

## BUSINESS

## Getting the right mix

Biotechnology companies come in many shapes and sizes, but, say two economists, the ones with the widest spread of skills in their teams stand the best chances of success. **Aaron Bouchie** reports.

For decades, founders of biotechnology companies have sought a winning formula for their enterprises. The key to success has proven elusive, however. Capable management and good relations with early investors are usually considered essential. But, according to one study, the factor that correlates most closely with a company's success is the diversity of skills encompassed by its research team.

In an unpublished paper called "Knowledge Bridging by Biotechnology Start-ups", David Hsu of the Wharton School of the University of Pennsylvania in Philadelphia and Kwanghui Lim, now at the Melbourne Business School in Australia, examined whether using expertise from disparate scientific fields would help a biotechnology firm succeed.

The authors show that by hiring researchers from various scientific disciplines (for example, experimental genetics and information technology), a company increases its chances to complete an initial public offering and have a drug approved by the US Food and Drug Administration. Scott Stern of Northwestern University's Kellogg School of Management in Evanston, Illinois, says the paper builds on the notion that combining ideas from different disciplines is more likely to yield revolutionary inventions. "A given idea can have a greater impact beyond its initial field. These guys show this elegantly," says Stern.

Lim and Hsu came to their conclusion after looking at the performance over two decades of 19 companies that built their businesses on a set of patents for recombinant DNA technology. The firms ranged from agricultural biotech companies such as Mycogen of Indianapolis and DNA Plant Technology of Oakland, California, to the two largest biopharmaceutical companies in the United States, Amgen and Genentech.

They looked at patent data to determine how many different scientific disciplines were built upon for each technological innovation; inventors are required to cite existing technologies that their patents build on in the same way that research journals require authors to include references. The authors found that the more scien-

tific fields referenced by a company's patents, the more likely the company was to succeed.

And they found that hiring a diverse group of researchers during the early stages of a company's development contributed most to its ability to "use ideas from one technical domain to innovate in another area". Surprisingly, obtaining venture capital backing or forging collaborations with other firms had little effect on the tendency to innovate.

### Teamwork

That somewhat defies conventional wisdom: venture-capital deals are supposed to provide access to networks of people that can assist young companies. And partnerships with other firms ought to have a similar effect. Hsu and Lim suggest that venture-capital backing can actually damage innovation by encouraging a focus on short-term success, whereas alliances with outside companies are often established to access marketing or manufacturing capabilities, not new knowledge.

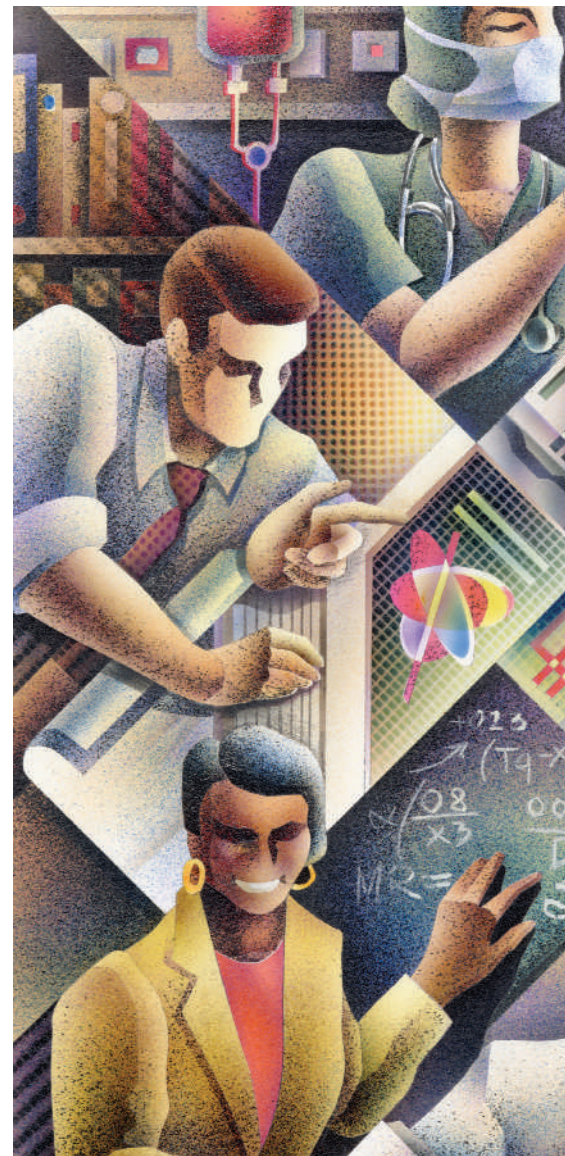
Their study, which is currently undergoing peer review at *Organization Science*, a management journal, is part of a broader effort by economists to use empirical methods to study factors behind the success or failure of young companies. For example, Toby Stuart and his colleagues showed in a 1999 paper (T. Stuart, H. Hoang and R. Hybels *Admin. Sci. Quart.* 44, 315–349; 1999), that a private biotech that has associations

with high-status investors and collaborators was more likely to complete a public stock offering. Lee Fleming of Harvard Business School has been looking at the effect of agreements that restrict the rights of biotech employees to go and work for other firms: he thinks such contracts are stifling the biotechnology industry.

The authors believe their study will help biotech executives modify how they budget their research dollars — although private investors may give such work short shrift. "Most of us investors read these types of study and gain some insight, but they're not driving our decisions," says Steve Burrill, chief executive of Burrill & Company, a San



David Hsu thinks combining skills can fuel innovation.



Francisco-based merchant bank that specializes in biotechnology. He thinks the most important single corollary for success in a young biotechnology company is the quality of its management. "It's better to have mediocre science and a balanced team than one Nobel prizewinner with no support."

Other economists say that diversity of talent came out as important in this particular study because the technology it looked at — recombinant DNA — could end up being used in many different ways. Fiona Murray of the Massachusetts Institute of Technology (MIT) in Cambridge says that if they had looked at companies that specialize in a particular disease, for example, then diversity of staff expertise might have mattered less.

Murray also contends that the best way to understand how knowledge gets passed between researchers is not to do just a patent analysis, but also to interview the researchers and find out directly. "Many folks in industry read patents and build on the knowledge they contain," she says. "But most researchers hear about technological advancements from research papers or



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directly from colleagues.” Hsu and Lim won’t have picked this up, she says, because their analysis relied solely on the patent record to show how innovations were conceived.

Although Hsu acknowledges such limitations, he says there is currently no easy method for adding qualitative data. “We looked at 19 firms over 20 years and we looked at changes within each firm year-by-year,” he says. “How would each inventor remember whom they talked to 15 years ago, 14 years ago, and so on?”

Robert Langer, an MIT chemist with some 500 patents to his name and a long track record of interdisciplinary research, says that having lots of different disciplines in a biotechnology company’s research team is not always necessary for it to bear fruit. “Some research groups might be better off staying within a single discipline,” he says, adding that the most important thing is the mix of personalities in the lab. “It is important to encourage people to reach for their ideas, and create an environment where people can do so,” says Langer. “Having an interdisciplinary team might contribute to that.” ■

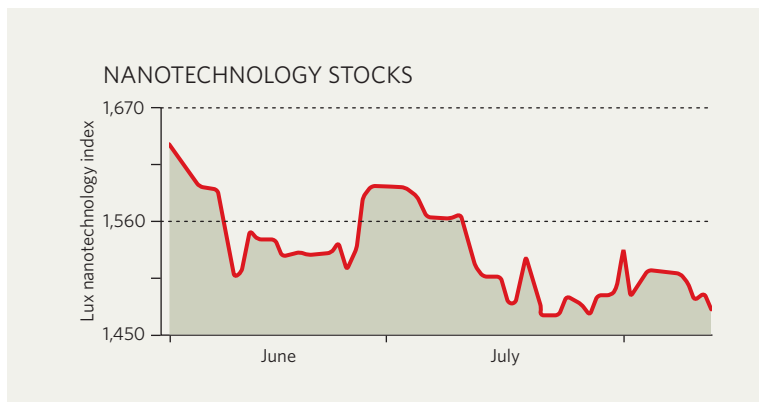
## IN BRIEF

**COTTON SWEEP** Monsanto, the world’s leading supplier of genetically modified crop seed, has agreed to buy Delta Pine and Land, a Mississippi-based cotton-seed supplier, for \$1.5 billion. The purchase, announced on 15 August, should end fierce litigation between the two companies over previous efforts by Monsanto, based in St Louis, Minnesota, to take over the Mississippi company. If regulators and shareholders approve the deal, it will widen Monsanto’s commanding lead in the transgenic crop market, where Switzerland’s Syngenta is its main remaining rival.

**SUMMER CLEAR-OUT** Jeff Kindler, Pfizer’s freshly appointed chief executive, has moved swiftly to reshape top management at the world’s largest drug company (see *Nature* 442, 734; 2006). Karen Katen, one of his rivals for the highest position and head of the company’s pharmacological division, will leave the company altogether, whereas David Shedlarz, the other contender and Pfizer’s finance chief, gains wider responsibilities. Kindler also named a seven-strong taskforce, including research chief John LaMattina, which, he said, would streamline company operations and accelerate decision-making.

**CHIP FLOAT** German semiconductor-maker Infineon Technologies managed to float its memory-chip arm, Qimonda, on the New York Stock Exchange. The public offering raised just \$546 million — not bad by current standards, but less than half what analysts had predicted when the float was first announced. The offer was hurt by bad market sentiment towards such offerings in all technology sectors and by falling prices for Qimonda’s main product, the memory chips used in personal computers. Some market watchers expressed relief, however, that the float actually went ahead in current market conditions.

## MARKET WATCH



Technology stocks are in the doldrums this summer after losses in the spring, and nanotechnology is no exception to the pattern. But within the basket of stocks that makes up the Lux Research index, individual company performance has been mixed.

One undoubted success has been NVE, a Minnesota-based spintronics company, whose stock soared from \$14 to almost \$22 in July on unconfirmed reports that its technology may be successfully incorporated in non-volatile memory chips made by Freescale Semiconductor.

Nucryst Pharmaceuticals, the Massachusetts-based company whose silver nanocrystals are now popular as wound treatments, was also on the up in July after declaring strong sales growth in the second quarter. And according to Peter Hebert, president of the New

York consultancy that runs the Lux index, investors are optimistic that the nanocrystals will eventually prove useful as drug treatments for infections and inflammation.

Less stellar performances were delivered by Cambridge Display Technology, the UK light-emitting diode (LED) display maker, whose shares sank from \$8 to \$5 in July in anticipation of weaker-than-expected sales in the third quarter. Similar concerns dragged down Oregon-based FEI, which makes scanning electron microscopes.

Hebert says an emerging feature of the nascent sector is the prevalence and importance of litigation over its intellectual property. Elan’s July decision to sue Abraxis Bioscience over its use of a nanoparticle formulation technique is, he says, “a sign of things to come”. ■

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