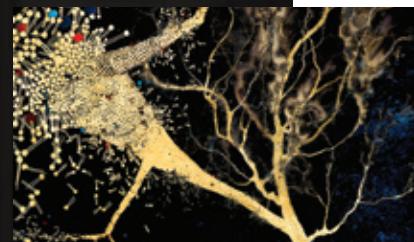


# Neural Networking

With the opening of the Tianqiao and Chrissy Chen Neuroscience Research Building, Caltech scientists have a vital new hub for interdisciplinary brain research.

The 150,000-square-foot building, made possible by a \$115 million gift from Tianqiao and Chrissy Chen, houses research and teaching laboratories, a neurotechnology lab, and a 150-seat lecture hall. As headquarters for the Chen Institute for Neuroscience at Caltech, which reaches across Caltech's six academic divisions, the new building promises to become an "idea factory" where advances in fundamental science will transform into knowledge that can help humanity.

The most recent issue of the *Caltech Effect* focuses on the new building and its importance to neuroscience research at Caltech. The following is a glimpse into the research, people, and stories shared.



## Sleep with the Zebrafishes

Over the last several years, Biology Professor David Prober and his team at Caltech have used zebrafish to make breakthrough discoveries in the three known ways that sleep is regulated: homeostatic regulation, which is based on internal cues for sleep need; circadian regulation, which responds to external cues tied to an animal's 24-hour circadian rhythm; and masking, the direct effects of light and dark on sleep and wakefulness.

In 2019, for example, his lab showed that serotonin produced by regions in the brain collectively known as the raphe nuclei is required for zebrafish to achieve normal amounts of sleep. Since the neurons in the raphe nuclei are most active when animals are awake, the researchers theorized that their release of serotonin during wakefulness leads to a buildup of pressure to sleep. By performing sleep deprivation experiments, they demonstrated that serotonin is essential for homeostatic regulation of sleep.

Prober's team will soon be able to take their zebrafish sleep studies to the next level when they move into a spacious new lab in the Chen Building that houses a microscope capable of monitoring all of the neurons in a fish's brain almost simultaneously.

"If you want to save people, if you want to reduce their suffering, you need to understand the secret of the brain."

— Chrissy Chen



"...[T]he science that we're creating, it isn't just for us. It doesn't stop there. It continues on, and it will impact millions and millions of people."

— Sabera Talukder  
Chen Graduate Fellow





“There is this ability to dream together. You can talk to your colleagues about some crazy idea, and they will say, ‘Oh yeah, that’s an interesting idea. Let me put my spin on it.’”

— Long Cai  
Professor of Biology and  
Biological Engineering



Tell us about the contributions of someone who is part of the Chen Institute whose work you find inspiring.

“I find [Assistant Professor of Biology and Biological Engineering] Joe Parker’s work really inspiring. He’s going in this completely new direction, trying to understand how the brain evolves and symbiosis evolves. I don’t know what it’s going to reveal, but I feel like it’s such an exciting new direction. Not just studying the brain as this static organ but this thing that’s changing over these evolutionary timescales and really understanding what are the precise changes in the circuits that enable these incredible symbiotic relationships. So I think that’s so pioneering, and I’m really excited to see what comes with that.”

— Doris Tsao (BS '96), Professor of Biology and T&C Chen Center for Systems Neuroscience Leadership Chair and Director

## How to Build a Better Fly Feeder

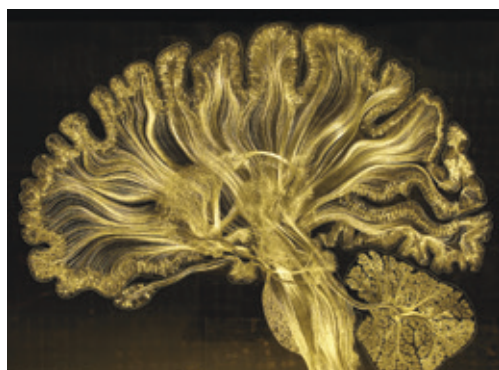
Research Professor Daniel Wagenaar is a neuroscientist and a problem solver. He also runs the Kevin Xu Neurotechnology Lab, where he helps his fellow scientists find novel solutions to a wide array of research equipment challenges. His move to a larger space in the Chen Building means he can say yes to more projects than ever.

“One of my favorite ever projects was a fly food mover for Betty Hong’s [BS '02] lab. Betty and I invented this chamber where the flies would just sit in their usual cylinder, but a dish underneath could be moved back and forth at a very slow pace allowing us to surreptitiously change food sources to control what food was available at what time.



“With our new space in the Chen Building, many of the labs we work with will be much closer. It’s surprising how much difference that makes, for people to just be able to walk along the hallway or take an elevator down. It really helps accessibility. And ultimately that’s what this whole thing is about.”

— Daniel Wagenaar, Director of the Kevin Xu Neurotechnology Laboratory



## A Universe of Complexity

In the lobby of the Chen Neuroscience Research Building sits a triptych depicting the human brain. It is the work of Greg Dunn, who earned a doctorate in neuroscience before embarking on his artistic career. The large centerpiece, titled *Self Reflected*, is a National Science Foundation-funded project created by Dunn, his applied physicist collaborator Brian Edwards, and a team of scientists over a two-year period. It is an animated and extraordinarily detailed representation of human brain activity, designed to mirror the functioning of the viewer’s own mind.

“I hope this artwork serves as a daily reminder of the audaciousness of our attempts to tackle some of the most difficult and compelling scientific questions of our time,” says Dunn.

“We will find things that we could never imagine.”

— Viviana Gradinaru (BS '05)  
Professor of Neuroscience and  
Biological Engineering

## Many Pathways into the Brain

The Chen Institute for Neuroscience at Caltech has been supporting graduate student research since it was inaugurated in 2016. Among them are: **Annie Erickson**, Chen Graduate Fellow, who aims to understand and map the pathways in the fruit fly brain when in flight; **Jonathan D. Kenny**, who studies the neural circuit dynamics of general anesthesia; **Guruprasad Raghavan**, who is growing neurons on a dish to fabricate “cortical computers” with graduate student **Varun Wadia**; **Sanghyun Yi**, a Chen Graduate Fellow, who studies how the human brain solves problems to improve machine learning algorithms; and **Jennifer Sun**, who is training machine learning models to recognize mouse behavior, allowing researchers to process larger volumes of data.

# In Memoriam

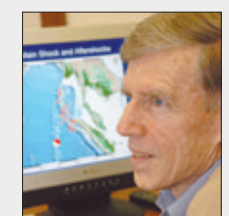
Read more about their lives at [magazine.caltech.edu/post/in-memoriam](https://magazine.caltech.edu/post/in-memoriam)



## Bill May 1942–2020

William “Bill” H. May, chairman of the board of directors of the Arnold and Mabel Beckman Foundation and former member of the advisory committee for Caltech’s Division of Chemistry and Chemical Engineering, died on October 10. He was 77. May was senior vice president, general counsel, and secretary for Beckman Instruments, the company founded by Arnold O. Beckman (PhD '28). After his retirement, May served as chair of the board of directors of the Arnold and Mabel Beckman Foundation.

## Bill Iwan (BS '57, MS '58, PhD '61) 1935–2020



Wilfred D. (Bill) Iwan, professor of civil engineering, emeritus, passed away on October 29. He was 85 years old. He joined the Caltech faculty in 1964 and remained at the Institute for the rest of his career. Iwan’s research focused on fundamental areas of mechanics, including work to understand and characterize

strong earthquake ground motion and the analysis and monitoring of the response of structural systems subjected to extreme events.



## Vince McKoy 1938–2020

Basil Vincent “Vince” McKoy, emeritus professor of theoretical chemistry, died on November 2. He was 82. Work he conducted in the 1960s led McKoy to focus on quantum scattering theory, a field

of study that seeks to understand how waves and particles scatter after a collision. For the rest of his career, he continued to study collisions between particles, later focusing on how electrons affect large biomolecules like DNA when they collide with them.

## Kim C. Border (BS '74) 1952–2020



Kim C. Border, a longtime professor of economics at Caltech, died on November 19. He was 68 years old. Border specialized in decision theory and sought to better understand

how and when people behave rationally when presented with risks. He applied insights from mathematical areas to design incentives to solve resource allocation problems; for example, his research helped in the design of auctions, such as those for greenhouse gas permits or online advertising.



## Jean-Paul Revel 1930–2020

Jean-Paul Revel, the Albert Billings Ruddock Professor of Biology, Emeritus, died on December 4 at the age of 89. Revel served as dean of students at Caltech from 1996 to 2005. In his research in cell biology, Revel studied cell-to-cell communication, electron microscopy, and scanning probe microscopy. He was the first to identify and characterize gap junctions, a means whereby cells can communicate to exchange small molecules and ions.

## Ward Whaling 1923–2020



Ward Whaling, professor of physics, emeritus, at Caltech, died on December 15. He was 97 years old. Whaling was an experimental nuclear physicist who taught for many years at Caltech and served as the secretary of the faculty for 16 years. Late in his scientific career, Whaling used

spectrometers, including the one at Kitt Peak National Observatory in Arizona, to measure precise energy levels of atoms

## Clarence Allen (MS '51, PhD '54) 1925–2021



Clarence Allen, professor of geology and geophysics, emeritus, and a prominent seismologist, died from COVID-19 on January 21. He was 96 years old. During his career, he was best known for his contributions to the evaluation of seismicity and fault movements in regions where earthquakes are common.

In addition to those individuals listed here, Caltech mourns the passing of staff members **Jose Mendez** and **Ramon Ramirez**. [Read more about them on page 11.](#)

Read the most recent issue of *Caltech Effect* at [breakthrough.caltech.edu/magazine/the-caltech-effect-february-2021](https://breakthrough.caltech.edu/magazine/the-caltech-effect-february-2021)

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