

## Biologists Give Bacteria Thermostat Controls

WHITNEY CALVIN  
Caltech Media Relations

*This article is adapted from a story that was originally published online at caltech.edu.*

A new helper in the fight against cancer and other diseases of the gut may be genetically altered bacteria that release medicines to tumors or the gut.

Now, a new study performed using mice demonstrates how doctors might one day better regulate those therapeutic microbes by engineering them to respond to temperature. For instance, if engineered bacteria were administered to a patient with a disease, doctors could, in theory, instruct the bacteria to release medicine to just the site of interest, and nowhere else in the body, by

using ultrasound to gently heat up the tissue.

“Bacteria can be designed to act like special agents fighting disease in our bodies,” says Caltech’s Mikhail Shapiro, assistant professor of chemical engineering and Heritage Principal Investigator, whose overall research goal is to create new ways to both visualize and control cells—bacterial cells and human cells—for medicinal purposes. “We’re building walkie-talkies for the cells so we can both listen and talk to them.”

Shapiro is principal investigator on a paper about the new research published November 14 in the journal *Nature Chemical Biology*. The colead authors are Dan Piraner and Mohamad Abedi, graduate students in Shapiro’s lab.

The research also shows how these engineered bacteria, once in

a patient, could be programmed to stop administering a therapeutic or to self-destruct if the patient’s temperature rises from a fever. A fever might signal that the therapy is not working, and thus it would be in the patient’s best interest for the bacteria to terminate its activity.

In another application of the technology, the researchers demonstrated how the bacteria could be designed to destroy themselves once they leave a patient’s body through defecation. The lower temperature outside of a host’s body would signal the engineered bacteria to activate a genetic kill switch, thereby alleviating concerns about the genetically altered microbes spreading to the environment.

“We can use these thermal switches in bacteria to control a variety of behaviors,” says Shapiro.

The strategy of using engineered bacteria to fight disease—part of a growing field called microbial therapeutics—has shown some promise in animal models and humans. Previous research has demonstrated that some bacteria naturally make their way to tumor sites because they prefer the tumors’ low-oxygen environments. Studies have shown that these bacteria can be directed to release a medicine onto tumors, such as the tumor-destroying drug hemolysin. Other studies have shown that bacteria administered to the gut can release molecules to reduce inflammation. But these bacteria might end up in other portions of the body, and not just at the sites of interest.

The glowing images in this animation were drawn on petri-dish plates with bacteria. The bacteria were engineered to

respond to temperature changes. The bacteria seen in the tree express green fluorescent protein at temperatures above 36 degrees Celsius. Bacteria seen in the sun express a red fluorescent protein above 40 degrees Celsius. Bacteria in the lawn have both the green and red thermal switches, and thus turn yellow at the higher temperatures. (Image credit: Shapiro Lab/Caltech)

The method developed by Shapiro’s lab solves this problem by providing a mechanism through which bacteria can be instructed to direct drugs only to a specific anatomical site. The idea is that the genetically engineered bacteria would activate their therapeutic program at a certain temperature induced via ultrasound tools, which

*Continued on page 3*

TOTEM Caltech's literary and visual arts magazine



contest submission theme

**DEADLINE: January 8, 2017**

**What:** Submit visual and literary artwork to win a \$25 Amazon gift card, as well as publication in Totem and The Tech!

**Who:** Undergraduates, grad students, faculty, etc...anyone affiliated with Caltech!

Please send submissions and questions to [totem@caltech.edu](mailto:totem@caltech.edu).



### Project IDEA. inspire discover express accept. Caltech's creative assignment for your week.

Please send all responses to [totem@caltech.edu](mailto:totem@caltech.edu).

**Write a letter giving advice to your past self and specify the age you are writing to.**

**What is the smell you associate with home?**

**What has changed you and how are you different? What has stayed the same?**

**Draw a picture of someone else's dream and have them also draw their dream. Send us pictures of the drawings.**

Totem, Caltech's literary and visual arts magazine, is an annual publication featuring poems, short stories, photography, drawings, and other work submitted by the Caltech community. Totem is also a group of students who wish to foster the artistic expression of our community members and spread awareness of the multitude of talents at Caltech. We host contests and regular writing group sessions, and students who are interested in literary/art events happening in the area are encouraged to share their interests with us.

Totem has started Project IDEA, inspired by Learning to Love You More (LTYM, [learningtoloveyoumore.com](http://learningtoloveyoumore.com)). LTYM was a community-based web project created by Miranda July and Harrell Fletcher. It provided “assignments” that guided participants with directions and gave them an opportunity to create. By providing some direction through our assignments, we hope to promote creative expression in the Caltech community. We want to inspire you to explore yourself and take another look at the people and world around you.

**Last week:** Write an advertisement for a job that if existed and was offered to you, you would take with no hesitation. Take a picture of a flower—a close-up of only one so it fills the view. Make a list of 50 things you like. If you could leave behind a building/site, what would it be like? Hospital? Museum? Amusement park? Feel free to include drawings.

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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 Katherine Guo 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. The mission of today's Y remains the same—to provide opportunities that will prepare students to become engaged, responsible citizens of the world. The Y seeks to broaden students' worldviews, raise social, ethical, and cultural awareness through teamwork, community engagement, activism, and leadership. 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.

Ongoing and past programs hosted by the Caltech Y:

Alternative Spring Breaks: Peru, Costa Rica, New York, Yosemite, San Diego, San Francisco

Make-A-Difference Day: Hillside Home for Children, LA County Arboretum and Botanic Garden, Children's Hospital Los Angeles (Coachart), Eaton Canyon, Lifeline for Pets

Explore LA: Lakers game, Next to Normal musical, Norton Simon Museum trip

RISE Tutoring program (an afterschool math and science-focused tutoring program that serves public school students between grades 8 and 12)

## Upcoming Events

### 1. Thanksgiving Office Hours

November 23rd - 25th  
The Caltech Y Office will be closed from 2pm on Wednesday, November 23rd until Friday, November 25th for the Thanksgiving long weekend. We will re-open on Monday, November 28th.

### 2. Caltech United Way Campaign

Until Friday | November 18th

We encourage Caltech faculty, staff and postdocs to designate the Caltech Y when contributing through the United Way Campaign, which will run through November 18, 2016. This is a great way to make your annual Friends contribution or a larger commitment to the Centennial Endowment Fund!

### 3. Boys and Girls Club Volunteering

Saturday | November 19th | 9:30AM - 12:30PM | Boys and Girls Club Pasadena

The Boys and Girls Club of Pasadena promotes the health, educational, social, vocational, and character development of young boys and girls. Volunteers will help spread mulch and do other gardening tasks to improve the front of the Pasadena center.

Transportation and lunch are provided. Please RSVP here: <https://goo.gl/forms/uSQXaqEGKkesregk2>

### 3. Union Station Adult Center

Saturday | November 19th | 5:00 - 9:15 PM | Pasadena

Prepare and serve dinner to the residents at Union Station Adult Center in Pasadena. Food and materials are provided. The Adult Center provides shelter, meals and supportive services for more than 150 homeless men and women each year.

For more info and to RSVP email [rsilva@caltech.edu](mailto:rsilva@caltech.edu).

### 4. Hathaway Sycamores

Every Wednesday | 5:30 - 8:00 PM | 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.

### 5. Pasadena LEARNS

Every Friday | 3:00 - 5:00 PM | 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 [azhai@caltech.edu](mailto:azhai@caltech.edu). Eligible for Federal Work Study.

### 5. Caltech Y Decompression

Saturday | December 3rd | 7:00 - 9:00 PM | Winnett Lounge

Stressed during finals week? Join us to decompress with free food - burgers, hot dogs, cookies, fruit and veggies, ice cream, chips and drinks; entertainment - movies; and just hanging out with your friends. It is a great way to relax a little before the first finals of the school year!

If you'd like to volunteer to help out, please fill out the form here: <https://goo.gl/forms/czSdG1zs67uxycq12>

Volunteers get a free gift card!

### 6. Support the Y everytime you shop on AmazonSmile

Black Friday is fast approaching and you can support the Caltech Y while you do your holiday shopping. When you shop at AmazonSmile, Amazon donates 0.5% of the purchase price to Caltech Y.

Bookmark the link <http://smile.amazon.com/ch/95-1684790> and support us every time you shop.

### 7. The Patrick Hummel and Harry Gray Travel Fund

Applications due January 10th, 2017

The Patrick Hummel and Harry Gray Travel Fund was established as a joint gift from Carla and Paul Hummel, Patrick Hummel, and Shirley and Harry Gray, Arnold O. Beckman Professor of Chemistry and Founding Director of the Beckman Institute. The endowed fund supports undergraduate travel opportunities that promote professional and leadership development and broadens students' perspective as engaged, responsible citizens of the world.

To apply and for more information, please visit:

[https://caltechy.org/programs\\_services/resources/PHHGTF.php](https://caltechy.org/programs_services/resources/PHHGTF.php)

### Beyond the Y

#### 1. Tutors needed for Aspires West

Tutors are desperately needed for the Aspires West after-school program: math (general math, geometry, algebra 1 and 2) and English for elementary, middle and high school students.

Tutor schedules are Monday through Thursday, 4 -7 p.m.; Saturday, 8:30-12:30 p.m. Aspires West, Pasadena (AWP) provides low-income students and parents with services and opportunities that provide the knowledge and fundamental skills for student success. Interested volunteers should contact: [inbox@fostercareproject.org](mailto:inbox@fostercareproject.org).

#### 2. Mentors needed for Hathaway - Sycamores

Hathaway-Sycamores, Child and Family Service, is seeking mentors for their El Nido (Altadena) Residential Campus. The Hathaway-Sycamores mission is to help cultivate hope and resilience to enrich the well-being of children, adults, families and communities. Interested volunteers should contact: [inbox@fostercareproject.org](mailto:inbox@fostercareproject.org)

## The California Tech

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Letters and submissions are welcome; e-mail submissions to [tech@caltech.edu](mailto:tech@caltech.edu) as plain-text attachments, including the author's name, by Friday of the week before publication. *The Tech* does accept anonymous contributions under special circumstances. The editors reserve the right to edit and abridge all submissions for any reason. All written work remains property of its author.

The advertising deadline is 5 p.m. 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."

# Turning Back the Aging Clock Findings have novel applications

LORI DAJOSE  
Caltech Media Relations

*This article is adapted from a story that was originally published online at caltech.edu.*

Researchers from Caltech and UCLA have developed a new approach to removing cellular damage that accumulates with age. The technique can potentially help slow or reverse an important cause of aging.

Led by Nikolay Kandul, senior postdoctoral scholar in biology and biological engineering in the laboratory of Professor of Biology Bruce Hay, the team developed a technique to remove mutated DNA from mitochondria, the small organelles that produce most of the chemical energy within a cell. A paper describing the research appears in the November 14 issue of *Nature Communications*.

There are hundreds to thousands of mitochondria per cell, each of which carries its own small circular DNA genome, called mtDNA, the products of which are required for energy production. Because mtDNA has limited repair abilities, normal and mutant versions of mtDNA are often found in the same cell, a condition known as heteroplasmy. Most people start off life with some level of heteroplasmy, and the levels of mutant mtDNA increase throughout life. When a critical threshold level of mutant mtDNA is passed, cells become nonfunctional or die.

The accumulation of mutant mtDNA over a lifetime is thought to contribute to aging and degenerative diseases of aging such as Alzheimer's, Parkinson's, and sarcopenia—age-related muscle loss and frailty. Inherited defects in mtDNA are also linked to a number of conditions found in children, including autism.

"We know that increased rates of mtDNA mutation cause premature aging," says Hay, Caltech professor of biology and biological engineering. "This, coupled with the fact that mutant mtDNA accumulates in key tissues such as neurons and muscle that

lose function as we age, suggests that if we could reduce the amount of mutant mtDNA, we could slow or reverse important aspects of aging."

The team—in collaboration with Ming Guo, the P. Gene and Elaine Smith Chair in Alzheimer's Disease Research and professor of neurology and pharmacology at UCLA, and UCLA graduate student Ting Zhang—genetically engineered *Drosophila*, the common fruit fly, so that about 75 percent of the mtDNA in muscles required for flight, one of the most energy demanding tissues in the animal kingdom, underwent mutation in early adulthood. This model recapitulates aging in young animals. *Drosophila* grow quickly and most human disease genes have counterparts in the fly, making it an important model in which to study human disease-related processes. The researchers chose to focus on muscle because this tissue undergoes age-dependent decline in all animals, including humans, and it is easy to see the consequences of loss of function.

Unlike mutations in the DNA in the nucleus, which can be corrected through cellular repair mechanisms, mutations in mtDNA are often not repaired. However, cells can break down and remove dysfunctional mitochondria through a process called mitophagy, a form of cellular quality control. What was unclear prior to this work was whether this process could also promote the selective elimination of mutant mtDNA.

The team found that when they artificially increased the activity of genes that promote mitophagy, including that of several genes implicated in familial forms of Parkinson's disease, the fraction of mutated mtDNA in the fly muscle cells was dramatically reduced. For example, overexpressing the gene *parkin*, which is known to specifically promote the removal of dysfunctional mitochondria and is mutated in familial forms of Parkinson's disease, reduced the fraction of mutant mtDNA from 76 percent to 5 percent, while the overexpression of the gene *Atg1* reduced the fraction to 4 percent.

"Such a decrease would completely eliminate any metabolic defects in these cells, essentially restoring them to a more youthful, energy-producing state," notes Hay. "The experiments serve as a clear demonstration that the level of mutant mtDNA can be reduced in cells by gently tweaking normal cellular processes."

"Now that we know mtDNA quality control exists and can be enhanced, our goal is to work with Dr. Guo's lab to search for drugs that can achieve the same effects," Hay adds. "Our goal is to create a future in which we can periodically undergo a cellular housecleaning to remove damaged mtDNA from the brain, muscle, and other tissues. This will help us maintain our intellectual abilities, mobility, and support healthy aging more generally."

The study is entitled "Selective removal of deletion-bearing mitochondrial DNA in heteroplasmic *Drosophila*." The work was supported by grants to Guo from the National Institutes of Health, the Kenneth Glenn Family Foundation, and the Natalie R. and Eugene S. Jones Fund in Aging and Neurodegenerative Disease Research; and to Hay and Guo from the Ellison Medical Foundation.

*Continued from page 1*

gently heat tissues with millimeter precision. A doctor could, in theory, administer genetically altered bacteria to a cancer patient and then, by focusing ultrasound at the tumor site, trigger the bacteria to fight the tumor.

"We can spatially and temporally control the activity of the bacteria," says Abedi. "We can communicate with them and tell them when and where something needs to be done."

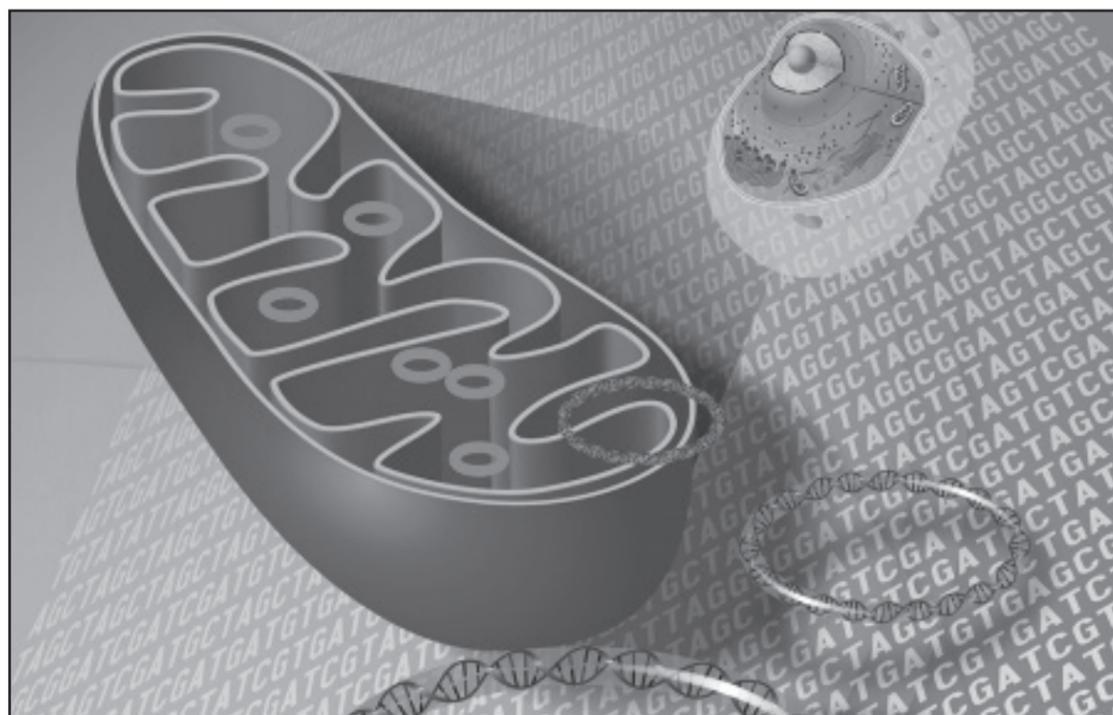
To create thermally controllable bacteria, the team first needed to find candidate genetic switches whose activity depends on temperature changes. They ultimately identified two candidates. The first is a protein in *Salmonella* bacteria, and the second originates from a bacterial virus called a bacteriophage. Both proteins bind to DNA to turn a genetic circuit on or off in response to temperature.

Next, the scientists used a protein engineering technique—"directed evolution," pioneered by Caltech's Frances Arnold—to evolve the proteins in the lab and tune their switching temperatures. For instance, the *Salmonella* protein was originally activated by temperatures ranging between 42 and 44 degrees Celsius. Using directed evolution, the scientists

generated versions with activation temperatures between 36 and 39 degrees Celsius. When these genetic switches are used to control the expression of therapeutic proteins, they can act like thermal controls to turn the therapy on or off at a given temperature.

"When we were thinking about how to get bacteria to sense temperature, we looked at nature and found a few systems where bacteria can do this," says Piraner. "We tested the performance, found the ones that had the best switching performance. From there, we went on to find that they could be tuned and amplified. It all started with what nature gave us, and engineering took us the rest of the way."

The study, titled, "Tunable Thermal Bioswitches for In Vivo Control of Microbial Therapeutics," was funded by the Defense Advanced Research Projects Agency, the Weston Havens Foundation, the Burroughs Wellcome Career Awards at the Scientific Interface, and the Heritage Medical Research Institute as well as through graduate fellowships from the National Science Foundation and the Paul and Daisy Soros Fellowship for New Americans. Other Caltech coauthors are Brittany Moser, now a PhD student at UC Irvine, and research technician Audrey Lee Gosselin.



Mitochondrial DNA is the small circular chromosome found inside mitochondria. The mitochondria are organelles found in cells that are the sites of energy production.

—<http://www.genome.gov/> (CCO)

## NOMINATE YOUR FAVORITE PROFESSOR FOR THE FEYNMAN TEACHING PRIZE!!!

Here's your chance to nominate your favorite professor for the 2016-17 Richard P. Feynman Prize for Excellence in Teaching! You have from now until December 15, 2016 to submit your nomination package to the Provost's Office to honor a professor who demonstrates, in the broadest sense, unusual ability, creativity, and innovation in undergraduate and graduate classroom or laboratory teaching.

The Feynman Prize is made possible through the generosity of Ione and Robert E. Paradise, with additional contributions from an anonymous local couple. Nominations for the Feynman Teaching Prize are welcome from faculty, students, postdoctoral scholars, staff, and alumni.

All professorial faculty of the Institute are eligible. The prize consists of a cash award of \$3,500, matched by an equivalent raise in the annual salary of the awardee. A letter of nomination and detailed supporting material, including, but not limited to, a curriculum vitae, course syllabus or description, and supporting recommendation letters should be emailed to [kkerbs@caltech.edu](mailto:kkerbs@caltech.edu) or directed to the Feynman Prize Selection Committee, Office of the Provost, Mail Code 206-31, at the California Institute of Technology, Pasadena, California, 91125. Nomination packages are due by December 15, 2016.

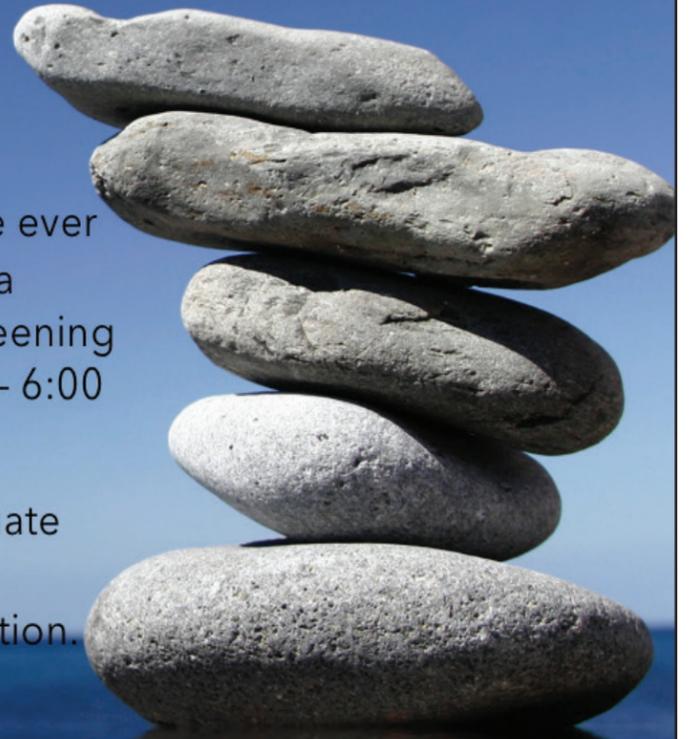
Additional information including guidelines for the prize and FAQ may be found at <http://provost.caltech.edu/FeynmanTeachingPrize>. Further information can also be obtained from Karen Kerbs (626-395-6039; [kkerbs@caltech.edu](mailto:kkerbs@caltech.edu)) in the Provost's Office.



# Mindfully RESILIENT

Mindfulness-based cognitive therapy is an 8-week structured program designed to reduce future depressive relapse. If you've ever dealt with depression before, and are not currently dealing with a depressive episode, you are invited to schedule a 30-minute screening interview for the Winter group. It will meet Thursdays from 4:00 - 6:00 beginning the second week of the term.

Mindfully Resilient is open to all currently enrolled Caltech graduate and undergraduate students. Call the counseling center at (626) 395-8331, or visit [counseling.caltech.edu](http://counseling.caltech.edu) for more information.



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## Freshman Andrews' four three's not enough in home opener

**GOCALTECH.COM**  
Actual Sports Content Editor

PASADENA - The Caltech men's basketball team fell short of a season-opening victory against visiting Occidental College in Tuesday's 110 Freeway Rivalry game.

The Beavers held things together defensively in the first half, limiting the Tigers to 10-of-28 shooting during that span. In doing so, they entered the second half trailing their opponents, 23-21, with the game well within striking distance.

Occidental found its rhythm in the second half, however, and Caltech ultimately succumbed to its SCIAC rival, 61-45, in a game that will not count towards either team's conference record.

Freshman guard Alec Andrews got the start in his first regular season game at Caltech and made the most of his opportunity. Andrews, who also started against Cal-State Fullerton last Friday, led the Beavers with

12 points, all of which came from four three-pointers on six attempts. Three of Andrews' triples came in the second half when his team needed them the most. Andrews also contributed in other facets of the game with five rebounds, two assists and two steals.

Senior center Nasser Al-Rayes asserted himself beneath the glass despite only scoring five points. Al-Rayes closed the game with 12 rebounds, 11 of which came on defense. He also blocked four shots, more than any other player on either team.

Seniors Ricky Galliani and David LeBaron each had 10 points and four rebounds. Galliani got to the free throw line more than any other player and converted on five of his eight attempts.

Occidental threatened to pull away early in the second half, but Caltech kept things close with a 11-5 scoring run keyed by an Andrews three-pointer at 13:16. By the four-minute mark, however, the Tigers had put the game firmly out of reach.



Andrews tries with all his might to prove that he is so much more than "just a fresh."

-gocaltech.com

## Lewis and company show flashes on Opening Night

**GOCALTECH.COM**  
Actual Sports Content Editor

PASADENA -- Senior Kate Lewis nearly had as many rebounds as she had points, but host Caltech was unable to overcome Benedictine University at Mesa (Ariz.) in Thursday's women's basketball home opener.

Lewis scored 15 points and pulled down 14 rebounds in the Beavers' 71-63 loss to the Redhawks. 10 of her rebounds came on defense.

Lewis was not the only Beaver to score 15 points. Freshman Samantha D'Costa got the start at guard and showed she could be an immediate contributor by scoring 15 of her own points. Both Lewis and D'Costa led the team with 40 minutes on the court, though points and minutes were not the only two statistics the two players shared. They also

each went 5-for-11, converted on five free throws and added two assists, three steals and one block. D'Costa even scored the Beavers' first two points of the season on a layup in transition following a Lewis steal.

Sophomore guard and fellow San Diegan Nika Halefiras and Alexa Lauinger each scored eight points to give their team some key depth scoring. Freshman Grace Peng got the chance to show her stuff as the Beavers' starting point guard and responded by leading the team with four assists to go with seven points.

Caltech had its chances throughout, and looked especially in sync early when it took a 21-16 lead into the second quarter. Neither team led by more than eight points and the Beavers even outshot and outrebounded the Redhawks by the time the final buzzer sounded.



That snarl, though. Killer Kate's crazy court face.

-gocaltech.com

## Men's basketball battles DI CSU Fullerton

**GOCALTECH.COM**  
Actual Sports Content Editor

FULLERTON, Calif. (Nov. 11, 2016) -- The Caltech men's basketball team rounded out its preseason schedule when it took on Division I California State University, Fullerton at Titan Gym on Friday night. The Titans were not the first DI team the Beavers saw this preseason, with Caltech previously having battled Big West Conference favorite Long Beach State the prior weekend. Friday's game marked the second time the Beavers have played the Titans, as the first meeting back in 2014 was Caltech's first game in program history against a Division I opponent.

"The reason we play these Division I games is to help us prep in the best manner possible for the rest of the season," Head Coach Dr. Oliver Eslinger said. "They provide great challenges since they are on the road and we don't have much info on the opponents. They allow us to really look at every detail of the game. Plus, they are really fun to be involved in."

Determined not to allow the road nerves to get to them, the Beavers started strong. Senior big man Nasser Al-Rayes held his own against a larger Titans squad by making plays both in the paint and on the perimeter. He drained the game's first shot, a three-pointer on a pass from fellow senior Ricky Galliani to give the Beavers an early boost



It's like a Halloween Oreo. When these three players twist apart, maybe they will dunk.

-gocaltech.com

and finished the game 3-for-9 from beyond the arc. The versatile center was an especially big part of the Beavers' game plan early on, as he logged 13 of the team's 18 first-half points, while Galliani finished the contest with four points of his own.

As the Titans began to find their rhythm offensively, the Beavers responded with a more aggressive defensive approach in the second half. Al-Rayes fouled out with three minutes remaining, but not before gathering a team-high 17 points and six rebounds in

27 minutes of action. Freshman guard Alec Andrews found his way into the starting lineup and tied Al-Rayes for the team lead in minutes. He made three of four shots for seven points to round out the scoring for the Beavers. Senior David LeBaron played for 24 minutes and while he was unable to contribute any points, he did chip in with three assists, two rebounds and two steals.

The Beavers trailed the Titans by a mere 12 points with just over a minute remaining in the first half and had a chance to cut the lead to 10 after LeBaron stole the ball, but he missed the layup in transition. The Titans would then convert on two three-pointers before the end of the half to make it an 18-point margin. Still, the Beavers held their own and used their time on the court against a superior team to work on specific areas in need of improvement.

"It was a good second exhibition in that it was a tough game on the road against great athleticism," Eslinger said. "We came out ready and focused on specific details. That was good to see. We created good opportunities for ourselves on both ends of the court."

"We prepare to be successful at each phase of the game," Eslinger said. "We are amped about the season opener and believe there is exciting basketball ahead on Tuesday and way beyond. Our fans are going to see some dynamic basketball."

# ASCIT Minutes

No ASCIT meeting this week.

Meetings are every week in SAC 13

## ASCIT Board of Directors Meeting

Minutes for 11 November 2016. Taken by Tim Liu.

**Officers Present:** Andrew Montequin, Tim Liu, Bobby Sanchez, Kalyn Chang, Robin Brown

**Call to Order:** 12:06 pm

## President's Report (Andrew):

- Present and accounted for
- Happy Veteran's Day

## Officer's Reports:

### V.P. of Academic Affairs (ARC Chair: Tim):

- Met with Core Curriculum Steering Committee and voted on the pass fail changes
- Student Faculty Lunch is happening on November 21st

### V.P. of Non-Academic Affairs (IHC Chair: Bobby):

- Met with Joe Shepherd and Dean Gilmartin to discuss town-halls about Bechtel
- Library committee is being formed

### Director of Operations (Sakthi):

- Met with DevTeam to talk about improvements to Donut
- Club steering committee met

### Treasurer (Kalyn):

- Houses have been using inter-house joint event funding

### Social Director (Robin):

- Movie night for *Fantastic Beasts and Where to Find Them* on November 18th
- Big I is happening on February 11th

### Secretary (Alice):

- 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.

**Meeting Adjourned:** 12:28pm

## VICE PROVOST'S OFFICE HOURS

Vice Provost, Chief Diversity Officer, and Professor of English, Cindy Weinstein, offers weekly office hours. This is an opportunity for undergraduate, graduate students, and postdocs to meet and discuss topics pertaining to the Council on Undergraduate Education; Caltech accreditation; the Staff and Faculty Consultation Center; Student-Faculty Programs; the Center for Teaching, Learning and Outreach; the Caltech Diversity Center; and the Libraries. There are four 15-minute appointments available per hour. Please sign up in Parsons-Gates room 104, or call the Vice Provost's Office at ext. 6339.

*Fall term hours: 12:00-1:00 p.m.*

*Tuesday, Nov. 22*

*Wednesday, Nov. 30*

*Thursday, Dec. 8*

*Tuesday, Dec. 13*

# Join the Meditation Mob!

Tuesdays, 12:00 - 12:50

Want to learn more about mindfulness meditation? It's a great way to improve your attention and to become more grounded in the present moment.

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## Bechtel Raises Security Issues

**HENRY SWANSON**  
Contributing Writer

Planning for the Betchel Residence has continued into this year, bringing with it a variety of discussions about safety and student life in Caltech's undergraduate housing facilities. Part of the current proposal for Bechtel is for the doors of the student rooms to have keycard-controlled locks, and it has been suggested that this be rolled out to the other undergraduate residences. While on the surface this proposal seems to improve security, it in fact reduces it, as well as being costly and inconvenient for all parties. There are better alternatives.

The current state of affairs is as follows: access to the undergraduate Houses is controlled via keycard readers on the external doors. There are no keycard readers inside the building, and instead, the rooms are fitted with mechanical pushbutton locks. These locks are not particularly secure; with only 1082 combinations, a dedicated person could try each one within an hour. As far as I know, this has fortunately not been an issue; theft is uncommon, and occurs when doors are left propped open. Still

though, one argues, there's nothing wrong with using more secure locks. It certainly can't hurt, right?

One of the benefits of the current system is that it has "two-factor authentication". The proverb among security researchers is that there are three ways to identify yourself: something you know, something you have, and something you are. Generally speaking, systems that use multiple authentication factors are more secure than those that use only one. Currently, access to undergraduate rooms requires two factors: a student ID (something you have) and a lock combination (something you know). With keycard readers on the rooms, we reduce to just one authentication factor. As an example of how this is less secure, consider that students frequently lose their ID cards (ask the card office). Anyone who finds that card can get into the residence. But if the locks are replaced with keycard readers, now they can immediately get into that students' room. The name on the ID could even help them find out which room it is, since many undergraduate rooms have the occupants' names displayed on their doors. The current combination of keycards

and locks is stronger than just using a keycard alone.

Secondly, this proposal would cause a significant inconvenience for students. One of the great things about the House System is that, to many students, the house is effectively another home. Having to carry your ID with you whenever you leave your room would feel like having to bring your house keys whenever you leave your bedroom. When you forget your ID and get locked out of the house, sure, it's a little frustrating, but you just need to knock on the door or call a friend, and they can let you in. But if you lock yourself out of your room, now you need to find your roommate, if you even have one. This can range from a minor inconvenience to a serious issue. Being locked out of your room in a towel is annoying, but ultimately harmless. Being unable to reach your medication without calling and waiting for security to assist you is not. It also would be more of an inconvenience to staff, in particular the RAs and Security, who would have to spend much more time responding to locked-out students. This is particularly true if a student loses their ID during a time when the card office is not able to replace it for an extended period of time (for

example, on a Friday after business hours).

Furthermore, giving a friend access to your room is a fairly common practice. If you're out of town, friends can pick things up from your room, stop by to water plants, or care for a pet. Some students who live off-campus like to be able to leave their things in a friend's room, or nap there in between classes. Even if there is a mechanism for students to grant their friends keycard access, this doesn't help non-student guests such as parents, prefrish, or alums. These guests would have to stay confined to the room when the host isn't around, and wouldn't be able to walk freely around the house or even use the bathroom without concern for being locked out. On a similar note, adding prefrish's keycards to every individual host's room for prefrish weekend would be a logistical nightmare; similar troubles would likely be encountered by hosts of athletic recruits or other prospective applicants who aren't given temporary keycards during their stay. The significant inconveniences that would inevitably be caused by keycard locks should be enough to make one think twice; even if they did add more security.

Fortunately, there's a good alternative. Electronic keypads, such as the ones in Marks-Braun, or in Ruddock 131, are significantly more secure than the current locks, without the disadvantage of keycard readers. The ones in Marks-Braun are set to 6 digit combinations, for a total of 1,000,000 possibilities, literally a factor of a thousand more than the current locks. And because they are also a type of combination lock, there are very few side-effects. There is still two-factor authentication, because it's a "something you know" method, and when you lose your ID, the process for getting back into your room is exactly the same as before. Lastly, you can still give your friend your combination if you need to. The only downside I've come up with so far is that, depending on the type of keypad, you may not be able to change your combination yourself. While I personally believe there's no pressing need to change our current locks, if the consensus is otherwise, I strongly suggest the use of keypads instead of keycards.

## Crossword

**Across**

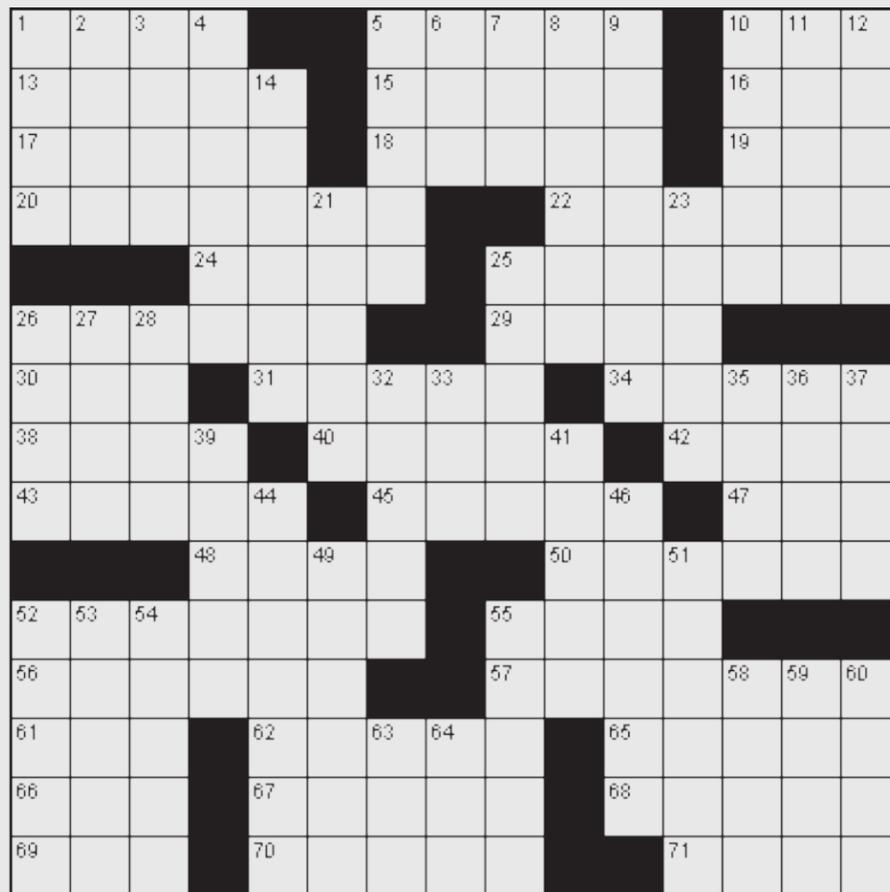
- 1. Chess piece
- 5. Sales talk
- 10. Health resort
- 13. Mistake
- 15. Trap
- 16. Possesses
- 17. Condition
- 18. Ire
- 19. Residue of a fire
- 20. Distinctive
- 22. Rough
- 24. Composure
- 25. Domestic fowl
- 26. Tranquil
- 29. Remainder
- 30. Imitate
- 31. Group of people related by blood and marriage
- 34. Melodic theme
- 38. Small hard fruit
- 40. Reliance
- 42. Food grain
- 43. Serf (Middle Ages)
- 45. On the move
- 47. Fish eggs
- 48. Legal document
- 50. Natural abilities or qualities
- 52. Inspiring admiration or wonder
- 55. Movable barrier
- 56. Form a queue
- 57. Live in
- 61. Poem
- 62. Lightweight wood

65. Elude

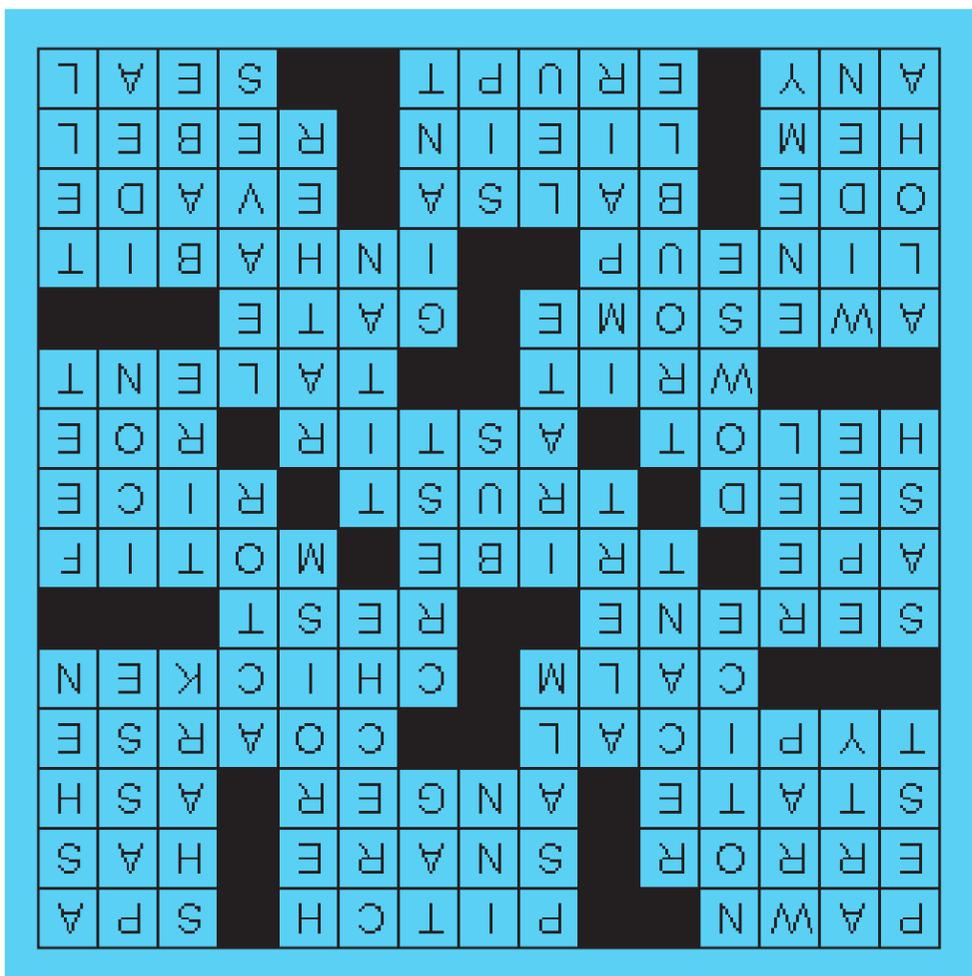
- 66. Cloth border doubled back and stitched
- 67. A long stay in bed in the morning
- 68. Maverick
- 69. One, some, every or all
- 70. Flare up
- 71. Marine mammal

**Down**

- 1. Persistently annoying person
- 2. Showily imitative
- 3. Enfold
- 4. Observe
- 5. Song of praise
- 6. Tavern
- 7. Label
- 8. Place where children are taken in and cared for
- 9. Exceptional courage
- 10. Carnivorous fish
- 11. Out of fashion
- 12. Livid
- 14. Abjure
- 21. Attentive and observant
- 23. Performer
- 25. Top line of a wave
- 26. Waistband
- 27. Fencing sword
- 28. Spool
- 32. Feeling or showing extreme anger
- 33. Public transport
- 35. Wheel covering
- 36. Visual representation
- 37. Pedal extremities
- 39. Wet thoroughly
- 41. Largest of the satellites of Saturn
- 44. Bother
- 46. Preferably
- 49. Make worse or less effective
- 51. Foliage
- 52. Hawaiian greeting
- 53. Broaden
- 54. Foe
- 55. Colossus
- 58. Infant
- 59. Notion
- 60. Narrate
- 63. Monetary unit
- 64. A small drink



Answers to current crossword (pg 7)



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dank memes



can somebody  
please eat  
either one of us

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