

Engineers Create Artificial Skin That “Feels” Temperature Changes

ROBERT PERKINS
Caltech Media Relations

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

A team of engineers and scientists at Caltech and ETH Zurich have developed an artificial skin capable of detecting temperature changes using a mechanism similar to the one used by the organ that allows pit vipers to sense their prey.

The material could be grafted onto prosthetic limbs to restore temperature sensing in amputees. It could also be applied to first-aid bandages to alert health professionals of a temperature increase—a sign of infection—in wounds.

A paper about the new material will be published in *Science Robotics* on February 1.

While fabricating synthetic woods in a petri dish, a team led by Caltech’s Chiara Daraio created a material that exhibited an electrical response to temperature changes in the lab. It turned out that the component responsible for the temperature sensitivity was pectin, a long-chain molecule present in plant cell walls.

“Pectin is widely used in the food industry as a jellifying agent; it’s what you use to make jam. So it’s easy to obtain and also very cheap,” says Daraio, professor of mechanical engineering and applied physics in the Division of Engineering and Applied Science.

Chiara Daraio, professor of mechanical engineering and applied physics in the Division of Engineering and Applied Science, explains how the new temperature-sensitive artificial skin works.

Intrigued, the team shifted its attention to pectin and ultimately

created a thin, transparent flexible film of pectin and water, which can be as little as 20 micrometers thick (equivalent to the diameter of a human hair). Pectin molecules in the film have a weakly bonded double-strand structure that contains calcium ions. As temperature increases, these bonds break down and the double strands “unzip,” releasing the positively charged calcium ions.

Either the increased concentration of free calcium ions or their increased mobility (likely both, the researchers speculate) results in a decrease in the electrical resistance throughout the material, which can be detected with a multimeter connected to electrodes embedded in the film.

The film senses temperature using a mechanism similar—but not identical—to the pit organs in vipers, which allow the snakes to sense warm prey in the dark by

detecting radiated heat. In those organs, ion channels in the cell membrane of sensory nerve fibers expand as temperature increases. This dilation allows calcium ions to flow, triggering electrical impulses.

Existing electronic skins can sense temperature changes of less than a tenth of a degree Celsius across a 5-degree temperature range. The new skin can sense changes that are an order of magnitude smaller and have a responsivity that is two orders of magnitude larger than those of other electronic skins over a 45-degree temperature range.

So far, the skin is capable of detecting these tiny changes across a range of temperatures roughly between 5 to 50 degrees Celsius (about 41 to 158 degrees Fahrenheit), which is useful for robotics and biomedical applications. Next, Daraio’s team would like to boost that up to

90 degrees Celsius (194 degrees Fahrenheit). This would make pectin sensors useful for industrial applications, such as thermal sensors in consumer electronics or robotic skins to augment human-robot interactions. To do so, they will need to change the fabrication process they now use to create the material, as that process leads to the presence of water—which tends to bubble or evaporate at high temperatures.

At ETH, Daraio collaborated with postdoctoral researcher Raffaele Di Giacomo; graduate students Luca Bonanomi and Vincenzo Costanza; and guest professor Bruno Maresca, from the University of Salerno, Italy. Their paper is titled “Biomimetic temperature-sensing layer for artificial skins.” This research was funded by the Swiss National Science Foundation.



Photo Courtesy of Caltech

The Salt Shaker Column - I’m Back

ANDRE COMELLA
Contributing Writer

Welcome to The Salt Shaker. What is it? Who am I? Well, the Salt Shaker is my new column for the Tech. In it, I hope to take on myriad issues at Caltech, and believe me, nothing is safe or sacred. I’ve been here long enough and been involved enough to know there’s a lot of problems with Caltech, some inherent, some caused by students, others by faculty, and administrators. In my time, I’ve done my best to stay involved and informed.

In the last year, I spent my time working in Cambridge and hanging around MIT. My friends at Tech

tend to be people who are heavily involved in building communities and shaping campus politics, and my friends at MIT were no different. I spent a great deal of time immersing myself in MIT culture, meeting new people, and discussing MIT culture, present and past. This experience gave me a new perspective, challenging the things I had thought about Caltech. So many parts of Caltech I took as given, inherent to a highly academically demanding university. But this simply isn’t the case. The irrational and patronizing administration, the poor education from apathetic professors, the toxic culture and status quo of crippling

depression. All of these don’t need to exist.

And so I have returned, with new thoughts and new perspectives. Three years here have given me experience. A year away has given me time to think, discuss, and analyze with the kind of clarity that can only come with distance. Despite the draining and crushing experiences I’ve had, the monumental inertia of the Institute, the daunting task of pushing for change, I find myself with an unusual feeling: optimism. No one made it to this school without strength and determination, and it is those qualities that will bring us to our brighter horizons.

So now I’m sitting in my room, listening to the Hamilton soundtrack, thinking about what it means to have a legacy. My year away gave me a unique opportunity to see what I had done, and what I will leave behind. I will admit, with some shame, that there was a sense of satisfaction that came with knowing that some things were worse off, weren’t going as smoothly. There’s something deeply validating about knowing my presence had an impact, and smugly satisfying in knowing my critics would be forced to admit my positive impact by confronting its absence.

Here once again, I find myself with the opportunity to make a

new impact. If the kind of impact I have is the kind that needs me to be here, then it’s not serving a greater good, it’s just stroking my ego. So to do something truly selfless and meaningful, I have to create something beyond myself. My goal here, in this column, is to use my thought, insight, and experience to spur discussion and change. To make an impact, however small, in this school and its people, that will last beyond my presence and even my memory. Legacy is about creating something that outlives you, something that lives beyond you, growing, changing, and ideally, improving.

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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.

Upcoming Events

1. Caltech Y Nuclear Winter Series International Nuclear Weapons Policy in the Current Era:

A Conversation with Dr. Michael Nacht

Wednesday | February 8th | 12:00 to 1:30 pm | Location to be announced | Lunch is provided (spaces are limited), RSVP Required

RSVP: <https://goo.gl/forms/UvTmxxsIvKAMazxCo1>

Michael Nacht served as Assistant Secretary of Defense for Global Strategic Affairs (2009-2010), for which he received the Distinguished Public Service Award, the Department's highest civilian honor. He also served as Assistant Director for Strategic and Eurasian Affairs of the US Arms Control and Disarmament Agency (94-97), during which time he participated in five Presidential summits – four with Russian President Yeltsin and one with Chinese President Jiang Zemin. Nacht currently holds the Thomas and Alison Schneider Chair in Public Policy at U.C. Berkeley and is Chair of the Policy Focus Area for the Nuclear Science and Security Consortium led by the Berkeley Department of Nuclear Engineering. He is the author or co-author of six books and more than eighty articles and book chapters on nuclear weapons policy; regional security issues affecting Russia and China, the Middle East and East Asia; cyber and space policy; counter-terrorism and homeland security; international education; and public management.

The Caltech Y Social Activism Speaker Series (SASS) Committee is hosting the lunch seminar with Professor Michael Nacht to discuss recent international developments in nuclear weapons policy as a part of a Nuclear Winter Series. As tempers flare and tensions rise across the globe, open dialog on nuclear arms is more important now than ever. Watch for more programs within the series this winter term. Programs coordinated by the Social Activism Speaker Series were made possible with generous support from the George Housner fund and the Caltech Y.

2. 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. Eligible for Federal Work Study.

3. Pasadena LEARNS

Every Friday | 3:00 - 5:00 PM | Pasadena 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. Eligible for Federal Work Study.

Beyond the Y

1. Rev. William Barber, President of the North Carolina NAACP

Wednesday | February 1 | 7:00 pm | Thorne Hall – Occidental College in Eagle Rock | Free

Oxy Facebook event page: <https://www.facebook.com/events/648332075331014>

Rev. Barber is the president of the North Carolina NAACP and leader of the Moral Monday movement, a multi-racial, multi-generational interfaith movement that has led protests at the NC General Assembly around issues of injustice, including voting rights, gun violence, immigration reform, school funding, LGBT rights, the minimum wage and workers' rights, and others. Hundreds of activists, including Dr. Barber himself, have also engaged in non-violent civil disobedience to expose what the politicians in North Carolina are trying to do in the dark.

The event is sponsored by Occidental College and several student groups and cosponsored by the Southern Christian Leadership Conference, Clergy and Laity United for Economic Justice, the Coalition for Humane Immigrant Rights in LA, the LA Alliance for a New Economy, the LA County Federation of Labor, the Black Worker Center, and LA Voice. Martin Luther King spoke in Thorne Hall in April 1967, 50 years before Rev. Barber's talk.

Rev. Barber's speech to the Democratic convention last summer made headlines around the world. If you weren't able to see it then, here's a link to that speech: <https://www.youtube.com/watch?v=aw3PUghqlAA>

2. Science Fair Judges Needed

February 6th - 9th | 9:00 AM - 2:30 PM (Flexible Hours) | Glendale, Ca

Volunteer judges are needed for Franklin Magnet School Science Fair in Glendale. Transportation available and we will feed you too! Graduate students preferred but all welcome to apply.

The times are flexible and you don't have to be present for the whole time slot. We are in need of 12 volunteers to judge our students' projects/submissions. Ideally these volunteers will have a solid background in science and/or currently work in a science-related field. Another preference is that the volunteers not be related to any children at our school to ensure impartiality when awarding prizes.

Please let me know as soon as possible if you or any of your colleagues would be willing to commit to this awesome event that fosters a love of science in our youth. Please email Mary at mbehar@gmail.com immediately if interested! Time is running short. Compensation will be in the form of a free lunch on the day(s) of service, networking with other scientists and the joy of having volunteered.

We are also open to any donated prizes you think elementary school-age children might want for first, second, third prize and honorary mentions.

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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.

Student Office Hours for Winter Term 2017:

2/2/17 Thursday 11:00 a.m.-12:00 p.m.

2/8/17 Wednesday 10:00 a.m.-11:00 a.m.

2/14/17 Tuesday 10:00-11:00 a.m.

2/22/17 Wednesday 10:00-11:00 a.m.

3/2/17 Thursday 12:00-1:00 p.m.

3/13/17 Monday 10:00-11:00 a.m.

Keck Observatory's New Planet Imager Delivers First Science

WHITNEY CLAVIN
Caltech Media Relations

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

A new instrument on the W. M. Keck Observatory in Hawaii has delivered its first images, showing a ring of planet-forming dust around a star and, separately, a cool star-like body, called a brown dwarf, lying near to its companion star.

The device, called the vortex coronagraph, was recently installed inside the Near Infrared Camera 2 (NIRC2), the workhorse infrared imaging camera at Keck. The vortex coronagraph has the potential to image planetary systems and brown dwarfs closer to their host stars than was possible previously. It was invented in 2005 by Dimitri Mawet while he was at the University of Liège in Belgium. Mawet is currently associate professor of astronomy at Caltech and a senior research scientist at NASA's Jet Propulsion Laboratory (JPL). The Keck vortex coronagraph was built by the University of Liège, Uppsala University in Sweden, JPL, and Caltech.

"The vortex coronagraph allows us to peer into the regions around stars where giant planets like Jupiter and Saturn supposedly form," says Mawet. "Before now, we were only able to image gas giants that are born much farther out. With the vortex, we will be able to see planets orbiting as close to their stars as Jupiter is to our sun, or about two to three times closer than what was possible before."

The new vortex results are presented in two papers, both published in the January 2017 issue of *The Astronomical Journal*. One study, led by Gene Serabyn of

JPL, the overall lead of the Keck vortex project, presents the first direct image of the brown dwarf called HIP 79124 B. This brown dwarf is located 23 astronomical units from a star in a nearby star-forming region called Scorpius-Centaurus (an astronomical unit is the distance between our sun and Earth).

"The ability to see very close to stars also allows us to search for planets around more distant stars, where the planets and stars would appear closer together. Having the ability to survey distant stars for planets is important for catching planets still forming," says Serabyn, who also led a team that tested a predecessor of the vortex device at the Hale Telescope at Caltech's Palomar Observatory near San Diego. In 2010, the team took images of three planets orbiting in the distant reaches of the star system called HR 8799.

The second vortex study, led by Mawet, presents an image of the innermost of three rings of dusty planet-forming material around the young star called HD 141569 A. The results, when combined with infrared data from NASA's Spitzer and WISE missions, and the European Space Agency's Herschel mission, reveal that the star's planet-forming material is made up of pebble-size grains of olivine, one of the most abundant silicates in Earth's mantle. In addition, the data show that the temperature of the innermost ring imaged by the vortex is around 100 Kelvin (or minus 173 Celsius degrees), a bit warmer than our asteroid belt.

"The three rings around this young star are nested like Russian dolls and undergoing dramatic changes reminiscent of planetary formation," says Mawet. "We have shown that silicate grains have agglomerated into pebbles, which

are the building blocks of planet embryos."

How the vortex sees planets

The first science images and results from the vortex instrument demonstrate its ability to image planet-forming regions hidden under the glare of stars. Stars outshine planets by a factor of a few thousand to a few billion, making the dim light of planets very difficult to see. The closer a planet is to its star, the more difficult it is to image. To deal with this challenge, researchers have invented instruments called coronagraphs, which typically use tiny masks to block the starlight, much like blocking the bright sun with your hand or a car visor to see better.

What makes the vortex coronagraph unique is that it does not block the starlight with a mask, but instead redirects the light away from the detectors using a technique in which light waves are combined and canceled out. Because the vortex doesn't require a mask, it has the advantage of taking images of regions closer to stars than other coronagraphs. Mawet likens the process to the eye of a storm.

"The instrument is called a vortex coronagraph because the starlight is centered on an optical singularity, which creates a dark hole at the location of the image of the star," says Mawet. "Hurricanes have a singularity at their centers where the wind speeds drop to zero—the eye of the storm. Our vortex coronagraph is basically the eye of an optical storm where we send the starlight."

A team at the University of Liège, led by Olivier Absil, designed a portion of the Keck vortex coronagraph called the phase

mask, which consists of concentric microstructures that force the starlight waves to swirl about the mask's center, creating the vortex singularity. This mask was forged at Uppsala University by Mikael Karlsson and his team, who etched the concentric microstructures into synthetic diamond. The etching is done in a plasma chamber where the diamond is bombarded by argon and oxygen ions, ripping the carbon atoms out of the diamond crystal.

The vortex was installed at Keck in the spring of 2015 by Keith Matthews, chief instrument scientist at Caltech, who has worked on dozens of astronomical instruments in his more than 50-year career at the Institute. The coronagraph was optimized and is operated with the help of the Keck Observatory staff. "Once the device is in there, users can operate it remotely from the base of the mountain or even from their home universities," says Matthews.

What's next for the vortex

In the future, the vortex will look at many more young planetary systems, in particular planets near the "ice lines," which are the region around a star where temperatures have become cold enough for volatile molecules, such as water, methane, and carbon dioxide, to condense into solid icy grains. Ice lines are thought to delineate the transition between rocky planets and gas giants.

Surveys of the ice-line region by the vortex coronagraph will help answer ongoing puzzles about a class of hot, giant planets found extremely close to their stars—the "hot Jupiters" and "hot Neptunes." Did these planets first form close to the ice lines and migrate in, or did they form in situ, right next to

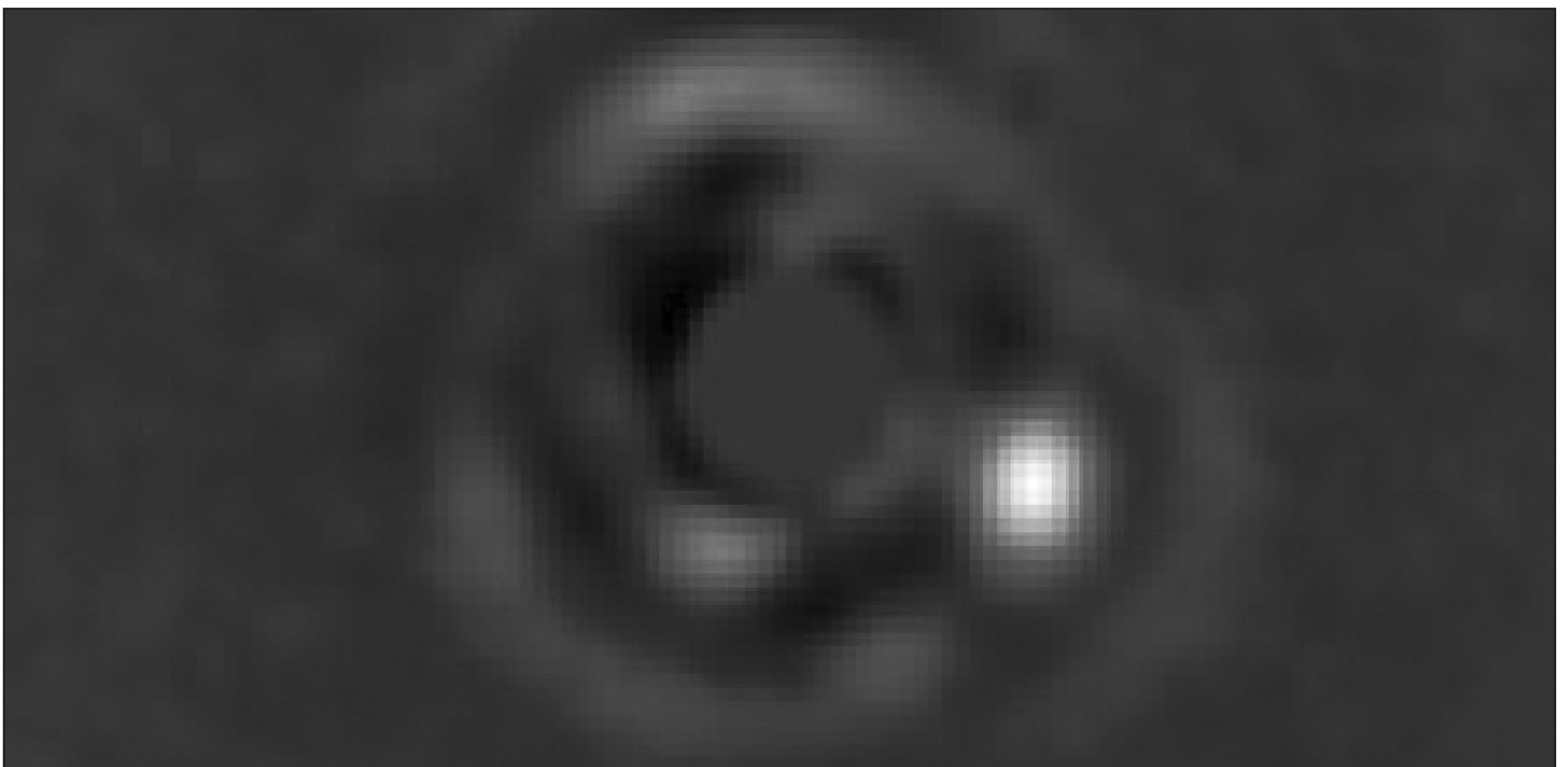
their star? "With a bit of luck, we might catch planets in the process of migrating through the planet-forming disk, by looking at these very young objects," says Mawet.

This month, a privately funded project called Breakthrough Initiatives announced that it is partnering with the European Southern Observatory to use similar vortex technology to find and image a putative Earth-like planet in the nearby Alpha Centauri star system. What's more, results from Keck's vortex coronagraph will help with a planet imager planned for the future Thirty Meter Telescope and with proposed NASA space missions, such as the Habitable Exoplanet Imaging Mission (HabEx) and the Large UV/Optical/IR Surveyor (LUVOIR), which would use next-generation vortex coronagraphs currently being designed in Mawet's group at Caltech.

The challenge of these facilities is to image planets even closer to their stars than those at the ice line, which includes Earth-like rocky planets. When combined with data from spectrograph instruments, which can identify molecules in planets' atmospheres, the images could help astronomers identify possible signs of life.

"The power of the vortex lies in its ability to image planets very close to their star, something that we can't do for Earth-like planets yet," says Serabyn. "The vortex coronagraph may be key to taking the first images of a pale blue dot like our own."

The Keck Observatory is managed by Caltech and the University of California. In 1996, the NASA joined as a one-sixth partner in the Keck Observatory. JPL is managed by Caltech for NASA.



An image of the brown dwarf HIP 79124 B, which is separated from its host star by 23 astronomical units. Photo Courtesy of NASA/JPL-Caltech

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Lewis, Peng shoulder women's hoops at Redlands

GOCALTECH.COM
Actual Sports Content Editor

REDLANDS, Calif. (Jan. 28, 2017) – Senior Kate Lewis and freshman Grace Peng combined to score 29 points in a 53-38 Caltech women's basketball loss at University of Redlands on Saturday evening.

It was all Lewis and Peng could do to keep it tight, scoring the Beavers' first 21 points of the game and finishing with 76 percent of the team's total production. With the already thin Beavers roster also down second-leading scorer Samantha D'Costa for the night, the visitors did well to keep pace midway through the third quarter before Redlands ran off 10 unanswered points over a seven-minute Caltech scoreless stretch.

Caltech trailed by seven just seconds before the end of the first quarter, but came back to make it 15-13 halfway through the

second quarter. The Beavers would not allow the Bulldogs to go up by more than four over the next eight minutes, finally tying the game at 23-23 when sophomore Elizabeth Eiden, who limited the Bulldogs' post player to mere seven points thanks to her imposing presence inside, chipped in the first points from anyone other than Lewis and Peng. Sophomore Madeline Schemel tied it again at 25-25 soon after and Lewis and Peng each tied it again, the latter at 29-29 with 5:10 left in the third quarter before Redlands took control and cruised to the win.

Lewis led the squad with 16 points and just missed what would have been her eighth double-double of the season with nine rebounds, while Peng dropped 13 for her seventh game in the last eight scoring in double figures. Schemel added six and Eiden blocked three shots, giving her multiple blocks in six of her last seven games.



"My name is Grace Peng. You killed my father. Prepare to die."

Photo Courtesy of The Big T

Eiden keys Caltech offense against Chapman

GOCALTECH.COM
Actual Sports Content Editor

PASADENA (Jan. 25, 2017) – Sophomore Elizabeth Eiden proved to be the Caltech women's basketball team's top offensive weapon in Wednesday's home loss to Chapman University in SCIAC play.

Eiden used her height as a means of countering the smaller Panthers and yielded 12 points on 50-percent shooting. All of her best looks came directly beneath the basket and she was especially effective on inbound plays. She also picked up six rebounds, one steal and one block and was on her way to a double-double before fouling out with roughly six-and-a-half minutes to go in the fourth quarter. Senior Kate Lewis came even closer to notching a double-double, scoring 10 points to go with nine rebounds and three assists despite flirting with foul trouble as well. Sophomore Madeline Schemel posted arguably her best all-around stat line of the season, totaling six points, seven rebounds and five assists, matching her assist total from Saturday's game at the University of La Verne.

The Beavers found the Panthers' relentless full-court press difficult to navigate and had to fight for every basket. The Caltech defense kept Chapman in check throughout the first quarter, as the Beavers trailed the

Panthers by just five points heading into the second frame. The Panthers, however, took control in the second and third quarter with the three-pointer being one of the game's key differences. Chapman made six more three-pointers than Caltech, but only outshot the Beavers by just over one percent. Caltech did win the rebounding battle and registered more points in the paint, which could be a point of emphasis the next time these two teams meet.



"Wait ...what were the rules of this game again?"

-gocaltech.com,

Galliani, Cahill Shine in Historic Win

GOCALTECH.COM
Actual Sports Content Editor

PASADENA (Jan. 26, 2017) – The hot hands of starting senior Ricky Galliani and sophomore Brent Cahill off the bench helped the Caltech men's basketball team knock off visiting Chapman University for the first time in 63 years in Thursday's SCIAC game. The Beavers defeated the Panthers, 64-52.

Both players finished with 15 points. The two guards led the Beavers in a near symmetrical two halves of good shot selection and sound perimeter defense, a puzzle which the Panthers were never able to solve completely throughout the game's 40 minutes. The end result turned out to be one of historic proportion.

"It's been a long time," Eslinger said. "You try not to think about it too much. I told the guys tonight how important [the win] was, how they should value this program, the records we can set and the history we can make. It's cool. It's a neat thing, it's historic and we always try to give the guys something for their confidence."

The Beavers end the first half of SCIAC play at an even 4-4, just one game out of a three-way tie for third place.

The victory was arguably the Beavers' best team performance of the season. Senior Nasser Al-Rayes had

11 points and seven rebounds. Fellow senior David LeBaron had 10 points, four rebounds and two steals. Some of the freshmen also saw a large chunk of the action as Alec Andrews tallied a career-high nine assists without committing a single turnover and Michael Li played 20 minutes at the point coming off the bench. Eslinger has seen great improvement from his younger players since the preseason and has grown increasingly

more confident in using them as the year has progressed.

"The first-year guys are not first-year anymore," Eslinger said. "They had a lot of experience in the nonleague against good teams. We wanted to do that, that's the reason we play a tough non-conference schedule. Then you try and figure out what your team's identity is going to be with that many new guys. They're just playing tough now. They understand the system and the

roles they're performing. We want to be able to use everybody."

Chapman held a narrow lead for the game's first seven minutes before Caltech went up for good on a Cahill layup to give the Beavers a 10-8 first half lead. Once the Beavers increased the lead to 10 on a Li layup with 32 seconds to go in the half, they were able to keep the Panthers at a distance for the rest of the game. Caltech opened the second half on a 9-2 run, which contained a three-pointer from Galliani to open the frame followed by two layups from LeBaron and one from Al-Rayes. Holding a 17-point lead with 15 minutes left to go, Caltech successfully held off its SCIAC foe the rest of the way, with Chapman never coming closer than eight.

"I think that we're playing with a lot of great energy leading up to these games," Eslinger said. "The guys have been really locked in the last week. We're playing really good teams, too. Conference play is just how much can you focus and can you take your focus to a higher level? Can the guys really lock in and salivate over the scouting reports and what you're trying to teach them with the game plan and the strategy? They've really done that the last couple games and we've got some good momentum going."



It's like a scene straight outta High School Musical. Gotta getcha head in the game, Brent.

-gocaltech.com

Counseling Center Groups and Workshops

Winter Term 2017

The counseling center is excited to announce our workshops for the Winter term:

Workshops

Catalyst: A 3-week workshop teaching general coping skills

Refresh: A 1-hour workshop teaching how to get better sleep

Emotion Lab: A 1-hour workshop to recognize your emotions better

Spark: A 1-hour workshop to cope with procrastination and work avoidance.

Groups

Social Confidence: A 7-week week group for anyone who'd like to be more comfortable and less anxious in social situations. Pre-screening required; see the webpage for more information. Begins 1/23.

Mindfully Resilient: An 8-week group focused on reducing the risk of relapse for depression and anxiety. Pre-screening required; see the webpage for more information. Begins 1/12.

For the full list of workshops, dates, and times, visit:

counseling.caltech.edu

and follow the link to the new classes and workshops.

ASCIT Minutes

Meetings are every week in SAC 13

ASCIT Board of Directors Meeting

Minutes for 26 January 2017. Taken by Alice Zhai.

Officers Present: Andrew Montequin, Tim Liu, Bobby Sanchez, Sakthi Vetrivel, Kalyn Chan, Robin Brown, Alice Zhai

Guests: John Li

Call to Order: 12:18pm

President's Report (Andrew):

- Met with Associate Director of Security - wants security to engage with the students more by showing up to house dinners and writing articles
- Meeting with Joe tomorrow for future town hall meetings

Officer's Reports:

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

- SFC is on February 1st
- Option fair is happening later this term

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

- 4 new presidents introduced to the IHC
- Rotation survey will be sent out soon

Director of Operations (Sakthi):

- Sent out yearbook request form about printed or digital yearbooks - will get results later in the week

Treasurer (Kalyn):

- Caltech Christian Fellowship asked for ASCIT funding for Veritas event
- treas@donut.caltech.edu does not work - use kcchang@caltech.edu to contact the treasurer

Social Director (Robin):

- GSC is partnering with ASCIT for the Winter Carnival
- Looking for a caterer for ASCIT formal
- Doing midnight pizza for prefrash weekend

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: 12:52pm

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4. Unity
7. Mythological vicious winged monster
12. Have confidence or faith in
13. Genus corvus
14. Drama set to music
15. Palliate
17. Interior layout and furnishings
18. Indicating maiden name
19. Deprive of freedom
21. Peculiar
22. Tonality
23. Source or germ
24. Zeal
27. Rotating mechanism
28. Arum
30. Affect emotionally
33. Singing voice
36. Earlier in time
38. Impulse
39. Type of fish
40. In addition
41. Hackneyed
43. Highly excited
45. Necessitate
46. Medicinal, magical or poisonous beverage
48. Frequently
50. Bobbin

51. From a great distance
53. Country, initially
56. Health spring
58. Have as a meaning
60. Steal
61. Large tropical ray
64. Concordant
66. Kind of lesion
67. Hint
68. A horse's manner of moving
69. Glimmer
70. Stitched cloth border
71. Conclude

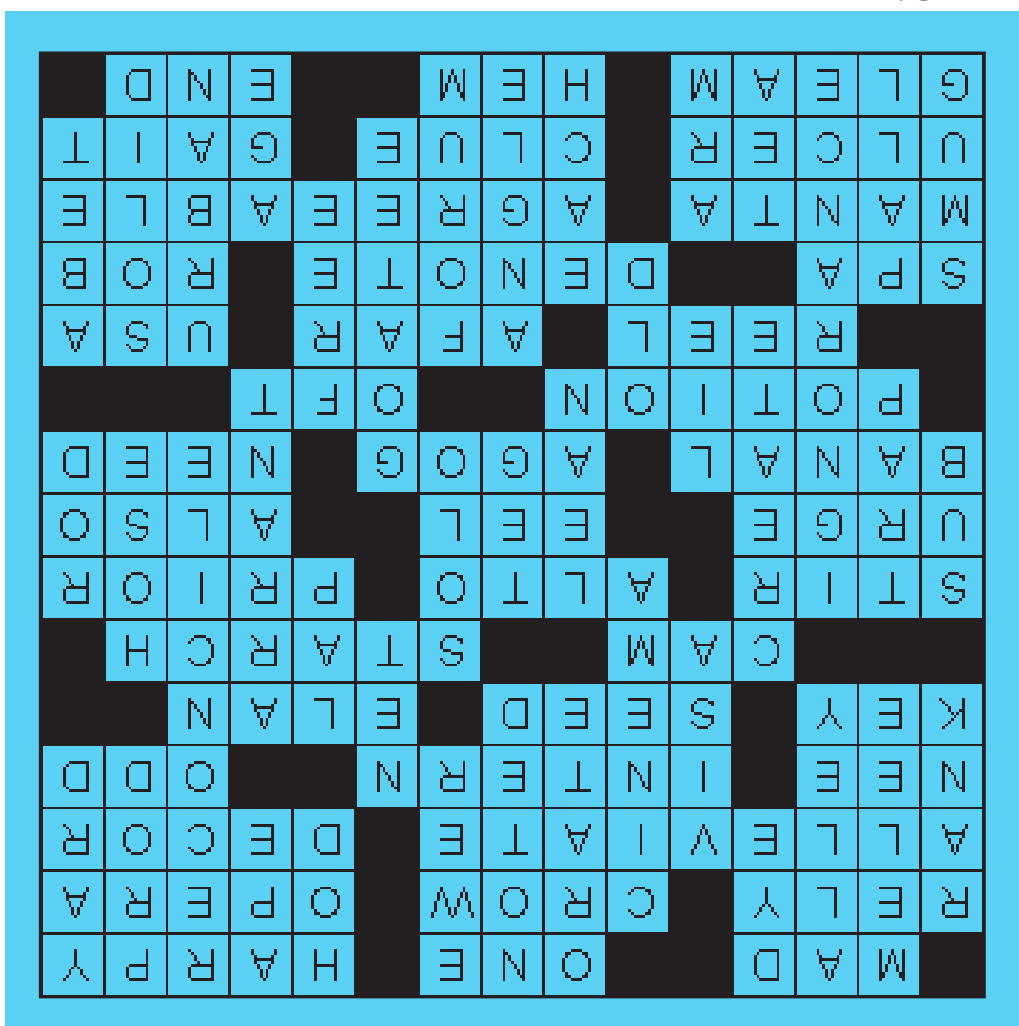
Down

1. Noisy riotous fight
2. Back street
3. Staining substance
4. Talk pompously
5. Observed
6. Large jug
7. Box on a pole for carrying bricks
8. Imitate
9. Bring into accord
10. Urge on
11. Linear unit
12. Relative status
13. Movie house
16. Passport endorsement
20. Mesh
25. Circuit
26. Without qualification
27. Bring into existence

28. Alone
29. Socks, stockings and tights
30. Long crusty roll sandwich
31. Snare
32. Lack of knowledge or education
34. Skimpy
35. Two-year-old sheep
37. Pole
42. Prevarication
44. Small beard
47. Past times
49. Liberate
51. Slant
52. Discussion group
53. Relating to a city
54. Financially sound
55. Assist in wrongdoing
56. Self-satisfied
57. Become less interesting or attractive
59. Apiece
62. Beverage
63. Supply with weapons
65. Historic period

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Answers to current crossword (pg 7)



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