



UNIVERSITY
OF
CALIFORNIA

Ideas, inventions, impact

Technology Commercialization Report

2013

Teach for California; research for the world

At the University of California, we discover, interpret and apply new knowledge. Our curiosity drives new innovations. We inspire the next generation of leaders, and we contribute to the public good. UC research inspires new ways of thinking, solutions and innovations that catalyze the industries that drive California's economy.

Transferring university research outside of the institution drives more research, creates new companies and stirs the development of products and services. By facilitating this shift, UC's Technology Transfer Offices are instrumental in promoting innovation and public benefit.

Through a collaborative management approach, UC's Office of the President (UCOP), the 10 UC campuses and Lawrence Berkeley National Laboratory (LBNL) share responsibility for UC's technology transfer activities. For UC's campuses and LBNL, UCOP sets overarching policy and guidance, provides legal oversight, conducts legislative analysis and manages information among other services in support of the overall program. The extraordinary innovations generated by UC researchers originate at UC's campuses and medical centers. As such, each campus actively manages its invention portfolios, fosters relationships between inventors and industry, and nurtures local entrepreneurial ecosystems.

As a National Laboratory managed by the University of California, certain aspects of technology transfer are different at LBNL as compared to the rest of the University. LBNL has a reporting period that covers a fiscal year ending Sept. 30, 2013, as compared to June 30, 2013 for the rest of UC. Also, while LBNL manages inventions in a way that is generally consistent with the principles and practices of the rest of UC, there are some important operational differences, such as LBNL's greater use of in-house patent attorneys. Unless otherwise noted, this FY13 University of California Annual Report provides the systemwide technology portfolio that includes LBNL-managed technologies.

Letter from the Director

As one of the premier research institutions in the world, the University of California has a vibrant tradition of transferring research into commercial success.

And, every day, this tradition is continued as the research conducted by students and faculty at the University of California is transferred to give us cleaner water, more bountiful harvests, improved patient care and enhanced quality of life. The research innovations highlighted in this year's report, illustrate this path of innovation: from identifying the critical needs for innovative solutions, to supporting and growing such solutions, to UC innovations that are making a difference today. These examples demonstrate our mission to teach for California and research for the world.

In FY 2013, UC researchers submitted 1,727 new inventions—an average of nearly five a day, 365 days a year—bringing UC's total portfolio to more than 11,500 inventions; entered into 427 new agreements, providing industry access to UC inventions; and launched 71 new startup companies.

We're proud of our role in transforming today's research ideas into tomorrow's commercial successes.

Sincerely,

William Tucker
Executive Director
Innovation, Alliances and Services



“UC researchers submitted 1,727 new inventions—an average of nearly five a day, 365 days a year.”



On the water front

Drought and supplying enough water to thirsty land and growing populations have long been a problem in California. And UCLA researchers are leaders in developing solutions.

In 1960, UCLA researchers patented the first commercially viable reverse-osmosis membrane, and later improved membranes that now are critical to water treatment technology. In 2005, they formed the UCLA Water Technology Research Center, where faculty and students have patented desalination techniques and formed collaborations with companies and government agencies to address the state's water shortage.

In 2011, Yoram Cohen won a UC Office of the President Proof of Concept grant to demonstrate the feasibility of a new technology to improve desalination of drainage water. The research was carried out in the San Joaquin Valley, where increasing salinity in irrigation water threatens to ruin 15 to 20 percent of prime agricultural land. Cohen's system, which pumps brackish water through a series of membranes to filter out undesired salts and gunk, is efficient enough to recover up to 95 percent of the water it processes and even make the water drinkable. The system also uses mobile desalination units, making it practical to desalinate a number of agricultural sites or supply water in localized or regional droughts.

In 2013, membrane material developed by Eric Hoek and Richard Kaner won a Distinction Award for Technology Innovation of the Year at the Global Water Awards. The new technology holds promise for cleaning municipal and industrial waste, and it makes water clean enough so that it can be safely reused.

UCLA technology is applied in its own backyard. A pilot system developed by Yoram Cohen and his student cleans hundreds of gallons of "gray water" running off from showers, sinks and washing machines in the back of a west L.A. home so that it may be reused to irrigate trees and gardens.

Feeding the world

California is the top agricultural producing state in the U.S., and UC supports the state's industries, especially when it comes to breeding new fruits and other food plants.

Places such as the UC Davis Plant Breeding Program and UC Riverside's Citrus Variety Collection help the industry develop new cultivars and improve harvest efficiency and food quality. The agriculture industry relies on UC innovation, particularly from the Davis and Riverside campuses, to move more and tastier products to market.

In 2013 alone, UC-created cultivars—specially-bred food plants—brought in more than \$9.8 million in royalty and fee income. These food plant cultivars included strawberries, citrus fruits, pistachios, walnuts, avocados and wheat varieties, developed at UC Davis and UC Riverside.

Six of UC's top 30 grossing inventions in 2013 were varieties of strawberries or citrus. These totaled \$7 million in royalty and fee income for the year.

In 2013, UC Davis added 46 new plant licenses and UC Riverside, 16. UC now has 674 active plant licenses, all from the two campuses.

For more than 40 years, UC Riverside researchers have developed varieties of cowpeas, a protein rich legume crop that is vital to the diet and economy of millions of people in drought-prone regions of Africa. In 2013, UC Riverside scientists received two grants totaling more than \$7 million from the U.S. Agency for International Development to continue work to increase the crop's yield and create cowpeas that resist drought, disease and insects. One grant created the Feed the Future Innovation Lab for Climate-Resilient Cowpea, a crop breeding project with partners in four African nations.





Hatching companies

Incubators throughout the UC system offer innovators and fledgling entrepreneurs space to work and links to the knowledge, ideas and creativity at a campus. There, they can grow their ideas and, perhaps, a new industry.

SRCH2, founded by UC Irvine computer science professor Chen Li, was the first tenant at Calit2's TechPortal business incubator. It also became the first from the incubator in 2013 to generate enough capital to open its own headquarters, which is near the Irvine campus.

SRCH2 has harnessed new techniques and processing resources to create a new type of search engine—powerful enough to solve complex problems, thin enough to sit on a handset, simple enough for most people to use. Already its technology is used in some mobile phones, social networks and cable boxes.

Li first applied his technology at UC Irvine in 2008, when he created Psearch to help find people in the campus directory even with incomplete or misspelled information. After the devastating Haiti earthquake in 2010, Li created a powerful search widget to help people to quickly learn the status of friends and loved ones in the stricken country.

In 2013, SRCH2 launched a “Pay it Forward” program under which its products and services are free or discounted to nonprofit and higher education institutions. Through the program, UC Irvine's Office of Technology Alliances added search capabilities to its mobile app, which lets businesses and potential investors easily access non-confidential descriptions of campus technologies available for licensing.

The California Institute for Quantitative Biociences' (QB3) Startup in a Box, at UCSF's Mission Bay campus, helps launch new companies. At the start, the companies are at the brink of realizing their commercial potential but need the push and resources to progress. Since it opened in 2011, Startup in a Box has “graduated” 23 operational companies, whose products range from powerful microscopes to new therapies for cancer and other diseases. Today, 88 companies are housed by the program.

Power of a product

One-tenth of all energy used in the U.S. is wasted through inefficient power conversion. It happens when electricity goes from alternating current to direct current and back to AC so that we can plug into the wide range of appliances and devices that we rely upon every day. We pay for that waste every month with our electricity bill.

Umesh Mishra, UC Santa Barbara electrical and computer engineering professor, has worked since 1996 with a material—gallium nitride (GaN)—which was useful in LED technology but never applied to electricity conversion. He later discovered that GaN was more efficient and cost-effective than traditional components, including silicon, for converting power.

In 2007, he co-founded a startup—Transphorm in Goleta, Calif.—that could reduce the electricity consumption of items ranging from computers to hybrid cars. Its technology could rid of us of the rectangular adapter connected to laptop cords, and electric cars may go farther.

In 2013, one of Transphorm’s GaN power conversion devices was named by the trade publication Electronic Products as a “Product of the Year.”

The company has believers, attracting \$110 million in venture capital backing from investors interested in Transphorm’s potential to save electricity at energy-gobbling data centers.

And the company has international impact and attention. Last year, Transphorm and Fujitsu formed an alliance to accelerate the introduction of Transphorm’s GaN power devices into technology that we use every day.

UC Santa Barbara’s Shuji Nakamura researched gallium nitride (GaN), beginning in 1989, to pioneer LEDs, high-brightness laser and high-power transistors. He also created the white LED and blue laser diodes used in Blu-ray discs and HD DVDs.

He has received numerous scientific honors, and in 2012 he received an Emmy Award for developing large-venue, large-screen direct view color displays. He is the founder of Soraa, a Fremont, Calif., LED manufacturer using GaN crystals for its products.





Better and brighter

The colors on flatscreen TVs, tablets and smartphones will become even more vivid, thanks to research at MIT, UC Berkeley, UC Santa Cruz, UCLA and Lawrence Berkeley National Laboratory.

Nanosys, which was founded in 2001, licensed UC technology to become a leader today in developing quantum dots. These are nanocrystals—10,000 times narrower than a human hair—that act as semiconductors to turn light into nearly any color in the spectrum.

Most of today's displays can show only one-third of the colors that the eye can see. But new quantum dot technology brings missing colors to viewers without draining power. Amazon's 2013 Kindle Fire HDX7™, the first tablet display to use Nanosys' quantum dot technology, is 20 percent brighter and has more hours of battery life than previous models.

The company now partners with some big names in tablets and TVs—including 3M, Samsung and Sharp—to bring more colorful and efficient products to consumers all over the world.

A growing company originally based in Boston, Nanosys in 2013 opened a new headquarters and plant in Milpitas, Calif., with 120 employees.

Step at a time

A bionic suit to help paraplegics walk: Not too long ago, that sounded like science fiction. But great strides in moving an invention to the market are turning a fantasy into reality.

It started with a Defense Advanced Research Projects Agency-funded project in 2000. Four years later, Homayoon Kazerooni and his team at UC Berkeley's Robotics and Human Engineering laboratory unveiled a device to help users carry heavy loads for long periods. It was then that Kazerooni recognized its potential use for physical rehabilitation and as an alternative to wheelchairs. In 2005, he co-founded Berkeley Bionics, which eventually would become Ekso Bionics, and the rest is medical and technological history.

Lockheed Martin in 2009 licensed Ekso Bionics' Human Universal Load Carrier to adapt the technology for the military, but the company's heralded innovation is its ready-to-wear, battery-powered robot, Ekso GT™, a gait training exoskeleton used by individuals with various levels of paralysis or hemiparesis due to neurological conditions such as stroke, spinal cord injury or disease, traumatic brain injury and more.

In 2012, the company shipped the first commercialized robotic exoskeleton for use in rehabilitative and medical facilities to Craig Hospital in Englewood, Colo. At the end of that year, the robotic device, called Ekso, helped individuals take more than 1 million steps that would not otherwise have been possible. Today that number is six million.

In 2010, Ekso Bionics made Time magazine's list of the 50 best inventions. In February 2014, Medical Device & Diagnostic Industry Magazine named Ekso Bionics as one of five startups poised to change medical technology forever.





Advocates for ‘orphans’

Prevalent disorders such as cancer and heart disease attract the bulk of research dollars and attention. Fortunately there are scientists, like UC San Diego’s Ranjan Dohil and Jerry Schneider, who are champions for people with rare diseases, which the FDA refers to as “orphans.”

Dohil and Schneider sought a therapy for cystinosis, a rare genetic disorder that affects some 500 people in the U.S. Fatal if not treated early in childhood, the disease is caused by an inability to metabolize an amino acid, called cystine, in a body’s cells. Cystine is toxic when it accumulates, damaging cells and causing the body to lose important nutrients. It leads to slow body growth, weak bones, kidney failure and, ultimately, early death.

The original drug for the disease, however, was difficult to stomach—particularly for babies. It caused such severe side effects, like vomiting and nausea, that many patients quit taking it. The UC San Diego team designed a process to coat the drug, allowing it to bypass the stomach and be absorbed in the small intestine. It then could be administered every 12 hours instead of the six hours prescribed for the previous drug.

Raptor Pharmaceutical Corp, based in Novato, acquired the license to Dohil’s and Schneider’s innovation, to march it to commercialization. It even made the drug more user-friendly for parents, who could open the capsule and sprinkle it on their young children’s food.

Drug development benefited from the Orphan Drug Act, which encourages companies to develop treatments for rare diseases by allowing special tax incentives and extended marketing exclusivity. In April 2013, the FDA approved Raptor’s drug, Procysbi, noting that it offered patients an important new treatment option.

In 2013—the same year that it was approved by the FDA—the drug for cystinosis, Procysbi, was 16th on the list of top-earning UC inventions, earning \$785,000 in royalty and fee income.

Getting under your skin

While research has produced a bevy of new drugs for a host of diseases, another challenge hovers: how to better deliver the therapies quickly and efficiently into the body.

Research at UCSF in the early 1990s bred a technology to unblock barriers just underneath the top layers of the skin so that sufficient doses of drugs can be absorbed into critical body tissue and blood vessels. The key to this technique is a genetically-engineered enzyme—recombinant human hyaluronidase (rHuPH20)—that dissolves a naturally occurring subcutaneous gel and opens microscopic passages for potential life-saving drugs.

The enzyme is the hallmark of San Diego-based Halozyme Therapeutics, co-founded in 1998 by former UCSF scientist Gregory Frost. Halozyme and its collaborators—which include Roche, Pfizer and Baxter—are developing drugs using rHuPH20 to attack disease.

In 2013, two products based on the rHuPH20 technology were approved by the European Medicines Agency. One product, Herceptin® SC, was launched in September in Europe by Roche. It is a subcutaneous formulation of the breast cancer drug Herceptin (trastuzumab) which utilizes Halozyme's rHuPH20. This new therapy is administered in two to five minutes, rather than 30 to 90 minutes with the standard intravenous form.

Halozyme also is advancing the technology to develop products to target cancer, diabetes and other diseases.

Programs launched in 2010 at UC's academic medical centers speed research to solve problems found at the frontlines of patient care. The UC Center for Health Quality and Innovation promotes, supports and nurtures innovations to improve quality, access and value in the delivery of health care. UC Biomedical Research Acceleration, Integration & Development (UC BRAID) accelerates biomedical research by linking clinical and translational research efforts throughout the UC health system.



All charts indicate systemwide figures, unless otherwise noted.

Inventions

Patents

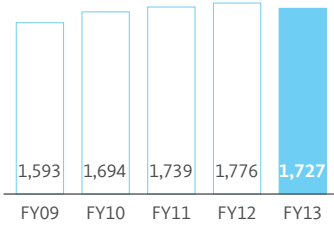
Licensing

Startups

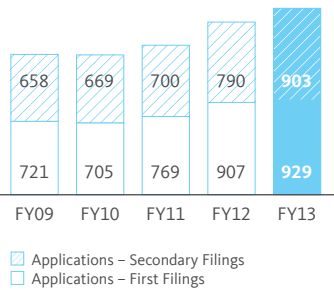
Royalty and fees

Top-earning inventions

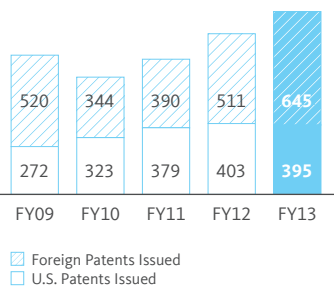
INVENTIONS DISCLOSED



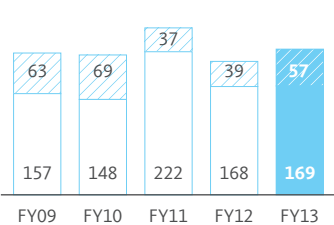
U.S. PATENT APPLICATIONS FILED



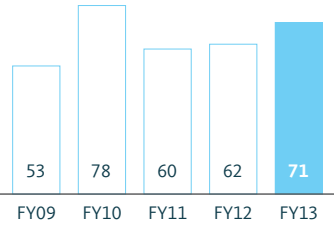
PATENTS ISSUED



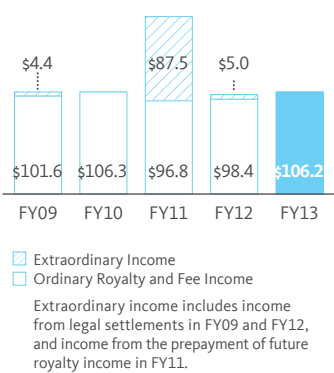
LICENSES ISSUED



STARTUP COMPANIES FORMED



ROYALTY AND FEE INCOME
(in millions)



TOTAL ACTIVE INVENTIONS

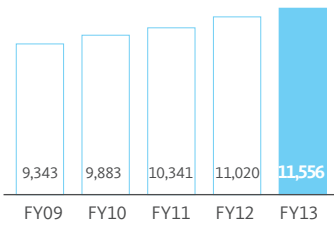


Figure does not include LBNL

TOTAL ACTIVE PATENTS

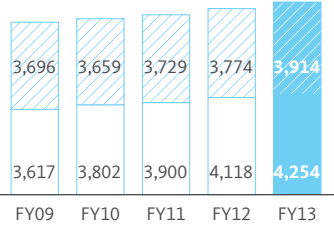
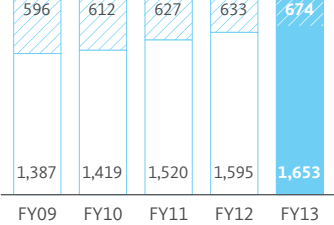
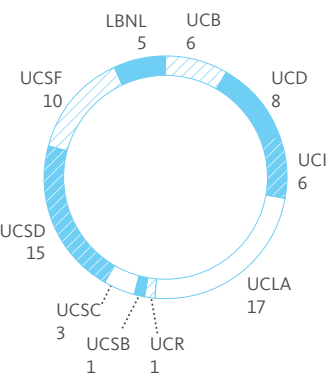


Figure does not include LBNL

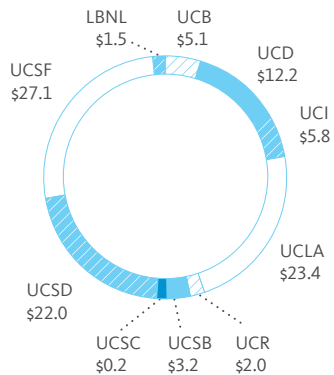
TOTAL ACTIVE LICENSES



STARTUP COMPANIES FORMED – BY CAMPUS, 2013



ROYALTY AND FEE INCOME – BY CAMPUS, 2013
(in millions)



1,727

New inventions disclosed by UC researchers in 2013

11,556

Active inventions in UC's portfolio in 2013

1,832

U.S. patent applications filed based on UC inventions in 2013

395

U.S. patents issued for UC inventions in 2013

4,254

Active U.S. patents covering UC inventions in 2013

169

New licenses for UC's utility inventions in 2013

57

New licenses for food plant cultivars in 2013

71

New startup companies formed in 2013 from UC inventions

719

Startups founded on UC patents since 1976

\$106M

Royalty and fee income to UC in 2013

INVENTIONS FY13 (Campus, Year Disclosed)

INVENTIONS FY13 (Campus, Year Disclosed)	ROYALTY & FEE INCOME (in thousands)
EGF Receptor Antibodies (UCSD, 1983)	\$12,971
Prostate Cancer Drug (UCLA, 2003, 2004, 2005, 2006 & 2007)	\$12,183
Hepatitis-B Vaccine (UCSF, 1979 & 1981)	\$11,569
Treatment of Intracranial Aneurysms (UCLA, 1989)	\$7,097
Bovine Growth Hormone (UCSF, 1980)	\$5,280
Subtotal (Top 5 Inventions)	\$49,100

Chromosome Painting (LLNL, 1985, 1989 & 1995)	\$3,619
Firefly Luciferase (UCSD, 1984)	\$3,238
Ablation Device for the Treatment of Atrial Fibrillation (UCSF, 1997 & 1998)	\$2,757
Detection of Mycoplasma (UCI, 1984)	\$2,434
Dynamic Skin Cooling Device (UCI, 1993)	\$2,381

Albion Strawberry (UCD, 2004)	\$2,124
Energy Transfer Primers (UCB, 1994)	\$1,969
San Andreas Strawberry (UCD, 2008)	\$1,722
Camarosa Strawberry (UCD, 1992)	\$1,530
Optical Network Switch (UCD, 1997)	\$1,146

Biodegradable Implant Coils (UCLA, 1998)	\$785
Nephropathic Cystinosis Treatment (UCSD, 2006)	\$765
Yeast Expression Vector (UCSF, 1982)	\$741
Universal Oligonucleotide Separator (UCB, 1996)	\$738
Golden Hills Pistachio (UCD, 2004)	\$731

Magnetic Resonance Imaging (UCSF, 1976)	\$706
Waveguide-Based Spatial Power Combining Array (UCSB, 1996)	\$706
Tango Mandarin (UCR, 2005)	\$693
Novel Phosphorous Fertilizers (UCR, 1990)	\$687
Ventana Strawberry (UCD, 2001)	\$604

Subtotal (Top 25 Inventions)	\$79,176
Total (All Inventions)	\$106,222
% of Total from Top 5 Inventions	46.2%
% of Total from Top 25 Inventions	74.5%

This list is limited to revenue-generating inventions that have been commercialized.

UC Technology Transfer Program–FY13

Summary Table

	UCB	UCD	UCI	UCLA	UCM	UCR	UCSB	UCSC	UCSD	UCSF	LBNL	UC System	% change from FY12
Inventions*													
Inventions Disclosed	164	206	128	359	11	61	97	44	351	205	146	1,727	-2.8%
Total Active Inventions	1,426	1,198	952	2,049	66	416	613	254	3,103	1,701	**	11,556**	4.9%
Patent Prosecution*													
Patent Applications Filed													
First US Filings	88	87	70	254	2	38	60	21	202	68	68	929	2.4%
Secondary US Filings	90	83	68	252	3	33	60	27	155	69	84	903	14.3%
Total US Patent Applications	178	170	138	506	5	71	120	48	357	137	152	1,832	8.0%
First Foreign Filings	39	44	23	122	4	12	27	23	72	48	29	429	10.3%
Patents Issued													
U.S. Patents Issued	48	22	40	95	1	7	43	4	62	35	42	395	-2.0%
Total Active U.S. Patents	696	391	365	748	4	113	442	89	816	653	**	4,254**	3.3%
Foreign Patents Issued	56	60	57	100	1	20	28	2	177	130	20	645	26.2%
Total Active Foreign Patents	553	433	334	713	2	144	110	29	836	779	**	3,914**	3.7%
Licensing*													
Letters of Intent (LOI) Issued	14	22	16	48	0	3	4	0	34	20	0	154	18.5%
Options Issued	7	4	8	12	1	2	2	3	2	2	4	47	23.7%
Total Active Options	48	10	11	27	1	11	8	3	2	13	8	137	-0.7%
Utility Licenses Issued	20	18	7	31	0	3	9	3	47	28	9	169	0.6%
Total Active Utility Licenses	323	152	94	262	2	41	61	20	339	360	77	1,653	3.6%
Plant Licenses Issued	0	46	0	0	0	16	0	0	0	0	0	57	46.2%
Total Active Plant Licenses	0	503	0	0	0	204	0	0	0	0	0	674	6.5%
Startup Companies													
Startup Companies Formed	6	8	6	17	0	1	1	3	15	10	5	71	14.5%
Royalty & Fee Income*** (in thousands)													
Running Royalties	\$2,320	\$9,157	\$2,222	\$14,315	\$19	\$1,708	\$1,090	\$3	\$16,880	\$18,623	**	\$69,824**	n.a.
Equity Income	\$0	\$0	\$0	\$5	\$0	\$0	\$2	\$0	\$312	\$0	**	\$319**	n.a.
Other Royalty and Fee Income	\$2,754	\$3,085	\$3,591	\$9,103	\$0	\$259	\$2,157	\$169	\$4,774	\$8,474	**	\$34,365**	n.a.
Total Royalty & Fee Income	\$5,074	\$12,241	\$5,813	\$23,423	\$19	\$1,967	\$3,249	\$171	\$21,966	\$27,097	\$1,490	\$106,222	2.7%
Distributions (in thousands)													
Inventor Shares Distributed	\$1,551	\$4,686	\$2,433	\$7,187	\$50	\$1,039	\$1,135	\$41	\$6,167	\$12,234	\$541	\$38,607	-16.8%

This table only reports technology transfer activity governed by the UC Patent Policy for inventions managed by all UC technology transfer offices, including LBNL. It does not include copyright and material transfer agreement activity that is also carried out by the campus and laboratory offices.

* Technology transfer activity related to inventions having one more inventors at each campus/lab. A number of inventions involve inventors from multiple UC campuses and/or LBNL. Technology transfer activity statistics for these inventions are reported multiple times, once for each campus/lab involved. Thus, for any given measure of activity, the sum of individual campus numbers may be greater than the systemwide totals reported in the right-hand column.

** These statistics are not available for LBNL-managed inventions, and are excluded from systemwide totals.

*** Financial activity related to inventions having one or more inventors at each campus/lab. A number of inventions involve inventors from multiple UC campuses and/or LBNL. Financial activity statistics for these inventions are pro-rated among the campuses and LBNL according to the number of inventors each campus/lab has. Since some financial activity reported here is credited to UC inventors who are not associated with a campus or with LBNL (including staff at other DOE laboratories), the sum of individual campus numbers may not equal the systemwide totals reported in the right-hand column.

UC Technology Transfer and Websites

Available Technologies	Website
Systemwide	techtransfer.universityofcalifornia.edu
Technology Transfer Offices	Websites
UC Office of the President Innovation Alliances and Services (IAS)	ucop.edu/innovation-alliances-services
UC Berkeley (UCB) Office of Intellectual Property & Industrial Research Alliances (IPIRA)	ipira.berkeley.edu
UC Davis (UCD) UC Davis InnovationAccess	research.ucdavis.edu/u/s/ia
UC Irvine (UCI) Office of Technology Alliances (OTA)	ota.uci.edu
UC Los Angeles (UCLA) Office of Intellectual Property & Industry Sponsored Research (OIP-ISR)	oip.ucla.edu
UC Merced (UCM) Office of Technology Transfer (OTT)	ott.ucmerced.edu
UC Riverside (UCR) Office of Technology Commercialization (OTC)	ora.ucr.edu/otc.aspx
UC Santa Barbara (UCSB) Office of Technology & Industry Alliances (TIA)	tia.ucsb.edu
UC Santa Cruz (UCSC) Office for Management of Intellectual Property (OMIP)	officeofresearch.ucsc.edu/omip
UC San Diego (UCSD) Technology Transfer Office (TTO)	invent.ucsd.edu
UC San Francisco (UCSF) Innovation, Technology & Alliances (ITA)	ita.ucsf.edu
Lawrence Berkeley National Laboratory (LBNL) Technology Transfer and Intellectual Property Management (TTIPM)	lbl.gov/Tech-Transfer

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