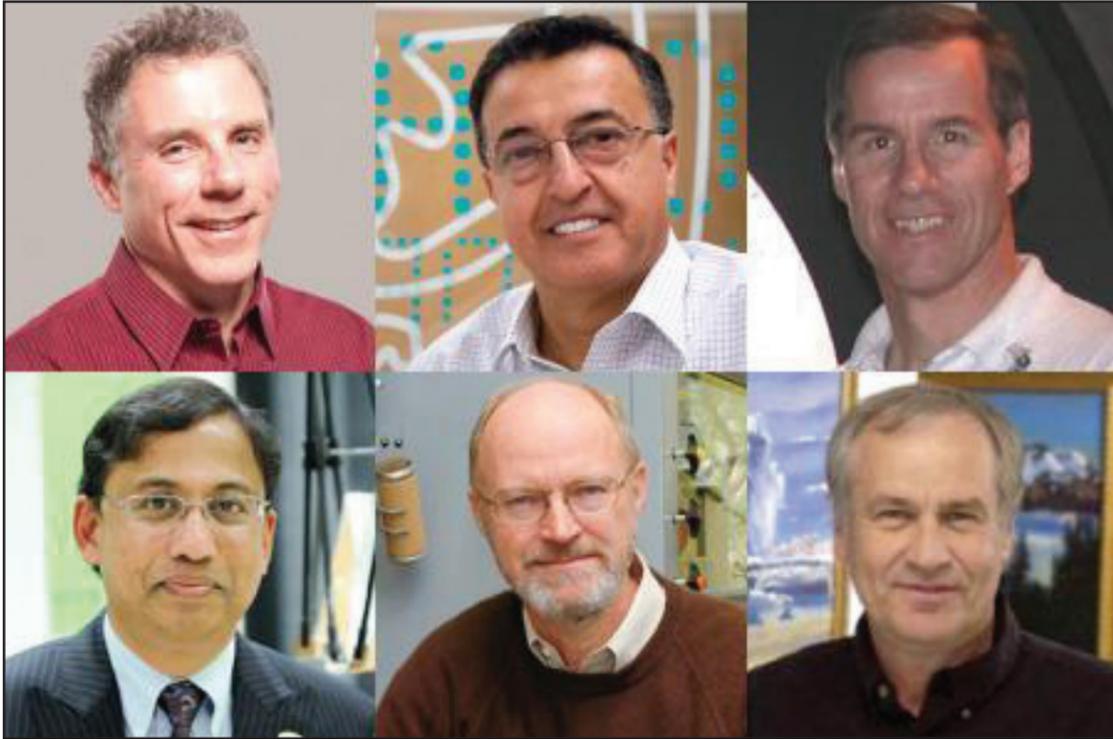


## Six from Caltech, JPL elected to National Academy of Engineering



(Clockwise from top left) Harry Atwater, Mory Gharib, Dan Goebel, Graeme Stephens, Robert Grubbs, and Ravi Ravichandran were among the 67 new members welcomed to the National Academy of Engineering.

**LORI DAJOSE**  
Contributing Writer

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

Six members of the Caltech community—Caltech professors Harry Atwater, Mory Gharib (Ph.D. '83), Robert Grubbs, and Guruswami (Ravi) Ravichandran, and JPL staff members Dan M. Goebel and Graeme L. Stephens—have been elected to the National Academy of Engineering (NAE), an honor considered among the highest professional distinctions accorded to an engineer. The academy welcomed 67 new American members and 12 foreign members this year. Included among the new class are four Caltech alumni, Dana Powers (B.S. '70, Ph.D. '75), Michael Tsapatsis (M.S. '91, Ph.D. '94), Vigor Yang (Ph.D. '84), and Ajit Yoganathan (Ph.D. '78).

**Harry Atwater**, the Howard Hughes Professor of Applied Physics and Materials Science and director of the Resnick Sustainability Institute, was cited for his contributions to plasmonics—the study of plasmons, coordinated waves of electrons on the surfaces

of metals. Atwater is developing plasmonic devices for controlling light on a nanometer scale. Such devices could be important for the eventual creation of quantum computers and more efficient photovoltaic cells in solar panels.

**Mory Gharib** is the vice provost for research and the Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering. His election citation notes his contributions to fluid flow visualization techniques and the engineering of bioinspired medical devices. Gharib's biomechanical studies are often coupled with medical engineering; for example, by studying the fluid dynamics of the human cardiovascular system, he and his group are better able to develop new types of prosthetic heart valves.

**Dan M. Goebel**, a senior research scientist at JPL, was honored for his contributions to low-temperature plasma sources for thin-film manufacturing, plasma materials interactions, and electric propulsion.

**Robert Grubbs**, the Victor and Elizabeth Atkins Professor of Chemistry and coreipient of the 2005 Nobel Prize in Chemistry, was elected for the development

of catalysts that have enabled commercial products. For example, Grubbs and his team developed a new method for synthesizing organosilanes—basic chemical building blocks. Normally these molecules are made with expensive and rare precious metals, but Grubbs's group has found a way to catalyze the reaction using a cheap and abundant potassium compound.

**Guruswami (Ravi) Ravichandran** is the John E. Goode, Jr., Professor of Aerospace, professor of mechanical engineering, and director of the Graduate Aerospace Laboratories (GALCIT). He is cited by the NAE for his contributions to the mechanics of dynamic deformation, damage, and failure of engineering materials. Ravichandran has studied the behavior of polymers under high pressures and strains, and how the peeling of an adhesive material—like Scotch Tape—may be modeled as a crack propagating in a medium.

**Graeme L. Stephens**, the director of JPL's Center for Climate Sciences, was elected by the Academy for the elucidation of Earth's cloud system and radiation balance.

## Caltech alumnus wants to connect world to Internet

CALTECH ALUMNI ASSOCIATION

*Cyrus Behroozi wants to connect the whole world to the Internet.*

*"Two-thirds of the world's population still doesn't have access," says Behroozi, an engineer with Google X, the Internet giant's experimental division. Although it's easy to think of the Internet as a luxury, he says, it's now inextricably tied to economic development.*

*Considering that Google X is most widely known for engineering the driverless car, its solution to global connectivity might seem charmingly low-tech—balloons. But these aren't everyday balloons. Behroozi leads the network engineering for Project Loon, an ambitious experiment by Google X that's focused on creating a global wireless network of balloons floating around the world 12.5 miles (20 kilometers) aboveground, within the stratosphere—twice the elevation flown by commercial airlines.*

*We spoke with Behroozi to hear about his path from Caltech to Google's lofty experiment.*

### Tell us about your time at Caltech.

My parents were physicists, and I had grown up with a bit of hero worship for Richard Feynman. So when I arrived at Caltech, I felt that I had found "my people." I fell under the wing of physics professor Ken Libbrecht (BS '90), who at the time was very interested in Bose-Einstein condensates [cooling subatomic particles to near absolute zero so that they coalesce into larger structures, in some cases observable on a macroscopic scale]. Being able to trap and observe atoms has a very obvious "cool factor," so I continued to pursue it after graduation. A couple of years later, I was part of a research team at Harvard that was able to slow down light traveling through a Bose-Einstein condensate. That project received a lot of press and really seemed to capture the imagination of the public. Jay Leno even made a joke about it: "Researchers announced that they were able to slow light. You know how they did it? They took a laser and aimed it through the post office."

### What exactly are Google X and Project Loon?

Google X is a research lab of Google, but it's not just focused on problems related to the company's core business. We look for big problems that might require radical solutions and breakthrough technologies. The self-driving car is perhaps our best-known project and a great example. The problem: People are generally terrible drivers; we cause traffic jams and get into accidents. A radical solution might be to teach computers to drive. Technology exists that might make that possible, but it's an enormous challenge to implement it. So—big problem, radical solution, breakthrough technology.

Project Loon is an attempt to solve the problem of Internet access around the world. Right now, two-thirds of the world's population does not have the ability to use the Internet. You might consider it a luxury, but access is now so closely correlated with economic development. There is an emerging global digital divide. People in developing countries could be greatly helped by gaining access.

So that's the problem: global Internet access. The radical approach and the breakthrough technology are doing it by balloon—and not just stationary balloons hovering over one location and providing access to a small group willing to pay for it. Most likely, that approach actually turns out not to be technologically feasible. Instead, the idea is to let the balloons float freely, travel with the winds in the stratosphere, and have just enough of them that as some drift out of range, new balloons come from the other direction to take their places.

### Why balloons? Why not use satellites?

Well, satellites are also a great solution, but they're extremely expensive to launch. There's a long time delay between when a satellite is proposed, when it's built, when you can get a launch window, and the duration that it has to last in orbit to sort of pay for itself. You might be developing technology for a satellite that launches five years from now. It has to last for the next 10 years to become economically viable.

*Continued on page 2*

See page 4 for candidate statements for Off Campus BoC rep and Off Campus CRC rep.

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# Caltech Y Column: News and events

## 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.

Founded by students in 1916, the Y was organized to provide extracurricular activities planned and implemented by students as an opportunity to learn leadership skills and discover themselves. 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. Reproducibility in Science Seminar Series: A Conversation with Prof. Pietro Perona

Tuesday February 24th | Noon - 1pm | Avery Library | Lunch is provided, but space is limited

RSVP Required

For the next installment of our scientific reproducibility series, we will be discussing quantitative methods in biology and publication standards. This topic is relevant because research in biology has steadily become more reliant on analytical methods, yet many biologists are not formally trained in mathematics or statistics. We aim to address how this trend has impacted reproducibility. Prof. Perona will give a short introductory presentation on his experiences followed by an open question and answer session.

Dr. Pietro Perona is the Allen E. Puckett Professor of Electrical Engineering at Caltech. He is the director of the NSF Engineering Research Center in Neuromorphic Systems Engineering. He also directs the Computation and Neural Systems PhD program centered on the study of biological brains and intelligent machines. Professor Perona's research centers on vision. His research is focused on the computation foundations of vision to help design machine vision systems. He has contributed to the theory of partial differential equations for image processing and boundary formation, and to modeling the early visual system's function. He is currently interested in visual categories and visual recognition.

Presented by the Caltech Y Social Activism Speaker Series. RSVP at <https://docs.google.com/forms/d/1jxkRNpJezqygmS0sJ7YkU9VTMVJrQpB4dvWrDUaCR90/viewform>.

#### 2. Horseback Riding at Griffith Park

Monday | February 16th | 9:15 AM

Want to go horseback riding through the dusty trails of Griffith Park? Sign up for the Caltech Y Explore LA series Horseback Riding event!

Where: Meet at the Caltech Y (505 S. Wilson Ave) to fill out

waivers; drive to Circle K Ranch (about 30 min away).

Price: \$15 per person for one hour of riding, paid the day of, in cash.

Transportation is not provided. Since sign-ups are first come, first serve, and there is limited space, you are expected to come if you RSVP. Please RSVP here: <http://goo.gl/forms/oTTTCF9ckh2>. A confirmation email will be sent out by Friday, 2/13.

#### 3. Federal Work Study Through the Caltech Y

There are many opportunities for community service through the Caltech Y. All are welcome and encouraged to volunteer. Students receiving Federal Work Study can also earn \$20 an hour for doing select community service programs through the Caltech Y!

#### Caltech Y Front Desk (ongoing)

Work during office hours (9am-5pm) at the Caltech Y. Duties include checking out equipment, answering phones, making reservations, and other duties as assigned. For more information email [amychoi@caltech.edu](mailto:amychoi@caltech.edu).

#### Rise Tutoring (Monday-Thursday from 4-6pm)

Tutor 8th-12th grade students in math and science at Caltech. For more information visit: [http://caltechy.org/programs\\_services/tutoring/](http://caltechy.org/programs_services/tutoring/)

Hathaway Sycamores Tutoring (every Monday) - Volunteer at Hathaway-Sycamores, a group that supports local underprivileged but motivated high school students. There are a variety of ages and subjects being tutored. 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).

Pasadena LEARNS Tutoring (every Friday) - Come volunteer at Madison and Jackson Elementary School! We are partnered with the Pasadena LEARNS program and 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 [vkumar@caltech.edu](mailto:vkumar@caltech.edu).

#### 4. Alternative Spring Break Multiple Locations | Multiple Dates | More Info Coming Soon

Explore a new place, meet new people, serve a community, and have fun! Join other Caltech Students experiencing a non-traditional spring break volunteering in the community.

Trips under consideration this year include: Catalina and Monterey Bay. More info and applications coming soon.

#### 5a. Pasadena LEARNS

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

Come volunteer at Madison and Jackson Elementary School! We are partnered with the Pasadena LEARNS program and 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 [vkumar@caltech.edu](mailto:vkumar@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. There are a variety of ages and subjects being tutored. 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

#### Community Science Event At Caltech

Monday | March 2nd | 4:30 - 7:30 PM | Winnett

Our first Community Science Event will be headlined by Prof. Ken Libbrecht on the topic "The Secret Life of a Snowflake." It is free to all K-12 teachers and volunteers who wish to participate (meal provided).

The intended audience is K-12 teachers with an interest in working together to create lessons taking into account new NGSS and Common Core guidelines. We welcome volunteers to host lab activities and demonstrations as well.

The events will be held in Winnett, with a schedule as follows:

4:30 pm to 5:30 pm -- Keynote seminar by Prof. Ken Libbrecht

5:30 pm to 6:30 pm -- Activities and lab demos by partners

6:30 pm to 7:30 pm -- Collaborative lesson creation by teachers.

Caltech volunteers (undergrads/grads/post docs/staff...) are needed. Register here: <http://csa.caltech.edu/cseVolunteer>. More info can be found at: <http://csa.caltech.edu/cse>

#### PCC Veterans Tutoring Program

Flexible Schedule | Tutor on Caltech's Campus or at PCC's Veterans Resource Center

Veterans at PCC Need Your Help! Tutors are needed in: Math, Physics, Chemistry, and Life Sciences with particular needs in Study Skills, Homework Review and Test Preparation. The Veteran students at PCC would appreciate a little extra support to prepare themselves for their civilian and academic careers. Having been out of school for several years creates special challenges that you can help them overcome. An hour or two per week could be a huge boost! How can you help? One-on-one tutoring sessions with self-identified Veterans. For more information and to volunteer contact Urte H. Barker at [udbarker@ix.netcom.com](mailto:udbarker@ix.netcom.com) or 626.379.7471.

# Balloons offer road to Internet

*Continued from page 1*

So you're dealing with technology that might be 10 or 15 years old by the time it really gets used.

With balloons, we have more flexibility. We can make them cheaply. We can launch and iterate the technology on a month-by-month basis. So it's sort of low-stakes aerospace. We get the altitude and coverage similar to a satellite and gain the ability to iterate quickly—all at a much lower cost.

### What are the challenges involved?

It's a terrific challenge of engineering. There's a big jump between making a balloon that can last one day and one that can last 100. Going through the day-and-night cycle is treacherous, requiring what's called a super-pressure balloon. Then, there's the navigation. Winds within the stratosphere tend to travel in one direction, which we can take advantage of to navigate. The balloon needs to be able to change altitude to catch a current headed in the right direction.

My responsibility is the communication, connecting the balloons to the end users on the ground. As balloons drift in and out of range, we need the connectivity to feel seamless. We also need to link the balloons to one another, back to ground stations, and the Internet. One of the first basic challenges we faced was the fact that most transmitters are polarized, meaning the signal transmits in only one direction. But balloons rotate. So we designed special antennae that provide a signal no matter which way the balloon is oriented.

So to make this all work, we need: balloons capable of staying aloft for 100 days, altitude-control systems, an "air-traffic control" system that can predict weather models, and a network to tie them all together.

### What stage of the project are you in?

Well, we've already done pilot testing in New Zealand and Brazil. We've been working furiously and growing the team since then. We're launching and flying balloons continuously right now. We're definitely "all in" to make this work.

[Update: Since this interview was conducted, Astro Teller, the head of

the Google X lab, announced that Project Loon had logged more than 1.2 million miles (2 million kilometers) in testing and was on track to have a "semi-permanent" ring of balloons in the Southern Hemisphere within the next year or so.

"We really look for what we call 'T-shaped people,' — people with really diverse backgrounds, but who also have very deep expertise in one area. That describes most Techers."

How did your training at Caltech prepare you for this career?

I really think that Techers fit very well within Google X. We have a bunch here right now. We really look for what we call T-shaped people—people with really diverse backgrounds (the top of the T) who also have very deep expertise in one area (the stem). Because of the way that Caltech trains us, that describes most Techers. I also believe that the collaborative culture at Caltech is really helpful. If I have a hard problem, my first reaction is to go find somebody else who might be an expert in it rather than attack it myself.

As an engineer, I'm very pleased to be here. Just about every project in Google X is something that relates somehow to the physical world. We have generous resources to tackle them and an environment that encourages risk—even if we end up failing.

Professor Libbrecht always impressed me with his ability to jump between projects and follow his interests. He often joked, "If at first you don't succeed, no need to make a fool of yourself." I would encourage people to be adventurous and explore many paths in order to find the ones that suit them best.



Cyrus Behroozi sits on Google's campus in Mountain View, California, with a prototype of a balloon's communications array.

<http://alumni.caltech.edu>

## The Pinkprint: A showcase for Nicki Minaj's rapping?

**NAILEN MATSCHKE**  
Contributing Writer

This week, *Tech* editors Monica Enlow and Liz Lawler requested that I review Nicki Minaj's most recent album, *The Pinkprint*, which was released on Dec. 12. I'll admit up front that this is the first of her albums I've listened to, and that in general I haven't given much attention to her music over the past few years. I have, however, been aware of her reputation as an underrated rapper, largely due to the overwhelming presence of pop songs on her first two albums. Throughout *The Pinkprint* there are times where this claim seems like it has some truth to it, and the album certainly goes farther than her previous LPs in terms of solidifying her voice as a unique female presence, particularly in the hip-hop world. This assertion of independence and talent really is the point of the album, and as its title suggests it tries to establish a concept of who Minaj is both as an artist as well as a real person. Some tracks offer surprisingly candid glimpses into her personal life, while others proudly show off her ability to pull off the extreme. Unfortunately, though, there are still some sections of the album which are almost cringeworthy, and these beg the question of how purely "Nicki" *The Pinkprint* is and how much is aimed for the mainstream.

One thing immediately apparent about this album is how impressively long it is, clocking in at just under 67 minutes, not counting the seven bonus tracks

split across releases. Minaj uses this time strategically, with the album's 16 tracks transitioning between a handful of moods without too many abrupt jumps.

The first, "All Things Go," decisively sets the stage for Minaj to take some time to give listeners a serious look at life from her point of view. For example, in the first verse she explains that she's all right with life's finite span "as long as seven years from now, I'm taking my daughter to preschool," and later in the third verse she hints at the abortion she had as a teenager. However, her rapping still feels almost lethargic on this intro along with its similarly emotional follower, "I Lied." For fans of Minaj who are interested in the intimate details of her life, these songs are some of the most meaningful in her discography, but musically there simply isn't much to write home about. The singing-heavy "The Crying Game (feat. Jessie Ware)" completes a trilogy before the album moves into its next phase.

The following five tracks are all downtempo, bass-heavy, straightforward hip-hop, and while they play it safe, they make up one of the most enjoyable sections of the album. "Get On Your Knees

(feat. Ariana Grande)" is co-written by Katy Perry, and is confidently unrelenting in its explicit sexuality, giving even Gangsta

three deliver competent verses. Drake's somewhat tongue-in-cheek lines relating his appreciation of Minaj's figure prove to be the most memorable, while Brown's delivery of the hook is completely uninspired.

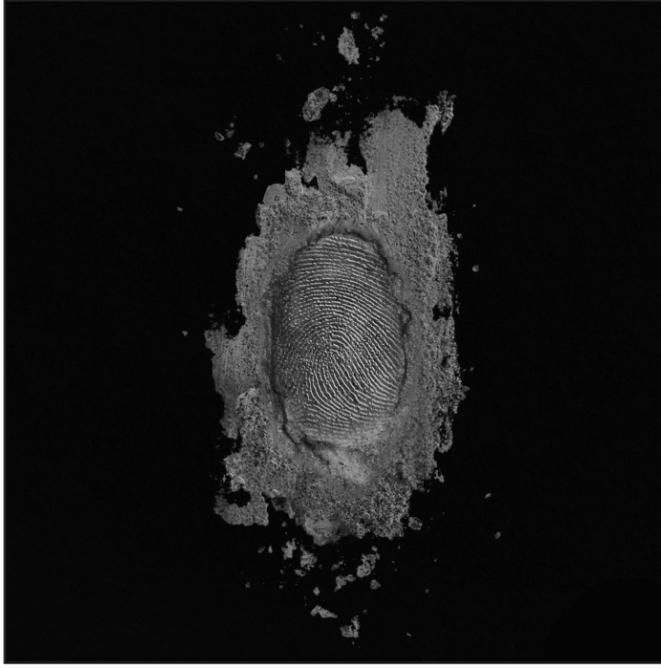
The album continues like this for a while and is generally enjoyable, but like all good things this comes to an end, beginning with "Buy a Heart (feat. Meek Mill)." Meek Mill absolutely throws away one of the song's two verses, and begins the track by blindsiding the listener with its painful hook. The following "Trini Dem Girls (feat.

LunchMoney Lewis)" isn't any better, serving as the album's token inclusion of Jamaican influence with an almost impressive lack of substance. Together, these two filler tracks back-to-back kill the album's momentum, and this feels like a waste, especially when some of the bonus tracks such as "Shanghai" and "Truffle Butter (feat. Drake and Lil Wayne)" showcase some of Minaj's best flows. It's clear that she wanted *The Pinkprint* to be about more than her just as a rapper or as a pop singer, but these songs are just flat-out not good. Next up is "Anaconda," which you probably

already know how you feel about. Personally, I'm a fan; even though it's largely a remix of Sir Mix-a-Lot's "Baby Got Back," I think it crosses the uncanny valley with its commitment to being abrasively ludicrous and ends up being one of the most unique tracks.

Most of the album's remainder can be skipped, as it starts off with the unforgivably awful EDM crossover "The Night Is Still Young." "Pills N Potions" is a somewhat touching piano-based pop ballad with impressive vocals, but this formula is then used for the album's last two songs, detracting from the feeling. It's usually sobering to hear artists' struggles, and Minaj does make an effort to open up to the audience with lines such as "Couldn't believe that I was home alone, contemplating / Overdosing," but ultimately these songs don't have very much to say, and this makes them come off as a bit forced in their attempts to emotionally impact the listener. The final song, "Grand Piano," also features quite a bit of singing from Minaj, but it drags on and brings the album to a boring close.

Minaj's *The Pinkprint* is clearly an album about her, and certainly stands above her previous two. It probably won't convince anyone of her rap skills, but that's what her mixtapes are for. The LP serves to establish what she wants herself to sound like, and it works most of the time, although the end result is far from perfect. I suggest checking out some of *The Pinkprint*'s singles, but unless you're already a fan of Minaj you probably won't get a great deal out of the album.



-<http://nickiminaj.wikia.com>

Boo's verse in *Run the Jewels 2*'s "Love Again (Akinyele Back)" a run for its money. This is followed by the banger "Feeling Myself (feat. Beyoncé)," which is again saturated with innuendo that can't quite contain itself, reiterating the point that Minaj is the "queen of rap," and which ends with a verse laden with jabs at her competition, as she takes a convincing stand against the view that she's just an industry-controlled pop star. Next is another standout cut featuring Chris Brown and Minaj's Young Money labelmates Drake and Lil Wayne, "Only," which sees all



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***Make a difference  
in our local schools.***

**[csa.caltech.edu/cse](http://csa.caltech.edu/cse)**

### 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.

## Candidates for Off Campus BoC Rep (5)



**ARJUN GOSWAMI**

Academic honesty has always been something very important to me personally. I believe that when we start to attach too much importance to grades, numbers, competition, and gaining an advantage over our peers, we sacrifice our love for actually learning the math and science, which is why we all originally came to Caltech. As your BoC rep I will help to make sure no unfair advantages are gained and that the playing field is level, so we can all continue to enjoy the amazing benefits (collaboration, take-home exams, etc.) the Honor Code brings us. I will be approachable, reasonable, and above all else, rational in my decision-making.



**JOSEPH SCHNEIDER**

The position of BOC rep is not one to be taken lightly. The time commitment is significant, the responsibilities are enormous, and the decisions can be emotionally taxing. But I believe that I am capable of living up to the expectations and fulfilling the duties responsibly. Student involvement in protecting the honor code is an invaluable part of Caltech, and I want to be an integral part in continuing this tradition. Only letting students sit on the BOC requires no little trust on the part of the faculty. I want to strengthen that trust. Why would I make a good BOC rep? Because I can handle the workload. I know the hours upon hours that the job can require, and I am prepared to make room in my schedule. I will never take shortcuts or avoid hard choices — BOC decisions are serious decisions, and cutting corners to save time or emotionally difficult choices is not acceptable. Furthermore, I am sensitive to the privacy issues that arise

*(Joseph Schneider, cont.)*

during BOC cases, and will always maintain confidentiality and protect the privacy of all parties involved. I will never take matters lightly, and I will always do what it takes to reach a fair and just decision. Additionally, being a BOC rep is more than just sitting on cases; I would also always be available to advise and help people who have questions about the BOC process. This is why I wish to be the off-campus BOC rep, and would be honored to have your vote.

**WILLIAM LAKE**

No photo or statement submitted.



**GABBY TENDER**

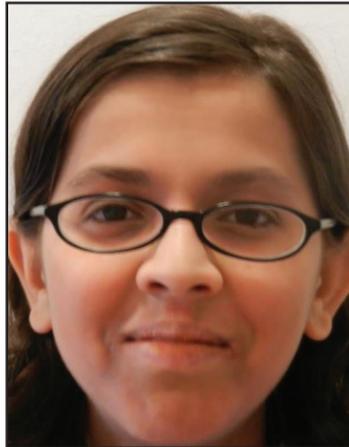
In all honesty, I never wanted to go to Caltech. Up until my first day on campus, I was researching transfer application deadlines for other universities. I am now embarrassed by how ridiculous I was then. Since starting at Caltech, I have been immensely happy. I cannot imagine transferring. Talking to my parents, I have narrowed down why I love Caltech to three major categories: my research, the people, and the honor code. I am now ready to make the honor code a bigger part of my life, because I have always devoted myself to things that really matter to me. The honor code makes me feel safe and comfortable everywhere on campus. I love how the honor code allows me to collaborate with my friends, never worrying that they'll simply my work or take advantage of my ideas. By adhering to the honor code's ideals during my study parties, I have learned more about the material and have made better friends faster than I could have imagined. I want to be a BoC Rep, because I want to support this important part of my life. I also believe that I would be a great BoC rep. I am able to stay calm and collected when I am forced to make difficult decisions. Balancing the honor code's ideals and the individual situation, I am confident that I'll be able to make tough decisions when necessary, but be understanding when I know that there was no malicious intent. I want to be a BoC rep to apply myself to this essential part of Caltech.



**KEVIN SHU**

It is vital that we undergraduates be able to trust each other; most aspects of daily life here would be impossible without that trust. Knowing that everyone will be rewarded according to their effort, that we can rest easily and be secure about other's intentions allows us to keep from losing our minds. Cases in which that trust is violated must be resolved so that despite that breach, no one has to fear for themselves. It's important to me that everyone, including perpetrators, be treated fairly, and therefore that the BOC is as effective and as secure as possible, so I am resolved to be a level-headed BOC rep.

## Candidates for Off Campus CRC Rep (4)



**BIANCA RAY AVALANI**

As a member of the Caltech community, I find that the Honor Code is an integral part of my life here both in academic and non-academic matters. The academic side of ethical behavior is often mentioned, but the personal and social side is equally important yet less visible. As last year's off-campus CRC rep, as well as through being a Title IX representative and UCC, I have had considerable experience investigating ethical concerns and ramifications in matters such as hazing, sexual harassment, and security breaches. This year, I would like to continue being a part of Caltech's system to protect the Honor Code in all areas, as well as to bring my increased skill set to

*(Bianca Ray Avalani, cont.)*

the table in order to keep the best interests of students and faculty in mind while upholding ethics in the matters that are crucial to our life at Tech.



**JAKE KETCHUM**

The Caltech Honor code is a vital part of what makes Caltech uniquely Caltech. It confers on us, as a student body, significant freedoms, and it is our responsibility as students to protect and uphold the Honor Code however we can. As CRC rep I will endeavor to approach every case with the utmost of integrity and the utmost of compassion.



**AMANDA GAO**

Hey, I'm Amanda, and I'm running for a spot on the Conduct Review Committee! I know that it's hard to judge a candidate by a few words and a picture, but in case you're still reading, I'd just like to say that I care deeply about keeping in the spirit of the Honor Code, and I will do my best to represent you and your interests if I'm elected. Thanks!

**ROSHAN AGRAWAL**

No photo or statement submitted.

Looking for some work? *The Tech* needs you!

*The California Tech* is looking for writers and photographers...and you can get paid!

Write reviews of interesting restaurants, new movies, and even books!

You can even submit your own comics!

Contact us at [tech@caltech.edu](mailto:tech@caltech.edu) if interested.

**The election will be from 10 a.m. to 11:59 p.m. on Tuesday, Feb. 17.**  
**You may only vote in this election if you did not vote for any house's BoC or CRC rep since September 2014. If you vote in this election, you may not vote in any other BoC or CRC rep election until September 2015. Contact [cdosen@caltech.edu](mailto:cdosen@caltech.edu) with any questions.**

## Kate Lewis gets 10th double-double of season, still hungry

**GOCALTECH.COM**  
Actual Sports Content Editor

CLAREMONT, Calif. (Feb. 14, 2015) – Sophomore Kate Lewis (San Antonio, Texas/Ronald Reagan) left no doubt in breaking the program single-season scoring record with her 10th double-double of the season to lead the Caltech women's basketball team at Pomona-Pitzer Colleges in an 81-52 defeat on Saturday afternoon.

Lewis poured in 27 points for her third straight and ninth 20-point effort this season to bring her season total to 396, shattering teammate Stephanie Wong's 2012-13 mark of 374 points with three games still in hand.

"Kate continues to produce big points when we need them, and it gives us a huge boost," Head Coach Sandra Marbut said. "She broke a big record tonight in a big way and is setting a bench mark that may stand for a very long time. She knows what she wants to get done this season and is staying focused on making it happen. She could really extend it out and challenge future players to step it up to meet her mark."

The Sagehens outshot the Beavers, 48-32 percent from the field, 33-17 percent beyond the arc and 60-53 at the charity stripe while also winning the rebound (+5) battle, although Caltech committed a season-low eight turnovers. Pomona-Pitzer improves to 6-16 overall and 5-8 in the SCIAC while Caltech is now 0-22 (0-13).

Both defenses stepped up at the start to keep it a 2-2 game over the first three minutes, but Pomona-Pitzer went ahead by double digits at 17-6 with 9:49 left to play. The Beavers hung near single digits as late as the 5:56 mark, when they trailed 23-15, but a 9-3 run to end the half saw Pomona-Pitzer lead by 14 at the break.

Lewis scored two quick baskets as the second half got underway, but the Sagehens' Amelia Hummel was on her way to a career day with 31 points and kept pace, allowing her team to extend the margin throughout the half to a high of 31 and final of 29.

"We found shots, they just didn't seem to fall and it complicated us finding any momentum," Marbut said. "It wasn't representative of what we are capable of doing – some games are a battle for reasons

you can't identify and this was one of those nights. We will look at who is next up and move past it."

Lewis' 27 points were just one shy of her career best, while her 11 rebounds completed the double-double and marked the sixth straight game she has been in double figures. Junior Stephanie Wong (Palos Verdes Estates, Calif. / Palos Verdes Peninsula) chipped in 12 points, seven rebounds and three assists while her sister, sophomore Michelle Wong (Palos Verdes Estates, Calif. / Palos Verdes Peninsula) added three assists and two steals.

"What I enjoy about Kate and Stephanie is that they keep working at it," Marbut said. "Neither was finding the rim in the first half, yet both kept getting back up and trying again. At one point, I talked with Kate about just focusing on her rebounding to get a little momentum going, and then she poured in a bunch of points. They are both capable of big games every night and when they relax into it, it usually happens. They both found their stride in the second half and helped us down the stretch with their scoring."



Kate Lewis sets the single season point record and our hearts on fire.

-<http://gocaltech.com>

## Watson hits first Beaver home run in quite some time

**GOCALTECH.COM**  
Actual Sports Content Editor

PASADENA, Calif. (Feb. 14, 2015) – Freshman David Watson (Fort Collins, Colo / Windsor) clubbed the Beavers' first home run since April 5, 2013 as the Caltech baseball team dropped a doubleheader to the University of La Verne on Saturday.

Game 1: Caltech 0, La Verne 12

It was a pitcher's duel right from the start as the Leopards opened the scoring with an unearned run in the top of the first inning, but neither team could string anything together in the early going. La Verne advanced a runner to third base in both the second and third frames, but the first came with two outs already on the board and a well-turned 6-4-3 double play erased the runners in the third.

Junior Daniel Chou (Blue Bell, Pa. / Wissahickon) kept the home squad in the mix all the way to his final pitch, allowing just three earned runs and one walk over 8 1/3 innings. Sophomore Harrison Jacobs (Tucson, Ariz. / Catalina Foothills) became Caltech's first baserunner with a leadoff single in the bottom of the third inning, but the Beavers could not advance him any further. La Verne tacked on another unearned run in the top of the fifth inning and made it 4-0 with runs in the sixth and seventh innings.

Caltech finally moved a runner into scoring position as sophomore Tim

Menninger (Norristown, Pa. / Chestnut Hill Acad.) led off with a single and reached third base before the inning ended. Senior Ryan Casey (Valencia, Calif. / Valencia) matched the feat after reaching on an error to open the eighth inning, but was also stranded as the Leopards scored again in the eighth and ended the game with seven runs in the ninth.

Menninger led the Beavers with two hits in four at-bats.

Game 2: Caltech 1, La Verne 18

La Verne took a quick 3-0 lead in the first inning and made it 9-0 in the second, eventually stretching out to 18-0 in the sixth. Senior Oliver Curtiss (Hudson, Ohio / Western Reserve Acad.) recorded the Beavers' first hit in the third inning and Chou sparked some late energy in the fourth, singling and advancing to second before the frame ended.

Casey added a single in the fifth inning and, after La Verne's five-run top of the sixth, Watson crushed his homer to right field with one out in the bottom of the seventh inning. Freshman Garrett Levine (Columbus, Ohio / Columbus Acad.) laced a single to shortstop but was later caught at third base on a fielder's choice.

Junior Michael Klionsky (Boca Raton, Fla. / Atlantic) recorded two outs in a clean frame while Jacobs finished things off with a hitless seventh inning, allowing just one walk.



David Watson really hit the ball out of the park with this one.

-<http://gocaltech.com>

## No hope for Hope International as Caltech is victorious

**GOCALTECH.COM**  
Actual Sports Content Editor

PASADENA, Calif. (Feb. 13, 2015) – A quartet of Caltech women's tennis players recorded wins at both doubles and singles in an 8-1 triumph over Hope International University on Friday afternoon.

The Beavers stay perfect to start the season at 2-0 while the Royals drop to 0-5.

Sophomore Sophia Chen (Newport Beach, Calif. / Corona Del Mar) and freshman Erin Wang (Auburn, Calif. / Del Oro) quickly wrapped up #3 doubles, 8-3, for the first point of the day, followed shortly by Freshman Grace Yao (La Palma, Calif. / Oxford Acad.) and freshman Vinci Chen (Austin, Texas / Westwood) taking #2 doubles, 8-4. Caltech

led for much of the match at #1 doubles as well, but the Royals rallied to take the final two games, posting their only win of the day, 9-7.

Wang and Vinci Chen took care of business in short order at #5 and #6 singles, each recording the 6-1, 6-0 victory. Sophia Chen took the clinching point at #3 singles, 6-3, 6-2, and Yao followed with a lengthy 6-3, 6-0 win at court #4. Freshman Sarah Cai (Livermore, Calif. / West Lafayette Jr./Sr.) then picked up the win in her first career match at #1 singles, 6-2, 6-2, leaving just junior Monica Li (Boulder, Colo. / Fairview) still playing at #2. Li fell behind by a set (4-6) but recovered with a dominant 6-1 second to force a superbreaker, in which she rode the momentum to a 10-6 victory..



Erin Wang moves with effortless grace as she brings the heat.

-<http://gocaltech.com>

# ASCIT Minutes

## ASCIT Board of Directors Meeting

Minutes for 13 February 2015. Taken by Sean McKenna.

**Officers Present:** Cat Jamshidi, Connor Rosen, Patrick Nikong, Sean McKenna

**Guests:** Margaret Lee, Elliott Simon, Chris Dosen, Allika Walvekar, Alex Hartz

**Call to Order:** 8:04 pm

### President's Report (Cat):

- Alex Hartz discussed a proposed change of the BoC bylaws which would need to be approved by vote of the undergraduate student body. A few minor dates and wording have been fixed, but there is also a more substantive proposed change. The purpose is for the Dean to have records of dismissed cases. In doing so, the Dean of Students would be involved in some capacity in dismissals, and this capacity will be negotiated by the Dean and the BOC Chair.
- ASCIT and the BOC will work further to come up with an exact wording of the proposed changes before calling for a vote by undergrads.
- Furthermore, the report suggested that some BoC and CRC responsibilities could be redelegated to ASCIT, potentially having an "Honor Code" representative on the Board of Directors. This position could take responsibility for things like BARC lunches and training new faculty. The BOD will determine if these issues would be better addressed by a position on the ARC or through ASCIT.
- Elections are on Tuesday 17 February for off-campus BoC and CRC reps. We have a non-trivial number of people running for both positions!

### Officer's Reports:

- V.P. of Academic Affairs (ARC Chair: Nima):**
  - The ARC is working with the Dean's office on freshman peer advising for next year. More details will come in the next couple of weeks, but it should look something like the option mentoring program from two years ago, where freshmen get paired with upperclassmen who can advise them.
  - The Dean's office is setting up a fund for option clubs to put on option-specific meet-and-greet events. This fund will be usable to start up new option-specific clubs rather than for established clubs.
  - You should take a prof to lunch! Get a small group of friends together and invite a professor to go have a good lunch with you. Details are here: <http://arc.caltech.edu/proftolunch.php>
- V.P. of Non-Academic Affairs (IHC Chair: Connor):**
  - Waiting for Ricketts President to turn over before the new IHC starts to ramp up.
- Interim Director of Operations (Sean):**
  - ASCIT projector/screen/speakers will be ready for use some time this week.
- Treasurer (Patrick):**
  - Allika Walvekar requested event funding on behalf of the Society of Women Engineers for their Introduce a Girl to Engineering Day event.
- 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 February 20th at 8pm in SAC 15.

**Meeting Adjourned:** 8:49

**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

CALTECH *presents*

Saturday, February 21, 2015 / 8 p.m.

\$40, 35, 30; Youth \$10

# Vienna Boys Choir



Beckman Auditorium

Call campus x 4652

visit the Caltech Ticket Office 101 Winnett Center



CALTECH THEATER offers several chances to branch out and take chances, have fun and expand your social network this year!

**WANTED:** Actors, singers, musicians, technical personnel, and designers for new, original Caltech musical *Alice Through the Wormhole!* This musical is currently in the development phase with a world premiere run Feb 20-March 1, 2015! If you are interested in any facet of production, including script development, contact Brian Brophy directly ([brophy@caltech.edu](mailto:brophy@caltech.edu)).

# Caltech Public Events Hiring Ushers

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**Contact: Adam Jacobo  
626.395.5907  
[ajacobo@caltech.edu](mailto:ajacobo@caltech.edu)**

## The California Tech

### Editors-in-Chief

Monica Enlow  
Liz Lawler  
Neera Shah  
Nehaly Shah

### Advisor

Richard Kipling

### Contributing Writers

Brad Chattergoon  
Lori Dajose  
Nailen Matschke

### Circulation Manager

Kit Chinetti

Caltech 40-58, Pasadena, CA 91125  
Contact [tech@caltech.edu](mailto:tech@caltech.edu)

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## Brad/Chad Business Tutorial: What is Finance?

**BRAD CHATTERGOON**  
Contributing Writer

Hey, Caltech. Week 7 is upon us and that means Drop Day is coming along soon. Midterm grades are in and if you're like me you now know which classes are definitely on your pass/fail list.

As many of you may know, America's favorite non-holiday was this past weekend: Valentine's Day. I am a firm believer that we should all be happy with our relationship statuses (and if not happy with it, then change it), but given our biological design to propagate the species, dating inevitably will show up in our lives. At a basic level, dating boils down to two roles, approacher and approached. Falling into the former category, I have wondered about the best strategy. The real problem is information asymmetries in early social interaction. Imagine a world where everyone knows everyone else's preferences in what could plausibly be represented by a very large two-dimensional preference matrix to answer the question, "Would he/she go on a date with me?" The complexity of the current situation would easily drop off. So why do I mention this? Well, perhaps it is possible to simulate a sparse version of such a matrix with only the information that is relevant to you. Namely, would you go on a date with a person and would they go on a date with you? How would one do this? If you encounter a person that you would go on a date with, ask if they want to go on a date with you and mentally fill in their response in your matrix. Sounds pretty simple right? Just some food for thought.

The word "finance" gets thrown around very loosely when describing career paths. For example, someone might say, "I want to work in finance." What does that mean? It could be venture capital, private equity, trading/stocks, or even at a hedge fund. Given the diversity of these careers, it might be difficult to determine why they are all termed as "finance." The common factor is that they are all built around a fundamental concept called "net present value."

Net present value stems from the existence of interest rates, or the idea that one dollar today is

worth more than one dollar in the future. Let's say someone offers me a \$1.00 today or \$1.05 in half of a year. Which option do I take? If there is an interest rate,  $r$ , such that investing \$1.00 today at an interest rate  $r$  will give me more than \$1.05 in six months, then I should take the dollar today.

If this were an exercise in simple interest, then these types of calculations would be trivial but the market functions on interest referred to as "compound interest" where any interest earned after a "compounding period" is compounded with the already existing principal during the next compounding period.

Let's look at an example of how this works. Let's say I invest \$100 in a savings account with a period interest rate of 5%. At the end of the first period I will have  $1.05 \times \$100 = \$105$  in the account. At the end of the second period I will have  $1.05 \times (1.05 \times \$100) = 1.05^2 \times \$100 = \$110.25$ . At the end of the  $n$ th period I will have  $1.05^n \times \$100$  in the account.

What about the net present value (NPV) of money that I am receiving in the future?

As an example of this, let's say I lend a friend \$100 and we make an agreement for him to pay me back \$5 every three months for six months and a return of \$100 at the end of the six months. Let us assume that the "risk free rate," or bank rate of interest, per three-month period is 5%. Then how much is the repayment worth today?

$$NPV = 5/(1.05) + \$105/(1.05^2) = \$100$$

So the value is equivalent. How does this make sense? Let's say I had instead invested the \$100 in a savings account. We know that we would get \$110.25 at the end of two periods. But  $\$5 + \$105 = \$110$ . Where is the extra \$0.25 coming from? After receiving the first \$5 after the first period we can reinvest it at the risk free rate. So in the second period we get  $\$105 + \$5 \times 1.05 = \$110.25$ . And voilà, equality.

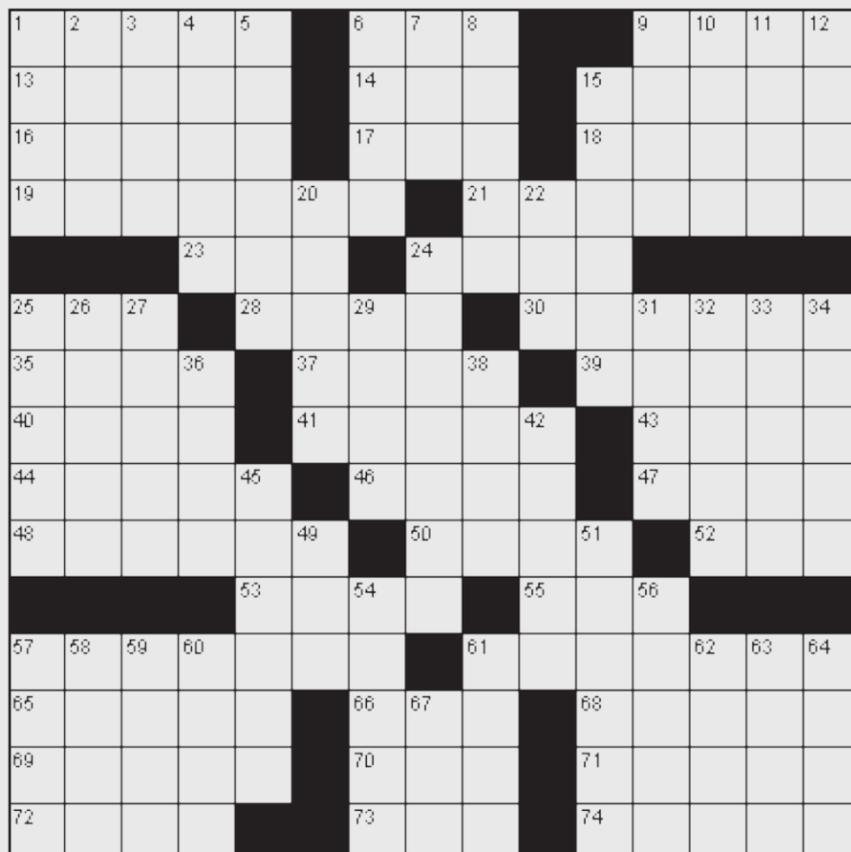
I hope this gives an insight into what the field of finance is based on.

Brad/Chad



-http://cardealermagazine.co.uk/

## Crossword



-http://puzzlechoice.com

### Across

1. Goodwill
6. The night before
9. Lawsuit
13. Access a computer
14. Cacophony
15. Relating to a particular neighborhood
16. Approximately
17. Fuel
18. Main artery
19. Demean
21. Innumerable but many
23. Bind
24. Partially carbonized vegetable matter
25. Indefinite but relatively small number
28. Entice
30. Full-bodied
35. Translucent mineral
37. Line made of twisted fibers
39. Mixed drink usually

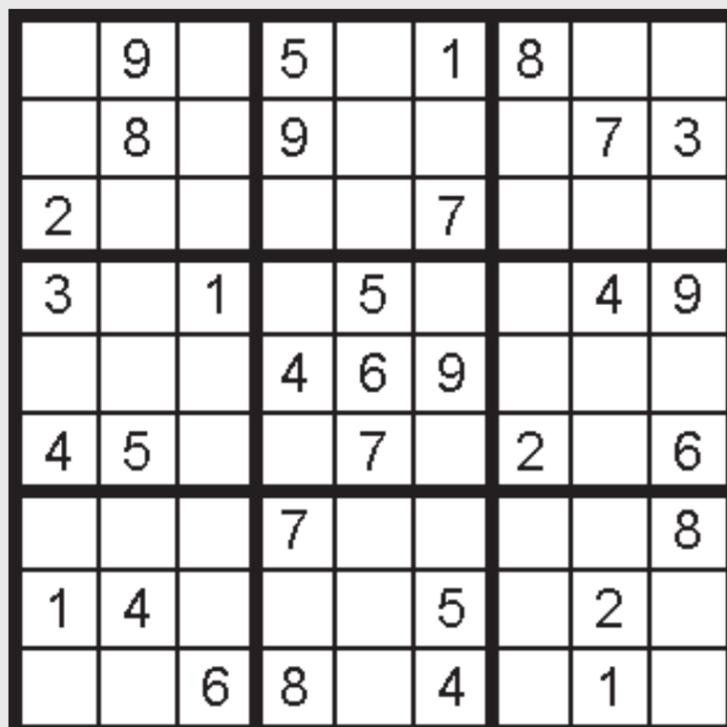
- served in a bowl
40. Scintilla
41. Tripod
43. Prevaricator
44. Fragrance
46. 5,280 feet
47. Drill
48. Source of danger
50. Hit with something flat
52. Novel
53. Bird structure
55. Unit of play in squash
57. Small crown
61. Impresario
65. Higher up
66. Rodent
68. Fragment
69. Relating to the sun
70. In the past
71. South American cud-chewing animal
72. Relate
73. Liveliness and energy
74. Church officer

### Down

1. Happy
2. Loose flowing garment
3. Highly excited
4. Judicature
5. Involve or imply
6. Boundary
7. By way of
8. Follow, as a result
9. Slow-flying bird resembling a duck
10. 4,840 square yards
11. Replete
12. Distinctive and stylish elegance
15. Portable computer
20. A tie in tennis
22. Spoil
24. Persevere
25. Force onto another
26. Era
27. Colorless binary compound
29. Wander
31. Electric lamp
32. Jointure
33. Frighten
34. Tossed

36. Well-defined track
38. Small wooded hollow
42. Tether
45. Person who makes leather from skins and hides
49. Golf peg
51. Folks
54. Elongated piece of leather
56. Cloth with parallel diagonal lines or ribs
57. Actors in a play
58. Woodwind instrument
59. Roster
60. Ellipse
61. Halt
62. Made of fermented honey and water
63. The highest point of something
64. Approach
67. Historic period

## Sudoku



-http://puzzlechoice.com

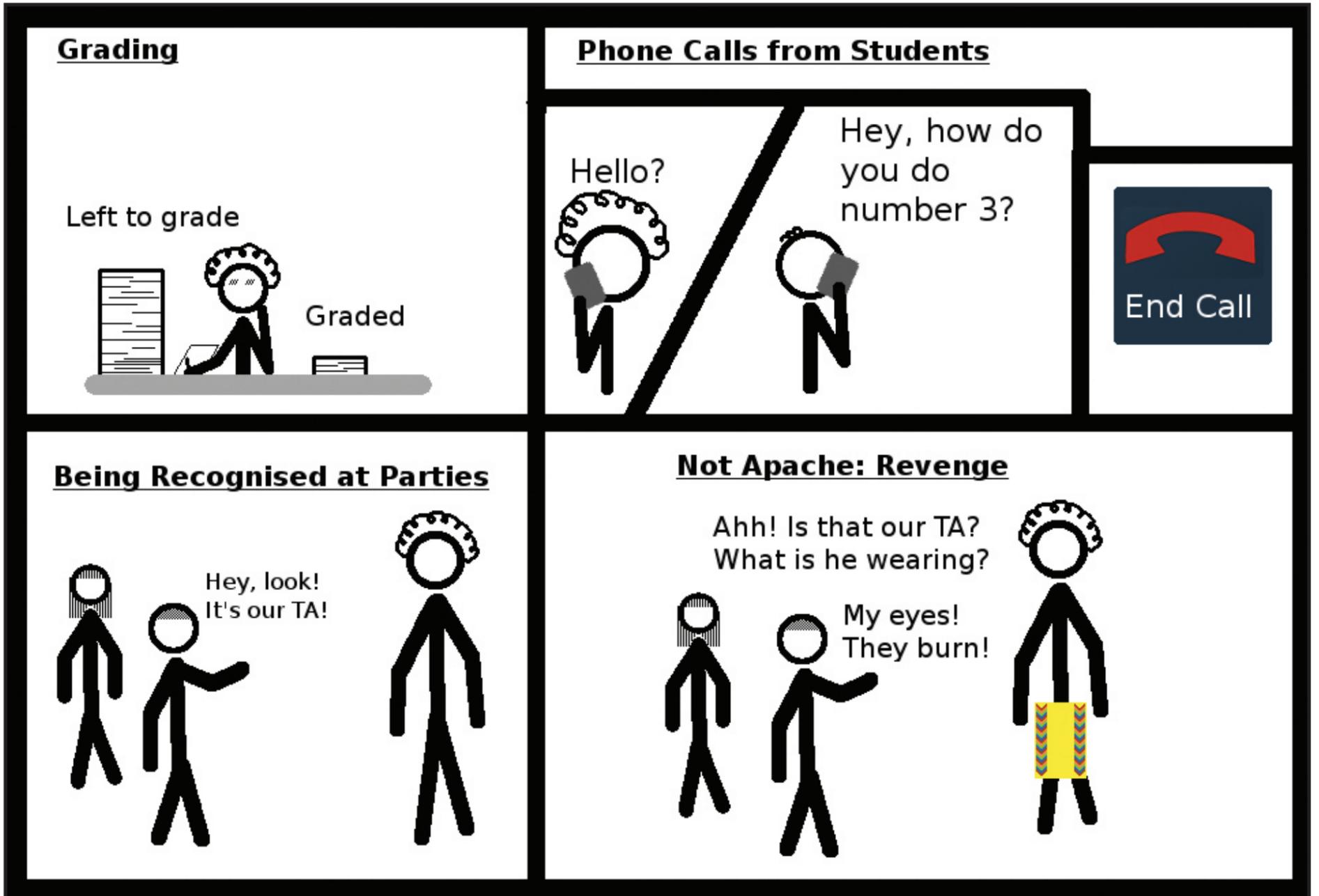
## Acquired Taste

Dr. Z



"This comic is not about Liz Lawler" (It's about TA-ing)

Georgio Kraggman



## Answers to previous Sudoku

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

-<http://puzzlechoice.com>

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