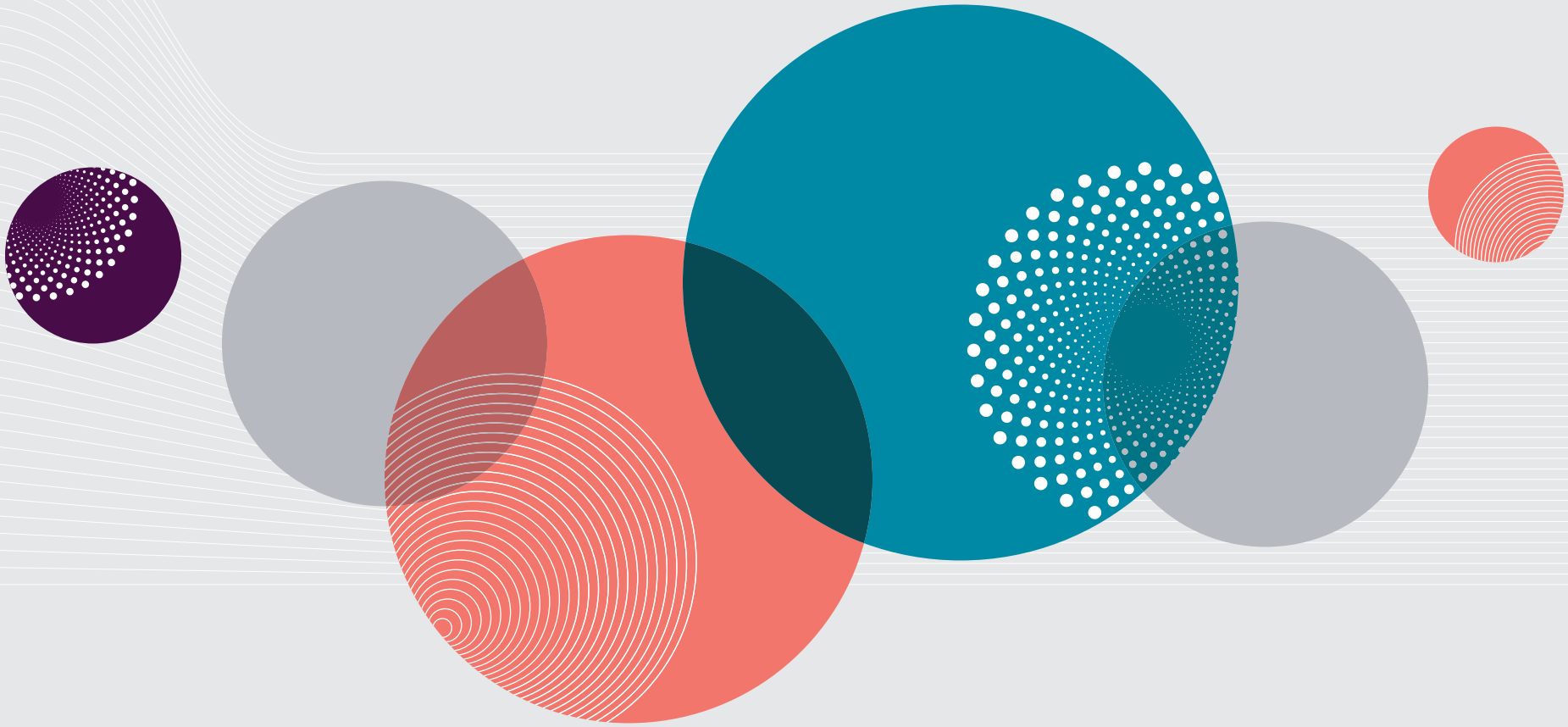
Wu Tsai Neurosciences Institute Annual Report
September 2021 to August 2022

A Transformative Year



Wu Tsai Neurosciences Institute
Stanford University

Table of Contents

03

Our Mission

04

Message from the Director

05

Interdisciplinary Research Impact

05 Knight Initiative for Brain Resilience
06 Big Ideas in Neuroscience
08 Neuroscience:Translate Awards
09 Seed Grants

10

Fostering the Next Generation

10 Interdisciplinary Postdoctoral Scholars
12 Graduate Programs
13 NeURO Undergraduates

14

Neurosciences Community Laboratories

17

Development Update

18

A Year in Photos

21

Our Team

Our Mission

The Wu Tsai Neurosciences Institute is dedicated to understanding how the brain gives rise to mental life and behavior, both in health and in disease.

Our research community draws from and informs multiple disciplines, including neuroscience, medicine, engineering, psychology, education and law. The discoveries that arise from these collaborations will transform our understanding of the human brain, provide novel treatments for brain disorders, and promote brain health throughout the lifespan. The creative, cross-disciplinary mindset we foster in our trainees is cultivating the next generation of neuroscience research.

Learn more about our Mission

Bruce Damonte, Ennead Architects

Our Goals

Engaging Extraordinary People
Our community includes six exceptional interdisciplinary faculty scholars and more than 500 faculty affiliates, hailing from all 7 Stanford schools and more than 50 departments.
Learn more

Fostering the Next Generation
Through our training programs, the Institute supports research fellowships for undergraduates, graduate students and postdoctoral scholars who will be the standard bearers for the future of the field.
Learn more

Promoting Diversity and Belonging
We believe diversity, inclusion, equity and belonging are essential to the advancement of science and to the development of a vibrant intellectual community.
Learn more

Seeding Interdisciplinary Research
We support scientific innovation and discovery through grant programs in the areas of NeuroDiscovery, NeuroEngineering and NeuroHealth.
Learn more

Creating Vital Infrastructure
The Stanford Neurosciences Building is home to more than 40 collaborative research groups as well as our shared Neuroscience Community Laboratories, which serve as a resource and catalyst for collaboration across the Stanford neuroscience community.
Learn more

Advancing the Science of Healthy Brain Aging
The Phil and Penny Knight Initiative for Brain Resilience at Wu Tsai Neuro aims to inspire new discoveries in brain aging and resilience and usher in a new era for brain science and extend human brain health long into what we now consider “old age.”
Learn more

Message from the Director

What a year of change this has been.

Most momentous of these changes was thanking our founding director, Bill Newsome, for his decade of service to Wu Tsai Neuro. Bill was instrumental in conceiving of our interdisciplinary mission and building this community from the ground up. Happily, as emeritus director, Bill continues to be a great source of wisdom and guidance to all of us here at the Institute.

This year we also bid a fond farewell to our founding executive director, Tanya Raschke, who was for many years the engine that turned the dreams of the institute into a reality. We were fortunate to be able to promote Jill Wentzell into the role of Executive Director, and she and I are working closely together to plan the next phase for the Institute.

It has been an honor to step into the role of Institute director, and I have spent the past months getting to know our diverse and innovative community. I am grateful for the institutional knowledge and wisdom of our dedicated Executive Committee — Marion Buckwalter, Rob Malenka, Alison Okamura, and Anthony Wagner — for their insights into the culture and mission of the Institute.

Of course, I am not the only new face here at the Institute.

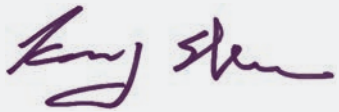
This year we supported a new round of Neuroscience:Translate research teams aiming to advance the clinical impact of our work and added dozens of interdisciplinary postdoctoral fellows, graduate students and undergraduates to our growing cohort of trainees that will make up the next generation of neuroscience. We welcomed five new research labs here at the Neurosciences Building, and our community laboratories have continued to expand and welcome new researchers to take advantage of these shared facilities and technologies.

We also reunited our community in venues large and small as the worst impacts of the COVID-19 pandemic finally receded. In addition to regular happy hours organized in partnership with our Diversity, Inclusion, Belonging, Equity and Justice committee, we held an exuberant and stimulating scientific retreat in Santa Cruz — the first time in four years we have been able to bring our community together in this way. We sent a delegation to the Society for Neuroscience meeting to highlight the impact of the Institute's programs — in particular our community laboratories and service centers.

This Fall's Symposium, entitled "Remembering the Past – Imagining the Future" brought our scientific community together in full force to examine the science of memory and the promising future of combating age-related memory loss. I thank Anthony Wagner for his leadership of the planning committee.

Our Symposium also celebrated another exciting new transformation: the launch in the Spring of the Phil and Penny Knight Initiative for Brain Resilience, housed here at Wu Tsai Neuro. Supported by a generous $75 million gift from Nike founder Phil Knight and his wife Penny, and led by my colleague and friend Tony Wyss-Coray, this ambitious scientific endeavor aims to build a new science of brain aging and identify approaches to extend the healthy lifespan of the human brain.

Next year's Symposium will celebrate the institute's 10th birthday with a look back at the remarkable community and scientific impact that the institute has cultivated since its founding in October 2013. I look forward to seeing you all there as we look forward to the next 10 years of Wu Tsai Neuro.



Kang Shen
Vincent V. C. Woo Director, Wu Tsai Neurosciences Institute
Frank Lee and Carol Hall Professor and Professor of Biology and of Pathology

Interdisciplinary Research Impact

The Wu Tsai Neurosciences Institute fosters interdisciplinary research across the neurosciences in the areas of NeuroDiscovery, NeuroEngineering and NeuroHealth. This year, we saw the impact of our support in many new breakthroughs, technologies, and treatments being developed by these teams. A sampling of these projects and discoveries follow, but more can be found on our website.

Gift from Phil and Penny Knight launches scientific endeavor to combat neurodegeneration

Excerpt of a *Stanford Report* story by Andrew Myers

A new campus-wide initiative will harness Stanford's multidisciplinary scientific expertise to tackle one of the most baffling questions in brain science: Why do some people succumb to degenerative brain diseases such as Alzheimer's and Parkinson's while others reach their 90s with their mental acuity intact?

Based at the Wu Tsai Neurosciences Institute, this scientific endeavor is being launched by a $75 million gift from Nike founder Philip H. Knight, MBA '62, and his wife, Penny. Tony Wyss-Coray, the D. H. Chen Distinguished Professor II of Neurology and Neurological Sciences at Stanford, has been appointed the inaugural director of the Phil and Penny Knight Initiative for Brain Resilience.

Wyss-Coray previously co-directed the Stanford Brain Rejuvenation Project, a partnership of researchers across campus funded by Wu Tsai Neuro's Big Ideas in Neuroscience program that in many ways laid the groundwork for the Knight Initiative's ambitious new goals.

Read more

Mission and Vision

The Knight Initiative for Brain Resilience envisions a world in which our brains remain fit and healthy as we age.

We are harnessing the collective genius of science and breaking free of established dogma to extend the healthy lifespan of the human brain — building the foundations for a world in which the word "dementia" is forgotten.

We are:

- Pursuing bold, untried approaches to advance the science of brain aging and resilience
- Sharing data, technologies, and know-how to drive progress across the field
- Linking fundamental research, human neuroscience, and clinical applications to accelerate the science of brain resilience and our impact on patients
- Achieving together what none of us can accomplish alone

Tony Wyss-Coray
Director of the Phil and Penny Knight Initiative for Brain Resilience, The D. H. Chen Distinguished Professor II of Neurology and Neurological Sciences at Stanford

Big Ideas in Neuroscience

NeuroChoice Initiative links stimulant-use relapse to distinct nerve pathway

You might assume that people who are most prone to developing a substance use disorder in the first place would also have the hardest time avoiding relapse following treatment. But a new study by scientists with the Wu Tsai Neurosciences Institute's NeuroChoice Initiative reveals that relapse may be linked to quite different brain circuits than addiction itself.

"There's a huge revolving door problem with relapse," said Brian Knutson, a professor of psychology and NeuroChoice Initiative co-lead investigator. "These findings suggest that what gets you into taking drugs may not be the same processes that get you out of it, which could be very valuable to help predict who is at highest risk of relapse coming out of treatment."

Read more

Social aversion during opioid withdrawal reflects blocked serotonin cues, NeuroChoice study finds

The acute physical illness characterizing opioid withdrawal is tough enough to endure even with full family, community, and medical support — so it is a brutal and sometimes deadly irony that one of withdrawal's salient symptoms is extreme social aversion.

"Self-isolation can cause addicted people to drop out of recovery programs, to get into conflicts, and to pull away from family and other social support networks that could help them to remain abstinent," says Keith Humphreys, PhD, the Esther Ting Memorial Professor in the Department of Psychiatry and Behavioral Sciences at Stanford an an international expert on addiction treatment and public policy.

New research by the lab of Stanford neuroscientist Robert Malenka, MD, PhD, the Nancy Friend Pritzker Professor of psychiatry and behavioral sciences, has identified a key molecular link between opioid withdrawal and social aversion in the brains of mice — suggesting the potential to help people in recovery from opioid addiction reconnect with their social support networks. The research was supported by the Wu Tsai Neurosciences Institute's NeuroChoice Initiative, led by Malenka, Humphreys, and psychology professor Brian Knutson, which seeks to link fundamental neurobiology to societal issues such as addiction.

Read more

Human brain cells transplanted into rat brains hold promise for neuropsychiatric research

Advancing research into mental disorders and brain development, investigators have successfully connected living human nerve cells, or neurons, and supporting brain cells with the brain tissue of rats to form hybridized working circuits. The research demonstrates a method for performing experiments that would otherwise be invasive, difficult or impossible. By growing and manipulating human brain tissue in the living laboratory of a rat's brain, researchers can observe effects on the animal's behavior, said Sergiu Pasca, MD, a professor of psychiatry and behavioral sciences and the Bonnie Uytengsu and Family Director of The Stanford Brain Organogenesis Program.

"We can now study healthy brain development as well as brain disorders understood to take root in development in unprecedented detail, without needing to excise tissue from a human brain," said Pasca. "We can also use this new platform to test new drugs and gene therapies for neuropsychiatric disorders."

Read more

Brian Knutson and Kelly MacNiven analyze brain imaging data.

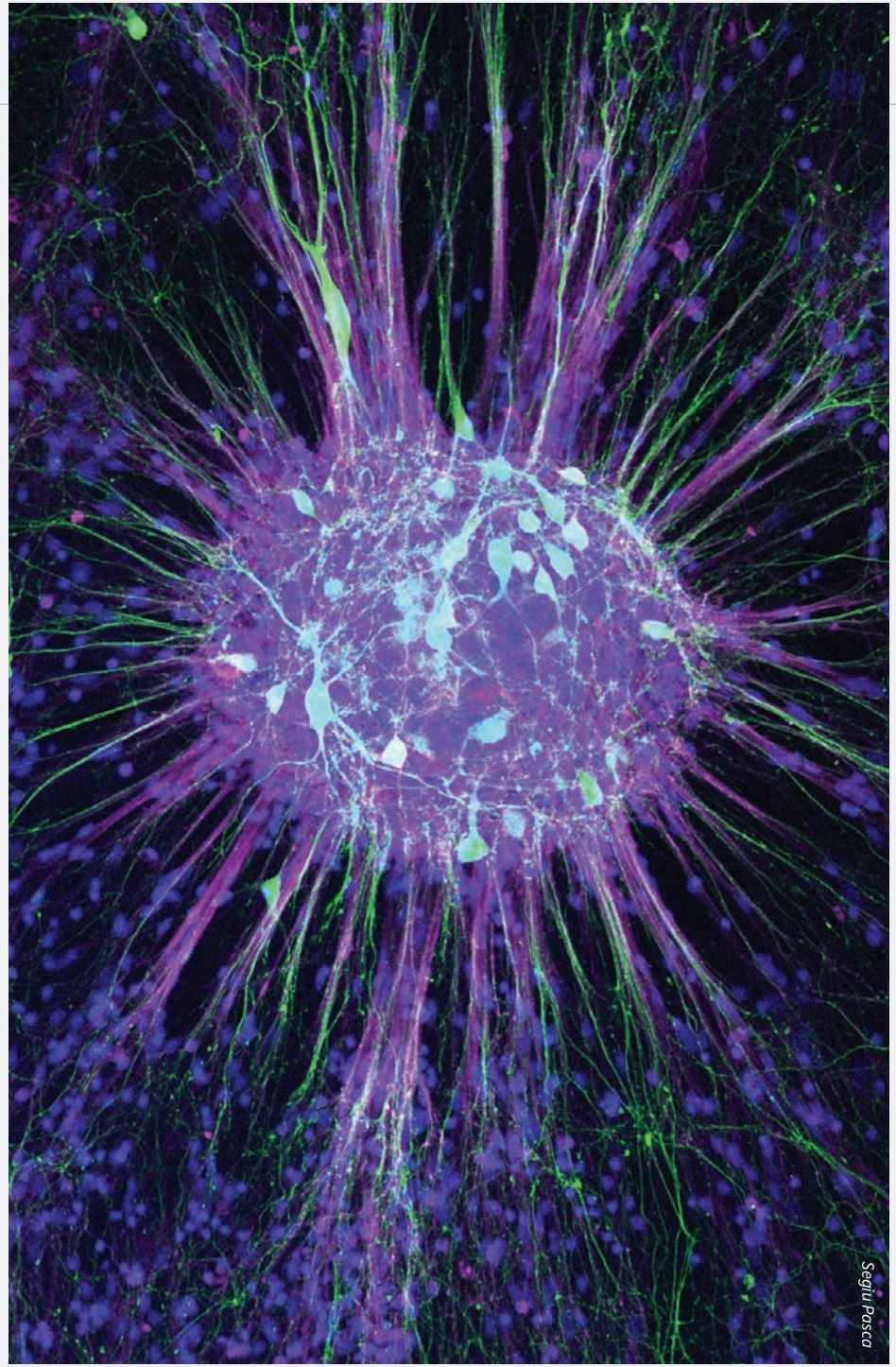
Big Ideas in Neuroscience

Neuro-omics Initiative sheds light on how neuronal connections are formed

The average adult brain consists of over 100 trillion connections, with some neurons linking to thousands of other cells. Given that the human genome only encodes for some 20,000 or so genes, scientists have long wondered how neurons are able to make so many unique linkages with so few starting blocks.

The Wu Tsai Neurosciences Institute-funded Neuro-Omics Initiative aims to bridge the chasm between the building units of the brain and its higher-order architecture using powerful new approaches such as transcriptomics, proteomics, and machine learning. New work from the lab of Wu Tsai Neuro affiliate Liqun Luo, PhD, the Ann and Bill Swindells Professor in the Department of Biology, used a novel proteomics technique developed through the Neuro-omics initiative to understand how a limited number of genes can specify trillions of unique connections.

Read more



Segiu Pasca

Celebrating Our Original "Big Ideas" Projects

Our flagship research projects, the Institute's Big Ideas in Neuroscience Initiatives each represent an innovative idea by a cross-disciplinary team of researchers that could fundamentally change how we understand the brain. Our first round of Big Ideas in Neuroscience projects concluded their funding in 2022, but their impact continues to grow:

The NeuroChoice Initiative set out to link our understanding of human decision-making at the level of brain circuits, individual psychology and societal behavior, with a focus on addiction policy.

The Stanford Brain Rejuvenation Project aimed to find new ways to slow or reverse brain aging and treat neurodegenerative disease. This effort paved the way for the new Knight Initiative for Brain Resilience.

The Stanford NeuroTechnology Initiative has developed next-generation neural interfaces including a bidirectional retinal prosthesis as part of the Stanford Artificial Retina Project.

Neuroscience:Translate Awards


Caitlyn Seim

How wearable tech can teach and heal with the power of touch

A Q&A with Neuroscience:Translate recipient and Wu Tsai Neuro Interdisciplinary Scholar Caitlyn Seim

Caitlyn Seim considered herself a technologist from a young age. Growing up with a mom who was once a mechanic meant that tinkering, for Seim, was just part of being a kid. By the time she finished her undergraduate studies in electrical engineering, she was determined to create tech that could solve real, human problems.

As a PhD student at Georgia Tech, Seim developed gloves that could "teach" the body using electrically generated vibrations, without the need for users to pay focused attention to what they were learning. Shortly after, a weatherman on CNN demonstrated to his audience how these "haptic" gloves had bestowed him with the ability to play the first notes of Ode to Joy on the piano, simply by stimulating the corresponding fingers as he went about forecasting the weather. The team could also teach the braille alphabet in a matter of hours, an approach that might one day help address the braille literacy crisis in the United States.

Since then, Seim has been determined to unlock the potential for wearable haptics in healthcare. In 2019 she moved her research to Stanford where she is working to apply her technology to reduce symptoms of stroke affecting the upper and lower limbs as part of a Wu Tsai Neuro Neuroscience:Translate Award team. In 2021, she won a Wu Tsai Neuro Interdisciplinary Postdoctoral Scholar Award to continue this work.

Read our Q&A with Seim

2022 Award Recipients

The Neuroscience:Translate grant program supports teams of researchers collaborating across disciplinary boundaries in the neurosciences to develop practical solutions to address unmet clinical needs.

Learn more about our 2022 awards

Development and validation of selective novel small molecule therapeutics for Parkinson's Disease
Mehrdad Shamloo
Neurosurgery; Director, Wu Tsai Neuro Behavioral and Functional Neuroscience Laboratory
Katrin Andreasson
Neurology and Neurological Sciences
Kathleen Poston
Neurology and Neurological Sciences

Extended reality (XR)-enhanced behavioral activation for treatment of major depressive disorder
Kim Bullock
Psychiatry and Behavioral Sciences
Jeremy Bailenson
Communication

Topical Hedgehog modulators to enhance motor nerve regeneration after injury and repair
Jon-Paul Pepper
Otolaryngology
Philip Beachy
Urology and Development Biology

Autism digital therapy with embedded endpoints and artificial intelligence for progress tracking and adaptive care
Dennis Wall
Pediatrics
James Landay
Computer Science
Gary Darmstadt
Pediatrics

Development of an extracochlear neurostimulation device to restore hearing
Peter Santa Maria
Otolaryngology
Guosong Hong
Wu Tsai Neurosciences Institute Faculty Scholar, Materials Science and Engineering

Remote reliable measurements of movement using a digitography device to solve an unmet need in neurological diseases
Helen Bronte-Stewart
Neurology, Neurosurgery
Allison Okamura
Mechanical Engineering, Computer Science

Seed Grants

Wu Tsai Neuro awards seed grants to fund focused, intense collaborations between 2-3 faculty members piloting novel and innovative research projects.

Researchers control brain circuits from a distance using infrared light

Researchers in the lab of institute scholar Guosong Hong have developed the first non-invasive technique for controlling targeted brain circuits in freely behaving animals from a distance.

By artificially outfitting specific neurons in the mouse brain with a heat-sensitive molecule called TRPV1, his team found that it was possible to stimulate the modified cells by shining infrared light through the skull and scalp from up to a meter away.

"[For the first time,] one could just shine invisible infrared light over an enclosure with cohoused mice to study the contributions of particular cells and circuits to an animal's behavior within a social group," said Hong, an assistant professor of materials science and engineering.

The new technique is one of many in which Hong's team is applying materials science know-how to develop new technologies to non-invasively study and stimulate brain circuits.

With support from a Wu Tsai Neuro seed grant, Hong and colleagues are also developing nanoscopic beads that can be injected into the bloodstream and produce light when stimulated with focused ultrasound. Paired with optogenetic techniques developed by Stanford's Karl Deisseroth, this virtual light source would let researchers rapidly stimulate or inhibit neural circuits anywhere in the brain within a single experiment.

"Conventional neuromodulation approaches gave us the ability to flip a few of the switches at a time in the brain to see what different circuits do," Hong said. "Our goal is to take these techniques a step further to give us precise control over the entire switchboard at the same time."

Read more

Faculty Awards and Honors

Institute faculty are among the brightest leaders in neuroscience. In the 2021-2022 academic year, our faculty received many awards and honors in recognition of their scientific achievements. Read more at the links below.

September 2021

Neuroscientist **Michelle Monje** awarded MacArthur 'genius grant'; **Karl Deisseroth** shares Lasker Award for research on microbial molecules behind optogenetics; Stanford's **Rhiju Das** and **Michelle Monje** announced as Howard Hughes investigators

October 2021

Monther Monther Abu-Remaileh among 2021 NIH High-Risk, High-Reward grants awardees; **Michelle Monje** among four Stanford professors elected to the National Academy of Medicine

December 2021

Paul Yock and **Shan Wang** among faculty named fellows of the National Academy of Inventors

January 2022

Institute faculty included in second cohort of CZ Biohub Investigators; **Zhenan Bao** is awarded the VinFuture Prize for female innovators; Wu Tsai Neuro affiliate **James Gross** named AAAS Fellow

February 2022

Polly Fordyce among Stanford faculty to receive NSF CAREER Award; **Carolyn Bertozzi** wins AAAS Lifetime Mentor Award; **Carolyn Bertozzi** wins Wolf Prize

April 2022

James Gross among Stanford faculty elected to the American Academy of Arts and Sciences

May 2022

Yi Cui among eight Stanford faculty elected to National Academy of Sciences

June 2022

Stuart Thompson among winners of Gores teaching award; **Karl Deisseroth** elected to American Philosophical Society

Fostering the Next Generation

The Wu Tsai Neurosciences Institute is cultivating the next generation of leaders in neuroscience. Our Interdisciplinary Scholars Program supports the cross-disciplinary work of exceptional postdoctoral scholars as well as providing career development and network-building. Our Center for Mind, Brain Computation and Technology (MBCT) promotes an interdisciplinary computational neuroscience and neurotechnology research community through its graduate student membership program. The NSF-funded NeuroTech Training Program helps Stanford graduate students from technical disciplines become leaders in the emerging field of neurotechnology. Wu Tsai Neuro also supports Stanford Interdisciplinary Graduate Fellows in the Neurosciences in partnership with Stanford BioX. And our Neuroscience Undergraduate Research Opportunity (NeURO) Fellowship provides first-time research experiences for Stanford undergraduates.

Our Diversity, Inclusion, Belonging, Equity and Justice Committee has spearheaded programs to support and enhance the diversity of our community, including the BELONG program, NSF-funded Pathways to Neurosciences program, and the NeURO-CC program (Learn more).

Interdisciplinary Postdoctoral Scholars

In January, 2022, Wu Tsai Neuro welcomed our eighth cohort of interdisciplinary postdoctoral scholars: six young scientists with backgrounds in computer science, psychology, education, engineering and pharmacology.

The institute's Interdisciplinary Scholar Awards support innovative, collaborative and creative postdoctoral researchers from across Stanford who are pursuing novel, multi-disciplinary approaches to understanding the workings of the mind and brain. In addition to receiving research funding, scholars meet regularly for workshops, journal clubs and other activities that allow them to learn from one another's varied research and personal backgrounds and establish community and collaborations.

The institute's newest scholars join 35 previous fellowship recipients including alumni who have made important advances in the neurosciences and gone on to careers in academia, industry, nonprofit and government organizations.

Learn more about the 2022 Wu Tsai Neuro Interdisciplinary Scholars

Meet the next generation of neuroscience in our series of profiles of institute postdocs and trainees past and present.

"Our scholars are all remarkable scientists with exciting interdisciplinary research plans, but they are also selected for their potential to form a diverse and supportive intellectual community. Our program fulfills an important need for postdocs, who often feel isolated, and it's been gratifying to see similar cohort-based programs crop up across campus in recent years."

Miriam B. Goodman
The Mrs. George A. Winzer Professor of Cell Biology and chair in the Department of Molecular and Cellular Physiology, Interdisciplinary Scholars Program founding director

Portraits: Tim Archibald

Interdisciplinary Postdoctoral Scholars

High-throughput brain mapping—a barcode for every synapse

Boxuan Zhao grew up in small-town China, far from the glow of research institutes or universities, but he inherited a love of the natural world and exploration from his parents, both of whom were science teachers. On weekends he loved to peer at botanical specimens in the microscope at the school where his father taught.

Always drawn to complexity, biology was a natural choice for Zhao, especially given his fascination with living things and the systems that underlie them. And brains, possibly the ultimate complex systems, were an early preoccupation, too. But he ended up majoring in chemistry, where he learned, for example, to apply protein engineering to make biosensors for small molecules in living cells.

As a 2018 Wu Tsai Neuro Interdisciplinary Scholar under the dual mentorships of chemical biologist Alice Ting and neuroscientist Liqun Luo at Stanford, Zhao has put his chemical and protein engineering skills to the test to develop new ways to create high-resolution neural wiring diagrams known as a brain connectome.

Their latest invention, dubbed connectome-seq, is at the heart of the Neuro-Omics Initiative, a Wu Tsai Neuro Big Ideas in Neuroscience project focused on linking our understanding of the brain across levels: from biochemistry to behavior and beyond.

The team plans to apply connectome-seq to piece together a complete reference map of the mouse brain, enabling new questions about how this map changes with learning in the healthy brain as well as in neuropathological conditions, such as Alzheimer's disease.

Read our Q&A with Zhao

Young cerebrospinal fluid may hold keys to healthy brain aging

In the past century, modern medicine has helped drive up average life expectancy in the United States and other developed countries by equipping doctors with the tools and know-how to manage our blood pressure, vaccinate us against dangerous viruses, swap out malfunctioning body parts with prosthetics or transplants, and much more. Unfortunately, though, modern doctors have little recourse when aging takes its toll on the brain.

Now, with a new study published in *Nature*, researchers at the Wu Tsai Neurosciences Institute, led by Interdisciplinary Postdoctoral Scholar Tal Iram, are helping to show that the cerebrospinal fluid that bathes our brains holds clues to healthy brain aging, a major focus of the new Phil and Penny Knight Initiative for Brain Resilience anchored at Wu Tsai Neuro.

Young CSF, they found, could improve memory and cognition in older mice, through effects on the development and function of oligodendrocytes, brain cells that wrap neurons in a fatty, insulating sheath, called myelin, which helps them send long-range signals. The findings open the door for potential new therapeutic targets for aging-related brain diseases like Alzheimer's and other forms of dementia.

Avery Krieger

***Iram collected tiny quantities of cerebrospinal fluid to study its effects on the aging brain, leading to a prominent publication in* Nature.**

Read more about the research

Read our Q&A with Iram and colleague Miguel Garcia

Our 2022 Interdisciplinary Scholars

Logan Cross
Funded Research Project:
Curiosity-driven Social Learning and Interaction in Artificial Agents and Humans

Darrel Deo
Funded Research Project:
Restoring multi-limb motion in people with paralysis via brain-computer interface

Elizabeth DuPre
Funded Research Project:
Assessing the generalizability of individual brain models

Christopher Miranda
Funded Research Project:
Next-generation brain imaging in freely moving animals

Zihao Ou
Funded Research Project:
Optogenetic screening of the gut-brain axis via an internal light source

Mengyuan Xu
Funded Research Project:
Structural analysis of chloride channel CLC-2

Graduate Programs

Q&A: Studying how the brain controls natural movements just got easier

Controlling movement is one of the brain's core functions — and also one of its most complex. To accomplish even the simplest of tasks, like picking up a glass of water, your neural circuits must precisely coordinate dozens of muscles in perfect synchrony.

More complex movements can involve hundreds of muscles across the whole body, and are often unique and unstructured — making them a challenge to study with standard experimental protocols.

Recently, a team led by electrical engineering graduate students Michael Silvernagel and Alissa Ling has developed custom technology that can capture all the complexity of naturalistic animal behavior and synchronize it with wireless recordings of brain activity.

Ling and Silvernagel, both of whom are members of the Wu Tsai Neuro Center for Mind, Brain, Computation, and Technology (MBCT) performed the research in the Stanford Brain Interfacing Laboratory, directed by Wu Tsai Neuro faculty scholar Paul Nuyujukian, an assistant professor in the departments of Bioengineering and Neurosurgery.

The team used 3D camera technology adapted from the growing self-driving car industry to track an animal's every movement — from walking to grooming to trying to catch a fly. The platform synchronizes these so-called "kinematics" with wireless recordings of brain activity from the motor cortex, allowing the researchers to study for the first time the details of how the brain controls complex, natural movements.

Read our Q&A with Ling and Silvernagel

2022 Interdisciplinary Graduate Fellows affiliated with Wu Tsai Neuro

Angela Y. Lee *(Communication)*
Mark and Mary Stevens Interdisciplinary Graduate Fellow
Research Project:
Leveraging screenomics to identify mental illness: Detecting bipolar disorder through computational analysis of smartphone screen data

Kwamina Nyame *(Biochemistry)*
Mark and Mary Stevens Interdisciplinary Graduate Fellow
Research Project:
Mechanistic insights into glycerophospholipid metabolism in the lysosome

Xianghao Zhan *(Bioengineering)*
Pfeiffer Research Foundation Fellow
Research Project:
Optimizing computational modeling of traumatic brain injury with machine learning: biomechanics and beyond

Fondation Photography

Winners of the 2022 Sammy Kuo Award in Neuroscience at the Wu Tsai Neurosciences Institute Annual Symposium. From left: Prof. Corinna Darian-Smith, Avin Veerakumar, Tal Iram, Emily Kubota, Felicity Gore, Kevin Kelley, and Wu Tsai Neuro Director Kang Shen. Not pictured: Daniel O'Shea, Omer Revah, Xulu Sun, Amelie Schafer. Learn more about the awards.

2022 MBCT Student Members

Alexander Durango *(Neurosciences)*
Lucas Encarnacion-Rivera *(Neurosciences)*
Sedona Ewbank *(Neurosciences)*
Andrea Gaspert *(Physics)*
Satchel Grant *(Psychology)*
Nava Haghighi *(Computer Science)*
Jiahao Liang *(Molecular and Cellular Physiology)*
Shawn Schwartz *(Psychology)*
Yandan Wang *(Biology)*

2022 NeuroTech Trainees

Sa Cai *(Bioengineering / Materials Science and Engineering)*
Yasmine Kehnemouyi *(Bioengineering)*
Anna Kochnev Goldstein *(Electrical Engineering)*
Alisa Levin *(Computer Science)*
Amrith Lotlikar *(Electrical Engineering)*
Robert Lupoiu *(Electrical Engineering)*
Itamar Terem *(Electrical Engineering)*
Lara Weed *(Bioengineering)*
Spencer Zhao *(Chemical Engineering)*

Learn more about our 2022 graduate student cohorts

Neuroscience Undergraduate Research Opportunity (NeURO) Fellowship

Stanford makes community college connections

Excerpt of a *Stanford Report* story by Lisa Chung

Isabel Caballero Teixeira, a De Anza College student studying biology, said she was "terrified-excited" when she was selected last spring for an internship through the Neuroscience Undergraduate Research Opportunity (NeURO) program at Stanford's Wu Tsai Neurosciences Institute. "I was just not very confident," she said. She considered not attending.

But as the end of the program approached, her courses and work with neurology Assistant Professor Paul George nearly complete, Caballero Teixeira described the summer as a success. "The classes provided by the NeURO program really have helped me to be able to digest the information. It's very, very empowering," she said as she bent over trays of cells in the School of Medicine Lab Surge Building, filling a pipette with media in order to maintain cells that are used in stroke research.

Her experience is part of a growing set of collaborations between Stanford University and the region's many community colleges that provide unique academic experiences for community college students. Such programs reflect Stanford's commitment to ensuring equity and inclusion in research and on campus, and to engaging with partners to learn from and give back to the local community.

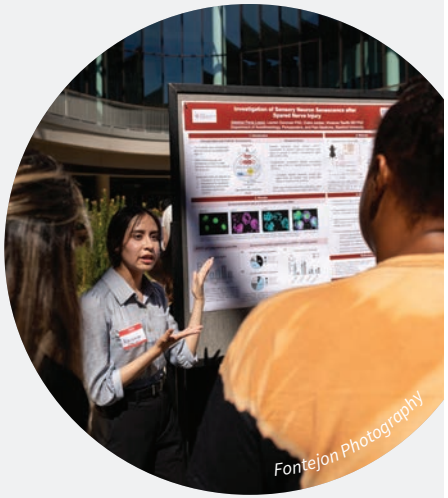
Read more

Above: De Anza College student, Isabel Caballero Teixeira, makes the media that maintain cells used in stem cell research as part of her NeURO internship.

2022 NeURO Fellows

The NeURO program was developed to provide Stanford undergraduates a structured introduction to the world of neuroscience research, with particular emphasis on recruiting students without previous lab experience or from communities historically marginalized in science. Beginning in 2020, Wu Tsai Neuro has expanded the program to include community college students through a partnership with DeAnza and Foothill community colleges.

Danielle Amir-Lobel *(Symbolic Systems & Economics)*
Jack Bartley *(Materials Science & Engineering)*
Natalia Castillo-Ramos *(Bioengineering)*
Alvand Daliri *(Biomedical Computation)*
Katie Dong *(Biology)*
Mohamed Zahier Elhassan *(Symbolic Systems & Economics)*
Katie Han *(Bioengineering)*
Solmih Kim *(Human Biology)*
Nelia Lechuga *(Human Biology)*
Aleishai Pena Lopez *(De Anza College)*
Noah Lowe *(Symbolic Systems & Economics)*
Nicholas Tolentino Macedo *(Bioengineering)*
Andres Michel *(Bioengineering)*
Jayden Murray-Houston *(Foothill College)*
Jenny Nguyen *(Bioengineering & Earth Systems)*
Audrey Nguyen-Hoang *(Biology & Psychology)*
Lour Drick Valsote *(Human Biology)*
Giovanni Talledos Sanchez *(Foothill College)*
Amelia Berot Spring *(Psychology)*
Isabel Caballero Teixeira *(De Anza College)*
Claudia Zimmerman *(Bioengineering)*



Neuroscience Community Laboratories

The Neurosciences Community Laboratories are a core component of our interdisciplinary research mission. These shared research platforms enable researchers across the university and beyond to access specialized technologies and expert guidance to conduct cutting-edge neuroscience research.

Nicholas Weiler

Left: NMS director Gordon Wang holds **The Van Golgi**, *by first-place winner Amalia Perna*

Top right: Detail from **Connected consciousness in a deep-sea egalimind**, *by runner-up Chiara Anselmi*

Wu Tsai Neuro hosts inaugural Andrew Olson Scientific Image Awards

A panel of judges selected ten images as winners of the inaugural Andrew Olson Scientific Image Awards, presented by the Neuroscience Microscopy Service (NMS) and sponsored by the Wu Tsai Neurosciences Institute and microscope manufacturer Carl Zeiss.

The awards were announced April 25, 2022 at a community gathering in the Stanford Neurosciences Building, where images were displayed as if for a museum gallery opening, drawing crowds of faculty, trainees and staff from across the Stanford neuroscience community.

According to NMS director Gordon Wang, the contest was a way of demonstrating a more creative side of science. "I was a literature major when I was an undergrad," Wang said. "Now that I'm the director of the NMS, I decided that it was time to showcase the other side of scientists."

The contest, named in honor of NMS founding director Andrew Olson, celebrates the "breadth, ingenuity and vision of the Stanford imaging community." The winning images and ten runners up are now permanently mounted throughout the Stanford Neurosciences Building.

Read more about the awards

"I made a couple of drives today [before announcing the awards]. The skies were really incredible. Huge cumulus clouds, puffy white and backlit by the sun. Incredibly dramatic. It's one of those evanescent moments of heart-aching beauty that we observe even as they slip through our fingers. One of the things that's remarkable about these scientific images is that they capture the same sense of awe and beauty, but give it permanence by advancing our knowledge. It's a reflection of the human spirit to learn and discover."

Andrew Olson
Founding Director,
Neuroscience Microscopy Service

Medical 'mixed reality' applications take center stage at open house event

From teaching the fine art of the spinal tap to gamifying at-home physical therapy for stroke survivors, creative uses of virtual and augmented reality technology in medicine were on display at an open-house held in December, 2021 at the Wu Tsai Neurosciences Institute.

Many of the projects on display were developed by students in the Fall Quarter "Mixed Reality in Medicine" course, hosted by Wu Tsai Neuro's Visualization Laboratory, which opened in 2021 as a community hub for researchers across campus to explore and develop new applications for these emerging technologies.

The course was led by Visualization Lab co-director Christoph Leuze and radiology professor Bruce Daniel. Leuze became interested in the possibilities of mixed reality technologies for visualizing MRI data during his time as a Wu Tsai Neuro interdisciplinary postdoctoral scholar working with Jennifer McNab, an associate professor of radiology who is now co-director of the Visualization lab.

Learn more and watch videos from the event

"Mixed reality technologies are maturing to the point where they can produce really useful applications, and medicine is one of the first fields that's going to benefit from that. We've seen huge demand from researchers and clinicians to get involved in mixed reality applications, but there has been a barrier because not many people have the technical know-how to get started. This course fills that gap by not only teaching students about potential applications of mixed reality technologies, but how to design and implement projects relevant to their own research interests."

Christoph Leuze
Co-director,
Visualization Laboratory

New GVVC director Nicholas Wall has a passion for nature's genetics toolkit

The Wu Tsai Neurosciences Institute is pleased to welcome Nicholas Wall, PhD, as the new director of the Gene Vector and Virus Core (GVVC), which supports the Stanford neuroscience community through production of powerful viral genetic engineering tools.

As part of Wall's doctoral work with neuroscientist Ed Callaway at UC San Diego, he designed a blockbuster viral toolkit for precisely mapping the wiring of the brain. Wall developed a two-virus system that enabled the mapping of intact brain circuits, ensuring that the rabies virus could only spread across a single synaptic connection, and only in the presence of an experimentally introduced transgene. Both safer and more precise than ever, the tool has since been taken up by hundreds of labs around the world.

More recently, Wall worked at Stanford as a postdoc and research scientist in the Nancy Pritzker Laboratory, directed by Robert Malenka, MD, PhD, where he has continued to use viral circuit tracing techniques and other virus-based tools for studying and manipulating the activity of brain networks implicated in addiction to cocaine and other drugs of abuse.

Read our Q&A with Wall

"I see my role at GVVC as a force multiplier to help push forward fundamental and translational neuroscience research for the Stanford community. With the efficiencies of scale and expertise we bring, developing a virus and testing its validity is no longer an investment of 18 months of a graduate student's PhD. Now you can just say, what's the best tool for the job and can I get it in a couple weeks?' And the answer is, 'Yes you can.'"

Nicholas Wall
Director,
Gene Vector and Virus Core

Neuroimaging symposium highlights new MRI facility's technology and services

Magnetic resonance imaging (MRI) plays a central role in the quest to understand the brain, but researchers not experienced with the technique may find the technology and its physics intimidating. The Neuroscience Preclinical Imaging Laboratory (NPIL) at the Wu Tsai Neurosciences Institute aims to make brain imaging more accessible for researchers of all backgrounds, especially those without prior imaging experience.

At the Inaugural NPIL Symposium on Apr. 15, speakers and panelists ranged from expert MRI application scientists to researchers who had just started to explore imaging techniques. Presenters discussed Stanford's newest MRI imaging facility's potential and explored a variety of MRI research, creating an encouraging environment for new users.

At the conclusion of the half-day event, lab director Jieun Kim, PhD, and faculty director Jin Hyung Lee, PhD, also announced the winners of its inaugural Neuroimaging Pilot Grants, designed to promote experimentation by new users of the magnet.

Read more

Tim Doyle

Neuroscience Preclinical Imaging Laboratory director Jieun Kim discusses MRI imaging with a symposium attendee.

Learn more about our community laboratories

Koret Human Neurosciences Community Laboratory serves as a Stanford-wide hub for collaborative human neuroscience research. The welcoming space provides access to technology and expertise to inform high-density electroencephalography (EEG) recording and transcranial magnetic stimulation (TMS) studies in human subjects.

Vincent V. C. Woo Sandbox Laboratory aims to enable collaborative projects and the development of novel equipment and engineering solutions for neuroscience experiments. The facility is fully equipped with tissue culture, in vivo procedure space, electrophysiology ("ephys") rigs, microscopy and open bench space for project and technology development.

Behavioral and Functional Neuroscience Laboratory is a state-of-the art facility designed to serve as a time-efficient and cost-effective service center for researchers in need of behavioral and neuropharmacological analyses in rodents.

Gene Vector and Virus Core centralizes the process of producing and distributing viral vectors and cDNA plasmids for use by the Wu Tsai Neuro community.

Neuroscience Microscopy Service. High-end light microscopy services, including confocal, light-sheet and multiphoton microscopes, are available in the Neurosciences Microscopy Service (NMS) community lab.

Neuroscience Preclinical Imaging Laboratory. Our mission is to provide state-of-the-art preclinical Magnetic Resonance Imaging (MRI) technology and expertise to the Stanford community to accelerate neuroscience-focused scientific discovery.

Visualization Laboratory provides a community space for the development of interdisciplinary augmented and virtual reality research projects. We also host a cutting-edge adaptive optics system to enable high-resolution imaging of the human retina.

Development Update

Bruce Damonte, Ennead Architects

A vibrant community of supporters has grown up around the Wu Tsai Neurosciences Institute, lending tremendous momentum to the institute's work. From the physical spaces we inhabit, including the beautiful Stanford Neurosciences Building and our Wu Tsai Neuro Community Labs, to our foundational programs and initiatives—all are made possible by visionary philanthropic investments. We are lucky to partner with such a dedicated group of advocates and friends.

The Knight Initiative for Brain Resilience is an excellent case study in the cumulative power of strategic philanthropy over time. Born out of the Big Ideas in Neuroscience Brain Rejuvenation Project, which itself was supported by key early investments from our community, the Knight Initiative is at its core a new model for funding interdisciplinary teams designed to tackle complex challenges. Generous support for our Big Ideas in Neuroscience program was integral in building a foundation of research upon which new discoveries will be made possible, bringing us ever closer to a world free from the ravages of dementia and other neurodegenerative conditions.

This new model of team-based thematic funding complements our more traditional approach of bolstering scientific discovery through professorships, grants, fellowships for interdisciplinary PhD and postdoctoral scholars, and other training programs. Strategic philanthropic support is invaluable because it enables us to provide brilliant scholars with the flexibility to pursue high-risk high-reward investigations that could not happen anywhere else and invest in the next generation of interdisciplinary innovators.

We are deeply grateful for the steadfast partnership of our remarkable community that shares in our bold vision. The impact of this support will only ripple wider as our researchers seek further discoveries, share their findings, and make progress toward new therapeutic strategies for brain health through every stage of life.

A Year in Photos

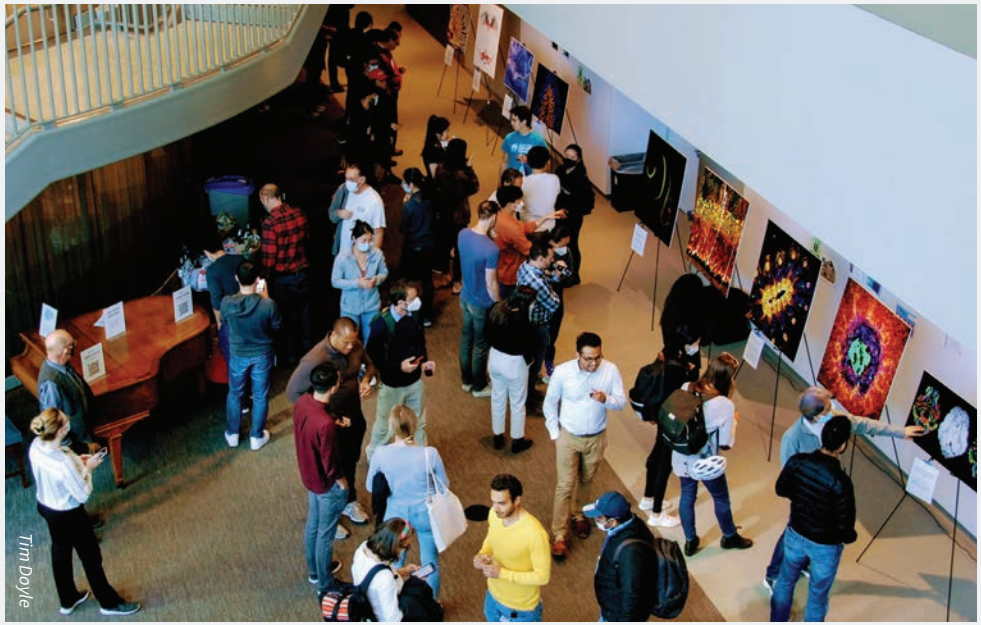
Our community reunited enthusiastically in 2022. We gathered with colleagues and old friends at weekly seminars; at monthly happy hours and art contests organized by our DIBEJ committee to celebrate the diversity of our community; at scientific gatherings hosted by our Neuroscience Community Laboratories; and at our first institute retreat in four years.

Avery Krieger

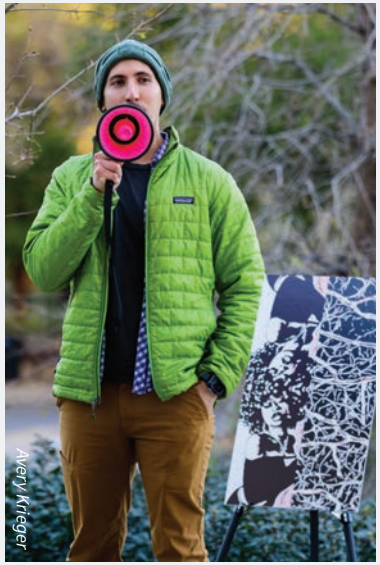
Spring Retreat
In May 2022, more than 200 Institute members gathered in beautiful Santa Cruz for a weekend of science, socializing, and sunshine! Our community heard from dozens of speakers from 25 different departments at Stanford — including graduate students, postdocs, and faculty affiliates — as well as a Keynote address from Cori Bargman of Rockefeller University about her work as Head of Science for the Chan Zuckerberg Initiative.

Stanford Medical Mixed Reality Open House
In December, we hosted an open house featuring virtual and augmented reality projects developed in the Wu Tsai Neurosciences Institute Visualization Laboratory. Here, Jasmin Palmer, a PhD student in the lab of Allison Okamura, discusses using augmented reality to train clinicians in the spinal tap procedure with Stanford Medical Mixed Reality organizer Lily Achatz.

NeURO Poster Session
In August, undergraduates participating in the Neuroscience Undergraduate Research Opportunity (NeURO) fellowship presented their research projects at an end-of-summer poster session attended by wide-ranging members of the neuroscience community.



Andrew Olson Scientific Image Awards
In April, 2022, our community gathered to celebrate the intersection of art and science at the Andrew Olson Scientific Image Awards, presented by the Neuroscience Microscopy Service (NMS) community laboratory and sponsored by Wu Tsai Neuro and microscope manufacturing firm Carl Zeiss.



Heritage Month Art Contests
This year, our DIBEJ committee launched a series of "heritage month" art contests to celebrate the experiences and perspectives of under-represented groups within our scientific community. Here, organizer Alex Gonzalez, PhD, a postdoc in the Giocomo lab, introduces "Neural Women" by Freshman Matthew Zachary-Bryant Jackson, the winner of our February 2022 Black History Month art contest.

Neurosciences Fall Picnic

In October, 2022 our community gathered for a festive picnic at the Stanford Neurosciences Building to kick off the new academic year and welcome our new director, Kang Shen, who spoke about the breadth and diversity of our community and his excitement about the future of the institute.

2022 Neurosciences Symposium

We gathered again in October to learn the latest science of memory from distinguished speakers at our 9th Annual Symposium, entitled "Remembering the Past, Imagining the Future," organized by institute deputy director Anthony Wagner. Among other highlights, we celebrated the launch of the Knight Initiative for Brain Resilience; honored founding director Bill Newsome, with a token of our gratitude for his service to the institute; and reconnected over a lively outdoor poster session.

Fontejon Photography

Our Team

Executive Committee

Kang Shen, PhD
Vincent V.C. Woo Director
Frank Lee and Carol Hall Professor
and Professor of Biology and
of Pathology

Jill Wentzell, PhD
Executive Director

Marion Buckwalter, MD, PhD
Deputy Director
Professor of Neurology and
of Neurosurgery

Rob Malenka, MD, PhD
Deputy Director
Nancy Friend Pritzker Professor of
Psychiatry and Behavioral Sciences

William Newsome, PhD
Founding Director
Harman Family Provostial Professor
Professor of Neurobiology

Allison Okamura, PhD
Deputy Director
Richard W. Weiland Professor
in the School of Engineering
Professor of Mechanical Engineering

Anthony Wagner, PhD
Deputy Director
Lucie Stern Professor in
the Social Sciences
Professor of Psychology

Communications

Nicholas Weiler, PhD
Communications Manager

Development

Elizabeth Allen
Associate Director, Donor Relations

Alana Bayona
Associate Director, Donor Relations

Maura McGinnity
Senior Director, Development

Emily Shimizu
Associate Director, Development

Finance and Administration

Aimee Garza
Administrative Associate

Alicia Haun
Administrative Associate

Philipe Irola, MBA
Associate Director for Finance
and Administration

Cathy Lau
Financial Analyst

George Mason
HR / Administrative Associate

Maritza Vallejo
Accountant

Knight Initiative for Brain Resilience

Tony Wyss-Coray, PhD
Director

Natasha Hussain, PhD
Associate Director

Alina Isakova, PhD
Brain Resilience Laboratory Director

Neurosciences Community Laboratories

Tim Doyle, DPhil
Associate Director, Neurosciences
Community Laboratories

Mehrdad Shamloo, PhD
Professor of Neurosurgery
Director, Behavioral and Functional
Neuroscience Laboratory (BFNL)

Nay Lui Saw
Lab Manager, BFNL

Peter Ciari
Staff Scientist, BFNL

Soheil Falsafi
Staff Scientist, BFNL

Gaku Ogawa
Staff Scientist, BFNL

Nicholas Wall, PhD
Director, Gene Vector and Virus Core
(GVVC)

Subba Dhulipala
Staff Scientist, GVVC

Rebecca Edwards
Staff Scientist, GVVC

Anitha Ponnuswami, PhD
Staff Scientist, GVVC

Christopher Cline, PhD
Acting Director, Koret Human
Neurosciences Laboratory

Gordon Wang, PhD
Clinical Associate Professor of
Psychiatry and Behavioral Sciences
Director, Neuroscience
Microscopy Service

Jieun Kim, PhD
Director, Neuroscience Preclinical
Imaging Laboratory

Christoph Leuze, PhD
Co-Director, Visualization Laboratory

Programs

Zulema Garibo Gonzalez
Training and Fellowships
Program Coordinator

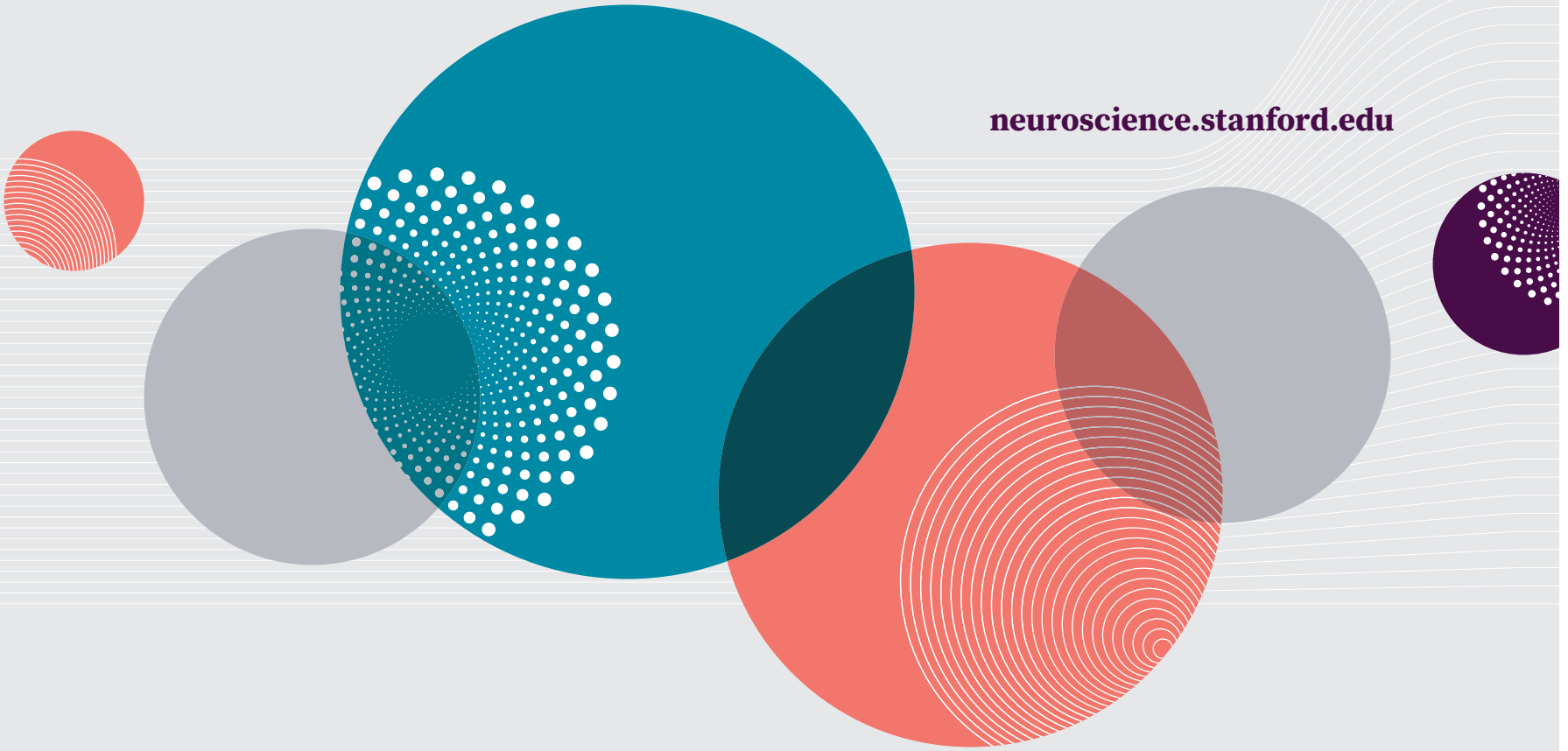
Ipshita Ghosh
Community Program Coordinator

Pictured, left to right: Kang Shen, Marion Buckwalter, Alison Okamura, Rob Malenka, Anthony Wagner

Pictured, front row, left to right: Maritza Vallejo, Aimee Garza, Zulema Garibo Gonzalez, Cathy Lau, Nicholas Weiler, Ipshita Ghosh, Natasha Hussain / Back row, left to right: Alicia Haun, Tim Doyle, Kang Shen, Alina Isakova, Jill Wentzell, Tony Wyss-Coray

Fontejon Photography

Stanford Neurosciences Building
290 Jane Stanford Way, Room E152
Stanford, CA 94305
E neuroscience@stanford.edu
T 650.723.3573



neuroscience.stanford.edu

Wu Tsai Neurosciences Institute
Stanford University