

2013 Impact Report

Office of
Technology
Transfer



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Caltech

 **268** Invention Disclosures (campus only)

144 U.S. Patents Issued

 **1,749** Active U.S. Patents

 **58** Licenses Granted (including options)

 **11** Start-Up Companies

CALTECH'S INNOVATION ECOSYSTEM

Caltech scientists and engineers tackle complex problems by combining fundamental scientific principles with unconventional, entrepreneurial ideas. The advances that result have the potential to transform society.

With the help of the Office of Technology Transfer, the best ideas with commercial potential from inventors at Caltech and the Caltech-managed Jet Propulsion Laboratory (JPL) not only take shape, but also make it into the marketplace.

OTT TIMELINE

Since Caltech's Office of Technology Transfer was established in 1995, its professionals have helped faculty and staff launch more than 130 start-up companies in industries such as biomedicine, communications, electronics, and energy.

PRE-1995

DNA SEQUENCER

Leroy Hood (BS '60, PhD '68) and Michael Hunkapiller (PhD '74) pioneered the field of genomics, inventing a method for the automated sequencing of DNA, which, among other things, enabled the Human Genome Project to map human DNA. Company: Applied Biosystems, now Life Technologies.



FY 2013

Putting the world in focus

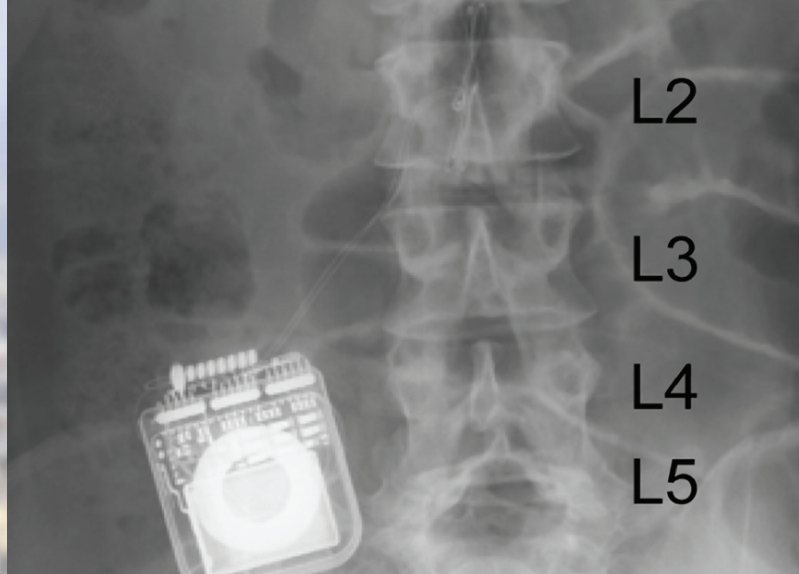
More than a decade ago, chemistry professor Robert Grubbs and chemical engineering professor Julia Kornfield (BS '83, MS '85) set their sights on addressing the issue of patients needing eyeglasses after cataract surgery.

Their solution was to implant a lens during the initial cataract surgery that can be precisely adjusted after surgery to meet a patient's shifting visual requirements. Their lenses, manufactured by Calhoun Vision, are now sold in Mexico, Europe, and Canada, and entered phase III clinical trials in the United States this year.



CMOS Former JPL engineer Eric Fossum developed the complementary metal-oxide semiconductor (CMOS) active-pixel sensor (APS) "camera-on-a-chip" technology for the U.S. space program. The technology is now the basis of today's digital cameras and digital photography.

SATELLITE COMMUNICATIONS Electrical engineering professor David Rutledge and his graduate students created a high-power transmitter for ground-to-satellite communications that is used by the military in Afghanistan and Iraq, for Wi-Fi service on commercial airlines, and for Internet access on cruise ships. Company: Wavestream, acquired by Gilat Satellite Networks.



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Digitizing the streets

Technology that was originally developed at JPL to allow rovers to autonomously drive over the surface of Mars is now informing everyday maneuvers on Earth.

A street-level 3-D mapping company, Earthmine, has licensed the software and algorithms that JPL senior research scientist Larry Matthies developed for the rovers to produce high-quality, seamless panoramic imagery with pixel-for-pixel 3-D information. In 2012, Earthmine was acquired by Nokia to help bolster its digital mapping service with the technology's 3-D capabilities.

Progress for paraplegics

Mechanical engineering and bio-engineering professor Joel Burdick and electrical and mechanical engineering professor Yu-Chong Tai are helping to provide paraplegics with greater mobility.

In collaboration with researchers at UCLA and the University of Louisville, they have modified existing implantable pulse generation technology in a way that has enabled four paralyzed individuals to stand, take steps with assistance, and over time, regain voluntary control of their limbs. The next step in their research and for start-up licensee NeuroRecovery Technologies is to develop an improved implantable electronics package system for humans, and to automate many of the routine procedures needed to deploy their approach so that it can be easily customized for each patient while requiring less training for clinical staff.

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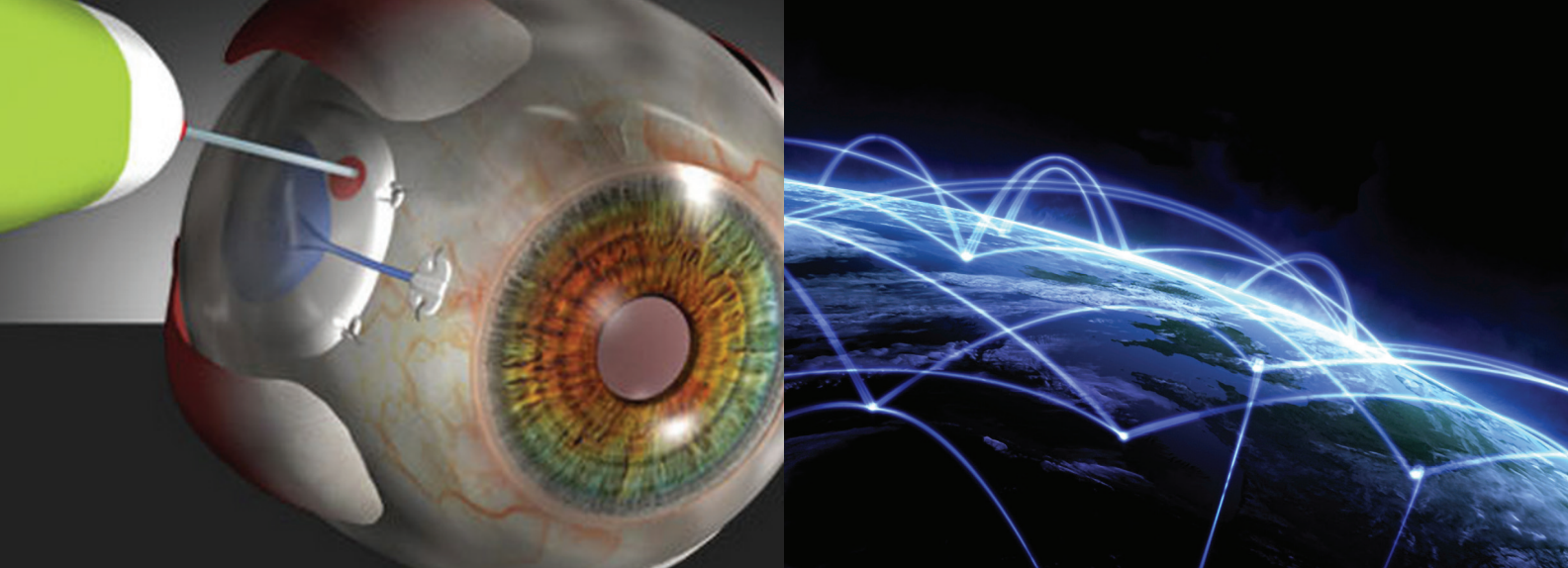
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CELL-PHONE TECHNOLOGY Electrical engineering professor Ali Hajimiri codeveloped a new power amplifier technology for cell phones. Using inexpensive CMOS processes, the redesigned amplifiers allowed for the creation of single-chip cell phones and significantly reduced the cost of cell-phone circuitry. Company: Axium Microdevices, acquired by Skyworks.

CANCER THERAPEUTICS Discoveries by biology professor Ray Deshaies and a colleague at Yale led to the formation of a company that developed Kyprolis, a drug that targets the proteasome—a very large cellular complex involved in breaking down proteins. Kyprolis is being used to treat hematologic malignancies and is being evaluated for use in other tumors. Company: Proteolix, acquired by Onyx Pharmaceuticals.



Preserving sight

Electrical and mechanical engineering professor Yu-Chong Tai is rethinking drug delivery and has worked out a way to use MEMS technology to improve treatment for serious eye diseases, including age-related macular degeneration and glaucoma.

Tai is the cofounder of Replenish Inc., a company developing a refillable, programmable, and battery-powered ocular drug pump that delivers nanoliter-sized doses of medicine directly to the inner eye. Replenish Inc. is currently expanding its manufacturing capabilities in preparation for phase II U.S. clinical trials.

Speeding up the Internet

Computer science and electrical engineering professor Steven Low's data-transfer protocol is making it possible for packets of information to be sent across the network at unprecedented speeds.

His FastTCP protocol and technology, which has been commercialized by FastSoft since 2006, manages and controls Internet congestion, enabling researchers to set new records for file transfer. FastSoft was acquired by Akamai during the 2013 fiscal year.

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DISEASE DIAGNOSTICS Electrical engineering, applied physics, and physics professor Axel Scherer and biology professor David Baltimore developed an inexpensive polymerase chain reaction (PCR) machine designed to evaluate and diagnose infectious diseases within 94 seconds. Company: Helixis, acquired by Illumina.

3-D DENTISTRY Engineering professor Mory Gharib (PhD '83) and his team designed and built an affordable, handheld 3-D camera that dentists can use to photograph teeth and build crowns and bridges. Company: Arges Imaging, acquired by Sirona.

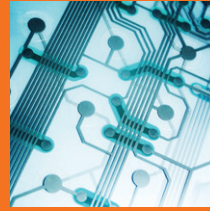
¹Reprinted from The Lancet, Volume 377, Prof Susan Harkema PhD, Yury Gerasimenko PhD, Jonathan Hodes MD, Prof Joel Burdick PhD, Claudia Angeli PhD, Yangsheng Chen PhD, Christie Ferreira BSc, Andrea Willhite BA, Enrico Rejc MSc, Prof Robert G Grossman MD, Prof V Reggie Edgerton PhD, Effect of epidural stimulation of the lumbosacral spinal cord on voluntary movement, standing, and assisted stepping after motor complete paraplegia: a case study, 1938-1947, Copyright 2011, with permission from Elsevier.

Take a look at what could be some of Caltech's next big ideas.



Autism therapy and diagnostics

Biology professors Sarkis Mazmanian and Paul Patterson could revolutionize how autism is treated and diagnosed with research that explores a unique link between the activation of the immune system during pregnancy and elevated risk for autism in the offspring. In a mouse model of this risk factor, a probiotic restores the balance of beneficial microbes in the offspring's gut, reduces gastrointestinal symptoms, and corrects autism-like behaviors. The presence of specific gut bacterial metabolites in the blood may also be used as an early diagnostic test for autism.



Memory technology

Computation and neural systems and electrical engineering professor Shuki Bruck would like to enhance how information is stored and processed. His team has developed a new system for writing and recording information in flash technology. The system is called rank modulation and has improved the capacity, endurance, reliability, and speed of flash memory, as well as made it possible for the flash technology already widely used in portable electronic devices to be expanded for use in large-scale computing and other big enterprises.



Wonder material

Physics professor Nai-Chang Yeh and staff scientist David Boyd are working toward a new material platform for tomorrow's nano-electronics and energy-generating and -saving devices. They are the first to have developed a method for cheaply and efficiently fabricating—at room temperature—large, high-quality sheets of a “wonder material,” graphene. This novel material is thin, flexible, and strong, as well as transparent and conductive.



Chemical synthesis

Chemistry professor Brian Stoltz is leading a research team that is creating new ways of making complex molecules that are useful in developing pharmaceuticals and natural products that would otherwise be too challenging to produce. The team has devised a chemical reaction that selectively and accurately produces complex compounds for use in creating products ranging from chemotherapeutic agents to bioactive plant materials such as morphine.

