

- A monument for a mascot
- A birthday for BBE
- Winging it around campus; and more

Fun with Fungi

Aelin Hunt (BS '23) served as Dabney House president—and its unofficial painter—before they graduated last summer. They fell in love with making murals during their first year at Caltech after taking a class with drawing, painting, and silkscreen art director Jim Barry. Hunt, who graduated with a degree in materials science and chemistry in June 2023, explains the peace they found while adorning several walls in Dabney House, and why it is so fun to paint mushrooms.

“I learned to do watercolors and then a little bit of acrylic painting. Over the next couple of years, I had the chance to do more acrylic painting. Then, when I became president of Dabney House, I had the chance to approve murals. The fun part is getting into the flow of a few hours of painting and listening to music. It’s a good time, and it was therapeutic also. Coming back from COVID, we had just returned to the house, and the mural policy was being revamped. Being able to paint something on the wall was, I don’t know, sort of poetic. ...

“I like mycology, and I think mushrooms look cool. I spent most of my summers in Maine in the woods where there is quite the variety of mushrooms, and I was also a summer camp counselor teaching campers how to survive in the woods. A lot of the counselors knew things about mushrooms and could identify them, so I picked things up along the way. I’ve done a lot of mushroom art. I painted this over winter break in 2022–23. It’s a pretty tall stairwell, and it was quite challenging to get a ladder to fit into it properly. I had to build a small platform so that I could balance the ladder between the stairs and the platform, and then stand carefully on the ladder to paint the top. It was a pretty involved project but one that I found to be a fun challenge.”



Three Questions for: Richard Thai

Richard Thai joined the Caltech Archives and Special Collections team in March 2023 as the Institute's first digital archivist. Thai came to Caltech from Cal State Northridge, and he previously held archivist positions at the LA84 Foundation and the Natural History Museum of Los Angeles County. Here, he explains what his job at the Institute entails.



1. What does a digital archivist do?

The role of a digital archivist can vary from institution to institution. At Caltech, I am working primarily with “born-digital” materials. As you can guess, those are materials that were created on a computer and not digitalized from a physical counterpart. So, instead of preserving letters and newspapers, I am preserving emails and websites. More importantly, I am developing the policies and workflows for preserving digital content and making it accessible.

2. What led you to a career as an archivist?

I like organizing stuff; I have a fondness for history, and I enjoy helping people. I thought I wanted to pursue a career in museums, but the only department that had an opening was the history department. They had a western U.S. history collection that needed processing, and the archivist needed help. Like many archivists, getting a taste of working in an archive was what sent me on my archives journey. I did not set out to be a digital archivist but, with things becoming increasingly digital, it is where the exciting new developments in the field are happening.

3. What about the field do you find challenging, and what excites you?

Digital archiving is a relatively young field, so we do not have a deep history of professional practice to fall back upon. Many of my digital archivist colleagues have told me that they are learning on the job. At the same time, we are not held back by decades-old professional dogma, and there are a lot of opportunities to be a pioneer in the field. It is daunting but also a very exciting time.

Koji Arai, a senior scientist at Caltech's Laser Interferometer Gravitational-wave Observatory (LIGO), loves hamburgers. He also loves math. So, in the grand Caltech tradition of cross-disciplinary research, Arai decided to investigate whether the basic shapes of a hamburger could be described by a single mathematical function. As it turns out, they can, and Arai has dubbed his delectable creation the “Burger Function.” Arai, who likes to paint watercolor portraits of burgers, explained that his wife challenged him to draw a burger in a CAD (Computer Aided Design) program, which he uses to design mechanical parts for LIGO. Arai thought that was too easy a task, so he opted instead to devise a single “grand unified” function for burgers—in which each of the seven layers of the burger—the two buns, onion, tomato, cheese, patty, and lettuce—are essentially spheres that get squeezed in different ways by changing the parameters of the function. “Seeing a burger expressed in math is like tapping into its pure essence,” he says. “For a physicist like me, this is very satisfying.”



Join us at the 2023–24 Watson Lectures and hear from scientists and engineers on the forefront of discovery and invention, who are tackling society's most pressing challenges. Lectures begin at 7:30 p.m. in Beckman Auditorium, and are free and open to the public. Arrive early to purchase food and beverages, and to enjoy music and other activities. Here are the remaining Watson Lectures in 2023:

November 8: Richard Andersen

James G. Boswell Professor of Neuroscience; T&C Chen Brain-Machine Interface Center Leadership Chair; Director, T&C Chen Brain-Machine Interface Center

Learn about neural prosthetics that help paralyzed people.

December 13: Wei Gao

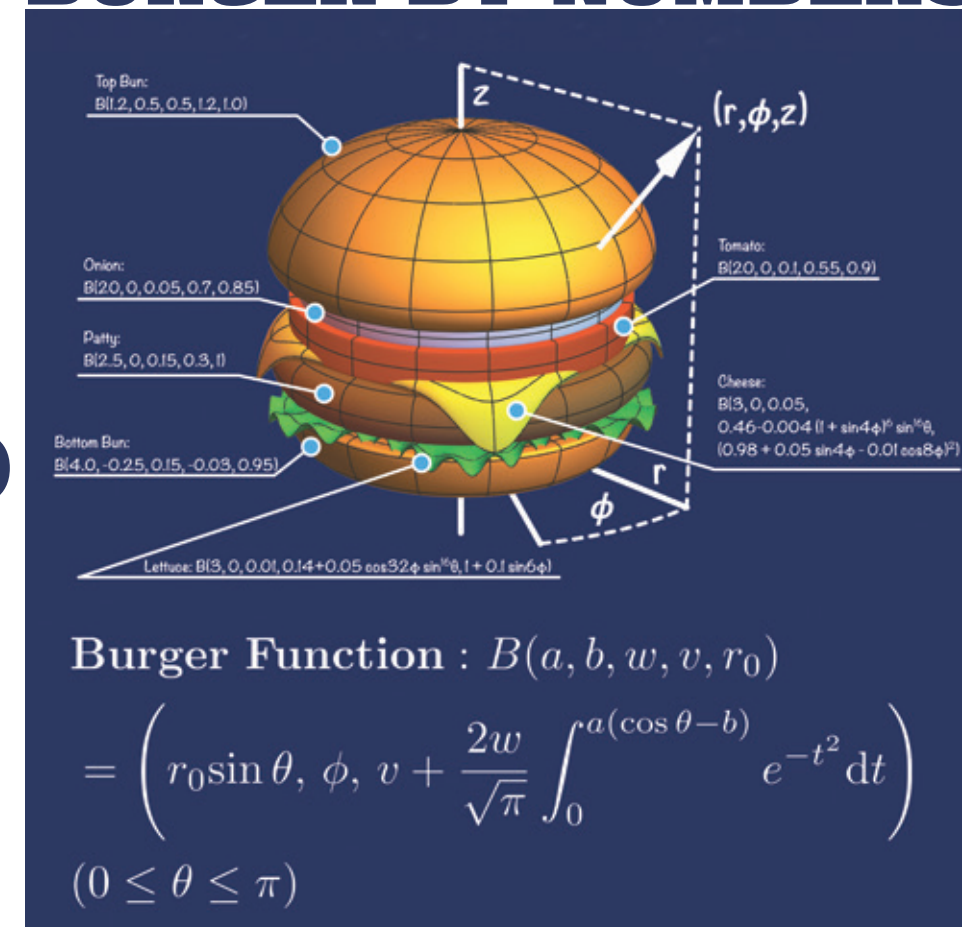
Assistant Professor of Medical Engineering; Investigator, Heritage Medical Research Institute; Ronald and JoAnne Willens Scholar

Learn about wearable sweat sensors that more accurately monitor health.

Visit Events.Caltech.edu/Watson for the full schedule and to register. Watch previous lectures on Caltech's YouTube channel:



BURGER BY NUMBERS



The Many Moods of Bernoulli



10 YEARS of BBE

This year marks a decade since the Division of Biology voted to incorporate the growing discipline of bioengineering and to change its name to the Division of Biology and Biological Engineering (BBE).

The transformation combined the division's traditional academic concentrations—genetics, biochemistry, developmental biology, immunobiology, microbiology, molecular biology, and neurobiology—with its newly established strengths in the fields of bioengineering, genomics, synthetic biology, and computational biology.

As a result of this reorganization, the number of faculty members in the division grew considerably, with 10 joint appointments awarded to researchers in other divisions whose work had a bioengineering focus. "Modern research in biology is increasingly intertwined with technological advances," says Richard Murray (BS '85), the William K. Bowes Jr. Leadership Chair of BBE. "Those technological advances in turn allow the possibility of providing new solutions to societal problems, ranging from human health, to sustainability, to new materials and devices."



The new face of Caltech Athletics is fierce, industrious, and quite loveable. Bernoulli was revealed as the new name of Caltech's beaver mascot in May 2023 following a poll conducted by the Caltech Student-Athlete Advisory Committee in which more than 700 votes were cast. Bernoulli was the most popular name among over 100 nominated. Sculptor Walter Horak crafted the beaver statue, which was unveiled outside Braun Athletic Center just before the polling began. The Institute first adopted the beaver as its mascot on October 21, 1921.

Betsy Mitchell, director of athletics, physical education and recreation, said at the naming event that the sculpture connotes "the reality of our sports teams—strong, persistent, smart, and loyal to each other." Since its unveiling, members of the community have left good luck charms for Caltech's sports teams in the statue's arms and at its (webbed) feet. The athletics department also adorns Bernoulli in festive gear for holidays and other special occasions throughout the year.



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Thomas Henning (third-year graduate student)

#SoCaltech is an occasional series celebrating the diverse individuals who give Caltech its spirit of excellence, ambition, and ingenuity. Know someone we should profile? Send nominations to magazine@caltech.edu.

Thomas Henning is a graduate student in social and decision neuroscience whose research focuses on neuroforecasting (the practice of using neurophysiology to predict population-wide behaviors from small groups of people), and on understanding how humans interact with AI agents. He is also the co-president of the Black Scientists and Engineers of Caltech (BSEC). In his free time, Henning enjoys video games, political discussions, film, and the NBA.

"I majored in business during undergrad, then I worked as a trader at Goldman Sachs for two years. During my tenure on Wall Street, I found myself spending all my free time on academic Twitter, browsing research papers, and thinking about various fundamental questions related to decision-making. I heard of this field called neuroeconomics where I could learn about human behavior and how it impacts the economic world from a basic science perspective. While working as a trader, I started working on research at night and on the weekends remotely with Professor Gregory Russell Samanez-Larkin at Duke after connecting on Twitter. Then I recognized that I liked research a lot more than my job. So, I applied to Caltech, and I've been here ever since.

My research focus now is a field called neuroforecasting, which is, basically, adding neural-imaging data to a focus group. Say a musician has multiple versions of a song, and you bring in a focus group of 30 people to ask their opinion. You're trying to predict which is going to be the biggest hit. Neuroforecasting researchers have found that if you conduct this focus group while recording each subject's neuronal activity in a functional MRI or electroencephalogram, you can predict how well that song is going to perform on Spotify better than asking the subjects themselves what they like the most."

For more #SoCaltech, go to tinyurl.com/MagSoCaltech



Flocking Together

Five bird-watchers paused on Wilson Avenue, binoculars trained on a bright yellow goldfinch. The group's leader, a man with a handlebar mustache and NASA baseball cap, earnestly marked the find on his checklist.

Alan Cummings (PhD '73), a senior research scientist in the Space Radiation Laboratory at Caltech who celebrated 50 years of service at the Institute earlier this year, is one of the founders of Caltech's bird-watching group, which has been going on weekly walks since 1986. "We've done over 1,700 walks now," says Cummings, who has developed experiments, analyzed data, and managed projects for various space missions, including NASA's long-running Voyager program, throughout his career.

On Tuesdays around noon, the group convenes to trek across campus and look for birds. Cummings diligently tracks each walk's data, noting walk attendees and how many acorn woodpeckers and red-whiskered bulbuls are spotted, among other avian varieties.

"Each walk is about 2 miles, so it's not for everybody," he says. "I can quite understand when people come and then they leave after a few walks. But once you start going, it's hard to stop. You've got a huge amount of data that you've collected, and you just feel obligated to keep it going. It's almost like Voyager."



Object Lesson:

Exquisite Corpse Totem Sculpture

This sculpture, titled *Scale vs. Size: The Exquisite Corpse*, was built by Caltech students in winter 2022 for a visual culture course called Relative to You: Representing Scale in Art and Science, taught by former Caltech visiting professor and artist-in-residence Lia Halloran. Students used accumulated knowledge from their academic disciplines to address the challenges of each project and create pieces that were meaningful to them. For this assignment, Halloran had students create a 3D-printed piece roughly 10-inches-by-10-inches in size that represented something either very big or very small. The pieces were then assembled into a single totem sculpture according to the "exquisite corpse" model, in which each person does not know what the others are creating until they all connect the parts as a group. "The project prompt was open-ended enough for students to think about the difference of scale versus size within their disciplines," Halloran says. "It was exciting when the students brought in their components and worked together to determine the placement order and how the piece worked together visually."



In the Community

Dungeons, Dragons—and Chemistry?

In the far-flung town of Terensby, seven adventurers were summoned to solve a mystery. Locks had been stolen, streetlamps smashed, and shovels, crowbars, and weapons taken—but no money was missing.

Skyler Ware, a chemistry graduate student at Caltech, set this scene for the Dungeons and Dragons (D&D) players she had invited to join her at Odyssey Games Pasadena. For the next four hours, the group tracked down the culprits: monsters that were corroding the town's iron into rust and eating it. The mystery—and the game module itself—were designed by Ware to share science knowledge through D&D, a fantasy tabletop role-playing game.

Ware's unusual approach to science outreach was inspired by the STEM Ambassador Program (STEMAP), a public engagement training program funded by the National Science Foundation (NSF). Ware completed a 10-week course with STEMAP as a requirement of NSF's Center for Synthetic Organic Electrochemistry, which funds her research. During the course, she developed her first engagement project: a D&D game incorporating elements of her research on battery science in the lab of Kimberly See, assistant professor of chemistry at Caltech.

"The STEM Ambassador Program has this focus on doing outreach in places where we don't typically think about doing outreach," Ware says. "A lot of folks think of doing outreach in schools, libraries, museums, science festivals, and that's all very important. But there are people who don't go to those spaces, who can't go to those spaces."

STEMAP encourages open-minded exchange and dialogue between scientists and members of the public rather than one-way communication. Ambassadors engage communities they are members of, and with which they have shared interests,



Graduate student Skyler Ware, standing back center, leads players through a science-inspired Dungeons and Dragons quest.

experiences, or identities. Ware says she focused her outreach on the D&D community because she had organized games for several years and knew her friends were curious about her research. In her first project, she created a D&D game in which players had to figure out how to charge their battery-powered teleporters during the adventure. Afterward, Ware handed out a sheet that described the "anatomy of a battery" and the chemistry that makes it work.

Her second outreach game encouraged players to think about chemistry through rust and iron while solving a mystery and tracking down monsters. After the game, she gave each player a handout that described the chemical reaction that creates rust and speculated how a monster could use electricity to corrode iron.

"This is one of the more unique D&D adventures I've been on; it was very

cool," said one of the players, Victoria Bian, who teaches English as a second language.

Dennis Lui, a K–12 educator who also participated in the game, said the role-playing experience lends itself naturally to scientific principles. "You're doing a lot of investigation using logic and using all the tools at your disposal like lightning, the elements, and acid," he said. "You can try to imagine the effect of what you're using in the real world."

In addition to their newfound chemistry knowledge, the participants said they valued the connections, fun, and inspiration that came out of the experience. "To people who didn't have science long ago, the things that we do in the real world now are like magic," Lui said. "So in a lot of ways, it's fun to explore both magic and science in D&D."

—Julia Ehlert

Origins

Department of Medical Engineering

Ares Rosakis, chair of the Division of Engineering and Applied Science (EAS) from 2009 to 2015 and the Theodore von Kármán Professor of Aeronautics and Mechanical Engineering, *on introducing academic departments in place of teaching options*: "The things that were in my mind when I became chair had to do with making the division nimble and more capable of responding to emerging interdisciplinary opportunities while addressing urgent societal needs. So, I introduced a well-defined departmental structure allowing us to increase the internal and external visibility of EAS and to focus our fundraising activities. The effectiveness of this approach became evident with the creation of the new medical engineering department."

YC Tai, the Anna L. Rosen Professor of Electrical Engineering and Medical Engineering, *in an oral history with the Caltech Heritage Project*: "There were many faculty who thought their research could expand into medicine. We started the effort to start a department, including a preparation to present this idea to the faculty board. That was in 2013."

Tai, *on the voting to create the department*: "During the faculty board meeting ... unanimously, they voted yes, not a single abstain or no vote."

Rosakis, *on the significance of the achievement*: "It was the first department ever created in the country carrying the name 'medical engineering.' We chose this name intentionally to highlight EAS's many connections to medicine and medical technology. I believe that this name choice has excited prospective students, faculty, and donors."

Andrew and Peggy Cherng, co-founders and co-CEOs of Panda Restaurant Group Inc., *on why they chose to fund the department in 2017*:

Ten years ago, Caltech became the first institution in the country to launch a department with the name "medical engineering." On its 10th anniversary, the department has become a leader in the development of micro/nano medical technologies and devices, medical nanoelectronics, biomedical materials and biomechanics, fluidics and bioinspired design, and medical imaging and sensing. Here, some of the department's influential faculty members talk about how it began, and where it is going.

"Supporting efforts to help medical professionals diagnose and treat patients in more efficient ways was the perfect way to make a difference in our local community and around the world. We felt this department at Caltech was uniquely positioned to succeed in this endeavor due to the strength of its faculty and its willingness to support forward-thinking and interdisciplinary research."

Tai, *on the effect of the \$30 million gift to name and endow the Andrew and Peggy Cherng Department of Medical Engineering at Caltech*: "Because of the Cherngs' endowment, which we decided to spend mostly on graduate students, we're creating opportunities for the smartest students to come to Caltech and work out the research they want to do. We don't lock them into something even before they come."

Tai, *on recruiting faculty to the department*: "It was suggested we should look at Professor Lihong Wang [who was then] at Washington University in St. Louis. ... He realized the first in vivo or functional photoacoustic tomography machine. ... He's really strong."

Rosakis, *on recruiting Wang in 2016*: "I was on vacation in Scotland speaking to

him over the phone continually. Eventually, we got him."

Lihong Wang, the Bren Professor of Medical and Electrical Engineering, who became the Andrew and Peggy Cherng Leadership Chair of the Department of Medical Engineering: "Dr. Tai has laid the foundation for the department to grow. In 2014, we started with four students. Right now, we recruit around nine per year. In 2012, we inaugurated with 10 faculty members. Now, we've got 20 outstanding members. Our department has created about 20 startups. That's a lot."

Wang, *on the future*: "People are the most important factor when you want to do first-rate research, and Caltech provides an outstanding research environment. The core of our department is applying engineering to solve medical problems, and we have no shortage of expertise in terms of engineering. There are a lot of opportunities for collaboration. ... Harry Atwater [Otis Booth Leadership Chair, EAS] puts it nicely: Caltech engineering works at the leading edges of fundamental science to invent the technologies of the future. We want to be a step ahead of everybody else."

—Omar Shamout



Peggy (left), and Andrew Cherng, who endowed the Cherng Department of Medical Engineering in 2017.