

# Chapter 6

## Fostering Technology Transfer, Innovation, and Entrepreneurship from the Perspective of a Public University

Benjamin Chu

**Abstract** The goal of a technology transfer office should be to encourage technology transfer, innovation, and entrepreneurship. For a public university, those goals must also be aligned with the university's mission as a teaching and research institution. This chapter describes some of the activities in the University of California system and at the University of California, Los Angeles campus in fostering technology transfer, innovation, and entrepreneurship in support of research, education, and public service. These include a new proof-of-concept fund, an on-campus incubator, and a growing student internship program.

### 1 Technology Transfer from a Public Research Institution

The University of California (UC) system comprises ten campuses (Berkeley, Davis, Irvine, Los Angeles, Merced, Riverside, San Diego, San Francisco, Santa Barbara, and Santa Cruz) which include more than 234,000 students, more than 207,000 faculty and staff, 50,000 retirees, and more than 1.6 million living alumni. As a public institution of the State of California, the UC is committed to teaching, research, and public service as its core mission. Whereas each campus and its technology transfer office have their own specifically defined mission statements, a theme central to all the campuses and technology transfer offices is to not only maintain the UC's core mission in its technology transfer practices, but to actively complement the core mission through technology transfer.

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B. Chu (✉)

University of California Los Angeles, Office of Intellectual Property and Industry  
Sponsored Research, 11000 Kinross Ave. Suite 200, Los Angeles, CA 90095, USA  
e-mail: bchu@research.ucla.edu

With a portfolio of 10,341 active inventions, 1,581 new inventions reported, 343 issued U.S. patents, and 1,285 total U.S. patent applications filed in fiscal year 2011, the UC system is highly prolific in its innovative discoveries and patenting. With 58 new startup companies formed (44 based in California), 217 new utility licenses issued, and over \$200,000,000 in licensing income, the UC has certainly found success in translating technologies to the marketplace [1]. In fiscal year 2011 the University of California, Los Angeles (UCLA), received 379 invention disclosures, 47 issued U.S. patents, 52 new license and option agreements, and over \$21,000,000 in licensing income [2]. In addition, 19 new startups were formed. As part of a public research institution, however, a technology transfer office should have goals beyond financial metrics by contributing to the broader research, education, and public service missions of the university.

## **2 Fostering Technology Transfer**

A technology transfer office is often in the delicate position of balancing many competing interests and cultures. For the UCLA Office of Intellectual Property and Industry Sponsored Research (OIP-ISR), stakeholders include faculty, staff and students; licensees, industry sponsors, and investors; and federal sponsors and the people of California. The most obvious example of balancing interests would be the relationship with industry, which is motivated by profit, and the university, which is in the business of fundamental research. A successful technology transfer office must find middle ground where the interests of all its stakeholders are represented. In doing so, it must find ways to become a vehicle to encourage collaboration.

### ***2.1 Public-Private Partnerships***

Licensing deals and revenue is one mechanism by which to measure the performance of a technology transfer office, but that should not cause it to lose sight of its ability to plant the seeds of technology transfer through other means of public-private partnerships. Research collaborations beginning at the grassroots level often grow into mutually beneficial relationships. Often it begins from a scientist or engineer at the university who shares a common intellectual interest with a scientist or engineer from a company. What can a technology transfer office do to encourage these relationships?

The obvious role a technology transfer office plays is in facilitating industry-sponsored research. In fiscal year 2012, the UCLA OIP-ISR executed 483 total agreements with 226 funded industry-sponsored research agreements, totaling USD 35,465,718. As universities generally conduct early stage research, they are in many instances working on high-risk projects that may be many years from finding a place in a commercial product. Despite the high-risk nature of early stage university

research, these projects hold appeal to companies that are looking toward the future and potential new products or disruptive technologies. Industry-sponsored research allows a company to leverage university expertise which may not exist within the company, university facilities, and the creativity and energy of faculty and students to explore research interests that coincide with the company's long-term business vision. Conversely, industry-sponsored research helps to support faculty, postdoctoral scholars, and students to continue to pursue their research curiosity beyond basic science and research (generally limited by federal research grants), and to direct their research toward applications which may one day benefit the public. On truly collaborative projects, expertise on both sides of the aisle can be leveraged. For instance, industry scientists or engineers with manufacturing expertise can provide insight and feedback to university researchers to better understand how university discoveries will respond and react outside of the laboratory and in real life conditions. A technology transfer office that not only helps facilitate such collaborations, but also proactively seeks to bridge these connections by identifying interesting research projects for industry or identifying potential partners for university researchers, plants the seeds for downstream licensing relationships.

### **2.1.1 Bridging the Gap**

University research is generally a high-risk, high-reward endeavor because research projects are at an early stage, yet are focused on breakthrough discoveries. Unfortunately, there is a gap between where federal funding leaves off and where industry, venture capitalists, or corporate investors are ready to partner up. Before a company is ready to invest in an unproven technology, researchers must demonstrate some level of feasibility before a company will be willing to take on the risk associated with an early stage technology. A technology that could potentially attract millions of dollars in investment may never reach that point unless the risk associated with the technology is reduced. It may take as little as \$100,000 to demonstrate a proof of concept, but so called "gap funds" or "proof-of-concept funds" are in short supply.

In 2011, the UC Office of the President initiated a new grant program called the Proof of Concept Commercialization Gap Grants (PoC Program) to bridge the gap between research and commercialization. The PoC Program supports 1-year projects which are on the brink of commercialization or licensing but have a clearly defined hurdle between research and commercialization. Research projects must address that hurdle. The goal is that by closing this gap to commercialization, the PoC Program will accelerate commercialization of technology and intellectual property owned by the UC by positioning the technology for licensing or leading to the development of a startup. Ultimately, the PoC Program plays into the public service mission of the UC by attracting investment, creating jobs, and translating discoveries from the UC's laboratories into commercial products and services to benefit the public and stimulate California's technology-based economy.

The PoC Program is open to all fields of research, but the intellectual property used in any project must be disclosed to the technology transfer office of the associated campus. Furthermore, the intellectual property must be assigned to the UC and be available for licensing. In this sense, a company should not leverage UC funds for a technology that is presently ready for investment. Rather, the technology must be unencumbered from any license agreements, sponsored research, or investment partners. Additionally, basic research or theoretical developments are not eligible for funding. Projects which may receive PoC funding include prototype development, commercial feasibility tests, research to demonstrate risk mitigation to potential licensees, or research to address a specific hurdle identified by industry as a barrier to attract capital. In their proposals, applicants must describe a clear path to commercial development, the market potential of the technology, and how the gap fund would lower the barrier to commercialization. Projects are reviewed mainly on their commercialization potential, meaning they must demonstrate research success and a specific deliverable, such as a demonstration, test result, or prototype, where achievement of such deliverable has the potential to result in the technology's being licensed to an established company or serve as the foundation of a startup company. Additional review criteria include: (1) exceptionality of the project as demonstrated by an innovative, well-conceived project; (2) qualifications of the personnel involved in the project; (3) resources, facilities, and infrastructure available to the researchers; and (4) benefit to California through economic development (attracting capital, investments, creating companies, and creating jobs) or by identifying new solutions to problems critical to California. Reviewers consist of both scientific peers and private investors. This enables the technologies to be evaluated on their technical merit as well as their commercial potential.

If awarded, recipients receive a one-time grant of up to \$250,000. In its first round of funding, the PoC Program awarded 13 projects across the UC campuses in areas ranging from water purification to medical devices. Amounts awarded were between \$100,000 and \$250,000, totaling \$2.7 million. UCLA received three such awards for the following projects: "In Vitro Diagnostic Sensors for Cardiovascular Disease," "Continuous Process for High Recovery Inland Desalination," and "Soft Error Mitigation for FPGA Based Systems." The UC PoC Program is a valuable program and hopefully the number of projects funded at UCLA in future PoC rounds can be increased.

### **3 Fostering Entrepreneurship**

Over the past 5 years, 99 new startups were formed around UCLA technologies. Often startup companies bear the risk of early stage university technologies. Encouraging entrepreneurship can thus help bridge the gap between the laboratory and the marketplace. A number of initiatives at UCLA have had a positive impact on the recent uptick in entrepreneurship. These range from establishing an on-campus incubator; leveraging on-campus synergies with other departments, student

groups, and the schools of law and business; establishing off-campus regional partnerships; and educational outreach.

### ***3.1 UCLA's On-Campus Incubator***

In 2009 UCLA launched the California NanoSystems Institute (CNSI) Technology Incubator to address a glaring need for affordable and accessible incubator space in a city notorious for high rents and long commute times. Perhaps one of the most difficult tasks facing UCLA's entrepreneurial faculty, staff, and students was finding physical space easily accessible from campus and affordable considering a startup company would need to manage its cash flow very carefully. Years in the making, the CNSI Technology Incubator was established to address this hurdle to commercializing UCLA technologies. It was housed in the CNSI building, which opened in 2007 as a state-of-the-art building equipped with a 260-seat theater, wet and dry laboratories, Class 100 and Class 1000 clean rooms, and eight core facilities housing electron microscopes, atomic force microscopes, X-ray diffraction microscopes, specialized optical microscopes, and high-throughput robotics for molecular screening. The CNSI Technology Incubator provides 2,000 square feet of laboratory space for startup companies that have licensed UCLA technologies.

The flexible laboratory space dedicated to company and technology incubation can hold up to ten companies. Each company gets two benches as well as access to dry and wet labs, fume hoods, and six of the core lab facilities. This access includes time on highly specialized imaging equipment such as fluorescence imaging; electron microscopy; scanning probe microscopy; atomic force microscopy; in-house expertise and training in high-throughput screening, drug discovery, and functional genomics; and access to the foundry and clean rooms. Access to the clean rooms and core facilities is on a charge basis, but eliminates the need for a bootstrapped startup company to go out and purchase capital-intensive equipment. Furthermore, despite being located physically on campus, the incubator space is designated as company space. Intellectual property developed using the incubator facilities by company employees will belong to the company, so long as university employees are not inventors. Another critically important advantage that the CNSI Technology Incubator provides is that because the incubator space leased to companies is considered company space and not university space, companies are able to apply for Small Business Innovative Research (SBIR) grants, which often require that the applicant have a dedicated company space that is not one's residence or university laboratory. The CNSI Technology Incubator is critical to opening up avenues to companies that were previously unavailable: proximity, affordable rent, access to prohibitively expensive laboratory facilities and equipment, and access to additional funding sources through SBIR grants. By making it more attractive for companies licensing UCLA technologies to stay close to UCLA, the hope is that as these companies mature, they will remain in the area thereby providing economic development and jobs to the local economy.

### 3.2 *On-Campus Synergies*

UCLA is in the fortunate position to have not only highly reputed engineering and medical schools, but also highly regarded business and law schools, in addition to a vibrant student community that proactively seeks collaborative projects across engineering, life sciences, law, and business. As is often the case with a technology transfer office, staffing levels cannot keep up with the volume of technologies coming through the door. This is where the UCLA OIP-ISR has been very fortunate to leverage the expertise from UCLA's Anderson School of Management, the UCLA School of Law, the School of Engineering's Institute for Technology Advancement, the UCLA Business of Science Center, and the Tech Coast Angels mentoring program.

The Technology and Innovation Partners (TIP) Program, offered by UCLA's Anderson School of Management in partnership with the OIP-ISR, the CNSI Incubator, the Institute for Technology Advancement, the UCLA School of Law, and the UCLA School of Medicine, is an educational program for students pursuing a Master's in Business Administration. It utilizes UCLA technologies for project-based learning. Over the course of a year, participants evaluate technologies by conducting technical and legal feasibility analyses, market feasibility, and financial feasibility. In these studies, participants try to answer some of the following questions: (1) What is the product, and what problem does it solve? (2) Who are the potential customers? (3) Which segment will use the product? (4) What is the total addressable market? (5) Why will the targeted customer use the product? In addition, a final report covers an intellectual property analysis. This involves potential prior art and freedom to operate, a high-level competitive analysis, and a developmental timeline with milestones and funding requirements. Participants take classes from both the business school and law school and work in interdisciplinary teams on real-life projects that involve UCLA-affiliated technologies. To encourage an interdisciplinary team, enrollment is open to students from the Anderson School of Management, the School of Law, and other graduate programs, generally from the medical school, engineering, or sciences. The goal is to provide a project-based educational experience that will also help accelerate entrepreneurship and commercialization at UCLA. Additionally, the researchers whose project is being evaluated gain valuable insights into the commercializability of their technologies. They often find themselves equally invested into a feasibility study with the interdisciplinary team of students.

What began as a seminar in 2003 by Professor Roy Doumani eventually evolved into a class, "The Business of Science: Exploring Entrepreneurship," offered through the Department of Molecular and Medical Pharmacology every year since 2004. The goal of the class is to expose graduate students and postdoctoral researchers to the business world, to understand how to move science from the bench to the marketplace, and to introduce academic researchers to the nuts and bolts of business. In addition, the class introduces UCLA's researchers to think beyond research careers in the laboratory and provides them with a tool set to prepare them for a career in

private industry should they choose to leave academia. The class became such a success that the Business of Science Center was established with a mission “to prepare scientific, engineering, law, medical, and business graduate students for careers in the private sector; to assist university faculty and clinicians in technology transfer; and to serve as a catalyst for increased industry support and involvement on campus.” The UCLA OIP-ISR has partnered with the Business of Science Center to provide UCLA technologies for Business of Science students to evaluate. The projects give students hands-on experience in analysis of patent rights, market analysis, business plan development, and understanding how to position a technology for investment.

Beginning with its first call for proposals in 2011, the Venture Competition offered by the Business of Science Center is another program at UCLA that helps their researchers and entrepreneurs move their technologies to the marketplace. Students, faculty, staff, and clinicians from the sciences, engineering, and business are encouraged to submit descriptions of innovative medical technologies. The technologies must be disclosed to the UCLA OIP-ISR and have, at a minimum, a provisional patent application filed. The technologies are screened and finalists are paired with a venture team consisting of PhD students, MBA students, postdoctoral researchers, and industry mentors. The venture team then provides a commercial assessment of the technology and presents their findings to a screening panel consisting of investors and industry executives to compete for a proof-of-concept grant and a chance to make a pitch at the Southern California Biomedical Council (SoCalBio) Annual Investors Conference. Two winning teams were chosen in the inaugural Venture Competition in 2011 and received \$20,000 each in proof-of-concept funding.

### ***3.3 Looking Outside: Regional Partnerships***

For an entrepreneurial ecosystem to coalesce, a region needs to have investment capital, human capital, and innovative ideas. Los Angeles has no shortage of any of these. Most importantly, it has within its borders three renowned research institutions: UCLA, the California Institute of Technology (Caltech), and the University of Southern California (USC). In 2007 the three universities, in partnership with Entreetech, a nonprofit organization that provides day-to-day support for new startups, joined forces for the inaugural “First Look LA” event. This event was designed to showcase each university’s most promising technologies and emerging startup opportunities to the investment community. Hosted by USC in the inaugural year, the event has been alternating among the campuses in each subsequent year and showcases technologies along two tracks: physical sciences and life sciences. The First Look LA event brings together university researchers and entrepreneurs with venture capitalists, angel investors, and potential CEOs. The technologies showcased by the universities feature some of the universities’ most promising opportunities



that have never before been seen by investors. A short presentation by the researchers is followed by a question and answer period to allow investors a chance to better understand the technology and future plans, and for the researchers to understand what hurdles to commercialization they may face. Even if the presentations do not lead to a direct investment, the investment community will see what is coming down the university pipeline, hopefully planting the seeds of future investments.

Partnering with the City of Los Angeles is another way for UCLA to enable entrepreneurship and economic development, and embed itself within the surrounding community. One such example is Clean Tech Los Angeles. Clean Tech LA is a collaborative effort to bring together Los Angeles's premier academic institutions, business community, and the city to make Los Angeles a leader and a hub of clean technology research, incubation, new companies, and jobs by working together to support new research endeavors, apply for federal grants, and promote economic development. Clean Tech LA involves UCLA, Caltech, and USC as academic partners; the Los Angeles Department of Water and Power, the Community Redevelopment Agency, the Mayor's Office, and the Port of LA as government partners; and the LA Business Council, LA Economic Development Corporation, and LA Area Chamber of Commerce as business partners. Part of Mayor Antonio Villaraigosa's vision of Los Angeles as a clean tech hub is the establishment of the Clean Tech Corridor, a 4-mile stretch along the Los Angeles River in downtown Los Angeles to incubate clean technology startups and support a business cluster dedicated to clean technology manufacturing. Through regional partnerships, a strong and motivated team with aligned interests can come together to accelerate the development and adoption of early stage university technologies. For example, in 2009 the federal Department of Energy awarded a \$60-million stimulus grant to the Los Angeles Department of Water and Power, in partnership with UCLA, Caltech, and USC, to modernize its aging electrical grid and develop a "smart grid" [3]. The smart grid project at UCLA, led by Dr Rajit Gadh, utilizes wireless sensors to create complex smart power meters that can be layered on top of the existing grid to make the grid compatible with renewable energy sources, respond and adjust to demand and minute-by-minute energy fluctuations, create smart climate-control systems, and switch among various energy sources depending on energy demand, availability, and pricing. Having a partner such as the Los Angeles Department of Water and Power is critical to demonstrating real-time and real-world testing and applicability of the UCLA technology.

### ***3.4 Educational Outreach***

A central component to fostering entrepreneurship is to nurture an entrepreneurial culture at UCLA. This often begins by getting students, staff, and faculty thinking about intellectual property and business. The most basic component of the UCLA OIP-ISR's educational mission is to help the UCLA community understand how to



protect their intellectual property. This is done with informal presentations to the laboratories, guest lectures and seminar sessions, and speaking engagements at events on campus. For many researchers and first-time inventors, the patenting process is a very foreign experience. Through its outreach efforts, the UCLA OIP-ISR hopes to help researchers understand what is patentable material, how to work with the OIP-ISR office to apply for patents, what constitutes a public disclosure, and how to protect their intellectual property.

More advanced topics such as business development, company incorporation, or specific topics on intellectual property law are offered as focused seminars in conjunction with invited experts from patent law firms, venture capital firms, or angel investors. For example, the UCLA OIP-ISR, with invited speakers from patent law firms, has sponsored seminars on select topics such as patenting small-molecule therapeutics, proper drafting of the written description and enablement requirement, and the ramifications of intellectual property case law, such as *Mayo v. Prometheus*. As another example, the CNSI Incubator, with support from the OIP-ISR, sponsored a “Managing Invention Seminar Series” with topics such as “Patents 101: record-keeping/notebooks and inventorship determination,” “UCLA technology transfer basics,” “Licensing to start ups: a step by step review of the process,” “Forming a startup around a UCLA invention: resources, guides, and tips,” “Building a sturdy foundation—startup corporate structure,” “Early stage founder positioning,” and “Venture capital and university based startups.”

Finally, the UCLA OIP-ISR offers internships and a Technology Assessment Fellows Program to graduate students for an immersive, hands-on experience in intellectual property and technology transfer. The internship program provides graduate students an opportunity to gain exposure to the university technology commercialization process, intellectual property management, marketing, and business development through interactions with licensing officers in the OIP-ISR, faculty inventors, outside legal counsel, and potential investors. Special projects are also assigned to the students. Traditionally, interns have been doctoral candidates in engineering and science, but the pool of interns has also included graduate students from the business school and law school. In these cases, the special projects might be tailored to their interests. For example, interns from the law school might focus on projects closely associated with patent prosecution, such as learning how to perform prior art searches with feature comparison charts. They also might receive training on analyzing, characterizing, and summarizing office actions from the patent office. The OIP-ISR has generally focused on having a larger class of interns during the summer months, although often the interns will continue on projects throughout the school year, but with more limited hours.

The Technology Assessment Fellows Program began in the summer of 2012 and focuses on providing students with experience in technology evaluation. Fellows are assigned projects on an as-needed basis to assess the commercial viability of new inventions, identify potential licensees or investors, develop marketing materials, generate business plans, conduct competitive analysis, and

analyze the patent landscape. Whereas students in the internship program work within the office, the fellows program is a remote-based program to allow fellows to log in remotely and perform their assessments on their own time. The technology assessment report has a summary of the background of the invention, what the innovation is, potential applications, development to date, a summary of the market overview and market size, the competition, key commercialization challenges, relevant patents and publications, and finally a short marketing summary of the technology. The goal is to be able to hand the researchers a technology assessment report so that they can have a better understanding of the applications, market size, and commercial feasibility of their technology, and to get them thinking about aspects of their research that they may otherwise have not emphasized. In return, fellows gain professional experience on the business side of science. Should they choose to transition out of the laboratory, their experience from the Technology Assessment Fellows Program will also help prepare them for their own entrepreneurial endeavors or careers in consulting, business development, law, or industry-related careers.

## 4 Future Goals

As many of the initiatives described in this chapter are in their infancy, the goal is to grow them slowly. Undoubtedly, learning what does and does not work can enable improvement of these initiatives. The on-campus incubator is currently limited regarding how many companies it can admit. Expanding the incubator is an eagerly sought goal, whether it be finding additional incubator space on campus, or building an incubator space close to campus. It is hoped to see the proof-of-concept fund expanded to fund additional projects with multiple calls for proposals throughout the year. An expanded proof-of-concept fund can spur technology transfer by reducing commercialization risks and making early stage technologies much more attractive to commercial partners and investors. The Technology Assessment Fellows Program accepted their first class of fellows in the summer of 2012, building excitement to expand this program in the future to admit more fellows, thereby providing opportunities to graduate students to work on technology commercialization and detailed feedback to the inventors. Ultimately, by supporting and improving these current initiatives, and continually exploring new initiatives, an environment of entrepreneurship and technology transfer can be fostered while simultaneously encouraging an education and public service benefit to the university and community.

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