THE SUCCESSFUL TRANSFER of new technologies from the research laboratory to the commercial sector has many benefits: the creation of wealth, new jobs and new solutions to society’s problems. For nearly three decades, Stanford University has been a leader in technology transfer, fostering the growth of northern California’s Silicon Valley and the biotechnology industry and providing a model for other research and educational institutions across the country and the globe.

Today, Stanford continues to show the way, providing creative solutions to new challenges as the need for university research becomes even more urgent. Few organizations can afford to finance basic research facilities on the order of a Bell Labs or a Sarnoff center, and with an ever greater percentage of economic growth coming from innovative, but capital-hungry, small companies, access to new technologies is critical. And for the great research universities, income from patent licenses can offset the shrinkage of federal funding.

If the birth of Silicon Valley dates from the meeting of William Hewlett and David Packard in a Stanford classroom in the late 1930’s, the modern era of technology transfer begins with the founding of Stanford’s Office of Technology Licensing by Niels Reimers in 1970. Of course, inventions had been made and licensed to industry before, but Stanford’s process had been ad hoc, alternately managed by patent attorneys and university administrators. It was Mr. Reimers’ vision, now widely emulated, to create a dedicated organization that would actively market Stanford’s intellectual property.

One has to think back to that mid-Vietnam, pre-Watergate era to imagine how controversial this proposal was; in fact, it passed the university’s regulatory processes by only the slimmest of margins. The idea that Stanford and private industry should profit from publicly funded research was cause for concern among faculty and staff. The potential for conflict of interest — in which scholarly research might be
skewed for the possibility of financial reward — seemed all too real.

Actually, university technology managers, whether at Stanford, Harvard or the University of California, still grapple with these issues. But 28 years of success provide a strong argument for the benefits of proactive technology transfer, and, if potential conflicts cannot be eliminated, they can be managed. The total of Stanford’s cumulative income from patent licenses since the creation of the technology licensing office is more than $300 million, but the annual revenues of the companies born at the university total more than $100 billion; their market capitalizations are in the tens of billions, and the jobs created in the hundreds of thousands.

None of that potential was immediately visible when Mr. Reimers, an aerospace engineer by background, arrived at Stanford in May of 1968. Patent license income from 1954 to 1967 “was something like $45,000,” said Mr. Reimers, who left Stanford in 1991 to consult to other universities. “I thought more could be done and decided to go in a different direction, to go to a market-based program rather than a legal base,” he said. “Working part time, I brought in $55,000 in the first year and was paid $13,500, so Stanford never had to reach into its pocket,” he said during a recent interview at his California home.

No one at Stanford said “first we kill all the lawyers,” but keeping attorneys out of the licensing practice is the gospel there, as well as at schools like Harvard and the Massachusetts Institute of Technology that have modeled their own technology transfer programs on Stanford’s practices. Stanford’s Office of Technology Licensing employs no attorneys, and, while outside counsel is available, such oversight is not required if an agreement does not deviate from the university’s standard practices of granting no warranty on an invention and total indemnification by the licensee. None do.

“We feel we are a marketing office, not a legal office,” said Katherine Ku, who has been director of Stanford’s Office of Technology Licensing since 1992. Ms. Ku came to Stanford from a small biotechnology company, and most of the office’s associates have
similar technical and scientific backgrounds. This kind of training is a stronger tool in negotiating license agreements than a law degree, she said. Successful negotiations require an understanding of the technology.

Jeffrey Labovitz, acting director of technology licensing at the University of California at San Francisco, another program set up by Mr. Reimers, agrees. “A lot of technology-transfer offices are built around patent attorneys, and they lead with the agreement as opposed to the deal, so it’s very hard for them to negotiate,” he said. “Deal-making is very much a creative endeavor, so the more you know about the variables, the more creative you can be. You need the law, but you don’t want to beat companies over the head with policy before you figure out what is the best deal,” he said.

Before the deal, however, is the disclosure. Since the passage of the Bayh/Dole Act in 1990, which allowed universities to take title to inventions, Stanford researchers are required to disclose to university management any patentable inventions and turn them over to the Office of Technology Licensing.

Within the office, each invention becomes a case, which is managed from beginning to end by one associate. It is the associate’s task to determine whether the invention is indeed patentable and, if so, whether it is licensable and likely to generate sufficient royalties to offset the $10,000 cost of filing a patent. The “magic number,” associates say, is $100,000 over the 20-year life of the patent. The same associate devises a marketing strategy, shops the invention to potential licensees and negotiates a deal.

“We believe a licensing agreement is the beginning of a relationship that lasts many years, so we believe in having one person handle it cradle to grave,” said Ms. Ku. “You can’t make a good licensing deal unless you know the market and the technology, its strengths and weaknesses. If you hand off in the midst of negotiations, there’s not that same connection between what the technology is and how much you can ask for it,” she said.

Stanford professors were not always obliged to turn over their inventions to the university; indeed, some today seem unaware that the policy changed several years ago. Technology licensing associates say they are often startled when a new invention is published in a trade or academic journal before they have had a chance to file for a patent and seek licensees, but they also say they do not see their role as policing campus research.

“We’re facilitators, here to get the technology out there. We’re not charged with enforcing policy,” said Mary Watanabe, an associate who, like Ms. Ku, came to the Office of Technology Licensing (O.T.L.) from the biotech industry. “I don’t think anybody at the university has the idea that we have to clamp down on everything to make sure Stanford makes a buck out of it. There’s enough intellectual property to go around,” she said. “On the other hand, we don’t want things going out the back door; that’s a missed opportunity.”

In reality, there has long existed a parallel, informal path from the university’s biochemistry labs and computer science classes to commercial markets, say the venture capitalists on Sand Hill Road along Stanford’s northwest border. Indeed, for every Cisco Systems Inc., whose original products were built with computer networking technology invented at Stanford and used under license, there is a Sun Microsystems Inc. Although Sun stands for Stanford University Network, and three of its four founders were alumni, the company actually used no patentable — and therefore licensable — technology. Unlike Cisco, Sun pays Stanford no royalties (although it has been
generous in grants to the university).

John L. Hennessy, dean of Stanford’s school of engineering, said this bifurcated approach simply reflects the nature of technological invention. “There’s two kinds of technologies in the world: stuff that is patentable and broadly applicable and the right thing to do is to give it to O.T.L. Then there’s stuff that is more a preliminary proof of a concept. It’s not patentable, and the real value is in the people and their understanding of that technology and how it can develop into a useful product,” he said. “O.T.L.’s role there is not to get in the way. That’s when the right thing to do is to say, ‘Godspeed, go do it,’” he said.

For all of Stanford’s reputation as the birthplace of startups — not only Sun and Cisco, but Silicon Graphics Inc., MIPS Computer Systems Inc., Yahoo!, Synteni Inc. and Pangea Systems Inc. — there is no university policy favoring the creation of new companies as licensees over established companies. University inventors who want to start a company must first turn over their invention to the Office of Technology Licensing, which tries to find the licensee most likely to succeed with the product. Many times, that is not a startup.

“Heard from an institutional standpoint, we have a public service mission,” said Ms. Ku. “At Stanford, we feel we need to make sure we pick the best licensee. We ask the companies, including the potential startup, to give us a business plan; then we pick,” she said.

Many times, no big companies recognize the invention’s value, so it goes to the startup by default. But Ms. Ku said there is still a value to the competitive process. “You have to have that fire in your belly to make a company go, so maybe it’s a good thing to put a few hurdles in the way of the entrepreneur,” she said. “But in the Valley, everyone wants to do a startup.”

For Dari Shalon, who came to Stanford with a grant from the National Science Foundation and the express intent of starting a company, having his invention shopped around was devastating. “They did not get any takers, which was a lucky break for me, so I said if I would take it back and pay the patent expenses,” he said. But after an article about the invention, a gene chip, appeared in the prestigious Science magazine, Stanford was besieged with licensing requests from pharmaceuticals and biotech companies. “To their credit, they stood behind me,” said Dr. Shalon, who subsequently sold his company, Synteni, to Incyte Pharmaceuticals Inc.

Other universities now give preference to the inventor if that individual wants to start a company. These include M.I.T., which enlisted Mr. Reimers to revamp its technology transfer program after the Stanford model in 1986, when Mr. Reimers took a leave from Stanford.

“I think Stanford is more meticulous than we are,” said Lita Nelsen, director of M.I.T.’s Technology Licensing Office. “If the inventor has the wish, and it makes even a little bit of sense, we will favor licensing to the startup and giving them a push for two reasons: the vision, the passion, the drive of the person who conceived the technology is not to be discounted in terms of pushing something forward, particularly undeveloped new technology; and, two, the concept that you grab somebody’s baby and shop it around [is wrong] — perhaps because it was Federally funded you should do
that, but there is no legal obligation to
do that,” she said.

Even when Stanford does shop an
invention around, the proprietary
ownership of something developed
with Federal funds can remain a con-
tentious issue. When Thomas Bren-
nan, a Stanford professor, developed
a method for automating DNA synthe-
sis, the Office of Technology Licensing
first shopped it to major companies
working in that field. Finding no tak-
ers, it licensed the method to Proto-
gene Laboratories Inc., Dr. Brennan’s
startup, which was subsequently ac-
quired by Life Sciences Inc. Life Sci-
ences sells DNA, but not the machines
to make it.

“That became quite rancorous
because the human genome centers
all wanted these machines,” said
Robert Molinari, chief executive offi-
cer of the Protogene unit of Life Sci-
ences. “We were willing to sell them
DNA, at about a fourth the going price,
but the centers wanted the machines
in-house so they could get DNA at
cost,” he said. “But if we had given it
to them in that form, we could never
have done the corporate deal that
drove down the price of DNA.”

One reason that inventions wind
up in the hands of startups is that larg-
er companies are reluctant to pay for
licenses, Ms. Ku said. Before 1990,
they often obtained university re-
search free, and they are accustomed
to cross-licensing patents among
themselves at no cost. “A lot of the big
companies aren’t licensable,” she
said. “There’s the not-invented-here
syndrome. They don’t want to pay.
They want ownership and control. Or
they don’t see a product within two
years, so it’s out of their range,” she
said.

So Stanford does more and more
deals with startups, whether it wants
to or not. Working with startups re-
quires some revision of fee strategies.
Typically, Stanford negotiates for an
upfront licensing fee, which varies
from very little to more than $100,000,
and a royalty on sales, which can also
vary from the low single digits to more
than 10 percent. Everything is flexible,
depending on the state of the devel-
opment of the technology, the size of
the market, whether a license is ex-
clusive or non-exclusive.

“In general, Stanford tends to be
pretty flexible and creative and tries
to find a win-win,” said Brian Kissel,
chief executive officer of Paraform
Inc., a software startup using technol-
ogy licensed from the university.
“They’re enlightened in that they
know the research technology is only
one part of a success, so they’re will-
ing to work with the licensing compa-
ny,” he said. A former Stanford Busi-
ness School student, Mr. Kissel was
an intern in the Office of Technology
Licensing before starting Paraform.

Startups are short on cash, so of-ten they want to offer the university
equity rather than an up-front pay-
ment. But taking equity, particularly in
faculty-sponsored companies, has
long been a touchy subject for univer-
sities, and Stanford is no exception.
Before 1981, Stanford had a blanket
policy forbidding the taking of equity,
and for years afterward it simply was
not done. Indeed, Mr. Reimers re-
signed in 1991 over the insistence by
Stanford’s president at the time, Don-
ald Kennedy, that he submit all equity
deals to administrative scrutiny for
potential conflicts of interest. Even to-
day, Stanford has equity in only a cou-
pel of dozens of the hundreds of com-
panies it has licensed.

“We try to get equity, but the feel-
ing is equity should be the icing on the
cake,” said Ms. Ku. In one major bio-
technology deal, with Ariad Pharmaceuticals
Inc., the company created a subsidiary
focused on the licensed technology
and gave Stanford equity in that. “We
saw that as perfectly reasonable,” said
Harvey Berger, Ariad’s president and
chief executive officer. “We’ve renego-
tiated the deal three or four times as
the industry has changed,” he said.
“It’s not adversarial. It’s truly sup-
portive.”

Some other research universities
are more conservative than Stanford
on this issue, among them the Univers-
ity of California at San Francisco,
which, as a public institution, rarely
ever takes equity. “Part of the problem
continued on page 83
Staccato: A Silicon Valley Startup

Stanford University does not normally get involved in the formation of startup companies; it doesn’t have to, with venture capitalists as much a part of the landscape as the oak trees that dot the sprawling campus. But unusual opportunities can call for unusual approaches.

A breakthrough technology for digital audio synthesis might seem a natural for venture funding, or licensing to a broad spectrum of musical instrument and computer companies. But two years ago, when a Stanford professor created an algorithm that permitted the digital modeling of any sound, whether musical, mechanical or imaginary, it proved a tough sell. For large companies and venture capitalists (V.C.’s) alike, a mathematical formula, no matter how powerful, was too far removed from a product.

“We tried to find V.C.’s,” said Katherine Ku, director of Stanford’s Office of Technology Licensing, “but a lot of our technology is too sophisticated and people can’t understand the market.” Several times the university almost came to exclusive deals for the digital sound modeling, she said, but, without a demonstrable prototype, no company stepped forward for a license.

So Stanford took the unprecedented step of supplying its own venture capital, and six engineering consultants were hired from 1993 to 1996 to assist the professor in producing some initial digital sounds and a software tool that could enable the creation of others. The Office of Technology Licensing (O.T.L.) also took the unusual step of applying not just for patents but also for a trademark on the collection of technologies that evolved and that it called Sondius. The hope was that the trademark could continue generating returns after the 20-year life of a patent ran out.

But the project could only go so far with university funding. “We put in $1 million, and figured out we couldn’t fund it any more” as the project wore on, said Ms. Ku. “When we decided to stop funding them, one of the people at O.T.L. took a leave to try and start a company,” she said, adding that those in on the startup in late 1996 “went for many months without salaries.”

The company was Staccato Systems Inc., based in Palo Alto, Calif., and its mission became to use the Sondius technology to provide interactive audio in personal computer and video games.

Funding Sondius and licensing Staccato was a bigger risk than many universities would have been prepared to take, but it fit Stanford’s entrepreneurial culture.
two decades earlier with a predecessor technology, FM Sounds, the brand name for frequency modulation synthesis. Stanford shopped FM Sounds unsuccessfully for three years before it was licensed by Yamaha in 1975, which spent another seven years turning it into the world’s first digital synthesizer, ultimately a multimillion-dollar product. Yamaha became the first licensee for Sondius, and also provided the first round of outside funding for Staccato.

“The original feedback on FM was that it was too complicated, too memory-intensive. But Yamaha saw the potential and the rest is history,” said Joseph Koepnik, the former licensing associate who left Stanford to start Staccato. “When we went out to license wave guide, we got the same feedback — it took a Ph.D. to understand it — but again Yamaha saw through that,” he said.

But this time, instead of granting Yamaha an exclusive license, the university carved out licenses based on geographic and field-of-use limitations. Because Yamaha intended to use Sondius exclusively in electronic musical instruments, it was not threatened by Staccato, whose aim has been to sell a programming tool to personal computer and video game software producers. Indeed, Yamaha may be a customer for that same tool.

“Yamaha’s a preferred stockholder; they’re members on our board,” said Mr. Koepnik, who is now Staccato’s president and chief executive. “It would be a business transaction if they wanted the tool from us,” he said.

For personal computer and game companies, the beauty of the Staccato tool is that, unlike previous digital synthesis technologies that required a specialized chip, it is entirely software-based. It can run on any reasonably powerful personal computer or video game console, and could even be transmitted over the Internet. It allows, for the first time, interactive audio, meaning that a game producer, or even a game player, can create and change sound in real time.

“It sounds like the real thing, it’s compressed and it runs anywhere,” said Bob Starr, Staccato’s vice president for sales and marketing. “So it solves a lot of audio problems.”

With the Staccato tool, cars in a video race game can have the distinct sound of a Ferrari V-12 engine or a Porsche air-cooled flat six; they can rev with acceleration or go out of tune after an accident. For music, the program can model the actual physics of any known musical instrument, or it can combine models to create instruments that could only exist in the virtual world — a plucked guitar string with the breathing overtones of a flute, for example.

Like any good Silicon Valley startup, Staccato began its life in a two-car garage in Mountain View. It has since moved to an office in Palo Alto, but the company is in the process of outgrowing its space as the original staff of six swells to 14, then an anticipated 30 next year. Staccato recently closed a $4.3 million round of venture capital, attracting some of the prestige firms that initially passed on the Sondius technology.

Mr. Koepnik originally planned to return to Stanford after starting up Staccato, but now he is sticking around. “My leave of absence is up; they held my job for a year,” he said. An electrical engineer by background, and an amateur musician, he has found the startup an invigorating experience. “Obviously Stanford survived without me, but whether the company would is another question,” he said. Having taken the technology way beyond the original algorithm, however, he is now able to report: “We’re going to ship a product to a customer in the next two months.”
of equity is having the staff to manage it,” said Mr. Labovitz, the acting director of that institution’s technology licensing program. “If you are going to be a shareholder, you need to know how to buy and sell stocks. Early shareholders get diluted out quickly unless they ante up and reinvest, and most universities are not prepared to do that,” he said.

But many other schools are now taking a more aggressive posture regarding equity. At M.I.T., “the thinking came along that said, ‘Why not?’” said Ms. Nelsen, the university’s licensing director. “There was a feeling that M.I.T. had lost a lot of potential in the past by not taking a piece of the action in all of the companies that came out of here,” she said. “So we pulled back and said, ‘What are we worried about?’” she said, referring to the potential for conflict of interest. “We’re engineers, we’re awfully logical. So we said if that’s what we’re worried about, let’s set up rules to avoid that,” she said.

These rules prohibit startup companies in which M.I.T. owns equity from hiring students doing related university research; require that data generated by university labs be published when available and not delayed until a product is ready for market, and forbid the use of funds from the startup company for research on campus. I can say it was an anomaly, not something inherent in the system,” she said.

At Yale University, Greg Gardiner is pushing the system still further. A former executive of Pfizer Inc. and now senior director of Yale’s Office of Cooperative Research, he has orchestrated the creation of six companies in the last two years, recruiting venture capitalists and taking equity in each, and even taking a board seat. “Conflict? I don’t have a conflict,” he said. “I’m there representing Yale’s block of stock. If things run against Yale’s interests, everyone on the board knows exactly what I’m going to do,” he said.

Dr. Gardiner said Stanford and M.I.T. can avoid his hands-on approach to starting companies because both exist in environments where starting companies is the norm. “They don’t do it because they don’t have to,” he said. “Their faculties have enough experience doing startups. Yale doesn’t have that background,” he said.

Jon Sandelin, an associate in the Stanford office who works primarily with startups, said he expects equity deals to become common. “I predict that 10 years from now, more of our royalties will come from equity liquidation,” he said. “A few of these equity situations will turn out to be highly valuable and others we’ll have to write off. It’s an averaging business. Our things are at such an early stage there’s no way to predict the winners and losers,” he said.

One way to improve the odds is to move the technology to a slightly later stage before seeking licensees, and toward that end Stanford has created a “birdseed fund,” which can supply $10,000 to $15,000 grants for further development. “If our adding value increases the likelihood something will be licensed, we can invest in that,” said Mr. Sondelin. But such “gap funding,” as it is more commonly known, is
unusual among universities and remains controversial. “People think that, of course, we need to spend $15,000 filing for a patent, but the thought that we should put $15,000 into a prototype raises concerns,” he said.

Those concerns center on the potential for conflict in funding faculty startups and the risks inherent in choosing which technologies to fund and which to leave to fend for themselves. Still, many other universities are looking to Stanford’s experience for guidance on how to proceed. “I think we’re pretty nearly identical” to Stanford’s technology licensing program, said Frances Toneguzzo, associate director of technology licensing at Harvard. “One thing they have that we haven’t figured out how to do is the birdseed fund. We don’t have anything like that,” she said.

Some other schools do have birdseed funds. But a combination of challenges and new opportunities is already pushing Stanford to take bolder steps.

The biggest challenge arises from the expiration last December of the university’s most lucrative piece of intellectual property, the Cohen/Boyer patent on recombinant DNA, the basic gene-splicing science that launched the biotechnology industry. Stanford licensed Cohen/Boyer, which it shared with the University of California, to more than 450 companies, so revenues since the patent’s expiration are expected to drop from more than $60 million in 1997-98 to just $15 million in 1998-99.

“I took the job knowing Cohen-/...
“The concept was to add tangible value to an intangible asset, a patent,” said Joseph Koepnik, a former associate in the Office of Technology Licensing who left in 1996 to form a software startup, Staccato Systems Inc., using the Sondius technology. (See accompanying story, page 81.) Patents live for 20 years from the date of filing, but a trademark lasts as long as a company maintains it. “We looked at the Dolby model,” he said, referring to the now ubiquitous noise-reduction technology, the patent for which expired long ago. “We realized that, with a trademark, we could realize a return after the patent expired.”

The first products using Sondius technology, a Yamaha synthesizer and some Sound Blaster cards from Creative Labs, reached the market this year. But it will be many years before Stanford can measure the true return on its investment and the success of its experiment in trademarking. In the meantime, other schools are watching warily.

“Perhaps we’re taking the coward’s way out, but at the present it doesn’t seem worth it,” said Ms. Nelsen, of M.I.T., acknowledging that Stanford’s approach “is creative.” Added Marvin Guthrie, president of the Association of University Technology Managers: “The thing that’s really interesting about the Sondius deal is the close collaboration between Stanford and the corporate partner,” Yamaha. “The structure of the whole deal was innovative,” he said. But Stanford is already looking to other innovative means to capitalize on its intellectual property and the value inherent in its own brand, beyond selling T-shirts and mugs emblazoned with “Stanford.” Traditionally, professors in the humanities have not had the same opportunities to generate and receive wealth as their counterparts in the sciences and engineering.

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