# EX-PE-RI-ENCE.

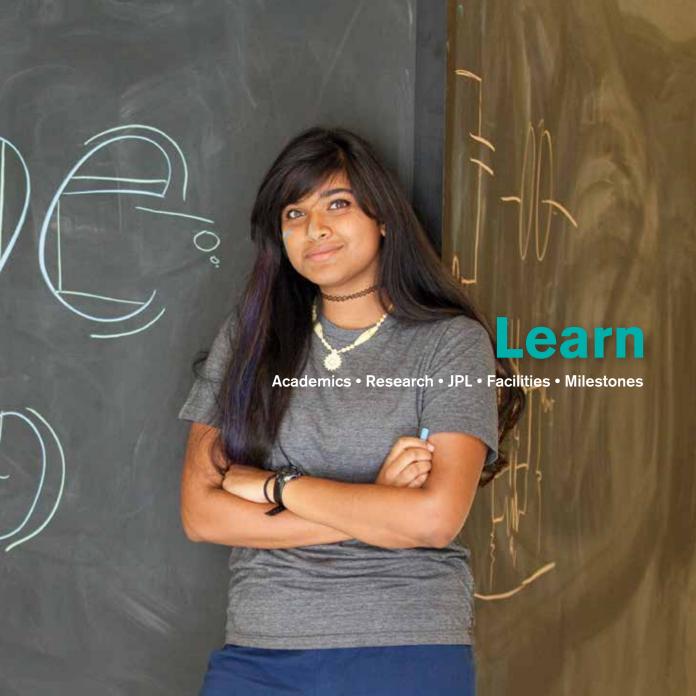


Caltech is a destination for people who want to fulfill their dreams their dreams of discovery in science and engineering.

# **Table of Contents**

Learn Academics • Research • JPL • Facilities • Milestones	2
Meet Faculty • Students • Alumni • Staff	16
Explore Campus Life • Did You Know? • Location	26
Engage	36





# **Academics**

With a challenging curriculum, access to a variety of learning opportunities, hands-on research, collaborations with faculty, and small class size, a Caltech education is unlike any other. Our students work toward undergraduate and graduate degrees in more than 20 fields of study, including physics, humanities, economics, math, chemistry, biology, and engineering—alongside their intellectual equals in a collaborative, cooperative environment.

#### **SURF Program**

Caltech's Summer Undergraduate Research Fellowships (SURF) program introduces students to the process of research under the guidance of seasoned research mentors at Caltech and JPL.

### **Study Abroad**

Caltech undergraduates interested in exploring the world through education can participate in programs at universities in England, France, Denmark, Scotland, and Australia.

#### Caltech's Six 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

#### **Premed Program**

Joint programs with several local medical centers provide Caltech students with clinical research experience in preparation for applying to medical school.

### **Hixon Writing Center**

Faculty and trained tutors at the Hixon Writing Center work with Caltech students, faculty, and staff to develop writing skills and promote excellence in communication.

95%

of Caltech undergraduates participate in research

3:1 Student/

Faculty Ratio

#1

in the Times Higher Education World University **Rankings** 

**Five years** in a row

### **Center for Teaching, Learning,** and Outreach

The Center for Teaching, Learning, and Outreach supports all facets of Caltech's educational efforts, including course and curriculum development, tutoring programs, and partnerships with local schools.



## Research

Caltech research provides solutions to the most complex global challenges of the 21st century. The discoveries our researchers make today will help fight disease, maximize environmental resources, and mitigate the impact of natural disasters in the future.

Stay up to date with our latest discoveries at caltech.edu/news.

We are...

# Advancing Health and Medicine

- Developing therapies to fight diseases such as HIV/ AIDS and cancer
- Harnessing gut bacteria for novel disease therapies
- Advancing neural prosthetic implants to allow patients more fluid, natural movement

# Sustaining Planet Earth

- Formulating cleaner chemical reactions for the production of hydrogen
- Devising new ways to harness sunlight for better solar fuels
- Creating new biocatalysts to produce more eco-friendly pharmaceuticals

# Improving Information Systems

- Engineering networks that transfer data at world-record speeds
- Transforming data analysis methods to protect individuals' privacy
- Developing potentially better data storage using ultra-fast laser pulses

# Engineering Advanced Materials

- Developing the world's lightest and strongest materials and structures
- Engineering biomaterials compatible with living systems
- Designing new materials using discoveries in fundamental science

# Explaining Behavior and Economics

- Identifying the neural processes that influence healthy decision making
- Uncovering how human behavior influences market behavior
- Understanding legal decisions and their impact on voters and elections

# Understanding Our Environment

- Discovering how the splitting of water molecules led to oxygen production on Earth
- Implementing and improving an earthquake early warning system to reduce damage, costs, and casualties
- Studying historical weather events and patterns to predict future changes

# Exploring the Universe

- Studying the earliest bursts of star formation to explain how galaxies form and evolve
- Discovering evidence of the farthest known galaxy in the universe
- Searching for gravitational waves with ever more advanced equipment

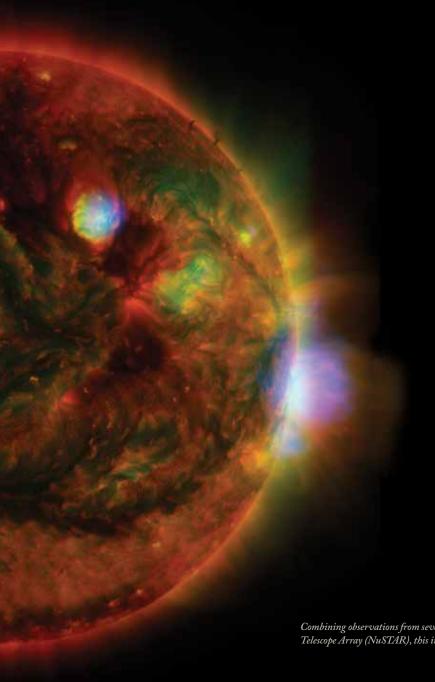
# Jet Propulsion Laboratory

What began as a student research project overseen by Caltech, JPL has become the leading U.S. center for the robotic exploration of the solar system. Managed by Caltech for NASA, Caltech and JPL scientists and engineers work together on missions that focus on planetary exploration, Earth science, and space-based astronomy.

JPL currently has 19 spacecraft and 10 major instruments on active missions, including the Mars Science Laboratory, which made history when its rover, Curiosity, landed on Mars in August 2012, and the Nuclear Spectroscopic Telescope Array (NuSTAR), which studies the universe with high-energy X-rays to better understand phenomena like black holes and exploding stars.

Learn more about JPL at caltech.edu/content/jet-propulsion-laboratory.





#### **NASA Facilities** at Caltech

**Infrared Processing and Analysis** Center (IPAC)

**NASA Exoplanet Science Institute** (NExScI)

**Spitzer Science Center** 

**Herschel Space Observatory** 

**Galaxy Evolution Explorer** (GALEX)

#### **Visit JPL**

JPL hosts more than 50,000 visitors each year through its open house and von Kármán Lecture Series.

Visit jpl.nasa.gov/events to learn more.

Combining observations from several telescopes, including the Nuclear Spectroscopic Telescope Array (NuSTAR), this image highlights flaring, active regions of our sun.

# **Facilities**

Caltech supports its eminent scientists and engineers with state-of-the-art laboratories, observatories, and instruments that enable cutting-edge research.



#### Seismological Laboratory

Caltech's Seismological Laboratory is a renowned center for geophysical exploration and the epicenter of earthquake research. Here, faculty and students study Earth's structure and dynamics to track, understand, and explain the sources and impact of seismic activity in California and around the world.

Check it out online at seismolab.caltech.edu.

#### LIGO

Caltech operates, with the Massachusetts Institute of Technology, a very different type of observatory—the Advanced Laser Interferometer Gravitational-Wave Observatory. Two recently redesigned and rebuilt facilities—one in Hanford, Washington, and the other in Livingston, Louisiana—operate in unison to detect and measure the ripples in the fabric of space and time caused by passing gravitational waves from cataclysmic cosmic events.

Learn more at ligo.caltech.edu.

#### **Observatories**

Caltech owns or jointly manages some of the world's most advanced astrophysical observatories. By leveraging the telescopes' abilities to see in different parts of the electromagnetic spectrum, our researchers gain access to unprecedented views of the universe.

Our facilities include:

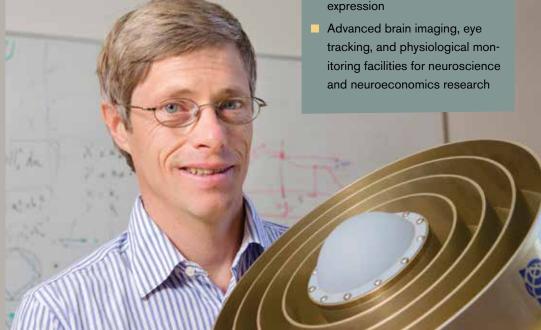
- The W. M. Keck Observatory
- Caltech Submillimeter Observatory
- Palomar Observatory
- Owens Valley Radio Observatory
- Chajnantor Observatory

Find out more at astro.caltech.edu/research/observatories.html.

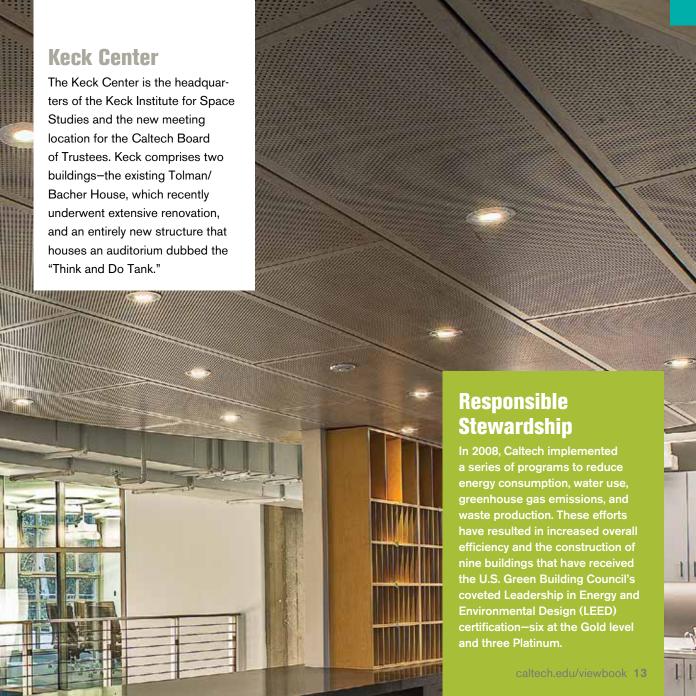
#### Campus Instrumentation

Some of the notable on-campus research facilities include:

- Shock and wind tunnels for studying fluid mechanics and simulating conditions for hypersonic aircraft
- An Earth Surface Dynamics
   Laboratory, featuring a 15-ton flume for studying water and sediment motion
- Gene sequencing facilities as well as a marine laboratory for studying embryonic gene







### **Milestones**

Caltech's scientists and engineers—past and present—are innovative thinkers, each contributing to the Institute's rich history of curiosity, discovery, and accomplishment.

#### 1926

Theodore von Kármán launches Caltech's graduate aerospace program (GALCIT), and with it the birth of Southern California's aviation industry.

#### 1910

The first building on the modern-day campus, Pasadena Hall, is built at Throop University. When Robert Millikan changed Throop's name to the California Institute of Technology in 1920, Pasadena Hall was renamed Throop Hall. It is now the site of the Turtle Pond.

#### 1929

Caltech builds Southern California's first seismic network. The stations cover a 500-kilometer radius centered around Pasadena.

#### 1931

The Athenaeum hosts its first formal dinner. In attendance were three Nobel Prize winners: Albert Einstein, Robert Millikan, and A.A. Michelson. Einstein was a visiting professor at Caltech until 1933.



#### 1891

Throop University, the forerunner to Caltech, is established.

#### 1924

The original student union, The Dugout, is dedicated, with 376 bricks engraved with students' names. Some of these can still be found on the south wall of Winnett.



#### 1928

Linus Pauling, an alumnus and faculty member who would go on to win two individual Nobel Prizes, writes his first paper on the quantum mechanics of the chemical bond. The same year, Thomas Hunt Morgan arrives with his fruit fly laboratory to found the biology division. Morgan would later go on to win a Nobel Prize in 1933.

#### 1925

Robert Millikan, Ira Bowen, Harvey Cameron, and Russell Otis discover high-energy X-rays bombarding Earth continuously from all directions. They named them "cosmic rays."

#### 1947

The 200-inch telescope at Palomar Observatory sees first light.

#### 1936

JPL's beginnings can be traced to the mid-1930s, when a few Caltech students and amateur space enthusiasts started tinkering with rockets. After an unintended explosion occurred on campus, the group and its experiments relocated to an isolated area next to the San Gabriel Mountains; that site is the current home of JPL.



#### 1950

Richard P. Feynman arrives as a full professor. He would go on to win the Nobel Prize in physics and write several popular science books about physics.

#### 1972

Alumnus Harrison Schmitt walks on the moon as a member of the Apollo 17 crew.

#### 1978

Robert Wilson. an alumnus, wins the Nobel Prize for discovering the cosmic microwave background radiation.

#### 2012

The Curiosity rover, led by project scientist John Grotzinger, successfully lands on Mars.



#### 1991

Work begins on what would become the Laser Interferometer Gravitational-Wave Observatory (LIGO).

### 1956

Charles Keeling publishes a graph of rising carbon dioxide levels in the atmosphere. That graph-called the Keeling curve-would become crucial in the discussion of anthropogenic climate change.

The first four women to earn bachelor's degrees from Caltech graduate.

#### 1977

Voyager I launches to explore the solar system. It becomes the first man-made object to travel to interstellar space.



#### 1998

The Caltech-led **BOOMERanG** mission maps the cosmic microwave background and proves that the universe is flat.

#### 2011

John Eiler directly measures dinosaur body temperatures for the first time, using a geochemistry technique he created on tooth fossils.

#### 2003

Stephen Quake launches the field of microfluidics at Caltech, a technology to manipulate fluids thousands of times smaller than a dew drop.







"Being around people who are so engaged by their research is very inspiring. In moments full of doubt or exhaustion, it makes you want to get back into it."

Dehn Gilmore

Professor of English

"Caltech is a place that truly believes if something is hard and worthwhile. you should do it."

Fiona Harrison

Benjamin M. Rosen Professor of Physics; Kent and Joyce Kresa Leadership Chair, Division of Physics, Mathematics and Astronomy

34 Caltech faculty and alumni have won 35

**Nobel Prizes** 

"At Caltech. we're always trying to do the first experiment on something, to conduct tests that people haven't tried or couldn't get to work, to be ahead of the pack technologically."

Colin Camerer

Robert Kirby Professor of Behavioral Economics

#### Caltech's faculty and alumni garner recognition:

National Medal of Science 58 recipients

National Medal of Technology 13 recipients and Innovation

National Academy of Sciences 75 members

National Academy of Engineering 44 members

American Academy of Arts and Sciences 100 fellows

## **Students**

Caltech students are passionate intellectuals who hail from diverse backgrounds but share an eagerness for discovery. Their proven ability to excel in the most rigorous academic environments has gained them entrance into a community that gives them the freedom to pursue their interests and the opportunity to achieve their dreams.

"Caltech is unique because the small community ... lets you focus really hard on things you like and allows those parts of you—whether science-related or personal—to grow."

Michael Grappone
Senior, Mechanical Engineering

"The students are so well-connected. For the most part, we all know each other, and people are very willing to help each other out."

**Ellen Yu**Junior, Chemistry

"Caltech offers me the freedom to pursue my non-science passions alongside some of the most brilliant minds in the world."

Michael Wong Graduate Student, Planetary Science

### **Affording Caltech**

Caltech selects students based on their academic and personal strengths—regardless of financial means. The Institute's policy is to provide students with the support required to meet 100 percent of their family's demonstrated need.



#### Who We Are

graduate students

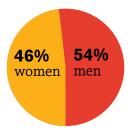
1,272\*

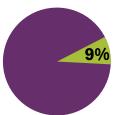
1,005\*

undergraduate students

\*as of October 1, 2015

#### Class of 2019





**6,507** total applicants **573** offered admission

Senior Rob Anderson, a mechanical engineering major, is a member of the men's basketball team and the founder of the Caltech Sustainable Vehicles Club.

# **Alumni**

Caltech's more than 23,000 living alumni include Nobel Prize-winning scientists (20 of them, to be exact), Academy Award-winning artists, trailblazing corporate executives, successful entrepreneurs, academic leaders, medical pioneers, and technological innovators. Our loyal worldwide network of graduates support and enrich the Institute through the Caltech Alumni Association.

Learn more at alumni.caltech.edu.



"I think fundamentally,
Caltech students are asked
to solve puzzles or problems.
I credit my Caltech training
for equipping me to step back
and look at the problem of
HIV differently. Throughout
my career, that training has
made the difference."

David Ho (BS '74)

Director and Chief Executive Officer, Aaron Diamond AIDS Research Center

Ho's breakthrough research into HIV in the mid-1990s directly led to a series of treatments that have dramatically increased lifespans for those affected by the disease.



"As I started my career, I looked around and thought, 'Why aren't there more women in engineering like me? And what can I do to change that?"

Bettina Chen (BS '10) Cofounder, Roominate

Chen created a building toy set for girls designed to foster an interest in science, technology, engineering, and math.



"Art-like science-is motivated by a curiosity of the world. Your evidence is the people you interact with. Your story is your hypothesis. I studied science but used my training to pursue art. When you come to an institute like Caltech, give yourself the space and leverage to study a variety of things. You never know what will resonate with you the most."

Iram Bilal (BS '04) Filmmaker

Bilal's first feature film, set in her native Pakistan, tackles themes of feudalism, social justice, and poverty.



"The kind of work that has been, and continues to be. done at Caltech translates into medicines of the future. which in turn impacts the lives of millions of people."

Richard Scheller (PhD '80) Chief Science Officer, 23andMe

In 2013, Scheller received the Albert Lasker Basic Medical Research Award for discoveries relating to the mechanisms of neurotransmission. He now leads research efforts to translate genetic data into new therapies, and serves on the Board of Trustees of Caltech.



"As a Caltech alumna, I've had access to the very best research facilities, faculty, and training that the world can offer and have a degree for which the rest of the world has tremendous respect. With a Caltech degree, people take you seriously the first time they meet you."

Andrea Ghez (PhD '93) Professor of Physics & Astronomy, **UCLA** 

Ghez's research helped to demonstrate the existence of a supermassive black hole at the center of our galaxy, with a mass four million times that of our sun.

## Staff

Caltech staff possess a diverse set of skills and experiences that contribute in variety of ways to Caltech's mission. They are researchers, finance specialists, fundraisers, food service workers, administrative associates, and technology professionals. And they take great pride in contributing to Caltech's reputation as an exceptional academic community where excellence is found in laboratories, classrooms, and offices alike.

"There is integrity here, and this work is important. It is meaningful to me to be able to share Caltech with the world."

Jodie Lee Senior Multimedia and Video Specialist, Academic Media Technologies

"I love what I do. I feel like the luckiest person alive to have been invited to participate and be a part of Caltech."

> Robert Taylor Instrument Specialist, LIGO





"Working at Caltech is much more than a job. It's being a part of an internationally renowned institution that shapes the world."

Angelica Santana Director, HR Systems and Services Human Resources "Working at Caltech, I feel like I am part of a family. When I see that smile from my customers—students, faculty, staff—it's a reward for me."

Ruben Carmona Cook, Dining Services

"Caltech is a place where you can grow and develop professionally, and forge lasting friendships with people as diverse as the world itself."

Chris Henderson Director, Graphic Resources and Mail Services







# **Campus Life**



#### **Honor Code**

At the heart of Caltech is its
Honor Code, the principle that
has guided the campus—and its
community of students, staff, and
faculty—since the Institute's earliest
days. It states, "No member
of the Caltech community
shall take unfair advantage
of any other member of
the Caltech community."

It's a simple idea—and one that is valued and regarded by everyone on campus.

### Housing

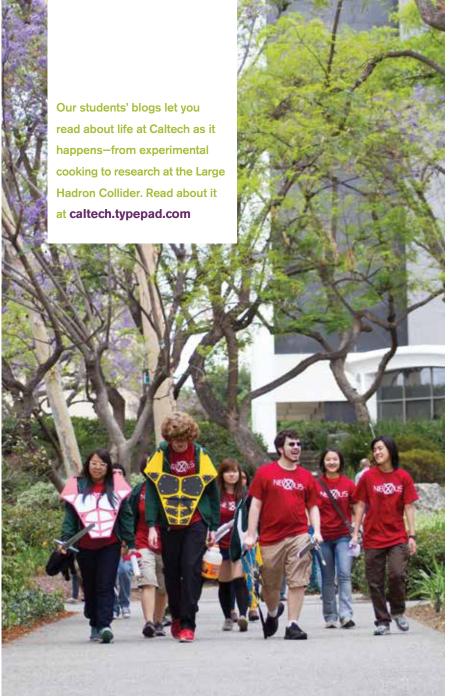
Undergraduate life revolves around eight campus Houses, each of which has unique traditions. First-year students explore each House during a selection period known as Rotation.

#### **Traditions**

- Ditch Day: one spring day, seniors vanish from campus, leaving behind puzzles and obstacles for the underclassmen to solve.
- Dinners: each weeknight, Houses have sit-down, family-style dinners served by students.
- Interhouse parties: each House has an extravagant annual party, often with outlandish themes and then construct elaborate props.

"Caltech's house system makes it truly unique. I love having a network of friends who have supported me throughout my time here."

**Bianca Lepe** Senior, Bioengineering



#### **Pranks**

Caltech students have a history of creating elaborate pranks to celebrate their school pride.

- 1961: Caltech students altered the University of Washington's card stunt during the Rose Bowl Game to display "Caltech."
- 1987: students changed the Hollywood sign to read "Caltech."
- 2005: Caltech students handed out more than 400 prank T-shirts at MIT's preview weekend.
- 2014: just before halftime at the Rose Bowl game, Caltech undergrads erected a 2,000-square-foot sign that spelled out "Pasadena" and "Caltech" in lights.

# **Campus Life**

# Athletics, Physical Education, and Recreation

Caltech sponsors 19 varsity teams that compete as members of the NCAA Division III and the Southern California Intercollegiate Athletic Conference (SCIAC).

Undergraduates must complete nine units of physical education to graduate. Course options include table tennis, karate, Ultimate Frisbee, aerobic dance, fitness training, rock climbing, and badminton.

Caltech's athletics and recreation facilities feature two gymnasiums, a 3,500-square-foot weight room with cardiovascular machines, two 25-yard pools, four racquetball courts, eight tennis courts, and more.



to community and extracurricular activities—planned and implemented by students—that prepare those students to become engaged, responsible citizens of the world.



### **Performing Arts** and Student **Organizations**

Students passionate about the arts can participate in a variety of groups such as the Caltech Orchestra, Jazz Band, Concert Band, Chamber Music Group, Glee Club, and TAC-IT (Theater Arts at Caltech).

With more than 100 student clubs. including the Anime Society, Ballet Club, Feminist Club, French Club, Juggling Club, Robotics Team, and Student Investment Fund, you will find people on campus who share your interests.

# Did You Know?

How well do you know Caltech? These interesting factsas well as many others-make Caltech ... well, Caltech!

> The Caltech mascot is the beaver—an homage to nature's engineer.

e cannon outside ricuino firmes throughout the year.

Re cannon outside ricuino firmes throughout the year.

Ne won't to n The cannot outside Fleming House We won't tell you when, just be prepared!

Caltech's motto:

"The truth shall make you free."

has made cameo appearances in several well-known TV shows and movies ..... Every morning during finals week, at **7 a.m.** on the dot, Richard Wagner's "Ride of the Valkyries" is played at an **ear-split** 

ting volume.

The Emmy-nominated television series, *The Big Bang Theory*, which is set at **Caltech**, taped an episode on campus that featured a cameo appearance by world-renowned astrophysicist **Stephen Hawking**.

The annual
Pumpkin Drop
takes place at
midnight on
Halloween,
when students
drop pumpkins
frozen in
liquid nitrogen
from the top of
Millikan Library
to see if they
give off

give off
a brief
glow as
they hit
the ground
and shatter.

Modern Family
The X-Files
The West Wing
Legally Blonde
Entourage
Mission: Impossible

Approved PE classes at Caltech include Ultimate Frisbee, table tennis, and power walking.

# **Points of Interest**

Located in the heart of the city of Pasadena, at the foot of the San Gabriel Mountains, Caltech is minutes from downtown Los Angeles and less than two hours from beaches, mountains, deserts, and the best that Southern California has to offer.

Palm Springs 105 miles east
San Diego 130 miles south
Las Vegas 260 miles northeast
San Francisco 380 miles north

Channel Islands National Park 70 miles west

Joshua Tree National Park 125 miles east

Yosemite National Park 280 miles north



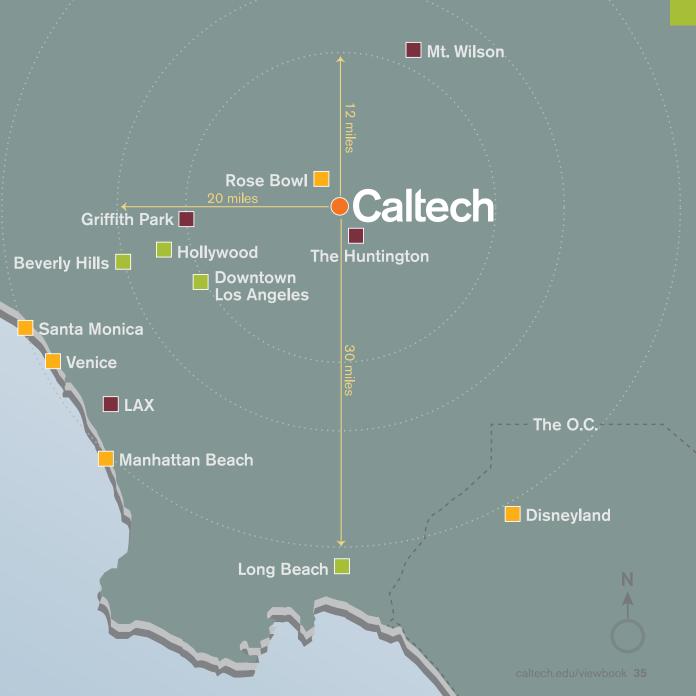
#### **Sports Teams**

Dodgers
Lakers
Clippers
Kings
Angels
Ducks

Average temp in **January 68** degrees F

Average temp in **July 89** degrees F

Average **annual temp 77** degrees F









Caltech is an integral part of Pasadena. Together with JPL, we are the city's largest employer and a source of programs that benefit our neighbors—teachers, businesses, cultural centers, and government.

## **Public Events**

For more than half a century, Caltech has hosted world-class scientists, artists, and speakers in lecture series and performing arts programs as part of *Caltechlive!*. For more information about campus programs, visit **caltech.edu/content/public-events** or call (626) 395-4652.



## **Caltech Online**

#### **Social Media**

Keep up with Caltech on social media to learn about the latest research news and campus events. Like us on Facebook (California Institute of Technology), and follow us on Twitter (@caltech) and Instagram (@caltechedu).

## **Engineering & Science** Magazine

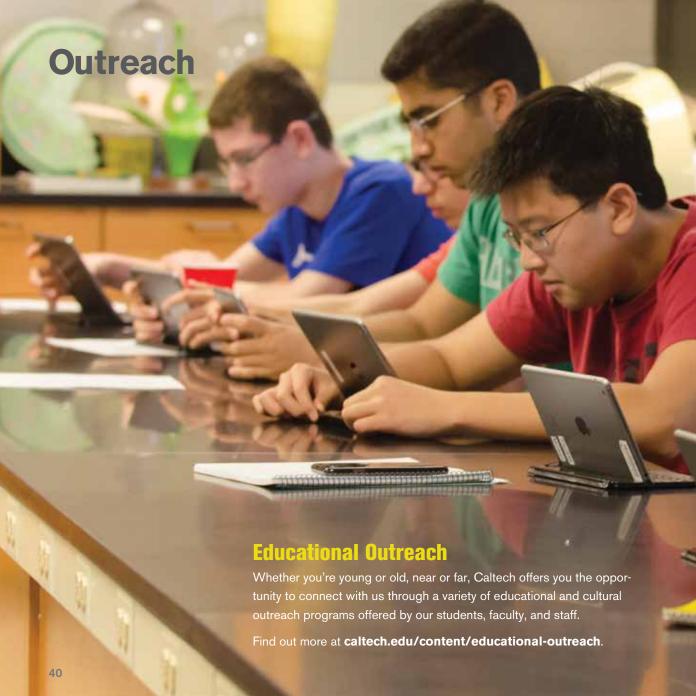
Our flagship publication, E&S magazine explores the ideas and discoveries of Caltech's researchers, students, and alumni. E&S+ is our online platform, where readers will find digital versions of the magazine's top stories plus specially created and curated content.

Read on at eands.caltech.edu.

#### Now@Caltech

To get the latest Institute news and top stories about Caltech in the media delivered to your email inbox, subscribe to Now@Caltech, our weekly, full-color e-newsletter.

Sign up at caltech.edu/content/ subscribe-nowcaltech.







# **Connect with Us**

Every gift to Caltech makes a difference. Your support enhances our educational environment, accelerates research, and affords students and faculty the opportunities to reach their potential. To learn more about giving to Caltech, visit caltech.edu/support.

#### **Caltech Associates**

Celebrating a 90-year legacy in 2016, the Caltech Associates is a vibrant philanthropic organization of approximately 2,000 community members, business leaders, entrepreneurs, and academics. Through dynamic programming and unique travel opportunities with faculty and students, Associates gain valuable insights into the academic and educational life on campus. For more information, visit **associates.caltech.edu** or call **(626) 395-3919**.

#### **Caltech Fund**

By cultivating support from current students, parents, and young alumni, the Caltech Fund enhances the student experience by providing support for undergraduate scholarships, graduate fellowships, student life, and research funds. For details, go to **fund.caltech.edu** or call **(626) 395-6323.** 

#### **Friends of Caltech**

Support Caltech's academic, cultural, and civic activities through these organizations:

Friends of Beckman Auditorium has supported the performing arts at Caltech for more than 40 years. Visit caltech.edu/content/fob for more information.

Friends of the Caltech Libraries provides library materials, equipment, and services that enhance research and learning. Find out more at library.caltech.edu/friends.



# credits

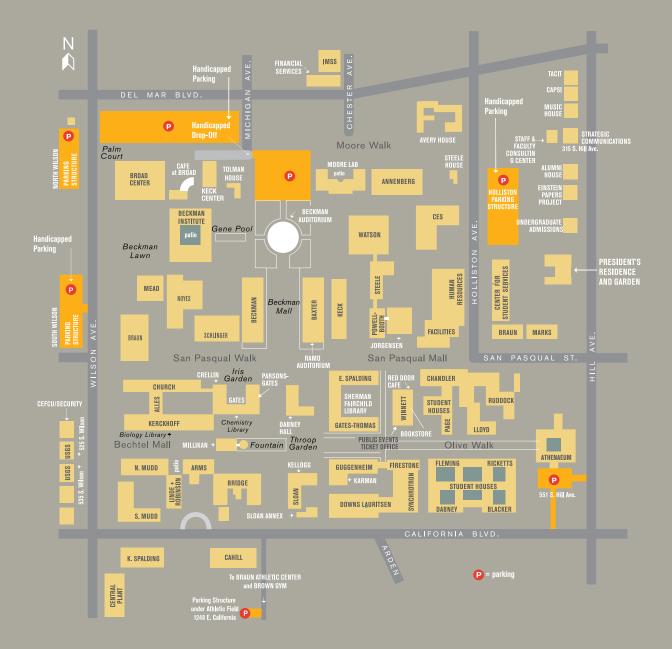
Produced by the Office of Strategic Communications, Caltech

#### **Photography/Illustration:**

Stephanie Diani: 2-3; Lance Hayashida: 5, 6-7, 14 (bottom left), 16-17, 21, 24, 26-27, 28, 29, 40-41, 42-43; Lance Hayashida and Jenny Somerville: 6-7, 32-33, 34-35; NASA/JPL-Caltech: 8-9; Palomar/Caltech: 10; Seth Hansen: 11, 18; Randall Howard: 12-13; Courtesy Caltech Archives: 14 (top), 15 (top, bottom); Courtesy Caltech Athletics: 30-31; NASA/JPL-Caltech: 15 (bottom); courtesy of MacArthur Foundation: 22 (left); courtesy of Genentech: 22 (right); Dustin Snipes: 23 (left); Jon Rou: 23 (middle); Danny Ghitis: 23 (right); Mario de Lopez: 25; Jenny Somerville: 36-37; Bob Paz: 38-39



1200 East California Blvd., Pasadena, CA 91125



# www.caltech.edu

