HWNI adapts and innovates in response to COVID-19

The Helen Wills Neuroscience Institute (HWNI) made many changes to our operations this past year due to COVID-19. Researchers worked in shifts to allow for physical distancing, and all of our events were held remotely. But in addition to adapting our existing activities, several of our members launched new initiatives to help combat COVID-19 and build community during the pandemic.

Several HWNI faculty shifted their research to the urgent problem of COVID-19. Stephen Brohawn, Diana Bautista, and Hillel Adesnik teamed up to study the structure and function of ion channels in the virus that causes COVID-19. They are also screening for drugs that could block the channels and serve as new treatments. Neuroscience PhD student Sonali Mali is a key researcher in the collaboration, which won funding from Fast Grants. Markita Landry began developing a rapid, reversible, and portable COVID-19 testing device, and the project was awarded funding from the University of California's Center for Information Technology Research in the Interest of Society and the Banatao Institute.

Making new connections and maintaining a sense of community has been challenging during this time of distancing, but our Neuroscience PhD students came up with some creative solutions. Several students organized an online “Ask Us Anything!” event for prospective students, facilitated by Holly Gildea. First-year students Laura Haetzel, Eric Hu, Samira Maboudian, and Maura McDonagh started a website, Picking Brains, where they publish profiles of HWNI faculty based on interviews about their paths in science. These are just some of the innovative ways our members have come together to help fight COVID-19 and mitigate its effects on our community.

HWNI launches center for psychedelic science and education

In the summer of 2020, HWNI launched the UC Berkeley Center for the Science of Psychedelics (BCSP) in collaboration with faculty from UCSF and the Graduate Theological Union, thanks to $1.25 million in seed funding from an anonymous donor. The new center will use psychedelics as a tool to investigate the brain and mind, explore spiritual and cultural aspects of psychedelics, create a public education program, and train facilitators as guides for psychedelic experiences. Michael Silver, an HWNI faculty member and director of the Neuroscience PhD Program, is the director of the BCSP. HWNI faculty member Andrea Gomez serves on the BCSP’s executive committee, along with Berkeley journalism professor and bestselling author Michael Pollan, and Berkeley faculty members Dacher Keltner, Tina Trujillo, and David Presti. HWNI faculty member Jack Gallant is also a BCSP collaborator.

Psychedelics have been used for millennia, and recent studies show they hold promise for treating numerous mental health disorders, including depression and post-traumatic stress disorder. The BCSP will study how psychedelics affect the brains of healthy volunteers to gain insight into cognition, perception, and emotion, which may also help uncover how psychedelics work to treat mental illness. The center will also train facilitators to support people through psychedelic experiences in research and therapeutic settings. Finally, the BCSP will produce a website to educate the public about psychedelic science, policy, and business. This unique interdisciplinary approach will help the BCSP advance scientific and public understanding of psychedelics, including what they can tell us about the human experience and how they can improve health and well-being.
**Messages from Our Directors**

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**Ehud Isacoff**

Director, Helen Wills Neuroscience Institute (HWNI) and Berkeley Brain Initiative (2013-present)

Director, Weill Neurohub East (2019-present)

Evan Rauch Chair in Neuroscience

Professor of Neurobiology, Molecular and Cell Biology Department

2020 was a difficult year with COVID-19, incidents of racial injustice, wildfires, and a contentious election. I am so proud of how the HWNI community has been navigating and adapting to these unprecedented times with grace and empathy. I particularly want to highlight our first-year Neuroscience PhD students who started graduate school during the pandemic, and the HWNI labs that rapidly shifted their research to COVID-19. Although our annual Berkeley Neuroscience Conference had to be held online this year, I am glad we could still interact, share our research, and discuss the critical issues of diversity, equity, and inclusion in our institute.

Despite the pandemic, we launched the UC Berkeley Center for the Science of Psychedelics in the summer of 2020. Congratulations to director Michael Silver and colleagues on this incredible achievement! I would also like to congratulate Jack Gallant and Chunlei Liu for becoming the new co-directors of the Berkeley Brain Imaging Center (BIC), and thank former director Mark D’Esposito for helping to build and lead the BIC over the years. 2020 also marked 150 years of women at UC Berkeley, and I would like to honor all of the fantastic women scientists of HWNI who have made innumerable contributions to the field of neuroscience.

We are thrilled that Doris Tsao and Yvette Fisher will be joining the HWNI faculty this summer. I look forward to the upcoming year with an even greater appreciation of how resilient, courageous, creative, and kind our community is, and it is an honor and a privilege to serve this remarkable community.

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**Michael Silver**

Director, Neuroscience PhD Program (2017-present)

Director, UC Berkeley Center for the Science of Psychedelics (2020-present)

Professor of Optometry and Vision Science and Neuroscience

In the midst of a dark year, there have been many beacons of light in our graduate program. Our students have put tremendous energy into social activism to enhance diversity, equity, and inclusion. Our beloved staff members Natalie Terranova and Candace Groskreutz sent care packages to our sheltering-in-place graduate students. Matt Davis was selected as an NDSEG Fellow, and Holly Gildea and Tobias Schmid were honored with Outstanding Graduate Student Instructor Awards. Heartfelt congratulations to the students that obtained their PhD in 2020: Jenna Adams, Zeke Barger, Jocelyn Breton, Franklin Cavai-Holme, Adam Eichenbaum, Malak El-Quessny, and Charles Frye.

Our PhD program partnered with other schools to obtain an NIH BP-ENDURE grant that will enable underrepresented minority students to conduct mentored neuroscience research at UC Berkeley every summer. We also held the inaugural mentor training for our faculty and “mentoring up” training for our students and postdocs. This training, conducted by expert facilitators from the Center for the Improvement of Mentored Experiences in Research, is now required for all faculty in the Neuroscience PhD Program.

Our entering class of 2020 (pictured, back cover) faced unprecedented challenges in starting graduate school this year. I admire their ability to navigate through these obstacles and establish connection in this time of isolation. In spite of the forces that are keeping us apart, I believe that our community is more united than ever, and it will be a joyful day when we are able to see each other in person again.
Research Discoveries

Brain waves can reveal when our minds are wandering

Professor Robert Knight and colleagues have discovered distinctive patterns of brain waves that occur when people’s thoughts are not focused on the task at hand, or are freely wandering from topic to topic. In the study, published in the Proceedings of the National Academy of Sciences in January 2021, the scientists monitored participants’ brain waves with electroencephalography (EEG) as they performed an attention task. The participants were periodically asked to categorize the type of thoughts they were having during the task. Different modes of thought — from focused to wandering — were found to be associated with different patterns of brain waves. In addition to providing insight into the variety of types of human thought, these findings could potentially be used to improve diagnosis of attention and psychiatric disorders.

Zebra finches have remarkable ability to remember the signature sound of individual birds

A study from professor Frédéric Theunissen’s lab, co-led by Neuroscience PhD student Kevin Yu and postdoc William Wood, has revealed that zebra finches can quickly learn to identify around 50 other zebra finches by their songs or calls alone, even when presented with a previously unheard version. They also found that the birds could retain these memories for a long time, at least a month. Being able to recognize and remember individuals is particularly important for social animals like zebra finches, who live in large colonies and mate for life. The study, published in Science Advances in November 2020, is the first to demonstrate such an extensive capacity for auditory memory of individuals in a nonhuman species.

Sleep quality predicts accumulation of protein associated with Alzheimer’s disease

A study from the labs of professors Matthew Walker and William Jagust found that poor sleep is associated with a higher rate of accumulation of beta-amyloid — a protein implicated in Alzheimer’s disease. The researchers assessed sleep quality in healthy older adults, and then used PET scans to measure the amount of beta-amyloid in their brains over several years. They found that people who had more fragmented sleep or less non-rapid eye movement slow-wave sleep were more likely to later have an increase in beta-amyloid. This research supports the idea that sleep quality could potentially be used to predict Alzheimer’s risk, and that improving sleep might reduce that risk. The study was published in Current Biology in November 2020.
Research Discoveries

Focusing on past success may help people with anxiety and depression in volatile times

It can be hard to make decisions during chaotic times when outcomes are uncertain, and according to a study by associate professor Sonia Bishop and colleagues, making sound decisions in volatile situations is particularly difficult for people with anxiety and depression. In the study, published in eLife in December 2020, participants performed a computerized decision-making task. When the probability of receiving a reward or punishment for their choices changed rapidly, people with symptoms common to both anxiety and depression were less able to adapt than others. The researchers also found that people who are more emotionally resilient adjust more quickly to these changes based on previous positive outcomes. This suggests that focusing on past success may be a helpful treatment strategy for people with anxiety and depression.

Ion channel models reveal new ways cells detect pH to regulate electrical signaling

Ion channels act like tiny gates in the cell membrane that open and close in response to stimuli. This regulates flow of ions across the membrane, which is critical for many functions in the body including electrical signaling in neurons. Assistant professor Stephen Brohawn’s lab has discovered two new ways that a potassium ion channel used by neurons to regulate breathing, TASK2, closes in response to pH. The researchers used cryo-electron microscopy to build detailed 3D models of TASK2. They found two regions that respond to intracellular and extracellular pH, respectively, and they both close the channel by novel mechanisms. These regions could be used to design drugs that regulate the activity of the channel for research and clinical purposes, such as treating breathing disorders. The study was published in Nature in September 2020.

Individuals have unique ‘visual fingerprints’

A study from professor David Whitney’s lab has found that different people viewing the same object judge its size and location differently, and that perception of these features varies even across a single person’s visual field. In the study, researchers asked participants to judge the size and location of objects on a computer screen. They found that each person had their own unique visual distortions, which the researchers could map to create a “visual fingerprint” for each individual. The study, published in the Proceedings of the Royal Society B: Biological Sciences in July 2020, could have broad implications, since accurately judging the size and location of objects is critical for many activities including driving, medicine, and sports.
News

Weill Neurohub partners with Genentech, Roche

In February 2021, UC Berkeley and UCSF announced a new research partnership with Genentech, a member of the Roche Group, to speed the development of new therapeutics for neurological diseases and disorders. The partnership, called the Alliance for Therapies in Neuroscience (ATN), is part of the Weill Neurohub — a collaboration between UC Berkeley, UCSF, and the University of Washington established in 2019. HWNI is a partner of the Weill Neurohub, and our director Ehud Isacoff is the director of Weill Neurohub East. Genentech and Roche are the first industry partners to join the Weill Neurohub’s effort to make breakthrough discoveries in neuroscience and translate those findings into novel therapeutics for diseases such as Alzheimer’s and Parkinson’s. The ATN’s initial projects include investigating molecular pathways involved in neurological disease and developing CRISPR-based therapeutics. UC Berkeley and UCSF will receive up to $53 million from Genentech over the course of the 10-year collaboration.

HWNI grants funds to study cognitive decline and epilepsy

As part of our mission to foster advances in neuroscience, HWNI sponsors the Radical Ideas in Brain Science Challenge (RIBSC) and the Rennie Fund for the Study of Epilepsy. This year, the winners of the RIBSC were HWNI members Lance Kriegsfeld, Yang Dan, and Daniela Kaufer for their project exploring how disrupted circadian rhythms and sleep during aging could lead to cognitive decline via degradation of the blood-brain barrier, and ways to potentially counteract this process. The RIBSC is made possible through the generosity of Berkeley Brain Initiative donors.

Two projects were selected for the Rennie Fund in 2020. HWNI member Andrea Gomez will investigate instructive cues for synaptic function, and HWNI members Richard H. Kramer and Stephen Brohawn will collaborate to explore an electromechanical mechanism of action potential propagation in myelinated axons. Both projects are focused on aspects of neural signaling that are often dysfunctional in epilepsy. The Rennie Fund was created from a bequest from the Mary Elizabeth Rennie Trust.

Celebrating the women of HWNI

2020 marked the 150th anniversary of women being allowed to attend UC Berkeley, and the campus celebrated with the 150 Years of Women at Berkeley project. Among the Cal women honored was our institute’s namesake, Helen Wills (Berkeley class of 1925), a tennis champion whose 1995 gift established the endowment for the Berkeley Neuroscience PhD Program. HWNI member Marian Diamond was also recognized for her groundbreaking contributions to neuroscience, including pioneering the field of brain plasticity. In 2020, the late Diamond was named a California Woman of the Century by USA TODAY, and HWNI faculty member Joni Wallis was awarded support from a fund honoring Diamond and her husband Arnold Scheibel. Women scientists have been important members of our institute from the very beginning, when HWNI was co-founded by former Berkeley professor Carla Shatz in 1997. Visit our website to learn more about the numerous accomplishments of our women faculty, students, postdocs, staff, and alumni.

For more about these and other Berkeley Neuroscience discoveries and news, visit our website: neuroscience.berkeley.edu/news/
Neuroscience PhD Program Alumni Profiles

From brains to self-driving cars
Helene Moorman’s path from academia to industry

“Being able to take initiative and decide what to do, and help lead others in what to do — I think a lot of that comes from the critical thinking skills that I developed doing research.”

Helene Moorman is a senior systems engineer at Cruise, where she helps develop their self-driving electric car. As a PhD student in Jose Carmena’s lab, she studied brain-machine interfaces (BMI) — specifically, how the brain can learn to control a virtual arm. Although her research at Berkeley might seem quite different from her work now, Moorman says the skills she gained in graduate school have been critical to her career in tech.

Moorman’s interest in BMI brought her to the Neuroscience PhD Program and Carmena’s lab. She says she particularly liked that the program is interdisciplinary, with frequent interaction between engineers and scientists from fields such as psychology and molecular biology. While in graduate school, she also served as the art director of the Berkeley Science Review.

After graduating, Moorman went into industry by taking a position as a human factors scientist at Exponent. She then moved to Cruise, and says she is motivated by their mission to produce a safer, more environmentally friendly alternative to traditional cars. She draws on her data analysis, visualization, and coding skills to help develop the safety and performance requirements for Cruise’s robotic car. Moorman says that in her job, she looks at problems “very scientifically, making sure we make decisions and draw conclusions based on evidence, evaluating the strengths and weaknesses of the evidence that we have […] All that comes from research and from my PhD.”

Home over hospital
Elena Allen develops products to manage heart failure at home

“To me, it seemed like building something — whether it’s an app, or an actual tool, or a device that someone uses — was a more concrete goal that I could literally put my hands on.”

Elena Allen, chief scientist at Rodin Scientific, is developing noninvasive devices that would allow patients to monitor their chronic heart failure at home. If an issue is detected, patients could adjust their medication or diet before it becomes a serious health crisis, reducing the need for repeated trips to the hospital. Allen’s work is grounded in data science, which she says overlaps significantly with the skills she developed doing neuroscience research.

For her PhD, Allen studied visual pathways in the brain in Ralph Freeman’s lab, with a focus on the technologies of functional MRI and transcranial magnetic stimulation. She says she was inspired by the talented people who surrounded her at Berkeley, which “inspires you to hold yourself to a higher standard, and encourages you to learn new things.”

After graduating, Allen did a postdoc at the Mind Research Network in New Mexico and a second postdoc at the University of Bergen, Norway. She then went into industry, where she says she particularly enjoys seeing her ideas turn into tangible products. Allen says of her move from academia into industry: “I like to learn anything new and I think I am truly not unique in that. I think most people pursuing any sort of higher degree are often driven by learning new things. The transition to industry provided a lot of new things to learn, which was really motivating and exciting.”
Being flexible
Michele Insanally studies plasticity and learning in the auditory system

“In terms of the science, the possibilities are endless. As far as I’m concerned, it’s a truly rare opportunity to study whatever questions fascinate me and make some interesting discoveries. What can be better than that?”

Michele Insanally is an assistant professor in the Department of Otolaryngology at the University of Pittsburgh School of Medicine where she studies flexibility in the neural circuits of the auditory system, with a focus on how we learn to interpret sounds. Part of her research explores how people learn to use cochlear implants and how the tuning of these devices might be improved using feedback from neural signals. Insanally integrates experimental and computational methods in her research — an approach that she says was heavily influenced by her training in the Neuroscience PhD Program.

At Berkeley, Insanally studied plasticity in the auditory system during early life in the lab of Shaowen Bao, who is now at the University of Arizona. She says that HWNI faculty members Frédéric Theunissen, Joni Wallis, and Bruno Olshausen also played particularly important roles in her scientific training. After graduating, Insanally went on to do a postdoc at New York University, where she expanded her research into auditory perception and behavior. She began her faculty position at the University of Pittsburgh in June 2020. Reflecting back on her time at Berkeley, Insanally says that the Neuroscience PhD Program is “very student-driven, and the faculty there really invest in [the students’] training. I felt like I was a young peer, and that really played a dramatic role in shaping me as a scientist — being taken seriously. It matters.”

Beyond the lab
Antonio Lara builds wearable devices to gain insight into the human brain

“What really interested me, and still interests me, is how neural activity gives rise to cognition.”

Antonio Lara is the director of neuroscience at Kernel, where he is developing wearable devices to record brain activity as people go about their daily lives, outside the constraints of a lab. Lara was Joni Wallis’ first graduate student at Berkeley, and says that the wide variety of hands-on skills he acquired while helping set up her lab was an important asset at Kernel, which was an early stage startup when he began working there.

In the Wallis lab, Lara studied mechanisms underlying working memory. After earning his PhD, he spent two more years in the Wallis lab and then went on to do a postdoc at Columbia University. An article about Kernel sparked his interest, and he ended up working there after talking with former HWNI and Berkeley colleagues who were familiar with or worked at the company.

Lara is particularly excited by the prospect that the technology he is developing could advance our understanding of the human brain by enabling larger scale neuroscience studies, in more natural settings. “To me, it would be amazing if we could get thousands of participants — brain recordings from thousands of people from every part of the world. A really diverse participant pool, not just university students or patient populations. Once that is possible, my hope is that we’ll start learning things that weren’t accessible before,” he says.

Read full versions of these and other alumni profiles on our website: neuroscience.berkeley.edu/alumni-profiles/
HWNI Faculty Honors and Awards

- **Helen Bateup** (Neurobiology) is part of a collaboration awarded $6.8 million from Aligning Science Across Parkinson’s.
- **Silvia Bunge** and **Kevin Weiner** (Psychology) were both awarded Innovations Fund grants from the UCSF-UCB Schwab Dyslexia & Cognitive Diversity Center.
- **Christopher Chang** (Chemistry) was awarded a John Simon Guggenheim Memorial Foundation fellowship.
- **Anne Collins** (Psychology) won a Young Investigator Award from the Cognitive Neuroscience Society.
- **Emily Cooper** (Vision Science and Optometry) received a Faculty Early Career Development Grant from the National Science Foundation.
- **Yang Dan** and **Daniel Feldman** (Neurobiology) were both honored with endowed chairs. Dan is now the Nan Fung Life Sciences Chancellor’s Chair in Neuroscience and Feldman is the Coates Family Endowed Chair in Neuroscience.
- **Yvette Fisher** (incoming Neurobiology) was selected as a Next Generation Leader by the Allen Institute for Brain Science.
- **Andrea Gomez** (Neurobiology) won the C.J. Herrick Award in Neuroanatomy from the American Association for Anatomy, and a Young Investigator Grant from The Brain & Behavior Research Foundation.
- **Corey Goodman** (Neuroscience, co-founder of HWNI) was a recipient of the Gruber Neuroscience Prize. He is donating his share of the prize to HWNI.
- **Evan Miller** (Chemistry; Biochemistry, Biophysics, and Structural Biology) was named a Camille Dreyfus Teacher-Scholar by the Camille and Henry Dreyfus Foundation, and also won a Donald Sterling Noyce Prize for Excellence in Undergraduate Teaching from the UC Berkeley College of Chemistry.
- **Teresa Puthussery** (Vision Science and Optometry) was awarded a Shaffer Grant from the Glaucoma Research Foundation.
- **David Schaffer** (Chemical and Biomolecular Engineering, Bioengineering, Neurobiology) received the Andreas Acrivos Award for Professional Progress in Chemical Engineering by the American Institute of Chemical Engineers.
- **Matthew Walker** (Psychology) was awarded the Carl Sagan Prize for Science Popularization by Wonderfest.
- **Gerald Westheimer** (Professor of the Graduate School Division of Neurobiology) was awarded the Ken Nakayama Medal for Excellence in Vision Science by the Vision Sciences Society.
- **Ke Xu** (Chemistry) is part of a collaboration that received a grant from the Pew Charitable Trusts’ Innovation Fund.
- **Michael Yartsev** (Bioengineering, Berkeley Nanosciences and Nanoengineering Institute) was appointed as a Vallee Scholar by the Vallee Foundation.

Entering class of 2020

Neuroscience PhD Program students

Top row: Natalie Bernstein, Zhongyan Gong, Laura Haetzel, Nancy Hernandez Villegas
Middle row: Eric Hu, Christopher Kymn, Amanda LeBel, Vivian Lu
Bottom row: Samira Maboudian, Maura McDonagh, Benjamin Parker, Miah Pitcher

Ways to give

You can support the research and education efforts of our faculty, postdocs, and students by making an online donation at this link: give.berkeley.edu/fund/FH5942000

To learn more about making a gift to neuroscience at Berkeley, please contact:

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