

# Chapter 7

## Fostering Innovation for the Benefit of Society: Technology Licensing’s Role at Stanford

**Kirsten J. Leute**

**Abstract** Fostering innovation for the benefit of society is part of the mission of Stanford’s Office of Technology Licensing (OTL); “To promote the transfer of Stanford technology for society’s use and benefit while generating unrestricted income to support research and education.” Throughout Stanford’s history, researchers’ drive to innovate formed Stanford into the active and prominent academic institution that it is today. To help understand the role of Stanford’s OTL in this system, this chapter reviews OTL’s history, policies, and practices. We provide some attributes that help OTL be successful in transferring technologies that will benefit the public, as well as examples of how OTL works with startups to move the technologies out from Stanford into companies. These companies might then produce new products that will benefit the world.

### 1 Stanford’s Background

Stanford’s history is steeped in innovation. One of the people who seeded and formed our university’s ecosystem and surrounding environment is Frederick Terman, former Professor, Dean, and Provost of the university. Professor Terman had a long history with Stanford, having moved to the university when his father took a faculty position. Following in his father’s professorial footsteps, he eventually became a faculty member at Stanford in the Electrical Engineering Department.

Professor Terman realized that California did not have many jobs for engineering graduates, so he helped to provide and build opportunities for such jobs, including

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K.J. Leute (✉)

Stanford University Office of Technology Licensing, 1705 El Camino Real,  
Palo Alto, CA 94306, USA

e-mail: [kirsten.leute@stanford.edu](mailto:kirsten.leute@stanford.edu)

making Stanford and the surrounding area a premier place to be. First, he established the “steeple of excellence” practice whereby the university recruited leading professors, which in turn attracted the notice of other important and rising academics. Second, he encouraged and helped students and former students to start businesses. One of the more famous examples is that of David Packard and William Hewlett. Third, he supported the development of the area surrounding Stanford for industry. One area developed was the Stanford Industrial Park (now called the Stanford Research Park), a high-technology park on Stanford’s land.

Stanford is presently a medium-sized university with 1,934 faculty members and over 15,000 students. Of our \$4.1 billion budget, \$1.2 billion is for sponsored research. The vast majority of the sponsorship for research at Stanford comes from the federal government of the United States (for example, the National Institutes of Health and the National Science Foundation). It has an endowment of around \$16.5 billion and part of the investment return from the endowment is used to support Stanford’s operating expenses. Stanford has seven schools—Business, Earth Sciences, Education, Engineering, Humanities and Sciences, Law, and Medicine. The majority of inventions that Stanford’s Office of Technology Licensing (OTL) handles come from Engineering, Humanities and Sciences, and Medicine, although we do receive a few from the other schools as well.

There are many ways Stanford transfers its knowledge and innovations to the world. Intrinsically, the education of students who go on to other endeavors is one of the main ways this happens. The publications, seminars, and presentations that the students, faculty, and other researchers give disseminate their findings. Stanford also has a faculty consulting policy where faculty are allowed to consult outside of the university 1 day per week [1, 2], using their knowledge to help companies prosper. There is also, of course, the licensing of the intellectual property owned by the university, the focus of this chapter.

## 2 Office of Technology Licensing

The mission of Stanford’s OTL is to promote the transfer of Stanford’s technology for society’s use and benefit while generating unrestricted income to support research and education. We put a large emphasis on “society’s use and benefit.” We do not license our technologies simply to gain income. Our exclusive licenses all include diligence to make sure a technology is not shelved, and we can terminate licenses if a company is not being diligent. Our goal is to have the technology developed and people’s lives improved. Although the majority of technologies do not actually become products or services, we provide the chance for it to happen.

The types of technologies we handle include patents, copyrightable material (including software), and biological material, such as cell lines, antibodies, and transgenic mice. The typical life cycle of a technology is:

- (a) New technology created, often with support from government or other funding sources

- (b) The technology is disclosed to OTL
- (c) OTL makes the decision whether to pursue the invention, which may include starting the patent process
- (d) OTL markets the invention
- (e) A company is founded to license the technology (licensee), or possibly many companies are founded
- (f) Licensing of the technology
- (g) Monies come in to support further research and education at the university
- (h) The cycle continues

This is not a self-sustaining cycle, and we do not know of a university where it is. As mentioned previously, the current amounts for sponsored research at Stanford are \$1.2 billion. Last year, OTL brought in \$66.8 million. OTL licenses between 20% and 25% of the invention disclosures it receives.

### 3 Stanford's Inventions

Our office was started in 1970 (after the era of local startups such as Hewlett-Packard and Varian). From the early days we had a number of interesting technologies. One of the first was FM Sound Synthesis developed by John Chowning. The FM Sound Synthesis technology allowed digital synthesizers to make new and interesting sounds. Yamaha saw the opportunity with this technology and licensed it from Stanford. It was the beginning of a long relationship that has lasted well after the initial patent expired in 1995.

In 1974, two researchers published an article on a method for recombinant DNA cloning. The director of OTL at the time read about the research and contacted the Stanford researcher, Stanley Cohen, about pursuing patenting and commercialization of the technology. Eventually, this was done in cooperation with the University of California–San Francisco and its researcher, Herbert Boyer. Recombinant DNA went on to become a university licensing success story; it was licensed by over 400 companies, brought in over \$250 million in royalties, and was used in numerous products. These included human insulin, which was developed by Genentech, a company founded in part by Dr Boyer. The benefits to humans and animals around the world from recombinant DNA technology have been enormous.

We have had inventions that were used in the DSL standards, production of monoclonal antibody drugs, microarrays, and the original algorithm for Google. The majority of our licenses are in the biotechnology field (for example, in our 2010 fiscal year, we signed 71 licenses in the biomedical space and 18 in the physical sciences). Going by the number of inventions licensed over our history, we licensed more inventions in the physical sciences. Of the 1,445 invention disclosures that OTL licensed, 560 were solely from biomedicine, 713 solely from the physical sciences, and 172 from both the medical and physical sciences areas. Large sponsored research programs from the physical sciences account for much of this discrepancy.

For example, if just one particularly large program is removed from that list, the number of inventions licensed in the physical sciences drops to approximately the same number as our biomedical innovations.

This makes sense because in the biotechnology field large portfolio licenses are uncommon as typically only a few to several patents are associated with a product. In high tech, thousands of patents often cover a single product.

## 4 OTL by Numbers

In our first year of existence, OTL had 28 invention disclosures, signed 3 licenses, and brought in royalties of \$50,000. In FY2011 (our fiscal year ends on August 31), we received 504 invention disclosures, signed 101 licenses, and brought in \$66.8 million in royalties.

Working on all of these activities are 38 staff members, including our director; 20 associates and liaisons on the licensing side; 6 industrial contracts officers (handling sponsored research, material transfer agreements, collaborations, and other types of agreements from industry); a patent agent; a few accounting personnel; and IT, compliance, and administrative staff members.

When Stanford receives royalties (payments) from its licensing activities, the monies are distributed as follows:

- (a) OTL takes 15% off the top—these monies pay for our activities (e.g., salaries, rent, travel, computers, and IT services). Our patent expenses are not paid for from this amount, except in the case of write-offs. Instead, the patent expenses are originally paid for by the university general fund, which OTL repays if and when the invention is licensed.
- (b) After the 15%, we deduct any expenses remaining on the docket. Usually, these are the patent expenses.
- (c) The remainder is divided into thirds:
  - 1/3 to the inventors
  - 1/3 to the inventors' department(s)
  - 1/3 to the inventors' school(s)

Our default for the inventors' shares is to divide it equally between the inventors unless they agree and tell us otherwise. We do not make apportionment decisions because the inventors are the ones who know who did what work, but in general we think it is easiest and creates the least conflict when each inventor receives an equal share of the inventor royalties.

Figure 7.1 illustrates OTL's income over time. Typically, it takes 10–15 years for any significant revenue to return to the university on one of its inventions. Our office first broke even for a single fiscal year 10 years after its founding. We came out of the red completely in 1985. Much of the reason we became self-

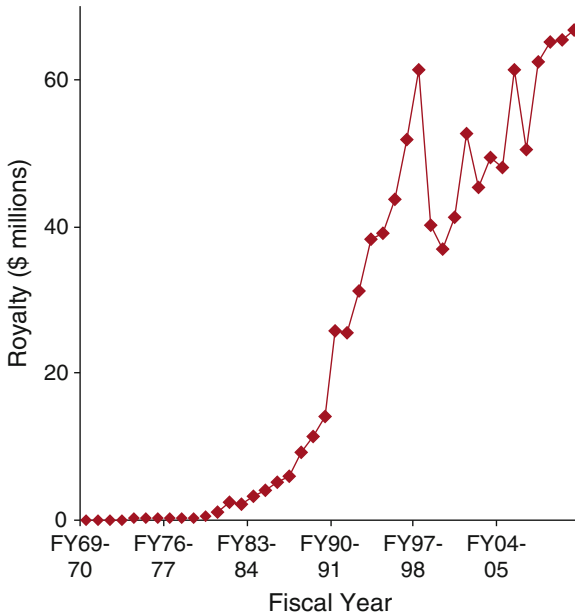
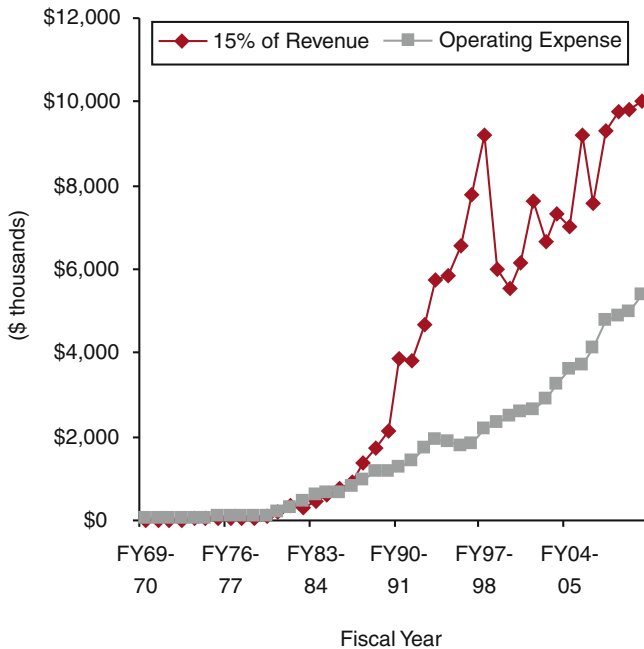


Fig. 7.1 Stanford’s income from royalties, fiscal years 1970–2011

sustaining is that a few technologies, particularly recombinant DNA technology and FM Sounds, were bringing in enough income to cover all of our office expenses (e.g., salaries, resources). Historically, Stanford’s Departments of Genetics and Medicine have been especially prolific in the technology development and licensing area.

Figure 7.1 shows hitting of our first revenue “cliff” in the late 1990s. This is when the Cohen–Boyer recombinant DNA cloning technology expired. We have since returned to the same levels, primarily because of a patent from Sherrie Morrison, Vernon Oi, and Leonard Herzenberg used in the production of monoclonal antibodies. That patent expires in 2015. In general, very few technologies bring in much income. At Stanford, we feel we have had three big technology transfer hits—recombinant DNA, Google, and functional antibodies—since our inception in 1970. This is out of the over 9,000 invention disclosures we have received. Naturally we hope our next big hit is already percolating among the more recent disclosures.

OTL remains self-sustaining from its 15% of gross revenue. Our operating budget in FY2011 was \$5.4 million. The left-over from the 15% after our budget is covered is returned to the university. Some of this has been used to help fund the Research Inventive Fund, which provides research funds across the university.



**Fig. 7.2** Stanford’s OTL’s income (15%) versus its operating expenses over time. The difference goes back to the university to support research and education

Monies have also been given to the Research & Graduate Fellowship Fund for graduate student fellowships at Stanford. Figure 7.2 shows the comparison of our budget versus the 15% over time.

For information on other universities’ statistics, the AUTM annual licensing surveys can be consulted [3].

## 5 Factors That Help OTL Succeed

A number of factors help OTL succeed in transferring technologies that will benefit society.

First, we try to be facilitators. Our job is part of a transition team for the technology to make its way from academia to industry. There are certain rules we need to follow (the Stanford policies and ethical practices), but we work within those guidelines to find solutions to shepherd technologies into their new homes for further growth. We try to avoid being a roadblock whenever possible.

As part of our role to foster innovation through technology licensing at Stanford, we belong to the Stanford Entrepreneurship Network (SEN) [4]. SEN brings together

many of the groups around campus that work with entrepreneurs and potential entrepreneurs. Once a year, the group puts together “eWeek,” a week spotlighting entrepreneurship around campus. Most members of SEN put on an event during the week that highlights the group’s focus. In 2012, OTL had an open house that displayed and discussed particular inventions.

Second, we strive to be reasonable in how we handle our technologies, including the financial terms of the licenses. We want a fair deal. If the company does well, then we do well.

Third, we try to “plant as many seeds as possible,” meaning we work on getting as many technologies out to industry or other developers as possible. Going back to the first point, we do not want to be a roadblock. We market all of our technologies to industry in the attempt to find a licensing partner. Still, our best leads for licensing are often through some sort of connection from our inventors. For quite a while now, we have been licensing around 20–25% of our invention disclosures. We think this is a good number considering the early stage of the technologies. Naturally we would like for it to be higher.

Fourth, we are fairly efficient. We have processes and license templates in place that we have worked on for decades. We do make changes to increase our productivity, including developing a core group of marketing people, continually updating our database, revising and improving our boilerplate agreements, and standardizing our option agreement terms and financials. When negotiating a license agreement, if we have not worked with the licensing party before, we let them know upfront which clauses we cannot change because of policies and guidelines. This can save everyone a lot of time trying to negotiate sections that do not have any wiggle room.

Startups in particular are sensitive to timing. If they have an eager investor, a startup may need to react quickly to mirror the enthusiasm of the investor to the opportunity. We will work with startups and investors on their schedules whenever possible.

Fifth, we want our licenses to be the start or the continuation of a long-term relationship with the licensing company. Through the license, we are allowing access to a Stanford asset (a researcher’s “baby”) and having the company nurture it into the success we all hope it will be. Like a report card from a child, we want to be kept informed of its progress. If there are any issues, we want to know about them early and work with the company on those issues before they become immense problems. But if the asset needs to return to Stanford, it is good for us to know it is coming and to prepare for what Stanford will then do with the technology.

Under the licenses, Stanford not only asks for yearly progress reports, but that developmental milestones be met. If a company isn’t pursuing the technology, Stanford can terminate the agreement and find another partner to develop the technology. This is the option of last resort, but does need to remain an option because our mission is to have the technologies eventually benefit society. Our hope is that the partnership leads to repeat customers. Even if the first license doesn’t yield a commercial outcome, we aim for all parties—the university, the researchers, and the company—to view the experience positively.

Finally, we seek to create an innovative environment. Stanford makes OTL's job easier by having an atmosphere where people want to create and often are willing to work together. People here want to solve problems and want to see those solutions disseminated.

An example of this is Bio-X. Opened in 2003, the center houses faculty and researchers from various disciplines in open laboratories to work on problems in biology and medicine. For example, a floor of the building could have researchers from mechanical engineering, statistics, and microbiology. More than just providing space, the program offers some funding mechanisms, interdisciplinary education, and potential to work with industry.

Connections are key to getting almost anything off the ground. Many of the researchers and business people on campus are already well connected. Others simply ask their neighbors for help. If someone needs help with connections, whether for potential financing, partners, or space for their startup, we can direct them to resources.

Stanford also has many resources for education regarding creating new technologies and starting a new business. There are formal courses but also workshops, groups, and programs in these areas. Examples include the Stanford Bidesign Program, the Stanford Technology Ventures Program, and the Center for Entrepreneurial Studies.

The resources that help sustain and grow our innovative environment have increased over the years. Some have blossomed while others have faded away. A program that has become particularly strong is SPARK, "an innovative, cost-effective way to overcome the hurdles associated with translating academic discoveries into drugs or diagnostics that address real clinical needs [5]." SPARK was started by Stanford faculty member Daria Mochly-Rosen in response to the need she saw at Stanford after she started her own company.

The SPARK mission is twofold:

1. To help academicians overcome the obstacles involved in moving research innovations from bench to bedside; and
2. To educate faculty, postdoctoral fellows, and graduate students on the translational research process and path to clinical application so that development of promising discoveries becomes second nature within our institution.

SPARK provides funding to select projects to translate them from basic research to more advanced stages where industry is more likely to pursue them. They also educate, mentor, and advise the grantees and all other interested academicians on this translational research process. A recent *Nature Medicine* article noted that about half of SPARK's projects have been taken up by commercial companies, and that other institutions are looking at SPARK's model [6].

Another program at Stanford that offers small amounts of proof-of-concept funding is the birdseed program. The program offers up to \$25,000 in further funding for technologies that have already been disclosed to and marketed by our office, but that just need a bit of extra work to make them more attractive for licensing by industry.



## 6 Working with Startups

As a part of the innovation cycle, university technology transfer organizations work with startups. Many of the startups have inventor/research involvement, but some do not. For example, sometimes entrepreneurs-in-residence from local venture capital firms look around the university for opportunities to start their next business.

However, most Stanford startups do have some sort of inventor involvement. In these cases, conflict of interest issues are of primary concern. The university addresses these licensing conflict of interest issues by a multi-step process that often begins with a conflict of interest memo provided by OTL. In the memo, OTL describes the technology under consideration for license, the interested company, and some particulars of the potential license. The group reviewing the conflict then meets with the affected researcher and a plan is devised, if needed, on how the researcher's work with the company will be separate from the work occurring or to occur at Stanford. Of particular importance in this review is how any student might be affected by the researcher's relationship with the company. Once this plan is worked out, the conflict of interest review group contacts OTL on whether it can proceed with the license. The review group continues to maintain oversight of the potential conflicts.

When negotiating the license agreement, OTL will typically not negotiate with the inventor unless the inventor has left the university. The inventor is in a conflicted situation, and because the inventor receives partial remuneration from the licensing process, OTL asks that the company have a non-inventor negotiate the license.

Startups sometimes first take option agreements when licensing. These options usually last 6–12 months and are simple agreements that require little negotiation. During the option period, the startup is looking for money or may be doing some proof-of-concept experiments. For an exclusive option, the university is not allowed to license the technology to any other company. If the company succeeds in whatever it was trying to accomplish during the option period, it then “exercises” the option to begin negotiation of the full license agreement.

Some of the areas we look at closely when negotiation these licenses are:

1. Upfront payment—This is usually a combination of cash and equity. We often take equity in any startup to which we exclusively license a technology. How much equity Stanford receives is balanced against the other financial considerations in the license. Some startups are more flexible on equity than others, which often depends on their sources of capital.
2. Annual payments—Because startups are cash-poor, annual minimums may be lower in earlier years and ramp up over time and after certain milestones.
3. Diligence—Any exclusive license has diligence, but this can sometimes be a moving target, particularly with startups. We find solutions that work for our need for strong diligence and the company's changing business plan, taking into account vicissitudes of the economy. For example, we may agree to certain diligence over the first 5 years of the license agreement and then will reconvene in 5 years to determine the next set of milestones.

4. Milestone payments—Because the upfront and other early payments are usually low, we try to counterbalance some of this with somewhat higher payments, including product milestones, later in the development cycle.
5. Sublicensing—Many startups will sublicense the technology. For example, when licensing a therapeutic to a startup, the startup knows that it will not likely be able to take the potential product through clinical trials on its own and therefore will have to partner. The partnering often includes sublicensing. Depending on when the sublicensing occurs, OTL will receive some part of the remuneration received by the startup from the sublicensing partner. Often the amount is scaled down over time as the company invests more of its own effort and money into the technology.

When working with startups, as with any company, we want them to succeed. Their success is our success. Many startups are run by new entrepreneurs, so we try to help where possible. First, we understand that startups are cash-poor. We try to make our licenses affordable, but the startup needs to have some skin in the game and some ability to raise money. When working on our license agreement, we advise the startup where we can be flexible and where our policies do not allow us much, if any, wiggle room. Startups sometimes hire attorneys to assist them with their license negotiations. Although a good idea, sometimes the attorneys can be overly ambitious and cost the company a lot of money negotiating points that are insubstantial or non-negotiable. The startups sometimes need to differentiate an important point to pursue and where they can also be more flexible.

Second, we renegotiate more with startups than with other entities. As mentioned above, startups are ever evolving, sometimes even when they are past the true startup phase. We recognize that their needs and capabilities might change over time. Many times events occur that are not anticipated by the license. Our end goal remains the same—products that benefit society—so if that is being met, we can often work out a solution to the company’s concerns on the license.

## 7 Symbiosis

Professor Terman had a vision of “close ties between Stanford students and the emerging technology industries [7],” and the fostering of this vision helped create the Silicon Valley of today. Stanford continues to see this as a great symbiotic relationship. Stanford is bordered by Page Mill and Sand Hill roads, homes to venture capital firms, the Stanford Research Park, and attorney firms. Stanford provides education to students who go to work at local companies or start their own. Stanford researchers create revolutionizing innovations that might be part of those same companies.

This synergistic relationship goes beyond these areas as well, helping Stanford to sustain and improve its amazing capabilities. As noted by President John Hennessy in a recent Fortune online interview [8]:

...think of the most money you could have charged Hewlett and Packard for their little discovery that they took out and started a company with, think of the most money. Multiply by 100,000 times and you'll begin to get an idea of the scale of their philanthropy to the university over many years.

So, we believe in that symbiotic relationship, we believe that if we're good to people they'll give back, and we can make something that works, and we won't be inhibiting the flow of technology, which I think is a really crucial thing, because in the end that's our long term contribution to society.

Stanford strives to keep this mutually beneficial relationship functioning and energized. OTL is one element in a long equation of factors that may produce the next cancer therapeutic or alternative energy solution. The better each factor works and works together with the other factors, the greater the likelihood of a positive outcome.

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