

CHEN TIANQIAO & CHRISSY INSTITUTE

Founders' Letter

As we reflect on the events and activities of 2019, our quest to better understand how the brain perceives, learns and interacts with the world remains foremost in our minds.

Although the modalities may change, our broad themes remain consistent - we continue, for example, to believe that a multi-disciplinary approach to brain science is best. We continue to invest in young scientists and we like to encourage healthy international collaboration. To that end, we expanded our support for scientific conferences and meetings in 2019, and introduced a new program which invites people to submit funding requests for conferences, meetings and workshops that are relevant to TCCI's mission.

Both the Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech and the Tianqiao and Chrissy Chen Institute for Translational Research in Shanghai took great strides this year, however, in some ways we are still in start-up mode, seeking ways to broaden our efforts and our commitment to advancing brain science. On this note, we had a very productive year, researching and envisioning new programs and partnerships which will come to the forefront in 2020.

We hope you find this report, an outline of the year's progress, interesting and informative and we thank you for your ongoing support.

Tianqiao Chen

Chrissy Luo

Our Vision

Improving the human experience by understanding how our brains perceive, learn and interact with the world.

Supporting brain research focused on:

- understanding the sensation-perception mechanisms and related systems of memory, attention, learning and expectations.
- advancing discoveries and applications that minimize the negative and enhance the positive impact of perceptions.

We believe that the ability to shape and refine perception will help us better understand our world, be it through more targeted therapies to alleviate negative psychological states such as depression or seamless brain-machine interfaces to enhance the utilization of mental capacity and capabilities.

Focus

Supporting fundamental research into brain function and how perceptions are formed

We are committed to bringing together the world's most talented researchers to investigate the complex interactions governing sensation, perception and cognition. We have three core areas of interest:

Brain Discovery

Understanding the brain at the fundamental level of individual neurons and synapses. We support research that will deepen our understanding of how the brain gathers, organizes and retains information, and translates perceptions into thoughts, emotions, decisions, actions and memories.

Brain Treatment

We seek to translate improved understanding of brain mechanisms and processes into breakthroughs in the treatment of physical and psychological suffering such as mental disorders and neurodegenerative diseases.

Brain Development

An acute understanding of fundamental brain processes will allow us to perfect the brain-machine interface, use technologies such as augmented reality or virtual reality to improve neurorehabilitation and inform the next generation of artificial intelligence.



Cornerstone Partnerships



TCCI for Neuroscience at Caltech

Caltech Research Centers

Founded in late 2016 and led by David Anderson, Seymour Benzer Professor of Biology at Caltech and a Howard Hughes Medical Institute Investigator, the <u>Tianqiao and Chrissy Chen</u> <u>Institute for Neuroscience at Caltech</u> represents our belief that basic research – understanding the brain at a cellular or neuronal level - is critical and we have much to learn in this area.

The Institute at Caltech comprises six interdisciplinary research centers focused on exploring and understanding the intricacies and complexities of the brain's structure and function. The centers bring together scientists and engineers from across the university who study the brain in different species to uncover general principles, as well as researchers who create new instruments and methods to answer previously unanswerable questions.



David Anderson

Seymour Benzer Professor of Biology, Tianqiao and Chrissy Chen Institute for Neuroscience Leadership Chair and Director, and Howard Hughes Medical Institute Investigator

<u>Mary Sikora</u>

Executive Director of the Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech

The T&C Chen Brain-Machine Interface Center

Led by <u>Richard Andersen</u>, T&C Chen Brain-Machine Interface Center Leadership Chair and James G. Boswell Professor of Neuroscience, the Center is advancing Caltech's work on a new generation of devices that can communicate with and stimulate the brain.

The T&C Chen Center for Social and Decision Neuroscience

Under the direction of <u>Colin Camerer</u>, T&C Chen Center for Social and Decision Neuroscience Leadership Chair and Robert Kirby Professor of Behavioral Economics, this Center is investigating two important higher-order functions of the human brain: decision-making, and processing/guiding social interactions.

The T&C Chen Center for Systems Neuroscience

Directed by <u>Doris Tsao</u>, T&C Chen Center for Systems Neuroscience Leadership Chair, professor of biology and Howard Hughes Medical Institute Investigator, researchers working in this Center explore the neural circuits and computations that underlie perception, thought, emotion, memory, decision-making, and behavior.

The Center for Molecular and Cellular Neuroscience

<u>Viviana Gradinaru</u>, professor of neuroscience and biological engineering and Heritage Medical Research Institute Investigator, leads this Center which unites a contingent of Caltech researchers making discoveries about the brain's anatomy and development, how neurons communicate, and how processes in the brain can go wrong.

The Caltech Brain Imaging Center

The <u>Caltech Brain Imaging Center (CBIC)</u>, originally founded in 2003 through a gift from the Gordon and Betty Moore Foundation and directed by <u>Ralph Adolphs</u>, Caltech's Bren Professor of psychology, neuroscience and biology and Allen V. C. Davis and Lenabelle Davis Leadership Chair, makes available state-of-the-art instruments and expert staff to provide detailed measurements of the working brain.

The Chen Center for Neuroscience Education

The <u>Chen Center for Neuroscience Education</u> is led by <u>Markus Meister</u>, Caltech's Anne P. and Benjamin F. Biaggini Professor of Biological Sciences and Executive Officer for Neurobiology. It provides fellowships to exceptional first-year graduate students in neuroscience options at Caltech and it recognizes the importance of fostering graduate student participation.

Visit the Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech website

The Chen Neuroscience Research Building, pictured here, is slated to open in October 2020.

TCCI for Translational Research



The Tianqiao and Chrissy Chen Institute for Brain Disease (Shanghai) was founded in 2018 and renamed the Tianqiao and Chrissy Chen Institute for Translational Research in 2019. A partnership with Zhou Liangfu Medical Development Foundation, Huashan Hospital and the Shanghai Mental Health Center, the organization is led by Professor Ying Mao, Director of the Tianqiao and Chrissy Chen Institute for Translational Research, Vice President of Shanghai Medical School, Fudan University; President of Hongqiao Campus, Huashan Hospital; Chairman Designate of Neurosurgery Committee of Chinese Medical Association. The Institute focuses on brain disease research, strengthening translational research between clinical and fundamental research and fostering international collaboration.

The organization brings together expert neurological and psychiatric researchers and identifies private capital to support projects. This creates sustainable development models which bridge both up- and down-stream research.

At CNS 2019, the 13th Biennial Conference of the Chinese Neuroscience Society, Professor Mao presented the organization's "China Strategy" which is focused is concentrated on funding projects that meet TCCI's five major criteria and which fall within its three-four layout—"three" stands for three fields (brain-machine interface; digital medicine; sleep research) and "four" represents the four dimensions of possible breakthroughs (research; standards formulation; translational research and talent development.)

Research focused on using digital medicine to evaluate and treat mental disease and disorders has been a core focus throughout 2019 - read more in the Research section of this report.

natureresearch

NATURE: Brain science and technology: initiatives in the Shanghai and Yangtze River Delta region

TCCI was included in a September article in the journal Nature which outlined the latest developments in brain science in Shanghai and the Yangtze River Delta in China. Professor Mao Ying, Director of the Tianqiao and Chrissy Chen Institute for Translational Research, Vice President of Shanghai Medical School, Fudan University; President of Hongqiao Campus, Huashan Hospital; Chairman Designate of Neurosurgery Committee of Chinese Medical Association was one of the authors of the article.

Read the Nature article



Mao Ying

Director of the Tianqiao and Chrissy Chen Institute for Translational Research, Vice President of Shanghai Medical School, Fudan University; President of Hongqiao Campus, Huashan Hospital; Chairman Designate of Neurosurgery Committee of Chinese Medical Association



Yang Yang

Deputy Director of the Tianqiao and Chrissy Chen Institute for Translational Research





cheninstitute.org

David Anderson

Seymour Benzer Professor of Biology, Tianqiao and Chrissy Chen Institute for Neuroscience Leadership Chair and Director, and Howard Hughes Medical Institute Investigator

Ralph Adolphs

Director of the Caltech Brain Imaging Center, Bren Professor of psychology, neuroscience and biology and Allen V. C. Davis and Lenabelle Davis Leadership Chair







Richard Andersen

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



Colin Camerer

Robert Kirby Professor of Behavioral Economics and T&C Chen Center for Social and Decision Neuroscience Leadership Chair and Director

Viviana Gradinaru

Director of the Center for Molecular and Cellular Neuroscience, professor of neuroscience and biological engineering and Heritage Medical Research Institute Investigator





Mao Ying, PhD Mentor, MD

Director of the Tianqiao and Chrissy Chen Institute for Translational Research, Vice President of Shanghai Medical School, Fudan University; President of Hongqiao Campus, Huashan Hospital; Chairman Designate of Neurosurgery Committee of Chinese Medical Association



Zhou Liangfu, PhD Mentor

Vice Chairman of Translational Research, Academician of Chinese Academy of Engineering, Director of Neurosurgery Department of Huashan Hospital

Chen Liang, MD

Professor of Neurosurgery at Huashan Hospital



Dean Mobbs

Chen Scholar and Assistant Professor of Cognitive Neuroscience





Huang Yanyan, Master Instructor

Professor, Deputy Director of Geriatrics Department at Huashan Hospital



Li Chunbo, PhD Mentor, MD

Vice President, Shanghai Mental Health Center; Vice President, Institute of Psychology and Behavioral Science, Shanghai Jiao Tong University, Professor of Psychiatry and Neuroscience



Huang Zhili, PhD Mentor, MD

Head of the Department of Pharmacology, Shanghai Medical School, Fudan University; President of Chinese Sleep Research Society

<u>Yuki Oka</u>

Zhu Wei, MD

Chen Scholar and Assistant Professor of Biology



Professor of Neurosurgery at Huashan Hospital





<u>Doris Tsao</u>

Professor of Biology, Howard Hughes Medical Institute Investigator and T&C Chen Center for Systems Neuroscience Leadership Chair and Director



Yu Huan, MD

Associate Professor of Neurology Department at Hushan Hospital, Fudan University; Executive Director of Sleep and Wake Disorders Center at Fudan University



Yang Zhi, MD

Professor, Shanghai Mental Health Center; Professor, Institute of Psychological and Behavioral Sciences, Shanghai Jiao Tong University PRINCIPAL INVESTIGATORS

Chen Graduate Fellows, 2019 - 2020



Sharon Chen Social and Decision Neuroscience

Sharon's research interest is in the neurological basis of social behavior, emotion, learning and decision-making, and its changes in psychiatric disorders. She received her Bachelor of Science in Computer Science at Columbia University and has a background in machine learning and AI, robotics, and natural language processing.



Brenden Eum Social and Decision Neuroscience

Brenden's research is in neuroeconomics, behavioral economics, decision theory, economics of information, and experimental economics. He received a Bachelor in Economics (with a minor in Mathematics) from New York University and completed a Masters in Economics at Columbia University.



Sabera Talukder Neurobiology

Sabera seeks to understand how the brain relies on various electrical and chemical feedback signals for learning and memory. Sabera graduated from Stanford with two Bachelors of Science with Honors in electrical engineering and biochemistry.



Yameng Zhang Neurobiology

Yameng previous worked in two labs at Columbia. At the Zucker Lab, she focused on signal transduction and information processing in sensory systems. In Paul Sajda's lab, she focused on characterizing the underlying perceptual and cognitive processes of cortical networks. Yameng has a B.S. in Neuroscience from Columbia University.

Caltech



George Barnum Computational and Neural Systems

George received a Bachelor of Science in Neuroscience and Cognitive Science, Mathematics, and Computer Science from the University of Arizona. He was an undergraduate research associate in the lab of Dr. Shaowen Bao where the research goal is to understand sensory processing.



Kejun Li Computational and Neural Systems

Kejun received a Bachelor of Science in Math & Computer Science and Neuroscience & Behavioral Biology from Emory University. For the past two years, her research has centered on understanding how large populations of neurons in the brain perform computations and represent intention.



Yue Xu Computational and Neural Systems

Yue received a Bachelor of Science in Computer Science with an additional major in Physics and a minor in Neural Computation from Carnegie Mellon University. Yue has spent the last year investigating the connections between scene statistics and neuronal codes at the individual and population level.

Read more on Caltech's Website

Recognition:

Congratulations to our 2019 award winners



In February 2019, Mikhail Shapiro, Professor of Chemical Engineering and affiliated faculty member of the Tianqiao and Chrissy Chen Institute for Neuroscience, was named a recipient of the Vilcek Foundation Prize for Creative Promise in Biomedical Science, a \$50,000 award recognizing exceptional early- to mid-career immigrant biomedical scientists.



In October 2019, Yuki Oka, assistant professor of biology and Chen Scholar, received a \$1.5 million grant from the New York Stem Cell Foundation. The award, distributed over five years, is one of three given internationally to early career neuroscience researchers.

Activity:

2019 was a year of firsts!

Caltech held its first Chen Institute Symposium in January, it launched a new initiative called Chen Institute Women in Neuroscience (CWiN) and awarded for the first time, the Chen Graduate Innovator Awards.

In China, TCCI for Translational Research ramped up activity, organizing and co-hosting several scientific meetings and also launching a "Cognitive Impairment Services Map" with the Shanghai Center for Disease Control.

Chen Institute Symposium 2019

The inaugural Chen Institute Symposium at Caltech was held in January 2019 and was well attended by a cross-section of neuroscientists from Caltech and other colleges, hospitals and institutions. The symposium began with a keynote on January 25 from celebrated neuroscientist, Nancy Kanwisher, founding member of the renowned McGovern Institute for Brain Research and Walter A. Rosenblith Professor of Cognitive Neuroscience, Brain and Cognitive Sciences at M.I.T. Her talk was titled "A Window into the Architecture of the Mind: Functional Imaging of the Human Brain".

Saturday, January 26, was a full day, featuring ten 30-minute talks from leading neuroscientists, covering a wide array of topics. Speakers included Edward Chang, Peter Dayan, Kafui Dzirasa, Robert Froemke, Christof Koch, Eve Marder, Richard Mooney, Vanessa Ruta, Carla Shatz, and Larry Zipursky.

Speakers bios and abstracts can be found on Caltech's website







CHEN INSTITUTE FOR NEUROSCIENCE Inaugural Symposium January 25-26, 2019 Ramo Auditorium

Friday, January 25: Keynole Address at 5pm



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Saturday, January 26: Day of Talks 8:30 am to 5:30 pm





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Register here: neuroscience.caltech.edu



Chen Institute Retreat 2019

The Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech hosted its second annual Chen Institute Retreat March 29-31, bringing together the Caltech neuroscience community with a mix of scientific talks and social activities.

Attendees at the retreat included 11 past and present Chen Graduate Fellows, 14 first-year graduate students, 23 faculty, 43 graduate students who were second year and above, 32 postdocs and eight scientific staff lab members. These attendees represented 24 labs across 4 academic divisions providing a diverse range of neuroscience topics. Over 50 of the graduate students (second year and above), postdocs and scientific staff presented a poster during one of the retreat's two poster sessions.

Read more on Caltech's website



The International Conference on Clinical Assessment of Cognitive Impairment

In April 2019, the Tianqiao and Chrissy Chen Institute (TCCI) for Translational Research co-hosted the "International Conference on the Clinical Assessment of Cognitive Impairment" together with the Shanghai Medical Doctors Association and the Shiley-Marcos Alzheimer's Disease Research Center at Huashan Hospital in Shanghai, China.

The four-day conference and training sessions invited 10 well-known experts and scholars in the cognitive field from China and abroad to discuss cutting-edge research, suitable technologies, and practical needs related to cognitive impairment assessment. More than 200 professionals from medical institutions, community health centers, Shanghai Municipal Center for Disease Control and Prevention, senior care institutes, and scientific research institutions participated in the event.

Learn more about the meeting













Tianqiao and Chrissy Chen Institute for Translational Research Holds "Games as Brain Disease Therapy" Symposium

In May 2019, The Tianqiao and Chrissy Chen Institute (TCCI) for Translational Research in Shanghai hosted a symposium titled "Games as Brain Disease Therapy" and prominent specialists from the US and China presented their latest findings. TCCI considers "digital medicine" (the use of games and other new technologies) to treat brain diseases a groundbreaking interdisciplinary field.

Professor Adam Gazzaley, Director of the Department of Neurology, Physiology and Psychiatry at the University of California, San Francisco, was invited to give the keynote at the symposium. Known as one of the first people to use games to cure brain diseases, Gazzaley developed a racing game over a decade ago to improve the cognitive ability and memory of seniors; results have shown it to be remarkably effective. He later developed a game that could increase children's concentration and serve as adjunct therapy for hyperactivity disorder.

Learn more about Symposium



Chen Institute Workshop Series

In June 2019, Caltech held the Chen Institute Workshop on Genomic Neuroscience which explored various applications of genomics to neuroscience including cell type classification, development, disease and technology. The Chen Institute Workshop Series is designed to introduce non-neuroscientists to some of the challenges regarding understanding brain function and to update them on state-of-the-art knowledge in the field. The Series also promotes discussion and interaction across divisions at Caltech.

Tianqiao and Chrissy Chen Institute for Translational Research Co-organizes International Symposium on Translational Research in Brain Stimulation

The International Symposium on Translational Research in Brain Stimulation: Neurophysiology, Neural Coding and Neural Control was held in Shanghai in November 2019. The meeting was organized by Fudan University's Institute of Science and Technology for Brain-Inspired Intelligence, the Tianqiao and Chrissy Chen Institute for Translational Research, the National Engineering Laboratory for Neuromodulation, Tsinghua University, The Ministry of Education Key Laboratory, The Shanghai Society of Neuroscience and the Overseas Expertise Introduction Center for Discipline Innovation ("111 Center").

The conference promoted cross-disciplinary exchanges and cooperation and the development and transformation of intelligent and precise neural regulation technology. The presentations also outlined how artificial intelligence, big data analysis, neurophysiology and neuroimaging research will open up new directions for neural regulation mechanisms and technology research.

Read more on the TCCI Website



Activity

Shanghai Cognitive Impairment Services Map

The Shanghai Cognitive Impairment Services Map, developed by the Shanghai Centers for Disease Control in conjunction with the Tianqiao and Chrissy Chen Institute for Translational Research and the Shanghai Mental Health Center, launched in 2019. Consolidating a variety of relevant websites and apps and including information on hundreds of Shanghai hospitals, community health centers, and cognitive care clinics for elder care institutions, the innovative online tool will help those affected by cognitive impairment find the best and nearest treatment centers.

Read more on the TCCI website





Chen Institute Women in Neuroscience (CWiN)

2019 saw the introduction of the Chen Institute Women in Neuroscience (CWiN) at Caltech. The group is open to faculty, staff, postdoctoral scholars and students in the neurosciences and aims to support the careers and education of women in neuroscience through invited talks, networking and career development opportunities, and advocacy for an improved campus climate.

Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech 2019 Awards

Director's Award - New Directions In Neuroscience

Investigating reverse signaling by FGF ligands in the developing nervous system

Awarded to Professor Angelike Stathopoulos and Professor Kai Zinn

Stathopoulos and Zinn hope to determine if Fibroblast growth factors (FGFs) exhibit reverse signaling and if so, whether that mechanism is of special importance for the early development of neurons and glia.

T&C Chen Center For Systems Neuroscience Awards

Platforms for behavioral analysis and brain imaging in interacting insects

Awarded to Professor Michael Dickinson and Asst. Professor Joe Parker

Dickinson and Parker plan to develop new methods for studying the social behaviors of rove beetles, using state-of-the art techniques in robotics and machine vision.

Molecular architecture of synapses by electron cryotomography

Awarded to Professor Grant Jensen

Jensen plans to resolve conformational changes of synaptic receptors, details of receptor anchoring and post-synaptic density organization, at nanometer resolution. He hopes that this will help to elucidate the molecular basis of information transmission and storage in the brain.









Zebrafish whole-brain functional imaging to derive basic principles that underlie sleep and wake states

Awarded to Professor David Prober

The neuronal mechanisms that regulate sleep and wakefulness are poorly understood. Prober will tackle this old problem by taking a new approach using whole-brain functional imaging in larval zebrafish.



Towards developing a synthetic brain from synthetic embryos

Awarded to Professor Magdalena Zernicka-Goetz

The cell's biological processes underlying the development of the primate brain are unclear. Current models of brain development are limited because brain regions develop in random positions. To overcome this, Zernicka-Goetz proposed developing new brain models from synthetic embryos.





T&C Chen Center For Social And Decision Neuroscience Awards

Elucidating the role of anxiety and interoceptive signaling in anorexia nervosa

Awarded to Research Asst. Professor Cindy Hagan and Professor John O'Doherty

Anxiety disorders are suggested to play a significant role in the risk of developing and persistence of the eating disorder, anorexia nervosa. Hagan and O'Doherty seek to better understand the role of anxiety and internal body signals in relation to this disorder by using a comprehensive set of assessments.

T&C Chen Brain-Machine Interface Center Awards

Brain-Machine Interface Hardware Development

Stimuli responsive micro-architected materials: enabling long term neural recording

Awarded to Professor Julia Greer

In this project, Greer proposes developing a novel platform for minimally invasive neurological sensing that is based on using "smart materials" as underlying constituents.

Brain-Machine Interface Machine Learning Analysis Methods

System-on-Chip for Machine Learning Based BMI

Awarded to Professor Azita Emami

The goal of this project is to develop hardware-efficient machine learning algorithms for decoding of neural data, and subsequently translating these algorithms to an implantable low-power System-on-Chip.

Non-invasive Human Interface Development

Feasibility of a Human Ultrasonic Brain-Machine Interface

Awarded to Professor Mikhail Shapiro

Functional ultrasound (fUS) has emerged as a breakthrough technology allowing non-invasive or minimally invasive imaging of neural activity. This technology could be used to open the door to a minimally invasive BMI system.

Read more on Caltech's website





Chen Graduate Innovators Awards

The Chen Center for Systems Neuroscience announced the 2019 winners of the Chen Graduate Innovator Grants which enable graduate students to conduct independent experiments. To embody TCCI's core values and encourage out-of-the-box thinking, proposals can't be an obvious extension of other research in their lab. To spark interdisciplinary thinking, collaboration between students in different labs is also encouraged.

"Sensorimotor computation underlying praying mantis predatory strike"

Annie Erickson and Tarun Sharma, Dickinson lab

"Evaluating temporal proteomics of Zika virus infection in neural progenitor cells using bioorthogonal non-canonical amino acid tagging"

Shannon Esswein, Bjorkman lab

"Investigating the reafferent chemosensory effects of an innate behavior"

Han Kim, Parker lab

"Investigating the neural basis of need-free appetite"

Sangjun Lee, Oka lab

"The role of sleep in birdsong maintenance"

Zsofia Torok, Lois lab

Supporting the Community:

In 2019, TCCI expanded its support of scientific meetings, increasing the number of events it supported and expanding our geographic scope.

IBI

IBI Coordinating Body Meeting, March 19-20

We joined the International Brain Initiative in February 2019 and were pleased to support the coordinating body meeting in Shanghai, China.



Central Nervous System Injury and Repair, June 16-21

We were happy to support this Gordon Research Conference which took place at Waterville Valley, New Hampshire. The meeting Chairs were Mark H. Tuszynski and Martin E. Schwab.



Japanese Neuroscience Society, 42nd Annual Meeting, July 25-28

We were pleased to support Professor Andres Luthi's plenary lecture at Neuro 2019, the 42nd annual meeting of the Japanese Neuroscience Society in Niigata, Japan.



The 13th Biennial Conference of Chinese Neuroscience Society (CNS 2019), October 10-13

In addition to sponsoring the welcome dinner at CNS 2019, TCCI supported a lecture by Professor Trevor Robbins and the neurosurgery and psychiatry content tracks.



Neuroscience 2019

This year at Neuroscience 2019, we were delighted to support Paola Arlotta, PhD's Presidential Lecture entitled "Understanding Cortical Development and Disease: From Embryos to Brain Organoids."



Australasian Neuroscience Society 2019 Annual Scientific Meeting, Dec 2-5

Extending our geographic reach down under, we happily supported Dr Selena Bartlett's plenary session on cellular and molecular mechanisms of addiction and obesity at ANS 2019 in Adelaide, Australia.

Bay Area Chinese Lifesciences Investigators Forum (BACLIF)

We're pleased to provide meeting space and other support for BACLIF, a newly formed group of Bay Area scientists that meets regularly throughout the year.

TCCI is currently accepting funding requests for conferences, meetings and workshops that are relevant to our mission. Email us at <u>events@cheninstitute.org</u>.



Advocacy:

Since its debut on the Discovery Channel in late 2018, Minds Wide Open has won eight international awards. A great tool for educating people about recent advances in the field of brain science, the film can be seen for free by <u>clicking here</u> or scanning the QR code below.

MINDS WIDE OPEN

London Brand Film Festival

2019 Gold Award, Best Brand Documentary

New York Festivals TV & Film Awards

2019 Gold World Medal, Science & Technology Documentary 2019 Gold World Medal, Best Branded Documentary Production 2019 Bronze World Medal, Feature Documentary Film Category

Public Affairs Asia

2018 Gold Standard Award for Broadcast and Video

Cannes Corporate Media & TV Awards

2018 Gold Award, Medical Category 2018 Gold Award, Education Category 2018 Gold Award, Science & Technology Category



2019: A Year of Exciting Research at Caltech and TCCI for Translational Research

Connection

Protein Signposts Guide Formation of Neural Connections

Kai Zinn,

Howard and Gwen Laurie Smits Professor of Biology

A major goal of neuroscience is understanding how all of the brain's neurons know how to connect to each other to achieve optimum function. Caltech researchers have determined how part of the fruit fly's visual system forms, an important piece in understanding the brain's connectivity.

Aggression

How Interacting with Females Increases Aggression in Male Fruit Flies

David Anderson,

Seymour Benzer Professor of Biology, Tianqiao and Chrissy Chen Institute for Neuroscience Leadership Chair and Director, and Howard Hughes Medical Institute Investigator

Caltech researchers have made progress toward understanding the neurological basis of the heightened aggression that male Drosophila show toward one another after recent encounters with females. Their research shows that your brain takes recent experiences into account when coordinating your responses to external stimuli.

Coordination



Visualizing DNA Labels in Cells and Tissues

Michael Elowitz,

Professor of Biology and Bioengineering, Howard Hughes Medical Institute Investigator, and Executive Officer for Biological Engineering

Long Cai, Professor of Biology and Biological Engineering

Carlos Lois,

Research Professor of Biology.

Caltech researchers developed an innovative way to understand how individual cells communicate with each other and grow over time. The new technique uses imaging technology which allows scientists to read out the histories of many cells within a tissue sample while they remain in their original location.

Scientists Identify a Genetic Basis for Healthy Sleep

David Prober.

Professor of Biology

50 to 70 million people in the U.S. suffer from chronic sleep disorders but the genetic mechanisms regulating sleep are poorly understood. Caltech scientists identified a genetic pathway necessary for proper sleep in zebrafish which seems to also regulate sleep in humans.

Scientists Use a Haunted House to Study Fear

Colin Camerer,

Robert Kirby Professor of Behavioral Economics and Director of the T&C Chen Center for Social and Decision Neuroscience

Dean Mobbs.

Assistant Professor of Cognitive Neuroscience and Chen Scholar

Last Halloween, using wrist devices to gather biometric feedback, a group of Caltech scientists partnered with a seasonal haunted house near LA to study different ways people react to fear.

Mending Broken Hearts with Neural Crest Cells

Marianne Bronner.

Albert Billings Ruddock Professor of Biology and Director of the Beckman Institute

Bronner discovered that embryonic cells from the hindbrain, called neural crest cells, migrate to the developing heart and form heart muscle in zebrafish and other species.







Fear





Sex



<u>Caltech Researcher Discovers that Male and Female Mouse</u> <u>Brains have Different Neurons</u>

David Anderson,

Seymour Benzer Professor of Biology, Tianqiao and Chrissy Chen Institute for Neuroscience Leadership Chair and Director, and Howard Hughes Medical Institute Investigator

Caltech researchers, working with the Allen Institute for Brain Science, discovered rare brain cell types that are unique to male mice and others that are unique to female mice. These sex-specific cells were found in a region of the brain that governs both aggression and mating behaviors.

Movies





Yang Zhi,

Professor, Shanghai Mental Health Center; Professor, Institute of Psychological and Behavioral Sciences, Shanghai Jiao Tong University

A research project supported by the Tianqiao and Chrissy Chen Institute for Translational Research identified an innovative approach to help identify mental disorders – analyzing one's brain activity while watching movies.

Genes



Researchers Make it Possible for Ultrasound to Reveal Gene Expression

Mikhail Shapiro,

Professor of Chemical Engineering Investigator, Heritage Medical Research Institute

Caltech researchers have overcome one of the main limitations to using "reporter genes," markers that help researchers get a sense for what cells are doing. Shapiro's team developed a new reporter gene that allows them to see genetic activity using ultrasound.

2019: A Year of Exciting Research at Caltech and TCCI for Translational Research

How Memories Form and Fade

Carlos Lois, Research Professor of Biology

Research done in the Caltech laboratory of Carlos Lois used mouse models to determine that strong, stable memories are encoded by "teams" of neurons all firing in synchrony, providing redundancy that enables the memories to persist over time.

Orchestrating Development in the Fly Embryo

Angelike Stathopoulos,

Professor of Biology

Research at Caltech illuminated how proteins act like conductors, giving cues during the earliest stages of development in fruit flies. This work will help scientists better understand basic biology underlying human development.

Settling the Debate on Serotonin's Role in Sleep

Viviana Gradinaru.

Director of the T&C Chen Center for Molecular and Cellular Neuroscience, Professor of Neuroscience and Biological Engineering and Heritage Medical Research Institute Investigator

David Prober,

Professor of Biology

Caltech scientists found that Seratonin is indeed necessary for sleep. Their work focused on a region called the raphe nuclei, which has the brain's main population of serotonin-producing (or serotonergic) neurons.

Sleep





Memory

Behavior



Gut Bacteria Influence Autism-like Behaviors in Mice

Sarkis Mazmanian,

Luis B. and Nelly Soux Professor of Microbiology and Heritage Medical Research Institute Investigator

Mazmanian discovered that gut bacteria directly contribute to autism-like behaviors in mice. To examine the microbiota's role, his team used "germ-free" mice. Gut microorganisms from children with autism were transferred into the mice via fecal transplantation; samples from people without autism were transplanted into others.

Thirst



Being Refreshed Is Not the Same as Being Hydrated

Yuki Oka, Assistant Professor of Biology and Chen Scholar

Oka was able to show that thirst satiation is governed by two independent pathways in the mammalian body and brain. These pathways work together to help keep animals properly rehydrated.

Anxiety



Anxious People Quicker to Flee Danger

Dean Mobbs,

Assistant Professor of Cognitive Neuroscience and Chen Scholar

Fear and anxiety are both responses to danger but differ in timing. New research conducted by Mobbs, shows that individuals with anxiety escape distant threats of danger sooner.

2019: A Year of Exciting Research at Caltech and TCCI for Translational Research

How the Brain Learns New Skills

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

Seeking to discover limits on brain plasticity, Andersen discovered that learning is easier when related to skills one already has because pre-existing neuronal structure constrains what one can learn.

The Salt-Craving Neurons

Yuki Oka, Assistant Professor of Biology and Chen Scholar

Caltech researchers in Oka's lab identified neurons that drive and quench salt cravings in the mouse brain. The findings are an entry point into regulating sodium cravings in humans.

Evidence for a Human Geomagnetic Sense

Shin Shomojo, Gertrude Baltimore Professor of Experimental Psychology

Joseph Kirschvink,

Nico and Marilyn Van Wingen Professor of Geobiology

Shomojo and Kirschvink, working with a neuroengineer at University of Tokyo, were able to show that many humans are able to unconsciously detect changes in Earth-strength magnetic fields.

S. A. B

Detection



Craving



Learning

Nicotine



This is a neuron on nicotine

Henry Lester, Professor of Biology

Caltech biology professor, Henry Lester, developed a protein sensor that glows in the presence of nicotine which allows researchers to observe nicotine's movements in cells and learn more about the nature of nicotine addiction.

Mind



Autism and Theory of Mind

Ralph Adolphs,

Bren Professor of Psychology, Neuroscience, and Biology and Allen V. C. Davis and Lenabelle Davis Leadership Chair of the Caltech Brain Imaging Center

Researchers in Ralph Adolphs' lab at Caltech came up with a new way of testing one's theory of mind (the ability to understand other people's beliefs, preferences, and intentions as distinct from one's own). The new approach may reveal subtypes of autism and could lead to new treatments.







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