Caltech 101

very

(the short course)

Although Caltech has been a presence in the Pasadena community since 1891, many of our neighbors still think of us only when there's an earthquake, or when senior Ditch Day makes the TV news. The *Caltech 101* column, which appeared in the *Pasadena Star-News* every Tuesday throughout 2000, attempted to expand that perception, offering readers an overview of Caltech's history, research, student life, and community outreach.

We hope this (very) short course of selected *101* columns will give you a taste of why Caltech is one of the world's premier research institutions. [If it whets your appetite for a longer short course, *Caltech 101 (the book)* is available in our campus bookstore.]

Tinker, thinker, and *Stinker*

The modern Caltech owes much of its character to the vision of its troika of founders: astronomer George Ellery Hale, physicist Robert Andrews Millikan, and chemist Arthur Amos Noyes (nicknamed by a campus wag "Tinker, Thinker, and Stinker"). Having come West from Chicago in 1903 to establish the Mount Wilson Observatory, Hale joined Throop Polytechnic's board in 1907. Hale envisioned transforming Throop into a first-class "college of technology and science," and he worked tirelessly to realize his vision. His opening strategy was to recruit Noyes from MIT. The prospect of wintering in balmy Pasadena enticed Noyes to visit Throop's campus, and a new chemistry building finally convinced him to stay.

Hale and Noyes identified the school's next pressing need: an eminent physicist. They agreed that Millikan, then at the University of Chicago, would be ideal. They had persuaded Millikan to join Throop's faculty part time when World War I interrupted and Millikan was tapped to head up the National Research Council. After Millikan relocated to Pasadena in 1921, he, Hale, and Noyes formed the first executive council, and set out to put the newly renamed California Institute of Technology on the map.

Noyes, Hale, and Millikan.

Movers and Shakers, *Part I*

How did Caltech become Southern California's premier source of earthquake information and news? The story dates back to the 1930s, when two different traditions—a European interest in global earthquakes and an American concern about local tremors—converged in Pasadena.

After the devastating 1906 San Francisco earthquake, a better understanding of seismic activity was clearly needed, but scientists often found local business communities hostile to studies that might stifle California's growth. Into this unpromising climate Caltech seismology was born, in the form of a remarkable meeting of the minds that almost didn't happen. Geologist Harry Wood, a survivor of the San Francisco quake who invented one of the first seismographs, only wanted to study Southern California quakes. Beno Gutenberg, a renowned German physicist who was chiefly interested in global seismic activity, joined the faculty only after Robert Millikan promised him significantly more money than most other Caltech professors then received (necessary, Gutenberg said, to pay his domestic help). And only after attending one of Millikan's lectures did Charles Richter quit his job as a warehouseman and enroll in Caltech's physics graduate program. He stayed on to work with Wood and Gutenberg, eventually developing the earthquake magnitude scale that bears his name.

Seeing Stars

Research in astronomy and astrophysics at Caltech benefits from an unprecedented collection of ground-based observatories that are available to both faculty and students.

The PALOMAR OBSERVATORY in San Diego County is the home of the famous 200-inch Hale Telescope, as well as the 48-inch Oschin and 18-inch Schmidt wide-angle reflecting telescopes, and a 60-inch telescope jointly owned with the Carnegie Institution of Washington.

The OWENS VALLEY RADIO OBSERVATORY outside of Big Pine, California, includes a 40-meter telescope, a six-element millimeter-wave synthesis interferometer array, a five-element interferometer for solar studies, and a 5.5-meter telescope dedicated to observations of microwave background radiation.

The Caltech 10-METER SUBMILLIMETER OBSERVATORY located on Mauna Kea, Hawaii, is used for the study of the chemistry and physics of planets and cool regions of the interstellar medium.

Caltech and the University of California jointly operate the W. M. KECK OBSERVATORY, also located on Mauna Kea. Each of the two 10-meter Keck Telescopes has four times the power of Palomar's Hale Telescope. The twin Kecks will operate as part of an interferometer, and are currently the largest optical-infrared telescopes in the world.

The twin Keck telescopes.

Start Me Up!

How do scientists and engineers get their discoveries and inventions from the laboratory into the "real" world? If they're part of the Caltech/JPL research community, they can turn to Caltech's Office of Technology Transfer (OTT) for assistance. OTT helps investigators protect the intellectual property developed in their labs by patenting and licensing inventions to industry. Although Caltech has a well-established practice of patenting its inventions (more than 600 U.S. patents have been issued to Caltech since 1980), its licensing efforts have seen a dramatic increase since OTT was established in 1995. More than 30 patent licenses and options are now executed each year.

OTT also fosters the commercial development of Caltech technologies in companies ranging from local start-ups to large, multinational firms. It's quite an eclectic group, comprising such diverse companies as Pasadena's Clinical Micro Systems, Inc., which specializes in microchip-based analysis of DNA and other biomolecules; Cyrano Sciences, which is working on an electronic nose that will enable machines to "smell"; Liquidmetal Golf, which makes golf clubs from an amorphous metal alloy that far outperforms titanium; and OmniCorder Technologies, Inc., which is developing painless, radiation-free, inexpensive technologies for the early detection of cancer.

Rocket man

Theodore von Kármán, a Hungarian-born engineer and applied mathematician who has been called "one of the eight or so certifiable geniuses of the first half of the 20th century," came to Caltech from Germany in 1926 to help establish the recently funded Guggenheim Aeronautical Laboratory (as well as to escape anti-Semitism). He brought with him a wealth of theoretical knowledge about aeronautics that was sorely needed in the U.S., where experimentalists dominated the still-young field.

At Caltech, von Kármán reworked the plans for the new 10-foot wind tunnel so that the tunnel's efficiency was doubled, and taught students the theories behind better airplane design. Beginning in the mid-1930s, he also provided facilities for a few grad students to pursue their interests in rocketry. In 1946, in a memo to the Army about the German V-2 rocket, he impulsively signed himself "Director, Jet Propulsion Laboratory"—even though JPL would not have a project or funding for another eight months!

Von Kármán later chaired the Pentagon's Air Force Scientific Advisory Board, where he predicted such post-war technology as supersonic flight, ICBMs, and SAM missiles. In 1963, President Kennedy presented him with the first National Medal of Science.

Von Kármán (center) and colleagues.

The undergraduate Experience

In August 1999, *U.S. News & World Report* named Caltech America's #1 university for undergraduate education. However, as President David Baltimore says, "It's more precise to call us unique." Besides our quantifiable qualities—a freshman class with the highest average SAT scores in the nation; a three-to-one student-to-professorial faculty ratio; and an average instructional budget of $192,000 per student, to name just three—the unquantifiable parts of Caltech's culture contribute greatly to our uniqueness. Our Honor Code—"No member of the Caltech community shall take unfair advantage of any other member"—means, for instance, that collaboration on homework is encouraged, and that tests are never proctored. Caltech also offers undergraduates more research opportunities than there are students to take advantage of them. Arguably the most popular of those opportunities is SURF—the Summer Undergraduate Research Fellowships program, which just completed its 23rd season. SURF was designed to help students experience the process of research as a creative intellectual activity and to develop a realistic view of the rewards and demands of a professional research career. Nearly 3,000 students have participated in the program since 1979.

Caltech students on Ditch Day.

Life **Beyond** Caltech

The Institute has about 19,000 living alumni. (In comparison, UC Berkeley graduates close to that many people every two years!) In addition to graduating 15 Nobel prize-winning scientists, Caltech has turned out leaders in almost every other field imaginable. The following is a sampling of some former Techers who have made their mark on the world.

Frank Capra (BS '18), *film director (*It Happened One Night; Lost Horizon; It's a Wonderful Life*)*

Chester F. Carlson (BS '30), *inventor of Xerography (photocopying)*

Simon Ramo (PhD '36) and
Dean E. Wooldridge (PhD '36), *cofounders of TRW Inc.*

Moshe Arens (MS '53), *former Israeli foreign and defense minister*

Gordon E. Moore (PhD '54), *chairman emeritus and cofounder, Intel Corp.*

Benjamin M. Rosen (BS '54), *chairman emeritus, Compaq Computer Corp.*

Harrison Schmitt (BS '57), *Apollo 17 astronaut (and 12th and last human to have walked on the moon); former U.S. senator*

Henry C. Yuen (PhD '73), *president and CEO, Gemstar Development Corp.; inventor of the VCR Plus+® video deck programmer*

David Ho (BS '74), *director, Aaron Diamond AIDS Research center; 1996* Time *magazine Man of the Year*

Sandra Tsing Loh (BS '83), *writer/performer (*Depth Takes a Holiday; Aliens in America; If You Lived Here, You'd Be Home by Now*)*

Caltech welcomes visitors. Tours are conducted throughout the year (except on holidays, during winter break, or on rainy days), Mondays through Fridays, leaving from the Visitors Center, 315 South Hill Avenue. A video is shown at 1:45 p.m., with a student-led tour of the campus grounds departing at 2:00 p.m. Call 626.395.6327 for further information. Self-guided tours are also available between 8:00 a.m. and 5:00 p.m., Monday through Friday.

In addition, architectural tours of the campus are conducted the fourth Thursday of each month, with the following exceptions: the tour in November is given on the third Thursday of the month, and there are no tours in July, August, or December. Tours leave at 11 a.m. from the front hall of the Athenaeum, 551 South Hill Avenue. For reservations, call 626.395.6327.

For further information, visit
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