

The breakthrough

Is Just the Beginning



At Caltech, a breakthrough may refer to breaking through boundaries to build collaborations across disciplines, to a landmark discovery or groundbreaking study, or to the **\$3.4 billion campaign** that has catalyzed the creation of new technologies, tools, and innovations to address global challenges and improve the human condition.

“Break Through funding supports a level of creativity. And creativity in research leads to the really interesting, big discoveries.”



— **Cam Buzard**, a graduate student who studies hot Jupiters, gas giants that orbit very close to their host stars. Buzard is a Beckman-Gray fellow, an award supported by the campaign that allows scholars the freedom to follow their intellectual passions and research interests without being constrained by funding sources.

Building for Innovation

Break Through gifts created 15 new centers and initiatives to build upon the Institute’s interdisciplinary practice and transform the physical environment in the process. The **Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech**, headquartered within the Chen Neuroscience Research Building, unites researchers across an array of disciplines who seek to deepen our understanding of the brain’s structure and how the brain works at its fundamental level. The **Resnick Sustainability Institute** brings together research across campus that addresses challenges and opportunities associated with climate change and the stewardship of natural resources. The **Merkin Institute for Translational Research** empowers scientists and engineers to turn their breakthrough innovations into real advances in human health.



The campaign also allowed Caltech to revitalize the **Gates–Thomas Laboratory**, build the **Bechtel Residence**, construct a robotic wonderland to house the **Center for Autonomous Systems and Technologies (CAST)**, renovate the **Ronald and Maxine Linde Hall of Mathematics and Physics**, and much more.

“Philanthropy allows you to take risks,” says Caltech president Thomas F. Rosenbaum, holder of the Sonja and William Davidow Presidential Chair and professor of physics. “It allows you to **push the limits of your imagination**. And when it works, then, of course, **you have transformation**.”



“A small school isn’t for everyone. It’s for people who want opportunities to get involved and make a difference—and I want to help make sure that all students feel like this is the place where they can do that.”

— **Mason Smith (BS '09)**, head of software engineering at TGS Management Company and Caltech young alumni trustee. Smith’s campaign support has buoyed not only scholarships but also the Freshman Summer Research Institute (FSRI), a program for incoming students from underrepresented or underserved communities.

During the *Break Through* campaign, donors invested more than \$3.4 billion to position the Institute for a **future of limitless discovery** and Caltech became **the smallest undergraduate institution in the country to raise more than \$3 billion**.

“Our undergraduate and graduate students are our backbone. They are the ones who actually do the work on the bench and make remarkable things happen.”

— **Shu-oh Shan**, Altair Professor of Chemistry and member of Caltech’s Center for Molecular Medicine, a collaboration at the interface of chemistry and biology made possible by Break Through funding from the Gordon and Betty Moore Foundation.



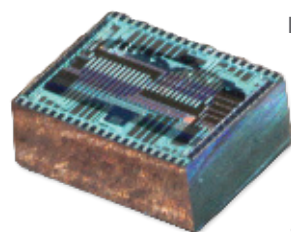
A Break Through Boost

Campaign donors have created forward-looking programs to help Caltech scientists and engineers across diverse fields maximize the impact of their work through translation of their discoveries into new products and ventures that improve lives.

To honor Carver Mead (BS '56, MS '57, PhD '60), the Gordon and Betty Moore Professor of Engineering and Applied Science, Emeritus, and his pioneering approach to research and innovation, more than 200 donors inaugurated the **Carver Mead New Adventures Fund** to boost exceptional projects at an early stage of development. New Adventures awarded its first grants in 2017, and has since funded research into computational microscopes that can see beyond what is possible with light alone; wearable devices that continually monitor a person's health; and a study of entropy in the genome of the SARS-CoV-2 virus, providing insights into the virus's evolution.

Inventors and innovators must face the "valley of death," where patent problems, testing snags, and funding issues can derail an interesting idea. The late James Rothenberg, a former Caltech trustee, and his wife Anne Rothenberg created the **Rothenberg Innovation**

Initiative (RI²) to provide up to two years of crucial support to help Caltech researchers get their ideas to market. This past year alone, RI² gave support to a flexible Band-Aid-sized instrument to continuously monitor body core temperature and to lensless, flat silicon chips to improve LiDAR (light detection and ranging) technology in self-driving cars and biomedical instruments. Since the program's inception, RI² grants have spurred 176 patents, 18 start-ups, and 40 disclosed inventions.



More than **14,500 donors**—including **9,400 alumni**, or more than 45 percent of living alumni—endowed **46 professorships**, **28 early-career professorships**, and **24 leadership chairs**, and amplified or established **15 institutes, centers, and research initiatives**.

Bridging the gap between medical innovations and bedside applications is the focus of the **Heritage Research Institute for the Advancement of Medicine and Science**, established at Caltech in 2015 with a gift from Caltech senior trustee Richard N. Merkin, MD. This new institute created a cohort of researchers, the Heritage Medical Research Institute Investigators, who focus on translational sciences and health technology. Among the recent advances made possible through this cohort are the discovery of a functional link between gut bacteria and Parkinson's disease as well as other neurological disorders, which may lead to new treatments for conditions ranging from inflammatory bowel disease to Alzheimer's, and the development of a prototype miniature device that could roam the body to diagnose and treat disease.

The campaign raised **\$136 million** for undergraduate scholarships and **\$275 million** for graduate fellowships.

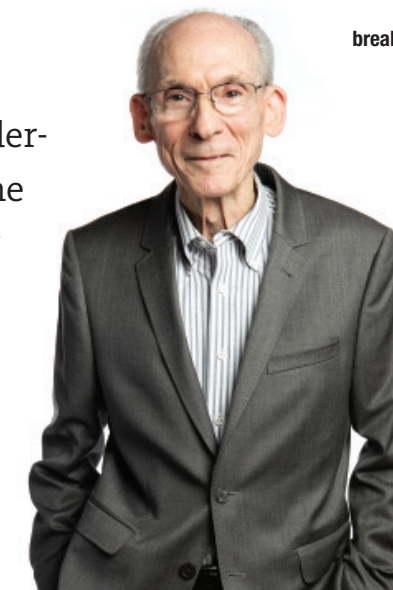
"Nobody cares whether you are a political scientist or a political economist or an anthropologist. At Caltech, you are judged by the answers you get, the mechanisms you discover, and their usefulness and reasonability."



— **Marina Agranov**, professor of economics and member of the Center for Theoretical & Experimental Social Sciences (CTESS) within the Ronald and Maxine Linde Institute of Economic and Management Sciences.

"I've been interested in supporting the Summer Undergraduate Research Fellowships (SURF) program from the beginning because I think it's an important opportunity for students to get the experience of working in a research environment as part of their education."

— **Ed Stone**, David Morrisroe Professor of Physics and Vice Provost for Special Projects. As inspiration for his gift to support a SURF, Stone cited a student in the 1960s who realized that an alignment of the outer planets would make possible the Voyager missions, of which Stone served as project scientist.



The breakthrough is just the beginning. The story of the *Break Through* campaign is one of seeding opportunities for high-risk, high-reward research that will benefit society for decades to come.

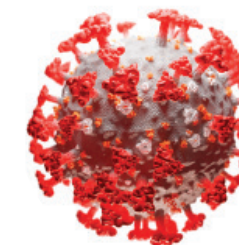
Points of Impact

Lasers Into the Brain: Lihong Wang developed a method called photoacoustic computerized tomography (PACT) that uses laser light and ultrasonic sound waves to image tissues and organs. This technology took a leap forward when a multi-university team led by Wang and including Andrew and Peggy Cherng Department of Medical Engineering staff scientist Konstantin Maslov showed that PACT can detect minute changes in the amount of blood traveling to different parts of the brain, thus measuring neural activity without many of the disadvantages of the ubiquitous functional magnetic resonance imaging (fMRI) machines, which are expensive and require patients to fit inside a narrow tube. Wang is Bren Professor of Medical Engineering and Electrical Engineering and member of the *Break Through*-supported **Andrew and Peggy Cherng Department of Medical Engineering**, Caltech's first named and endowed department, which backed this research.

Where the Sun Always Shines: Donald Bren, chairman of Irvine Company and a life member of the Caltech community, and his wife, Caltech trustee Brigitte Bren, donated \$100 million to *Break Through* to support endowed professorships as well as the **Space-based Solar Power Project (SSPP)**. The project aims to build a prototype of an orbiting solar energy system that could collect the sun's rays all the time, with no worries about the effects of nightfall or cloud cover on the ability to take in energy. After converting solar energy to electricity, it would transfer that clean energy

wirelessly back to Earth using radio frequency electrical power. The first test of the prototype is slated for 2023.

Chasing COVID: Pamela Bjorkman, the David Baltimore Professor of Biology and Bioengineering, has studied viruses such as HIV, but when COVID-19 brought the world to a standstill, researchers in her lab raced to apply their expertise to understanding SARS-CoV-2, the virus behind the pandemic. A team in the lab designed a nanoparticle-based immunization technique with the potential to protect against many kinds of coronaviruses. Another team characterized many different antibodies to SARS-CoV-2 and identified those most effective at neutralizing the virus. The *Break Through*-funded **Merkin Institute for Translational Research** supported this effort. 📺



"I'm grateful to all who have decided Caltech is the place that deserves this very, very generous support, which provides us with a firm foundation to go forward into unknown territories," says David L. Lee (PhD '74), chair of the Caltech Board of Trustees.