting to know

people, there was this overarching backdrop that you had to get a feel for as well," said Ken Ho '07.

Despite finding it entertaining, most upperclassmen agree that one week provides enough time for Rotation to come to a needed end.

"One can only ask 'which kitchen appliance would you be?' so many times," said Ho.

NIH Honors Phillips, Quake DNA Breakthroughs With 'Pioneer' Award

By ROBERT TINDOL

The National Institutes of Health (NIH) has announced that California Institute of Technology mechanical engineering and applied physics professor Rob Phillips is one of nine recipients of the first annual Director's Pioneer Award. Stephen Quake, the Thomas E. and Doris Everhart Professor of Applied Physics and Physics at Caltech, currently at Stanford University, is also among this year's recipients.

The Director's Pioneer Award will provide Phillips with \$2.5 million in funding for the next five years as part of the NIH's new "Roadmap for Medical Research" program. Phillips, an authority on the nanoscale mechanics of biological systems, says he will use the funding to enter into novel research areas.

"The NIH Director's Pioneer Award is both a huge honor and a privilege for which I am tremendously grateful," Phillips says. "Quite frankly, this award is going to completely transform my scientific life and will permit me to pursue some questions about the dynamics of complex systems such as cells that have been gnawing at me since I was a teenager.

"My background is of someone who builds mathematical models of these kinds of systems," he adds. "As a result of this award, we can now design and build experiments aimed at concretely exploring the extent to which our

Layoff Sounds Dirge For 'Alive With Music!'

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performance and fields ranging from electrical engineering to psychology.

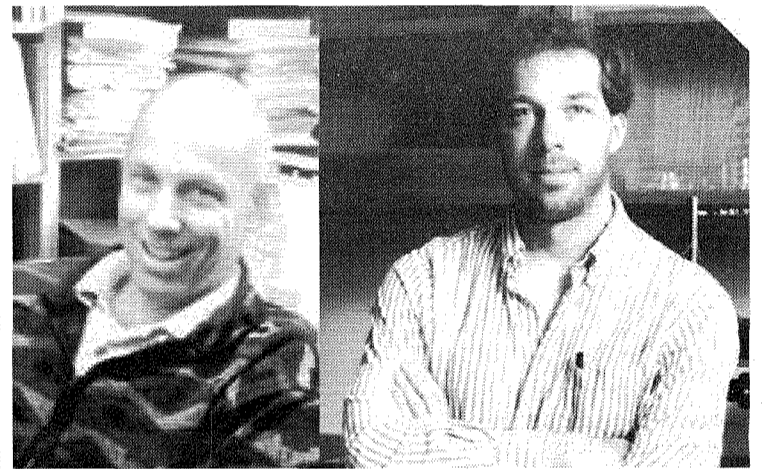
"[...] any experience, if directed by a person able to appreciate and draw on Caltech students' unusual abilities, will be a far richer and more lasting experience than any mere reproduction of an 'ordinary' course," said Boyk. "I have always loved working with Caltech students, whose liveliness, creativity, respect for direct experience, curiosity, intelligence, openness to new ideas, willingness to experiment, wide experience, intellectual honesty and energy made my work a delight."

Margo Marshak, Vice President of Student Affairs, refuses to comment, citing that "while [the] questions are very intelligent," she does "not feel at liberty to answer those concerning Mr. Boyk. Personnel matters should not be made arbitrarily or publicly [sic]." Boyk, on the other hand, has expressed no concern about

the matter being made public, arbitrarily or otherwise.

Some students who are concerned about what they perceive as a lack of transparency in the administration view the quiet circumstances of Boyk's dismissal as an attempt of the administration to stifle debate and protest from their side. The original wave of firings after Marshak's appointment in 2002, which was immediately made public by e-mail, generated protests and rallies from undergraduate as well as graduate students.

In the meantime, Boyk has found a location close to campus to continue to teach private lessons for members of the Caltech community. Asked about his experience in 30 years at Caltech, Boyk says: "I have learned enormously from Caltech students and am grateful for the education, as I'm grateful to Caltech audiences for their role in my maturing as a concert pianist."



Courtesy of Popular Science

Mechanical Engineering Professor Rob Phillips and Applied Physics Professor Stephen Quake received awards for virus research.

models are correct.

"In the short run, this overall vision will be played out in the context of a few key case studies, including how viruses manage the physical requirements of packing and releasing their genomes, how macromolecules conspire to decide when genes are turned on and off, and how cells respond to mechanical forces."

A graduate of Washington University, Phillips has worked recently on DNA injection and packing that occur during the life cycles of bacterial viruses, as well as on how certain classes of ion channels are gated by mechanical forces. He is the author of a book titled

Crystals, Defects and Microstructures that is based on his extensive work in modeling materials and which served as his jumping-off point for modeling living materials.

According to a statement from the NIH, the Director's Pioneer Award is intended to provide substantial support for researchers "willing and able to explore ideas that were considered risky at their inception.

"Such individuals are more likely to take such risks when they are assured of adequate funds for a sufficient period of time, and with the freedom to set their own research agenda," the statement continued. "Many of the new opportunities for [biomedical] research involve crossing traditional disciplinary lines and bringing forward different

conceptual frameworks as well as methodologies. These developments appear to justify support for more aggressive risk-taking and innovation."

The nine recipients were formally announced at 9 a.m. PDT Wednesday by NIH director Elias A. Zerhouni, M.D. During a telebriefing, Zerhouni and the Pioneer Award program cochairs, Stephen E. Straus, M.D., and Ellie Ehrenfeld, Ph.D., will discuss the selection process and the areas of research the awardees will explore.

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CALTECH CONVENTIONAL WISDOM WATCH



Provosts and Pioneers: Interestingly enough, it's Jennings who's interested in quakes and Quake who's interested in genomes.



Rotation: It's always fun to meet the freshmen, but it's only so many times that you can bear to ask what kitchen appliance you'd be.



Boyk Bonked: The pianist is no longer alive with music, which has only trebled discontent. Word is that Student Affairs wrote the cadence in Boyk's requiem.

Bush Foreign Policy Is Dishonest, Misguided Incompetent Leadership Calls for Regime Change in Washington

By SWAROOP MISHRA

Although Caltech students are not known for our activism, we should take the opportunity to speak up as this November's election approaches. For the safety and security of the nation, we should work to bring an end to the Bush Administration's counterproductive activities. Even disregarding the hypocrisy of its environmental policies, the crippling effect of its record budget deficits, the cronyism of its no-bid contracts, and the fact that Bush is the first president since Herbert Hoover (think "Great Depression") whose presidency will result in a net job loss, the current administration is plainly incompetent. The self-described "wartime president" is pursuing a "war on terrorism" that is ill-advised and is already a failure.

Even with Afghanistan in turmoil and Osama bin Laden at large, an invasion of Iraq became central to the Bush strategy. Eighteen months ago, prior to the invasion, I submitted a series of arguments against it in a letter to the California Tech. In response to inaccuracies in Bush's 2003 State of the Union speech and Colin Powell's subsequent presentation to the United Nations, the letter said, "It would appear that in the rush to war, the U.S. government is not placing sufficient importance on the legitimacy of its evidence or its claims." This statement was substantiated in the invasion's aftermath, as no "weapons of mass destruction" were found and Bush's own "9/11 Commission" determined that there were no links between Saddam Hussein and al Qaeda. Instead of taking responsibility for his false claims, Bush blamed the intelligence community and pushed out the director of the CIA.

As it became clear that Saddam Hussein could not be tied to "weapons of mass destruction" or al Qaeda, Bush began emphasizing the "freedom" that the Iraqi people would enjoy after the invasion. Did Bush recognize that this third justification was no more legitimate or realistic than the first two? The March 2003 letter to the Tech noted that many "recent examples demonstrate that the fall of an oppressive regime does not necessarily lead to freedom and democracy, but instead to instability and perhaps further oppression." A simple knowledge of history and politics led me to conclude that "the power vacuum created by Hussein's fall would lead to severe instability in Iraq" and that it would be "comical to assign a great deal of predictability to the eventual outcome of an invasion of Iraq, let alone to believe that Hussein's regime would be replaced by 'freedom and democracy.'" As I - and many others - anticipated, the puppet government of former exile Iyad Allawi is propped up by American force and is being steadily undermined by violence, assassinations, and the widespread perception of its illegitimacy. Although the popular religious movements of Ayatollah Ali Sistani and Moqtada al-Sadr pose well-known threats to American control, their cooperation or containment would not guarantee stability to Iraq. It may only be a

"Hatred for the United States is bred by American hegemony, imperialism, and unilateralism."

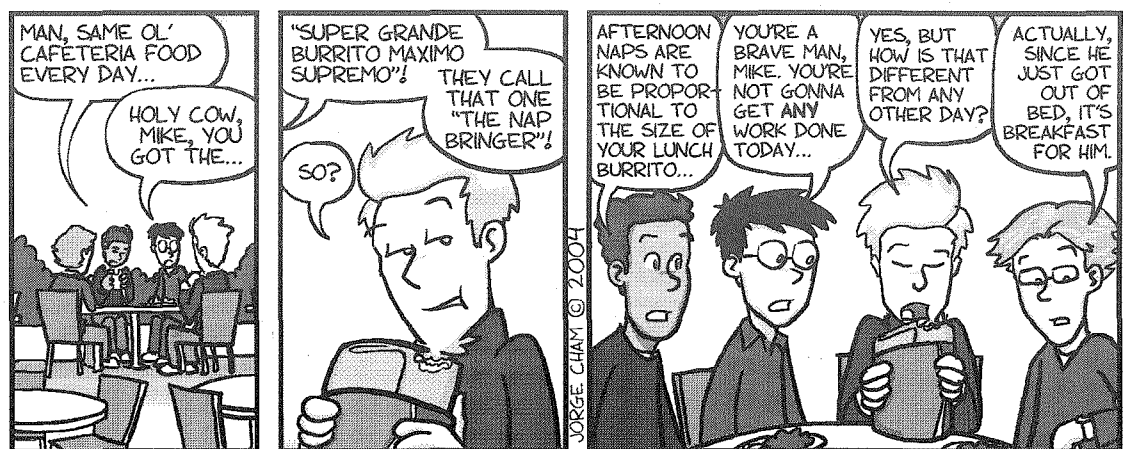
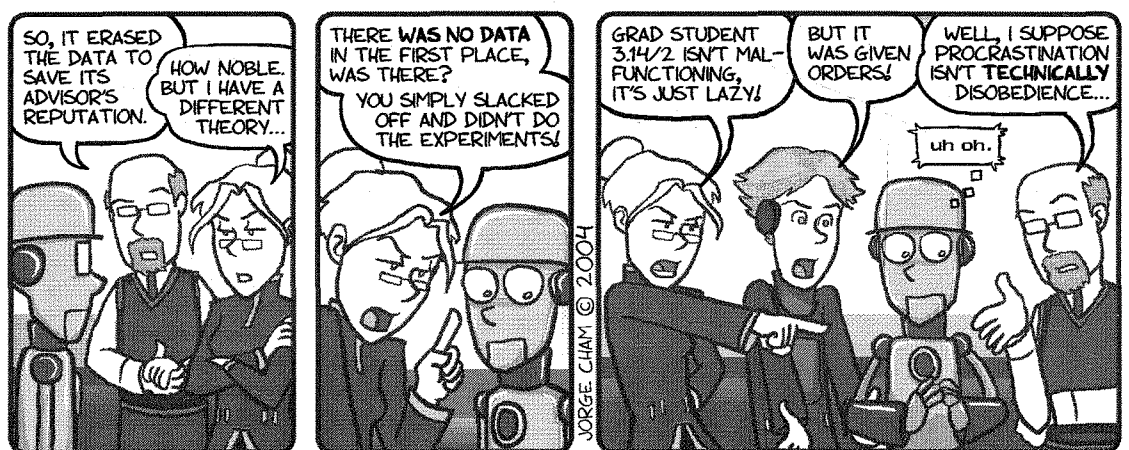
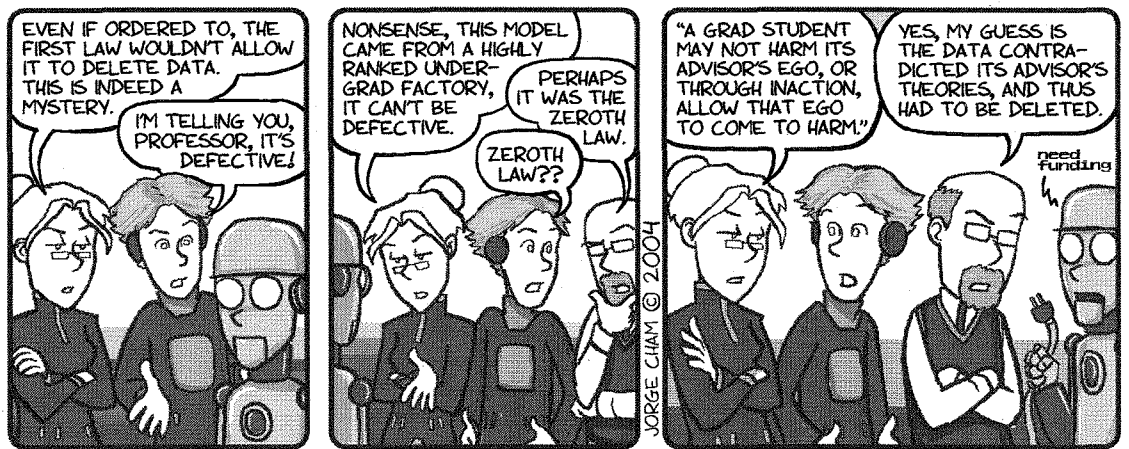
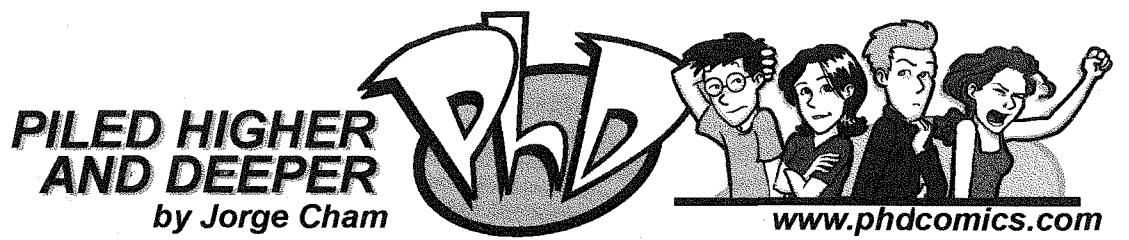
matter of time before the historically separatist and traditionally well-armed Kurdish population tires of concessions and discontinues its participation in the government.

Unfortunately, the Bush Administration's greatest failure in this invasion may not be its false claims and hypocrisy, its damaged relationships with America's historical allies, its violations of the Geneva Convention, the disarray in which it has left Iraq, its commitment of American troops to a quagmire, or even the pointless loss of hundreds of those troops' lives. To conclude my previous letter, I wrote, "A peace in which the United States unilaterally enforces its will and protects its interests through instigation of military conflict is not a just peace, it is simply tyranny on a different scale." The nature of the American invasion was exposed in the images of humiliation, torture, and murder perpetrated by the conquerors at Abu Ghraib. More recently, American forces have engendered anger in the Muslim world through military action in Najaf, site of one of Islam's most important shrines. As demonstrated by Indira Gandhi's 1984 assault on insurgents in Amritsar's Golden Temple, people are left especially angry and vengeful when their shrines are attacked.

Tyranny leaves a long and bitter impression, and the youthful population of the Muslim world has millions of impressionable minds. In Saudi Arabia, homeland of Osama bin Laden and of a majority of the 9/11 hijackers, 60% of the population is under the age of 18 (http://www.aec1.com/facts_saudi.htm). As it loses the minds of these youth, the United States will lose its "war on terrorism."

Terrorists are not inspired to kill themselves in attacks on the United States because they adhere to a certain religion or because they don't believe in "freedom" or in the American way of life. Hatred for the United States is bred by American hegemony, imperialism, and unilateralism. The Bush Administration's unilateral and abusive invasion of Iraq - and its subsequent and inevitable efforts to wield power there - have doubtless fanned the flames of fury burning in terrorists' hearts and aided their recruitment efforts. We should expect terrorist attacks against the United States as a result of, and not in spite of, the foolhardy George Bush "war on terrorism." Rather than waiting and wondering what color of "terror alert" will come with each new day, we should bring a "regime change" to Washington before the Bush Administration inflicts further damage on the security and future of this country.

The writer is a graduate student in chemical engineering.



Mainstream Media Ignore Third-Party Candidates

Imbalance in Political Coverage Stifles Serious Voices, Hurts Voters

By SIMON QUE

The night of Thursday, September 30, saw the first official presidential debate of the 2004 election. The participants were, not surprisingly, George Bush and John Kerry. Conspicuously missing from this debate were third-party voices, such as Ralph Nader of Election 2000 fame. People who were not familiar with politics who turned on the TV would have been hit with the suggestion that Bush and Kerry were the only candidates running for President.

But why only two candidates? On August 30, there was an "unofficial" presidential debate held in New York City. The organizers sent out invitations to Bush, Kerry, and four other candidates: Ralph Nader (Independent), David Cobb (Green Party), Michael Badnarik (Libertarian Party), and Michael Peroutka (Constitution Party). These are all significant third-party candidates who have made the ballot in a majority of the states. Yet not one of them received an invitation to the Bush-Kerry debate.

Two of these candidates, Cobb and Badnarik, took part in the August 30 debate. They held their own debate again on the night of the Bush-Kerry debate. Cobb and Badnarik are ideologically very different from the two major candidates. For instance, both candidates oppose involvement in Iraq and call for the withdrawal of troops. They have both criticized the administration's various violations of civil liberties, such as the provisions of the PA-

TRIO Act. Nader and Peroutka have voiced similar concerns. But you won't be hearing these views from the big players anytime soon. George Bush wants to continue involvement in Iraq and to renew the PATRIOT Act, while John "Flip-flop" Kerry seems incapable of giving a straight answer on anything.

Meanwhile, the news media seems to be perfectly compliant to go along with the illusion that there are only two viable candidates. They ignored the Cobb-Badnarik debates, instead covering the concurrent GOP convention and Bush-Kerry debate. While a news channel's camera cannot be in two places at once, surely it wouldn't have been too much trouble to obtain transcripts of both events, and report on them side-by-side on the front page of the next day's paper? In the latest debate, Cobb and Badnarik waited for the Bush-Kerry debate to conclude and then made their comments and rebuttals to the two major candidates. That would have certainly been worthy of airtime. But the major news outlets are silent.

Even outside of these live debates, third party candidates don't get much news coverage. As a test, I searched the websites of ABC, CBS, CNN, and FOX News for the keywords "Bush," "Kerry," "Nader," "Badnarik", "David Cobb," and "Peroutka," counting hits from the last three months. Looking at the results, it should not be hard to see the lack of coverage of third-party candidates. None of them gets

Website	Bush	Kerry	Nader	Badnarik	Cobb	Peroutka
www.abcnews.com	6982	3822	283	3	6	3
www.cbsnews.com	14103	2792	413	0	16	0
www.cnn.com	1099	734	85	0	0	0
www.foxnews.com	3046	2123	148	1	8	1
Ballot states*	50	50	39	48	27	37
*As of September 21						

Table compiled by the author

The table summarizes the number of mentions the presidential candidates received on the websites of various major news outlets. Even the most prominent third party candidates got a vanishingly small amount of coverage compared to the Democratic and Republican contenders.

any front-page coverage at all. Presumably, Nader is mentioned more frequently than the others because he has already become a significant third-party presidential candidate due to his candidacy in 2000. But Nader is not more impressive than the other third-party candidates. For instance, Badnarik is on the ballot in 48 states, more than Nader's 39 states. His party, the Libertarian Party, is the third-largest political party in the U.S. And 68% of respondents in a Rasmussen poll believed that he should be invited to the main presidential debates, while only 20% believed that he should not. Put simply, Badnarik is no lightweight for a third-party candidate. Neither are Cobb and Peroutka; just look at the number of states on which they have made the ballot. Millions of voters would open a ballot on Election Day and see the names of these four candidates. Yet the news media continues to ignore them.

But even if they were very popular, so what? One purpose of reporting news is reveal things that may otherwise be unknown.

Granting more news coverage to candidates on the basis of popularity does the exact opposite. A much more reasonable criterion to use would be the degree of ideological difference between candidates. Compared to the aforementioned third party candidates, Bush and Kerry's views are not that different. (Just visit the campaign and party websites of Badnarik, Nader, Cobb, and Peroutka, and see for yourself.) Ideas are far more important than popularity, as politics is theoretically about ideas and not about people. Even if one accepts that third-party candidates are not electable but only force the major parties to adopt their ideas, that is still no reason to ignore them. And popularity ought to serve as only a "tiebreaker" to pick between candidates with similar views - possibly between Nader and Cobb, for example.

G. K. Chesterton once said that "the democracy has the right to answer questions, but it has no right to ask them. It is still the political aristocracy that asks the questions." The political aristoc-

racy in America - i.e. the Republican and Democratic Parties - has a great deal of control over which questions are asked by silencing or ignoring alternate voices, such as through restrictive ballot access and campaign finance laws. Voters have little chance of being exposed to these other viewpoints and instead get a two-party duopoly.

But more serious is the direction that the major news sources have taken. Their traditional role in society has been to expose corruption and abuse by those in power, including the silencing of third parties' voices. However, the mainstream news media has effectively joined the political aristocracy by ignoring third parties and presenting elections as if the Republicans and Democrats were the only two choices. FOX News may dress up its election coverage under the banner of "You Decide 2004," but the truth is that the news media has already decided much for the voters.

This sort of media bias does a great disservice to Americans.

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Dire Out of Gas Predictions Meet Economic Realities

By SAM DINKIN

In David Goodstein's *Out of Gas: The End of the Age of Oil*, a grim picture is painted of "Civilization as we know it" coming to an end. The basic argument is as follows: "In the 1950s, M. King Hubbert predicted that the rate at which oil would be extracted from wells in the United States would peak around 1970 and decline rapidly after that." The so-called "Hubbert's peak" in extraction occurs when about half the oil is gone. Hubbert's prediction for the US was spot on. Goodstein extrapolates a global Hubbert's peak and comes up with sometime between now and 2020.

With prices of oil hovering near \$0.40/liter (\$48/barrel), everyone is suddenly wondering whether the sky is the limit for the price of oil. This might open up a case for lunar platinum exports (Review: Moonrush <http://www.thespacereview.com/article/205/1>) and solar satellites.

Goodstein worries that there will not be time to emplace an earthbound "array spread over 200,000 square kilometers" of solar cells when only 10 have been produced so far. Solar cells cost about \$3.69 per watt at www.partonsale.com. For \$295 we can buy one that is about 2/3 of a square meter. That's 6.7 x 10⁻⁷ square kilometers. So the entire 200,000 kilometers conversion of the Earth to solar power could be produced for \$87 trillion. That's a big number, but the world economy is \$50 trillion/year. We do not have to convert all in one year. Recall that at Hubbert's peak, half the usable oil is still unused.

Goodstein worries that there will be trouble ramping up production in time. This may be the \$64 trillion question. IDC figures that by 2008 we will have \$280B/year in semiconductor sales. At that rate, it would take centuries to build up enough capital stock to go solar. Oops, it looks like I fell into one of the traps that Goodstein says that geologists fall into, that we will "continue at the same rate we are doing now". Continuing at the 12% growth rate IDC says we will slow to in 2008 from 18% in 2004, it will only take 30 years to emplace all the solar cells if the entire industry converts over to producing solar cells by 2008.

Remember that we only need to use about half as much oil in the transition because we will have nearly half as much solar cells half way through the installation. That means we need only about 15 years of consumption left when we get religion and a sufficient industrial base. We could probably get some gains for mass production that would cancel out the costs of the rushed semiconductor production conversion and allow us to make the solar conversion quicker if not cheaper.

If Earth-based solar is good, space-based solar could be better. Goodstein says that about 800 solar satellites the size of Manhattan in geosync would do the trick. At \$1,000 per kilogram we would only need to spend \$15 trillion or so on launch costs to heft 15 billion kilograms of solar

cells which would only be about 1/4 as much as 200,000 square kilometers because there's about 4 times as much light up there with no clouds and no night. Throw in another \$10 trillion for the cells and some more for the microwave ground stations and we have a pretty good case for solar orbital. We should probably exhaust the case for stratospheric lighter than air solar before we invest, but there are other objections.

One trouble with this plan is that oil, coal, natural gas, and oil sands are so cheap that no one will want to switch away from fossil fuels to solar until they are closer to running out. I have been taught since I was a kid (and Goodstein repeats) that it is better to use our finite reserve of hydrocarbons to make plastic and pharmaceuticals instead of burn it. That makes about as much sense as conserving water. If there was a shortage of plastics expected, the manufacturers would bid up the price of plastic. The economy works great to use resources where they are needed most.

Economics also works great

to use resources when they are needed most. Economics predicts that because owners have to be made indifferent between extracting now and extracting later that the price of non-renewable resources will rise roughly at the rate of interest. If it rose faster, it would pay to wait to extract later. If it rose slower, it would pay to extract it all now and put the money in the bank. It is not a big leap from there to say that the price of oil now and the interest rate make a very good predictor of the price of oil for next year and the year after. If in 20 years the price of fossil fuels is still less than the price of bottled water, it will take some effort to get people to switch to solar.

So the markets say that Goodstein is wrong when he predicts a major social upheaval in the transition away from oil. (Of course it was also predicting in April that the price would be \$0.24/liter in 2024.) If you don't believe my calm prediction, buy oil stocks or build a bolt hole somewhere depending on your level of disbelief.

The key argument that Good-

stein misses is that he should be looking for Hubbert's peak for global fossil fuel energy usage instead of for oil. Back in April before the price of oil spiked up, Reuters http://64.233.167.104/search?q=cache:PRsyED29q44J:www.enr.com/news/2004-04-15/s_22838.asp+global+energy+demand&hl=en reported that world demand for energy would be up 54% in the next 20 years. Oil use peaking in 2010 is a non-event in the global economy if energy use keeps going up. The normal turnover of automotive capital will switch to whatever becomes the most economical whether it is natural gas or something like hydrogen or direct electric (maybe in the roads) both produced by burning coal.

What if the price of oil doubled to \$0.80/liter? People would take mass transit more. They would maybe use an inbound model for food and order it over the internet to be delivered instead of taking a there-and-back trip

"The key argument that Goodstein misses is that he should be looking for Hubbert's peak for global fossil fuel energy usage instead of for oil. . . Oil use peaking in 2010 is a non-event in the global economy if energy use keeps going up."

to the store. Maybe they would telecommute to work more and have more telemeetings instead of plane trips. They would probably drive a hybrid car and use an LED light instead of an incandescent one. That might reduce oil use by 40% which is right around what economists estimate the long term price elasticity of oil is. People would ride trains, minis and bicycles. It would look a lot like The Netherlands where gasoline is already triple what it is in the United States.

Continued on Page 6, Column 1

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World Markets Can Solve Energy Crisis

Continued from Page 5, Column 5

I agree with Goodstein that if we continue to burn fossil fuels, we face uncertain consequences about rising sea levels and higher atmospheric temperatures. A prudent government strategy would be to impose a carbon tax to encourage decreased consumption and a switch to nuclear, wind, geothermal, tidal and solar. The size of the carbon tax would have to be really big to make a dent. Energy demand might not drop much unless the price of energy doubled. An oil tax to have much bite would have to be about \$0.40/liter to cut it 40%. That

would raise nearly \$2 trillion a year worldwide. I think it would have to be more than twice that if all other forms of fossil fuels were also taxed. That could raise \$9 trillion a year in energy taxes including natural gas, hydrites, and coal. If you recall what trouble the \$63 billion that the oil for food program generated, you ain't seen nothing yet. Since that would be 18% of world GDP, I guess I have to agree that civilization as we know it would be at an end. The income and social security taxes should probably be repealed with such a steep energy tax or at least scaled back to the top few percent of earn-

ers. It probably makes sense to cut the sales tax and value added tax and expand the earned income tax credit. A big difficulty in the transition would be my spin on Gate's law that "Software expands to use all available memory and processing power"; government spending expands to use up all available money. Anyone at NASA for a carbon tax?

"If there was a shortage for plastics expected, the manufacturers would bid up the price of plastic. The economy works great to use resources where they are needed most."

I helped pen an Automobile Manufacturers Association recommendation for a \$0.25/tonne tax on coal in 1997 working for Charles River Associates, Inc. That would be a little less than a 1% tax on coal and raise about \$250M/year and cut coal use by 2%. Coal use would probably be more inelastic for higher tax levels especially if there was a huge tax on oil and natural gas. We might need about a 100% tax to cut consumption in half taking the price of coal up from about \$20 to \$40/tonne at the mine which would raise maybe \$10B/year in taxes in the US. It's funny how when coal states are so-called "battleground" states for the presidential election the candidates are falling over themselves to provide tens of billions of dollars in coal research subsidies instead.

So much as I would like to believe it, the case is not really there for lunar extraction yet (except perhaps for the presidential platforms and ADM's lobbying agenda). Solar satellites may do better than terrestrial solar, but that is not really relevant until the price of oil hits \$0.80/liter or the price of space access drops. So it appears that the energy problem will be little different than the bowling ball pendulum that Goodstein risks in "The Mechanical Universe" <http://www.its.caltech.edu/~tmu/> that swings across the Caltech lecture hall and back and always comes a few inches from doing any harm.

Sam Dinkin, B.S. Economics, Caltech, '91, Ph.D. U of AZ, '96 is a regular columnist at the Space Review. Hubbert's Central Texas birthplace has disowned him for talking down the price of oil. The jury is out on Caltech. He can be reached at (888) 4-Dinkin and oil@dinkin.com.

MEN'S SOCCER EARN'S SECOND STUNNING WIN

GOALKEEPER
ELLIOT PALLETT NAMED
ATHLETE OF THE WEEK

WOMEN'S VOLLEYBALL
POSTS TWO LOSTS TO
LA VERNE AND CLAREMONT

By MIKE RUPP

The Caltech Men's Soccer team earned their second win of the season with a stunning 1-0 victory on Saturday.

Sophomore Forward Sanjeeb Bose scored off an assist by Sophomore Midfielder Meghan Crowley in the 25th minute in a hard-fought match.

It's the second win for Men's Soccer this season, who won a 2-0 decision at Bethany College on September 9th.

It's the first time since 1999 the program has had as many as two wins in a season, and the first time in 15 years the team has recorded two shutouts in a season.

The win came just three days after Caltech had an outstanding first half against Cal Lutheran before eventually falling, 0-6.

Freshman Goalkeeper Elliot Pallett was named Caltech's Athlete of the Week for his tremendous performances in helping his team to a 1-1 week. Against Cal Lutheran on Wednesday, Pallett had 11 saves, leaving Cal Lu scoreless through the first forty minutes of the match. Then on Saturday against Whittier, he had two saves to preserve the 1-0 victory; Caltech's 2nd of the Year.

Just seven matches into his Caltech career, Pallett already has 46 career saves, and has solidified a key position for the program for years to come.

The Men's Soccer team's record is now 2-5. The team plays its next match this Wednesday at home against Claremont Mudd-Scripps. The match will begin at 4:00 PM.

The Women's Volleyball team played two SCIAC opponents this past week, losing to each in three straight games. Against La Verne, one of the top teams in the nation, Senior Kristen Zortman and Sophomore Rebecca Streit lead the way with five kills apiece. Against Claremont M-S, Senior Middle Blocker Delia Rosca had 7 kills. The team plays next Tuesday night at Cal Lutheran.

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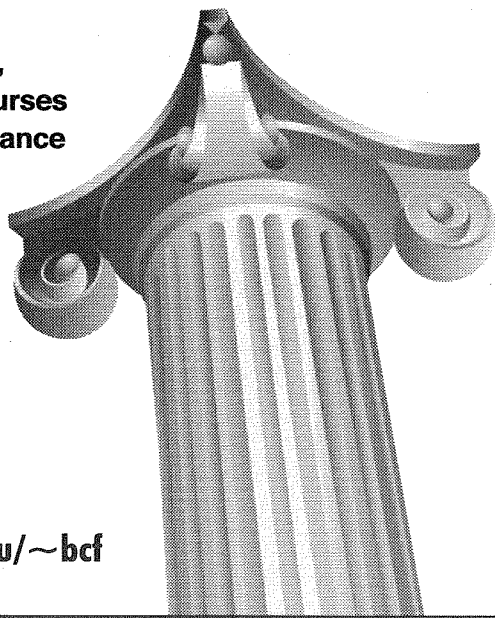
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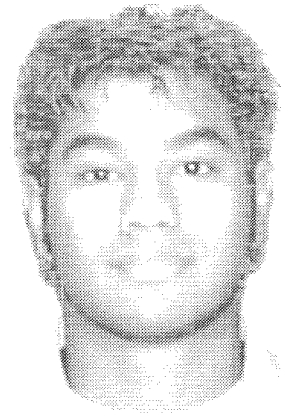
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courtesy of donut.caltech.edu

Sophomore Sanjeeb Bose scored the winning goal that secured a win against Whittier College for Caltech Men's Soccer.

Earthquake Engineer Jennings Takes Provostship

Continued from Page 1, Column 5

campaign and extensive construction and renovation around the Institute, there are many things left for him to resolve. For example, Jennings said that he hopes to keep the closeness between administration, faculty, and staff that exists in Caltech, despite the increasing difficulty caused by the continued growth of the institute.

It's not a significant problem now, he said, but he hopes to increase communication between the different groups to resolve issues before they become major problems and to help Caltech keep the community feeling of a small university even as it evolves to meet changing needs.

Another key goal that Jennings has set for his term as provost is to oversee the recruitment and promotion of cream-of-the-crop faculty. "If you recruit the very best faculty, all the other problems get smaller," he explained. Not to say that he's excessively worried about looming problems: "things are in good shape," he held. The

budget is balanced, the institute is growing, and in general, no crisis is to be seen on the horizon.

Jennings also plans to use his position as provost to help shape the future direction of the institute. This aspect of his job is far more subtle than the hiring of faculty; many more people and issues are involved, and no straight-forward decision can be made. For example, Caltech is now trying to strengthen its position in the field of information technology, and also faces the question of what its most appropriate role would be in the field of bio-engineering. For an administrator, this means that a lot of work is to be done.

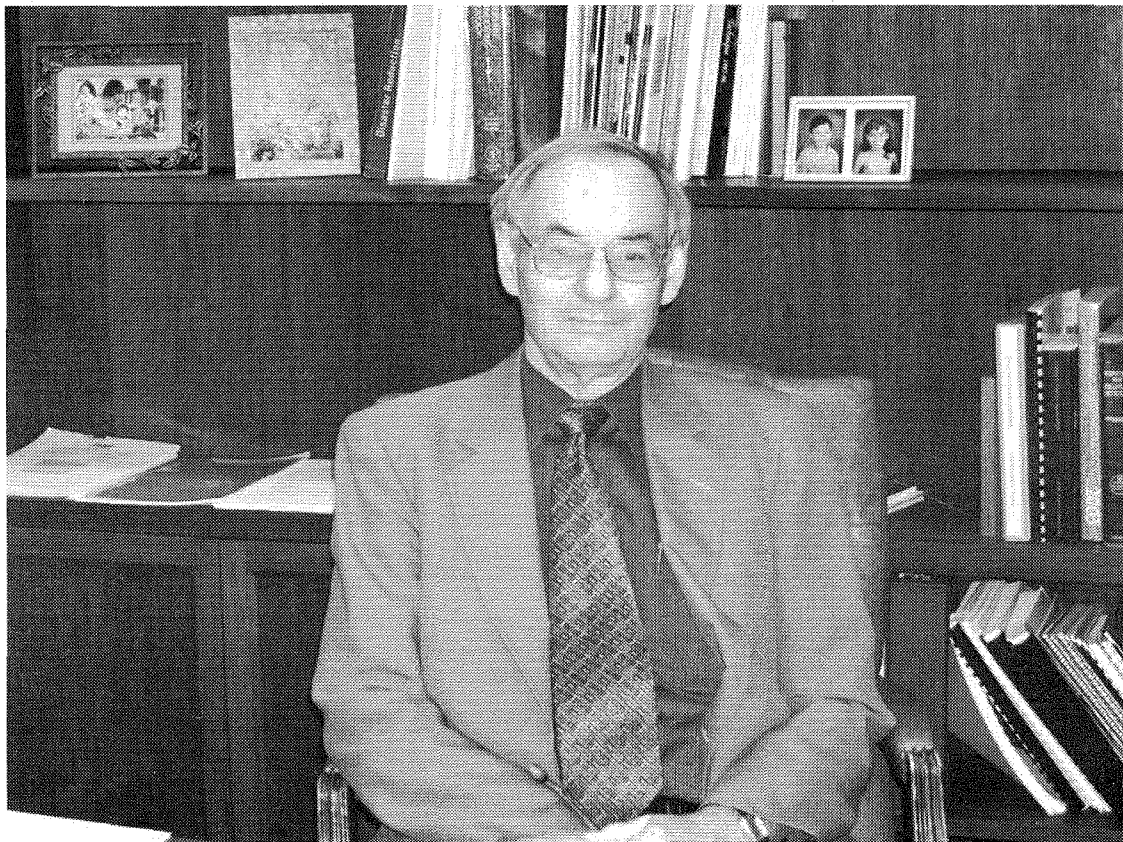
Despite the challenges of such work, Jennings said that he enjoys being provost. "You meet many interesting people that you would not meet otherwise, and you learn a lot about science and engineering," he explained. As well, he enjoys working with others in the administration, many of whom he worked with during his first provostship or subsequently.

His position in administration also allows him to see the "big picture" of what is happening in science. While his main interest is earthquake engineering, Jennings says that he likes to see the general trends in science, and finds his possibility to do so an interesting educational experience. Still, he remains involved in his field; he is currently working of a paper on structural dynamics of buildings in earthquakes.

According to his colleagues, Jennings himself is a pleasant, easy-going man who enjoys fly-fishing and hiking. He and his wife, Missy, have four grown daughters. Born in Colorado, Jennings earned his B.S. in 1958 from Colorado State University. His association with Caltech began shortly thereafter, as he received his M.S. and Ph.D. from the Institute in 1960 and 63, respectively. In 1965, Jennings be-

came Research Fellow in Civil Engineering; he soon moved on to become Associate Professor in 1968, and Professor in 1972. Until his retirement in 2002, he worked as Professor of Civil Engineering and Applied Mechanics at Caltech.

His retirement, he says, made him forget "how much stuff comes through" in the line of work—but he's getting back into the swing of things as the end of the beginning of his term as provost approaches.



L. Tran/The California Tech

Ex-provost Paul Jennings is poised to assume the provostship for the second time in his storied Caltech career. He steps in for the departing Steve Koonin, on a leave of absence to work as chief scientist for a U.K.-based chemical company.

Osheroff Lays Out Columbia Inquiries, NASA Exploration

Continued from Page 1, Column 5

First, he noted the events that led to the catastrophe. On January 16, 2003, during liftoff, a piece of foam insulation fell from the external fuel tank and struck the left wing of the Columbia, ripping a hole in the far end of the leading edge of the shuttle's wing. When it happened, however, there was initially little indication that the shuttle was at all damaged. Problems only began to surface at the beginning of the shuttle's re-entry into Earth's atmosphere. At 8:15 a.m. eastern standard time on February 1, 2003 the shuttle began its deceleration over the Indian Ocean, still without any problems.

Half an hour later, at 8:44, Columbia entered the atmosphere at 400,000 feet. A few minutes later, sensors in the left wing began registering off-normal behavior. Very hot gas was entering through the hole in the wing, burning through everything. At 8:59, mission received its last communication with the shuttle, and Columbia broke up almost immediately afterwards, at 9:00 a.m. The ensuing recovery effort involved 25,000 people, a search of 3500 square miles, and 1.5 million hours of work. Even with such efforts, only 38% of the shuttle was recovered for analysis.

Subsequently, the investigative committee conducted experiments and simulations to determine if the foam was indeed responsible. Analysis of video recordings and simulations showed that a 0.75 kg piece of foam hit the wing at 238 m/s (780 ft/s), a speed comparable to that of a bullet fired from a rifle.

Experiments were then conducted on spare sections of wing panels to determine the effect of the foam strike. These trials were quite convincing: Pieces of foam launched at the panels tore holes in them. The investigators were also able to determine more closely the probable impact site RCC Panel 8. Several pieces of evidence supported this conclu-

sion.

The CAIB found that there were several indications of problems during the mission. Observations from the ground showed a piece of debris orbiting with the shuttle. Additionally, some scientists expressed concern after seeing video of the foam strike. Unfortunately, their requests for more detailed observations of the left wing were overruled. NASA would not believe that foam could damage the orbiter, stated Dr. Osheroff.

He then explained the reason for this belief. The foam was used on the external fuel tanks for isolation. Machines sprayed it on to the tank, a process that left voids in the foam cover. These voids greatly weakened the foam and caused pieces of it to fall. In fact, insulating foam fell during most launches, and this was considered an acceptable phenomenon. Now that falling foam has been shown to be dangerous, NASA will use heaters instead of foam on the external fuel tank.

Dr. Osheroff highlighted another factor in the accident. The CAIB indicated that NASA culture needs to change. NASA, in turn, has acknowledged this and is making an effort to improve its policies and procedures.

Finally, Dr. Osheroff described the change in policy caused by the Columbia accident. President Bush has indicated that the United States will shift its focus to the Moon and Mars, with the eventual goal of landing astronauts on Mars.

For its part, the NASA response has been more than swift: the Hubble Space Telescope is being abandoned, and America will pull out of the International Space Station as soon as NASA meets its obligations. Also, the Space Transportation System of orbiters is to be phased out by 2010. Indeed, as many observers have since noted, the Columbia accident has led to large changes in NASA's policies.

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HERC Web Site Aids Academia's Job Seekers

By JILL PERRY

Colleges and universities in Southern California expect to hire more than 50,000 new employees in the next five years, and a new Web site officially launched September 29 at UCLA will make it easier for job seekers to find those jobs.

The Southern California Higher Education Recruitment Consortium (HERC), an association of 23 public and private colleges and universities in Southern California, including the California Institute of Technology, is sponsoring the first higher education employment Web site in the region, at www.socalherc.org.

The site gives job seekers access to centralized information about thousands of faculty and staff positions at HERC colleges and universities. Previously, job seekers had to visit the Web sites of each college and university to search for employment opportunities. Currently there are about 1,500 jobs are listed on the site.

"Higher education is a significant economic force in Southern California," said UCLA Chancellor Albert Carnesale. "HERC member campuses have a combined overall budget estimated at over \$10.6 billion, and they employ close to 80,000 faculty, staff, administrative, and executive employees."

"In the next five years, HERC member campuses expect to hire more than 50,000 employees to continue to fulfill our shared mission of educating young people, advancing society through scientific and technological innovation, and developing responses to social problems in a rapidly changing world," Carnesale added. "In the next 10 years, Southern California HERC campuses will hire over 100,000 new employees."

HERC members include University of California and California community college campuses, and private colleges and universities. Participating campuses are in areas south of Monterey County, from Santa Barbara in the north to San Diego in the south, and as far east as Palm Desert.

Dlorah Gonzales, director of the employment office at Caltech, said universities are often over-

looked by job seekers. "Many people don't think of colleges and universities when they are looking for a job. We're hoping this online service gives them new options in their search for a new job or a whole new career," Gonzales said.

"Higher education represents a microcosm of the overall job market," said Pepperdine University assistant provost Steve Hewgley. "Colleges and universities employ people in a wide range of fields and with all levels of education. In addition to faculty and research positions, there are also positions for people in many other occupations including lawyers, mechanics, engineers, Web developers, accountants, psychologists, animal care specialists, administrative assistants, and dozens of others."

Biologist Deshaies Catches Fireflies in Test Tube

By MARK WHEELER

"Sometimes letting nature tell you what's important is the better way to go," says Raymond Deshaies, an associate professor of biology at the California Institute of Technology. Deshaies is referring to new work to come out of his lab and the lab of Randall King at Harvard that defies conventional thinking—they've discovered a chemical that stops a key cell function, but, more importantly, suggests a new possible target within a cell, once thought to be untenable, for future therapeutic drugs.

In a report in this week's issue of the journal *Science*, lead author Rati Verma, a Howard Hughes Medical Institute (HHMI) Research Specialist in the Deshaies lab, Deshaies, also an assistant investigator for the HHMI, and nine other authors report that a small molecule called ubistatin blocked an important step in the so-called cell cycle, a process fundamental to life where a cell makes duplicate copies of its own DNA for distribution to two daughter cells. Knowing how to stop cell duplication is critical in preventing diseases like cancer, when mutated cells go out

of control and proliferate madly. Further, ubistatin blocked the cell cycle by preventing two proteins from interacting together. Prior to this, it was thought unlikely that a compound with low molecular weight like ubistatin—or any future drug—would have much impact on the interaction of proteins with each other.

While ubistatin has other properties that preclude it from being a drug candidate, its stoppage of the cell cycle provides an important clue for future drug development, says Deshaies. "We've found a chemical Achilles' heel in this cell pathway, at least from the viewpoint of these small molecules that comprise most therapeutic drugs."

Because the cell cycle is mad-deningly complex, researchers usually pick a single pathway (a pathway is a series of chemical events within a cell that perform some task), then try to make a chemical to block it. They may find such a chemical, but often find it difficult to discover where in the pathway—the target—their drug hit. Finding the target is like finding the proverbial needle in a haystack.

Deshaies's colleague Rati Verma found the needle. Instead of using the typical "top down" approach of starting with a specific target, then looking for a drug to block it, the researchers took a "bottom up" approach of starting with a drug and then searching for the target it blocks. They decided to test a large number of molecules to see if any of them might block any step in one particular pathway called the ubiquitin-proteasome pathway (UP pathway): within the cell cycle, when a protein's job is done, another chain of proteins called ubiquitin attaches to it. That serves as a signal to yet another protein called

proteasome. The proteasome, says Deshaies, is the biological equivalent of a Cuisinart. "It attaches to these ubiquitin-marked proteins, then ingests them and chews them up."

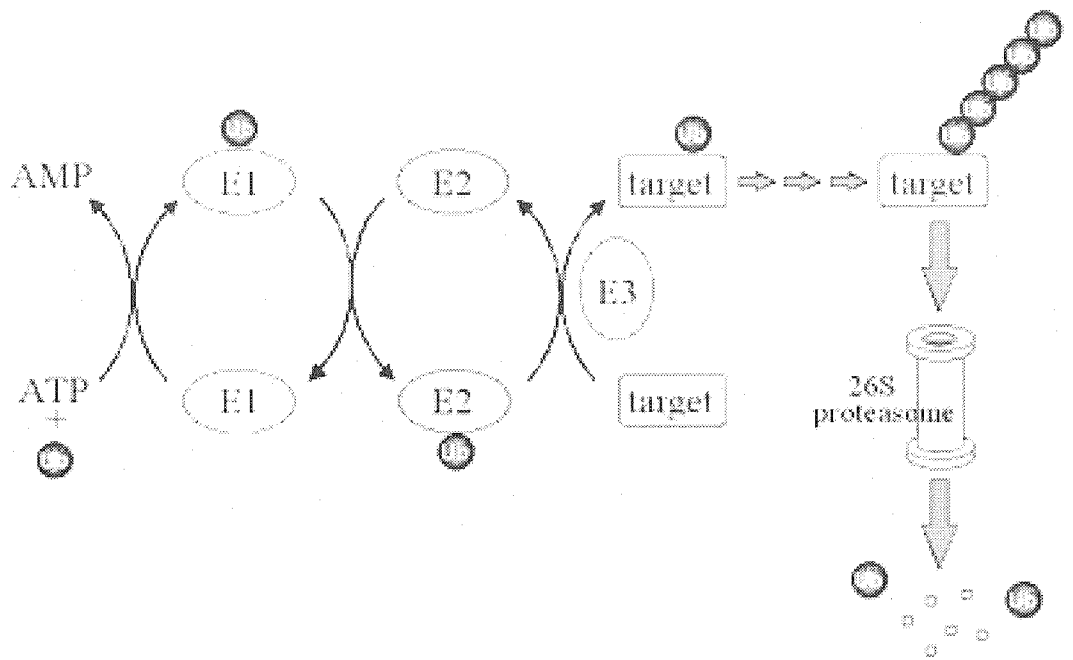
The researchers examined an entire cell, specifically that of a frog's egg. The King group decided to screen 110,000 molecules to see if any had an impact on the cell. First, they weeded out those molecules that had no effect on cellular function in the UP pathway. King attached a molecule of luciferase ("the stuff that makes a firefly light up," says Deshaies) to certain proteins that are normally destroyed during cell division. Next, he added this newly created protein (now a readily detectable biological "flashlight") to droplets of cellular material extracted from the frog's egg that had been placed in individual chambers. As the egg extract conducted its normal cell division, the luciferase flashlight was destroyed and the chambers went dark. That meant those proteins had been destroyed as part of the normal progress of the cell cycle. He then separately added the 110,000 small molecules to see if any of them would prevent the loss of the luciferase—essentially looking for a lit-up reaction chamber in a field of darkness.

Using this approach, the researchers eventually narrowed the molecules they were testing down to a few that were operating in a specific part of the pathway—downstream from where ubiquitin attaches to the soon-to-be doomed protein, but before the proteasome ingested and chewed it up. But given that numerous

proteins are involved in this process, the question remained—where specifically was the molecule they were testing working? In short, where was the target?

To find out, Deshaies turned to work they had done over the last five years with ubiquitin, which examined how it interacted with various other proteins, including proteasome. Through a process of elimination, says Deshaies, "we figured out that these small molecules called ubistatins were blocking the recognition of the ubiquitin chain by the proteasome." Graphic evidence for how this occurs was provided by a 'picture' taken by David Fushman at the University of Maryland with a nuclear magnetic resonance spectrometer.

This step blocked by ubistatin involves a protein-protein interaction, a surprise to Deshaies. "One interesting thing about our discovery is that it is further evidence that you can affect a protein-protein interaction with a small molecule. The conventional thinking was that if you look at a footprint of a drug binding to a protein, the drugs are small, but the footprint that corresponds to one protein binding to another is big. So most people thought that the idea of trying to block the huge footprint of protein-protein interaction with a tiny drug was extremely unlikely. So if I were asked to predict what we would find, I would never have proposed that a drug could prevent the ubiquitin chain from binding to the proteasome, because I was also influenced by this conventional wisdom."



Associate Biology Professor Raymond Deshaies leads study into what he calls "biological flashlights": luciferin and ubiquitin, the molecules responsible for a firefly's glow.

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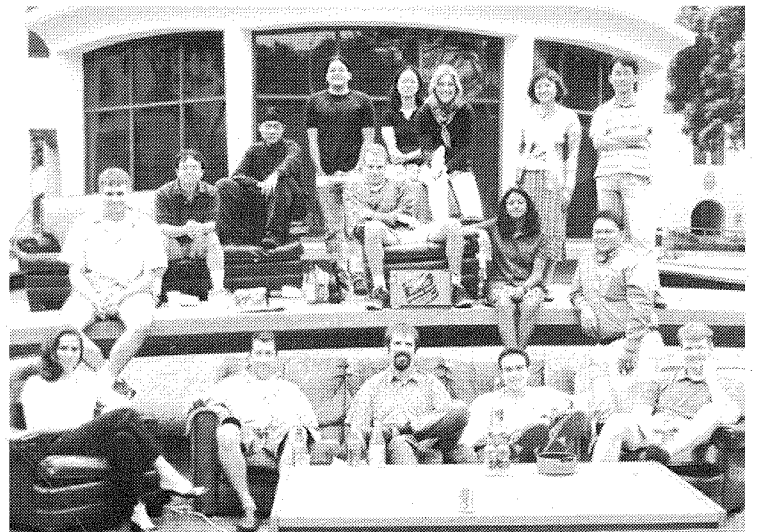
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Known for his friendly persona, Associate Biology Professor Raymond Deshaies spearheads groundbreaking ubiquitin research.