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**SECONDINTERNATIONAL FORUMON
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HUMANITYINTHE21ST CENTURY**

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INVENTIONSAND INNOVATIONS –KEYELEMENTSINTHESTRIVEFOR
COMPETITIVE ADVANTAGE

THEROLEOFUNIVERSITIESANDRESEARCHANDDEVELOPMENT(R&D)
ORGANIZATIONSINTHEINNOVATIONCYCLE

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INTRODUCTION

1. Thank you for inviting me to speak to you today on the role of universities in the innovation cycle. I started at OTL six years ago and my background is a Bachelor's degree in Biological Sciences and a Master's in Business Administration, with a couple of years of experience working in a diagnostics' company. I am pleased to talk on inventions and innovation today.
2. The different topics I would like to cover are:
 - University-Industry Relations at Stanford – some of the different ways in which Stanford and industry currently interact. I'd like to encourage all participants to use their universities as a resource, especially for intellectual capital;
 - OTL Background/Invention Process – how OTL started out, how we've evolved, and how we currently do our job of technology transfer;
 - The Innovation Cycle, Silicon Valley, and how we at OTL and Stanford play a part.

INDUSTRY-UNIVERSITY INTERACTION

3. In order to give you an idea of my perspective on the role of universities in the innovation cycle, I'd like to give you some background on the four different offices at Stanford that mainly deal with companies looking to work with the University. The first is the Development Office, which mainly deals with gifts given to Stanford, but they also handle the Affiliates Programs. The Affiliates Programs are research – area-specific groups that companies can join in order to have facilitated access to the faculty and students associated with the particular area of research. One example is the Center for Integrated Systems, an Affiliates Program in Stanford's School of Engineering, with over ten departments participating in the Program. The purpose of CIS is to develop top world-class graduates and research results in integrated systems. "Integrated systems" are research projects in hardware and software resulting from complex interactions across engineering, science and management disciplines. Companies pay a fee to join the Program.
4. The Office of Sponsored Research deals mainly with government sponsorship grants and contracts, but they also handle clinical trials sponsored by industry. The main entity handling these contracts within the Office of Sponsored Research is called Access, which was put together to provide better service and support for companies interested in conducting clinical trials at Stanford.
5. The Industrial Contracts Office (ICO) supports Stanford's research mission by negotiating agreements between the University and industry, including sponsored research, collaborations, consortia and material transfer agreements. The ICO was founded in 1997 in order to address industry's special concerns in its contracts. The activities of the ICO used to take place under the Office of Sponsored Research, since the majority of the agreements are for sponsoring research. However, the bulk of the contracts and grants that the Office of Sponsored Research dealt with were from the Federal Government, and they have very different provisions and clauses from the industrial contracts. Therefore, when the Office of

Sponsored Research received a potential industry contract, they would not have much knowledge of the applicable policies and guidelines at Stanford that would apply to those contracts. Also, many of the industrial contract provisions dealt with licensing, so the contract administrator would approach OTL for guidance and approval. Since the Industrial Contracts Office deals solely with this industry, we've been able to address many of the prior issues and concerns industry had in dealing with Stanford.

6. The Office of Technology Licensing, the office I work for, handles licensing agreements with industry. The majority of my tasks will concentrate on our interactions, since we deal with the intellectual property created at Stanford. Although I haven't noted it on this slide, the faculty and students often act with industry independently, often through consulting or advisory board relationships.

OTL MISSION

7. The mission at Stanford's Office of Technology Licensing is to promote the transfer of Stanford technology for society's use and benefit and for the generation of unrestricted income to support research and education. Basically this translates to mean that Stanford wants the technologies created at Stanford actually to help people, and, at the same time as the technologies are used, to assure it of part of the income that the companies gain from the successful product.

THE INVENTION PROCESS

8. OTL handles all inventions created at Stanford by University employees or graduate students. First, the inventions are actually disclosed to OTL by the inventors. The OTL associate or liaison handling the case makes an evaluation in the light of many factors, including market size, development stage of the invention and past experiences with the inventor(s). Marketing the invention to companies may also be included in the evaluation. If companies are interested in the invention, or if we have good past experiences with the inventors or feel positive about the invention, we will probably move forward on patenting it. The marketing, patenting and licensing strategy decisions are often intertwined.

9. Licensing strategy is concerned with the type of licenses that we will offer for the invention. Is it a method invention, which may be broadly used by a number of companies, or is it a therapy, which will require ten years of specific development by a company to make it to market? Our experience, together with input from the inventors, will help us with this decision. If a company is interested in licensing the invention from Stanford, OTL then negotiates a license agreement with the company.

10. Lastly, it is important to note that the relationship with the licensee doesn't end after the license is signed. This is a company that we normally plan on working with for many years. We want to see the company commercialize the technology successfully in order to fulfill our mission – transferring the technology for society's use and benefit while generating income for the University to support further research. Our current licensees are also potential future licensees. We want people to have good experience with the office so they will want to come back and work with us again.

OTL NUMBERS

11. OTL was founded by Niels Reimers in 1969. In that year the office earned Stanford total revenues of US\$50,000. In this past fiscal year of 2000 -2001 (our year -end on August 31), our revenue was US\$41.2 million. OTL's all-time high for revenue was US\$60.1 million back in 1997 -1998, due mainly to the payments received for the Cohen - Boyer Recombinant DNA Cloning Technology, a tool used almost throughout the biotech industry. The revenue was shared with UCSF, which co-owned the patent. The Cohen - Boyer patent expired in 1997, but Stanford continued to receive royalties for a couple of years on account of products made but not sold before the expiration. OTL had expected its revenue to fall over a cliff, but instead the descent has been more gradual. The gradual descent is also due in part to equity received by Stanford for some of the licenses that OTL has negotiated over the past few years. A couple of the equity payouts have been large, and have added to Stanford's revenue each year they've occurred.

12. In the fiscal year 2000 -2001, Stanford executed over 130 licenses. Some of them were for the same invention; the Genscan program, for example, created at Stanford in 1997, currently has over 70 licensees, of which many took licenses in the previous fiscal year. A "licensee" is a company that has licensed a technology. OTL currently has over 800 active licenses, with more signed every year.

13. The number of invention disclosures OTL receives is about three to four a week, which come to around 250 inventions a year. Since OTL's inception, we've received over 4,500 invention disclosures. From our licensing record, only about one in 4,000 inventions is going to hit it really big, bringing in over a hundred million dollars in revenue. As mentioned previously, our big hit so far has been Cohen - Boyer.

14. The staff at OTL consists of 16 people dedicated to licensing, as well as staff members responsible for accounting, information systems and reception, and of course our director. Our budget of approximately US\$2.9 million covers our rent, salaries, travel, information systems, database construction, phones, etc. The office as a whole feels it is important to keep up with the latest technology and therefore allocates large amounts to updating our computers and continuing the development of our customized database that tracks all inventions, inventors, licensees, other contacts, licensing negotiations, accounting matters, royalty-sharing agreements and marketing and numerous other tasks. We are now able to e-mail marketing directly from our database and record all responses we receive from the marketing sent out.

15. Patent costs can exceed US\$3 million a year. Some of these costs are paid back by licensees, but much of it is kept on our books until we do get a licensee or is written off when a case is deactivated. In the United States the cost of obtaining a patent varies, but in our experience the average US patent costs approximately US\$20 -25 thousand over the lifetime of the invention; European patent costs are well over US\$40 thousand, and Japanese patents even higher.

16. If an invention is licensed, the cash royalties are split in the following manner: first OTL takes 15 percent off the top for its budget; any expenses still remaining on the invention docket are then repaid (such as patent expenses), then the net is split evenly between three parties: the inventors, the inventors' school(s), and the inventors' department(s). As mentioned earlier, we sometimes also receive equity in part -payment for a license. In that case OTL receives 15 percent, then the net is split into one -third for the

inventors and two-thirds for the Stanford Graduate and Fellowship Fund. The Stanford Management Company, which handles Stanford's endowment, handles the equity allocated to OTL and the Stanford Graduate and Fellowship Fund. They normally liquidate the equity as soon as a liquidation event permits.

OTL CYCLE

17. The revenue that Stanford receives from licensing partly returns to the areas of research that produced the original technology (for example, the schools and departments shares as mentioned in the previous slide). It is this as a growing cyclic process whereby technologies are transferred and developed into products, potential revenue comes back to the University when the technologies are licensed and products are sold. That revenue in turn helps create more technologies, and the cycle continues.

INNOVATION CYCLE

18. This slide shows a simple diagram of an innovation cycle. A company or person has an idea for a potential technology, they do research and development on the technology, they discover something novel and go ahead with the patenting process; they complete a product which the company then manufactures, markets and sells, all of which brings in further resources to continue the innovation cycle. Universities mainly fit in with the topics highlighted in red – Identify an Opportunity, Research and Development and Protect Intellectual Property. Universities can provide the opportunities and some of the research and development on the technology. However, our inventions are normally at a very early stage of development, so a company often must do more research and development on its own to make them into products. The university technology may however save the company much of its own research time by creating the technologies initially. Also, the universities may already have applied for or received patent protection for the inventions.

19. University resources (mainly the people) may also be involved with the rest of the innovation cycle if they are involved with the companies making the products.

TWO WORLDS

20. It is important to recognize certain factors that vary between universities and industry before jumping into relationships. The university is a very open environment, where colleagues talk freely about their research and collaborate with other researchers, and are all working towards a goal of education and cutting-edge research. The faculty and students must have the freedom to publish their work. At tenure-track universities, this is crucial to an assistant professor potentially receiving tenure, but again is a part of the guaranteed openness in an academic institution. At the same time, the universities are non-profit, but they do need money to survive.

21. On the industry side, the protection of proprietary knowledge is vital. Industry does not want its secrets leaked out, because each company needs to maintain its competitive edge. Companies in the United States are mainly responsible to their shareholders, and need to show profits in order to survive, and protection of their research can often be essential to that objective.

22. Naturally the question is how to bring two such different environments together. It has taken anumber of years, but in the United States industry and universities work fairly comfortably together now, as you will see from the issues and examples shown on the next slide. Our role at OTL is to help bridge the gap between these two worlds and make the innovation cycle move better and faster.

UNIVERSITY INVENTOR' S ROLE IN TECHNOLOGY TRANSFER

23. The inventor' s role in technology transfer, and in maintaining an innovation cycle, is critical. A good relationship with the inventor, and the inventor' s own enthusiasm, are normally of prime importance when transferring technology.

24. For OTL to have any technologies at all to transfer, an inventor must first disclose them. It has happened in the past that we haven' t heard about a technology until we read about it in a publication, or a company calls up wanting to license a technology that we haven' t heard of. Even in these cases, the inventor would have to work with us in order to license the technology. If it is to be patented, for instance, the inventor will participate in the patent preparation and prosecution. No one knows the technology better than the inventor, so he is required to help the patent attorney write up the application and respond to the patent examiner' s questions and arguments.

25. Many of our inventors are well acquainted with industry, particularly that related to their field; they can identify companies within the field that could potentially be interested in licensing the technology. Those interested in the inventor' s research may already have approached him. If a company does become interested, the inventor can host visits by potential licensees or simply talk to them on the phone. The inventor can also help OTL with the licensing strategy, such as the areas in which the technology could be licensed (such as diagnostic and therapeutic -medicine).

26. Again because no one understands the technology better than the inventor, the licensee of the technology may want to hire him as a consultant to help with the research and development of the commercial product that may result from the technology. As noted above, this consulting position would conform to the 13 days per quarter guideline for a faculty member. A faculty member does not need to use all his consulting time on a particular company. Undergraduates, post -doctoral students and other Stanford people may also consult, but be subject to different guidelines. Normally they have to seek permission from Stanford before starting a consulting position with a company.

27. Lastly, in the tradition of Silicon Valley, the inventor may also be a founder of a company, which often concerns itself with the inventor' s university research.

WHAT OTL CAN DO FOR INDUSTRY

28. At OTL, we think of ourselves as a service organization for both inventors and companies. As mentioned earlier, our mission is both to transfer the technologies successfully so that it will benefit the public and to renew our resources at Stanford. We can help carry out that mission by providing ways in which we can benefit industry. This helps the University remain part of the innovation cycle.

29. As mentioned a couple of times, we can track companies' areas of interest in our database. We will send them the technologies relevant to their areas of interest as we receive them. Stanford also has a searchable database for faculty members which we can use to aid companies in their search for faculty work in certain disciplines. We strongly believe in active communication, and will follow up any enquiry as soon as possible. We also will visit companies, especially if invited and if they are good licensing prospects. We believe face-to-face contact helps ensure a healthy, trusting and prosperous relationship.

30. Stanford's OTL also wants to remain at the cutting edge of technology transfer, and so therefore we try at all times to be as flexible and creative as possible to meet a company's needs within Stanford's policy boundaries.

31. Of course, our main service to industry is in transferring technology, thereby potentially supplementing a company's research and development work or providing the technological basis for a start-up company.

START-UP TRADITION

32. Stanford's start-up tradition is most notably associated with the founding of Hewlett-Packard. HP owes its existence in part to the encouragement and resources of the man pictured here, Frederick Emmons Terman. Dr. Terman was the advisor to Hewlett and Packard while they were at Stanford, and encouraged them both to come back to the area to pursue their careers after they both left on completing their degrees. Legend has it that Dr. Terman provided some of the first funding, a few hundred dollars, for Hewlett and Packard to found HP and build their first product. Perhaps more importantly, he provided them with the encouragement and advice with which to pursue their start-up. This encouragement of start-up has remained a tradition at Stanford.

33. As you are probably aware, start-up has become a mania in Silicon Valley in the recent past. At Stanford, there was and still is a "me-too" mentality, which basically means that, if everyone else is doing it, why shouldn't I? OTL has taken equity in over 100 start-up companies since about 1994 as a part of its licensing projects.

34. Silicon Valley has a plethora of resources, and Stanford borders right on Sand Hill Road, home to the most prominent venture capitalists. Owing to the local resources, Stanford does not for the time being have an incubator. Instead we can concentrate on other things. Finally, Stanford is not a risk-taker, but will share something of the risk by taking equity for start-up licenses. Therefore Stanford can share a bit in the upside if the company is successful. All of the inventors will too, since they also receive a share of the equity.

EXAMPLES OF SUCCESS

35. In 1999, one-fourth of the top 150 public companies in Silicon Valley were "Stanford founded." The total revenue in 1999 of those Stanford-founded companies was US\$90 billion, or about 40 percent of the total for all of them.

36. Silicon Valley, in the broader context, generates enough economic output to command 37 percent of the US high-tech market, representing a colossal value of US\$450 billion.

37. In 1996, in the early days of the Internet, one start-up went public every five days. Those IPOs created staggering individual wealth. In fact the Silicon Valley engine was creating 62 millionaires every 24 hours. By almost any reference, Silicon Valley has been a success, owing in some part to the prominence of Stanford and its cooperation with industry. Mostly, however, Stanford's success can be attributed to individuals who care about Stanford, people like Jerry Yang and David Filo of Yahoo! and Jim Clark (of SGI and Netscape). These people and many others have the pioneering spirit that was imparted to Stanford on day one. Although Yahoo! did not need to take a license, another recent start-up that many people are familiar with did, namely Google. If you haven't used Google as your Internet search engine yet, I can highly recommend it. Although I may be a bit prejudiced because of where I work, I do think it is a terrific way of finding information on the Internet.

TAKE HOME MESSAGE OF COMPETITIVE ADVANTAGE CREATION

38. Of course I would be pleased if you remembered everything from my presentation, but there are some main points that I especially hope you will take home with you. I think these are the most significant alliances between industry and academic institutions.

39. First, as each of the examples of success has shown, creating good relationships is everything. This holds true for both inventors and licensees, as well as any other people you meet. Good relationships will always end up helping you. In each of the success stories, the inventors played a role in making the technology successful. Their belief, and sometimes their work with the companies, were essential to the success of the technology. With regard to the licensees, you will work together better and be more creative if you've created a good relationship initially. Even if you've made a bad start, it isn't too late to turn it around and make it into a positive relationship for both parties.

40. Secondly, use your local resources, if there are any. For example, get in touch with your university faculty members, see what sort of intellectual capital they may be able to provide you with. Contact business school students who may be interested in working on projects *pro bono*.

41. Thirdly, you need good people. Whether you are looking to start a company or a technology licensing office, license a technology or simply negotiate a deal, you need good, strong, competent people to work with you.

42. Fourthly, you should always try to create a win-win situation. What seems like a good deal for you but is bad for the other party is always going to be a bad deal. We are looking at the long term: we want to work with someone not just right now, but for the next 20 years. We want them to be successful, because that in turn makes us successful. To highlight this, I'd like to tell you about the OTL Museum. All around our office at Stanford we have glass boxes containing technologies that have actually made and become products. Visitors often enjoy strolling around the halls of the office, seeing what has been developed, in part, as a result of Stanford innovations. OTL and Stanford take pride in these products; we want all parties to succeed.

CONCLUSION

43. Finally, for universities to be a part of the innovation cycle, they should be open and flexible; as I mentioned, the two worlds are very different, so you need to find common ground from which both of you can start working. Be innovative; our director's motto is "Think outside of the box." Not only does being innovative often help your relations with contacts, it also can make your job more fun, interesting and challenging.

WEB INFORMATION

44. At Stanford, we have numerous websites where you can review further information on the ways in which Stanford and industry interact. First on the list is OTL's website, <http://otl.stanford.edu>. Second is the website for ICO, <http://www.stanford.edu/group/ICO>. Lastly, the corporate Stanford website will link you to all groups at Stanford that work with industry and explain how industry can work with Stanford. I think this is a site well worth the visit. The web address is <http://corporate.stanford.edu>.

45. Thank you for giving me the opportunity to speak to you today. I hope I have provided information that will be useful to each of you. I look forward to the possibility of speaking to you individually.

[Powerpoint presentation follows]