



The California Tech

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D. Korta/The California Tech

Students enjoy a dirty game of Tug of War during the triumphant return of Mudeo, a former Caltech tradition that had been on a six year hiatus.

North Field Construction Brings Return of Lost Tradition: Mudeo

By ROYAL REINECKE

What do you get when you mix a large amount of dirt, some water and a whole lot of techers? A recipe for fun known as Mudeo! Indeed, seemingly all of the students who participated in this past Monday's Mudeo enthusiastically agreed with senior David Hardy's description of the event as "a lot of fun and a lot of mud!"

This year has brought with it the revival of a long-standing tradition, grand and illustrious, equal in magnitude and sacredness almost to Ditch Day. Yet most students know little or nothing about this event; they probably had not

even heard of it until now.

Over just a few short years, Mudeo managed to become nothing more than a dirty little secret—lost to the Caltech student body. But now, thanks to the efforts of senior Jeff Cox and Director of Campus Life Tom Mannion, Mudeo has returned.

On the afternoon of January 19, students let their troubles wash away as they were given the opportunity to fully immerse themselves in dirt. Afterwards Junior Javier Soliz triumphantly exclaimed, "There's mud in my ass crack!" Other techers responded with equally thorough enthusiasm.

Cox first became enamored by this unique tradition from a brief mention in the little t. "I had to know more," he comments. Since then he has been working to research and restore Mudeo to its full glory. He has consulted resources ranging from alumni to old Big T's in order to discover all the details about Mudeo.

The mud-wrestling extravaganza began in the 1920's as a challenge put by the sophomores to the frosh to see which class would have to pay for a major

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Spitzer Data Begins Filling Universe Map

By K. SZWAYKOWSKA

If one were to follow the path of the Earth's orbit around the Sun, in reverse, one would soon come across the newest and final addition to NASA's "family" of "Great Observatories": the Spitzer Space Telescope.

This space observatory, launched on December 1, 2003, is only six weeks into its five-year mission and the data which it has sent back so far is just starting to be analyzed.

Whereas the earlier three observatories, the Hubble Space Telescope, the Compton Gamma Ray Observatory and the Chandra X-Ray observatory, imaged space in the optical and ultraviolet, the gamma ray*** and the x-ray regions of the electromagnetic spectrum, respectively, Spitzer Space telescope detects lower-energy infrared radiation.

Thus, the data collected by the observatories is mutually complementary; each observatory contributes information collected by observing a different wavelength of electromagnetic radiation, which, put together with in-

formation collected by the other observatories, will fill in many blank spaces in our map of the Universe.

Spitzer Space Telescope was renamed only recently, after an essay contest was held to determine the new name (previously, the project was known as the Space Infrared Telescope Facility). Thus, it is appropriately named after Lyman Spitzer, Jr., one of the first astronomers to realize the importance of placing telescopes in space.

In his paper, "Astronomical Advantages to an Extra-Terrestrial Observatory", written in 1946, Spitzer detailed the benefits of placing a telescope in space; it was not until 1990 that Hubble Space Telescope, the first of this kind, was launched. Since then, however, many more "extraterrestrial" telescopes have gone into orbit.

Their main advantages are that these telescopes, unlike their earthbound counterparts, are not obstructed in their observations by the Earth's atmosphere

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Nanotechnology Plan Targets Disease Cells

By KEVIN BARTZ

As part of his effort to pinpoint precise molecular defects causing disease, Chemistry Professor Jim Heath is using nanotechnological and microfluidic developments for "informative diagnoses" that may replace more invasive methods, the chemist said last Wednesday in his Watson Lecture, "NanoSystems Biology."

"Medicine right now is at a cusp," he said, "a cusp where, in the next 20 years, it is poised for a big change."

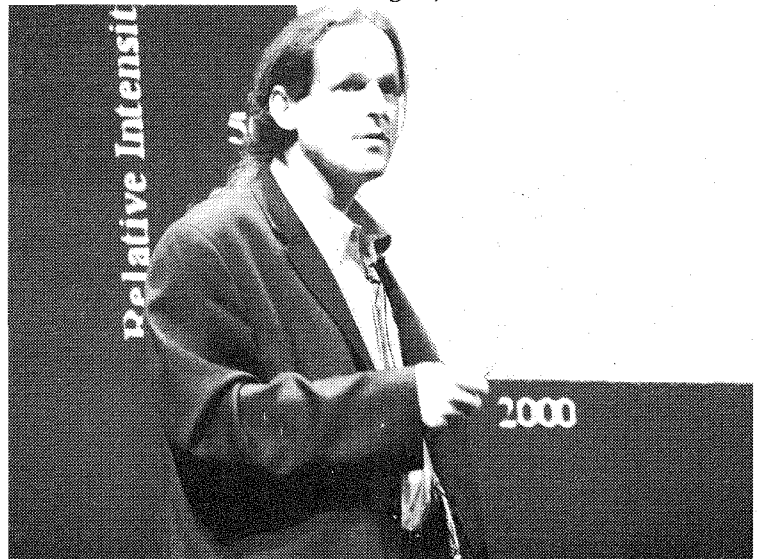
Heath's talk laid out the road map for his NanoSystems Biology Alliance, a group he formed to attack disease at its roots, targeting the molecules, cells, DNA and proteins that together program human health. His idea runs against the grain of traditional medicine, which typically recognizes disease through external symptoms

or invasive surgery. Diagnostic procedures for breast cancer, for instance, are as basic as they were in the '70s despite billions of research dollars, said Heath.

"Contained in your proteins is a lot about the state of your body and your disease," he held. Heath believes diagnosis must begin on the atomic level, with the molecules stimulating the body's cells according to DNA "software code." His study targets those proteins whose chemical pathways carry out these instructions, the first place a scientist could locate abnormalities.

But disease can be the result of a biological error at any of thousands of proteins, which means that Heath's diagnostics must be arduously comprehensive. "Because there are a bunch of ways this can happen, like a protein es-

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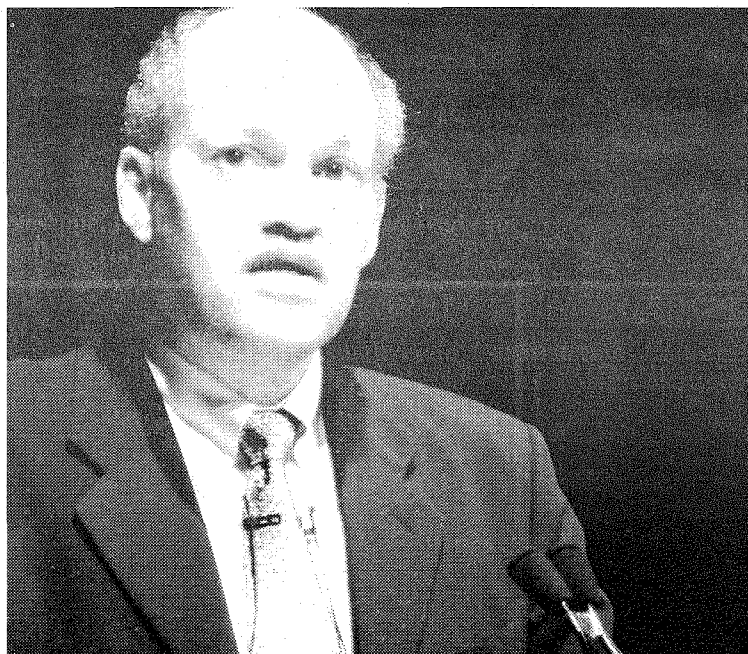
D. Korta/The California Tech

Dr. James Heath explains the growing possibilities for nanotechnology applications.

Education Disparity, Failure Of Scientific Progress Haunt Africa

By ROBERT LI

Last Thursday, in the first of a series of events to commemorate Martin Luther King Day, Dr. Wilmot James, the Moore Visiting Professor of History and Sociology, gave a talk entitled "The Evolution of Human Diversity".



D. Korta/The California Tech

Professor Wilmot James discusses the importance of starting research initiatives in Africa.

Dr. James is a major scientific and social figure in South Africa. He is the executive director of the Human Sciences Research Council, a Cape Town based organization responsible for social cohesion and integration research. Among his many accomplishments, Dr. James co-founded the

Africa Human Genome Initiative, an effort integrate African laboratories into the worldwide genomic research effort.

Dr. James has a PhD in sociology from the University of Wisconsin-Madison and has written and edited 14 books. He was formally the dean of humanities at the University of Cape Town, the executive director for the Institute for Democracy of South Africa and a professor of sociology at the University of Cape Town. Currently, Dr. James is the Executive Director of the Human Sciences Research Council based in Cape Town.

In his hour-long talk, Dr. James addressed the numerous and serious social issues facing science and especially biology education and research in Africa. At the beginning of his talk,

Dr. James noted as one symptom of Africa's failure in its scientific development the total lack of participation of any African research lab in the human genome project.

According to Dr. James, Africa is failing in its scientific development for many reasons. First and foremost, research is expensive and Africa is, in general, very

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Cox Fights Apathy to Bring Back Tradition, Students Drawn Out

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dance. Over the years, however, the event became, as Jeff puts it, basically "an excuse to drag the frosh through the mud." Typical events ranged from tug-of-war to fighting over a tire to basically any activities that become more fun in an enormous sloppy squishy pit of dirt.

While the mud provided the fun, construction on campus provided the mud. For example, the building of Baxter during the 1960s supplied massive muddy abysses for Mudeos throughout the decade.

As time went on and construction decreased, grounds people dug large holes in the dirt for Mudeo. Soon enough, even that practice ceased. The last known Mudeo took place about six years ago during the construction of the Del Mar fire station.

Currently the North Field is being dug up so that a new underground parking structure can be built. Jeff Cox seized the ripping up of the field this year as an op-

portunity for teachers to participate in a little mudslinging and a lot of fun. He regards Mudeo as an opportunity for people to "screw around and have a good time."

Planned activities for this year's Mudeo included team sports such as soccer and football in addition to wheelbarrow races and tug of war, but as Jeff imagined the Mudeo would ultimately "devolve into fighting in the mud."

Teachers took advantage of the event as a welcome relief from their everyday ritual of studying. Freshman Vinh Nguyen explains that "I had been working on math all morning, so I thought it would be fun to come."

Cox views traditions such as the Mudeo as a way to make Caltech not only livable but a truly special and unique place. Mannion regards the Mudeo as "a fun event that builds spirit and community."

Similar to floating people and throwing rolls at dinner, such practices give teachers a release from stress and worries. Indeed

our traditions allow us to get away with a lot of things—we can make believe that we are, once again, the little kids who didn't know of problem sets or finals.

Despite all the benefits of our unique customs at Caltech, Jeff Cox, a member of Fleming, has seen even certain traditions in his own house die out during the time he has been here. He deems student apathy the culprit, "When one class does not carry on a tradition, the next class does not know to do it and I don't want that to happen for good."

As in the case of Mudeo, once four years have passed, pretty much no one knows about a particular ritual and it can easily be forgotten permanently. Yet traditions need not die out. Mannion cites the Caltech administration as particularly willing to support student endeavors.

Especially in the case of an event as spectacular and grandiose as Mudeo, we must carry on our traditions before they are washed away forever by time and apathy.



Frosh Alex Padilla, top, and David Romero lie collapsed in the mud after losing the tug of war.

African Labs Need To Join Research Projects

Continued from Page 1, Column 5

poor. However even in a comparatively rich country like South Africa, the level of scientific development has still been very limited.

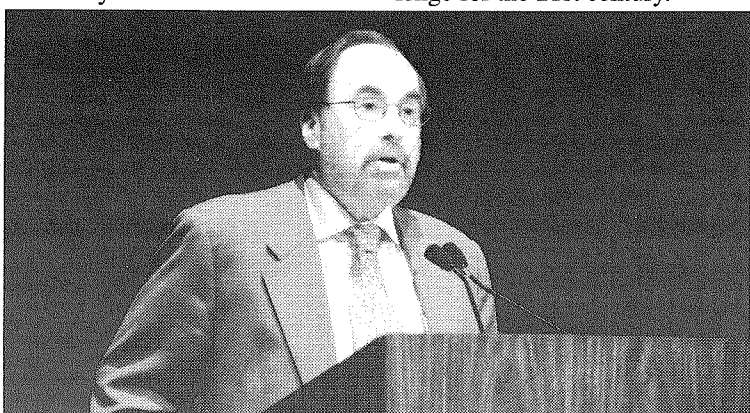
There are two major reasons for this. The legacy of apartheid in South Africa has resulted in black children receiving a substandard to nonexistent education in scientific principles. This has resulted in a lack of blacks entering college and pursuing scientific careers. Only after the end of apartheid in the mid-90s did this situation begin to change.

Among the whites, coloreds and Indians of South Africa, the science education received has been tempered by a disregard for the biological sciences as unimportant compared to traditional sciences such as physics and chemistry.

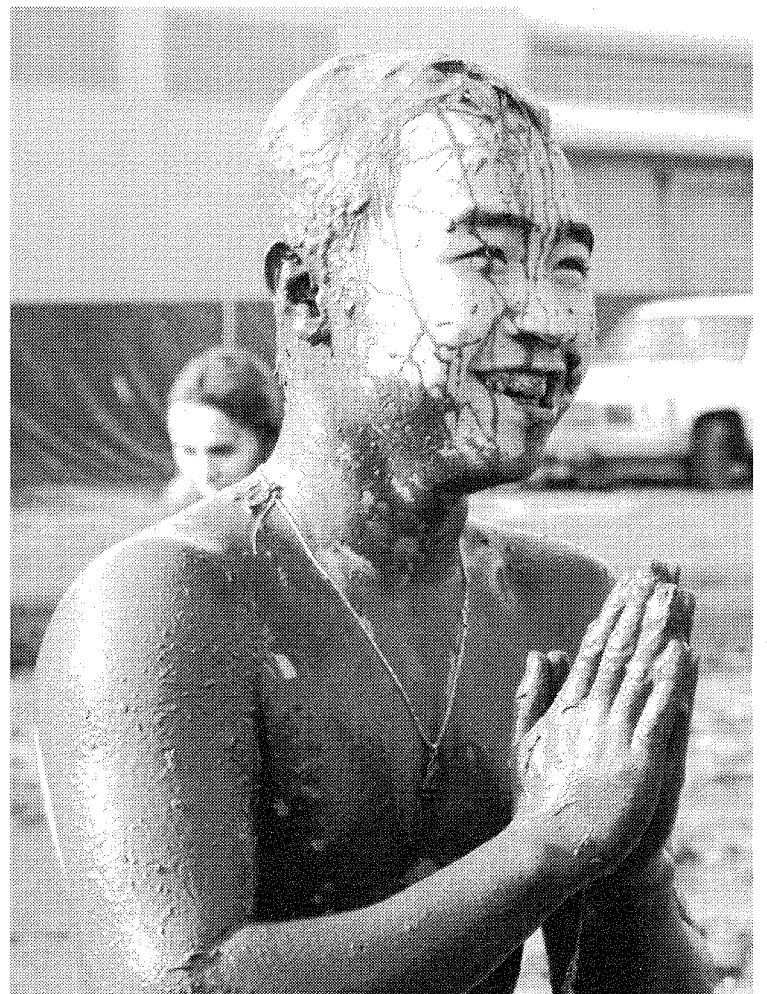
Furthermore, because many in South Africa are strongly opposed to the teaching of evolution for religious reasons, this attitude has hindered on the progress of biological and especially genomic research efforts in South Africa.

The consequences of Africa not participating in scientific research and in genomic research in particular are serious, according to Dr. James. Because Africa lacks the scientific development and resources found in the West, many issues specific to Africans, such as the lack of medical treatments for malaria, a leading cause of death in Africa, are not being addressed.

Dr. James believes that African research efforts must develop in order to make up these deficiencies and that this is Africa's challenge for the 21st century.



President Baltimore introduces Professor James as part of the Presidential Lecture Series on Diversity.



A muddy Vinh Nguyen displays his enjoyment after one of Mudeo's events.

Students Strive to Make Faculty Luncheon a Regular Occurrence

By CHRIS MCCLENDON

At lunchtime, on Nov. 26, 2003, Avery Dining Hall was bustling with activity far beyond what one would expect for the spacious, quiet lunch destination. However, instead of seeing the usual grad students, Avery residents and other visitors enjoying a quiet lunch, one saw a sight not often seen at Caltech: undergrads and professors sitting at the same tables enjoying a meal together.

Around noon, only the tables in the back of the dining hall were occupied. However, as 12:30 rolled around, the spacious dining hall was full of conversation. Many tables in the dining hall had one or two professors at them and one wondered where the Student-Faculty Lunch ended and the normal Avery crowd began.

The first Student-Faculty Lunch was held on Nov. 26, 2003. About 20 professors and 60 students attended. The event was mostly advertised by word-of-mouth, by students inviting their professors to come with them to the event and by fliers placed around campus. The next Student-Faculty Lunch will be held on Friday, Jan. 23, at noon in Avery Dining Hall. The only disadvantage is that everyone buys their own meals.

The Student-Faculty Lunch is another initiative to improve understanding between students and faculty. That there exists a large gap between professors and undergrads was recognized a few years ago before the first Student-Faculty Conference was organized. The Student-Faculty Conference began as a student-initiated effort and now is a yearly event involving diverse committees that work to identify key areas of misunderstanding and propose solutions that will hopefully improve the lives of students and professors.

Like the Student-Faculty Conference, the Student-Faculty Lunch is a student-initiated effort. However, the lunch provides an informal environment for students and professors to get to know each other as human beings, fostering a level of understanding

that builds Caltech into a community rather than a confederation of students separated from a league of powerful professors.

Overall, students and professors seemed to think that the lunch helped break down the barriers between them. From my own experience and from talking to other people, I find that sometimes it can be a little intimidating to talk to profs you don't really know. So, I think that the student-faculty lunches are a good opportunity to overcome that, said Candace Seu (05, Blacker).

It's important for us, the undergrads and the faculty to support each other, although we probably need them more than they need us, because if we get the rest of the community to see that we're worthwhile people and not just big parasites who don't take showers, maybe things can get better.

Professor Vincent McKoy (Theoretical Chemistry) also thought the event to be a success. I thought it was very helpful, he said. I always enjoy getting to speak to students in a different context ... It was refreshing. I was amazed ... at how many people were there. McKoy commented that many of the faculty do not get to really know the undergraduates. Its a small step, but I think it is a significant one, he said.

It is hoped that this next Student-Faculty Lunch will attract even more people than the last one and that it would become a regular event that would occur two or three times a term. Though it seems like an isolated event, the students and professors who come to the Student-Faculty Lunch will get a chance to understand each other better and the benefits of greater student-faculty understanding are many.

First, students and faculty that understand each other better will be able to share a more open classroom environment, where students feel free to give feedback on how a course is going, where professors who understand what students do outside of the classroom can challenge students without making their class inor-

dinately demanding and where learning is something enjoyed by both students and professors.

Secondly, students and faculty that understand each other can do better science together. Students that understand faculty will have a larger perspective on why they're learning what their learning and can do research with professors with an understanding of what professors expect of them and what to expect of their professors.

Finally and perhaps most importantly, students and faculty that understand each other can better do their part to make the Honor Code a way of life, something more than a set of rules and a general principle.

The first Student-Faculty Lunch of the term was deemed a success. The next Student-Faculty Lunch is this Friday and interested students are encouraged to invite one of their professors to come to the event. It'll be a great opportunity to lunch with your favorite professor.

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On Being Asian and Living in Avery

By RUMI CHUNARA

Last term our ASCIT President Tom Fletcher finally brought to the forefront an obvious fact in the form of a question that had begged to be asked for a long time: Why is it that so many Asian students choose to live outside of the 7 undergrad houses -- and most notably in Avery House?

First, let's check if this observation truly deserves merit (I wasn't convinced by his p-level mumbo-jumbo, I'm an electrical engineer!). A quick survey of Avery house reveals that approximately 62% of undergrads who choose to live in Avery are Asian, by the typical definition. Interesting to note, another 11% are from South-East or Far-East Asia. A glaringly lower 36% (approximate) of non-freshman from the next largest house, Ruddock house, are Asian (freshman must live in the undergrad houses so are not included in this poll).

Since this is determined to truly be an existing phenomenon, I think it will be worthwhile to attempt to answer some of the valuable questions Fletcher has posed. For example, how can we bridge the gap between the so-called "traditional" Caltech community (i.e. the student houses) and the "ghettoized" community that is relegating itself to various off-campus locations? Even better, how can we work towards closing this gap? Why is this current division being perpetuated, and is this a healthy situation for us students? If not, what can both sides do to bring the groups closer together?

As scientists, we know the best way to try and solve a problem is to first understand why it occurs. As a resident of Avery, and an Asian, under the less-typical but more correct definition, what are the reasons I, and many of my neighbors, choose to live in Avery?

Of course the Asian community in Avery gains momentum by the sheer existence of a number of Asians here already, and thus the community perpetuates. There are other reasons for living in Avery or off-cam-

pus opposed to the undergraduate houses. These include meal plan freedom, location (yes, there are a large number of EE's in Avery who find the closeness to Moore useful) and environment. The sleek, white lines of Avery architecture provide a much brighter and cleaner environment than some of the other housing options. Finally there is the aspect of social life. Contrary to popular belief, Avery-life does exist, I've seen it first-hand. In my experience I have seen that some Avery students have very broad and fulfilling social lives. Ones that aren't necessarily fulfilled by going to house dinners and using AIM - perhaps why some Avery residents are obscured from the majority of Caltech students' vision.

From the perspective of most undergraduates it is probably hard to think of reasons someone would choose not to live in the houses. From Rotation on, there is a strong sense of community in all of the Houses. So much so that this sense may bar the

"Living in the bubble of an intense place such as a university... can impede our desire or ability to interact with different cultural groups on campus even further."

possibility of getting to know students who do not fit the normal characteristics of a house--characteristics which are definitely

difficult to judge over the course of one week of dinners. In addition, the types of activities that Houses engage in may not be terribly enticing for all students--(remember that social calendars are not revealed during Rotation) - therefore, these students who are left by the so-called wayside can take advantage of the opportunity to get together and live off campus in a place such as Avery.

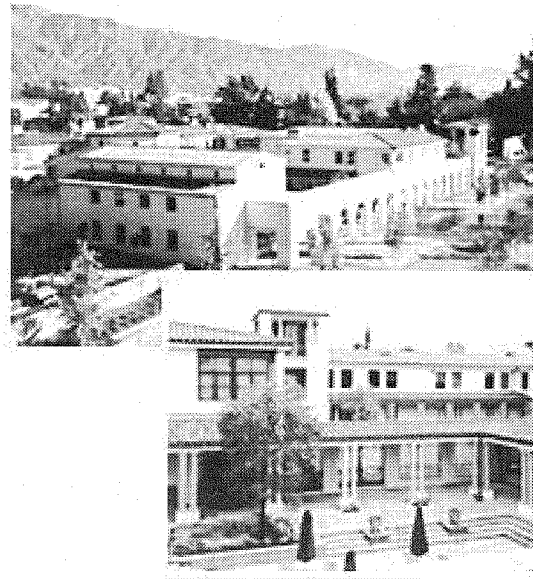
House association also has its drawbacks. Provocative *Tech* commentator Libin Zhang pointed out last fall how FSI counselors must now be limited to two per house to prevent House biasing to FSI students. Being unable to participate in a campus activity simply because other members of your house have similar interests is an unfortunate restriction.

Is there a need to remedy this segregation that is occurring within our undergrad body? If so, what can be done? Zhang also mentioned that division by culture or race does happen naturally in many environments. Just take a look at culturally centric areas of Los Angeles such as Artesia (the brown capital of LA) or Alhambra (if you don't know what is there and you have been in Pasadena for at least three months, shame on you).

This doesn't make it okay for the same situation to happen here, but rather gives more incentive for us to remedy the situation on a local scale. Living in the bubble of an intense place such as a university can easily lead to being unaware of the world around us and can impede our desire or ability to interact with different cultural groups on campus even further. Segregation also occurs within the houses. Although you may associate with people from different cultures, it is most often those who have shared similar experiences that tend to hang around each other.

However, as educated adults we can agree that only with the desire to integrate all members of our community can we work towards the strengthening and enhancement of a pluralist civil society. If we fail to recognize pluralism as a fundamental value, we deprive ourselves of the opportunity for development and will be threatened by a serious danger to our future. As members of the 21st century we cannot claim to be ignorant to the consequences of evading the need to become more compassionate and interested in the needs and differences of our neighbors, colleagues and compatriots.

More urgently, if we allow this separation now by standing back and watching merely as spectators in our young college lives, we promote dissension between entire communities and nations above and beyond just groups on campus. We are lucky to have the intellectual capacities to be able to anticipate this situation and remedy it. Locally, what can we do?



courtesy of www.its.caltech.edu/~housing

Undergrads sometimes choose to live in Avery for meal plan, location and environment, in addition to cultural reasons.

This situation does not necessarily mean we should all become friends regardless of our interests and personalities. However, it may help to become more educated by simply taking more of an interest in our own friends' cultures and backgrounds. Take the time to talk to your neighbor. Assume not, because that only fosters stereotyping. Find out what they are cooking for dinner. Encourage more cultural events on campus and show support for the ones that already occur. Academically, we are fortunate enough to be in the company of some of the brightest students from around the world. Let's take further advantage of the situation by recognizing and celebrating the diversity amongst which we live.

We should also see some effort from students not living on campus to integrate into campus life. I believe the benefits are equal in both directions. The Houses provide a valuable chance to interact with a variety of people in a number of different environments, from sports to academics. Stereotyping, of course, perpetuates the segregation and the best way to avoid incorrect ideas about a group is through education. We can avoid having false ideas about others or others having false ideas about us by actively making the effort to learn about each other.

To give our efforts a more global context we can take back these lessons we have learned and set an example in our homes, our new jobs, our grad schools. As members of the scientific community we have great status in the world. The level of education we hold is respected multilaterally and people look to us for guidance above and beyond scientific matters.

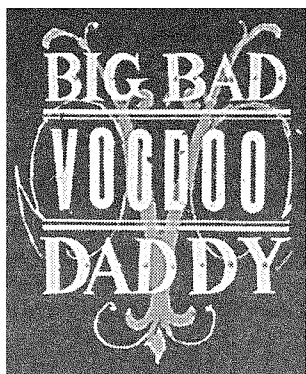
Martin Luther King Day is a great chance for us to both celebrate Dr. King's dream and start actively making our own lives reflect the consequences of his work. Let us ensure that our Houses are not the walls that divide, rather form the bridges that unite.

On a lighter note, has anyone else ever noticed that Avery is a lot like Canada? It is very multicultural, clean, and lies to the North of campus. Hmm...maybe that's why I feel so at home here.

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It's all about Mingus

The Caltech Jazz Bands in a free concert featuring dancers from the Los Angeles High School for the Arts in a program of music by Charles Mingus and his friends
Saturday, January 24, 8:00 PM
Beckman Auditorium

Film Critic Stein on the Best of 2003: Fish, Pirates, Lords, Kings

By HARRISON STEIN

2003 was a most interesting year in the film industry. Led by a herd of blockbuster sequels, 2003 was the second most profitable year in the history of cinema. Many years from now, the year will be remembered for the stunning collapse of the once-proud *Matrix* franchise, the triumph of the *Lord of the Rings* trilogy, the rejuvenation of Sean Penn, a vulgar Santa Clause that would put Dennis Rodman to shame, and a little fish named Nemo that outgrossed terminators, machines, bad boys and pirates at the box office. Unfortunately, 2003 lacked a collection of fantastic films as only a handful of pictures were truly influential and memorable. On the other hand, there were very few bad movies, as only four or five were truly unwatchable (coming next week: The Worst Films of 2003). In all honesty, I have not seen every film released in 2003, so my Top 10 list is somewhat incomplete. Still, I have seen enough good movies to justify making this list, so without further adieu, here are the best ten of the past year.

10. *Finding Nemo*

What a delightful film. Pixar has made better films, but *Finding Nemo* does nothing to damage the company name. The screenplay is undoubtedly clever, including an uproarious Fish Eaters Anonymous meeting of sharks and wonderful scene with surfer turtles. Most of all, the animation is simply amazing as I have never seen a more beautiful array of colors on the screen at one time.

9. *Pirates of the Caribbean*

In general, theme park rides and motion pictures are not a good match but Johnny Depp and Keira Knightley prove everyone wrong with this enormously entertaining swashbuckler. Depp steals every scene as the hilarious Captain Jack Sparrow, and with every witty line, he helps negate a completely flat performance by Orlando Bloom. Besides, the special effects are great and the film is so fun that the 143 minutes pass in an instant.

8. *Love Actually*

The year's premier romantic comedy is also one of the all-

time greatest collections of vignettes. Of the ten or so different love stories, seven or eight hit the mark. The themes of love and Christmas are emphasized ad nauseam, but the movie is very cute as a whole. Hugh Grant, Liam Neeson, and especially Bill Nighy are all very funny and the gigantic supporting cast holds its own. Even if you enter the theater in a grouchy mood, you will leave believing that love actually is all around.

7. *La Folie... Pas Du Tout (or He Loves Me, He Loves Me Not)*

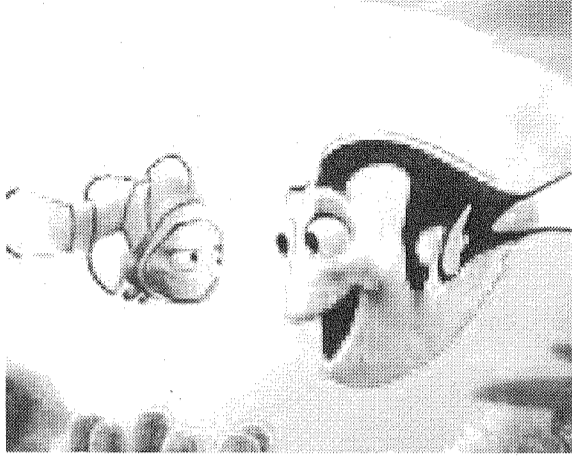
Every year, there's one film that no one sees that just happens to wander onto my Top 10 list. This year's obligatory independent film is a twisted French movie starring Audrey Tautou, the pretty girl who played the title character in *Amelie*. The movie is about a girl who has an affair with a married doctor only to be slowly faded out of his life. Then, halfway through, the story is told from a completely unexpected perspective which shines a totally new light on the plot. The twists and turns in this film are jolting and Audrey Tautou is incredible in a surprisingly difficult role. Don't miss this one!

6. *Identity*

I love films that keep you guessing until the credits roll, and of all the pictures released in 2003, none did a better job of thrilling the audience than *Identity*. On the night of a vicious rainstorm, ten complete strangers meet in a shady motel, and one by one, they start falling at the hands of a serial killer. Unlike most slasher films, *Identity* remains intelligent throughout as all of the twists make perfect sense. And if you aren't spooked by the shocking final scene, you might have to check your pulse!

5. *Kill Bill: Volume 1*

Quentin Tarantino proves he's



the quintessential filmmaker of our generation by creating a fantastic action film unlike anything we've ever seen. His movies are typically famous for tremendous dialogue, but with *Kill Bill*, Tarantino shows he has an extraordinary amount of artistic creativity. The film is a non-stop action extravaganza with some of the most in-depth battle scenes you'll ever see. The big name cast is adequate, but it's clear from the start that this is Quentin's film.

4. *21 Grams*

2003 had two critically acclaimed Sean Penn vehicles that tugged at your heartstrings. Though Penn probably gave a finer performance in the flawed *Mystic River*, *21 Grams* is a far superior film. Thanks to a heartbreaking portrayal by Naomi Watts (one of the year's best) and a superb effort by Oscar Winner Benicio Del Toro, *21 Grams* never misses a beat. The complex plot structure is a bit distracting, but the story is so evocative that we develop intense feelings for each of the three main characters. *21 Grams* is young director Alejandro Iorritu's sophomore effort, so if this movie is any indication, we can expect great things from him in the future.

3. *The Lord of the Rings: The Return of the King*

Everyone's favorite picture of the year is a very exciting epic with unparalleled special effects and some touching performances. Nonetheless, two other films left a far bigger impact on me, mostly because *ROTK* has a useless final half-hour. At the same time, I cannot deny the accomplishment of the enormous cast and crew. Peter Jackson and company have made

Week in Caltech Sports

Swimming, Basketball Post Losses

By MIKE RUPP

Athlete of the Week

Jim Rebesco--Men's Swimming. The senior from Munster, Indiana was the top performer for Caltech at the Pomona-Pitzer meet two Saturdays ago. Rebesco, who already has one AOW award this year from his performance with the Men's Water Polo team, finished first in the Men's 50 yard freestyle with a time of :22.55 and first in the Men's 100 yard freestyle with a time of :51.37. Rebesco also anchored Caltech in the Men's 200 Yard Medley Relay.

Week in Review

Women's Basketball (0-10)

The Women's Basketball team finished its Non-Conference schedule with a difficult loss to Gallaudet University. Freshman Kristen Ward led the team in scoring with 6 points and added 6 rebounds. Junior Shelby Montague led the team in rebounding with a season-high 11 boards.

Women's Basketball

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Women's Swimming/Diving

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Swimming/Diving

In addition to Jim Rebesco's impressive wins, Freshman Tom Jurczak won the Men's 100 Yard Breast with a time of 1:06.63. Jurczak also competed in the Men's 100 Fly, the 500 Free, the 200 Medley and the 800 Relay. Senior Jacki Wilbur placed 2nd in the 100 Yard Free, and also competed in the 400 IM and the 800 Free Relay. Sophomore Rebekah Eason was the top performer from the diving competition, winning the 1-meter with a score of 196.70. Senior Ben Solecki also made his team proud with a great performance in his 400 IM.

Track/Field

The track and field team is looking forward to another exciting season. Sophomore Jeremy Leibs, who finished 3rd in Conference last year in the 110 meters, is the top returner, and the Beaver most likely to bring home a SCIAAC Championship. Fellow Sophomore Gustavo Olm also made last year's all conference team, finishing 6th in the 5000 meters. The Men's 4x400 Relay team, which finished 4th in the SCIAAC last year, reenters Sophomore Stuart Ward and three new runners who hope to take the squad even higher, including Sophomore Patrick Boyle. For the Women, last year's MVP Helen Tai looks to push both the hurdles and relay teams into contention. Kamalah Chang, who finished 4th in the Steeplechase, and Tamara Becher, who finished 6th in the 1500 meter, round out the team's top returners. The team's first meet is the Caltech Invitational on February 7th.



The California Tech archives

Senior Jim Rebesco was this week's Athlete of the Week. With his great times in the swim meet against Pomona-Pitzer, he was Caltech's top performer.

a supposedly impossible transition from book to film, and he has deserved any laurel he's received. *ROTK* might not be the best film of 2003, but it when all is said and done, it will be the most remembered.

2. *The Last Samurai*

One reason I couldn't rank *ROTK* number one is that one week after I viewed it, I saw a similar epic that was more engaging, more beautiful, and more powerful than any of the three *Lord of the Rings*. Sometimes, Tom Cruise's production seems like an all-out effort to win him an Oscar (which he probably won't win this year), but supporting actor Ken Watanabe gives an out-of-this-world performance as the influential Japanese samurai. Like *LOTR*, *The Last Samurai* was shot in New Zealand, and the scenery adds an incredible component to the film. Despite some anti-American sentiments, *The Last Samurai* is a tour-de-force that deserves a spot alongside such epics as *Braveheart* and *Crouching Tiger Hidden Dragon*.

1. *Lost in Translation*

Amazingly, after 52+ weeks of

watching movies, I still had not seen a four-star film that truly deserved the honor "best of the year." As good as *The Last Samurai* is, it would have been the weakest best picture in at least ten years. Alas, on the eve of writing this essay I saw a stunning movie with two of the best performances you'll ever see and some of the best direction ever. Bill Murray and Scarlett Johansson play lonely American strangers who meet in a Tokyo bar and form a most unusual bond. The two leads are so good that by the time the film is over, there isn't a single scene left to be stolen. In the meantime, Sofia Coppola shows that despite her miserable failings as an actress, she is just as good of a director as her famous father Francis. The film is perfectly paced with an ideal mixture of humor and solemnity. Although very little happens with the plot, the movie is never boring and has no dull moments. You can sense the movie's greatness within the first ten minutes, and amazingly, *Lost in Translation* never wilts. I knew the second the credits began to roll that I had just witnessed the best film of 2003.



photos courtesy of www.imdb.com

***Finding Nemo* and *The Last Samurai* are two movies among Stein's top 10 movies of 2003. He cites their cinematographic beauty, and engaging storyline for their success.**

Fireside Chat: Elections, Late Fees

By TOM FLETCHER

Upcoming Elections!

Sign-ups for ASCIT elections come down on Tuesday night (one more day to sign up people!). As of the writing of this column, two people are signed up for President and none for BOC Chair. I encourage more of you to run, especially since the two candidates already signed up were on this year's BoD. During an election, there should be as many choices as possible, and while Galen and Andrea are very capable people, the more people running the better, so everyone can feel that they are voting for someone they love.

This year, the BoD had to deal with a lot of budgetary issues (the black hole of ASCIT formal costs, huge overruns on the *Totem*) that constrained a lot of our social options (but we still got We Are Scientists here twice, and a third time in February!). We had to try to find new ways to solve a lot of problems in communication between the students, faculty, and administration, and a lot of work (especially with regard to faculty committees) still needs to be done. A lot of time and effort had to go into building a rapport with new administrators and faculty leaders, especially in the wake of debacles like the Firepot and Apache security. Galen and the BOC had to deal with something of a crisis in confidence in the BOC across campus, and it is with great pride that we can say to the student body that there have been no BOC cases with freshman defendants this year!

Working to change attitudes, make people believe, and convince people to pitch in has been our greatest challenge this year, and next year the BoD will have to deal with it again. The next BoD will also be dealing with moving the computer labs and, working in connection with the IHC, help fundraise (by wooing alumni) and plan for the renovation of the new houses.

These are the problems you will face if you are elected, and if they strike a chord, please run for the office, so that the best representative of the students will win!

Whom I Met With This Week

I met with the faculty board this week. They discussed a number of issues, mainly focusing on the working arrangement between JPL and Caltech (not much effect on students) and hearing a report from their institute size committee that is examining the question of where the school is going, how

big it should get, and what is being done to keep Caltech as the best. The preliminary report noted a growing amount of staff and a boom in the number of graduate students, all of which have been leading to larger lab groups in some areas. Provost Koonin also formally announced his resignation as provost to the faculty.

I also met with Margo Marshak, and I took the two signed-up candidates (Andrea and Galen) with me so they could start learning how the job of president works (To one else signs up, please tell me and I will start bringing you as well). We had many things to discuss and we went over many of the surveys that ASCIT will be posting soon. The honor code survey was discussed last week; the other survey will focus on computer lab use as both UGCS and ITS labs are slated to be moved in the coming year. The survey will collect information on usage, needs, and shortcomings so that the administration can set up new labs that provide even better service than the ones being evicted.

Lastly, an ad hoc group has been meeting for many months to plan a leadership program to help students develop their leadership skills. The date is close to being pinned down, so try and save the weekend before third term so that you can participate in this workshop. A large number of students have been involved in planning this, and I think their efforts will be reflected in an excellent program. If you end up running for an ASCIT or House office in the next few weeks, I especially encourage you to keep an eye open for this!

Late fees?

Since graduate students have started using the DVD library and we have spent so much time and money improving it, the BoD is considering adding late fees to the rentals to ensure that people return them, and to create a little money to keep buying new titles. At present, the idea is to have a charging scheme based on 2^x. What you ask? Basically, movies are due back after two days. Then, there would be a five day grace period. After that, you are charged \$2. After another week, you're looking at a \$6 bill. Another week puts you at owing \$14, then \$30, and then you would be charged for a new DVD. The idea is that such a scheme would force people to

be considerate and return their DVDs, and keep the BOC and the honor code out of DVD rentals (at the BOC's request). We also think that most people that rent a movie should have no trouble returning it in a week, and that if they cannot, it is reasonable for them to contribute to keeping up the library for the use of others. If you have any strong opinions on this scheme, please email bod@donut.ugcs.caltech.edu so that we don't act hastily.

Closing thoughts

I hope you all had a good Martin Luther King Day, and I encourage you all to see Wilmot James talk on the Caltech website if you missed it on Thursday. It was excellent, and hopefully postulated that some of our racial strife will be eased by the blending of our different races brought about by increasing intermarriage and globalization, as well as digressed on the musicality of DNA, and the condition of education in South Africa. I'd like to thank President Baltimore for making the talk possible.

The State of the Union is on Tuesday night. Please be safe.

And because I can't help but that as a setup, "Looking back on the strengthening of the honor code, the connections we have formed with the administration, the bonds we have built with the graduate students, and the institutional changes that have made the BoD more open and accessible, I can say without hesitation that the state of our student body is strong."

Peace out,
Tom Fletcher

PS: VOTE NEXT MONDAY!!

The California Tech will be sponsoring a debate between the candidates for ASCIT President and candidates for BOC Chair. Keep your eye out for date and time. Come out to participate and to make an informed decision about who you elect to be your next student leaders.



Are you interested in Chinese culture, do you seek to enrich your life, or do you simply need a break? It is our pleasure to invite you to the **Caltech Chinese Culture Week, Jan 26-31**, full of exciting (and free) events. It is sponsored jointly by the Caltech C, the Hong Kong Student Association, the Asian-Pacific Student Union, and the Caltech Chinese Student Association. The final event will be the immensely popular Spring Festival Party, marking the Chinese New Year. We hope to welcome you to our activities! For more information, please contact Wei Ji Ma (Vice-President, Caltech C), x2873, ma@klab.caltech.edu.

CHINESE CULTURE WEEK AND SPRING FESTIVAL PARTY

January 26 - 31, 2004

Mon 26, 11:30 am - 1 pm, in front of the Red Door Cafe. Chinese Calligraphy Workshop, hosted by Caltech C. Calligraphy experts will teach you the basics of this ancient art and in particular of writing Spring Festival Scrolls. There will be plenty of opportunity to practice yourself.

Tue 27, 11:30 am - 1:30 pm, in front of the Red Door Cafe. Chinese Chess Workshop, hosted by the HKSA and the Caltech C. Looking for an intellectual challenge? Come to learn this captivating form of chess. There will be experts to teach you, and plenty of opportunity to practice yourself.

Wed 28, 11:30 am - 1 pm, in front of the Red Door Cafe. Chinese Handcraft Workshop, hosted by the Caltech C. Traditional Chinese handcraft products, such as chains and knots, will be made on-site. You can learn how to make them yourself, and keep whatever you make!

Thu 29, noon - 1 pm, outside Winnett Center. Art performance, hosted by the APSU.

Fri 30, 7:30 - 10:30 pm, Winnett Lounge. Chinese Brush Painting Class, hosted by the CCSA. Learn the basics of this traditional Chinese art from an expert. Of course you get to produce your own brush paintings.

Mon-Fri, 7-10 pm, Beckman Institute Auditorium. Chinese and Vietnamese movies, hosted by the Caltech C, the HKSA, and the APSU. We show one movie every day. It will be preceded by a reception from 6-7, in the Beckman Institute Courtyard.

Sat 31, 6-10 pm, Baxter Hall. The grand Spring Festival Celebration, hosted by all four clubs. We will serve excellent Chinese food from 6 to 8 pm, outside Ramo Auditorium (\$3). From 7:30 to 10 pm we will have cultural performances, including Kungfu demonstrations, Zither music, and traditional dances. After 10 pm we will show the Spring Festival programs of the Chinese television.

Caltech Ice Skating Night, organized by Caltech Ice Skating Club. **Come join us for a night of ice skating fun and hot chocolate!** When: Sunday, February 8, 8:30-10pm. Cost: FREE admission and rentals. Where: Pasadena Ice Skating Center, 310 East Green Street, 626-578-0801, www.skatepasadena.com. (The rink is across Green Street from Paseo, same building a Civic Auditorium, but enter in the back around the northwest corner of the building). If you want to drive, you can park for free at the parking meters on nearby streets or in Paseo parking lot (\$1 if you validate parking at Gelson's - with a small purchase).

If you have questions or want to join the Caltech Ice Skating Club mailing list, please email skating@caltech.edu.

The Monticello Foundation and Robert and Delpha Noland Summer Internships 2004.

The Deans' Office is accepting proposals for the Monticello Foundation and the Robert and Delpha Noland Summer Internships. Three to five Caltech undergraduate women (current freshmen, sophomores and juniors) will be given an opportunity to participate in research projects outside the Caltech-JPL community for ten weeks during the summer. Each student will receive a \$5,000 stipend. Applicants are required to identify the projects in which they wish to participate. All arrangements with the principal researcher will be the responsibility of the student.

Interested? Identify a sponsor for your experience at a research facility for a ten-week period. In a short essay, describe your project, and submit it to the Deans' Office, 210 Center for Student Services, along with two faculty recommendations.

PROPOSALS ARE DUE MONDAY, MARCH 1, 2004.

The US Department of Education is currently accepting applications for the third year of the **Martin Luther King, Jr., Scholars Program**. The program was established in commemoration of the late Dr. Martin Luther King, Jr., and his contributions to civil and human rights in America. Under this initiative, continuing college juniors, seniors, and graduate students are eligible to apply for an eight-week paid internship in the United States Department of Education in Washington, D.C. They expect to select up to ten students for this prestigious honor. The students will be placed either in the office of the Secretary of Education or in the office of one of the Assistant Secretaries, where they will gain experience in policy analysis and development. This program is an exceptional way for outstanding students to learn about the federal role in education and to understand better the value of government service.

For more information go to: www.ifap.ed.gov/dpclatters/

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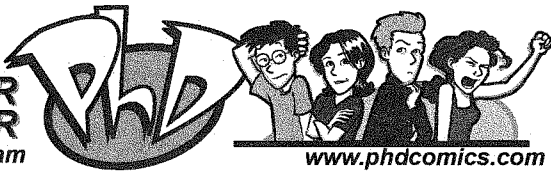
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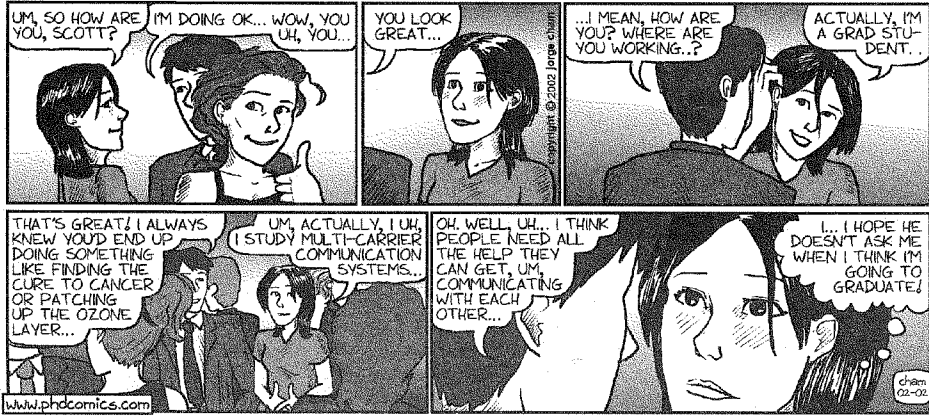
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by Jorge Cham

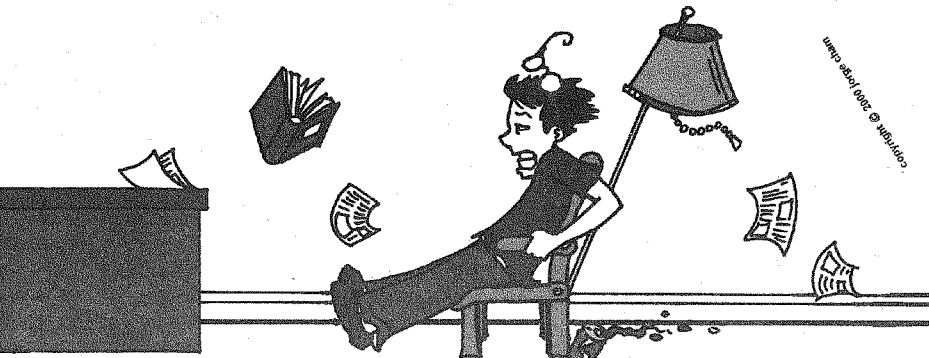
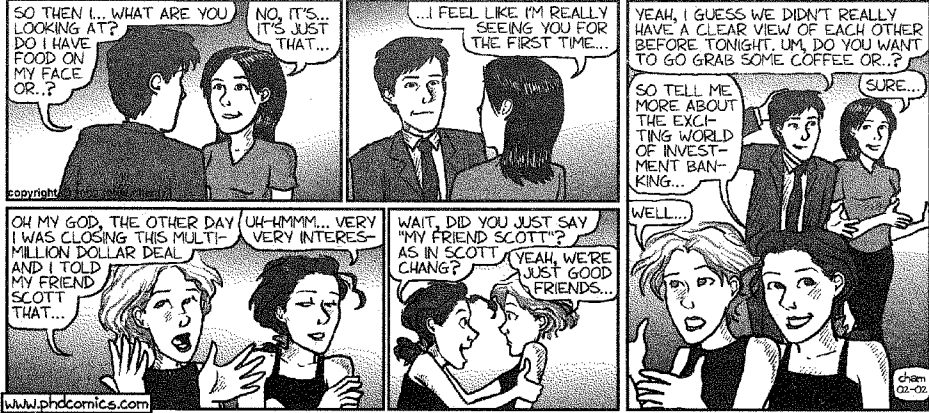


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Continued from Page 5

GEN0314MLK.html, or visit the deans' office, 210-87.

Congressional Research Awards. DEADLINE: Proposals must be postmarked no later than February 1, 2004. The Dirksen Congressional Center invites applications for grants totaling \$35,000 in 2004 to fund research on congressional leadership and the U.S. Congress. The competition is open to individuals with a serious interest in studying Congress. Political scientists, historians, biographers, scholars of public administration or American studies, and journalists are among those eligible. The Center encourages graduate students to apply and awards a significant portion of the funds for dissertation research. Undergraduate or pre-Ph.D. study, research teams of two or more individuals, and organizations are not eligible.

There is no standard application form. Applicants are responsible for showing the relationship between their work and the awards program guidelines. Applications are accepted at any time. All application materials must be postmarked on or before February 1, 2004. Awards will be announced in March 2004. Complete information about eligibility and application procedures may be found at The Center's Web site: <http://www.dirksencenter.org/grantcongresearchaward.htm> Frank Mackaman is the program officer; email: fmackaman@dirksencenter.org.

The Center, named for the late Senate Minority Leader Everett M. Dirksen, is a private, nonpartisan, nonprofit research and educational organization devoted to the study of Congress and its leaders. Since 1978, the Congressional Research Awards (formerly the Congressional Research Grants) program has paid out \$585,500 to support 315 projects.

Upcoming HPS Lectures:

- 30 January 2004 (4:00 pm 25 Baxter) Munro Seminar Jorge Canizares (History, SUNY Albany) "demons, knights, and nature in the early modern colonial expansion to the new world"
- 6 February 2004 (4:00 pm 25 Baxter) Munro Seminar William Reddy (History, Duke University) "The Rule of Love: The History of Western Romantic Love in Comparative Perspective."
- 13 February 2004 (4:00 pm 25 Baxter) Munro Seminar Robert Essick (UC Riverside) "Information and Knowledge on the Internet: The Case of the William Blake Archive."
- *** 19 February 2004 (8:00 pm Beckman Auditorium) *** Larry Principe (Johns Hopkins) "Stories and Histories of Alchemy from Nicholas Flamel to Harry Potter"
- 20 February 2004 (4:00 pm 25 Baxter) HPS Seminar Larry Principe (Johns Hopkins) "Revisiting the Academie Royale des Sciences: Wilhelm Homberg and his Chemistry"
- 27 February 2004 (4:00 pm 25 Baxter) HPS Seminar Sabine Brauckmann (Konrad Lorenz Institute, Altenberg), The morphogenetic field and the epigenetic landscape
- 5 March 2004 (4:00 pm 25 Baxter) HPS

Seminar Nico Bertoloni Meli (Indiana University) "From Pappus and dal Monte to Galileo and Newton"
12 March 2004 (4:00 pm 25 Baxter) Munro Seminar Justin D'Arms (Ohio State) "Objectivity in Taste and Emotion."

One Act Theater (OAT) has received funding from MHF to produce evenings of one act plays this term. We need directors, actors, technical staff, and anyone who is interested in helping. If you are interested, particularly in directing (the play of your choosing), please email oat@its.caltech.edu and check the website <http://www.its.caltech.edu/~oat/>.

Dance Classes
Beginning Bellydancing

Saturdays, 12:45-1:45 PM, starts 1/10, 8 classes. Professional Instructor: Leela. Trial class fee: \$5 for students, \$8 for others. Caltech students full term fee: \$20 (\$2.50 per class!). Other Caltech community members full term fee: \$50 (\$6.25 per class!) **CLASS SIZE IS LIMITED** so RSVP to Kathy.Kelly@caltech.edu Class meets in the Braun Gym multipurpose room. No special clothing or shoes required.

Intermediate Jazz

Thursdays, 9:30-11 PM, starts 1/8, 8 classes, all held in the Braun Gym multipurpose room. Professional Instructor: Collette Sibal. Trial class fee: \$5 for students, \$8 for others. Caltech students full term fee: \$20 (\$2.50 per class!). Other Caltech community members full term fee: \$40 (\$5 per class!). We will also be working on choreography for a piece to be performed in the Caltech Dance Show (March 12 & 13).

Learn the sexy Latin Samba with CDBC members Marcel Gavrilu and Sharon Liu. The class is in Braun Gym from 9 to 10 pm for five Tuesday nights starting Jan 6. Cost: Free! (However, there is a \$5 Braun gym entrance fee without a Caltech ID.) Both beginners and more advanced dancers welcome. This class will be more routine based; i.e they'll teach a routine probably covering a range of beginning to advanced moves. They also focus on technique. No experience is expected, but since some of the moves are higher level then more experienced dancers can also benefit. As always, no partner necessary!

Try competitive style Cha-cha and Waltz classes taught by Michael and Alice Cho, one of the top amateur 10-dance couples in the country! If you came to the CDBC Intro Night last fall, they danced for our showcase. Nine Sunday evenings, Jan 11 - March 7 held in Winnett lounge. Intl Cha-cha is from 4:30-5:30 pm, and Intl Waltz is from 5:30-6:30 pm. Cost is \$25 for one 9-week series (i.e. chacha or waltz). Both beginners and more advanced dancers welcome. Refreshments will be served!

Join Caltech Ballroom Dance Club to master West Coast Swing! West Coast Swing is a hip fun dance that is ever-popular at clubs and parties. This class is taught by professional instructor Michael Eads for five weeks, starting Jan 5 (7:30 - 9:00 pm in Winnett Lounge). Though the class is open to everyone, dancers should have some previous west coast swing experience. Cost for students is \$6/class or \$25 for the 5 week series. For everyone else, the cost is \$8/class or \$35 for series. Refreshments will be served. No partner necessary!

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Haile Group Finds Material That Overcomes Fuel Cell Limitations

By KATHERINE POULIN

PASADENA, Calif.—The quest for a cheap and robust fuel cell for future cars may be a bit closer this week to the “grail” moment. Scientists at the California Institute of Technology have announced that they’re getting promising results with a new material that solves various limitations of previously tested fuel cells.

In an article published online November 20 by the journal *Science* on the Science Express Website, associate professor of materials science and chemical engineering Sossina Haile and her colleagues report that they have created a new phosphate-based electrolyte to go inside the fuel cells. The new substance, formally named cesium dihydrogen phosphate is, for a variety of reasons, better than the team’s previously favored electrolyte, which was based on a sulfate.

“It’s a whole new way of doing fuel cells that opens up tremendous possibilities for system simplification,” says Haile, a leading authority on fuel cell technology.

Haile’s most spectacular results in recent years have been with the “solid acid” electrolytes, such as both the phosphate and the sulfate materials, that ferry current along the fuel cell in a way that minimizes the use of expensive parts that rapidly wear out.

Fuel cells have for some time been promoted as a way to help wean global society away from its addiction to gasoline and internal-combustion engines.

Like a combustion engine, a fuel cell uses some sort of chemical fuel as its energy source, but like a battery, the chemical energy is directly converted to electrical energy, without a messy and inefficient combustion step.

The components in a fuel cell

that make this direct electrochemical conversion possible are an electrolyte, a cathode and an anode. In the simplest example hydrogen fuel is brought into the anode compartment and oxygen is brought into the cathode compartment. There is an overall chemical force driving the oxygen and the hydrogen to react to produce water.

In the fuel cell, however, the direct chemical reaction is prevented by the electrolyte that separates the fuel (H₂) from the oxidant (O₂). The electrolyte serves as a barrier to gas diffusion, but it will let protons migrate across it.

In order for the reaction between hydrogen and oxygen to occur, the hydrogen molecules shed their electrons to become protons. The protons then travel across the electrolyte and react with oxygen atoms at the cathode, where they also pick up electrons to produce neutral water.

An additional requirement for these electrochemical reactions to occur is that there be some external path through which the electrons migrate; it is precisely this electron motion that provides usable electricity from the fuel cell.

Traditional fuel cells, which utilize polymer electrolytes, are hampered by a number of problems. The most notable are the cells’ inability to operate at high temperatures, their requirement for complicated water regulation systems and their failure to control fuel diffusion.

Haile and her associates have addressed these shortcomings by creating a novel fuel cell with a solid-acid electrolyte. Solid acids have unique properties that lie between those of normal acids and normal salts. Importantly, solid acids are very efficient at conducting protons when they are heated to “warm” temperatures.

However, their use for any application was largely ignored because they are water-soluble and difficult to fabricate into useful forms. In previous work, Haile explored the applicability of the solid acid CsHSO₄ as a fuel cell electrolyte and demonstrated the successful operation of such a fuel cell.

She found that the key to creating a functional solid-acid fuel cell is an operation temperature above 100 degrees C, which ensures that water in the system, which would otherwise dissolve and leach away the solid acid, is present as harmless steam.

The CsHSO₄ electrolyte fuel cell suffered from a serious problem that prohibited its use for power generation. Specifically, the output of the fuel cell decreased over time as the hydrogen fuel reacted with the solid acid in the presence of the catalyst.

As reported in their *Science* paper, Haile and her colleagues circumvented this problem by replacing the CsHSO₄ solid acid with CsH₂PO₄, which does not react with hydrogen.

According to Haile, they were initially hesitant to use this material because it decomposes via dehydration into a nonuseful salt. However, they found that humidifying the fuel cell anode and cathode chambers with a relatively low level of water vapor could prevent the dehydration reaction and thereby maintain the fuel cell for long-term power generation.

Haile’s humidity-stabilized CsH₂PO₄ fuel cells solve several critical problems that have plagued polymer fuel cell development. First, these solid-acid fuel cells can be operated at higher temperatures than those built with polymer electrolytes, which are limited to temperatures less than 100 degrees C.

Operation at “warm” temperatures, 100–300 degrees C, brings a number of benefits to fuel cell technology. Most directly, catalyst activity is enhanced, resulting in higher-efficiency fuel cells and allowing one to use less of the expensive catalyst.

In addition, the susceptibility of the catalyst to poisoning from carbon monoxide contamination of the fuel decreases. As a consequence, the fuel stream need not be purified as thoroughly as for polymer fuel cells, reducing the overall system complexity.

Perhaps most significantly, operation at warm temperatures opens up the possibility of using less-expensive base-metal catalysts, which are not active enough to be considered for low temperature applications.

Additional system simplifications come about from the fact that the radiator necessary for maintaining a fuel cell at about 200 degrees C is much smaller than the one required for maintaining a temperature of about 90 degrees C.

This has significant implications for automotive applications. Warm-temperature operation can furthermore be easily integrated with onboard hydrogen-generation systems that produce hydrogen also at warm temperatures. For a polymer electrolyte fuel cell, the hydrogen stream from these generators has to be cooled before it can be introduced into the cell.

Solid-acid fuel cells can be operated in the temperature range of 100–300 degrees C because, unlike polymers, they do not rely on water molecules to transport protons from one side of the membrane to the other.

This “dry” proton transport results in additional advantages. In particular, there is no longer a need to remove water that accumulates at the cathode and replenish it at the anode. As a consequence, the overall system is, again, significantly simplified.

In the case of CsH₂PO₄, a

small amount of water partial pressure, equivalent to about 10 percent relative humidity at 100 degrees C, is required in order to prevent dehydration of the material, but no water recirculation is necessary.

The dry, solid-acid electrolytes are furthermore much less corrosive than their hydrated, polymer counterparts. This allows for much more flexibility in the choice of materials for the other components of the fuel cell system.

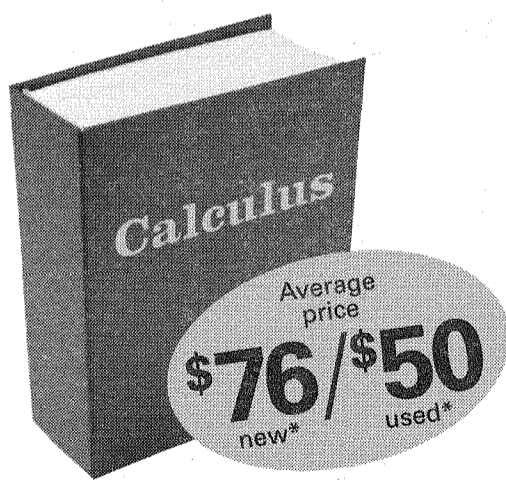
Where solid-acid fuel cells have tremendous advantages over polymer electrolyte fuel cells is in the use of alcohol (e.g., methanol) fuels. Hydrogen “stored” as methanol results in a liquid fuel with a high energy density, which is much easier to transport, store and carry on board than hydrogen.

Polymer-based fuel cells do not work well with alcohol fuels because the fuel diffuses across the electrolyte, consuming fuel without generating electrical output. The solid-acid electrolytes are entirely impermeable to methanol, which means very high power outputs are possible—much higher than from polymer fuel cells running on methanol.

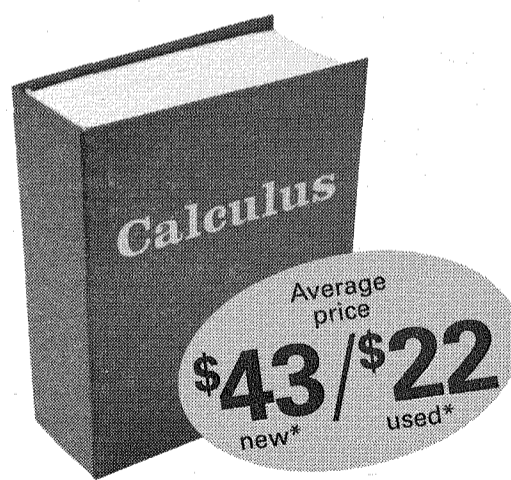
While the solid-acid fuel cells solve many of the problems of polymer fuel cells, there are still a few obstacles standing in the way of extensive fuel cell use. A continuing problem of the solid-acid fuel cells is the water solubility of the electrolytes. Haile suggests that clever engineering could circumvent this drawback. However, she plans to solve this problem by developing new solid-acid materials that are water-insoluble.

In developing humidity-stabilizing CsH₂PO₄ fuel cells, Haile was assisted by the lead author Dane Boysen, a graduate student in materials science; and Tetsuya Uda and Calum Chisholm, both postdoctoral scholars in Haile’s lab.

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Space Telescope Studies to Reveal Clues to Development of Galaxy

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and they are free of radiation in the earth's environment, which would otherwise interfere with measurements.

This is especially advantageous for a telescope operating in the infrared, like the Spitzer. Infrared radiation is given off by all bodies whose temperatures exceed absolute zero temperature (about -273°C). On the earth's surface (which is, after all, very warm in comparison with space), there is quite a lot of "noise", or radiation in a telescope's environment that obscures radiation from objects in space.

Tom Soifer, director of Spitzer Space Telescope, compares observation under such circumstances to stargazing in the daytime; there is simply too much "light" that one must see beyond.

In the infrared, there are wavelengths which simply cannot be seen at all from the surface of the Earth and others which it is difficult to detect.

Thus the Spitzer, with its 85-cm telescope, placed away from such obstructions and operating in an environment of about 35K (-238°C), (while observation parts of the telescope themselves are cryogenically chilled to about 5.5

K, or -268°C), is about ten times more sensitive than the 1000-cm telescopes at Keck Observatory, Hawaii.

The equipment of the last of NASA's four most important space observatories is surprisingly simple. In addition to its infrared array camera with which it images space at near- and mid-infrared wavelengths, Spitzer is equipped with an infrared spectrograph to enable astronomers to analyze the chemical makeup of observed objects (each molecule has a "fingerprint" emission/absorption spectrum which can be analyzed to determine the identity of the molecule). It also carries a multiband imaging photometer which takes care of imaging and also collects some limited spectroscopic data.

The purpose of the Spitzer's mission is to collect information about, as Soifer says, the "old, the cold and the dirty" in the Universe. The term "old" here pertains to the "high red-shift universe", that is, to stars and galaxies which lie as far as 12 billion light years away, which we now observe as they appeared in the distant past.

These bodies are moving away from us due to the Universe's expansion and because of this and the associated Doppler effect, the wavelengths which we observe as coming from them are longer

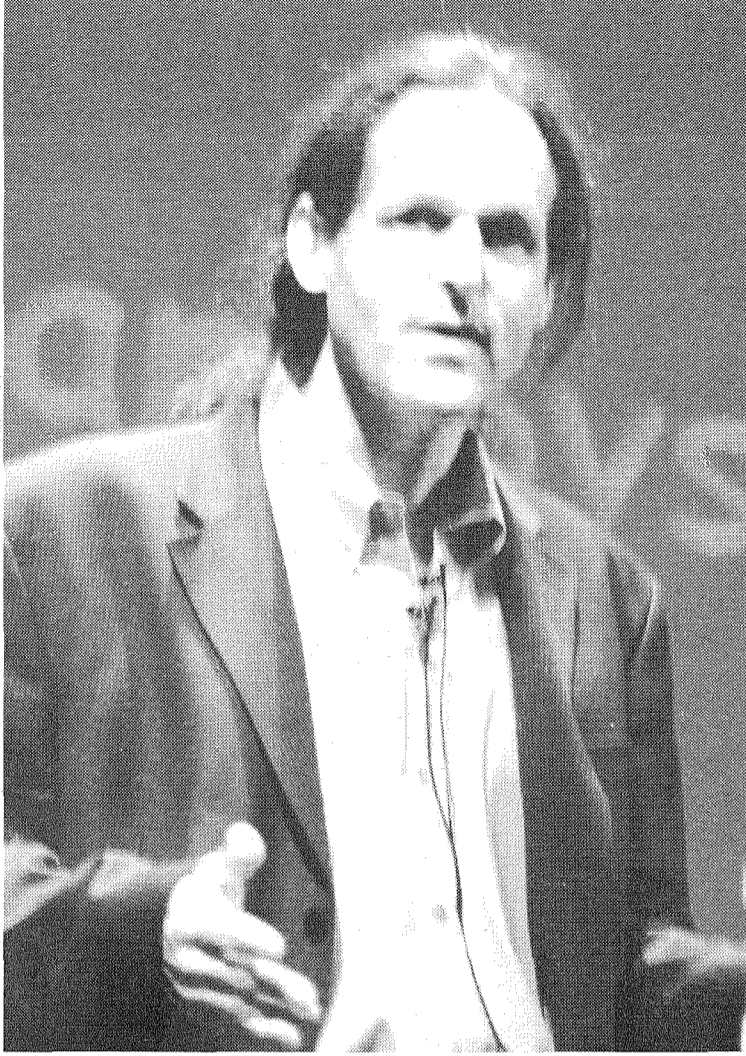
than they might be; they lie in the infrared region of the spectrum which Spitzer "sees."

The "cold", on the other hand, is interstellar matter which forms clouds of molecular gas and dust, often no more than a few tenths of a degree above 0 K. These clouds can collapse in on themselves, producing regions of hot, dense material and eventually forming stars, so that, looking at the process in the infrared, we can learn much about the formation of stars.

Other celestial bodies, such as "Ultra Luminous Infrared Galaxies" and "failed stars", called brown dwarves, emit most of their radiation in the infrared and will also be examined by Spitzer.

The last of Spitzer's targets for observation, then, is the "dirty"; this includes clouds of interstellar dust which permeates interstellar space and eventually forms asteroids and planets. Through the new telescope we may observe previously invisible details of the different stages of formation of distant solar systems.

Though data collected so far is still only in the beginning stages of analysis and there have not been any unexpected results found so far, Tom Soifer says that he looks forward to "tremendously exciting discoveries" as Spitzer's mission continues.



D. Korta/The California Tech

Dr. Heath's research has helped pave the way for new disease curing methods and tests to diagnose them.

New Diagnostic Tests Detect Errors in Cells

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establishing a separate pathway," he said, "there are many ways you can get a disease."

Another challenge is the body's rate of communication: proteins signal each other every tenth of a second—a rate too high for most machinery to detect. Moreover, these pathways exist on the molecular level, so equipment must be very small—nanoscale. It must also be sensitive; Heath needs to detect everything down to a hydrogen-hydrogen bond joined by a force of just 10 piconewtons. "Nanotechnology has gotten a lot of press in the last few years," he said, "but the problem is that there's no manufacturing approach for these devices."

In response, Heath drew on colleagues such as Biology Professor Steve Quake to assemble a nanotechnological toolbox of microfluidics, tiny "biological circuit boards" which transport, mix, absorb and expel nanoliters of liquids that detect—and possibly later, cure—cellular malfunctions. "Microfluidics automates the detection process," he said.

His precise instrument is a set of "ultra-high-density nanowire sensors," which at 10 millimeters in diameter are finer than the smallest semiconductor. With clever chemical additives, Heath's team can link these wires—"color" them, in his words—to particular proteins. "Once you can create

this array you have to make it so each wire communicates with a different protein," he said.

Once linked, the device forms a magnifying glass into the protein's function that makes it easy to spot any molecular misstep. "Just like in a video game," maintained Heath, "most of the software goes into making ceilings and details and only a little bit of information goes into how to get from Level one to level two."

The end result is a robust set of "informative diagnoses" that scan cells for common molecular glitches. "You're trying to capture, at the various levels of complexity, all the information available to you at that complexity level," he explained. "In this small laboratory, you have everything in the world going on. Like Chicago in the 1920s, it's a factory—only smaller."

For a disease like breast cancer, then, Heath's most pressing charge is to compile a relevant glossary of proteins possibly at fault. "If you want to stratify breast cancer," he said, "you probably have to look at 100 different proteins—and to assess [the disease] over time, upwards of 1000."

Daunting, perhaps. Still, Heath's methods nonetheless showed clinical promise that didn't go unnoticed among the audience.

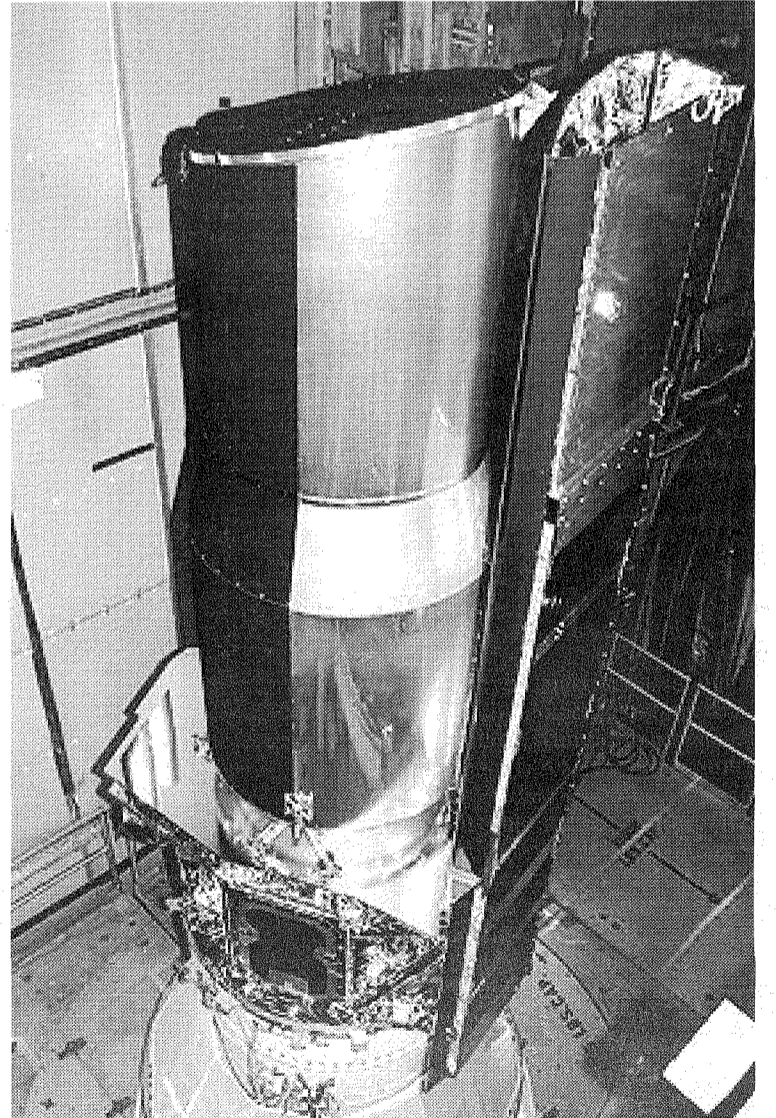
"Heath's work is probably the future of medicine and is prob-

ably the quintessential breakthrough in visualizing the proteins that have been so elusive," said James Kholos, national vice president of the Curing Old Age Disease Society. "The number of variables he is able to handle with his technology is mind-boggling and definitely cutting-edge."

Board of Caltech Associates newcomer Cathy Wiltsey concurred, lauding also the speed of Heath's research. "I'm just amazed at what Heath accomplished in a year—just one year—having really revolutionized computing and then transferring it to this project here. It's just an incredible integration of technologies."

Looking beyond scientific curiosity, former physicist Taylor Korbidge saw market potential for Heath's work. "These instruments might not be very big and might not be very expensive and there's a market for them," he said. "Five billion people or so will be needing these things."

And that time may just be at hand. In the eyes of those like Heath's graduate student Erica DeIonno, who anticipates "a revolution in the way that disease is going to be diagnosed and treated," it won't be long before Heath can detect and even cure a variety of illnesses long thought to be clinical dead ends, all by handling single cells rather than surgically invading bodies. "We must be able to decode the language that the biological systems are speaking and learn to speak it ourselves," said Heath.



Courtesy of spitzer.caltech.edu

The Spitzer Space Telescope, formerly SIRTf, is shown ready for launch, perched on its Delta rocket.

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Spitzer ready to go: Despite a recent name change, this Space Observatory is ready to scope out some extraterrestrial thermal activity.



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