The California Tech

VOLUME CXIX NUMBER 28 PASADENA, CALIFORNIA TECH@CALTECH.EDU MAY 16, 2016

LIGO team awarded Breakthrough Prize in Fundamental Physics

Photo Courtesy of the Breakthrough Prize

CALTECH MEDIA RELATIONS

This article was originally published online at caltech.edu.

The Selection Committee of the Breakthrough Prize in Fundamental Physics has announced a Special Breakthrough Prize in Fundamental Physics recognizing the scientists and engineers who contributed to the detection of gravitational waves by the Laser Interferometer Gravitational-Wave Observatory (LIGO).

The $3 million award is being shared between two groups of laureates. The three founders of LIGO — Caltech's Ronald W. P. Drever, professor of physics, emeritus, and Kip S. Thorne, the Richard P. Feynman Professor of Theoretical Physics, emeritus, and MIT's Rainer Weiss, professor of physics, emeritus — will share $1 million equally. In addition, 1,012 contributors will equally share $2 million; of these, 1,005 are the authors of the paper from the LIGO and Virgo collaborations, while the remaining seven are scientists who "made important contributions to the success of LIGO." This group of seven includes Caltech's Mark Scheel, senior research associate in physics, and Rochus E. Vogt, the R. Stanton Avery Distinguished Service Professor and Professor of Physics, Emeritus.

In announcing the special prize, Yuri Milner, one of the founders of the Breakthrough Prizes, said, "The creative powers of a unique genius, many great scientists and the universe itself have come together to make a perfect science story."

For more about Caltech's Breakthrough Prize in Fundamental Physics laureates, read "Glitz and Qubits" in the current issue of Caltech's *E&S* magazine.

The Breakthrough Prize trophy was created by Olafur Eliasson. "The whole idea for me started out with, 'Where do these great ideas come from? What type of intuition started the trajectory that eventually becomes what we celebrate today?'" Like much of Eliasson's work, the sculpture explores the common ground between art and science. It is molded into the shape of a toroid, recalling natural forms found from black holes and galaxies to seashells and coils of DNA.

News briefs from around the globe

A brief list of events from the past week, compiled by the editors

HALO Trust to remove landmines around church near Jordan River

5,000 landmines near land marked as Jesus' baptism site to be cleared by world's largest humanitarian landmine removal organization [CNN]

Colombian police seize record size domestic haul of illegal drugs

8 tons of cocaine hidden on a banana plantation found by authorities [BBC]

Ex-CIA agent Donald Rickard reveals tip-off led to Mandela arrest in Durban, South Africa

1962 arrest landed Mandela, who was wanted for alleged ties to a terrorist organization, in jail for 27 years [BBC]

Brazilian Senate votes to begin impeachment trial of President Dilma Rousseff

55 vote in favor of, 22 against impeachment; Rousseff formally accused of borrowing from state banks to conceal deficit [NYT]

Andre Brahic, one of discoverers of Neptune's rings, passes away

73-year-old was a key figure in increasing public awareness of research into space [BBC]

Facilities holds campus-wide meeting for Bechtel Residence

NEERA SHAH
Page Editor

On May 13, members of the Caltech community were able to attend a presentation on the current plans for the new Bechtel Residence. The presenters were Jim Cowell, assistant vice president for facilities; Hall P. Daily, director of government relations; Don O'Neil, senior director for capital projects, modernization, planning, design and construction; and Brian Kenworthy, associate partner at ZGF Architects.

Caltech's master plan for how it will use its land will be up for review in 2019. The discretionary review and design approval for Bechtel began in 2007. The institution is currently entitled to build up to 600,000 square feet in the open area on the south side of Del Mar Boulevard. The plan is for the Bechtel house to be 100,000 square feet with 200–250 beds, a servery and a dining hall. This new residence will allow all undergrads to live on campus for all four years. It is likely that the board plan will be required, but this has not been confirmed yet.

In order to make space for the building itself, the child care center was moved on campus last year. Bechtel Residence will be built between Avery and Lot 10. This land was originally designated for academic or administrative space, but this can be changed to allow housing instead upon modification request. After the new house is built, Lot 10 will only be accessible through Michigan Avenue, and it will be closed during construction. The building plan has three stories along the two sides facing Del Mar and Avery and two stories along the other two sides, except for a one-story section for the dining hall, which will face Moore Walk.

Throughout the design process, the design team consulted several members of the Caltech community, including students, IHC, ASCIT and RAs. Inside the residence, the current prototypes for suite options are a four-, six- or eight-bedroom suite and a select few one-bedroom singles for students. The faculty-in-residence will have a two-bedroom apartment, while the RAs and RLC will have one-bedroom apartments. Individual bedrooms will primarily be singles and have an area of about 96 square feet.

Graduate student housing options may increase as a result of undergrads moving into Bechtel (e.g., apartments in the 150 South Chester Avenue complex may be converted into grad housing). Only about 450 grad students out of 1,200 are currently provided with Caltech housing each year. It is also possible that some housing in Bechtel will be available to grad students, but these plans have not been finalized yet.

In terms of sustainability, the goal is to be LEED Platinum. Opportunities to consider include net zero energy, net zero water and installing photovoltaics on the roof. Regarding the exterior, there will be a courtyard enclosed by the four sides of the building. It is designed such that there will be two distinct parts — one half will have softscape, including a lawn, while the other half will have hardscape.

The schematics were developed in late 2015, and design development completed in spring of this year. Construction is set to begin in winter of 2017, so new residents should be able to move in to the house in the fall of 2018.

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Caltech Y Column

CALTECH Y

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

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. Science, Technology, and Innovation for Achieving the United Nations Sustainable Development Goals: A Conversation with Dr. William Colglazier

Thursday | May 19th | 3:00 to 4:30 p.m. | Sign Up at: http://goo.gl/forms/PqMMvhXKZV

(priority will be given to students)

Dr. E. William Colglazier is s Editor-in-Chief of Science & Diplomacy and Senior Scholar in the Center for Science Diplomacy at the American Association for Advancement of Science (AAAS). He is also co-chair of the committee appointed by the U.N. Secretary General for advising on the role of science, technology, and innovation for achieving the United Nations Sustainable Development Goals (SDGs).

He served as the fourth Science and Technology Adviser to the Secretary of State from 2011 to 2014, first under Secretary Clinton and then under Secretary Kerry, providing scientific and technical expertise and advise in support of the development and implementation of U.S. foreign policy. From 1994 to 2011, he was Executive officer of the U.S. National Academy of Sciences (NAS) and the National Research Council (NRC) where he helped to oversee the studies that provide independent, objective scientific advice on domestic and international public policy issues.

He received his Ph.D. in theoretical physics from Caltech in 1971, and prior to 1994 worked at the Stanford Linear Accelerator Center, the Institute for Advanced Study in Princeton, the Center for Science and International affairs at Harvard s Kennedy School of Government, and the University of Tennessee. While at Harvard, he also served as Associate Director of the Program in Science, Technology, and humanism of the Aspen Institute. He is past chair of the Forum on Physics and Society of the American Physical Society (APS) and a Fellow of the AAAS and APS.

The Caltech Y Science Policy Series provides an opportunity for students to explore the intersection of science and policy to promote informed, engaged citizenship. The Science Policy Series is organized by the Caltech Y Social Activism Speaker Series (SASS) Committee - which is open to any students interested in organizing programs focused on science policy or other issues of global significance. Contact caltechy@caltech.edu for more information. The series was made possible with generous support from the George Housner Fund.

2. Education inequality and social justice: a conversation with Miles Corwin

Monday, May 23rd | 12:00-1:00 p.m. | Location TBD | To Sign Up Visit: http://goo.gl/forms/FSCgL51rtE

Miles Corwin spent a year with twelve gifted high school students from disadvantaged communities in LA. Corwin chronicled their journeys as they faced the greatest challenges of their academic lives in his book, *And Still We Rise*. The book won the PEN West award for nonfiction and was a Los Angeles Times Best Book of the Year. On May 23rd, Corwin will come to Caltech to discuss his unique perspective on the challenges facing students in disadvantaged communities.

Praise for the book:

"An exuberant tale of South-Central kids…On every page, their voice ring as clear as church bells and make even a jaded reader feel inspired."

USA Today

"An impressive, important work of narrative journalism…A more gifted reporter can barely be imagined."

San Francisco Chronicle

Corwin Bio: Miles Corwin is a former crime reporter at the Los Angeles Times, where he wrote about the LAPD, homicide in South-Central Los Angeles, prisons, and the criminal justice system. A native of Los Angeles, he graduated from University of California, Santa Barbara and received an M.A. at the University of Missouri School of Journalism. Corwin is the author of three nonfiction books: *The Killing Season*, a national bestseller; *And Still We Rise*, the winner of the PEN West award for nonfiction and a Los Angeles Times Best Book of the Year; and Homicide Special, a *Los Angeles Times* bestseller. *Kind of Blue*, his first novel, was named one of *Booklist*'s Top Ten First Crime Novels of 2010. His next book in the Ash Levine series, *Midnight Alley*, was released in April 2012. Corwin teaches literary journalism at the University of California, Irvine.

3. Food and Shopping for a Sustainable World

Friday | May 20th | 12:00-1:00 p.m. | Winnett Lounge

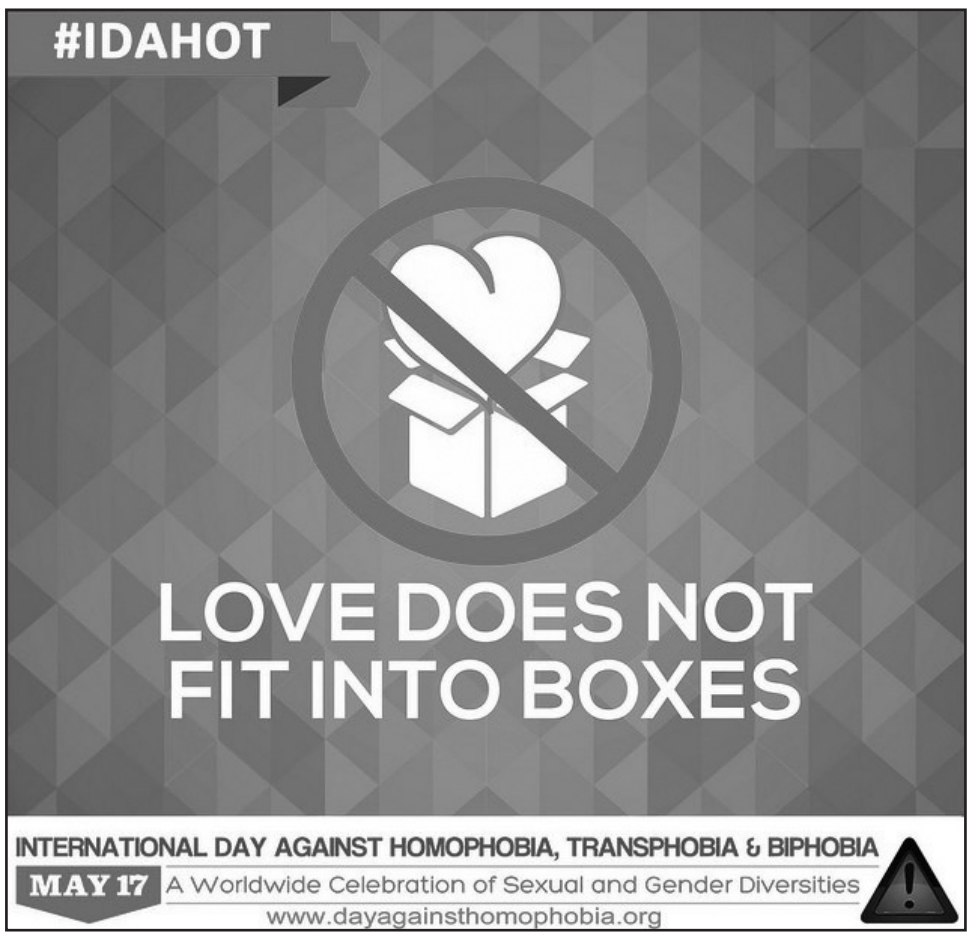
Sustainable Works, an educational organization that promotes sustainable actions to foster a safe, healthy and equitable world, will lead a seminar about how you can make your lifestyle more sustainable. This workshop will give perspective on shopping, consumer goods, organic food and how they influence the environment. Come learn how your actions can make a difference.

Students, staff, and faculty are all welcome. Lunch provided on first come first served basis. The Sustainable Living Series is coordinated by Amanda Shing - Grad Student and 2015-16 Caltech Y ACT Award Recipient - and is made possible with generous support from The Caltech Employees Federal Credit Union and the Caltech Y.

4. Hathaway Sycamores

Wednesdays | 5:30-8:00p.m. | Highland Park

Volunteer at Hathaway-Sycamores, a group that supports local underprivileged 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.



It all began in 2004 when Louis-Georges Tin started a campaign in France to create the International Day Against Homophobia. The idea took off: in less than one year people from over 50 countries joined to celebrate. May 17 was chosen to commemorate World Health Organization's decision made in 1990 that homosexuality was not a disorder. On May 16, 2009, France became the first country in the world to officially stop classifying transgender issues as disorders. The same year the word Transphobia was added to the title and since then the official acronym has remained IDAHOT despite Biphobia being appended in 2015. It is important to note that the IDAHOT committee acknowledges the shortcomings of the title and therefore encourages adaptations that make it more inclusive to all sexual and gender minorities.

May 17 is now officially recognized by many countries, including but not limited to Canada, Spain, and Brazil. Last year in the official statement from the White House Barack Obama summarized what this day is about: "We take this opportunity to reaffirm that lesbian, gay, bisexual, and transgender (LGBT) rights are human rights, to celebrate the dignity of every person, and to underscore that all people deserve to live free from fear, violence, and discrimination, regardless of who they are or whom they love."

-Agne Skripkaite (Graduate Student)

Caltechlive!

WEDNESDAY, MAY 25, 2016 • 8 PM

EARNEST C. WATSON LECTURE SERIES

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Paul Rothemund, Research Professor of Bioengineering, Computing and Mathematical Sciences, and Computation and Neural Systems

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Leave and MIT: Peering at another institution

ANDRE COMELLA
Contributing Writer

There's an old belief that of all the combinations of words in the English language, there is none more beautiful than "cellar door." Maybe that's true for linguists, but to a Caltech administrator's ears, the most beautiful words are "peer institutions." Peer institutions are the universities we compare ourselves to when considering rankings or making policy decisions and are defined as MIT, Stanford, Harvard, and maybe one or two others. It's unclear what makes a university worth comparing ourselves to, or when such comparisons are deemed appropriate. There has been a trend to use our peers as justification for unpopular decisions but to cite "Caltech's uniqueness" when students want to copy policies from other institutions.

A few weeks ago, MIT released a 34-page report (available at http://web.mit.edu/acadinfo/cap/about/report.pdf) on its policies governing leave and return for undergraduate students. It is truly an incredible read, and I recommend that everyone check it out. The report came at the request of the chancellor (roughly analogous to our vice president of student affairs), who organized a committee of students, staff and faculty to investigate current leave policies and suggest improvements.

The report makes a series of bold recommendations and assertions. It calls for financial support for students dependent on financial aid going on leave — to a total of half a million dollars a year. It also recommends offering MIT health insurance to all students on leave (currently only those on medical leave are allowed to continue using MIT insurance). The report continues with many more changes, but the most striking aspect was the assertion, all throughout, that "all undergraduate students, once admitted by MIT, remain members of the MIT community," and whenever a student goes on leave, "MIT still expects the student to return (if he or she wants) and finish the degree." This is astounding — MIT is voluntarily taking on more responsibility for students who go on leave. As an institute, MIT stands in sharp contrast to Caltech, which is pushing students on leave away, hoping they transfer, or at the very least, never come back.

After releasing the report, MIT held a town hall run by some of the staff and faculty who crafted the report. At this town hall, students formerly or currently on leave came to ask questions and speak about their experiences. It was amazing to hear their stories, each varied and uniquely crushing. They described the experiences of going on various types of leave. I heard a tale of a student who was on leave for five years working to earn enough money to take the classes necessary to be allowed to return. I heard from a young woman asking why she was required to take classes while on medical leave and how she was supposed to fit them with four or five doctor visits a week. I sat next to a friend as she spoke about going on leave for four years and the difficulties that came from incompetence and misinformation from those in administration meant to support her.

Most uplifting was seeing how MIT made great efforts to address all the major issues presented by the leave and return process. Most of those heart-wrenching stories dealt with issues that had been directly addressed. See, MIT's policies were already impressive, but now the people there are putting substantial effort into making them even better. Into letting students know that they are always welcome and always a part of their community. Into supporting students even when it means more costs, more work and more liability. Caltech stands in juxtaposition with no support for students on leave, no avenues of communication and significant effort to push students on leave away from the Institute.

"We can take up the challenge set before us, to elevate the needs and well-being of our students above all else."

It was an amazing experience to see so much pain and struggle borne by some incredible people. It would be a mistake to assume that such stories are unique to MIT; rather, other schools are often just as bad or even worse. We can sit around hypothesizing about what a set of policies will lead to or what an experience would be like, but that is nothing compared to the raw emotion of meeting people so deeply affected. To understand, to truly know, we must learn from those who have gained understanding through experience. These are human problems and cannot be solved while neglecting human experience and human input.

And here we return to Caltech's fondness for emulation. If there is ever a time to follow the example of a peer, it is now. We have an opportunity now to follow a path already cut for us. MIT has already done the hard work, the research, the policy crafting. We can use that and perhaps even build upon it. We can take up the challenge set before us, to elevate the needs and well-being of our students above all else. We, as students, succeed by learning from our peers, from emulating what works best; is it not time for our Institute to do likewise?

Collaboration in computing: Getting to know Professor Adam Wierman

TOM SHERIDAN
Contributing Writer

Personally and professionally, from cloud computing to social media, the connections of the modern age are everywhere. Many, particularly among the millennial generation, could not recognize a world where these networking tools do not exist. But for Adam Wierman, professor of computing and mathematical sciences, who grew up in tandem with their expansion, what he saw profoundly affected him. In his own words, "The most exciting thing for my generation in computer science was the emergence of the internet. Bringing the world networks was something that I lived through." Living in this specific era and gaining an inclusive mix of interdisciplinary knowledge have uniquely equipped Wierman for the task of fitting modern cloud computing to the challenges of a greener power grid.

At Carnegie Mellon University, where he acquired his bachelor's and master's degrees as well as his Ph.D., Wierman bounced around, delving into statistics, psychology, engineering and math. Surprisingly, for a computer science professor, "I only came to CS late in my junior year." This may help to explain both the style and subject of his research, as his focus on transitioning from first principles of multiple subjects to practical applications in systems is plain to see in his research history.

"One aspect that he gets very excited about is that elegant or simple mathematics can lead to improvements in practice," said Niangjun Chen, a graduate student in Wierman's research group. "You can come from simple observations to extract a model, and from this model you can get some insight into how you can control the system optimally."

For his professional style, Wierman prefers hands-off management, setting up research goals but allowing his graduate students to use their own knowledge as well as some trial and error to reach them.

John Ledyard, Allen and Lenabelle Davis Professor of Economics and Social Sciences, has abundant experience in experimental economics and modeling and is a longtime collaborator of Wierman, characterized his approach as "If they flounder, they flounder, but they learn something by floundering."

Wierman's involvement with his students goes far beyond the classroom or the computer lab. It includes hikes, hangouts and even the occasional marathon. However, an easygoing nature and a constant smile can hide his competitive side. Wierman has already completed numerous triathlons with respectable placings. Endurance, self-discipline and consistency are key to him both in his research and in his life. But to Wierman, these activities are less about comparisons and more about connections. "If everyone knows each other, then there are opportunities for collaborations that can surprise you and lead to big results," he said. "This is part of the Caltech way — people in different areas knowing each other well enough to find connections between unexpected areas."

Although his early publications were highly theoretical, his thesis was based on the necessity to apply the principles of computer science to real systems, both in modeling their behavior and improving their efficiency. This modeling is critical to any project interacting with a complicated power grid. The efficiency of power distribution and production has been vastly increased due to the ability of companies to act on precise models that can predict consumer demand. Statistics, economics and engineering have all contributed to this greater understanding, but networking has presented a new issue of efficiently powering the workhorses of the information age: data centers.

The primary issue of huge server banks needed for today's vast cloud computing network is that they demand enormous amounts of power, and recent advances have sent usage skyrocketing. Data centers now account for over 3 percent of all power consumption worldwide[1], and while overall power consumption is slowing in the United States[2], the nation's data centers are expected to eat up 50 percent more energy by 2020. Because most of these servers must always be on, they are a constant power sink for an already-strained network.

The unreliable nature of the most popular green energy sources complicates the problem, since it is incredibly difficult for a power grid to efficiently juggle the fluctuating demand of consumers with the varying supply of energy from renewable and non-renewable sources. If enough non-renewable power is already in the grid to satiate demand, then any incoming renewable power will be wasted. On the other hand, if there is too much reliance on renewables, the whole system could risk a brownout or blackout on a cloudy day.

"Endurance, self-discipline and consistency are key to him both in his research and in his life. But to Wierman, these activities are less about comparisons and more about connections."

However, with the help of collaborators in electrical engineering, economics and applied math, Wierman founded RSRG (Rigorous Systems Research Group), which focuses on utilizing these servers as resources, rather than drains, for the energy grid. "We're trying to convince people in the grid to squint at data centers and see a battery," said Wierman. "There are a lot of tasks that can be scheduled for these servers, and if you can use this flexibility anywhere on the grid, you're effectively working as a battery."

In other words, if dry but necessary tasks like search engine optimization and e-mail sorting can be shifted to times when temporary solar or wind power can be utilized, and these changes in availability of renewables can be instantly identified by power companies, this could contribute to a revolution in the way green energy is handled in the grid and to a quantum leap in the efficiency of server banks that might otherwise stand idle for hours on end.

The economic implications are far from trivial. Even if data centers are able to serve as timely power soaks, markets still need to be established, and a network between the data centers and the power grid that allows the flexibility of the center to be utilized without presenting it with undue risk must be formed.

"You can do all the engineering you want in terms of redesigning individual data centers," said Wierman, "but without the right markets, you can't accomplish what you want in terms of integration of clean energy into the grid." This is where Wierman's split interests shine through. The ability to get algorithms to accommodate the dynamics of a market full of changing variables relies on a deep understanding of both fields. "Many engineers don't get economics, but Adam has the background and the interest. It's only natural to work with him," said Ledyard.

However, RSRG is only part of Wierman's position at Caltech. Wierman was made executive officer for the computing and mathematical sciences (CMS) department in 2015 and now presides over a rapidly expanding major that has the potential to reshape not just computer science at Caltech, but nearly every other field as well. For Wierman, "There's an increasing recognition [of] CS as being central to science these days, and almost every research center involves CS faculty in some way."

The challenges are numerous. In a recent data release, Wierman presented a statistical analysis

Continued on page 4

Professor Wierman uses split interests to inform research

Continued from page 3

of the various flaws of the CMS department as it was — with the flood of new CS majors, the number of faculty and the number of possible specializations were simply not up to the task. Class sizes have ballooned, and solutions will have to be applied over years.

As someone who has taught numerous classes, including a mixed CS/economics class on algorithmic game theory, Wierman has a direct perspective on these issues. "There's a tension in designing an undergraduate CS program," he said. "You don't want to teach a watered-down version of algorithms just because they're not CS majors; you want to teach them algorithms!"

Five additional faculty members are already planned for the next five to seven years to alleviate the mounting enrollment pressure that high-level classes in CS are facing.

Wierman hopes to repeat a statistical analysis of the CS major using data from this year, and many of his thoughts on computer science and sustainability are readily available at his blog, Rigor + Relevance.

Being a specialist in networking and interdisciplinary efforts, it is not surprising that Wierman is an expert in the collaboration that allows computer science to have influence in many different subjects. This includes communication with undergraduates as the executive officer of the CMS department, prompt back-and-forths with graduate students and showing the outside world the potential of his research. He is determined to bring this powerful combination of interdisciplinary knowledge and smooth collaboration to a task that will test them to their limits — forging a network that will make data centers cleaner around the world.

1 Preimesberger , Chris."Intel's Low-Power Atom Chip Making Way Into Data Centers". Web. http://www.eweek.com/storage/slideshows/intels-low-power-atom-chip-making-way-into-data-centers.html?kc=EWKNLESB09082013STR1&dni=77668363&rni=24932747

2 Thibodeau, Patrick. "Data centers are the new polluters." Web. http://www.computerworld.com/article/2598562/data-center/data-centers-are-the-new-polluters.html

Community enjoys dance, music and food at OASIS Annual Show

Photos Courtesy of Anushka Rau

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Women's tennis finishes sixth at SCIACs, best since 2007

GOCALTECH.COM
Actual Sports Content Editor

CLAREMONT, Calif. (May 8, 2016) – The Caltech women's tennis team recorded its best finish at the SCIAC Championships since 2007, placing sixth with a victory over Chapman University sandwiched between defeats to national No. 4 and eventual champion Claremont-Mudd-Scripps Colleges and the University of La Verne.

#7 seed Caltech 0, #2 No. 4 CMS 5

With rain already having shuffled start times across the conference, the Beavers and Athenas elected to start singles first and play to decision in an attempt to beat the weather. Although a short delay mid-match proved inevitable, CMS soon claimed the victory with wins at all but #1, where sophomore Vinci Chen had played West Region No. 6 Katie Kuosman to a 6-3 first set and taken another two games in the second. Freshman Julia Reisler also won a pair of games in each set at #2.

Such concentration. Much focus. Wow.
Photo Courtesy of Michael L. Wong

#7 Caltech 7, #6 Chapman 2

Having fallen to the Panthers in the regular season during the absence of junior Sophia Chen due to injury, the Beavers were eager to reach this matchup. It showed from the outset as Caltech took both #2 (8-6) and #3 (8-2) doubles, then claimed the first set in four singles matches. Chapman claimed #1 to level the match, but sophomore Erin Wang and freshman Cecelia Andrews pulled the Beavers within a point of clinching with identical 6-0, 6-0 wins at #5 and #6. Freshman Kana Moriyama clinched the match soon after, 6-1, 6-1 at #3, with Reisler and Sophia Chen making the final score even more decisive at #2 (6-2, 7-5) and #4 (6-3, 6-1).

#7 Caltech 3, #5 La Verne 6

Looking to avenge another narrow 5-4 regular season defeat, the Beavers came up just short in the season finale. A 2-1 deficit after Reisler and Andrews picked up the only win at #3 doubles left Caltech needing four victories in singles play, but only Wang and Reisler could oblige at #5 (6-1, 6-4) and #2 (6-2, 5-7, 6-2) while Sophia Chen fell in three sets at #4 (1-6, 6-4, 6-1) and Moriyama succumbed after an epic tiebreak with the match already on hand at #3 (6-3, 2-6, 15-13).

Head Coach Mandy Gamble's squad enjoyed a number of impressive individual performances in addition to the team's major step forward. Reisler, Moriyama and Wang each reached double digits in singles wins, marking the first time that has happened since 1998. Reisler also recorded the program's first individual win over a regionally ranked opponent since 2014 NCAA participant Rebekah Kitto, while four Beavers notched victories between the ITA West Regional and Ojai Valley Tournament, including Reisler's run to the semifinals of the first consolation bracket in the fall.

Bradley earns second CoSIDA Academic All-District Honor

GOCALTECH.COM
Actual Sports Content Editor

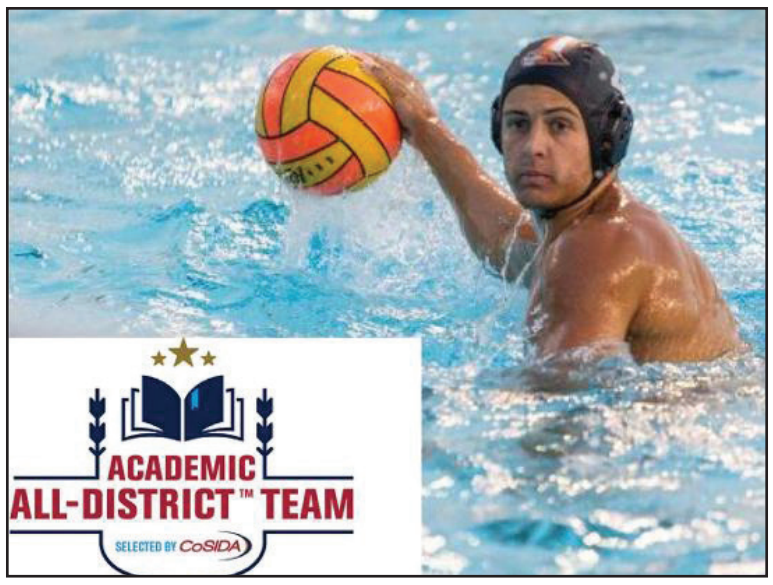
GREENWOOD, In. (May 12, 2016) – Caltech men's water polo junior Christopher Bradley has been named to the Capital One Academic All-District Men's At-Large Team, which is selected by the College Sports Information Directors of America. He is the first member of the men's water polo program to earn the honor.

Bradley followed up his 2014 program-record 134-goal campaign with an impressive all-around junior season in which he scored another 89 goals, assisted 25, made 30 steals, blocked 26 shots and drew 29 exclusions. He already has totaled an eye-popping 285 goals in his three years as a Beaver.

Bradley is one of only three Division III water polo players in the country to have been recognized by the regional honor. Last year, he was also one of just three DIII water polo players in the nation to be named Academic All-America, becoming the first Beaver in over a decade to earn the prestigious distinction.

Student-athletes must maintain a cumulative, non-rounded 3.30 GPA, have completed at least one calendar year at the nominating institution and reached at least sophomore athletic standing to be eligible for nomination.

As a First Team honoree, Bradley will advance to the Capital One Academic All-America Team ballot once again, where first-, second- and third-team All-America honorees will be selected later this month.



One of these articles is not like the other ...
-http://gocaltech.com

Men's tennis finishes sixth at SCIACs, best since 2005

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Actual Sports Content Editor

CLAREMONT, Calif. (May 8, 2016) – The Caltech men's tennis team recorded its best finish at the SCIAC Championships since 2005, placing sixth with a victory over Occidental College sandwiched between defeats to Whittier College and Chapman University.

#5 Caltech 4, #4 Whittier 5

The Beavers battled the Poets to open the tournament in an instant classic that stretched across two days due to multiple rain delays. Things began the same way they did in the regular season matchup just one week prior, with Whittier claiming #1 doubles but junior Ruthwick Pathireddy and freshman Derik Nguyen came up with a break in the final game to take #2, 9-7.

Having given up a 4-1 lead in the previous matchup, junior Morgan Lebby and freshman Zixiao Li had no intentions of doing the same this time. Although the pair failed to take advantage of multiple chances to break Whittier's serve, they held their own as well through to 7-7, when a brief delay was caused by some light rain.

With a point awarded to the Beavers on a code of conduct penalty during the delay, Lebby and Li were able to overcome Whittier taking two of the first three points and hold serve, then break the Poets for crucial 2-1 match lead. Singles play had commenced as the final doubles match conclude in an attempt to beat the weather, but only Pathireddy and Li were able to finish a first set before the rain returned, necessitating the postponement of the match to the following morning.

This photo has captured the essence of the infamous "tennis grunt."
Photo Courtesy of Ellen Friedlander

The tension was palpable in Claremont on Saturday morning with the guarantee of no worse than fourth place in the balance. Things started off well for Caltech as Pathireddy's opponent at #3 defaulted the match, giving the Beavers the 3-1 lead while Li led at #6 and freshman Andre Liu won a fifth straight game at #2 to take the first set, 7-5. The tide began to turn, however, even as Li locked up #6 (6-2, 6-4). West Region No. 22 Andrew You keyed the Whittier rally with a win at #1, followed by David Stanko and Tyler Linscott winning at #4 and #5 to level the match, leaving just Liu and the Poets' #1 player last year, 6'5" Samuel Farmer. The rookie more than held his own after taking the veteran to a third set the week prior but again went down in a third set, 7-5, 3-6, 3-6.

#5 Caltech 5, #8 Oxy 0

Just an hour after the final singles match versus Whittier had ended, the Beavers were tasked with dispatching Oxy for the second time this season and were more than up to the challenge. Despite the potential for both fatigue and heartbreak after the epic opening-round match, Caltech swept doubles, with only #2 particularly close as Pathireddy and Nguyen again won 9-7. Senior Rushikesh Joshi and Li quickly closed up shop at #1 and #6 for the win and chance to play for fifth place the following day.

#5 Caltech 4, #6 Chapman 5

Fortune was on the Panthers' side on Sunday morning as Chapman swept doubles, with Pathireddy and Nguyen putting up the closest fight but falling in a tiebreak, 9-8 (3). The Beavers took first sets at three courts in singles, but needed five to rally for the win and were able to come up with just four. Pathireddy, Nguyen, junior Ramsathwick Pathireddy and Li each registered victories at #3 (6-3, 6-3), #4 (6-1, 6-4), #5 (3-6, 7-6 [3], 10-5) and #6 (6-2, 6-3).

Head Coach Mandy Gamble's squad finishes the season with an even 10-10 record, the program's most wins since 2000 and the first time Caltech has finished at or above .500 since 1994. In addition to notching the program's first win over a nationally ranked opponent and earning their first-ever national ranking, the Beavers rewrote a good portion of the record books. Li outpaced the previous single-season record for singles victories (14), besting Lebby's 12 set in 2014, while also posting a team-record 8-2 mark in conference play between #4, 5 and 6 singles. Ruthwick also tied Lebby's previous record of 12 winsand became the program's career leader in singles wins with 29, while the Pathireddy twins maintained their program record for doubles wins as a pairing, recording their 21st this season. Ruthwick and Nguyen recorded an historic doubles win as well, marking the program's first individual victory over a regionally ranked opponent in at least the last five years.

ASCIT Minutes

Meetings are every week in SAC 13

ASCIT Meeting 5.12.16

Officers: Serena Delgadillo, Sakthi Vetrivel, Robin Brown, Tim Liu, Kalyn Chang
Others: Chris Dosen, Vaishnavi Shrivastava, Olivia Hindera

Start: 12:12pm

I. President Updates: Serena
- A. New board! Yay!
- B. Midnight donuts is the 18th
- C. Fire and Ice event went well
- D. Transition dinner is on the 30th (Memorial Day)
- E. Performing and Visual Arts is having a concert off campus on the 21st
- F. Appoint a secretary soon (sign-ups go up next Monday (5/16) and interviews are the following Sunday)

II. ARC Chair updates: Tim
- A. ASCIT teaching awards picked out last Sunday
  1. There will be an Ath dinner for the winners, their nominators, and a few ARC members
- B. Committee appointments this Sunday for academic faculty committees

III. Director of Ops Updates: Sakthi
- A. Projector will be set up
- B. Rethink how yearbook is done (electronic yearbooks?)
  1. People didn't pick up the yearbooks
  2. Come out after people have already left campus

IV. Treasurer Updates: Kalyn
- A. Ordering senior boxes (tentatively to be delivered on the 23rd of May)

V. Social Director Updates: Robin
- A. Movie on Friday went well
- B. Looking at possible events for the rest of term

VI. Other
- A. Passing resolution to make senior class co-president election during third term
  1. Currently, they are elected after ditch day and this doesn't give much time
- B. Tim moves to amend the ASCIT Resolution I Section 1 to "Elections for Senior Class Co-Presidents shall be held using the procedures established in Article VII during third term of their junior year
  1. Serena seconds
  2. Vote passes 5-0-0

Ends: 12.28pm

REMINDER FROM COUNSELING CENTER:

Meditation Mob

(drop-in mindfulness meditation group)
Meets every Tuesday, 12:00-12:50 p.m.
Bottom floor of Winnett

VICE PROVOST'S OFFICE HOURS

Vice Provost, Chief Diversity Officer and Professor of English, Cindy Weinstein, holds regular office hours. This is an opportunity for undergraduate, graduate students and postdocs to meet and discuss what they'd like 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 appointments per hour, 15 min. each. Sign up the morning of the office hour in 104 Parsons Gates, Vice Provosts' Offices (x6339).

Spring Term Office Hours
12 p.m. - 1 p.m.

Wednesday, May 18
Tuesday, May 24
Friday, June 3

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The California Tech

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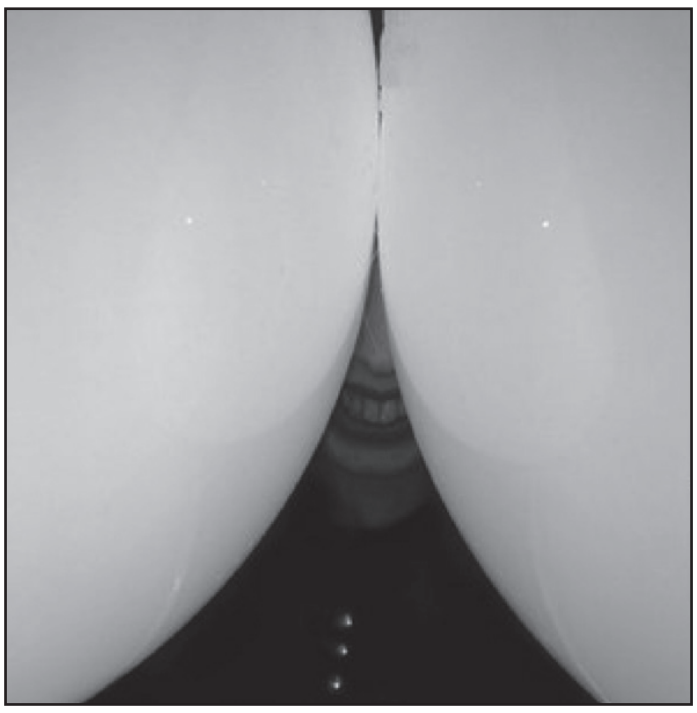
The advertising deadline is 5 p.m. Friday; all advertising should be submitted electronically or as camera-ready art, but *The Tech* can also do simple typesetting and arrangement. All advertising inquiries should be directed to the business manager at *tech@caltech.edu*. For subscription information,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

Bottomless Pit: Death Grips, the condensed version

NAILEN MATSCHKE
Contributing Writer

Just six years into its career, it seems all but certain that Death Grips will be immortalized as one of the great subversive acts in the canon of popular music. Despite the wealth of experimental hip-hop released this decade, no artist has come close to the mixture of aggression, noise, social commentary and catchy hooks that the group continues to refine with every record. This alone is remarkable, but when one considers that the band has already put out four critically acclaimed studio albums in under four years, not including any mixtapes or instrumental releases, the competition really starts to fade away. Of course, the group's members have done their share to stay in the public eye as well, from announcing their breakup several albums ago to missing tour dates with no explanation, to various online antics utilizing social media, producing a rabid and decidedly masochistic fanbase. Having finally satiated cries for *Jenny Death*, the second half of double album *The Powers That B*, the band was left with a cleaner slate than it had had in years for *Bottomless Pit*, released on May 6. Accordingly, the album doesn't quite fit into the progression of its predecessors, but rather it combines their most distinguishable elements into an intense collection of hits that you'll want to play again and again.

The two tracks that bookend *Bottomless Pit*, "Giving Bad People Good Ideas" and "Bottomless Pit," are those which most closely resemble the guitar-driven sound that Death Grips had been working with on Jen*ny Death*. The distortion is through the roof, easily causing audio clipping, while Zach Hill plays drums like a madman and MC Ride yells more or less unintelligibly. On the surface, this is what we've come to expect from the band in recent years, but the focus on the hook in these two tracks stands out, especially in the case of the opener, featuring a descending female vocal line repeating the song title. This attention to pop sensibility is a large part of what made 2012's *The Money Store* such a successful debut, and though Death Grips has dialed it back ever since, it is back in full force on *Bottomless Pit*.



-https://commons.wikimedia.org/

Apart from the aforementioned first and last tracks, the album is heavily electronic, and just about every song has the well-defined sense of structure and melody that one expects from a single. Each one brings something to love, making it difficult to pick favorites, but many are among the catchiest songs the group has ever written. "Spikes" features a downright moshable chorus to complement high-tension verses about "skidding out" of control, while "Houdini" is a banger lampooning mindless music fans with a hilarious bridge I can't repeat in print.

"Three Bedrooms in a Good Neighborhood" has a convoluted three-part chorus, all of which will manage to get stuck in your head. Oddly enough, "Hot Head," the lead single, is arguably the least like the others given its extreme variation in dynamics and tone, but it still holds its own in the track listing. Another pair that sticks out on aesthetic alone is "Eh" and "Trash" with slick but low-key instrumentals that allow MC Ride's wit to shine through. The former has him ranting about how trifling naive fans and his competition are, until it takes a dark turn as the attitude of "Eh" swallows up all, with MC Ride telling us, "I'm way too loose, like / catch me hanging from my noose like eh," the last syllable chillingly drawn out with a digital effect. "Trash," on the other hand, laments the virtual garbage heaps of online content cluttering our daily lives, "be it Motel 6 to vogue vino trash," supported by a two-note drone that I suspect is the repeatedly layered sound of a floppy drive spinning up. *Bottomless Pit* displays an impressive breadth of topics and aesthetics, and with 13 tracks clocking in at just under 40 minutes, nothing overstays its welcome.

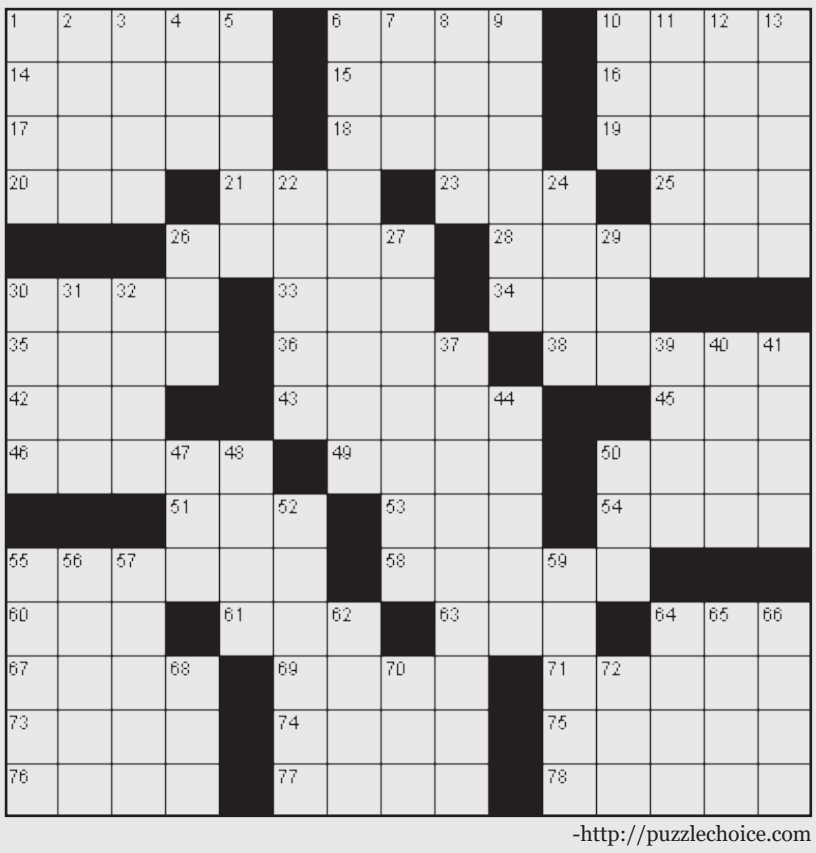
Since the album doesn't delve much into unexplored territory for the band, I was a bit concerned at first that the material would rely on rehashing that of previous albums. However, especially after going back and listening to Death Grips' other projects, it's clear to me that *Bottomless Pit* applies all of the techniques and skills the group has acquired over the past few years, and the songwriting is truly on another level as a result. Sure, *The Money Store* had strong hooks and danceable beats, but instead of the production simply serving as a beat to rein in MC Ride's chaos, it frequently works in concert with his vocals to mimic a rock-esque style. The two halves of the music feel much more aware of each other, and as evidenced by the quick one- or two-measure transitions all over this album, they were written to fit together, improving the overall flow and listener appeal. As far as heavy electronic instrumentation is concerned, "Warping" and "BB Poison" easily rival anything off *No Love Deep Web*. Furthermore, while the haphazard sampling of MC Ride on *Government Plates* was one of fans' chief complaints upon its release, the time spent crafting beats out of Björk vocals for the first half of *The Powers That B* has completely eliminated the issue for the parts of "Spikes," "BB Poison" and other tracks that rely on vocal samples.

Finally, while the album as a whole doesn't utilize guitar nearly as much as *Jenny Death*, it fits in so well that the songs that do could almost be off a punk record. *Bottomless Pit* has by far the best production of any Death Grips album, and MC Ride more than lives up to the standard he has set for himself. Though it may lack innovation, it is a perfect amalgamation of the Death Grips catalog thus far, standing both on its own and in context as a testament to the talent and absurd work ethic of one of this decade's most important acts.

Crossword

Across
1. Development stage before metamorphosis
6. Steep rugged rock or cliff
10. Travel through water
14. Egg-shaped
15. Dwelling
16. Instinctive motive
17. New
18. One of a pair used to control a horse
19. Used in brewing and distilling
20. Female animal
21. Frozen
23. Carried out an action
25. Digit
26. Humiliate
28. Writer
30. Faction
33. Very intense
34. Hawaiian garland
35. Wan
36. Used as an astringent
38. Lukewarm
42. Employ
43. Lawful
45. Fuss
46. Send or direct for treatment
49. Waistband
50. Sleigh
51. State of decay
53. Definite article
54. In addition
55. Litter of pigs
58. Ahead of time
60. Anger
61. Indefinite but relatively small number
63. Indicating maiden name
64. Space between two things
67. Wear away by rubbing
69. Salacious
71. Curtain
73. Story
74. To obscure or conceal
75. A simulated semblance
76. Song of praise
77. A slight competitive advantage
78. Go in

Down
1. Solitary
2. Declare solomnly
3. Wander
4. Compete
5. Extemporize
6. Pupa of a moth or butterfly in a cocoon
7. Fish eggs
8. In the middle of
9. Affable
10. Total
11. Ire
12. Ice hut
13. Measuring instrument
22. Camarilla
24. Song for two
26. Consumed
27. Develop by training and teaching
29. Bind
30. Incite or stimulate
31. Facilitate
32. Musical notation
37. Fumble
39. Sudden numbing dread
40. Parts of the Roman calendar
41. Extinct bird
44. At that place
47. Make a mistake
48. Protective covering
50. Express in words
52. Square root of a gross
55. Fractional equivalent of 20%
56. An impressive display
57. Domain
59. Shelf
62. Unwanted garden plant
64. A horse's manner of moving
65. Part of a church
66. Look searchingly
68. Japanese currency
70. Hairpiece
72. Operate



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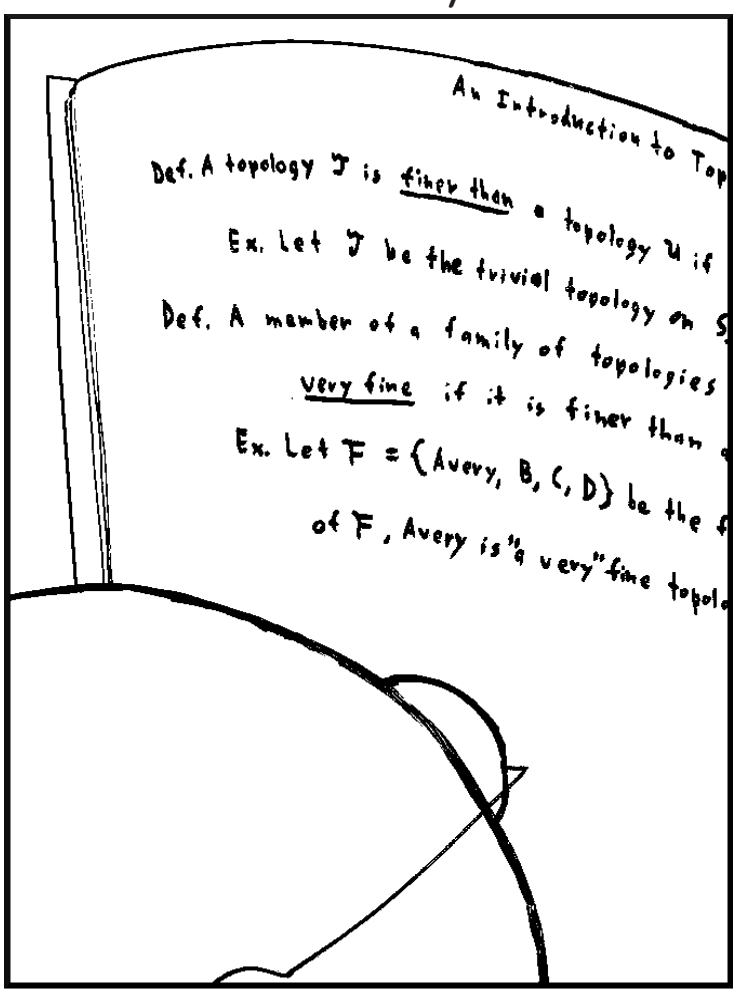
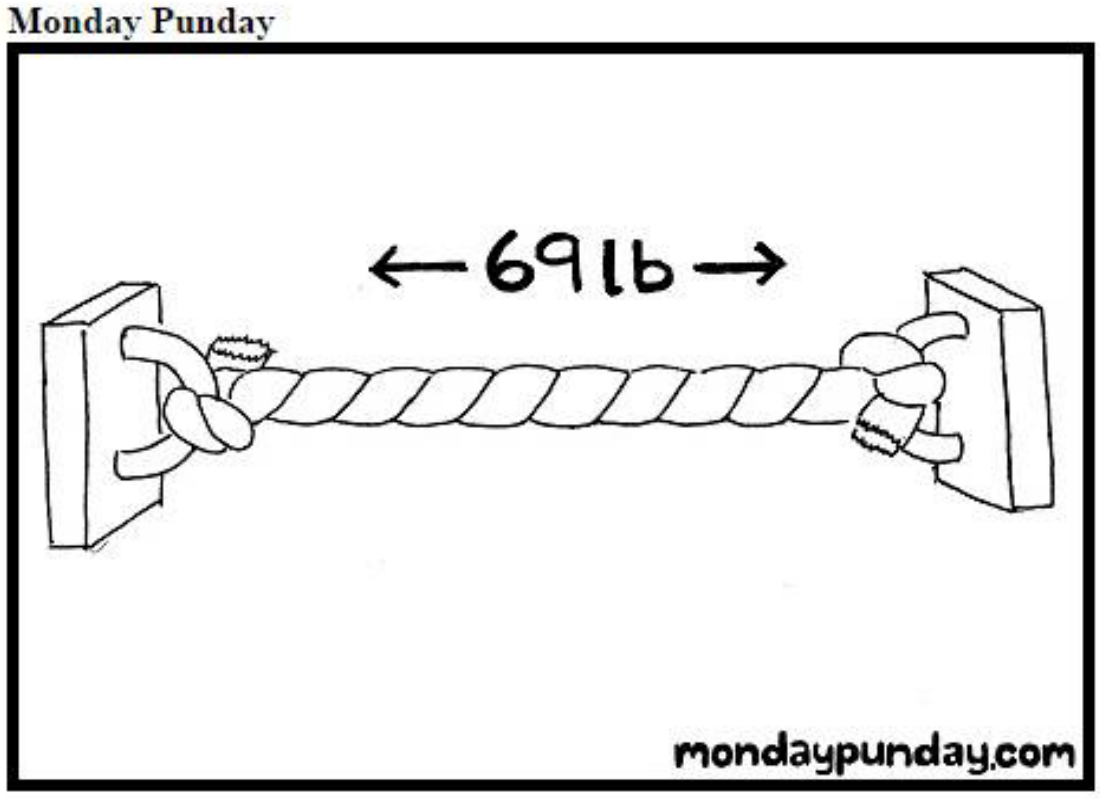
Sanity Considered Harmful

p-adic Larson



Billy had heard of DEI references hidden in circuit boards and other places, but this was the first instance of Avery propoganda he had seen.

Monday Punday

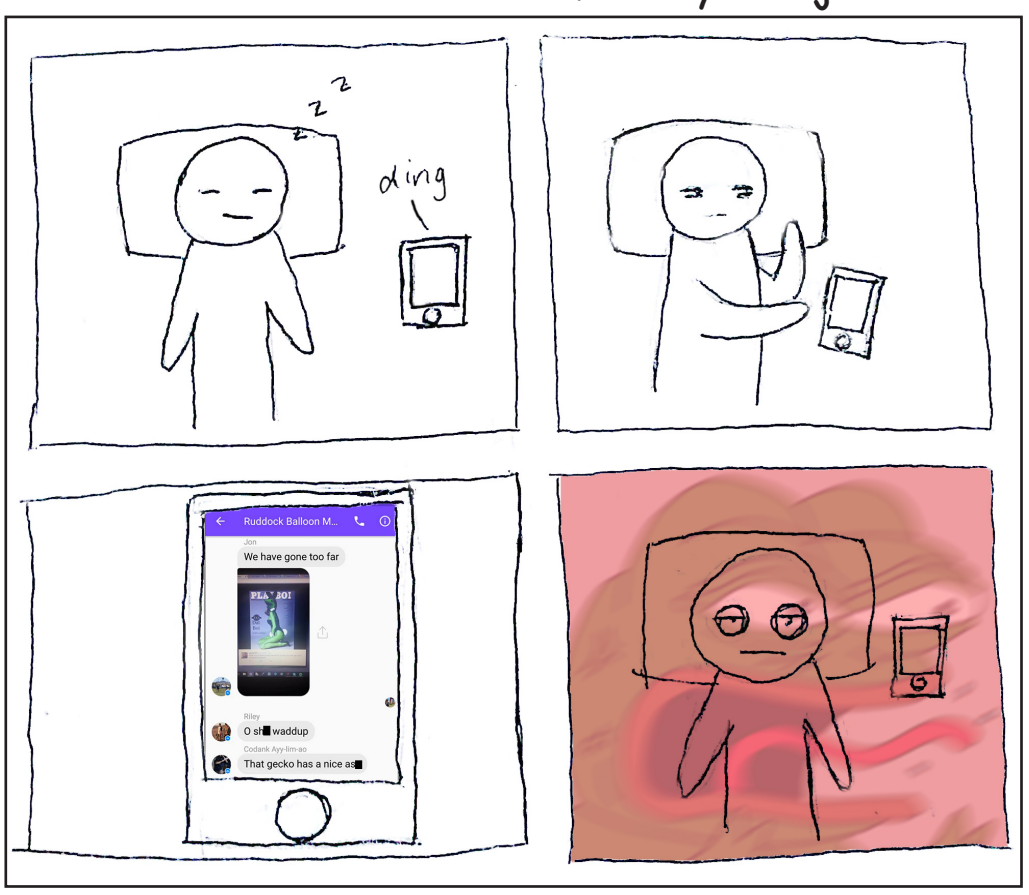


This picture represents a common phrase, title, or person.

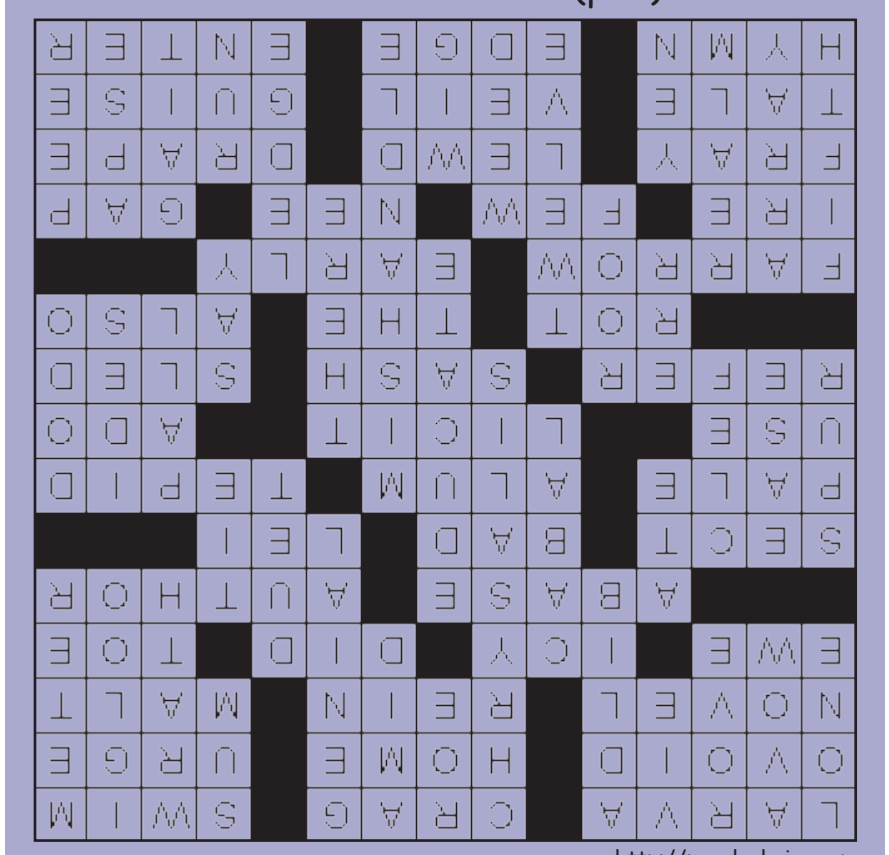
Think you know the answer? Take a guess at `mondaypunday.com/117`

the trains chat

definitely not jon cotler



Answers to current crossword (p. 7)



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