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The University-Industry Interface at Stanford

by Katharine Ku, Director

The university-industry interface is exciting and yet complex. At Stanford, we are always looking for creative ways to establish closer ties with industry for Stanford's and industry's mutual benefit. Stanford's formal relationships with industry are on a continuum - beginning with corporate philanthropy, to Industrial Affiliates Programs, to sponsored research, to licensing...and more.

Each program offers its own special opportunities for a particular company and gives us flexibility in the way we interact with industry. Different industries/companies work with different sectors of the University for different reasons, all of which can be beneficial for both Stanford and the companies.

Industrial Affiliates Programs

Industrial Affiliate programs offer corporations a "window" into Stanford research, including facilitated access to faculty, staff and students.

Industrial Affiliates Programs

- Membership
- Window into Research
- Contact with Students
- 50 programs
- 380+ companies
- Approx. $15M per year generated by programs within the Schools (1997 figures):

Engineering (SOE)	*$8.4M*
Earth Sciences	*$4.5M*
Dean of Research (DOR)	*$1.7M*
Humanities& Sciences (H&S)	*$0.146M*
Medicine (SOM)	*$0.122M*

Because Industrial Affiliate programs are considered membership arrangements, intellectual property rights are not associated with such membership. Each program is intended to be self-support-

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OTL: By the Numbers

by Kirsten Leute

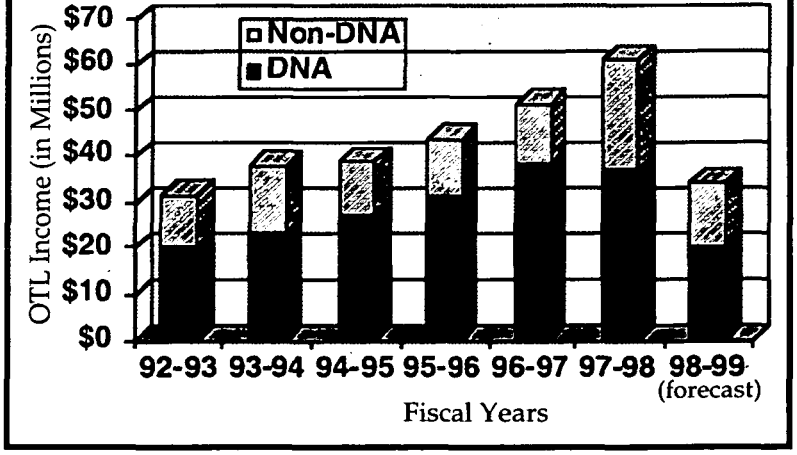
As many know, OTL completed one full licensing cycle of inventions disclosed in the 70's when the Cohen-Boyer Recombinant DNA Cloning (DNA) patents expired on December 2, 1997. The royalties from the DNA patent haven't quite followed suit yet, with 1997-98 being OTL's all time high, but OTL expects revenue income to be significantly lower in 1998-99.

So what does the past look like? And what do we expect for our future?

The Past

Figure 1 is a graph of the income received by OTL in the past six fiscal years, as well as a forecast for the 98-99 fiscal year. Note that the non-DNA income for 97-98 was a significant increase from the past several years due to a one-time equity cash out of almost $8 M. Since OTL's inception, the total income received by OTL is almost $410 Million, over $250 Million of which is attributable to the Cohen-Boyer technology.

Figure 1: OTL Royalty Income, Actual and Projected, 1992-1999



The number of different technologies that are producing income in any one year is steadily increasing, from 214 in 1992-93 to 298 in 1997-98. While it is typical to have minimum payments in exclusive licenses, OTL has made a concerted effort to negotiate maintenance payments for nonexclusive licenses as well, thus contributing to the increase in the number of technologies which produce income and improving license diligence of our licensees.

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Stanford University
Technology Transfer
Through Licensing
Office of Technology Licensing

STANFORD TECHNOLOGY BRAINSTORM

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Stanford Technology BRAINSTORM is published quarterly to provide information about OTL and general information of interest to the licensing community, both within and outside Stanford.

OTL's services are available to any Stanford faculty, students, or staff who invent technologies which may benefit the public or be of commercial value.

To learn about a specific technology or to disclose one of your own, contact us at the above address.

University-Industry Relations at Stanford

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ing and self-sufficient, with income being returned directly to the program. Altogether, the combined programs generate approximately $15M per year.

Industry Sponsored Research

When a company is looking for a solution to a specific problem and is interested in funding Stanford faculty and graduate students to do research in a particular area, a company will often enter into a sponsored research contract. Typically, the particular research has commercial relevance to the company. In funding a sponsored project, the company is interested in access to intellectual property which may result from the research, although there is no guarantee that any intellectual property will arise at all.

Industry Sponsored Research
- Specific research in area of interest
- Technical reports
- Intellectual property
- 300+ projects sponsored by 300+ different companies
- $24.3 M per year
  (based on expenditure reports, 1996-97)
  SOM- $14.7M (includes $7.7M in clinical trials)
  SOE- $5.7M (including SRC)
  DOR- $1.7M
  H&S- $0.6M
  Earth Sciences- $0.4M

The previous table shows that the departments within School of Engineering and School of Earth Sciences receive significant Industrial Affiliate income. In contrast, researchers in the School of Medicine and Engineering receive more Industrial Sponsored Research funding than the School of Earth Sciences

Technology Licensing

For licensing, a company is looking for intellectual property access to particular products for their pipeline. Typically, the company wants either freedom of action (and are willing to take a nonexclusive license) or a proprietary position (and want an exclusive license.) For most companies, the license represents a product-driven business decision, and an investment in a particular product rather than a research decision. In 1996-97, OTL's statistics show:
- 715 active licenses
- 400 companies
- $51.8M of which the Schools' shares were:

SOM	*$6.8M*
SOE	*$0.8M*
DOR	*$0.2M*
H&S	*$0.2M*
Earth Sciences	*$0.02M*

A Sampling of Licenses Granted by OTL in the Last Quarter

Docket(s)	Title(s)	Uses	Licensee(s)	License Type
S93-027	"Treatment with Nitric Oxide"	Gene Therapy	Megabios Corp.	Field Exclusive
S97-072	"GENSCAN"	Gene Identification	Genset Corp.	Non-exclusive
S97-096	"WIPE™"	Image Filtering	Rulespace	Non-exclusive
S98-015	"Genomic Integration Vector"	Gene Therapy	Tosk, Inc.	Exclusive
S98-059	"1D6 MAb & Human CD81"	Monoclonal Antibody	Serotec	Non-exclusive

In licensing, the royalty income to the Schools is almost opposite the revenue distribution from Industrial Affiliate memberships.

Who Belongs to What?

Each of the three programs (Industrial Affiliates programs, Industrial Contracts and OTL) works with approximately 300-400 companies at any one time. It appears, however, that individual companies are selective in their interaction with Stanford to meet their particular needs. For example, one major semiconductor company is a member of 7 Industrial Affiliate Programs. They are sponsoring 2 research programs, but OTL does not have any licenses with this company.

Another example is a major local biotechnology company. This company is one of our biggest revenue generating licensees under the Cohen-Boyer license and has 7 other licenses with OTL. They have funded 2 sponsored research projects but are not an Industrial Affiliate member of any program.

A final example is a major defense contractor company. We have a significant sponsored project program and a substantial licensing program with them but they are not a member of any Industrial Affiliates programs.

With regard to licensing, "big" companies do not readily license technology from universities. OTL's traditionally active arena is life sciences and biotechnology because industry requires proprietary protection for long product development cycles. Another active area for OTL is the "start-up" arena; start-ups generally do not have the time or money to spend on Industrial Affiliate relations or even sponsored research. With Industrial Affiliates programs, it is clear that the biggest membership comes from Fortune 500 companies and physical science companies because the physical science companies have not traditionally relied on intellectual property for market protection. The physical science industry (e.g., semiconductor/electronics) keeps in touch with university research through Industrial Affiliates programs and can usually generate company-proprietary products on their own. Small companies are not a significant factor for Industrial Affiliates memberships because they are spending their resources on product development.

From a University perspective, should we be encouraging industry interaction in one area more than another? Probably not. The overriding consideration should be that a positive relationship between Stanford and a particular company be established.

The financial benefits to the "University" from Industrial Affiliates, sponsored research and technology licensing vary considerably by program. So, we at Stanford strive to work together so that we are not disadvantaging one program in favor of another.

- Industrial Affiliates income goes directly to the organization (typically department) which supports the Industrial Affiliates programs.
- Sponsored research dollars go partly to a research account under the control of the Principal Investigator and partly to the General Fund.
- Technology Licensing revenues go to the inventors, the Department, and the School.

Working Together

OTL and Industrial Affiliates

OTL has been working closely with the Center for Integrated Systems (CIS) and the Center for Telecommunications affiliates programs to make sure that all their members get a chance to review and license inventions that result in whole or in part from their membership funds. In the early days of the School of Medicine's **Spectrum** Industrial Affiliate program, OTL and **Spectrum** sponsored a meeting to highlight School of Medicine inventors and inventions.

Some have suggested OTL offer discounted licenses to Industrial Affiliate members. It is an idea worth considering, if it will attract membership. In order to do so, OTL needs to be able to:
1) value the license "before" it's discounted - and we don't always know that value!; and
2) discount without disadvantaging the inventors

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OTL: By the Numbers

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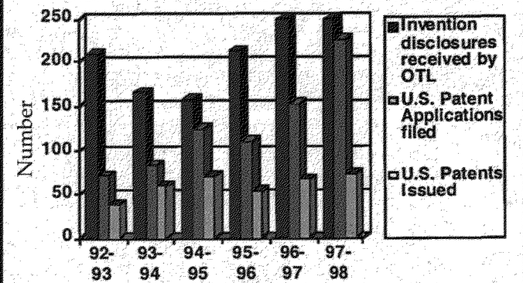
Invention disclosures received by OTL are also increasing, as shown in Figure 2. Since inception, OTL has evaluated over 3,600 inventions. As the number of disclosures increase, the patent applications filed are also rising. There is not a one-to-one correlation between invention disclosures and applications filed, or patent applications filed today and patents issuing tomorrow. There are many reasons behind this. First, for various reasons, we may sometimes delay filing an application, even up to a year or more. Second, the patent office has a large backlog of patents to process and applications are often taking three years, and sometimes longer, to issue. Thirdly, an invention may have more than one filing, but only one patent is issued. Lastly, OTL abandons applications if it turns out that the patent protection (e.g., narrow claims) is not worth the expense.

What's Stanford's share in the income received? Figure 3 shows the distributions to inventors, departments, schools, research incentive fund, and the OTL budget for the six previous fiscal years. OTL's budget has been fairly even while the other distributions rose.

Figure 2: Stanford's Invention Disclosures, U.S. Patents Filed and U.S. Patents Issued

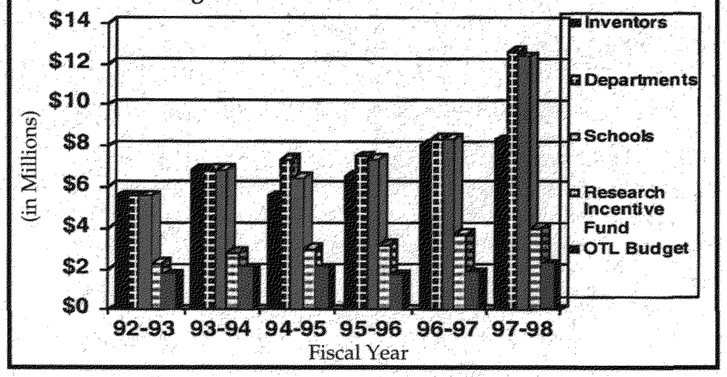


The Future

Although the income received by OTL will be significantly smaller in the next few years than in the past couple of years, we expect the non-DNA income to continue to rise. Entrepreneurial activity is stronger than ever, the number of invention disclosures is going up, and industry-university collaborations are seen as more essential by both parties (see article by Katharine Ku in this issue). All of these factors should lead to more licenses and greater dissemination of the technologies created at Stanford.

For a full copy of the Stanford OTL Five-Year Report, please contact Sandra Bradford at (650) 725-9037.

Figure 3: Distributions of OTL's income



Technology Spotlight: Immune System Adjuvant Helps Reverse Allergic Responses

Allergy shots can be painful, time consuming and expensive. With the help of a potent immune system adjuvant (a drug effectiveness enhancer), the efficacy of these shots may increase dramatically.

Researchers Rosemarie DeKruyff, PhD and Dale Umetsu, MD, PhD found that when *Listeria monocytogenes* is used as an adjuvant with allergy shots, the effectiveness of the allergy shots increased dramatically. In studies conducted with mice, ongoing allergic responses, that include production of high levels of IgE as well as symptoms of asthma, could be reversed dramatically with one or two injections of heat killed *Listeria* combined with the allergen. Normally, conventional allergy shot therapy requires 50-100 shots to be effective in alleviating allergic symptoms. However, when allergen immunotherapy is effective, it is a satisfying method to treat allergic disease and asthma since it can result potentially, by converting detrimental allergic immune responses into protective immune responses, in "cure" of the disease. In contrast, most medications used today for these chronic diseases require chronic administration of the medication to control symptoms. The use of heat killed *Listeria* as an adjuvant to boost allergy shot therapy could revolutionize immunotherapy and make it a first line therapy for allergy and asthma.

According to Dr. Umetsu, *Listeria monocytogenes* is a relatively common organism that doesn't cause significant infections, except in pregnant women. In any case, since the *Listeria monocytogenes* is killed prior to mixing with the allergen, there is no risk of infection with *Listeria.*

Drs. Umetsu and DeKruyff developed the idea of using heat-killed *Listeria* as an adjuvant for allergen immunotherapy while working with Interleukin-12, a cytokine that they found partially inhibits allergic reactions. Since *Listeria* increases Interleukin-12, they tried using heat killed *Listeria* to induce IL-12 and increase the potency of allergy shots. They achieved remarkable results and found that the *Listeria* was more effective than administration of recombinant IL-12 in reversing allergic responses. Drs. Umetsu and DeKruyff are also looking into using these findings as an immunotherapy for cancer.

Stanford is seeking a licensee to further develop the technology and take it to market. A patent application is pending and a publication is available. For further information, please contact Lisa Primiano at (650) 725-9120 or lisa.primiano@stanford.edu.

The University-Industry Interface...

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and Schools.

OTL and Sponsored Research

In September, 1997, the Dean of Research made a strategic decision to streamline the process for companies to negotiate sponsored research agreements at Stanford by establishing the Industrial Contracts Office. Today, the ICO is part of OTL, but focuses on industry sponsored research (excluding clinical trials) and works to facilitate sponsored research agreements between academia and industry. Since OTL has established relationships with companies from a licensing perspective and also knows of the invention activity of the various faculty, the synergy between industrial sponsored research and inventive activity is a close one.

OTL is working collaboratively with the Industrial Contracts Office on several projects, including the Digital Camera Consortia and the Corn Genome Consortia. The Industrial Contracts Office is establishing Master agreements for sponsored research, with intellectual property terms mutually agreed upon ahead of time, to make it easier for industry to contract with Stanford.

Conclusion

Industrial Affiliates programs, the Industrial Contracts Office and the Office of Technology Licensing offer different ways for companies to work with Stanford. By working together, we enhance Stanford's ability to interact with corporations for mutual benefit. It can be win-win for all.

For more information on how Stanford and Industry can work together, please visit http://corporate.stanford.edu/index.html

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