

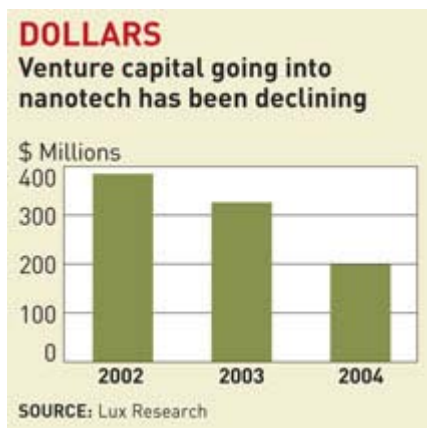
# NANOTECH INVESTING

**Although a few firms using nanotechnology have gone public, venture capitalists still wait for a payoff from their investments**

[ANN M. THAYER](#)

This year is expected to be the first in which the money put into nanotechnology R&D globally by industry will exceed that coming from government. Billions of dollars are being poured into the nascent technology, gradually helping to create products rooted in nanoscale features or innovations. Established corporations are driving much of this, but many small firms are contributing and some may eventually generate the sales and earnings needed to survive long-term. Many more, however, will be acquired, and even more will fail.

There are more than 1,200 nanotech-related start-up companies worldwide, with about half of those in the U.S., according to the advisory firm [Lux Research](#). Only about 10% have ever attracted venture capital, and just 10% of those have received more than one round of funding. Government grants have gone a long way in supporting start-ups. But prominent venture capital firms specializing in technology ventures have backed many small firms now considered standouts.



Nevertheless, venture capital investing in companies using nanotech has fallen over the past two years from \$385 million in 2002 to just about \$200 million in 2004. "This is in line with a sustained decrease overall in venture capital spending," says Matthew M. Nordan, Lux's vice president for research. "The percentage of total venture capital devoted to nanotechnology has held more or less constant between 1.5 and 1.7%." By most estimates, the number of nanotech deals rose last year, with smaller amounts being put into early-stage investments.

This year, though, has been radically different, Nordan says. In just one week in January, [Nano-Tex](#), [Nanomix](#), and [Nantero](#) snared a combined \$66 million in largely late-stage funding deals, followed by a \$12 million round for [NanoOpto](#) in February. "We expect this year is going to be much stronger, back between \$300 million and \$400 million," Nordan concludes.

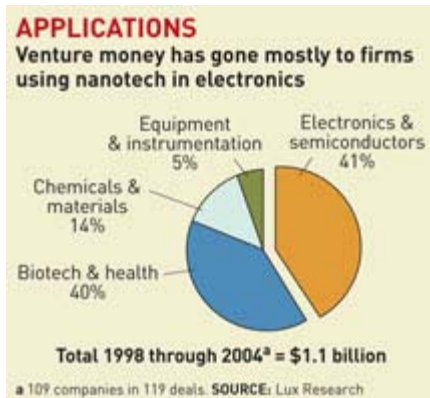
The total might go higher if any companies successfully go public and make such investments look like attractive bets. Investing runs in cycles, and money is more likely to flow in when investors see an exit opportunity for their investments. Playing against this has been a sluggish market for initial public offerings (IPOs) of stock. Even so, many investment groups are sitting on large amounts of cash raised during the Internet era, and they want an outlet.

How a venture capital firm uses its money depends on its investment philosophy. [Draper Fisher Jurvetson \(DFJ\)](#), for example, is among the most active investors overall. About 20 companies, or 17% of its total portfolio, are in the nanotechnology, microelectromechanical, and novel materials areas. As an early-stage investor, DFJ looks for "near-term" opportunities.

"Near term means that in the next three to five years there will be a major commercialization ramp-up of a company's products," explains Steve Jurvetson, DFJ managing director, "and that within about five to seven years, there's some possibility of it going public or a major inflection point in its maturation, so that it's not just a research-stage enterprise anymore." Jurvetson, who serves as a cochairman of the [NanoBusiness Alliance](#) trade association's advisory board, has electrical engineering and business degrees and spent time working in the computer industry.

[Harris & Harris Group](#), which invests only in "tiny tech" and has a current portfolio of 20 companies, has a similar approach. "We hope our investments fit into the classic venture capital time horizon of five to seven years, although there isn't enough historical data in nanotechnology to know if this will materialize," says Douglas W. Jamison, who serves as president and chief operating officer. Unlike most venture capital firms, Harris & Harris is a public company and raises capital via stock offerings and through sales of its investments, rather than through time-limited funds; its assets were just over \$79 million at the end of 2004.

"Because we have permanent capital, if things take longer to develop than we first thought, that's certainly going to affect internal rates of return, but we can still make decisions at the time of the new investment," Jamison explains. The firm has been expanding to keep up with about 150 potential deals every six months. Recent hires are Alexei A. Andreev, a Ph.D. physicist formerly with DFJ; Daniel V. Leff, a Ph.D. chemist formerly with [Sevin Rosen Funds](#); and Daniel B. Wolfe, a Ph.D. chemist who had done some business planning for [Nanosys](#).



Despite the interest these and other investment firms have in nanotech-related businesses, the bar remains high for getting venture capital money. They all emphasize that, as so-called value investors, they are not investing in nanotech per se, but on a case-by-case basis in promising companies with unique technologies being applied across a range of industries.

**IN CONTRAST**, momentum investors look for buzz-worthy sectors and then take a more shotgun approach, hoping to find a winner. Although momentum investing can yield quick returns, value investors look for strong business plans, large potential markets, clear product and commercialization strategies, solid intellectual property positions, and good management around which companies can be built.

Deal flow in nanotech-related companies is strong, agrees Daniel T. Colbert, chief technology officer at [NGen Partners](#), a venture capital firm that specializes in the materials science area. "A lot of companies are positioning themselves as nanotech companies, and credibility versus hype is a factor here," he adds. NGen provides second-stage funding to emerging businesses, and its portfolio includes 15 companies.

The firm has several major corporations as its limited partners and academic scientists as venture partners. Colbert--who was a [Rice University](#) chemistry professor and a cofounder of [Carbon Nanotechnologies](#) with Nobel Laureate Richard E. Smalley--coordinates the technical due diligence process as investments are evaluated.

Colbert and other venture capital investors say the "nano" label actually increases their skepticism and generates no premiums as it might for momentum investors. "NGen thinks in terms of fuel-cell deals, battery deals, or pollution abatement deals, and doesn't really give a hoot whether anyone would say they are enabled by what you would call nanotech or not," Colbert says. "Because that doesn't add any value; it's whether the market wants what they are offering no matter what the underpinnings of the technology.

"We are moving through a period where nanotechnology has the opportunity to be approached as a momentum play," he explains. "Within maybe just a couple years, I think it will be seen largely for what it is, which is a foundational technology that plays into many industries."

In evaluating companies, it makes more sense, Colbert believes, to map companies to the relevant end-use sector instead of grouping them under a nanotech label. "To draw circles around nanotechnology and call it an industry is inauthentic," he continues. "On a technical level there is authentic value in talking about nanotechnology, but not on an investing level, at least not as a value investor."

Jurvetson agrees that it's wise to invest in companies and not sectors, but says his firm does try to focus resources on emerging trends that offer new ideas, new products, and big potential breakthroughs. Broadly speaking, he says, nanotech fits this bill. DFJ also believes in building lean, sustainable companies that don't set out with a strategy requiring large amounts of capital and can learn to manage cash conservatively as they grow.

"If you can get away with the same outcome with less capital on the front end, you are going to make a better return, but it also affects company culture," Jurvetson says. His intuitive sense is that "looking back, the single best determinant of failure in the long run has been a start-up raising a lot of money early."

Beyond traditional investment considerations, delving into nanotech-related areas requires a deep technical understanding and thus in-house expertise, investment managers maintain. Harris & Harris has capabilities to understand the science, intellectual property, and technology transfer, Jamison says, but complements these skills by working with other firms that bring industry domain expertise.

**A GOOD EXAMPLE**, he says, was the January 2003 funding of NanoGram Devices, a maker of nanoscale silver vanadium oxide for use in batteries for implantable cardiac defibrillators. The investment syndicate included Harris & Harris, two power/energy investors, and a medical device venture capital firm. In March 2004, [Wilson Greatbatch Technologies](#) acquired NanoGram Devices for \$45 million, yielding for Harris & Harris more than three times what it paid in.

Indeed, acquisitions and mergers are the most common way for venture investors to liquidate their investments, reports the [National Venture Capital Association \(NVCA\)](#). In 2004, nearly 60% of the money returned to investors was from acquisitions. When the window for IPOs is closed--as it was last year--companies may be more willing to accept buyout offers. Still, 2004 was the best year for exits overall, including acquisitions and IPOs, after three years of decline.

"Our portfolio economics is driven by the standout winners, the home runs if you will, not the base hits," Jurvetson says. "Doubling our money on an investment is equally as bad an outcome as losing all of our money--it makes no difference to the overall portfolio." He says venture capital investors look for one-of-a-kind companies that will offer 100-fold or greater returns. "And generally speaking, the chances of making an outrageous return are higher in an IPO."

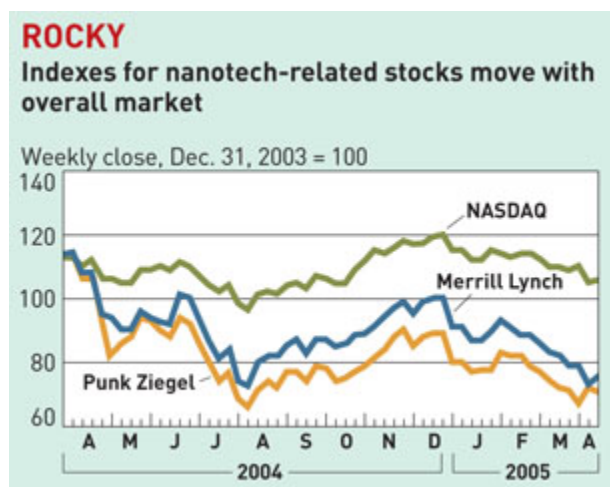
The risk-reward ratio is high; even venture capital investors considered successful see more than half their investments lose money. A recent notable failure was [Optiva](#), which shut its doors in February. The company was developing nanoscale thin crystalline films and had raised in excess of \$41 million from venture capital firms, including Harris & Harris and NGen.

A year ago, Optiva was being touted as a nanotech-related company that had the potential to go public. The issues Optiva faced are typical in the development path for early-stage high-tech companies, its investors explain. "Just as I wish people wouldn't hype nanotechnology," Colbert comments, "I wish people wouldn't blame nanotechnology when things fail."

"At the end of the day, most companies fail not because of technology, but because of execution," Jamison says. The company even had major partners and sales to producers of polarizers for liquid-crystal displays. However, its initial product provided lower margins than desired, and more profitable products needed additional time and money for development. In the end, it couldn't find investors with the additional capital willing to bet on its doing so.

"The companies that have been successful in raising money this year have all been in late-stage fund-raising," Lux's Nordan observes, where "typically they are not showing ideas or prototypes, but a large-scale manufacturing concept." For example, although it was Nano-Tex's first time raising venture capital, the company has been well-funded by other routes, and investors consider it a later stage business.

After venture capital funding, the next question brewing is when companies will be ready for the IPO market. Momentum investors, who bought in a few years ago when nanotech hype was rising, have been somewhat disappointed, expecting big near-term returns only to find that nanotech-related applications would take longer to develop and the companies longer to mature. The Internet boom, when a company could move from start-up to IPO in 18 months, may have unrealistically shifted expectations.



**THE IPO WINDOW** hasn't been wide open for about four or five years. In 2004, all eyes turned to Nanosys, which filed for an IPO in April and pulled the offering in August, citing unfavorable market conditions. Justly or unjustly, Nanosys was dubbed the "bellwether" that would show how other nanotech-focused companies would fail or succeed in the public markets. Not surprisingly, pundits have scrutinized the IPO's timing and importance.

The four-year-old Nanosys has a broad intellectual property estate, important partnerships validating its technology, a highly successful management team, and an advisory board that reads like a who's who in nanotechnology. But it had no product revenues, offering instead the promise of a platform of technologies that potentially could go into diverse applications. As such, it is a more complicated story and speculative investment. Although Harris & Harris has invested in Nanosys, DFJ and NGen have not.

The market's ability to assume risk changes over time, investment managers explain. During the Internet boom, that willingness was high, and a company with just a business plan could easily go public. But in August 2004, the market's sentiment shifted, becoming more conservative and less enthusiastic overall about technology stocks. The result was the pulling of a significant number of IPOs. Thus, Nanosys' cancellation is by no means a nanotech story, investors say, but one simply of market cycles and timing.

Three nanotech-related companies did manage to launch IPOs in 2004, but with little fanfare. "In all three cases, those companies weren't sold to Wall Street as nanotech," Nordan explains. "They were sold as 'cancer' or 'displays' or 'polymers,' and the 'nano' component wasn't played up." Leveraging the sector's strengths, rather than focusing on an unproven technology, made sense, he adds.

One of the IPOs was [Immunicon](#), which is developing cancer diagnostics based in part on metal nanoparticles. The company's IPO was priced at \$8.00 per share, and although its stock jumped to \$10, it now trades near \$5.00. In March, the company received Food & Drug Administration approval for its CellTracks Analyzer II.

Another of the companies was [Cambridge Display Technology](#), which uses nanoscale materials in polymer light-emitting diode (PLED) displays. It has major corporate partners and a leading patent portfolio in PLED technology. CDT went public in late 2004 at \$12 per share, but its stock has never reached that level again and trades at just over \$7.00 per share. The 13-year-old company had \$13.3 million in revenues and a net loss of \$16.8 million in 2004.

The third was [Lumera](#), which is developing nanostructured polymer materials for a broad range of applications, including wireless antennae, biochip arrays, and electro-optic devices. Although its stock shot up more than 30% above its \$6.95-per-share offering price, it now trades under \$5.00. Lumera remains a platform technology company with 2004 revenues only from government contracts.



Even before these IPOs, a few nanotech-related raw materials companies have been publicly traded. Among the first was [Nanophase Technologies](#), which, despite having product sales, hasn't posted a profit since its 1997 IPO. Its offering price was \$8.00 per share, and it now trades just over \$5.00.

Although the declining stock prices of existing nanotech-related companies have provided no referendum for IPOs, analysts and investors have a short list of nanotech-related firms that might soon be able to go public. On the list are [Nanofilm](#), [NanoDynamics](#), Nantero, [Konarka](#), [Molecular Imprints](#), [ZettaCore](#), Zyvex, and, eventually, Nanosys. The front-runner seems to be Nano-Tex, despite its repeated claims that it has no IPO plans.

"The requirements are going to be companies with real products and substantial revenues," says Marcus Mainord, an analyst with the investment banking firm [Stephens Inc.](#) For example, Nano-Tex makes nanotech-based textile treatments and has more than 80 customers. For investors, Mainord points out, it is "an easily understood story." Nano-Tex was among 33 companies presenting in April at Stephens' first nanotech investors conference.

Several other late-stage companies making analysts' lists offer similar revenue-based stories, although exactly how many of them will go public and when is uncertain. If Nano-Tex were to be successful, Mainord believes there might be "a flurry of three or four." He doesn't see that as likely to happen, however, until the first half of 2006 or possibly fourth-quarter 2005.

Nordan is slightly more bullish. If economic conditions hold steady, he told C&EN in early April, he expects at least one "unambiguously nanotech" offering by the end of the third quarter. If that happens and "the shares don't tank immediately following the offering, we think others are likely to move in the fourth quarter" to file with regulators but probably not launching an offering until early 2006.

"Investment markets and high-end investors are very fickle, so if one of the companies attempts an IPO and either isn't able to pull it off or the shares tank immediately, then you can set back the clock another 18 to 24 months," Nordan warns. He also predicts that Nanosys will successfully approach the market again at the end of the year but will be forced to accept a more conservative valuation.

According to NVCA, the first quarter of 2005 was the slowest for IPOs since the third quarter of 2003, so any success in nanotech IPOs is sure to bring out more investors. "As soon as there is an existence proof that there is money to be made here, a lot of money will come in." Nordan says. He cautions, however, that it will bring out investors who are "less informed" than those currently exploring the nanotech area.

Valuing nanotech companies, especially the ones with more speculative business models, is a difficult prospect. Nanotech-related stocks experienced a run-up after President George W. Bush signed the Nanotechnology Research & Development Act in late 2003,

but in the past 12 months, there's been a sell-off, with nanotech-related stocks down about 25 to 35%. "I would argue that a large portion of the hype is already priced out of the stocks," Mainord says.

"Initially, the word 'nanotechnology' conveyed higher growth opportunities than other stocks in the market," says JoAnne Feeney, an analyst with the investment firm [Punk, Ziegel & Co.](#) Feeney, who has a doctorate in economics, was senior business strategist for [Albany NanoTech](#)--the State University of New York, Albany, center for nanoelectronics innovation and commercialization--before joining Punk Ziegel. She was also among the founding faculty at the College of Nanoscale Sciences & Engineering at Albany.

"While nanotechnology and nanoscale innovations have a great potential to change existing markets and therefore a lot of growth opportunity," she says, "I think people are realizing that it's difficult to distinguish among these stocks." Evaluating them, she says, involves understanding the science as well as the business plan. Forecasting established cash flow and earnings metrics is difficult due to the technical complexity and product uncertainty.

Feeney and her colleague Juan F. Sanchez, who has medical and business degrees and has been following nanotech since 2001, advocate separating nanotech-related companies into two groups: single-focus companies and pluripotent companies. Valuations for single-focus companies are based on more standard measures used for companies with products and strategies targeting a given industry. Platform technology, or pluripotent, companies have the potential to impact many sectors and present more complicated analyses. While offering more upside potential, they also present higher investment risk.

Meanwhile, if nanotech is getting ready for the market, is the market ready for nanotech? In March 2004, Punk Ziegel launched a stock index, posted on the firm's website, that tracks 22 nanotech-related companies. The companies making the cut have "future prospects we believe are going to be largely driven by their nanotech operations," Feeney says. Very large companies, despite having leading research endeavors, are not included because nanotech doesn't currently drive their businesses.

About 40% of the companies on the Punk Ziegel index are in life sciences. Another 38% are in instrumentation or equipment, 11% are in materials, 7% are in devices, and 4% are investment firms, including Harris & Harris. The aim is to "give the investor a way to examine the current performance of nanotechnology as it's appearing across the economy and clarify the opportunities that are emerging from nanotech innovations," Feeney says.



## Funds Combine Nanotech-Related Companies For Investors

**ACTIVEST NANOTECH FUND**  
**Created:** November 2002  
**Status:** Trades on Luxembourg exchange  
**Portfolio:** 65% technology, 10% health care, 6% services, 19% other  
**Top holdings (as of Dec. 30, 2004):** Agilent Technologies, Dai Nippon Printing, Harris & Harris, IBM, Jeol, Nanometrics, Nanophase Technologies, Plug Power, Samsung Electronics, Zygo

**DAC NANOTECH FUND**  
**Created:** September 2003  
**Status:** Trades on Luxembourg exchange  
**Portfolio:** 29% technology, 25% pharma/biotech, 15% electronics; 11% nanotech, 10% environmental, 10% other  
**Top holdings (as of Feb. 28, 2005):** Acacia Research, Amcol, Applied Films, BEI Technology, Bruker Biosciences, Headwaters, Hyflux, Keithley Instruments, Masterflex, MTS Systems

**FIRST TRUST NANOTECH PORTFOLIO 1**  
**Created:** March 2004  
**Status:** Trades as FTNATX  
**Portfolio:** 33% information technology, 21% health care, 21% materials, 15% industrials, 7% energy, 3% other  
**Top holdings (as of April 1, 2005):** Dow Chemical, DuPont, ExxonMobil, FEI, General Electric, Headwaters, Hewlett-Packard, IBM, Medtronic, Varian

**FIRST TRUST NANOTECH PORTFOLIO 2**  
**Created:** March 2005  
**Status:** Trades as FTNAMX  
**Portfolio:** 35% information technology, 29% health care, 17% materials, 13% industrials, 6% other  
**Top holdings (as of April 1, 2005):** Accelrys, American Pharmaceutical Partners, General Electric, Headwaters, Hewlett-Packard, IBM, MTS Systems, Nanometrics, Skyepharma, Veeco Instruments

**WESTLB NANOTECH FUND**  
**Created:** May 2004  
**Status:** Trades on Stuttgart and Frankfurt exchanges  
**Top holdings (as of April 2005):** Applied Films, BioSante Pharmaceuticals, FEI, Flamel Technologies, Headwaters, JEOL, Masterflex, Micronic Laser Systems, Symyx Technologies, Veeco Instruments

**"IN SO DOING,** we are trying to draw a distinction between a fiction which is called a nanotechnology sector and a reality which we believe is that the existing market sectors are very much likely to be affected," she says.

Punk Ziegel has seen interest developing within its own investment community and held its first nanotechnology conference in late April. The Punk Ziegel index has been moving pretty much in sync with the technology-company-heavy NASDAQ stock market, Feeney says, starting off 2004 at a high, hitting a low in the summer, and recovering some late in the year. The index is down 20% since the start of 2005. Looking ahead, "there are signs of growth, which is always good for the technology areas," she says, "although there are still mixed signals coming out of the semiconductor industry."

Merrill Lynch debuted its index--which is listed on the American Stock Exchange (AMEX) but is not an investable product--just after Punk Ziegel. The Merrill Lynch index was widely criticized by other investors and many in the nanotech field for the criteria used to include companies. Within days, Merrill analysts refined the criteria, dropping six companies and adding three.

Most of the 27 companies now on the Merrill Lynch index fall in the instrumentation, biotech, and materials areas and must indicate "that nanotechnology initiatives represent a significant component of their future business strategy." The firm points out that it hasn't performed any analyses and is not commenting on the investment merits of any of the companies.

Last month, Lux Research joined the fray with its own 26-company index. Unlike the other two, the Lux index includes large companies. It also is listed on AMEX, but is not for purchase. Despite the very different mix of companies, the Lux index has been tracking closely with the Merrill Lynch and Punk Ziegel indexes and the overall stock market.

Lux's index differs in three ways from the others, Nordan explains. First, he says, it is an attempt to provide a balanced view of nanotech innovations across a value-chain ranging from nanomaterial producers to manufacturers of intermediate products that incorporate nanomaterials or have nanostructured features to those producing the final goods. Also included are companies making tools, equipment, and software used by researchers.

Second, the index is designed to showcase the sectors actively applying nanotechnology. Among the large companies, the end-use incumbents that will ultimately take products to market, Nordan points out that there is not a single life sciences company. Not having any in the index is consistent with Lux's research, he says, which shows a low level of nanotech R&D at pharmaceutical companies compared with materials manufacturing and electronics firms.

And third, the Lux index focuses only on emerging applications of nanotechnology in materials and manufacturing, electronics and information technology, and health care and life sciences. "We hope we have created something intellectually coherent," Nordan says,

"that presents a view of what emerging nanotechnology development is, how it breaks out across value chains, and how it impacts industries. We didn't see that in the other indexes."

Meanwhile, the investment firm [Asensio & Co.](#) has become a vociferous critic of the nanotech indexes. When the Merrill Lynch index debuted, Asensio called on the firm to remove certain companies and on the New York State attorney general to investigate misuses of the nano label. It charged that the moniker artificially raised some stock prices and is being used fraudulently by stock promoters and some companies. A year later, Asensio continues to take issue with stocks included on the indexes, a favorite target being the company [NVE](#).

While the arguments around what is and isn't nanotech continue, the investment firms have chosen from 40 very diverse companies to make up their indexes. Tim Harper, who heads the consulting firm [Cientifica](#), has referred to the group as a "random selection of technology stocks" in his online TNTlog. He has been surprised just as much by those left out as he has by those "tangentially and/or tenuously related to nanotech" that are included.

**EVEN BEFORE** the indexes appeared, a handful of largely European investment firms had fashioned mutual funds or portfolios for purchase and trading on stock exchanges. Some of the same companies--and many more--that appear in the indexes are in these diverse funds as well. [Activest](#) in Germany created the first fund in late 2002. Activest's fund started off slowly, dipping about 10% in early 2003. It then rose more than 50% by early 2004, but fell again, and ended the year up 20% with assets of \$40 million.

Some investors and industry participants are concerned that stock indexes or funds, which are normally created for definable industrial sectors, will mislead unsophisticated investors into believing there's a nanotech industry in which to invest. The fallout might be more hype, a herd mentality toward momentum investing, and, ultimately, disappointment when reality sets in. All this could spell a backlash and setbacks for nanotechnology development.

The financial future of nanotech-related companies hinges on market cycles, IPO windows, investor interest, and flow of results out of research and product development and into the marketplace. Although investors today believe that expectations are more realistic, valuations more sensible, and analyses more grounded, they still want to avoid a bubble forming and then bursting.