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 teachers? 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 Dictch Day. Yet most students knew 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 former 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 techer responded with equally thorough enthusiasm.

Cox first became enamoured 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 the frosh to see which class would have to pay for a major hiatus. Thus, it is appropriately named the Mohammed by the Earth’s atmosphere

D. Karta/The California Tech

Spitzer Data Begins Filling Universe Map

By K. SZWYKOWSKA

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 11, 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 x-ray regions of the electromagnetic spectrum, respectively, Spitzer Space telescope detects lower-energy infrared radiation.

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

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

Continued on Page 8, Column 1

Dr. James Heath, the Moore Visiting Professor of History and Sociology, wrote the book entitled “The Evolution of Human Diversity”.

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 for 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

Continued on Page 2, Column 1

Continued on Page 8, Column 3

Continued on Page 2, Column 1
Cox Fights Apathy to Bring Back Tradition, Students Drawn Out

Continued from Page 1, Column 3

dance. Over the years, however, the event, became as Jeff puts it, basically “an excuse to drag the fresh 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 qushy 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 Mudeo 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 DelMar 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 op­portunity for techers to participate in a little mudmilling 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.”

Techers 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 dining halls, practices give techers 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 modern children that 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 a few criticisms in his own house die out during the time he has been here. He deems the event a “waste of time,” “When one class does not carry on a tradition, the next class does not know what to do and it can simply 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, one class does not carry on a tradition that will ultimately “devolve into fighting in the mud.”

Below are the plain text representations of the text, formatted for readability.
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 undergraduate housing options -- 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-freshmen from the next largest house, Ruddock House, are Asian (freshman must live in the undergraduate 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 prevent this from happening? As scientists, we know the best way to try and solve a problem is to first understand why it occurs. As a result of Avery, and an Asian, under the less-typical but more correct definition, what 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 current division perpetuates. There are other reasons for living in Avery off-campus 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 facade 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 at first-hand. In my experience I have seen that some Avery students have very broad and fulfilling social lives. One 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. 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 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 enjoyable for all students. A member that social calendar days are not revealed during Rotation - therefore, those 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.

Avery association also has its drawbacks. As a vocative Tech commentator Libin Zhang pointed out last fall how FSL communal must now be limited to two per house to prevent Asian 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 a segregation that is occurring within our undergraduate 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 centered 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). It doesn't make one's 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 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 in members of our community can we work towards the strengthening and enhancement of a pluralist civil society. If we can recognize diversity 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 remain to be ignorant of 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 college lives live, we promote disfunction 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?

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 it for 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 ourselves, course, perpetuates segregation and the best way to avoid incorrect ideas about a group is through education. We can avoid having false ideas about others or 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 we can promote a sense of responsibility above and beyond scientific matters.

Marlin Luther King Day is a great chance for us to celebrate Dr. King's dream and start actively making our own lives reflect the consequences of his work. Let's 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's very multicultural, clean, and lies to the North of campus. Hmm...maybe that's why I feel so at home here.

“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.”

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
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.
Elections!

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program.

grand Spring Festival Celebration,

Class, hosted by the

learn to do Kungfu demonstrations, Zither

paintings.

Chinese Brush Painting

Wed 28, 11:30 am - 1 pm, in front

Traditional Chinese handcraft products, such as chains and

will be made on site.

outside Ramo Auditorium

Serve excellent Chinese food from 6

for an intellectual challenge? Come

sent in the building). If you want to

parking meters on nearby streets

or in Paseo parking lot ($1 if you

Club mailing list, please email

Vall. com.

Chicago, hosted by the Caltech C.

HKSA and the Caltech C. Looking

China, you simply need a better

It is our pleasure to invite you to the

Caltech Chinese Culture Week on

Jan 26-31, full of exciting (and

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scheme, please email gom@caltech.edu so that we don't

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ugcs.caltech.edu

boD@donut.

Mon-Fri, 7-10 pm, Beckman

Thu 29, noon - 1 pm, outside

be placed either in the office of the

secretary of education or in the of­

States Department of Education in

Washington, D.C. They expect to

mer Internships 2004. The Deans'

are sponsored jointly

The Monticello Foundation and

Robert and Delpha Noland Summer Internships. Three to five Caltech undergraduate women (current freshmen, sophomores and juniors) will be given an opportunity to par­

ticipate in research projects outside the Caltech-JPL community for ten weeks during summer 2004. 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 projects will be the responsibility of the student.

are interested for your experience at a research institute, and would like to write a short essay, describe your project, and submit it to the Deans' Office, please email Caltech's GSAS office.

CHINESE CULTURE WEEK

February 14-15, 2004

China's rich history, its architecture and dance, and its music will be on display during this exciting event.

Free and open to the public.

-looking Forward to Seeing You!

For more information contact

hong@caltech.edu.

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"Limited Time Offer! Some restrictions apply."

Continued on Page 6
Congressional Research Studies: 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 researchers who are working on projects 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. Undergraduates 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 all times. 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.dirkcenter.org/grants/onresearchaward.htm. Frank Mackaman is the program officer (fmackaman@dirkcenter.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 the Senate and its history. Since 1973, the Congressional Research Studies (formerly the Congressional Research Grants) program has paid out $858,500 to support 315 projects.

Upcoming HPS Lectures:
- 30 January 2004 (4:00 pm 25 Baxter) Munro Seminar Jorge Cantizanes (History, SUNY Albany) “demons, knights, and nature in the early modern colonial expansion to the new world.”
- 19 February 2004 (8:00 pm Beckman Auditorium) *** Larry Principe (Johns Hopkins)’s/“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 Académie Royale des Sciences: Wilhelm Homberg and his Chemistry”
- 23 February 2004 (4:00 pm 25 Baxter) HPS Seminar Sabine Bruckmann (Konrad Lorenz Institute, Altenerding) “The morphogenetic field and the epigenetic landscape”
- 5 March 2004 (4:00 pm 25 Baxter) HPS Seminar Nico Bentoloni Mell (Indiana University) “From Popes and old Monte to Galileo and Newton”

One Act Theater (OAT) has received funding from MHRP 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.it5.caltech.edu/oat/.

Dance Classes
Beginning Kellidancing

Saturdays, 12:45-1:45 PM, starts 1/10, 8 classes. Professional Instructor: Loelia. Trial class fee: $5 for student, $8 for others. Caltech students full term fee: $20 ($5.25 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. Hop to step this New Year last fan, they danced for our showcase. 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 ($5.25 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 CDCB instructors. Manou Gazulla and Sharon Corn. The class is in Braun Gym entrance (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 all of the basic steps. We will then do some of the moves are higher level then the other classes but there will be some of the moves are higher level then the other classes but the difference is that we can also benefit from the experience of the advanced dancers to create more experienced dancers can also benefit. As always, no partner needed.

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 CBDC into Night last fall, they danced for our showcase. Nine Sunday evenings, Jan 11 - March 7 held in Winnett lounge. Int Cha-cha is from 4:30-5:30 pm, and Int Waltz is from 5:30-6:30 pm. Cost is $25 for one 9-week series (i.e. cha-cha 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 Marie Gillis and Alice Cho. 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 $50 or $25 for the 5 week series. For everyone else, the cost is $50 or $35 for series. Refreshments will be served. No partner necessary!

COME TO MEETING: 10 January 2004, 7:30 pm in the Braun Gym. All members Marcel Gavriliu and Sharon Liu.

Institute, Altenberg), The morphogenetic Wilhelm Homberg and his Chemistry”

8 February 2004 (4:00 pm 25 Baxter) Munro Seminar Larry Duggin (English) “The Case of the William Blake Archive.”

13 February 2004 (4:00 pm 25 Baxter) Munro Seminar Robert Eisick (UC Riverside) “Informati

15 March 2004 (4:00 pm 25 Baxter) Munro Seminar Galileo and Newton”

5:30 pm, and Int Waltz is from 5:30-6:30 pm. Cost is $25 for one 9-week series (i.e. cha-cha or waltz). Both beginners and more advanced dancers welcome. Refreshments will be served!

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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 sulfite.

"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 have been obtained with the "solid acid" electrolytes, such as both the phosphate and the sulfite materials, that ferrum 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 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 unlike the chemical, the 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 electrical energy 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 function 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 the "solid base" materials that rapidly wear out.

The output of the fuel cell decreased over time as the hydrogen fuel reacted with the solid acid in the presence of the cathetate.

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 at high temperatures, their requirement for complicated water regulation systems and their failure to control fuel diffusion.

Although the fuel cell anode and cathode at high temperatures, their requirement for complicated water regulation systems their failure to control fuel diffusion.

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 cell 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.

"It's a whole new way of doing fuel cell..."
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 almost cannot be seen at all from the surface of the Earth and 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), where the observation parts of the telescope themselves are cryogenically chilled to about 5.5K, can get a disease.

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.

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 calculations and details and only a little bit of information goes into how to get from Level one to level two.

The 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 their words--to particular proteins. "Once you can create this array you have to make it so that each wire communicates with a different protein," he said.

"Once linked, the device forms a nanowire of liquid that detect--and possibly later, cure--cellular malfunction.

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 of the biological systems are speaking and learn to speak it ourselves," said Heath.

Space Telescope Studies to Reveal Clues to Development of Galaxy

Continued from Page 1, Column 2

**continued: from Page 1, Column 5**

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**

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 through 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--nanoscule. It must also be sensitive; Heath needs to detect single molecules, proteins. "Once you can create a nanowire of liquid that detect--and possibly later, cure--cellular malfunction.

"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 nanometers 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 their words--to particular proteins. "Once you can create this array you have to make it so that 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 calculations and details and only a little bit of information goes into how to get from Level one to level two.

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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.

"Health's work is probably the quintessential breakthrough in visualizing the proteins that have so eluded us," said James Kholos, national vice president of the Curing Old Age Disease Society. "The number of variables he is able to handle with this technology is mind-boggling and definitely cutting-edge.

Board of Caltech Associates newcomer Cathy Wilsey 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 to physical reality, Taylor Kebridge 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 of the biological systems are speaking and learn to speak it ourselves," said Heath.

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