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# Senior Connie Hsueh wins Gates Cambridge Scholarship

**JESSICA STOLLER-CONRAD**  
Caltech Media Relations*This article was originally published online at caltech.edu.*

Senior Connie Hsueh, a physics major, has been awarded a 2015 Gates Cambridge Scholarship that will fund graduate studies at the University of Cambridge. She is the seventh Caltech undergraduate student to receive this award.

The Gates Cambridge Scholarship program, established in 2000 through a donation to Cambridge University from the Bill and Melinda Gates Foundation, recognizes young people from around the world who not only excel academically, but also display a commitment to social issues and bettering the world. Hsueh and the 39 other American recipients were selected from a pool of 755 applicants competing for this year's U.S. award. In April, 55 international scholars, selected from a pool of around 3,000 applicants, will join Hsueh and her U.S. colleagues as Gates Cambridge Scholars.

A native Californian, and the only student in this year's U.S.

applicant pool to win a Gates Cambridge Scholarship to study physics, Hsueh will use her scholarship to pursue an MPhil in physics. She will use computational and theoretical techniques to investigate novel battery materials—an interest that began for her while doing experimental work with batteries at Caltech in the laboratory of Brent Fultz, Barbara and Stanley R. Rawn, Jr., Professor of Materials Science and Applied Physics.

"The summer after my sophomore year, I investigated the electronic properties of lithium-ion rechargeable batteries in Professor Fultz's lab," Hsueh says. "I think it's incredible that through a variety of spectroscopic techniques, we can explain how materials behave at the atomic level. That we have the ability to probe materials on these scales—so many orders of magnitude smaller than what we physically deal with—is what astounds and interests me about physics. In addition," she adds, "Professor Fultz has been an

incredibly supportive advisor and friend to me as I have tried to figure out what I want to do with my life."

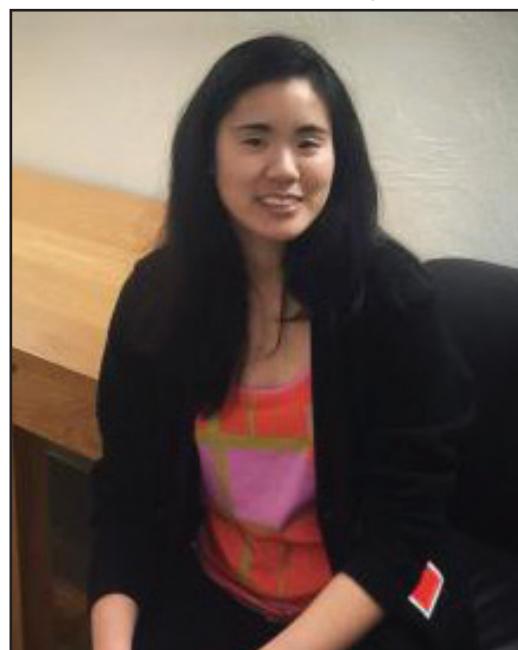


Photo Courtesy of Connie Hsueh

professor of chemistry. In 2014, she completed a summer internship at Lockheed Martin, where she gained experience in computer modeling and experimental research for defense-related technologies.

While at Caltech, Hsueh also kept a busy schedule outside of the laboratory and the classroom, serving two terms as the director of operations of the Associated Students of the California Institute of Technology (ASCIT) board of directors, four seasons on the Caltech volleyball team, and three seasons on the water polo team. Surprised that there was no physics club for students, Hsueh co-founded the Caltech Physics Club to give interested students a place to explore physics topics outside of the classroom.

Hsueh, who is currently studying abroad at Cambridge as a participant in Caltech's undergraduate exchange, the Cambridge Scholars Program, "is an outstanding student and

human being," says Lauren Stolper, director of the Fellowships Advising and Study Abroad Office and the Career Development Center. "Connie has invested herself in her Caltech education and always considers how she can help her peers academically or by bettering extracurricular opportunities for them. She will be an excellent representative for Caltech as a Gates Cambridge Scholar," Stolper adds.

After Cambridge, Hsueh would like to continue to pursue an academic career and, one day, become a professor. However, this pursuit is not her only goal.

"It's always been my ambition to improve society and do good in the world. What that means exactly is still up in the air—maybe it will mean encouraging and mentoring future generations, or maybe it will mean inventing a life-changing device that completely revolutionizes the world," she says. "I'm honored to join the community of Gates Cambridge Scholars because I believe that they share this passion for improving the world, and I hope that we will support one another in this mission."

## Wage gap among different groups still prevalent today

**HANNALORE GERLING-DUNSMORE**  
Contributing Writer

The commonly cited number for the wage gap between men and women is 77 cents on the dollar. This is correct in that if someone took a large number of American women and averaged their salaries, and then took an equal number of American men and averaged their salaries, the average for the women would be about 77% of the average for the men. However, this does not take into account the actual job each person is doing. In a 2009 Labor Department report, it was found that women get paid about 5% less than men doing the same job. This, of course, is unacceptable, and needs to be fixed, but also raises the question: why is the average so much less for women?

This bias in hiring contributes to the gender wage gap in two ways. First, if women are hired less often, they are going to be either more desperate when they come upon a job offer and won't be willing to negotiate for a higher salary, whereas someone with more job offers would be able to leverage these offers for a higher salary, or they are going to have to settle for "underemployment," getting a job they are entirely overqualified for, and thus mostly likely getting paid less.

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## Women offer honest perspectives on grad school

**CASEY HANDMER**  
Contributing Writer*\*All names have been changed.*

"I expected grad school to be awful, and it was. In hindsight I think I shouldn't have come to Caltech or pursued a Ph.D." We all know grad school is one of the most challenging career paths available. Long hours, low pay, little external recognition and, if you're lucky, a postdoc when it's all over. Yet the excitement of science will lure most Caltech undergraduates to apply to grad school, a career path about which they know almost nothing.

One challenging aspect of science as a career is highlighted by the universal deficit of women in senior positions. Attaining a senior position in academia is a long, difficult road, so even small but consistent gender biases at each step can result in a large disparity at the end. This "leaky pipeline" is understood to begin in elementary school, but a large proportion of prospective scientists leave academia during or after grad school. To assess the extent to which this exodus contributes to the leaky pipeline at Caltech, I sat down with a number of my female colleagues to hear firsthand what grad school is really like.

This article differs somewhat from a regular news snippet in that it deals primarily with inherently subjective perceptions rather than objective fact. However, when it comes to intelligently engineering a working environment that is welcoming and supportive for everyone, perceptions are what count. Caltech is a community of smart, well-intentioned people. A culture that unintentionally harms a segment of the population often harms the lot. My purpose is to help facilitate the ongoing conversation.

Aubrey\* is a first year grad student whose parents are both academics. "I knew precisely what I was getting into. A lot of first years aim too high and try problems that are too difficult. It helps to be humble." Aubrey recognizes that her level of foreknowledge is unusual, but her level of confidence is not. In grad school, many students experience what Caltech undergraduates know well — they are no longer very big fish in a very small pond — which can lead to imposter syndrome. Cynthia-Rose recently completed her Ph.D. "Many grad students come in thinking that they know everything. They think 'I was accepted to Caltech and my undergrad research project went

well, so Nature will be mine.' It's a little naive."

Getting reliable information during prospective visits can be difficult. Cynthia-Rose added, "I don't think I'll be invited back to talk to the prospectives. My friends even came with popcorn. I tried to scare off as many as possible. The panel was three first years and me, who was the only one who had passed candidacy. Don't listen to the noobs, they just don't know what they're talking about. They still think their PI is their friend. They haven't been screwed out of any publications!" Cynthia-Rose also has advice for women during prospective visits. "You have to be careful when joining a lab. How many people are like me? How does my prospective boss interact with them? Before you join a lab, go to group meetings. Any male talking over a female group member is a huge red flag. It's happened to me many times. You also need to establish what your backup is in the event of project failure. How many other things is this lab doing that I can do? How well-funded is this lab? [To get the truth] I always recommend talking to grad students and doing it off campus, without strings."

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# Caltech Y Column

## CALTECH Y

The Caltech Y Column serves to inform students of upcoming events and volunteer opportunities. The list is compiled by Neera Shah from information given by the Caltech Y and its student leaders.

More information about the Caltech Y and its programs can be found at <https://caltechy.org>. The office is located at 505 S. Wilson Avenue.

### Upcoming Events

#### 1. Hydrodynamic instabilities, painting and the story of a Mexican rebel

Wednesday | March 4th | Annenberg 105 | Lunch is provided, but space is limited

RSVP Required

The Caltech Y is hosting a lunch talk by Professor Roberto Zenit who is on sabbatical from Universidad Nacional Autonoma de Mexico in Mexico City. He is a Fulbright Scholar at Caltech.

In this investigation, we reproduce the technique described by David Alfaro Siquieros, a famed Mexican muralist, in a controlled manner. We analyze the patterns created by this process from a fluid dynamics point of view. An analysis of the time and length scales of the problem is conducted. We also propose a measurement of the complexity that can be achieved from this process. We also discuss the similarities with other relevant flows. This project has jump-started an exciting new multidisciplinary area of research: hydrodynamic instabilities in painting.

[https://docs.google.com/forms/d/1LM\\_nsZzrGLQKYiE1eFGYmZ9y4PqDz\\_uMu9aBocZARA/viewform](https://docs.google.com/forms/d/1LM_nsZzrGLQKYiE1eFGYmZ9y4PqDz_uMu9aBocZARA/viewform)

#### 2. Smith Mountain Hike

Sunday | March 8th | 8:00 AM

The Caltech Y Outdoors group will hike to the summit of Smith Mountain in the heart of the San Gabriel Mountains. This seven-mile trip is good for both beginners and advanced hikers, with the first three miles gently climbing to a ridge straddling the border of the San Gabriel Wilderness. The last half-mile of the hike climbs steeply over 800 vertical feet off-trail to the summit of Smith Mountain, with 360 degree views that include the entire San Gabriel range, distant Southern California mountain peaks, and the Pacific Ocean in the distance if the atmosphere is especially clear. Beginners or those not comfortable on steep trails may choose to skip the last section to the summit and hike another trail to a neighboring mountain less than a mile away. We will leave the Caltech Y at 8:00am and return at around 2-3pm depending on our pace and traffic. To sign up, fill out the form at the below. If you have questions, email Jeremy Sandler at [jsandler@caltech.edu](mailto:jsandler@caltech.edu).

<http://goo.gl/forms/rzYPDzVeM6>

#### 3. Kids Reading to Succeed

Saturday | March 7th | 8:15 - 11:15 AM | Villa Park Community Center | 363 E. Villa Street

Do you have an interest in working with kids? Would you like to inspire in others a love of reading? If so, come out and volunteer with KRS! Volunteers read with kids for the first half and then do fun activities the second half. To RSVP and for more info email Aleena Patel at [apatel@caltech.edu](mailto:apatel@caltech.edu)

#### 4. Caltech Y - Alternative Spring Break Trips

Applications Due March 6th

The Caltech Y is seeking applicants for our 2015 Alternative Spring Break trips. Join other Caltech Students for an adventure on one of our non-traditional spring break experiences in Malibu or on Catalina Island. Both trips will include opportunities for volunteer work as well as relaxation and adventure...not to mention making new friends with other Caltech students.

More info and applications available at [https://caltechy.org/programs\\_services/areas/asb/index.php](https://caltechy.org/programs_services/areas/asb/index.php).

#### 5a. Pasadena LEARNS

Friday | 3:00 - 5:00pm | Madison and Jackson Elementary School | Pasadena

Come volunteer at Madison and Jackson Elementary School! We work with their Science Olympiad team or do regular tutoring along with occasional hands-on science experiments. Transportation is provided. For more information and to RSVP, contact [vkkumar@caltech.edu](mailto:vkkumar@caltech.edu). Eligible for Federal Work Study.

#### 5b. Hathaway Sycamores

Monday | 5:30-8:00pm | Highland Park

Volunteer at Hathaway Sycamores, a group that supports local underprivileged but motivated high school students. The service trip includes about an hour of travel time and 1.5 hours of tutoring. Transportation is included. For more info and to RSVP email Sherwood Richers at [srichers@tapir.caltech.edu](mailto:srichers@tapir.caltech.edu). Eligible for Federal Work Study.

#### Other Announcements - Beyond the Caltech Y

#### Washington Elementary STEAM School Science Fair Mentors

Fridays | 1:00 -2:00 PM | Washington Elementary School | 1520 N. Raymond, Pasadena

Science Fair mentors are needed for the 4th and 5th grade classes. They are matched with a classroom and commit to come at least 2x/month from 1-2 pm. Mentors help students generate science fair project ideas by asking questions that get students to dream and explore; help guide students through the process of completing a science fair project; and help students learn about the scientific method and share their own story about being a scientist.

## Gray wins medal for achievements in chemistry

### LORI DAJOSE

Contributing Writer

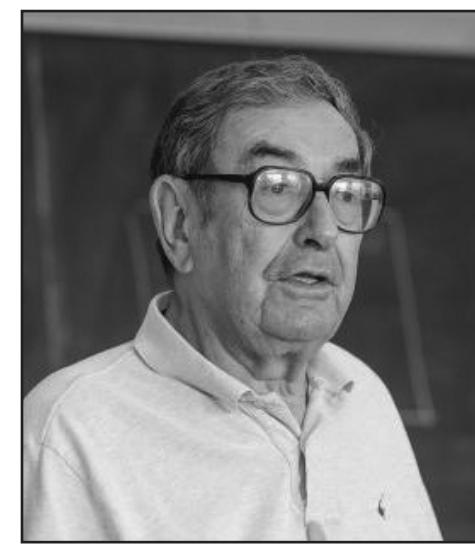
*This article was originally written for the Marketing and Communications Office and is published online at caltech.edu.*

is a cornerstone for much of chemistry, its mechanisms can be complex. Researchers in the Gray group measure rates of electron exchange within diverse metals

using artificial photosynthesis. Artificial photosynthesis requires a catalyst to absorb solar energy to split water into hydrogen fuel and oxygen. Traditional catalysts for this artificial process, like platinum, tend to be expensive and scarce. Gray's group is hunting for a mixture of simple, inexpensive, and abundant metal-oxide catalysts that can mimic the complex mechanisms of photosynthesis that occur in nature.

Gray has received numerous awards and honors, including the National Medal of Science in 1986 and the California Scientist of the Year in 1988. He is a member of the National Academy of Sciences and a fellow of the American Academy of Arts and Sciences. He has also published 17 books and more than 730 research papers.

Gray will receive the Richards Medal at the NESACS meeting on March 5, 2015, where he will give an award address titled "Solar-Driven Water Splitting."



[-http://caltech.edu](http://caltech.edu)

and proteins, and have accelerated those rates for certain compounds that naturally transfer electrons very slowly.

Gray is also the director for the Center for Chemical Innovation (CCI Solar), which aims to create a clean, storable fuel from sunlight

## Professors named fellows of American Physical Society

### LORI DAJOSE

Contributing Writer

*This article was originally written for the Marketing and Communications Office and is published online at caltech.edu.*

biological propulsion—particularly using jellyfish as a model. His group aims to discover biologically inspired design principles that can be applied in engineering systems.

In addition, Dabiri oversees the Caltech Field Laboratory for Optimized Wind Energy (FLOWE), an experimental wind farm for testing the energy-generating efficiency of various configurations of vertical-axis wind turbines. By optimizing the placement of the wind turbines based on observations of schools of fish, Dabiri and his group demonstrated that power output can be increased tenfold.

Professor of Physics Maria Spiropulu is an experimental particle physicist. She has worked with particle accelerators and detectors for the past 22 years and has pioneered new methods of data

analysis in order to learn about the physics of the universe at both astrophysical and atomic scales. She was nominated by the APS Division of Particles and Fields for her work searching for evidence of supersymmetry (a theory that says that every fundamental particle has a supersymmetric partner) and extra dimensions at the Tevatron, a proton-antiproton collider at Fermilab in Illinois. Spiropulu was also noted for her work on the characterization of the Higgs boson—a long-sought fundamental particle thought to give other particles their mass—at the Large Hadron Collider (LHC) in Geneva, Switzerland.

In addition to Dabiri and Spiropulu, 39 other Caltech faculty and researchers have been elected as fellows of the APS since the program began in 1980.

## News briefs from around the globe

*Here's a brief list of events from the past week, compiled by The California Tech editors:*

### Mo Ibrahim prize given to Namibian leader

\$5M awarded to outgoing Namibian President Hifikepunye Pohamba for leadership [[BBC](#)]

### Homeland Security avoids shutdown

1-week funding extension passed by Congress in 357-60 House vote [[BBC](#)]

### Astronauts leave ISS for spacewalk

3rd time in 8 days; mission to rig cables for antennas successful [[TIME](#)]

### Afghan army to wage first solo offensive

1st offensive against Taliban w/out aid of US, NATO troops launched in Helmand [[TIME](#)]

### Murder of Boris Nemtsov sparks march

10k+ people marched through Moscow to honor Putin's fallen opponent [[BBC](#)]

### Nurse sues hospital after contracting Ebola

1st known person to contract Ebola in US in outbreak sues for inadequate training [[TIME](#)]

# Change in attitudes of society necessary to close wage gaps

*Continued from page 1*

At the bar, with the department paying for the beer, is not good enough."

How does this play out once you're in grad school and committed to the long haul? Several women I talked to emphasized the importance of cultivating a supportive group of friends. Patricia, who is nearing the end of her Ph.D., emphasized that her fellow students and postdocs were overwhelmingly not misogynists, but were nevertheless mostly clueless about the experience of women in academia. This is one of the tougher cases, wherein people who bear no ill will toward women in STEM (often the contrary) inadvertently contribute to discrimination.

Patricia shares an office with Bumper, a male grad student who has gradually become much more aware of the issues. "I had a meeting with a renowned [non-Caltech] professor on Skype. My [overcommitted] advisor couldn't make the meeting, so she sent Bumper, who works on an unrelated project, to be on the call to supervise me. [Afterwards,] I confronted my advisor, and was told I had misunderstood her intentions. I wanted to talk to renowned professors, but it was handled in a last minute, disempowering, dismissive way. It feeds imposter syndrome, if I feel my advisor thinks I can't meet with collaborators by myself. [Bumper] was mostly unaware of the squashing. It's unintentional, but still harmful. There is poor insight on part of other students."

Things eventually took a turn for the better. "A few months later at a conference, a senior professor in the field approached me and said a sexist thing right in front of Bumper and another professor. I was floored. Bumper stood up for me. I was glad, but [he] just walked away without apologizing. The fact that I had talked about my experiences and was open about it helped him realize. He started being more of an advocate after that, but it's [terrible] that a fellow grad student has to be an advocate. [I] felt that I have to call other people out and make a scene to be heard. I have to be impolite to get noticed. I would like to give my lab mates credit, as their view of me has not been negatively tainted by my confrontation. Now they come and engage more, and the situation has normalized. I was not expecting to have to do this myself when I came to grad school."

One surprisingly common aspect of Patricia's experience is that workplace sexism was perpetrated or enabled by other, more senior women in the workplace. Cynthia-Rose came under pressure from a senior (non-tenure-track) female scientist in her lab. "She was trying to help, but she was hurtful and judgmental.

She intimated that science is hard enough without being different or pursuing other hobbies. Pressure to shape up, to conform, is very common. I don't talk or act or dress 'like a scientist,' and that's seen as not appropriate for a woman in science. It is important to act like man, to play down being female. I feel I should be able to be judged

explicitly asking me to have an affair with them. These people have power over me. When I was an undergrad [at another prestigious university], I had one direct supervisor, a married postdoc with children, who asked me to have an affair with him. I said no, but it became an ongoing, repeated discussion. I've had slightly less

explicit propositions from men also working in my field at other institutions when we were at conferences together, for example. They have no direct power over me, but they're working on the same kind of stuff.

You can't just blow these people off, aggressively. There was one instance where we were at a bar and had had a couple of drinks, but otherwise these were totally sober discussions."

As an adult, Chloe enjoys going out for drinks with colleagues and professors after the day's work, especially at conferences. It's a great way to meet people, unwind, and network. "I frequently drink with professors and it's fine. I think it's not inappropriate for faculty to go have a drink with their students, to have the ability to have a personal discussion with them, to talk about imposter syndrome, career, etc. I think those discussions are appropriate if it's the student working through something emotional that has to do with work and the senior person is offering solicited advice."

A student-adviser relationship can be much more fraught if it strays too far from the professional model. A substantial minority of students, including Chloe, switch advisers during grad school. "Having the senior person solicit advice from the student for their personal emotional problems becomes more tricky. Particularly when that's tied up with the senior person's feelings, not necessarily romantic, about the student. There was an emotional weight to the relationship with my ex-advisor because he was very personally and emotionally invested in my relationship with him that was beyond 'being there' professionally. I think that was what made me

*"...we've already seen a few instances where, for a variety of reasons, research groups became hostile places for women."*

uncomfortable. To be clear, he never sexually harassed me, but he was very emotionally involved, to what I felt was an inappropriate extent. We would have these very personal discussions about his psychology toward dealing with students and how he takes things personally. I can't help but play the therapist to these grown men who should have these things figured out, or should

be seeking professional help, instead of talking to their students about their problems. That's been my biggest issue, not sexual but emotional harassment. I sincerely doubt it's happened between him and male students."

Incredibly but hardly uniquely, Chloe errs on the side of introspection and self-blame. "It's hard not to blame myself. I tend to try to talk people through their issues even if they directly supervise me. I find myself in an advisory position," a clear reversal of the professional relationship.

Patricia is quick to point out that creating a positive, inclusive atmosphere doesn't mean treating women with kid gloves. "One of my colleagues has the view that it's okay to make mistakes [i.e., inadvertent sexism], and that doesn't make you a bad person. But you're a bad person if you continue to do so, or if you don't make an effort."

Chloe finds that actions speak louder than words. "Some of the people who are most conscientious about making my department a more welcoming place for women

*"Advisers need to be human beings and realize that hardship is not gender specific. You don't need to say that women need you to be more sensitive; people of all genders benefit from reasonable advisers."*

are in practice the worst for students. I've seen advising relationships, especially for women, go horribly with them. I think it comes down to the idea that you need to treat women in a special way. I think some professors do, in some sense, view female students differently, even if it's just a ramped up anxiety over doing something wrong. The professors I get on with best are the ones that don't talk about it, they just treat male and female students the same — treat them all like people. Advisers need to be human

beings and realize that hardship is not gender specific. You don't need to say that women need you to be more sensitive; people of all genders benefit from reasonable advisers. I don't think gender is a reason to be treated differently. The situations in which I've been most comfortable are the ones in which it did not matter what gender I was."

Chloe's experience of an adviser-student relationship becoming too personal is not uncommon, but dealing with it is highly non-trivial. "It wasn't clear for me how to address this because it wasn't a situation where I was being solicited for sexual favours, which I know how to reject. I met with (Graduate Dean) Fecilia Hunt, and she gave me all the harassment policy literature. Those are designed to deal with sexual harassment [for Title IX compliance], or where it's very clear that this person is discriminating based on gender, or is asking for a [sexual favor] in return for something. It's a lot less specific or helpful if someone

is being abusive in an emotional rather than sexual way. I don't know if my being female had something to do with my treatment. It may have had something to do with my willingness to sit down and try to work through those problems."

As Chloe points out, Caltech's harassment policy would benefit from revision to cover instances of non-sexual harassment. While this is not explicitly required by law, it is clear that fostering non-threatening workplaces is in everyone's best interest.

Caltech's policy ([https://hr.caltech.edu/documents/46-citypolicy\\_harassment.pdf](https://hr.caltech.edu/documents/46-citypolicy_harassment.pdf)) begins "It is the policy of Caltech to provide a work and academic environment free of unlawful harassment ("harassment") and retaliation. Harassment is the creation of a hostile or intimidating environment in which inappropriate conduct, because of its severity and/or persistence, is likely to interfere significantly with an individual's work or education, or affect adversely an individual's living conditions."

Chloe experienced an intimidating environment due to inappropriate conduct that forced her to change advisors. But the remainder of the document provides examples relevant

to race, gender, disability, etc. without making it clear that advisors bear responsibility for preserving the professional nature of their relationship with students.

Cynthia-Rose was faced with a choice when she was subjected to sexist behavior. "I felt I should call HR right away, but I wanted to graduate more than I wanted my dignity. The [complaint] process is annoying and time consuming. I wasn't worried about reprisals, I simply did not have time for the distraction."

Lilly, whose quote opened this article, was at one point involved in an advocacy group on campus. "There are certain professors that are extremely sexist and have harassed female students, but they're protected if they're famous or bring in lots of money. In one severe case, a student was subjected to gender-specific verbal abuse in front of other several other faculty members and no one said anything."

This story highlights perceived student powerlessness against relatively rare but institutionally enabled instances of sexist behavior. "Officially, HR has a policy in compliance with Title IX. Unofficially, HR will be unable to protect you against a faculty member. [The] only approach is to leave the program or change advisers."

*It's not all bad news.*

*In the issue next week, we examine what Caltech is doing right and unpack some of the cultural obstacles facing workplace equality.*

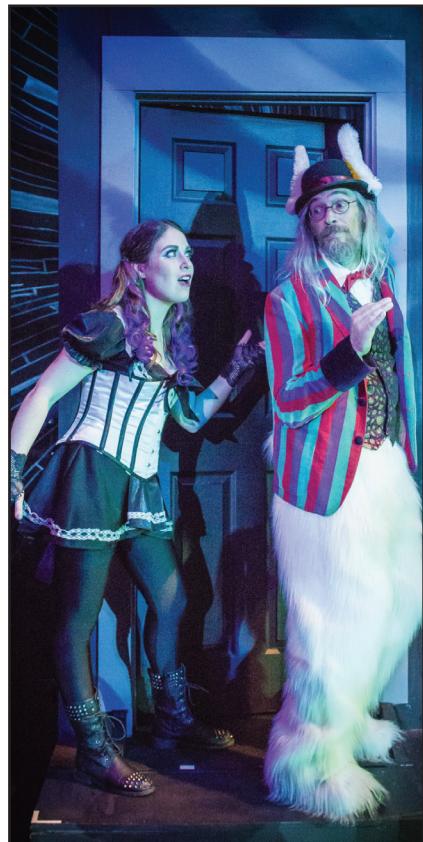
# FEATURE

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MARCH 2, 2015

THE CALIFORNIA TECH

## Techers tear up the stage in original *Alice through the Wormhole*



Undergraduates, graduate students, postdocs, and Caltech staff members came together to put on the original production of *Alice through the Wormhole*. Alice ran for two weekends in Ramo Auditorium from Feb. 20 to March 1.

Photos Courtesy of Michael L. Wong

## Women discuss gender-based difficulties of graduate school

Continued from page 1

Second, as a woman is usually perceived as less qualified even if she has the same objective qualifications as a man, she is likely to receive a lower salary offer. These are two first-order effects contributing to the 5% gender wage gap for people doing the same job. However, there are second-order effects that many people believe contribute as well. As one example, on average, men are socialized to be more confident, to be more upfront, and to have a higher view of their work than women. Thus, it is theorized that men are more likely to feel as though they deserve a raise. Additionally, as men are socialized to be more confrontational than women, it is likely that men feel more comfortable asking for a raise, and also feel more comfortable fighting for that raise if it is not immediately given.

Perhaps these are the majority of factors impacting why equally qualified men are getting paid 5% more than women for doing the same job; perhaps not. Hopefully continued research will shed light onto the issue and can propose a solution to rectifying

this particular gap. For someone earning a \$50,000 salary, that is a \$2,500 difference per year — over the 40 years someone may remain in a given career, that comes out to two years' entire salary. However, as unacceptable as the 5% gap between a man and a woman doing the same job is, the 23% gap between the average man and the average woman still needs to be discussed.

The simple answer is that men and women tend to pursue different careers. The highest paying of the most common jobs for women is “registered nurse,” making about \$1,000 per week, whereas the highest paying of the most common jobs for men is “manager,” making about \$1,300 per week. Assuming four weeks of unpaid vacation, that gives a \$14,400 per year difference; that’s 30% of the nurse’s salary, in this approximation. In vacuum, this would be a satisfactory explanation: women are getting paid less because they are picking careers that pay less. Unfortunately,

an individual’s choice in careers is not made in vacuum, and is heavily shaped by experiences even before college. It is well-established that girls are pushed away from math and science — the basis for most of

the highest paying jobs available, as well as technological fields, which are among the fastest-growing sectors of the economy — even as toddlers. Boys are taught to be vocal and take leadership positions (traits which get one paid more once in a given career path), while girls are taught to be quiet and follow orders. This leads the children to develop different interests and behavioral traits, which shapes the careers they later choose. Until children are free to explore their interests and choose careers without external pressures placed on them because of their gender, any gender wage gap has to be considered as part of marginalization, rather than benign preference.

However, the issue of wage gaps becomes even more difficult when one considers “intersectional” factors. Intersectional factors are those that come from an individual belonging to more than one marginalized group (women of color, gay women, transgender women, poor women, disabled women, etc.). For example, Hispanic women earn 89% of what Hispanic men do, and only 53% of what white men earn. Black women earn 89% of what black men do,

and 64% of what white men earn. Even Asian women only earn 79% of what Asian men earn and 87% of what white men earn, despite being “model minorities” — a minority that is considered to be as successful or more successful than those who are not marginalized. The same factors that are believed to cause women to seek lower paying jobs than men also cause racial minorities to seek lower paying jobs than white people.

Within a given racial demographic, there is serious disparity between education levels. Hispanic women with a high school diploma make about 61% of those with a bachelor’s degree; black women with a high school diploma make about 57% of those with a bachelor’s degree. For white women, those with a high school diploma make 61% of those who have a bachelor’s degree, and for Asian women, it’s 53%. At first, this seems reasonable and fair — until one remembers that the education level one attains is very closely related to the income level of one’s parents. No one is arguing that one should be paid the same for having fewer qualifications, of course; however, the income level of one’s parents should not dictate

the educational opportunities an individual has.

Wage gaps based on gender, race, and childhood poverty are, unfortunately, more complicated problems than they would seem at the surface. More research is necessary to understand how to entirely combat all the factors that create these gaps, and more societal change is necessary to fix the factors that are already understood, like socialization. However, at the individual level, each person can choose to encourage all children to pursue their interests and foster interest in topics that can lead to higher paying fields, as well as encourage boys and girls of all racial demographics to develop strong leadership skills and confidence. Further, each person can work on becoming aware of their own biases — both conscious and unconscious — and actively work to eliminate them to prevent personally contributing to marginalization. While this will not solve the entire problem, it will certainly be a solid start.

In addition to the ones mentioned above, more facts and statistics on the gender wage gap can be found at <http://www.aauw.org> and <http://www.womensorganizations.org>.

# Track is in season and now we are off to the races

**GOCALTECH.COM**

Actual Sports Content Editor

CLAREMONT, Calif. (Feb. 21, 2015) – Junior Aditya Bhagavathi (West Windsor, N.J. / West Windsor-Plainsboro North) recorded a top-three time in program history in the 3000-meter run to lead an all-around successful day for the Caltech men's and women's track and field team at the Pomona-Pitzer All-Comers meet on Saturday.

"We focused on competing against the high-quality fields across all events and found that brought us solid performances," Head Coach Ben Raphelson said.

Bhagavathi dropped 12 seconds from his previous personal best to clock in at 8:43.28, placing seventh against a deep field that included several key conference competitors. The junior ran wide for a significant portion of the race as he moved up in the field, but overcame the extra distance with a strong finish to come in just three seconds off the program record of 8:40, set by the same runner, Ian Shapiro, whose 8k mark he broke in cross country this past fall.

"Aditya is getting better and better at competing," Raphelson said. "He had work to do early to make his way through the crowded field, but he stayed calm and executed a great race. He mixed it up with

some highly accomplished runners and showed that he's a force to be reckoned with in the conference."

Junior Alex Anemogiannis (Atlanta, Ga. / Marist School) joined Bhagavathi in the 3000m for his first track race in nearly two years after dealing with an injury and also posted a career-best time. Senior Jared Forte (Lake Elsinore, Calif. / Elsinore) gave Caltech more reason to celebrate as he contended for the top finish in his heat of the 1000-meter run.

Senior Victor Duan (Darien, Ill. / Illinois Math and Science Acad.) and junior Kevin Yei (Carlsbad, Calif. / La Costa Canyon) each shaved .22 and freshman Alec Ho (Vancouver, Wash. / Columbia River) dropped .13 off their 100-meter dash times and even more in their 200-meter dashes from the Caltech All-Comers meet two weeks prior. Duan chopped off over a full second in the 200m, posting a 24.77, while Yei and Ho trimmed another .63 and .47, respectively.

On the women's side, sophomore Lucy Chen (Boonton Township, N.J. / Mountain Lakes) and freshman Serena Delgadillo (Denton, Texas / Texas Acad. of Math and Science) improved in both sprint events as well. Chen recorded perhaps the best performance of the day with more than a full-second drop from her time at the Caltech All-

Comers meet two weeks prior in the 200-meter dash, clocking in at 31.28 while Delgadillo shaved .66 off her time to just miss breaking the 30-second barrier. Delgadillo cut another .32 from her 100-meter dash time while Chen dropped .07.

"Our sprint squad showed consistent gains over their marks from two weeks ago," Raphelson said. "As coaches, we didn't have to say much to them after each race. They've developed a solid technical awareness and already knew what they need to work on. That should lead to some very productive practices."

Freshmen Caroline Atyeo (Parkland, Fla. / Marjory Stoneman Douglas) and Christopher Haack (New York City, N.Y. / The Browning School) rounded out the running events in the 1000-meter and mile runs, timing in at 3:14.43 and 5:29.31, respectively.



*He's beauty, he's grace, he'll run really fast in a race. Aditya Bhagavathi makes running look effortless.*

-<http://gocaltech.com>

In the field events, junior Morgan Hill (San Diego, Calif. / Wasatch Acad.) placed fifth in the hammer with a throw of 118 feet, five inches while Delgadillo improved by .18 meters in the long jump, clearing 4.05 meters, and Chen leaped .04m further.

## John Galden continues to hit the ball, which is a good thing

**GOCALTECH.COM**

Actual Sports Content Editor

THOUSAND OAKS, Calif. (Feb. 28, 2015) – Sophomore John Galden (Columbus, Ohio / St. Charles Prep) recorded a fifth straight hit in as many at-bats as the Caltech baseball team squared off at No. 9 Cal Lutheran University in a SCIAC doubleheader on Saturday afternoon.

After going 3-for-3 in Friday's series opener, the second baseman singled in his first two at-bats of the doubleheader.

Cal Lutheran took both games to improve to 8-1 overall and 5-1 in the SCIAC, while Caltech is now 0-12 (0-9).

Game 1: Caltech 1, No. 9 Cal Lu 18

The Beavers wasted no time getting going in the first game, as junior Daniel Chou (Blue Bell, Pa. / Wissahickon) led off with an infield single, advanced to second on a sacrifice bunt by senior Ryan Casey (Valencia, Calif. / Valencia) and came around to score on an RBI single right up the middle by freshman Chris McCarren (Kenilworth, Ill. / North Shore Country Day) for the 1-0 lead. Cal Lu hit right back with four runs in the bottom of

the frame, though, and added three more in the second.

After senior Derek Kearney (Carlsbad, Calif. / La Costa Canyon) recorded a 1-2-3 third inning, the Kingsmen put up another six runs in the fourth, one in the fifth and four in the sixth to end the game. Caltech had a pair of golden opportunities to score, loading the bases in the fifth inning and putting runners on second and third in the sixth, both with no outs, but could not capitalize.

Game 2: Caltech 0, No. 9 Cal Lu 18

The Kingsmen stayed hot in the nightcap, scoring 13 runs in the first three innings. Caltech had a chance to get on the board in the top of the third inning as junior Dylan Schultz led off with a single and Chou joined him on the base paths with just one out, but a double play ended the frame. That would be the Beavers' best opportunity to score, while Cal Lu added four more runs in the fifth and a final in the sixth.

Chou ended the day 2-for-7 with the Beavers' lone run scored, while Schultz also impressed at the plate, going 2-for-3, including a pinch hit single in the first game.



*John Galden waits expectantly for his burrito to arrive.*

Photo Courtesy of Nhi Casey (via <http://gocaltech.com>)



*Caltech alumnus Mel Levet (BS '39, MS '40) joins the young Beavers and throws the first pitch against Occidental. It's nice to have former athletes come back and strut their stuff.*

Photo Courtesy of Lance Hayashida/Caltech Marcomm (via <http://gocaltech.com>)

## Men's tennis picks up victory, doesn't want to set it down

**GOCALTECH.COM**

Actual Sports Content Editor

PASADENA, Calif. (Feb. 27, 2015) – The Caltech men's tennis team picked up its first win of the season with an 8-1 victory over Hope International University on Friday afternoon.

The Beavers move to 1-3 on the season while the Eagles drop to 0-8.

With HIU a player short, Caltech was awarded a default victory at #3 doubles, and quickly made it 3-0 as the #1 pairing of sophomores Ruthwick Pathireddy (Irvine, Calif. / Whitney) and Sathwick Pathireddy (Irvine, Calif. / Whitney) won 8-1 and

the #2 duo of sophomore Morgan Lebby (Laguna Beach, Calif. / Laguna Beach) and junior Rushikesh Joshi (Sunnyvale, Calif. / Archbishop Mitty) won, 8-4.

A default at #6 put Caltech within just one point of clinching the match, and that came sooner than expected as Ruthwick Pathireddy's opponent at #2 singles retired down 3-0 in the first set.

Lebby made short work of his foe at #4 singles, winning 6-0, 6-1, followed by junior Alexander Henny (Scarborough, Maine / Scarborough) at #5 (6-3, 6-0) and Sathwick Pathireddy at #3 (7-6 [1], 6-1) for Caltech's final point.



*I legitimately don't know who is in this photo but it could be either Ruthwick or Sathwick Pathireddy...regardless, look at that game face.*

-<http://gocaltech.com>

# ASCIT Minutes

## ASCIT Board of Directors Meeting

Minutes for 27 February 2015. Taken by Sean McKenna.

**Officers Present:** Cat Jamshidi, Nima Badizadegan, Patrick Nikong, Sean McKenna

**Guests:** Margaret Lee, Elliott Simon, Chris Dosen

**Call to Order:** 8:06 pm

### President's Report (Cat):

- The proposed BOC Bylaw changes will be put to a vote on March 9th, the same day as the IHC/CRC/BoC/Tech elections
- As frosh make decisions on declaring majors, the Dean's Office would like to remind students of the availability of the Independent Studies Program.
- Midnight Donuts will happen on Wednesday the 4th.

### Officer's Reports:

- V.P. of Academic Affairs (ARC Chair: Nima):**
  - Take a prof to lunch! You get reimbursed by ASCIT. Check out the ARC website for more details.
- V.P. of Non-Academic Affairs (IHC Chair: Connor):**
  - Event registration is online now
  - House endowment payouts are more regular now.
- Interim Director of Operations (Sean):**
  - Take a prof to lunch! You get reimbursed by ASCIT. Check out the ARC website for more details.
  - Ping pong table is now ready for use. Contact Sean if you lose the balls or paddles.
- Treasurer (Patrick):**
  - Budget is going along with no major changes.
- Social Director (Annie):**
  - Absent
- Secretary (Sean):**
  - Nothing to report.

If anyone has any questions or concerns about a section of the minutes please email the appropriate officer. We are happy to answer any questions. The next meeting will take place on March 6th at 8pm in SAC 15.

**Meeting Adjourned:** 8:33

**YOU ARE NEVER ALONE.**

**REMINDER FROM  
THE COUNSELING CENTER:**

Meditation Mob  
(drop-in mindfulness  
meditation group)  
Meets every Tuesday  
Bottom floor of Winnett  
12:00-12:50 pm

## 2015 CALTECH UNDERGRADUATE WRITING PRIZES

Each year the division of Humanities and Social Sciences awards a number of prizes for undergraduate writing. Consider submitting your work to be recognized and rewarded for your work as a writer.

**Submit your Writing this year for these prizes:**

### MARY A. EARL MCKINNEY PRIZE IN LITERATURE

AWARDED TO THE BEST ORIGINAL POETRY AND FICTION. SUBMIT UP TO 3 POEMS. FICTION SHOULD NOT EXCEED 12,000 WORDS.

Prize amount: \$ 500.00/each category

### HALLETT SMITH PRIZE

Awarded to an outstanding essay related to the work of Shakespeare.

Prize amount: \$500.00

### Submission Guidelines:

#### Deadline: April 3<sup>rd</sup>, 2015

Only currently enrolled full-time students may submit. Entries should be double-spaced PDFs. Winners will be announced in June, and winners' names will be in the commencement program. Winning writing will be archived using CODA through the Caltech Library. Email entries to Sini Elvington at [elvington@hss.caltech.edu](mailto:elvington@hss.caltech.edu), noting the prize to which you are applying in the email subject and filename.

Contact Sini Elvington at [elvington@hss.caltech.edu](mailto:elvington@hss.caltech.edu) with any questions

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The advertising deadline is 5 PM Friday; all advertising should be submitted electronically or as camera-ready art, but *The Tech* can also do simple typesetting and arrangement. All advertising inquiries should be directed to the business manager at [tech@caltech.edu](mailto:tech@caltech.edu). For subscription information, please send mail to "Subscriptions."

## Caltech Public Events Hiring Ushers

**Flexible hours.**

**No experience needed.**

**Outgoing Personality.**

**Pay Rate:**

**\$15 per hour**

## Caltech Students only!!

**Contact: Adam Jacobo**

**626.395.5907**

**[ajacobo@caltech.edu](mailto:ajacobo@caltech.edu)**

# FEATURE

THE CALIFORNIA TECH

MARCH 2, 2015

7

## Brad/Chad Business Tutorial: How do I make money with this big data thing?

**BRAD CHATTERGOON**  
Contributing Writer

Hey Caltech. Week 9, whoop whoop. I'm omitting a monologue this week. Hopefully people still read the article...

Companies often know more about this than we would like to think. Case in point: Target was able to discern from a newly pregnant teenager's purchasing trends that she was in fact pregnant, much in advance of her father knowing.

Although, it did come to his attention by the coupons that were delivered to said teenager from Target via snail mail.

This kind of insight into our behavior is not uncommon. The interesting thing about humans is that while on the micro-level our behavior is fairly haphazard and, say, "unique," when we aggregate behavior to the macro-level it becomes clear that our behaviors are much more similar than they are different. So how do we take advantage of that? How do businesses take advantage of that? Welcome to the world of data analytics.

Within data analytics there is a very niche subfield called data science, with people in that field called data scientists. Data science is defined by the intersection of three areas, applied mathematics, computer science and business. Missing one of those three means that the skill set under consideration will fall outside the realm of data scientist.

The role requires working knowledge of applied mathematics principles to work with the large data sets which are stored as matrices. Knowledge of optimization techniques, linear transformations, and matrix manipulation is necessary to understand the algorithms to work with the data.

A computer science background is necessary because the role involves a lot of coding and working with scripting languages and data manipulation. The computer science background is also relevant for understanding and implementing machine

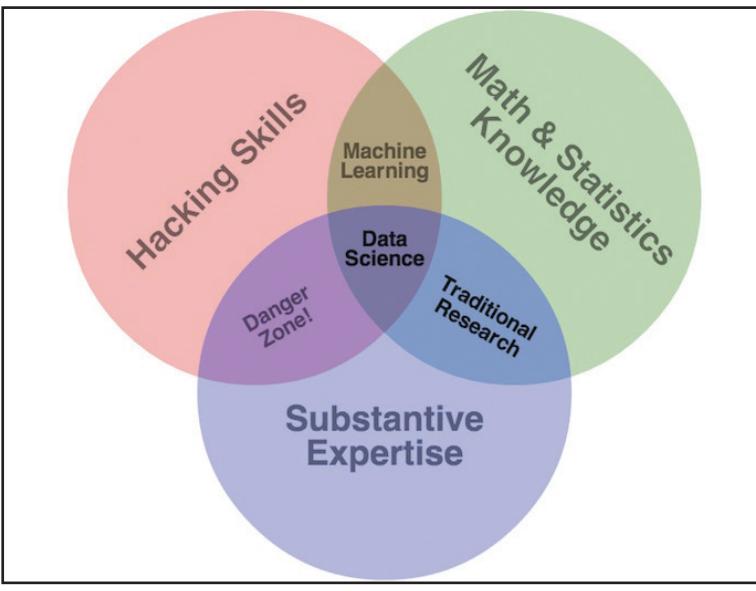
learning protocols, which are key tools for determining what the data available implies about consumer behavior. Examples of extremely useful tools are unsupervised learning algorithms, such as cluster analysis, and supervised learning algorithms, like Bayesian statistics. The theory behind these algorithms also links back to applied mathematics principles.

The business intuition introduces a non-technical aspect to the job and is in general what separates a data scientist from a data analyst. The most important detail that businesses want to know is, "How does this data analysis help us increase our bottom line?" It is the responsibility of the data scientist to come up with strategic suggestions based on the information contained in the data. In particular, Target's data scientists decided that the company should send out targeted ads in order to boost sales.

So how do I become a data scientist at Caltech? In most cases the role is filled by advanced degree candidates, either a Ph.D. or master's degree holder.

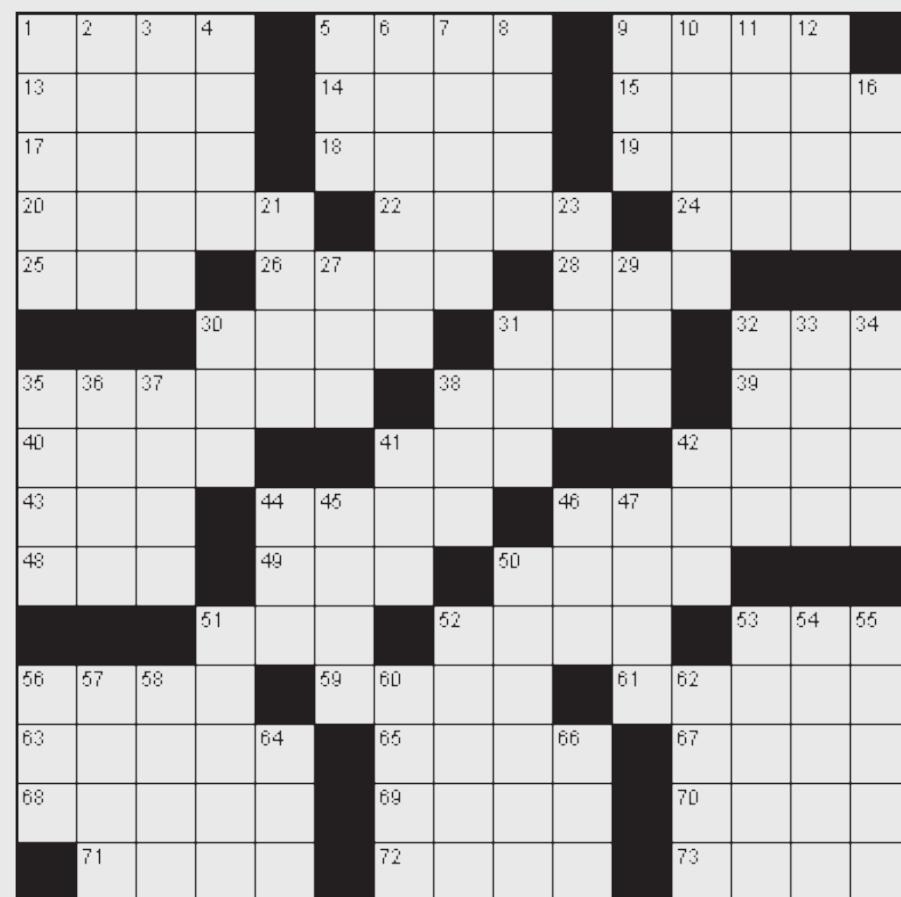
However it is possible to simulate the necessary qualifications solely through undergrad by doing an ACM/BEM double major with a minor in CS, which is no small feat. Decide early if that is the path that you want to choose. If you would like to whet your appetite for the field I strongly recommend taking BEM/Ec 150: Business Analytics. The class is being offered for the third time this spring term. It is taught by Lloydie alum Dr. Alice Lin, who earned both her bachelor's degree and Ph.D. from Caltech and spent some time in consulting with both Bain & Co. and BCG. I took it last year and it really set me on the data science path. The course will also help put some application perspective on classes like CS/CNS/EE 156A: Machine Learning, and ACM/CMS 113: Mathematical Optimization. At the very least, it helps fulfill the social science requirement through interesting and applied coursework.

-Brad/Chad



<http://www.mitforumatlanta.org/>

## Crossword



<http://puzzlechoice.com>

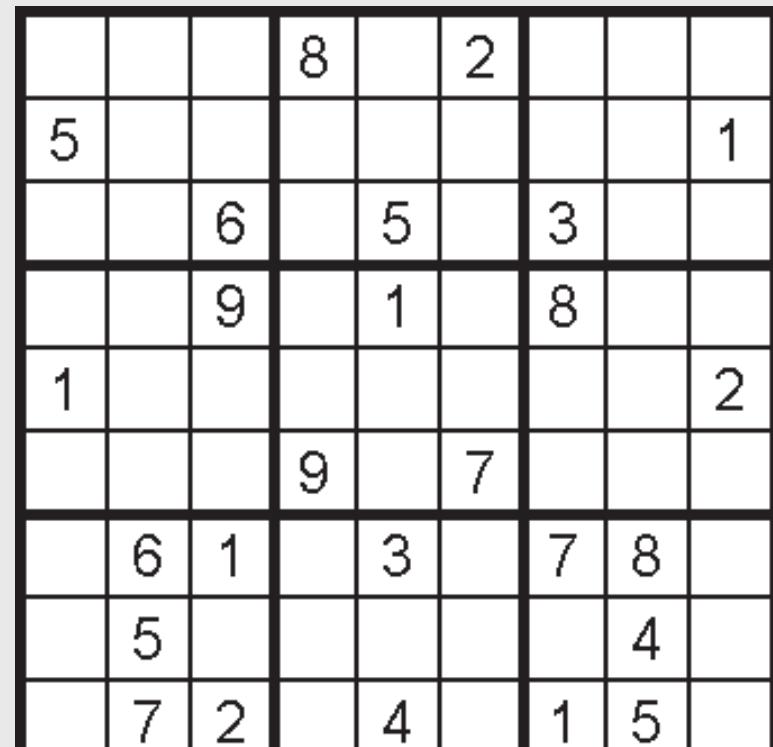
### Across

1. Passport endorsement
5. Take notice of
9. Bitter quarrel
13. Golf club
14. Notion
15. Pointer
17. Young male horse
18. Grime
19. Tenet
20. Heavy block where hot metals are shaped
22. Prejudice
24. Notable achievement
25. Cereal grass seed
26. Not in use
28. Pastry item
30. Color
31. Animal coat
32. Travel a route regularly
35. Modernize
38. Charter
39. Regret
40. Narrow secluded valley
41. Part of a journey

### Down

42. Scintilla
43. On the sheltered side to deceive
44. Something intended to deceive
46. Small storeroom for food
48. High-pitched bark
49. Peculiar
50. Pack of cards
51. Append
52. Conceited
53. Small fruit seed
56. Endure
59. Slender
61. Evade
63. Theatrical performer
65. In addition
67. Region
68. Musical instrument
69. Without speed
70. Approach
71. Sketched
72. Rational
73. Small wooded hollow
74. Part of a journey
1. Clergyman
2. Satire
3. Figure out
4. Not in favor of
5. Concealed
6. Comestible
7. Spooky
8. Information
9. Craze
10. Wear away
11. Exhort
12. Concave shape
16. Batch
21. Rhythmicity
23. Incite or stimulate
27. Scheduled to arrive
29. Anger
30. Prohibit
31. Mediterranean fruit
32. Poke
33. Stringed instrument
34. Period of time
35. Horrible
36. Supplication
37. Unfathomable
38. Jinx
41. Boy or man
42. Irritate
44. Brick carrier
45. Betting ratio
46. Hawaiian garland
47. Skin condition
50. Sweet dark purple plum
51. Make amends
52. Country house in ancient Rome
53. Food processed in a blender
54. Paragon
55. Sometimes found in an oyster
56. Circuit
57. Turns litmus paper red
58. Celestial body
60. Young girl
62. Bring ashore
64. Angry dispute
66. Be indebted to

## Sudoku



<http://puzzlechoice.com>

## Acquired Taste



Dr. Z

## "Registration"

I read up on all the Hums. I've made 5 contingency plans. I've read all the TQFRs and I have completed the blood sacrifice.

I AM READY!

7:45 am



Liz Lawler

## Answers to previous crossword

S	T	E	M		H	A	D		C	H	A	R
T	U	L	I	P	E	W	E		C	R	A	V
A	B	A	S	E	E	E	L		H	O	T	E
G	E	N	E	R	A	L	F	L	W	O	E	R
					R	I	D	S	T	I	R	
F	I	G	L	O	D	E	T	U	S	S	L	E
I	R	I	S	R	E	N	T	S	A	L	O	N
R	A	V	E	E	N	S	U	E	N	E	W	T
S	T	E	E	D	T	U	R	N	D	E	E	R
T	E	N	D	E	A	F	A	R	P	R	Y	
					C	E	L	C	O	T		
B	R	A	V	A	D	O	S	T	A	U	N	C
R	A	P	I	D	C	U	E	S	T	O	L	E
A	I	S	L	E	U	S	E		T	O	T	A
G	L	E	E		S	A	P		R	E	N	D

[-http://puzzlechoice.com](http://puzzlechoice.com)

## Answers to previous Sudoku

2	4	9	7	1	3	6	5	8
6	1	8	5	9	2	3	4	7
7	3	5	8	4	6	9	2	1
8	6	4	2	7	5	1	9	3
5	9	7	3	8	1	2	6	4
1	2	3	9	6	4	8	7	5
3	5	6	4	2	8	7	1	9
9	8	2	1	5	7	4	3	6
4	7	1	6	3	9	5	8	2

[-http://puzzlechoice.com](http://puzzlechoice.com)

# Ask Dr. Dirge:

## *taking you from P to P/poly*

**DR. DIRGE**  
Not a Doctor

**How do I balance house activities with academic life?**

This is an interesting question. We can consider this to be a simple optimization problem. There are actually three possible ways to spend time here (discounting errands and other such things); house activities, schoolwork, and other ways of spending free time. The ideal amount of schoolwork that you want to do is the amount of schoolwork that interests you plus the amount of schoolwork that does not interest you but that you need to complete to get a sufficient grade in classes. Now, what counts as a sufficient grade? The answer is simple; a grade is sufficient when it will help you achieve your goals. Grades are not an end in itself, but a means to an end (like jobs or graduate school). Thus, it is not necessary, and even unfeasible, to get an A or A+ in every class. The main purpose of grades is to signal that you have learned the class material, and thus you should spend enough time on your schoolwork to make sure that this is achieved.

Unlike most schoolwork, house activities are often fun. They involve people that you

know well and are friends with, and it can be easy to get caught up in these activities. I say, let yourself get caught up in these activities sometimes. One thing that I have found is that it is always possible to make time for activities by not spending so much time wasting time on distractions like the Internet. When you look back on your experience at Caltech in several years, what will you remember? Will you remember what you spent long hours working on, or will you remember the awesomeness that you and your friends made happen?

**How do I deal with a constant feeling of inadequacy?**

Have you ever been to Wal-Mart?

**What advice do you have about dealing with people?**

Don't.

**I'm a frosh! How do you not act froshy?**

Wait 12 months.

To submit questions, send email to [askdrdirge@gmail.com](mailto:askdrdirge@gmail.com)

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