

Caltech Launches New Autonomous Systems Research Center

ROBERT PERKINS
Caltech Media Relations

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

The Center for Autonomous Systems and Technologies (CAST) will unite engineers and scientists from many disciplines to advance research on robotics, drones, driverless cars, and machine learning.

On October 24, Caltech will officially open the new Center for Autonomous Systems and Technologies (CAST), a 10,000-square-foot facility where machines and researchers will work together and learn from one another.

At CAST, researchers from Caltech's Division of Engineering and Applied Science (EAS), Division of Geological and Planetary Sciences (GPS), and the Jet Propulsion Laboratory (JPL) will collaborate to create the next generation of autonomous systems, advancing the fields of drone research, autonomous exploration, and bio-inspired systems. Researchers will continue pioneering work on technologies ranging from prosthetic legs that use machine learning to automatically adjust to a wearer's gait to a flying, self-driven ambulance.

"The goal is to teach autonomous systems to think independently and react accordingly, preparing them for the rigors of the world outside of the lab," says CAST Director Mory Gharib, Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering.

The facility will be a living experiment. While engineers construct and test drones, robots within CAST itself will learn to help run the facility—all while being observed by 46 cameras that provide complete coverage of the interior, tracking each robot's motion down to within 100 microns (about the thickness of a human hair).

The CAST team includes more than two dozen engineers and scientists. Instead of developing autonomous systems simply for the sake of advancing the technology, the work will be guided in part by scientists and other stakeholders who would benefit tremendously from autonomous systems. For example, by collaborating with seismologists and first responders, engineers could develop a swarm of flying sentinel drones that automatically activate during an earthquake, rapidly scan damaged areas, and relay information about where there are likely to be injured people in need of medical attention. "The CAST team will also work on

the next generation of drones and robots to explore the solar system, including submersible vehicles designed to operate in the ice-covered oceans of Europa, a moon of Jupiter," says CAST steering committee member Woody Fischer, Professor of Geobiology.

The facility will include an assembly room with an 85-foot-long oval track for walking robots and an aerospace robotics control lab with high-precision flat floor that allows researchers to fly "spacecraft" that have been engineered to hover through high-pressure jets (like a reverse air hockey table) and simulate the frictionless motion of space flight. But CAST's centerpiece is a three-story-tall, wholly enclosed aerodrome—the tallest of its kind—in which to test flying drones. To simulate the ever-shifting environmental conditions that drones face in the real world, the aerodrome includes a 10-foot-by-10-foot wall of 1,296 fans capable of generating wind speeds of up to 44 mph, with a side wall of 324 fans to create a crosswind. The wall is capable of creating a nearly infinite variety of wind conditions for drones to learn to react to—everything from a light gust to a stormy vortex. It can also be tilted 90 degrees to simulate vertical take offs and landings.

"The current state-of-the-art in autonomous systems is very promising on two divergent fronts," Gharib says. "The bodies, or machines and sensors, have become more and more sophisticated and capable. Meanwhile, the algorithms that collect and interpret behavior are increasingly fine-tuned. We plan to bring these two together through a series of 'moonshot' challenges that we will undertake in the coming years."

Like their ambitious namesake that challenged Americans to send a human to the moon in the 1960s, CAST's moonshot goals will require advances in engineering to accomplish feats not yet possible. They include building a robot (guided by a network of flying drone scouts) that can walk from Mexico to Canada without assistance and creating a drone delivery service between Caltech and JPL.

One key goal of CAST is the development of an autonomous flying ambulance for urban applications. Flying vehicles offer significant benefits over their ground-based counterparts: three-dimensional space is easier to navigate safely than two-dimensional space, and there is an advantage to rising above the gridlock that, with 60 percent of the world's populations expected

to live in cities by 2030, will only continue to get worse.

"This isn't just as simple as creating a UAV big enough to carry a person. You need a fault-tolerant vehicle that can adapt autonomously to shifting weather conditions and navigate through skies without colliding with other UAVs. You need the best in aerospace engineering, machine learning, GPS-free navigation—and all of it scalable," Gharib says. "It's a huge challenge, but at CAST, we can and will build it."

Corporations and industry members will play a key part in the development of CAST technologies and systems. With the lead sponsorship of Raytheon Company as well as the support of corporations such as AeroVironment, industry partnerships will help fund CAST and the development of the next generations of autonomous systems. Through these partnerships and collaborations, industry members will assist CAST researchers in bringing the resulting products to market faster.

This endowed center was established through the generous support of Foster and Coco Stanback. More information about the CAST facility can be found online at <http://cast.caltech.edu>.

Serendipity, on Purpose

CALTECH BREAKTHROUGH
CAMPAIGN

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

Caltech surprised chemist and neurobiologist Linda Hsieh-Wilson when she arrived as a new professor in 2000. The unusually interactive campus felt like a community, even a family.

"Here, it is easy to find people with common interests or learn about other people's research," says Hsieh-Wilson, who is now Caltech's Arthur and Marian Hanisch Memorial Professor of Chemistry. "That has helped my students and our research, allowing us to venture into new areas of science."

For instance, Hsieh-Wilson recently created antibodies that one day could help patients recover from brain or spine injuries—an invention that started with a

serendipitous conversation years ago.

About a decade ago, Hsieh-Wilson and her students wanted to see if a sugar molecule they were studying might play a role in the way vision develops in the brain. But as organic chemists, they didn't have experience with the specialized biological research techniques they needed to follow their hunch.

Then, in a lucky break, one of Hsieh-Wilson's graduate students struck up a conversation with Caltech biologist Jost Vielmetter, who leads a center in Caltech's Beckman Institute. That institute's philanthropic funding and mission give its scientists freedom to assist scholars across campus. So Vielmetter took time to teach Hsieh-Wilson's group techniques they needed to trace cellular connections between the eyes and brain.

Using those techniques, Hsieh-Wilson and her team discovered that their sugar does help with sensory perception—linking neurons in the eye to those that control vision, deep in the brain. More broadly, they found, it helps wire neurons in the brain during so-called "critical periods" of development, when neural circuits can be sculpted by experience. During critical periods, infants' and toddlers' brains are more malleable so that children learn fast during those early years. But later in life, the sugar reverses function to prevent our brains from fully rewiring themselves after they are injured.

The antibodies that Hsieh-Wilson and her students are refining now—with the aim of helping people recover from brain or spine trauma—actually block this sugar so patients can regenerate more neurons. In 2012, researchers at Harvard Medical School used these antibodies to regenerate injured optic nerves in mice.

Hsieh-Wilson has attracted robust philanthropic support, including a Beckman Young Investigator Award, an Alfred P. Sloan Fellowship, and appointments as a Howard Hughes Medical Institute Investigator and as Caltech's Hanisch Professor.

That generous support has freed her to invent new techniques that open up unexpected possibilities for other scientists in and beyond her areas of research—creating luck for others. Specifically, Hsieh-Wilson's group invents tools that make studying sugars and their associated proteins easier.

"Carbohydrates are complex molecules," Hsieh-Wilson says, laughing. "Organic chemistry itself is a conversation stopper, and people roll their eyes at the thought of studying carbohydrates."

In one case, her group developed a way to tag and visualize certain carbohydrate molecules that

are involved in communication inside cells. That technology, now commercially available, is in use by labs around the world.

"People who used to turn away from studying carbohydrates are pursuing investigations now because they have the tools," she says.

Hsieh-Wilson credits her philanthropic support for helping her make these contributions, which already have changed how science is done and what we know about sensory development.

"The advantage of private support is that it allows you to pursue new ideas, perhaps riskier ideas," she says. "You can be fearless in your approach. You don't have to map everything out and know all the answers in advance. That type of intellectual freedom is important to science, because so much of science is serendipitous discovery, and trusting your instinct."

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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

Caltech Y Raffle

Thank you to @VIZIO for donating an all-new 50" Ultra HD Display to the Caltech Y 10th Annual Golf Tournament and Auction! Everyone will have the opportunity to purchase a raffle ticket to win this beautiful display that features a 4K Ultra HD picture and Chromecast built-in!

Call us at 626-395-6163 or email caltechy@caltech.edu or drop by our office at 505 S. Wilson Ave. to purchase your raffle ticket now! Tickets are \$5 each or \$20 for 5. The raffle will be drawn at our Dinner Auction on October 30th and the winner will be contacted after the event.

Since you are buying a chance to win a prize with the purchase of a raffle ticket(s), your raffle ticket donation is not considered a tax-deductible contribution, according to IRS regulations.

Take the HungerU Quiz to donate a meal to Union Station

Take this 5-min quiz <http://hungerchallenge.com/> before November 1st and HungerU will donate one meal per finished challenge to Pasadena Union Station Homeless Service. Simply select "California Institute of Technology" as the location and complete the quiz!

Caltech Y Social Activism Speaker Series presents Doing Good Well: A Discussion about Effective Altruism with Michael Dello-Iacovo - Former CEO of Effective Altruism Australia and President of The Life You Can Save Adelaide

Friday | November 3rd | Location: TBA | 12:00 to 1:30 PM

[There will be a 12:50 break for those with 1:00 commitments]

Lunch Provided, RSVP: <https://goo.gl/forms/m1h2zKGtdnGYAnVA3>

In this talk, Michael will cover some key concepts used by the effective altruism community to determine how to increase ones' positive impact on living beings and the world. He will also discuss how to find the most high impact opportunities to make a difference as an individual and cover the latest state of research on the evidence of effectiveness for different interventions to help humans and other animals, both directly and indirectly.

Michael, a PhD student at the University of New South Wales in Australia, is currently interning at JPL where he is working on some of the technical, economic and ethical challenges involved in space exploration.

Previously he was CEO of Effective Altruism Australia, President of The Life You Can Save Adelaide, and held various roles as a geoscientist in the energy industry.

Caltech Explore LA Series: Horseback Riding in Griffith Park

Sunday | November 5th | 10:15 - 11:45 AM | Transportation NOT provided

\$20 for 1 Hour Ride (due on sign-up) | Sign up at the Caltech Y

Join us for an exciting morning ride in beautiful Griffith Park. We will be riding horses from Circle K Ranch. Beginners and seasoned riders are welcome, as there are horses to meet every skill level. Our group will meet at Circle K Ranch (914 S. Mariposa St, Burbank, 91506) at 10:15 and should be back on campus around 11:45 AM. Spaces are limited. Those who wish to receive a spot will be expected to visit the Caltech Y to sign up and make payment (\$20) by the end of business hours, Thursday, November 2nd (as space allows).

Caltech Y Social Activism Speaker Series presents Understanding Uncertainty in Polling – A Look at 2016 Lunch Discussion with Dr. Erin Hartman - Assistant Professor of Political Science and Statistics, UCLA; Co-Founder, Blue Labs: Analytics, Data, Technology; and former Head of Analytics Polling, Obama for America.

Friday | November 10th | Annenberg 105 | 12:00 to 1:30 PM

[There will be a 12:50 break for those with 1:00 commitments]

Lunch Provided, RSVP: <https://goo.gl/forms/rUD3bQ6TruAqpayn2>

There have been a number of public polling misses in recent years, including the 2016 election, the "Brexit" election, and the loss of house majority leader Eric Cantor in 2015. These setbacks to the polling industry come at a time when measuring the attitudes of Americans is of utmost importance as both political parties struggle to reconnect with the American electorate after the struggles of the 2016 cycle. In this talk, we will consider "total survey error"—all the ways in which a survey can go wrong—and consider how this could lead to error in the 2016 polls. Understanding and communicating how statistical uncertainty and systematic bias can impact polls is important for ensuring that the public has confidence in our understanding of public opinion.

Erin Hartman is an Assistant Professor of Political Science and Statistics at UCLA. Her recent research focuses on creating new methods—including both theoretical approaches and new estimation strategies—for identifying and validating causal effects. In particular, she studies the methods under which experimental findings can be extrapolated beyond the experimental sample.

In 2012, Erin ran the polling operation for Obama for America's Analytics department, which very accurately predicted election outcomes in the campaign's battleground states. She also co-founded a successful analytics and technology start-up, BlueLabs, focused on providing analytics services to clients in politics, issues advocacy, healthcare, and education.

Caltech Y Explore LA Series: L.A. Kings vs. Vancouver Canucks at Staples Center

Tuesday | November 14th | 7:30 PM | \$27 | Transportation NOT provided

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Sign up at the Caltech Y (payment due at sign up)

Sign-up starting Thursday, Oct 19 at the Caltech Y at 10 AM

Come watch the LA Kings take on the Vancouver Canucks Tuesday, November 4th at 7:30 PM. Escape the LA heat and discover what's cool on this outing to the Staples Center in downtown LA. Check out the thrilling atmosphere, the fast paced action, the drama, the excitement! Whether you are a hard core hockey fan or new to the sport... don't miss out.

This offer is for students only; however, students purchasing tickets are permitted to purchase tickets for up to one guest each – and that guest can be a non-student. Explore LA is coordinated by the Caltech Y. The Caltech Y is located in the Tyson House 505 South Wilson (Bldg. 128)

Caltech Y Explore LA Series: The Color Run

Sunday | November 12th | 9:00 AM - 12:00 PM | StubHub Center, Carson

Sales begin Thursday, October 23rd at the Caltech Y

Subsidized cost: \$23 due when signing up | Transportation NOT provided

The Color Run is the world's first Color 5K event and is the original paint race. It's an event that promotes healthiness and happiness by bringing the community together to participate in the Happiest 5K on the Planet.

Color runners will feel on top of the world as they run through dreamy colored foam and will be delighted by new colors (PURPLE!) in the classic powder Color Zones. Along the course, participants can paint their aspirations on the Dream Wall,

snap whimsical photos with giant unicorns and be the ultimate color inspiration as they party with friends at the Finish Festival amidst vibrant bursts of color throws.

Each Color runner will receive a limited-edition Dream Tour race shirt, embroidered headband, a fun temporary tattoo, and a one-of-a-kind Unicorn finisher's Medal. It's a 5K course that will have everyone feeling like they're on Cloud Nine.

This offer is for students only; however, students purchasing tickets are permitted to purchase tickets for up to one guest each – and that guest can be a non-student. Explore LA is coordinated by the Caltech Y. The Caltech Y is located in the Tyson House 505 South Wilson (Bldg. 128).

Pasadena LEARNS

Every Friday | 3:00 - 5:00 PM | Pasadena

Come volunteer at Washington Middle and Elementary STEAM 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.

Hathaway Sycamores

Every Monday | 5:45 - 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 40 minutes of travel time and 1.5 hours of tutoring. Transportation is included.

Laser-Imaging Technology Brought into Focus

EMILY VELASCO
Caltech Media Relations

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

Caltech engineers have improved a technique for taking three-dimensional (3-D) microscopic images of tissue, allowing them to see inside living creatures with greater precision than before.

The technology, called 3-D photoacoustic microscopy (PAM), bombards tissue with a laser beam. As the energy in the laser light is absorbed, it causes the tissue to vibrate ultrasonically. Those vibrations are picked up by sensors and used to assemble an image of the tissue's internal structures in a process similar to ultrasound imaging.

The technique was invented by Lihong Wang, Caltech's Bren Professor of Medical Engineering and Electrical Engineering, and his team in the Caltech Optical Imaging Laboratory, part of the Andrew and Peggy Cherng Department of Medical Engineering in the Division of Engineering and Applied Science.

One constraint of the technology to this point has been its limited depth of field—the range at which objects are in focus. This phenomenon would be familiar to anyone who has used a camera. When the camera is focused on a nearby object, objects in the background will be blurry. When the camera is focused on something in the distance, nearby objects are blurry.

While such blurring can add an artsy flair on Instagram, it is not desirable in 3-D medical imaging, so Wang and his team set out to tweak their technology to minimize the effect. In a paper published in the October 3 issue of *Nature Communications*, they describe a modified form of the technology they're calling spatially invariant resolution photoacoustic microscopy, or SIR-PAM.

SIR-PAM builds on previous PAM technology by pre-processing the laser

beam with a specialized optical chip found in certain types of TVs and projectors. The chip splits the beam in two, and each of those beams bombards the object to be imaged from a different angle.

When the beams cross inside the object, they create precise interference patterns that provide acoustic signatures needed to construct a clear 3-D image of internal structures throughout the scanned area.

These modifications give SIR-PAM a depth of field 32 times larger than what PAM could achieve while also improving its resolution to as small as 90 nanometers (1/1000th the width of a human hair).

"This gives us the ability to look through opaque materials and see what's inside," Wang says. "It's like an extension of the human eye, like Superman's X-ray vision."

"Photoacoustics is unique," he says. "It can be scaled to image everything from structures inside a cell all the way up to an entire organism, affording an unprecedented opportunity for omniscale biological research with consistent imaging contrast."

The paper is titled "Motionless volumetric photoacoustic microscopy with spatially invariant resolution." Wang's other co-authors are Caltech researchers Jiamiao Yang, Yuecheng Shen, and Pengfei Hai, Lei Gong, Xiao Xu, and Yuta Suzuki, researchers from Wang's former lab at Washington University in St. Louis.

Funding for the research was provided by the National Institutes of Health.

Molecular Biologist Recognized for Discovering the Biology of the Ubiquitin System

LORI DAJOSE
Caltech Media Relations

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

Alexander Varshavsky, Caltech's Thomas Hunt Morgan Professor of Biology, has received the 2017 Heinrich Wieland Prize from the Boehringer Ingelheim



Alexander Varshavsky
Photo Courtesy of Caltech

Foundation. The prize, named after the late Nobel Laureate Heinrich Wieland, honors "outstanding research on biologically active molecules and systems in the fields of chemistry, biochemistry, and physiology as well as their clinical importance."

Varshavsky was recognized for his work on the biology of the ubiquitin system, a large set of molecular pathways that have in common a small protein called ubiquitin. A major function of the ubiquitin system is the regulated degradation of cellular proteins. The ubiquitin system targets for selective destruction not only misfolded or otherwise abnormal proteins, but also normal proteins

that have evolved to be short-lived, depending on specific physiological conditions. The destruction of such proteins underlies a multitude of biological processes, including cell growth and division, cell differentiation, gene expression, and DNA replication. Malfunctions of the ubiquitin system cause numerous human diseases, including neurodegeneration, diabetes, cancer, and immune deficiencies.

Varshavsky studied chemistry at the Moscow State University in Russia and received his PhD in biochemistry from the Moscow's Institute of Molecular Biology in 1973. In 1977, he took a faculty position at the Massachusetts Institute of Technology, where he began his research into the ubiquitin system, at the time a nascent area of study. In 1992, he moved his laboratory to Caltech. Varshavsky is a member of the American Academy of Arts and Sciences and the National Academy of Sciences. He has received a number of major awards, including the Canada Gairdner International Award, the Albert Lasker Basic Medical Research Award, the Max Planck Award, the Albany Medical Center Prize in Medicine and Biomedical Research, and the Breakthrough Prize in Life Sciences.

The Heinrich Wieland prize of 100,000 euros (approximately \$118,000) was awarded on October 18 in Munich, Germany, at a scientific symposium in Varshavsky's honor.

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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.

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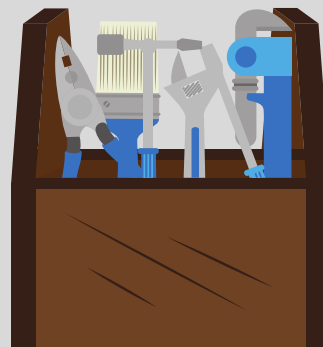
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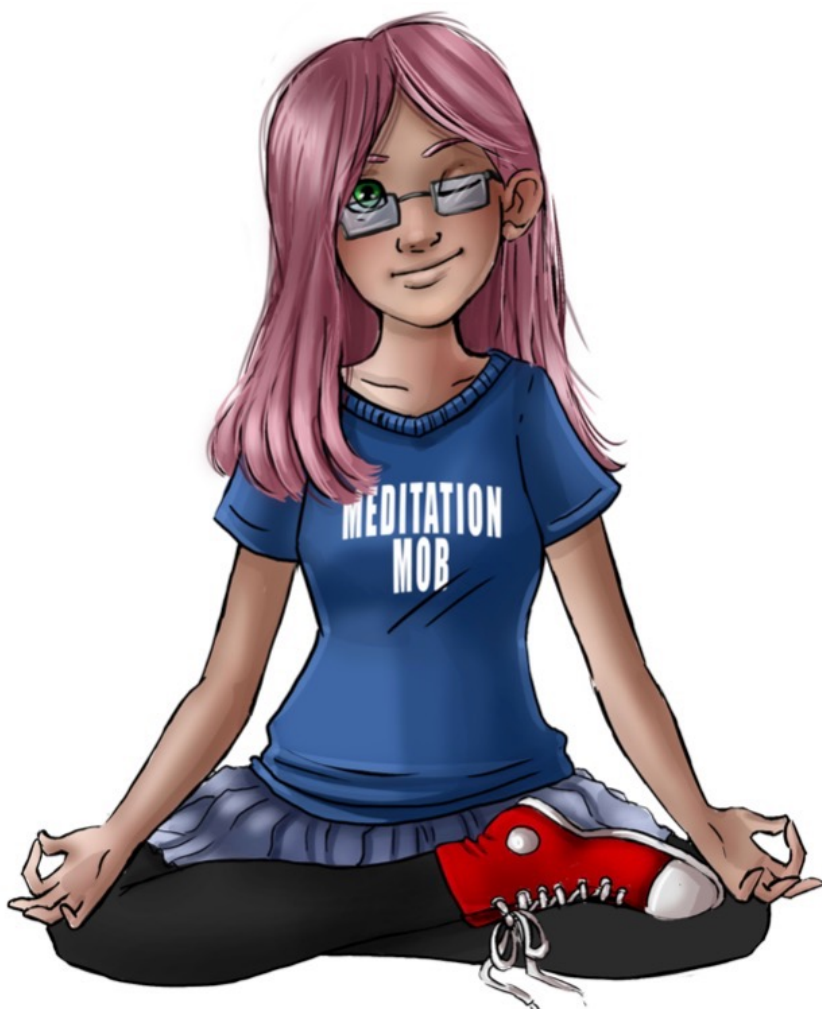
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Men's Basketball's Core Message Remains the Same

GOCALTECH.COM
Actual Sports Content Editor

PASADENA (Nov. 2, 2017) – For a men's basketball program to graduate its winningest senior class in school history, the idea would appear to indicate tougher times

Hollywood), a scrappy guard/forward who can score in spots but will likely be tasked with taking on the opposition's top scorer and creating offense on the counter attack. Kawashima missed a handful of games last year with a minor injury but recovered to play a key role for the Beavers

Bret Johnson (Carlsbad, Calif. / Santa Fe Christian) played similar minutes to Li and was utilized as a bench scoring option. Sophomore Roshan Bal (Saratoga, Calif. / Pinewood School), meanwhile will be tasked with playing a similar role to Johnson last year while giving the Beavers

skills he didn't show last year so we're excited for them to show what they can do."

Perhaps the greatest amount of intrigue surrounding the 2017 Beavers is how the incoming freshman class will fit into the equation. Eslinger made it a point to bring in talented guards that come from winning cultures and new additions Matthew Riker (Bethlehem, N.Y. / Bethlehem Central), Gokul Srinivasaragavan (San Ramon, Calif. / Dougherty Valley) and Marcus Gee (Santa Monica, Calif. / Santa Monica) all fit the bill. Spencer Schneider (Houston, Texas / Clear Brook), a 6-foot-6 forward could join Huh and Carter as front court contributors but has the versatility to play positionless basketball anywhere on the court. The skilled and disciplined quartet may yet be the answer to Caltech's scoring questions.

"The freshman are all really, really good," Eslinger said. "They all know what it takes to contribute to a winning program. Matt is a gritty and smart point guard who led his team, my alma mater in New York to the state tournament for the first time since 1972. He knows how to lead and is very coachable. Gokul is a combo-guard who can shoot, has quickness and can defend at a high level, so he is dynamic in that sense. Marcus can shoot it, has basketball IQ and can do a lot all over the court. Spencer is able to play every position and has a relentless attitude on the court.

"We will need to count on all of them."

The turnover of talent is not limited to the roster. Eslinger will feature three new assistants on his staff this year, including Derek Glasser, a four-year starter at Arizona State under Herb Sendek, Vanderbilt-alum Eli Horowitz and Syracuse-alum Andy Sherman. Spencer Levy, a 2016 graduate of Occidental will return to Eslinger's staff for his second season with Caltech. All of Eslinger's assistants should bring something unique to the table.

"Our assistants come from all different backgrounds," Eslinger said. "They all put in the time and all have a love of basketball in common. We just look for them to bring energy and ideas in addition to fulfilling all the tasks we need to field a high-level program."

Eslinger and the Beavers head to NAIA Master's University to take on the Mustangs in an exhibition game on Saturday, Nov. 4 at 7 p.m., then host an exhibition against Vanguard University on Tuesday, Nov. 7 at 6 p.m. Caltech will then travel to Occidental for the annual 110 Freeway Rivalry to officially open the season on Wednesday, Nov. 15 at 7 p.m.



Everyone in this photo is really into the game, but Calvin is on a whole different level right now.

-gocaltech.com

ahead the following season. That will be not the case for Head Coach Dr. Oliver Eslinger and the Caltech men's basketball team in the 2017-18 season. In fact, the youthful bunch which includes just one senior and no juniors are eager to continue to build on the foundation that Eslinger has helped foster as he enters his 10th season with the team.

The Beavers finished the prior season fifth in the SCIAC, just four games out of the coveted fourth-place position. Led by newly minted member of Al-Sadd Sports Club and seventh all-time leading rebounder Nasser Al-Rayes '17 in addition to departed seniors Ricky Galliani '17 and David LeBaron '17, the Beavers turned a corner when the SCIAC portion of the schedule hit. They picked up key wins over Pomona-Pitzer Colleges on Senior Night, no less, Occidental College and nearly upset then-Division III No. 16 Claremont-Mudd-Scripps Colleges in Braun Gymnasium on Feb. 2. While the senior trio certainly left their mark as four-year contributors to the team, as Eslinger puts it, "there is no rebuild, only build."

"We've never stopped building," Eslinger said. "Togetherness fuels the philosophy of group dynamics; staying together, being there for each other, trusting each other and motivating others and yourself to pick up the slack when needed will be conducive to the success that comes our way. I think this is the tightest group we have had in terms of working together and believing in each other. They're energetic with each other, really talkative and engaging with one another like we will need them to."

The presence of just one senior means Eslinger will be working with the youngest group he has ever fielded in his 10 years with the program. The lone senior is David Kawashima (Studio City, Calif. / North

down the stretch. His best game came in the team's third Occidental meeting: a 12-and-12 double-double. Caltech will need him to be an asset on and off the court as the team's lone upperclassman presence.

"David has been a great leader so far," Eslinger said. "He cares about this team a lot and he has put in a lot of work in the offseason too, so we are expecting big things from him."

Behind Kawashima is a youthful team not light on sophomores. Second-year players make up half of the Beavers lineup and all six of them will be expected to fall into featured roles, particularly in the scoring department. The bulk of Caltech's scoring last season came from a group of four players, all of whom averaged at least 10 points of game.

With none of those players returning, the Beavers will look to sophomore guard Alec Andrews (Folsom, Calif. / Folsom), who averaged 7.9 points per game over last year's 25-game schedule. Andrews also finished the season as the SCIAC's second-leading assists leader (3.3 per game) and finished second on the team in minutes. He is able to contribute in a number of different ways, and that led to him being leaned on heavily by Eslinger and his coaching staff in year one.

"Alec started every game last year for us," Eslinger said. "We want him to have expanded his game and be more dynamic."

The remaining trio of guards contributed in bunches last year and all are expected to take on expanded roles this year. Sophomore point guard Michael Li (Bryn Mawr, Pa. / Radnor) came off the bench to work in with Andrews acting as more of a freelance shooting guard and played meaningful minutes against some of the top guards of the SCIAC. Another guard, sophomore

some energy and scoring off the bench.

"Mike is going to be counted on to be a leader and extension of our coaching staff out on the floor," Eslinger said. "He is a highly aggressive defender and want him to be able to play make for everybody else. Bret is a really hard worker and we need him to be able to score for us and defend at a high level, which he can do. Roshan can really shoot it as well so hopefully he'll get a real shot this year to showcase that part of his game."

A big key for the uncharacteristically small Beavers (only three players exceed 6-foot-4) will be finding a combination in the front court that is going to pay dividends. Sophomore pair Ross Carter (Sudbury, Mass. / The Rivers School) and Calvin Huh (Fort Lee, N.J. / Bergen Tech) both saw minutes last season, especially as the year wore on and the duo grew more comfortable in Eslinger's system. With a year to study the success Al-Rayes and LeBaron had down low last year however, Eslinger believes both players are well equipped to handle an increased workload and have all the intangibles he looks for as leaders and contributors.

"Ross and Calvin learned a lot last year from Nasser and LeBaron," Eslinger said. "They know as sophomores the time is now to get in there and get lots of reps. Going against each other and playing with each other, they have both had some impressive moments in practice. I expect them to be our force in the paint and around the rim but I have seen good things and we will count on them."

Ross was a great leader as a freshman and it's more apparent now. He communicates well and tries to put people in the right places. Calvin has shown some moments of offensive and defensive

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Here's your chance to nominate your favorite professor for the 2017-18 Richard P. Feynman Prize for Excellence in Teaching! You have from now until December 15, 2017 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 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, 2017.

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) in the Provost's Office.

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11/7/17 TUESDAY 9:00-10:00 A.M.
 11/16/17 THURSDAY 11:00 A.M.-12:00 P.M.
 11/21/17 TUESDAY 10:00-11:00 A.M.
 11/27/17 MONDAY 10:00-11:00 A.M.

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ASCIT Minutes

Meetings are every week in SAC 13

ASCIT Board of Directors Meeting

Minutes for November 3, 2017. Taken by Dana He.

Officers Present: Sakthi Vetrivel, Kavya Sreedhar, Sarah Crucilla, Alice Zhai, Dana He

Guests: Kelly Woo, Chris Dosen

Call to Order: 10:13 AM

President's Report (Sakthi):

- Received bylaw amendment proposal to change ASCIT voting system to matched pairs.
- Marsh Fund and faculty board meeting coming up soon.
- ASCIT movie night is tonight.
- ASCIT retreat planning in progress.
- Club funding meeting on Sunday, November 5th from 11:00 AM – 5:00 PM.

Officer's Reports:

V.P. of Academic Affairs (Kavya):

- Student-faculty lunches will be during week 10.
- Software seminar will be during week 9. Thinking of teaching git.
- Creating a committee to look into curriculum revisions. This includes splitting Math 3 different parts to be more option-specific and adding CS 1 to core.
- Will discuss TQFR and option-advising improvements during ARC retreat.
- Looking into how the change in unit requirements impacted students.
- Drop day is next Friday.

V.P. of Non-Academic Affairs (Rachael):

- Not in attendance.

Director of Operations (Sara):

- Not in attendance.

Treasurer (Sarah):

- Proposal for \$800 for Lloyd-Ricketts joint-house broomball event approved.
- COUCH just released article about core values. There will be a couple more articles about Bechtel house options. Seems like themed housing and quiet housing are relatively popular. Decision to be made in February.
- Got financial statement from last year; had \$55,000 left over. However, there are still a lot of clubs that requested reimbursement last year that haven't received it yet because of the lack of a point person. Needs to figure out how to transfer leftovers from last year to this year's budget.

Social Director (Alice):

- ASCIT movie night (Thor) is tonight.

- Haunted maze went well.
- Looking into ASCIT formal venues.
- Midnight donuts will be in the next couple weeks.

Secretary (Dana):

- 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: 10:56 AM

Crossword

Across

- Jump lightly
- Cut
- Consternation
- Manage
- Motor vehicle
- Musical form
- Kitchen appliance
- Cook slowly in liquid
- Braid
- Left-hand page
- Aura
- Part of the Roman calander
- Epoch
- Particle
- Writing block
- Celestial body
- Young animal
- Gear wheel tooth
- Solicit
- Direction
- Simian
- Decapod
- Any high mountain
- Scale drawing
- Cleaning implement
- Cut of meat
- Smother or suppress
- Female sheep
- Single
- Basketball target
- Tennis serve that must be replayed

- Snake tooth
- Fairy
- Couch
- Display
- Performer
- Corpulent
- In addition
- Ill-mannered
- Square root of 1,600
- Prevaricated
- Surface boundary
- Taut
- Ripped
- Very small

Down

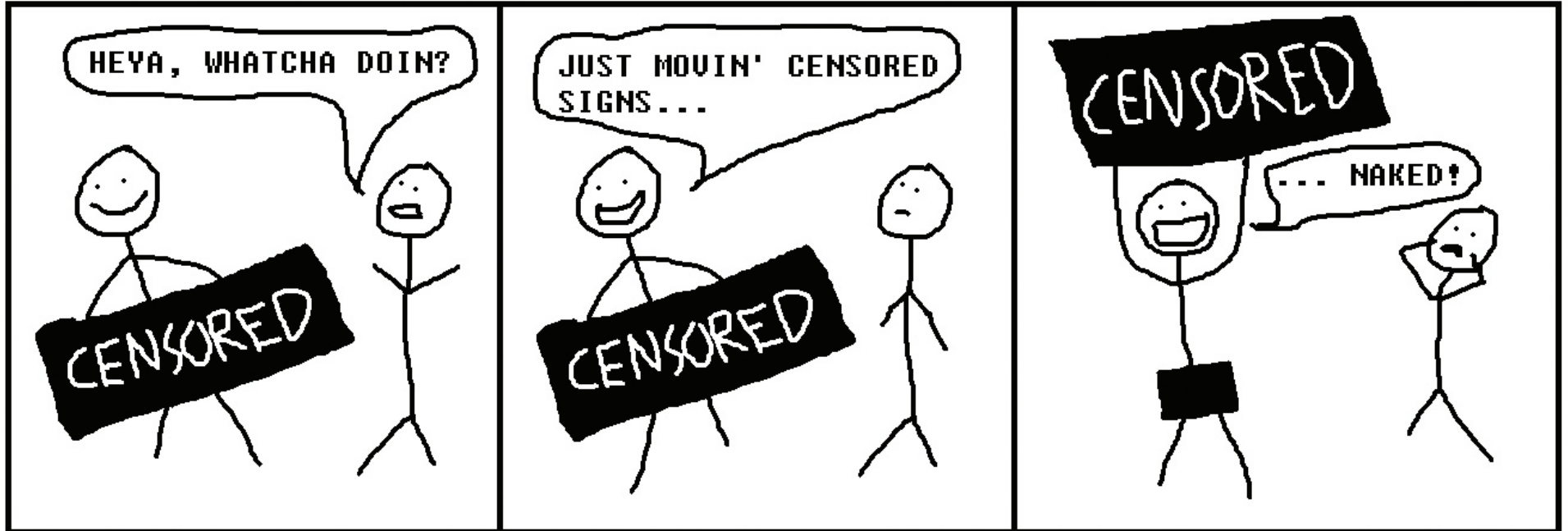
- Levitate
- Drama set to music
- Writing implements
- Fuel
- Writer
- Rise as vapor
- Ululation
- Toward the stern
- Glaringly vivid or graphic
- Matured
- Artifice
- Military dining room
- Small inlet
- Cereal
- Musical composition
- Tackiness
- Pertinent
- Weep convulsively
- Worthless or oversimplified ideas

- Young whale
- Translucent mineral
- Segment of DNA
- The highest point
- Brag or gloat
- Ness
- Moose
- Hotshot
- Fruit seed
- Fish eggs
- Small insects
- Male offspring
- Garment of ancient Rome
- Large heavy rope for nautical use
- Endures
- Pagination
- Musical composition, intended as an exercise
- Hotel for travelers
- Liberate
- Relatively low in volume
- Woodwind instrument
- Flowerless plant
- Stop
- Ship's company
- Oculus
- Epithalamium

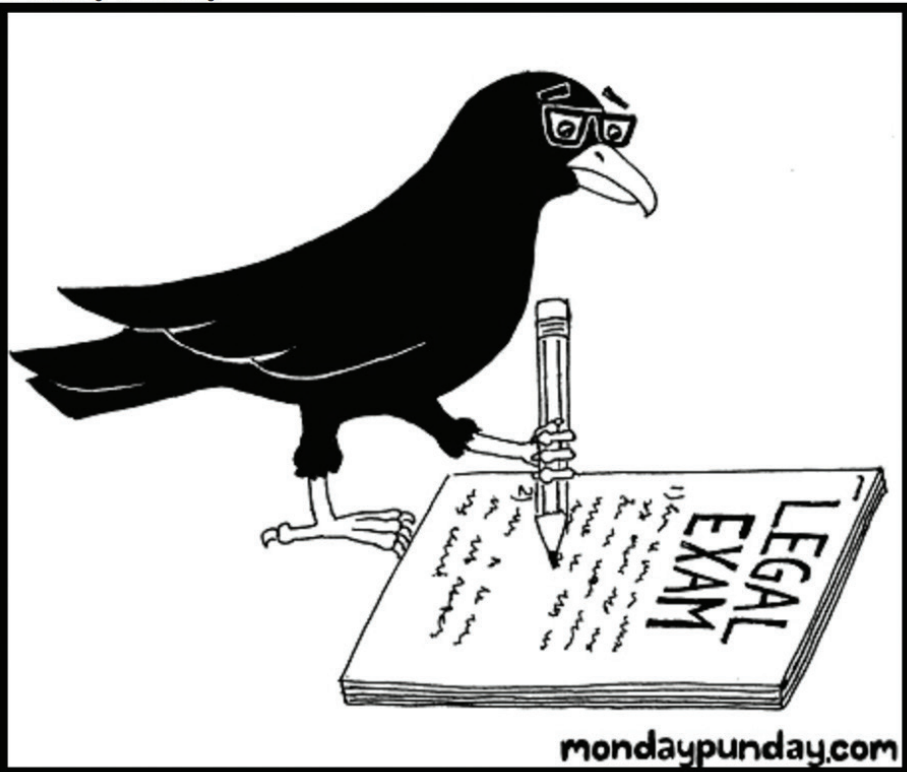
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SEXY COMIC

BY DAVID GINOLA



Monday Punday



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

Think you know the answer? Take a guess at mondaypunday.com/103

Answers to current crossword (pg 7)

	E	W	E		R	E	T	O	R	E	S	E	N	S	E	T
E	D	G	E		E	D	L	I	E		Y	T	F	O	R	T
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R	O	R	A	C	T	O	R	A	C	T	O	R	S	H	O	W
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-<http://puzzlechoice.com>

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