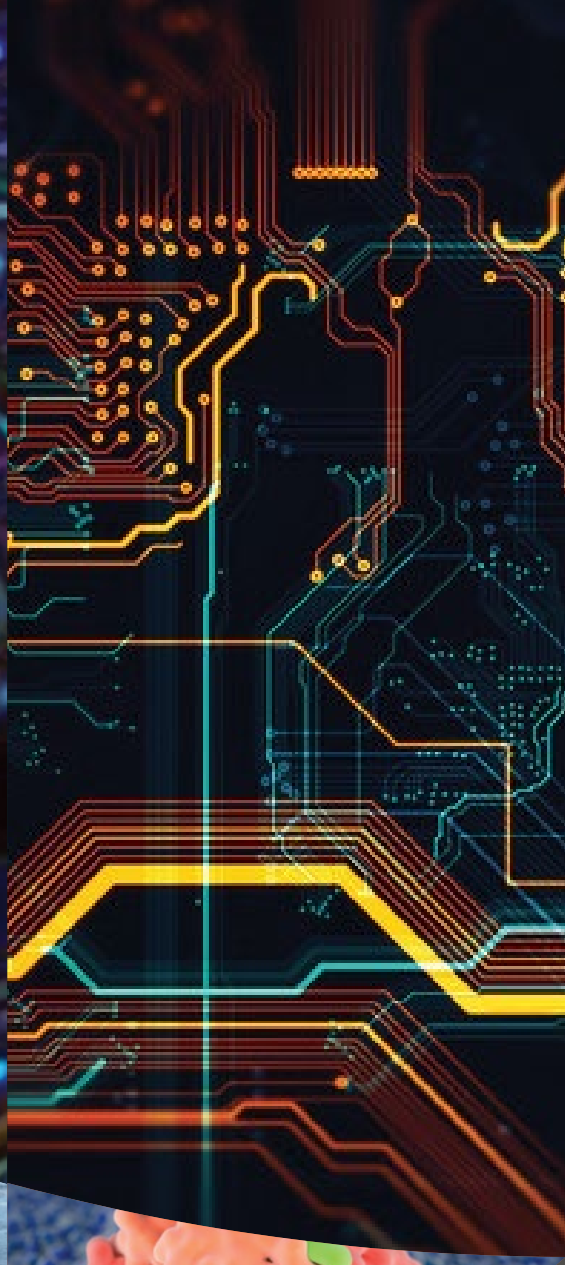
2018 Impact Report



Caltech Technology Transfer & Corporate Partnerships

COLLABORATION
INNOVATION
ENTREPRENEURSHIP

Recent Launches

Holoclara

Holoclara is an immunotherapy startup company in Pasadena, CA founded by Caltech Bren Professor of Biology Paul Sternberg and Caltech alumna Andrea Choe. Dr. Choe has a Doctor of Medicine from the University of Southern California and a PhD in Biology from Caltech. Holoclara is developing immunotherapies to bring relief to millions of people suffering from immune and autoimmune disorders through the isolation and optimization of key components of nematode secretions called ascarosides. Holoclara has shown these nematode-derived molecules have potent therapeutic properties in mouse models, and are further developing human therapeutics for treatment of asthma, type 1 diabetes, and IBD. Holoclara has received venture funding from Kairos Ventures.

1200 Pharma

1200 Pharma is a biotechnology company in Pasadena, CA and founded in 2017 based on technology developed in the lab of Brian Stoltz, Caltech Professor of Chemistry. 1200 Pharma is developing novel small molecule therapeutics for the treatment of human cancers. The company is commercializing chemical design and synthesis techniques and methods developed in the Stoltz laboratory for the preparation of structurally unique targets possessing interesting biological and physical properties. The company's CEO is Dave Licata, formerly Caltech's inaugural Entrepreneur-in-Residence, and has raised equity funding from Kairos Ventures.

Golden Eye Bionics

Golden Eye Bionics is a medical device company in Pasadena, CA founded by Anna L. Rosen Professor of Electrical Engineering and Medical Engineering, Yu-Chong Tai. The company is developing retinal prosthetics for restoration of vision using novel neurostimulation technology. The device was developed using novel wireless micro-electrical-mechanical system (MEMS) sensors, thin-film materials, and production techniques to create a retinal implant medical device. The device is biologically inert to avoid an immune response from the patient and delivers neurological stimulation to the optic nerve, restoring vision. The company co-founder and CTO is Caltech alumnus Changlin Pang, a former Tai laboratory graduate student. Golden Eye Bionics has raised $15M in venture investment. (http://gebionics.com/home)

Auspion

Auspion is a Pasadena-based startup company founded by Ali Hajimiri, Bren Professor of Electrical Engineering and Medical Engineering. Auspion's vision is to provide a unified and novel wireless power and data transfer platform to consumers and commercial customers, with technology that enables a broad range of new applications and enhances the user experience in many existing ones. The company's CEO is Caltech alumnus Florian Bohn, and CTO is Caltech alumnus Behrooz Abiri, both of whom completed their doctoral studies in the Hajimiri laboratory. Auspion has received venture investment through Kairos Ventures. (https://auspion.com/)

FY 2018

169
Invention Disclosures
(campus only)

182
U.S. Patents Issued

1,944
Active U.S. Patents

80
Licenses Granted
(including options)

11
Startup Companies

40
Companies
Sponsoring Research

121
Companies Giving Gifts

$24.8M
Corporate Contracts & Gifts

Innovation. Entrepreneurship. Collaboration.

Our mission is to drive the transfer of scientific and engineering knowledge created by our researchers to maximize societal impact by developing partnerships with industry through the creation of new ventures, collaborations with corporations, and transfer of intellectual property while nurturing an entrepreneurial environment.

CAST – Center for Autonomous Systems and Technologies

Caltech's Center for Autonomous Systems and Technologies (CAST) is a 10,000-square-foot facility where researchers from Caltech's Division of Engineering and Applied Science (EAS), Division of Geological and Planetary Sciences (GPS), and the Jet Propulsion Laboratory (JPL) will collaborate to create the next generation of autonomous systems, advancing the fields of drone research, bio-inspired systems, and autonomous exploration such as natural disaster, space, and underwater environments. Under the directorship of Professor Mory Gharib, Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering, the bipedal robot Cassie walks through a 2,500-square-foot Advanced Mobility Lab, which has multiple tracks and a 15-foot-long treadmill able to reach speeds up to 40 miles per hour for testing high-speed robotic running gaits to develop autonomous robots and human prosthetics applications. CAST is developing an Autonomous Flying Ambulance, a drone big enough to carry a person and supplies for urban aid and disaster applications. But CAST's centerpiece is a three-story-tall fully- enclosed aerodrome, the tallest of its kind, in which flying drones are tested in varying conditions. To simulate the ever-shifting environmental conditions that drones face in the real world, the aerodrome includes a 10-by-10-foot wall of 1,296 fans capable of generating wind speeds of up to 44 mph, and a 324-fan side wall to create a crosswind. The wall is capable of creating a nearly infinite variety of wind conditions for drones to learn to react to—everything from a light gust to a stormy vortex. The fan "wind" can also be shifted 90 degrees to simulate vertical take offs and landings. Through partnerships and support from corporate partners such as Raytheon and AeroVironment, industry members will assist CAST researchers in bringing the resulting innovations to market for a myriad of practical applications.

The Chen Institute for Neuroscience at Caltech

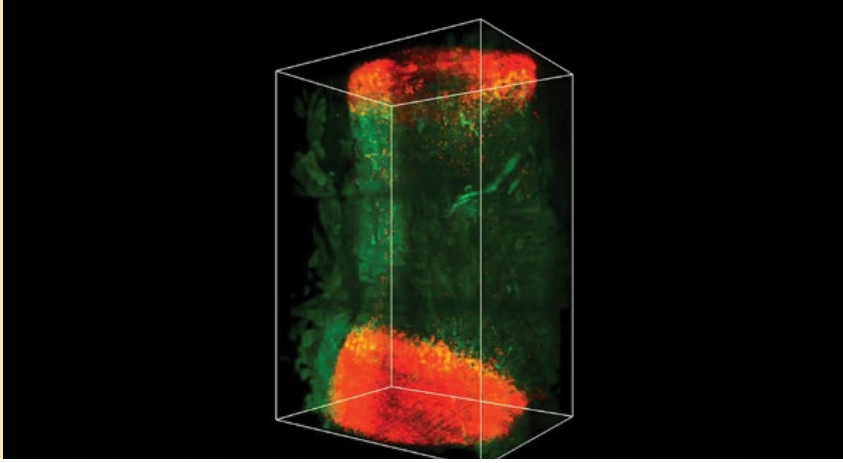
The Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech was founded with the generous support of philanthropists Tianqiao Chen and Chrissy Luo. It is a key component of a neuroscience initiative that is geared toward deepening our understanding of the brain's structure and how the brain works at its most basic level, as well as why and how it fails as a result of disease or through the aging process.

Directed by David Anderson, the Seymour Benzer Professor of Biology and a Howard Hughes Medical Institute Investigator, the Tianqiao and Chrissy Chen Institute for Neuroscience draws upon Caltech's strengths across a broad range of disciplines. It brings together faculty from throughout Caltech's academic divisions, catalyzing interactions within a diverse community of researchers from neuroscientists and biologists to economists, chemists, physicists, computer scientists, social scientists, and engineers. The work of these researchers will be focused through the Chen Institute at Caltech's six interdisciplinary research centers:

- T&C Chen Brain-Machine Interface Center, Led by Richard Andersen, Caltech's James G. Boswell Professor of Neuroscience
- T&C Chen Center for Social and Decision Neuroscience, led by Colin Camerer, Caltech's Robert Kirby Professor of Behavioral Economics
- T&C Chen Center for Systems Neuroscience, let by Doris Tsao, professor of biology and a Howard Hughes Medical Institute Investigator
- Center for Molecular and Cellular Neuroscience, led by Viviana Gradinaru, Professor of Neuroscience and Biological Engineering, Investigator, Heritage Medical Research Institute
- Caltech Brain Imaging Center, let by Ralph Adolphs, Caltech's Bren Professor of Psychology, Neuroscience and Biology
- Chen Center for Neuroscience Education, led by Markus Meister, Caltech's Anne P. and Benjamin F. Biaggini Professor of Biological Sciences

The Chen Institute at Caltech will be housed in a new, state-of-the-art building that will be named in honor of the donors and function as the nexus for neuroscience research at Caltech.

aws Caltech



Amazon Alliance

Amazon Web Services (AWS), a cloud-computing platforms subsidiary of Amazon, has embarked upon a research partnership with Caltech to collaborate on research in artificial intelligence (AI), data science, and machine learning. AWS Computer Vision team researchers, some temporarily co-located on the Caltech campus, will collaborate with Caltech researchers to train deep neural networks and push the boundaries of artificial intelligence using the AWS cloud and other AWS resources. In addition to providing opportunities for research collaborations between Caltech and AWS researchers, the partnership will also provide summer internships for students and employment opportunities for graduating students. Affiliated with Caltech via the Computing and Mathematical Sciences Department of the Division of Engineering and Applied Science, AWS has already committed $2.5 million to Caltech for graduate student fellowships and cloud-computing credits, providing a ready pipeline for Caltech projects and marketable research. Caltech professors who helped launch the partnership include: Pietro Perona, Allen E. Puckett Professor of Electrical Engineering; Anima Anandkumar, Bren Professor of Computing and Mathematical Sciences; Aaron Ames, Bren Professor of Mechanical and Civil Engineering and Control and Dynamical Systems; Joel A. Tropp, Steele Family Professor of Applied and Computational Mathematics; Adam Wierman, Professor of Computing and Mathematical Sciences; and Yisong Yue, Assistant Professor of Computing and Mathematical Sciences.

Amgen Partnership in Health Sciences

Caltech and Amgen joined forces in 2015 under a formal multifaceted partnership spanning research, graduate student training, and shared resources. The collaboration has been so fruitful it was renewed in 2018 for an additional three-year term. Under the terms of the agreement, Amgen funds research projects called the Chem-Bio-Engineering awards (CBEAs) every year—bridging the divisions of Chemistry and Chemical Engineering, Biology and Biological Engineering, and Engineering and Applied Science, the projects have focused on large- and small-molecule drug discovery, drug-delivery devices, and diagnostic technologies. Amgen also provides support for Amgen Graduate Student Fellows in Caltech's interdisciplinary Graduate Program in Biochemistry and Molecular Biophysics. Amgen-supported CBEAs have been awarded to numerous Caltech researchers in the areas of cardiac health, novel materials, syringe engineering, small molecule oncology therapeutics, antibody engineering, 3D tissue and cell imaging, cell-specific drug and antigen delivery, single-molecule nanomechanical analysis, microbiome, computational modeling for high-throughput screening and drug delivery, biomarkers of neurological disease, deep brain stimulation, and fundamental research into sleep disorders.

Ideas in the Lab

Rothenberg innovation initiative (RI2) 2018 awards

A gift from Caltech Trustee James F. Rothenberg and his wife Anne launched the Caltech Innovation Initiative (CI2) in 2009 to provide essential seed funding for early-stage research that addresses important problems and could lead to marketable technologies that benefit society. Each RI2 award provides up to two years of support, with up to $125,000 in funding per year, to help Caltech professors, students, and post-docs mature their research beyond the conceptual stage to a point that the innovations are attractive to outside investors for commercial development of the technologies. Bolstered by an additional $15M gift in 2017 and renamed the Rothenberg Innovation Initiative (RI2), the program funded six new projects and two renewal projects in 2018:

- **"T cell antigen discovery using Signaling and Antigen-presenting Bifunctional Receptors (SABRs)"**
  A new method for figuring out what antigens are being targeted by the immune system's T cells. The method, developed by David Baltimore, President Emeritus and the Robert Andrews Millikan Professor of Biology, could identify whether those T cells are malfunctioning, potentially leading to autoimmune diseases

- **"Predictive Diagnostics Platform Using Single Cell Profiling of Human Blood"**
  A system for diagnosing many diseases from just one blood draw, using single-cell messenger RNA profiling of the immune system, created by Sisi Chen, Senior Research Scientist, and Matthew Thomson, Assistant Professor of Computational Biology; Investigator, Heritage Medical Research Institute

- **"Wearable Sweat Band for Non-Invasive Monitoring of Stress and Depressive Disorders"**
  A wearable band, invented by Wei Gao, Assistant Professor of Medical Engineering, to provide non-invasive monitoring of a person's stress and mood states by tracking changes in the components in their sweat

- **"Smart Patch Sensors for Health and Fitness Monitoring"**
  A low-cost wearable "smart patch" device that measures the physiological stress on athletes and patients suffering from chronic health conditions, developed by Axel Scherer, the Bernard Neches Professor of Electrical Engineering

- **"Development of bis-Tetrahydroisoquinoline Anticancer Compounds"**
  A project by Professor of Chemistry Brian Stoltz to develop anticancer drugs from natural compounds known for targeting the DNA in cancer cells

- **"Turnkey, Frequency-Agile Optical Technology-on-a-Chip"**
  A technology that would provide frequency-optics on a chip for medical diagnostics, information technology, cybersecurity, and metrology, by Amnon Yariv, the Martin and Eileen Summerfield Professor of Applied Physics and Electrical Engineering

- **"An Engineered Enzyme Platform for Biocatalytic Synthesis of Non-canonical Amino Acids"**
  Renewed funding for a project developed by Francis Arnold, the Linus Pauling Professor of Chemical Engineering, Bioengineering and Biochemistry, to engineer enzymes that create amino acids that do not exist in nature for use in a wide variety of industries ranging from pharmaceuticals to chemical catalysts

- **"Ultra-Portable Three-Stage Ozone-Assisted Nano-Filtration (ULTRON) Device for Point-of-Use Water and Wastewater Treatment Market"**
  Renewed funding for a portable nano-filtration device for easy to use off-the-grid renewable wastewater treatment, by Michael Hoffman, the John S. and Sherry Chen Professor of Environmental Science, and Kai Liu, postdoctoral scholar

Spotlight on Entrepreneurial Alumnus

Dr. Raymond Weitekamp is an entrepreneur and polymer scientist hoping to change the way we make materials on this planet. He is the founder and CEO of polySpectra, Inc., an advanced additive manufacturing company, a primary investigator on an ARPA-E funded research project that is developing paintable coatings to improve the energy efficiency of single pane windows, and a curator of PhDtoCEO.com, a website and an affiliated newsletter dedicated to helping academic scientists transition into entrepreneurship. Raymond received his Ph.D. from Caltech where he worked in the laboratories of Professor Robert Grubbs and Professor Harry Atwater, and his A.B. in Chemistry from Princeton University. During his graduate work at Caltech, Raymond was named as an inventor on over 20 patent applications and has sought to bring these inventions to commercialization through his company and his work with ARPA-E.

polySpectra's core technology is based on leveraging the discovery of a class of light-activated catalysts that Raymond developed during his PhD research at Caltech, to make functional materials in a sustainable manner. polySpectra's mission is to transform polymer 3D-printing from a prototyping aid into a production manufacturing tool, a goal that the 3D printing industry has long sought, and, so far, failed to achieve. Raymond is a member of the founding cohort at Cyclotron Road, the groundbreaking hard technology innovation program at Lawrence Berkeley National Laboratory. polySpectra is supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office, the National Science Foundation, and the Molecular Foundry. (http://polyspectra.com/)