



2019

# This is Caltech

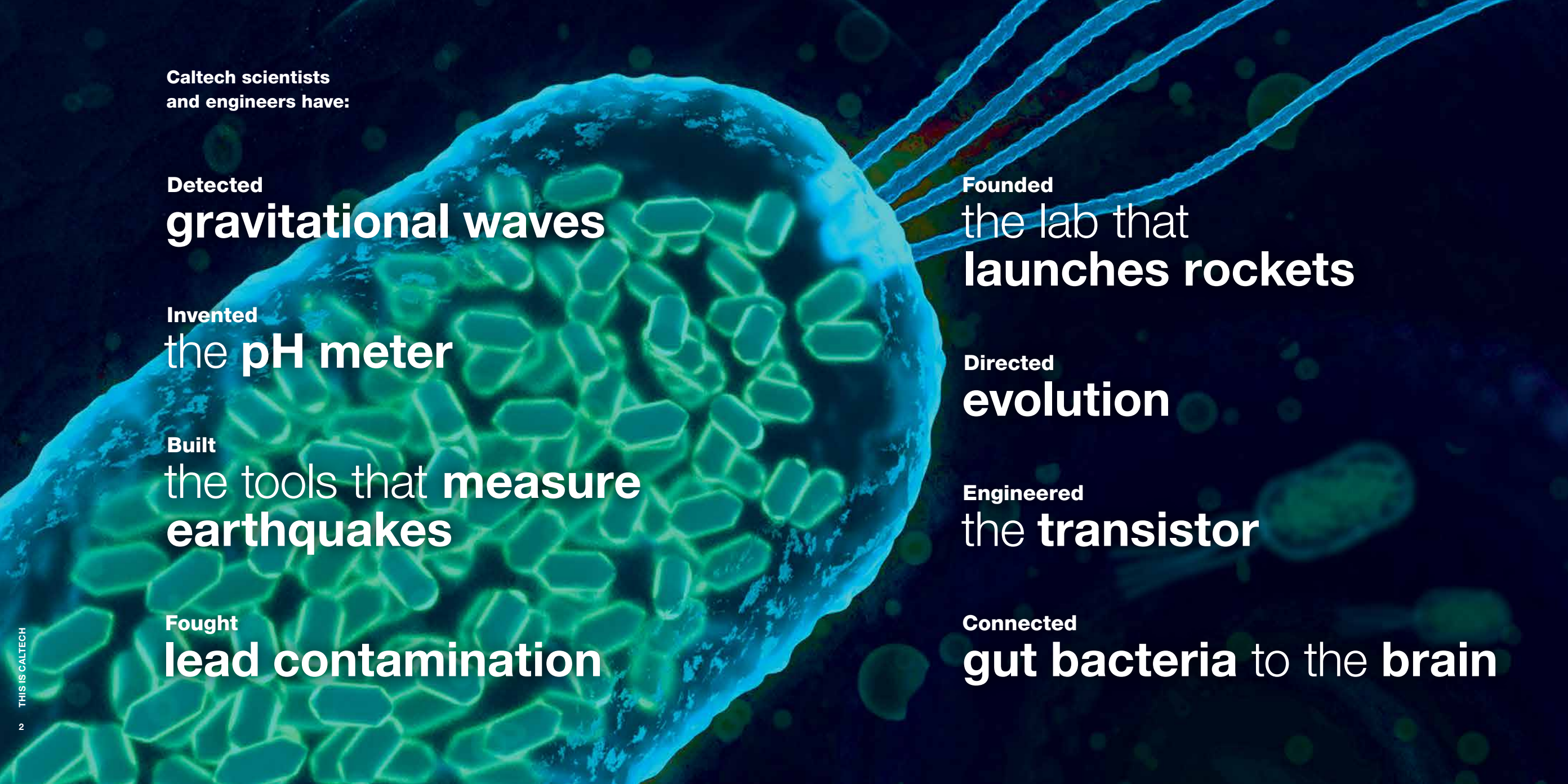
“Throughout its history, the California Institute of Technology has ventured into unexplored realms, defining new fields in science and engineering, and pushing interdisciplinary boundaries in the service of discovery. Fearlessness in attacking large and important problems at scale, from the nature of the chemical bond to quarks and quasars to the structure of the brain, marks the cultural capital that aligns and knits together Caltech’s intellectual community.”

—CALTECH PRESIDENT  
THOMAS F. ROSENBAUM



Founded in 1891, Caltech is a world-renowned science and engineering Institute that marshals some of the world’s brightest minds and most innovative tools to address fundamental scientific questions and pressing societal challenges. An independent, privately supported institution located in Pasadena, California, Caltech also manages the Jet Propulsion Laboratory (JPL), located 6 miles north of campus, for NASA.





Caltech scientists  
and engineers have:

Detected  
**gravitational waves**

Invented  
the **pH meter**

Built  
the tools that **measure  
earthquakes**

Fought  
**lead contamination**

Founded  
the lab that  
**launches rockets**

Directed  
**evolution**

Engineered  
the **transistor**

Connected  
**gut bacteria** to the **brain**





# Students



# Student Facts

Fall Class of 2018:

46% women

948 undergraduate students

1,285 graduate students

7.7% freshman admission rate

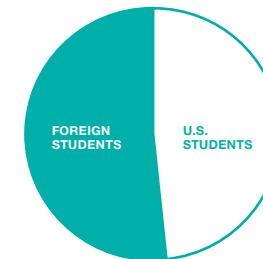


Caltech's mascot is the beaver, an homage to nature's engineer.

Caltech undergraduate students live in **close-knit communities** that provide them with opportunities to study, socialize, and dine together.

46.5%

of the graduate population in 2018–2019 are foreign students. The top five countries from which these students hail are China, Canada, India, South Korea, and Taiwan.



THE CALTECH HONOR CODE:

**No member of the Caltech community shall take unfair advantage of any other member of the Caltech community.**

"I love the sense of purpose that being a student at Caltech gives you. I went through high school completing classes and doing homework because that was the main goal. At Caltech, the goal is to make the world better, and the classes and workload are the means by which this is done."

—ALEX WUSCHNER,  
UNDERGRADUATE STUDENT





# Academics

Undergraduate students choose from 28 options (majors) and graduate students choose from 29 programs among 6 academic divisions.

**Biology and  
Biological Engineering**

**Chemistry and  
Chemical Engineering**

**Engineering and  
Applied Science**

**Geological and  
Planetary Sciences**

**Humanities and  
Social Sciences**

**Physics, Mathematics  
and Astronomy**

MD/PhD programs, available to graduate students, **train doctors** who will also have extraordinary scientific expertise.

“The small size of Caltech makes it a really unique place to do research. Because every professor in my department is studying something different, it’s broadened my horizons and allowed me to pursue interdisciplinary research questions.”

—GIULIANA VIGLIONE,  
GRADUATE STUDENT



**90%** of undergraduates participate in research as part of their academic program



MOST POPULAR UNDERGRADUATE MAJOR:

Computer  
Science

STUDENT/FACULTY RATIO:

3:1

STUDENTS



# Student Research

Students in the **NASA/JPL Summer Programs** live on campus and join a large community of undergraduate researchers.

# 80%

of all Caltech undergraduates participate in SURF (the Summer Undergraduate Research Fellowships program), during which they spend 10 weeks working in labs on research projects.

Graduate students conduct thesis research and receive credit for graduate courses at the **Scripps Institution of Oceanography** at UC San Diego.

Through the Caltech-led **GROWTH** (Global Relay of Observatories Watching Transients Happen) collaboration, astronomy-inclined undergraduates may spend up to 10 weeks at one of the network's partner institutions in Germany, Taiwan, India, Israel, Japan, or Sweden.

THROUGH STUDY ABROAD  
AND EXCHANGE PROGRAMS,  
UNDERGRADS TRAVEL TO

Cambridge  
London  
Copenhagen  
Edinburgh  
Paris  
Melbourne  
Iceland  
South Korea

"I'm building experiments, I'm running them, and it really does feel like it's my own project. I didn't expect that. I expected to have training wheels, but there are no training wheels. I'm doing it myself. It's really exciting."

—ASHIMA AGARWAL,  
UNDERGRADUATE STUDENT



# Student Life

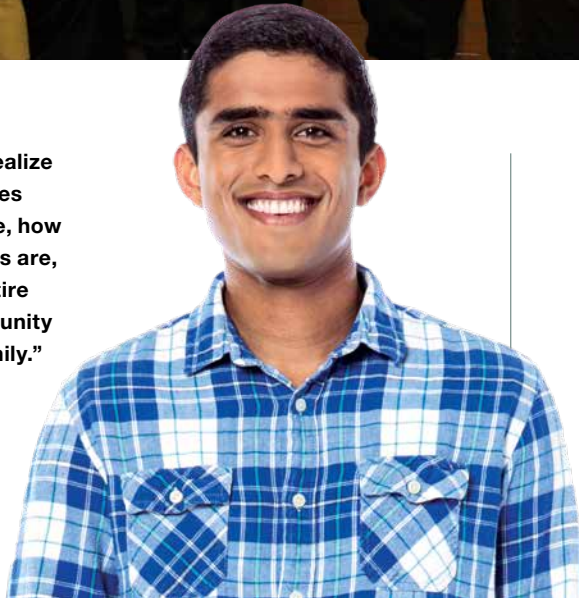
Caltech's performing and visual arts programs range from silk screening and virtual reality to improvisation, musicals, symphony orchestra, and guitar classes.



Caltech's 18 Division III varsity teams compete primarily in the Southern California Intercollegiate Athletic Conference (SCIAC).

"I don't think people realize the social opportunities that are available here, how enriching the activities are, and how close the entire undergraduate community is. It's really like a family."

—RAMRUTHWICK  
PATHIREDDY (BS '17)



The **Caltech Y**, a student-led campus organization, offers outdoor adventures, community service, social activities, and cultural programs.

There are more than 150 student clubs and sports organizations on campus, ranging from juggling and alpine climbing to entrepreneurship and robotics.

**80%** of undergraduates participate in intercollegiate, club, intramural, and informal recreational activities.

#### ATHLETICS FACILITIES:

- ▶ A 400-meter running track in Caltech's signature orange color
- ▶ Two gymnasiums
- ▶ 10,000-square feet of weight/cardio space
- ▶ Two 25-yard pools
- ▶ Four racquetball and two squash courts
- ▶ Eight tennis courts



# Faculty

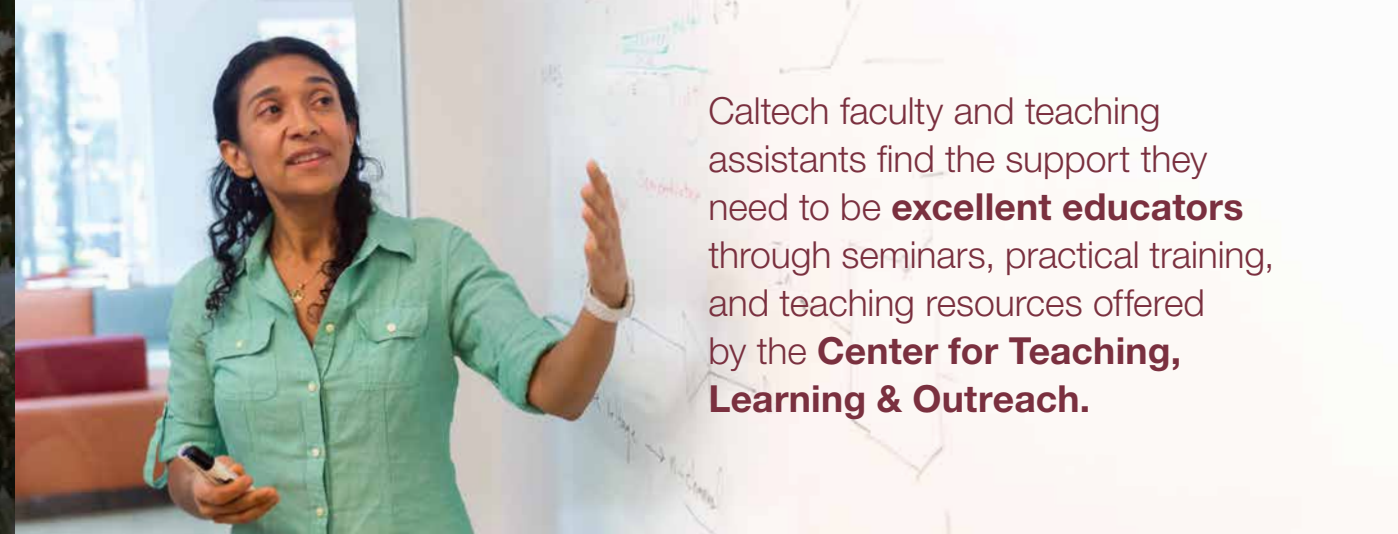




# Faculty Facts

Just over 300 professorial **faculty members** direct **discipline-defining research** while offering a **vigorous curriculum** and access to hands-on research to 948 undergraduates and 1,285 graduate students.

7 Nobel laureates in residence



Caltech faculty and teaching assistants find the support they need to be **excellent educators** through seminars, practical training, and teaching resources offered by the **Center for Teaching, Learning & Outreach**.

CALTECH FACULTY, ALUMNI,  
AND TRUSTEE HONORS:

38 Nobel Laureates

58 National Medal of  
Science recipients

13 National Medal of  
Technology recipients

127 Elections to the  
National Academies

**“Nobody at Caltech disappears into their disciplinary pigeonholes. You constantly learn what is new in other fields and share what is exciting in your field. It makes for a very stimulating environment.”**

—JOERN CALLIES,  
ASSISTANT  
PROFESSOR OF  
ENVIRONMENTAL  
SCIENCE AND  
ENGINEERING

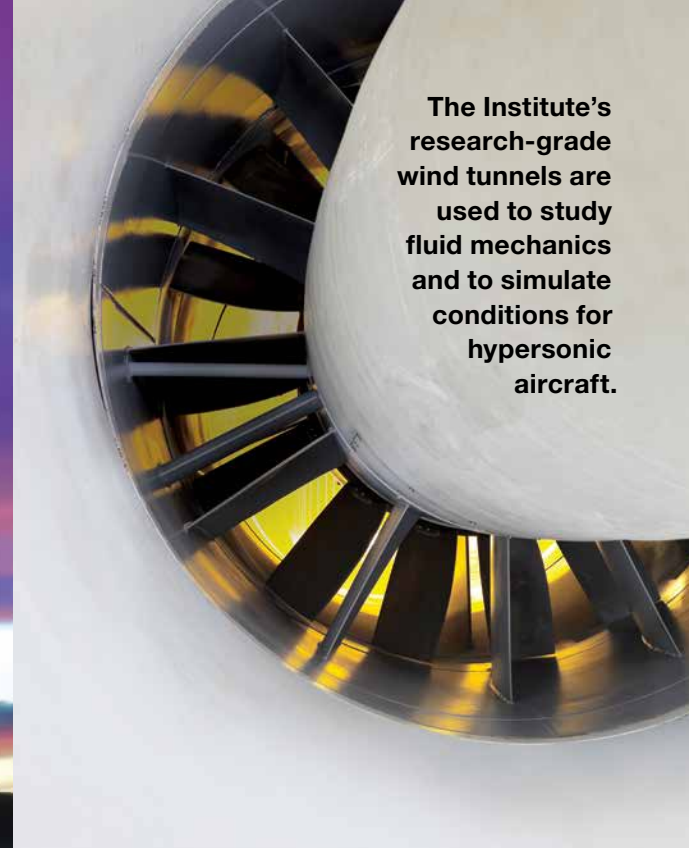




# Facilities



Advanced telescopes and cutting-edge instrumentation at the **Keck** and **Palomar observatories** have played a critical role in astronomical discovery by Caltech scientists, who are also planning and designing the **Thirty Meter Telescope (TMT)**, set to become the most powerful tool of its kind.



The Institute's research-grade wind tunnels are used to study fluid mechanics and to simulate conditions for hypersonic aircraft.

A state-of-the-science **atmospheric chamber** facility in the **Ronald and Maxine Linde Center for Global Environmental Science** is used to study the photochemical reactions of gaseous and particulate pollutants.

Caltech's **Seismological Laboratory** is renowned for geophysical exploration and is the epicenter of earthquake research.

"The continued success of discovery at Caltech relies on our ability to take chances on people whose talent, drive, and creativity have the capacity to change the world."

—CALTECH PROVOST  
DAVID A. TIRRELL

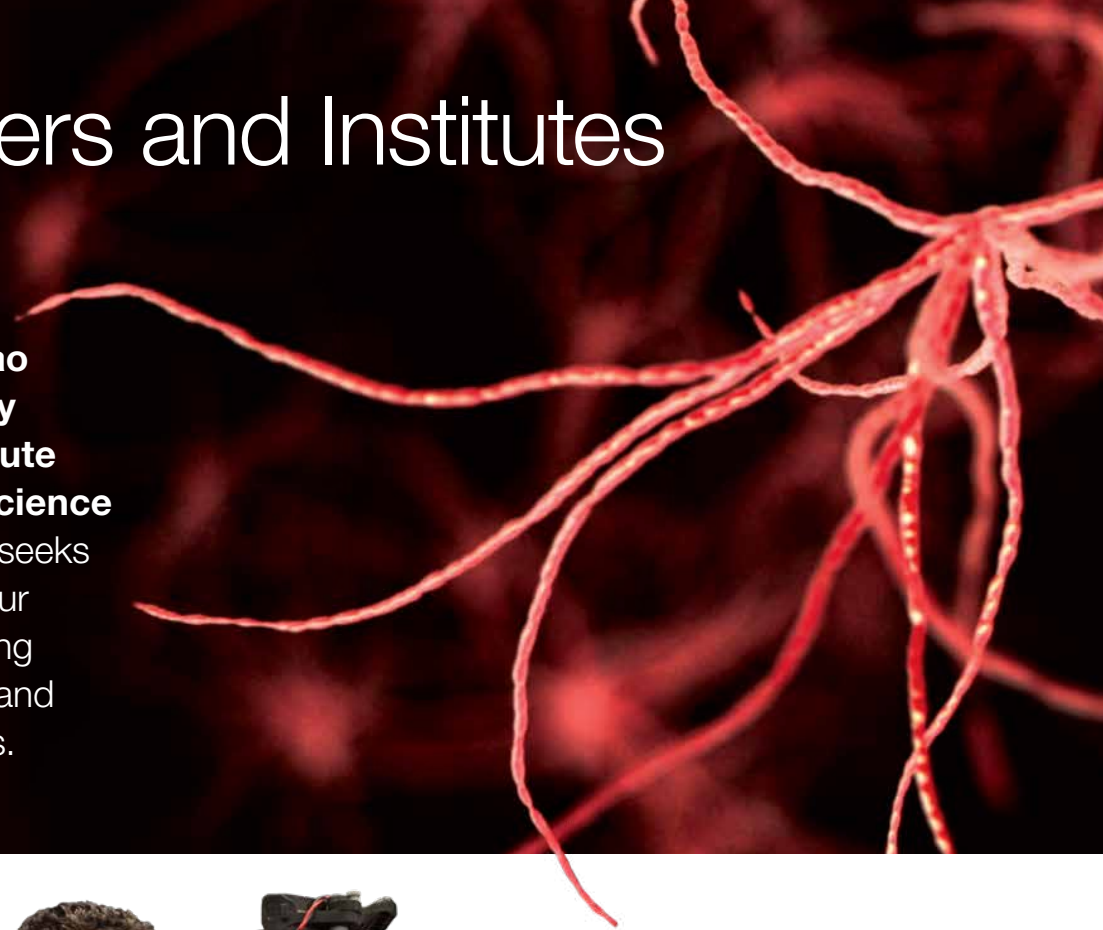


Caltech scientists have designed a **mass spectrometer** that can measure the temperatures at which biological materials were formed.

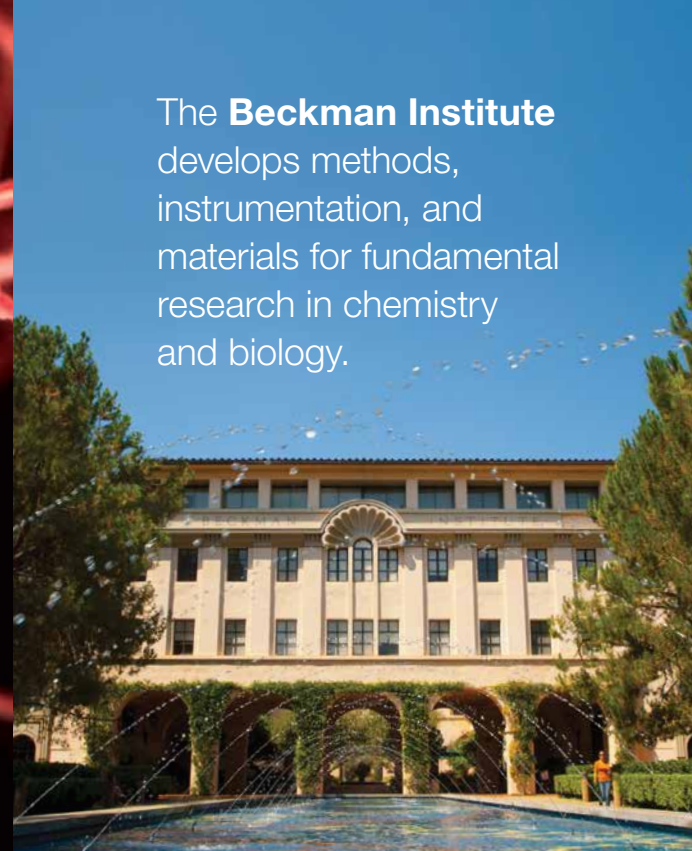


# Centers and Institutes

The **Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech** seeks to deepen our understanding of the brain and how it works.



The **Beckman Institute** develops methods, instrumentation, and materials for fundamental research in chemistry and biology.



The **Donna and Benjamin M. Rosen Bioengineering Center** encourages intensive, fruitful collaborations between bioengineering researchers.

The **Resnick Sustainability Institute** fosters advances in energy science and technology through research, education, and communication.

“At Caltech, collaboration outside of your specific discipline is easy. You can walk out your door and talk to a theoretical computer scientist or a learning person or a vision person. You can live at the intersection of disciplines.”

—AARON AMES, BREN PROFESSOR OF MECHANICAL AND CIVIL ENGINEERING AND CONTROL AND DYNAMICAL SYSTEMS

The **Kavli Nanoscience Institute** advances cross-disciplinary research in the areas of nanoscience and nanotechnology.





# Innovations and Partnerships

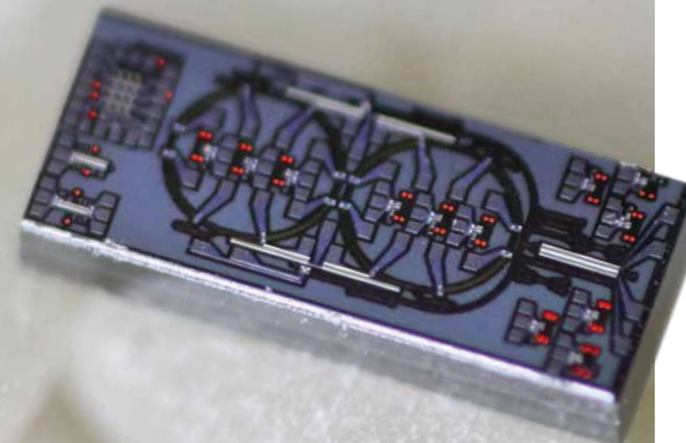


Caltech's Office of Technology Transfer and Corporate Partnerships (OTTCP) helps scientists and engineers on campus and at JPL transfer the fruits of their research to the commercial sector.

In 2018, the **number of companies** sponsoring research at or giving to Caltech totaled more than **160**.

Between 2014 and 2018, Caltech led its peers with **more than 900 U.S. patents** issued.

The corporate partnerships team within OTTCP helps to drive the transfer of knowledge created by Caltech researchers by establishing and maintaining mutually beneficial relationships between industry and the Institute.



## IN 2018:

- ▶ **182 U.S. patents** issued
- ▶ **1,944 active U.S. patents**
- ▶ **11 new startups**
- ▶ **80 licenses** (including options)
- ▶ **277 material transfer agreements**

## HIGHLIGHTS:

- ▶ Caltech and **Amgen** established a partnership in 2015 focused on the biological sciences, specifically drug discovery, drug delivery, and diagnostics.
- ▶ Caltech and **Boeing** have collaborated since the 1930s.
- ▶ Caltech has long-standing ties with **Dow**; the two have worked on projects ranging from sustainability to materials chemistry to applied physics.
- ▶ Caltech recently entered into a partnership with **Amazon Web Services** in which AWS provides cloud credits for research across campus, as well as support for graduate fellowships.
- ▶ Caltech has begun a collaboration with **Disney Research** to work on robotic and artificial intelligence technologies that will more smoothly interact with humans.



# Jet Propulsion Laboratory

More than eight decades ago, faculty at Caltech established the Jet Propulsion Laboratory in the arroyo 6 miles north of campus. Since 1958, Caltech has managed JPL for NASA, keeping the U.S. at the vanguard of space exploration and planetary science. Today, campus and Lab researchers collaborate across a variety of missions and disciplines to advance understanding of Earth and the universe.

"The spirit and ambition of JPL help define the character of Caltech. Together, we unlock the secrets of the universe, trace the changes on our planet, capture the imagination of our fellow citizens, and inspire the next generation of scholars. We are able to think big because the separation between our campuses remains small."

—CALTECH PRESIDENT  
THOMAS F. ROSENBAUM

**"We have two strands of DNA: one of our strands of DNA is NASA, and the other strand of our DNA is Caltech. That makes us agile and innovative."**

—JPL DIRECTOR  
MICHAEL WATKINS



# JPL

EXPLORES THE

## Solar System

PROBES THE

## Cosmos

WORKS TO UNDERSTAND OUR

## Planet

DEVELOPS

## Autonomous Systems





Caltech

# Community



# Environs

Our city, **Pasadena**, is home to the Tournament of Roses Parade, the Norton Simon Museum, the Pasadena Playhouse, and The Huntington Library, Art Collections, and Botanical Gardens.

EMPLOYEES:

**3,500** Caltech

**6,200** JPL

**> 500** Postdoctoral scholars



“The weather, of course, is great, but the ability to get outside to the beach or to the mountains on the turn of a dime is incredible. There is a wealth of natural beauty here and such a visceral connection with geology that is unlike anything I have experienced in a big city before.”

—CLAIRE BUCHOLZ,  
ASSISTANT PROFESSOR  
OF GEOLOGY

AVERAGE HIGH TEMPERATURE:

**77°**

**124-acre  
campus**

## Hollywood

is 25 minutes from Pasadena

## Downtown Los Angeles

is a few stops away on the Metro Gold Line

## The Rose Bowl Stadium

is 10 minutes from Caltech's campus

Malibu

Santa Monica

Hollywood

LAX

Manhattan Beach

Long Beach

JPL

Caltech

Pasadena

5 miles

10 miles

20 miles

Disneyland

COMMUNITY

29



# Community and Educational Outreach



Each year, Caltech's educational outreach programs bring the excitement of scientific discovery to thousands of future scientists and engineers, and to curious community members of all ages.



Popular **summer programs** for schoolchildren include **Project Scientist Academy**, in which 4- to 12-year-olds tackle themes ranging from the science of crime to STEM in sports; **Summer Research Connection**, in which high school students and teachers are embedded in Institute labs for summer-long research projects; and **Community Science Academy**, which offers local high school students hands-on experience in biology, chemistry, and engineering.

## Rise Tutoring Program

This afterschool math-and-science-focused tutoring program serves public school students between grades 8 and 12. Tutoring is provided by Caltech undergraduate and graduate students.

## Coding is Elementary

Caltech undergrads earn credit for teaching weekly coding classes to 3rd, 4th, and 5th graders in local elementary schools.

## For Adults: Astronomy on Tap

Caltech astronomers give informal talks at a local Pasadena pub, complete with fun quizzes and lively discussion.



## In the Classroom

Caltech brings STEM to life for schoolchildren throughout the Pasadena area. Through **Visiting Scientists**, Caltech graduate students and postdocs teach hands-on science in elementary school classrooms; during **Science Nights**, Caltech volunteers conduct science demonstrations at schools across the San Gabriel Valley.





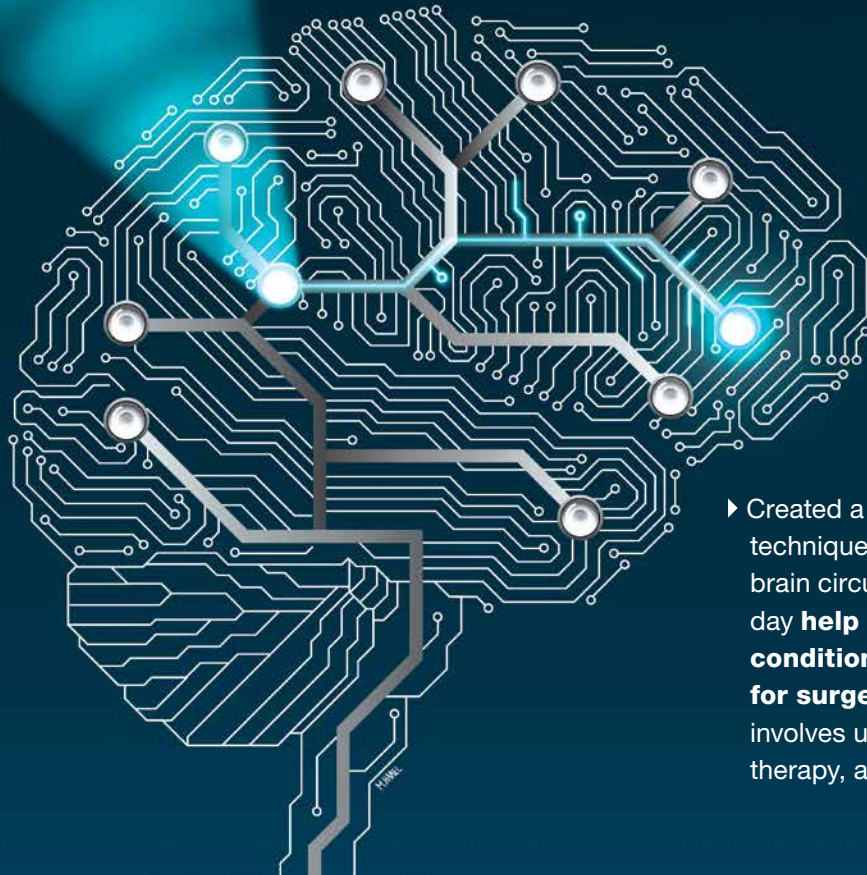
# 2018 Year in RR review



# Research

Researchers at Caltech explain behaviors, develop techniques to treat diseases, explore ways to lessen the impact of natural disasters, and solve intractable problems.

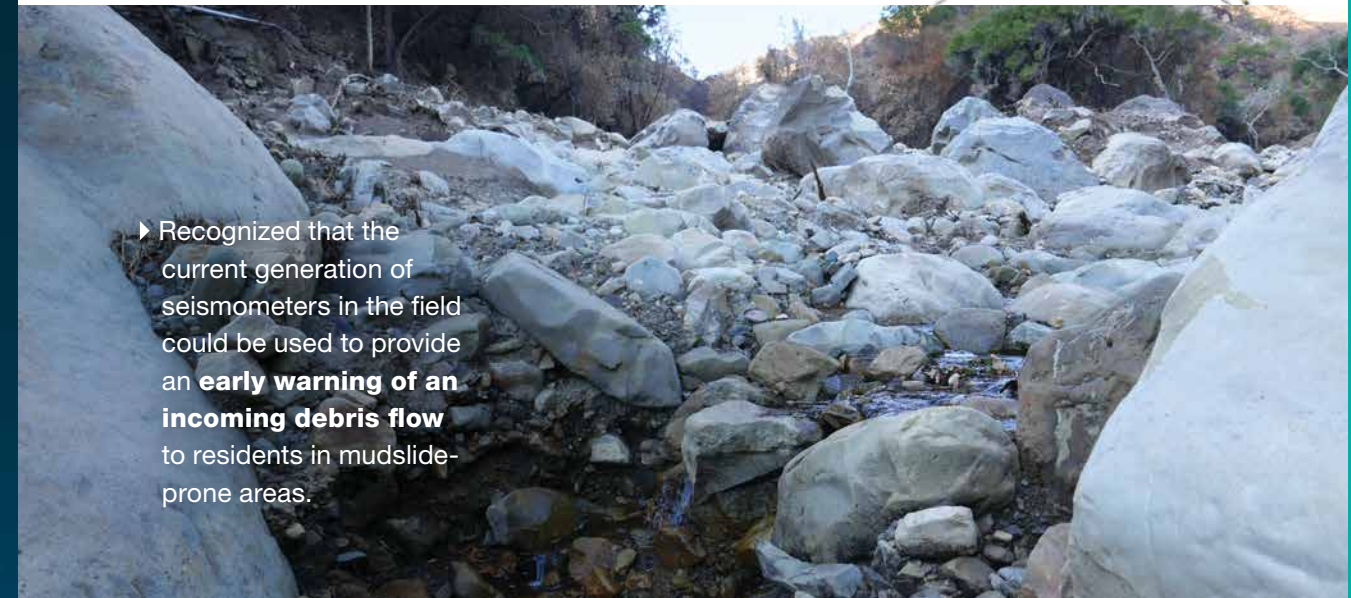
In 2018, researchers...



- Created a new noninvasive technique for precisely controlling brain circuits that could one day **help treat neurological conditions without the need for surgery**. The method involves ultrasound waves, gene therapy, and synthetic drugs.

- Showed that people can make **better-than-chance judgments** about whether an unknown politician has been convicted of corruption based purely on the width of the politician's face.
- Discovered a new mechanism to explain how **the act of dust moving through gas leads to clumps of dust**, providing a possible explanation for everything from planet formation to outflows from stars.
- Developed a new control algorithm that **enables a single drone to herd an entire flock of birds** away from the airspace of an airport. The team is now exploring ways to scale up so that multiple drones can guide multiple flocks to safety.

- Concluded that, similar to nautical navigators of old, **fruit flies use celestial cues such as the sun to navigate** in straight lines.



- Recognized that the current generation of seismometers in the field could be used to provide an **early warning of an incoming debris flow** to residents in mudslide-prone areas.



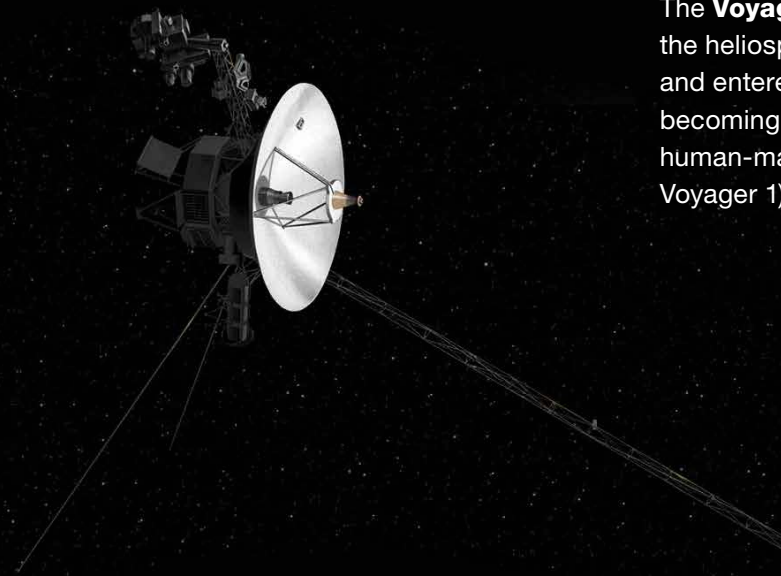
# JPL

In 2018, JPL finalized plans for the Mars 2020 rover launch and brought to an end Dawn's 11-year journey to the asteroid belt. Also, Kepler successfully finished its exoplanet-hunting mission.

The **Mars Science Laboratory mission's Curiosity rover** discovered ancient organic molecules in sedimentary rocks near the Martian surface as well as seasonal variations in the atmosphere's methane levels. The former finding suggests the planet could have supported ancient life; the latter validates the continued search for life on Mars today.



2018 marked 15 years since the **Spitzer Space Telescope** became the last of NASA's four Great Observatories to reach space. Since then, Spitzer has illuminated some of the oldest galaxies in the universe, revealed a new ring around Saturn, and detected seven Earth-size planets orbiting the star TRAPPIST-1.



The **Voyager 2** probe exited the heliosphere in November and entered interstellar space, becoming only the second human-made object (after Voyager 1) ever to do so.

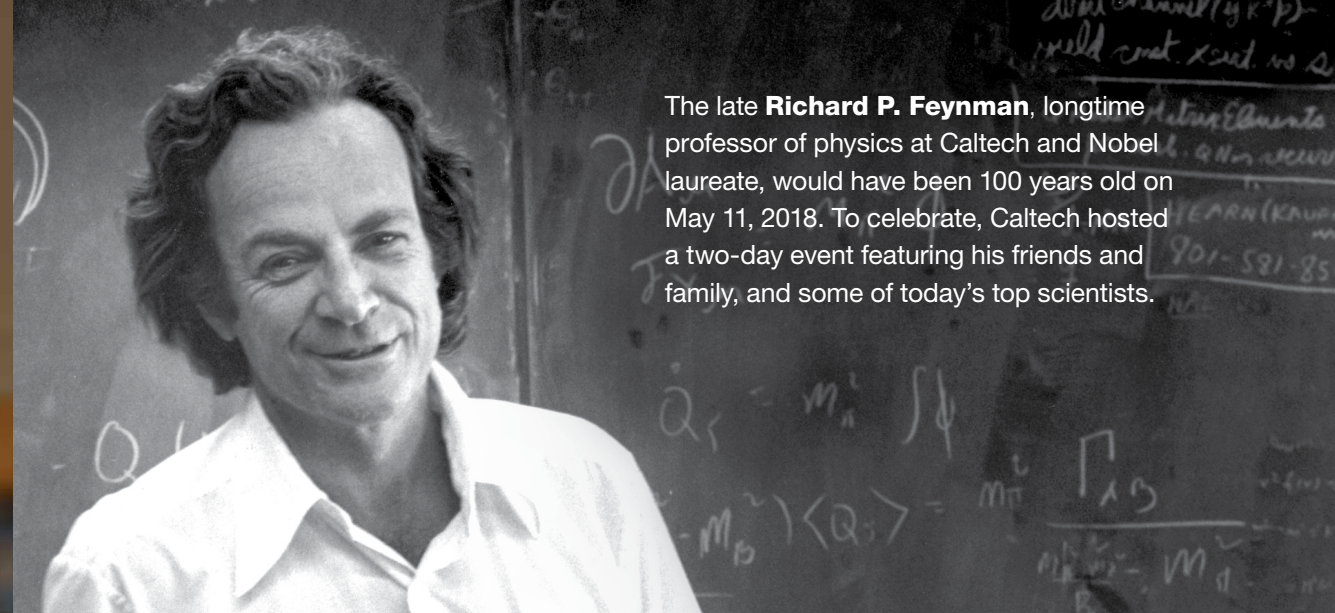


The **Mars InSight** mission landed on the Red Planet in November after a 300-million-mile trip to study for the first time what lies deep beneath Mars's surface.



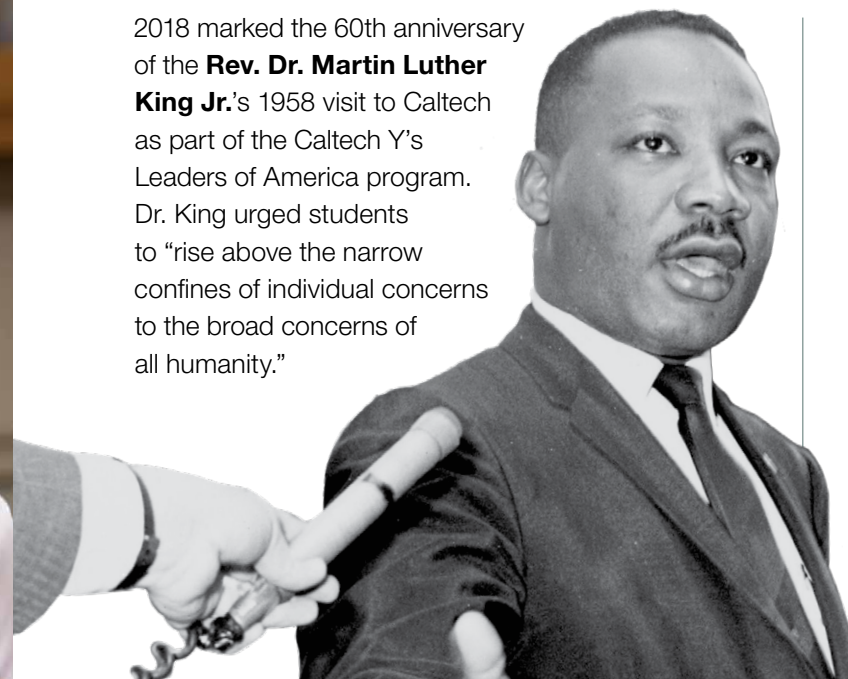
# Celebrations

**Frances Arnold**, the Linus Pauling Professor of Chemical Engineering, Bioengineering and Biochemistry, won the **2018 Nobel Prize in Chemistry** for her work on directed evolution. She is Caltech's first female Nobel laureate.



The late **Richard P. Feynman**, longtime professor of physics at Caltech and Nobel laureate, would have been 100 years old on May 11, 2018. To celebrate, Caltech hosted a two-day event featuring his friends and family, and some of today's top scientists.

2018 marked the 60th anniversary of the **Rev. Dr. Martin Luther King Jr.**'s 1958 visit to Caltech as part of the Caltech Y's Leaders of America program. Dr. King urged students to "rise above the narrow confines of individual concerns to the broad concerns of all humanity."



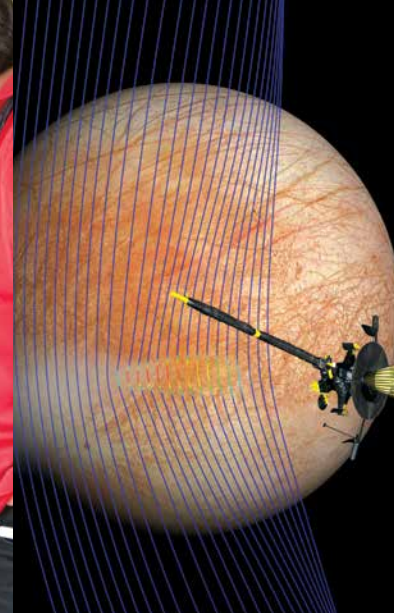
The spring of 2018 marked the **150th anniversary** of the births of two of the Institute's founders, **George Ellery Hale** and **Robert Andrews Millikan**.



# Events

“At Caltech, you open your minds, your arms, your hearts, and your souls to those that have been left out and left behind. We need science now more than ever before.”

—REPRESENTATIVE JOHN LEWIS, KEYNOTE SPEECH, CALTECH COMMENCEMENT, JUNE 15, 2018



More than 2,000 science enthusiasts flocked to campus on March 31 for the first **Science for March**, a celebration of science held on Beckman Mall.

In July, Caltech hosted **Astrofest**, in which the world's leading experts in space science gathered in Pasadena for talks, roundtable discussions, and exhibits on a wide range of space-science subjects.

Caltech hosted the **Southern California State Science Olympiad Tournament**, one of the country's premier science competitions since the 1980s. More than 1,000 K–12 students competed in science and engineering challenges.



# Community engagement

“You get one kid inside the planetarium to go ‘Wow!’ and you think, ‘Yes, that’s why we’re here.’”

—CALTECH RESEARCH SCIENTIST JESSIE OHRISTIANSEN ON WORKING WITH CARNEGIE OBSERVATORIES TO BRING A PORTABLE PLANETARIUM TO LOCAL CHILDREN’S HOSPITALS.



Performers visiting campus in 2018 included the **Brentano Quartet** with Dawn Upshaw; Adonis Puentes and the Voice of Cuba Orchestra; Capitol Steps; and the Kingston Trio.

Caltech’s **Signature Lecture Series** combines JPL’s Theodore von Kármán Lecture Series (which came to campus in 2018 for the first time) with the long-running Earnest C. Watson Lecture Series. The lectures are free and open to the public. Marina Agranov, one of the 2018 Watson lecturers, discussed the role of negotiations in group decisions.





# Campus Construction

Caltech, on its present campus since 1910, continues to grow.

The **Bechtel Residence**, Caltech's newest undergraduate residence, opened in September. Located along Del Mar Boulevard, the complex adds 211 beds to campus housing, allowing for the first time in Institute history all undergraduates to live on campus.

The newly renovated **Ronald and Maxine Linde Hall of Mathematics and Physics** includes “spaces for both teamwork and quiet contemplation.”

Scheduled to open in February 2019, the **Hameetman Center** will feature a public lounge, a cafe and food market, the Caltech Store, music rehearsal studios, student club spaces, and a conference room.

At the northwest corner of campus, the **Tianqiao and Chrissy Chen Neuroscience Research Building** will open in the fall of 2020, home to labs and offices as well as support spaces for the Division of Biology and Biological Engineering.





# Alumni

Caltech's more than 24,000 living alumni include trailblazing corporate executives, Academy Award-winning artists, successful entrepreneurs, academic leaders, medical pioneers, and technological innovators.

**Mansi Kasliwal (PhD '11)**, an assistant professor of astronomy at Caltech who studies stellar explosions and other cataclysmic events in the night sky, was awarded a **2018 Packard Fellowship in Science and Engineering**, which funds early-career researchers pursuing science and engineering studies.

"This gives me the freedom to dream big and try something adventurous."  
—MANSI KASLIWAL

**Harold McGee (BS '73)**, who writes about the chemistry of food and cooking, is exploring new ground in his next book, which surveys the smells of the world at large. McGee is best known for *On Food and Cooking: The Science and Lore of the Kitchen*, his 1984 compendium about kitchen science.

## 2018 Distinguished Alumni

Each year, Caltech bestows its highest honor, the Distinguished Alumni Award, on graduates who have had a significant impact on science and society.

**Gary Demos (BS '71)**, *Founder, Image Essence LLC*

**Gary Flandro (MS '60, PhD '67)**, *Professor Emeritus, University of Tennessee*

**Jessica Tuchman Mathews (PhD '73)**, *Distinguished Fellow, Carnegie Endowment for International Peace*

**Arthur B. McDonald (PhD '70)**, *Professor Emeritus, Queen's University, winner of the 2015 Nobel Prize in Physics*

**Ronald H. Willens (BS '53, MS '54, PhD '61)**, *Internet connectivity and telecommunications entrepreneur*

## 2018 MacArthur Fellows include two Caltech alumnae

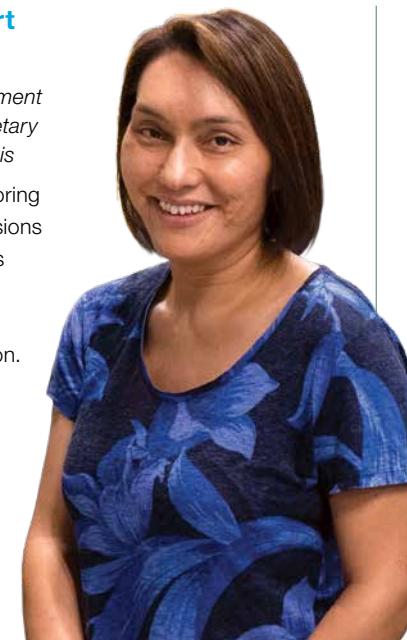
The John D. and Catherine T. MacArthur Foundation annually awards unrestricted fellowships to individuals who show extraordinary originality and dedication in their creative pursuits.

**Two of 2018's 25 MacArthur Fellows were Caltech graduates.**

### Sarah Stewart (PhD '02)

*Professor, Department of Earth and Planetary Sciences, UC Davis*

For her work exploring how celestial collisions give rise to planets and their natural satellites, such as the earth and moon.



### Doris Tsao (BS '96)

*Caltech professor of biology, T&C Chen Center for Systems Neuroscience Leadership Chair and Director, and Howard Hughes Medical Institute Investigator*

For her work studying the neural mechanisms underlying primate vision. In 2017, Tsao and her team discovered the system the brain uses to recognize facial identity.





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