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New Nanotech Funds: Hurry, Hurry, Step Right Up.

Ever since I started this newsletter in 2002, subscribers have been asking me if there were any mutual funds or exchange traded funds (ETFs) devoted to nanotechnology. Everyone wants to buy into nanotech, but few are willing to do their homework. They want funds.

Finally there is a new nanotechnology focused exchange traded fund designed especially for individual investors. Starting on October 26, investors can buy into a diversified nanotech exchange traded fund created by PowerShares and my affiliated institutional research firm, Lux Research. The American Stock Exchange listed shares will trade under the ticker "PXN". The ETF is based upon the 26-stock Lux Nanotech Index™ (also listed on the AMEX under the ticker "LUXNI"), which is designed to track the performance of securities involved with nanotechnology.

Given that I am an investor in Lux Research, I am of course biased and hope that this new Nanotech ETF is a big success. I should let you know, however, that I personally had nothing to do with the index or its selection process. The LUXNI's selection committee is comprised of Lux Research's Matthew Nordan and former **Lehman Brothers** [LEH] investment policy committee member and investment manager Mark Kimsey.

The Index is sorted into two groups: nanotech specialists and end-use incumbents. Nanotech specialists are defined as small- and mid-sized companies (less than $5 billion in annual revenue) that focus specifically on developing or funding emerging nanotechnology applications. All have nanotechnology as either a company-wide or business-unit-wide focus, and most work with larger companies as manufacturing or distribution partners. Examples here include Nanosphere members like **FEI Company** [FEIC] and **Harris & Harris Group** [TINY], both part of this newsletter's model portfolio.

End-use incumbents are large companies (greater than $5 billion in annual revenue) that are applying nanotechnology to existing product lines. All are leaders in nanotechnology R&D, commercialization in products, or both. An example is **3M** [MMM], which Morgan Stanley recently estimated has annual nano-enabled product sales of $800 million.

The index is structured as a modified equal-dollar weighted portfolio. This means that the two groups contain equally weighted stocks with seventy-five percent (75%) applied to the nanotech specialist components and twenty-five percent (25%) for the end-use incumbent components. The key takeaway is that the inclusion of 3M or **GE** [GE] does not skew the portfolio's weighting towards the large cap stocks (as it does in the S&P 500 or Nasdaq Composite because of their market-weighted structure). The ETF's largest holdings will be **Elan** [ELN], **Headwaters** [HW], **American Pharmaceutical Partners** [APPX], **Westaim** [WEDX] and **Veeco Instruments** [VECO].

ETFs have become investor darlings in recent years, thanks to generally lower expenses, intraday pricing, and tax advantages. PowerShares is an up-and-coming ETF company, willing to take risks on innovative ETFs, as long as it thinks they will sell. Other new PowerShares ETFs include International Dividend Achievers ETF, the Wilder Hill Clean Energy portfolio and a Golden Dragon Halter ETF devoted to Chinese stocks. The PowerShares nanotech fund has an expense cap of 0.60%, which is relatively expensive compared to most ETFs. Merrill Lynch's **Biotech HOLDRs** [BBH], for example, has an expense ratio of 0.08% and **Vanguard's Information Technology VIPERs** [VGT] has an expense ratio of 0.25%. Standard & Poor's Depositary Receipts, otherwise known as "**Spiders**" [SPY] has an expense ratio of 0.12%, or one-fifth that of the new PowerShares Nanotech ETF.

Despite a relatively high expense ratio, which seems to plague most of PowerShares' offerings, this Nanotech ETF may be the best bet for individuals looking to buy a diversified portfolio of nanotech stocks. The other nanotech funds available are even less desirable. First Trust introduced a Unit Investment Trust (UIT) focused on nanotech in March 2004. A UIT is a trust that holds a fixed portfolio of securities and is offered to investors in "unit" increments. Unit holders receive a share of the trust's earned income, if any, and their share of the holdings at the trust's maturity. Unlike a mutual fund, a UIT is created for a specific length of time and is a fixed portfolio, meaning that the UIT's securities will not be sold or new ones bought, except in certain special situations.

Based on strong demand from the first series, First Trust launched a second **Nanotech-**

INSIDE

nology Series [FTNAMX] on March 9, 2005. The launch price was $10 per unit and it currently trades at a price of $9.144. This new UIT holds stocks such as **Exxon Mobil** [XOM], GE and **Intel** [INTC], as well as Veeco, **NVE** [NVEC] and **Flamel** [FLML]. Its first portfolio, Series 1, came out in March 2004 at $10 and is now trading at $8.33, or 16.7% below its offering price. There have been two distributions to date, totaling four cents. So this hot nanotech trust IPO has been a big loser so far.

Of course, unlike ETFs, UITs are typically sold by brokers, so they are laden with fees. First Trust's Nanotech portfolio in standard accounts carries an initial 1% transactional sales charge, with a 3.45% deferred sales charge. There is an additional 0.50% creation and development fee tacked on. The maximum sales charge listed on the product is 4.95%. Other examples of UITs include Lehman Brothers' 10 Uncommon Values product.

There is also DAC Nanotech-Fonds, a German nanotech mutual fund launched in January 2003. The minimum investment is EUR 1,000 and the fund carries a 1.7% management fee with a max load of 5%. As of August 31, the funds largest holdings included **Unigene** [UGNE.OB], Headwaters, **Bruker Biosciences** [BRKR], **Spire Corp** [SPIR], **Zygo** [ZIGO], **Keithley Instruments** [KEI], and **Applied Films** [AFCO]. The advisor to the fund is investment firm Nanostart AG, which is itself publicly listed. Nanostart went public in a June 2005 IPO on the Frankfurt exchange, and currently trades under the ticker "NNS" in Germany and is quoted in the U.S. under the ticker "NASRF.PK". Nanostart's crossover portfolio includes private companies like Arryx, MagForce Nanotechnologies, NanoOpto and NaturalNano, and public names like **Arrowhead Research** [ARWR] and **Obducat** [OBDU.B]

Other methods for playing nanotech baskets include directly buying shares of nanotech venture capital investors **Harris & Harris Group** [TINY], **Advance Nanotech** [AVNA.OB] and Arrowhead.

At this point I am not recommending any of these nanotech sector fund products and as you know we currently have a "Hold" on Harris & Harris. Longtime readers of this newsletter know that I strongly believe that you need to be a stock picker in the relatively risky market for nanotech stocks. The holdings in our current Nanosphere portfolio on page 8 represent companies on which my team and I have done extensive due diligence. My 10 Nanosphere "Buys" are your best bet for long term for nanotech profits.

Nanotech Noses into RFID

On the bottom of a box of razor cartridges or the plastic packaging of a new DVD, have you seen a thick sticker with tiny wires inside? Perhaps you pay highway tolls with E-ZPass? If so, you've used RFID technology.

Radio Frequency Identification (RFID) tags are replacing Universal Product Code (UPC) symbol barcodes. Rather than relying on light sensors to read between little black lines, RFID tags consist of integrated circuits connected to a tiny antenna. They store and transmit much more data than barcodes.

RFID tags have been hailed as the harbinger of more efficient manufacturing and shipping processes, which would eventually lower product costs and increase customer service levels. Manufacturers and retailers are excited about keeping better track of inventory, making better use of storage space, and cutting transportation and production costs. But there are still hurdles for RFID to jump--mainly high costs and a lack of reliability in chip quality.

The RFID Alliance Lab at the University of Kansas tested all nine UHF RFID tags currently used in supply chains. The results weren't pretty. Few tags lived up to their marketer's claims for reliability. Mark Roberti, editor of RFID Journal, says it wasn't clear whether the problems were with chips, antennae, or the bond between the two. But he says this bond is a major problem.

The good news is that the US government (especially the Department of Defense) and many large retailers are creating a healthy market for RFID. **Wal-Mart** [WMT] requires their top 200 suppliers to use RFID tags on all boxes and palettes by 2006. **Target** [TGT], Tesco and **Best Buy** [BBY] are mulling similar mandates. **Gillette** [G] got a jump and purchased 500 million tags from California-based startup Alien Technology Corporation. **Procter & Gamble** [PG] and **Altria** [MO] also use RFID inventory systems.

Nanotech can help improve tag reliability. Nanosys [*Full Disclosure: My firm Lux Capital is an equity investor in Nanosys*] is trying to develop a technology to print both chip and antenna at the same time, eliminating the need to connect them in a separate process. Nanosys doesn't plan to make end products, but is looking to partner out the technology to RFID manufacturers or label makers like Alien, **Symbol Technologies** [SBL], Avery, and Rafsec. These companies, along with Intermec and **RR Donnelley** [RRD] are developing what industry insiders call Gen 2 tags. **Kimberly-Clark** [KMB] is currently testing these tags and they may be using them by year-end.

One advantage Gen 2 tags enjoy is their compliance with international standards, while most current tags comply with the US standards only. They also have the potential to carry up to 256 bits of memory per tag-nearly triple the memory of first generation tags. Gen 2 readers have also been improved to have better read rates and less interference with each other, letting companies have more readers in a single facility.

Tom McAuliffe helps run an internal business unit at **Motorola** [MOT] that teamed with St. Paul, Minn.-based Cima NanoTech in a multi-year RFID research project. If all works out as planned, McAuliffe says, "one of the applications could be the printing on paper or other materials of complete RFID tags."

The group will be focusing on transportation, distribution and logistics assets. "We see the market beginning to truly adopt asset tracking solutions in a big way in late 2006 into 2007," says McAuliffe. He also cautions, however, that one big obstacle for quick adoption of RFIDs is the uncertain return on investment they'll produce for businesses.

While some companies are getting sucked into the vortex of hype and investing in RFID now, others are taking a wait and see approach. In the end it doesn't matter all that much. At this stage of the game, the tags are a cost center and in and of themselves don't create any direct return. How companies use them to improve their processes may eventually make a positive impact on the bottom line. Are we alone in hearing that sound of all those information technology consultants chomping at the bit to get a piece of the action?

Right now, RFID chips are just too expensive for most manufacturers to afford, espe-

cially for smaller firms. The cheapest tags cost about $0.50, quickly eating up the meager profit margin on a $30 box of goods; some tags cost $1.50 and up.

Two things must happen for costs to get down to the magic $0.05 per tag that many analysts predict will mean widespread adoption of RFID. First, the variance must be minimized and second, high-quality mass production must become routine.

It's unlikely that mass production will be done by the small nanotech startups. Large electronics manufacturers like **Philips** [PHG], EM Electronic, and **Texas Instruments** [TXN] are the global leaders in RFID transponder shipments, with total combined market share around 70%.

Tony Sabetti, UHF supply chain director at TI, says the components of the chips are the most expensive part of the tag, and miniaturizing them using nanotech will lower costs of tags to prices that are justifiable to even the smallest companies. Texas Instruments is already designing a 130 nm device to be included in all of their Gen2 chips.

With so many steps in the manufacturing process of these tags-make a chip, attach an antenna, put them on a label-consolidation is likely in the cards for many firms. For example, a label maker like **Avery Dennison** [AVY] or Zebra Technologies could merge with a chip-innovator instead of partnering. This scenario is unlikely for startups flush with cash like Alien, but dozens of others could find suitors shopping for patents on the cheap.

Manuel Alberts, director of business development at Philips, says applications for these types of RFID tags are limited only by creativity. Already more than 200 libraries worldwide are using Philips tags to track books, and airlines are looking at RFID to track lost luggage. The pharmaceutical industry could use the tags to help prevent counterfeits from reaching your medicine cabinet. And with all the lawsuits Big Pharma faces today, tags could help companies recall impure medicines by the batch, instead of the much costlier blanket recall. While there's no market "pull" for that application yet, the US FDA has issued a "recommendation" that drug makers use RFID to track their products.

Another potentially lucrative market for RFID tags is in tracking livestock. With the recent mad cow disease scares, the tracking of cattle and sheep is on the rise. Advanced ID is one company hoping to gain a toehold in this market. Todd Noble, CFO of Advanced ID, says that tagging is mandatory in Europe and Canada, and will be mandatory in the US by 2008. Most livestock tags currently on the market use low frequency transponders, which cannot be read from very far away. Advanced ID is working on UHF tags, which can be read from greater distances--something necessary when moving thousands of head of cattle a day. Advanced ID is looking for a partner to mass-produce its chips, which are currently handmade and cost $2 each. Their tags can also be used on crates of poultry--an emerging market driven by recent outbreaks of avian flu in Asia.

Philips' Alberts also distinguishes between the simpler RFID tags used for supply chain management and the more complex "smart chips" that hold sensitive information and thus require sophisticated encryption algorithms. He says public transportation is the biggest current market, and success there has encouraged other industries to follow suit. For example, Visa, Mastercard, **American Express** [AXP], and **Chase Bank** [JPM] all have credit cards with RFID chips that can be used to pay at certain locations. **CVS** [CVS] and **McDonalds** [MCD] are in the process of deploying point of sale readers, so that customers with a "smart card" can pay with a wave. Alberts predicts that movie theaters, gas stations, and event complexes will be next to roll out such readers. You could even pay with a chip in your cell phone. Motorola, **Nokia** [NOK] and Samsung all currently offer cell phones that contain RFID chips, and Alberts predicts that by the end of this year, up to 90% of all cell phone manufacturers will follow suit.

Nanotech can also play an important role in RFID readers. Tom Miller, president of Intermec, believes that the real value of RFID will be in combining data with sensors in readers, such as temperature and light exposure, which can affect viability of products such as pharmaceuticals. Miller says that Intermec and other companies are currently working on integrating such sensors into readers.

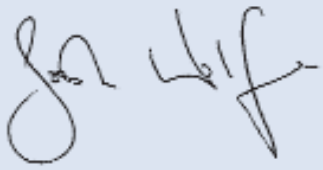
Some researchers at the MIT Media Lab are working on a tag that uses a photodiode and an LED that will blink when interrogated by a special flashlight. Such a tag would be ideal for locations that have lots of metal and electromagnetic waves that might interfere with RFID antennae, such as locating an infected computer server in a room with hundreds of servers. These kinds of tags, however, need a battery and also await a nanotech solution.

The Insider

This October issue is a timely one. My team is wrapping up the Lux Executive Summit in Cambridge, Mass., where the buzz is all about markets and making money. The key message? Nanotech is maturing quickly, as losers get pruned and winners gain momentum in changing economic landscapes.

Many of our longstanding subscribers have repeatedly inquired about a nanotech exchange traded fund. Until just this month, there's been no U.S. option. Be sure to read our review of the first ever nanotech ETF, PowerShares Lux Nanotech Portfolio. Of course, I'm on the board of Lux Research which helped to create the fund's holdings, and I hope that the fund succeeds.

Also this month, our nanosensor and RFID article shows how these technologies already touch your daily life, and names companies that benefit from selling and using them. Here's to thinking big about thinking small...



Nano in the News

Sharp & Nanosys Sign Display Agreement

Sharp Corp. of Osaka, Japan and Palo Alto, Calif.-based Nanosys Inc. entered into a multi-year development agreement to develop display technologies incorporating Nanosys' proprietary nanotechnology. Financials or details on the agreement were not revealed. This is the second major collaboration agreement announced between Nanosys and Sharp over the past 12 months. The first agreement focused on developing a new fuel cell technology for portable electronics [*Full Disclosure: My venture capital firm, Lux Capital, is an investor in Nanosys*].

Thinking Small: Z.L. Wang

When I first met Z.L. Wang at Georgia Tech, he gave me a sneak peek at his yet to be published work in anticipation of starting a company to commercialize it. He hasn't done it just yet, but as director of the Center for Nanoscience and Nanotechnology at the Georgia Institute of Technology, he's one to watch closely. He received his PhD in Physics from Arizona State University and has worked at Georgia Tech for the last decade. In 2001, Dr. Wang discovered the nanobelt, which has been compared to the discovery of the nanotube. Dr. Wang also discovered the first piezoelectric spring and the nanobalance. He is a frequent keynote speaker at nanotechnology conferences across the globe, and between 2001 and 2003, his work on nanobelts was the most cited academic paper in chemistry.

So what exactly is a nanobelt?

A nanobelt is a one dimensional nanostructure. It is a wire-like structure that has a rectangular cross section and whose surface is well defined. It looks just like a ribbon.

What sparked the interest in them?

We have an ongoing interest in functional oxides, which have applications in optics, optoelectronics, dielectrics, sensors, actuators, magnetisms and superconductivity. It's my belief that oxide based nanostructures are probably the most important nanomaterials for nanotechnology. The term "nanobelts" was first defined by us in 2001, and I am convinced that nanobelts will have many applications for building nano-scale sensors, resonators, transistors, light emitting diodes and field emitters. I think this technology will not replace products as much as it will make them 100 times better. I believe it's more about integration and improved performance.

How do nanobelts differ from carbon nanotubes?

Carbon nanotubes were the first widely studied nanomaterial starting around 1999 and 2000. They have a few applications in composite materials, but the highest hope has been for use in electronics and that hasn't happened. The greatest difficultly in using carbon nanotubes is the lack of ability to control the chirality angle, which lets you determine whether a material is a metal or a semiconductor. Either you make a batch to make it 60% semiconductor and 40% metal, but you can't make only one or the other. So the rate of growth in research of nanotubes has begun to slow. On the other hand, research in nanobelts and nanowires has increased. Over 1,000 papers were published last year and 2,000-3,000 will be published this year. Interest is rising dramatically now. Nanobelts are a wide range of materials. They're more stable and easier to integrate, especially for electronics where nanotubes have disappointed.

What are some unique properties?

We've made nanobelts for semiconducting oxides like zinc, tin, and cadmium. With these and other oxides, all we make are semiconductors, and they are structurally determined nanomaterials. The surface and geometry are very well defined. This is true of 20 materials of different chemical materials which can be made in ribbon shapes: zinc oxide, zinc sulfide, aluminum nitride-almost all the important materials can be made into this shape.

So diversity is a key advantage?

Exactly. And oxides are also very stable. They can tolerate environments much better than other materials. For some metals you worry, but if the wire is oxide you needn't worry. Nanobelts are easier to integrate, especially for electronics. A nanobelt's surface can easily be customized for gas and chemical sensing.

And the applications?

There are a number of important ones. We want to use it for gas, chemical, and biological sensing. We want to detect single biomolecules, to build a sensor to be implanted in situ for real time information, like a biosensor for early detection of cancer that is small with low power consumption so you have the potential to implant it. Another key area is using it as a transducer or actuator. Zinc oxide, itself, is a piezoelectric. Piezoelectrics take mechanical signals like force or stress and convert them into electrical signals or vice versa. This is important because in biological systems, people suffer from pressure and this provides the opportunity to sense it. Optoelectronics is a third area where nanobelts can be used to build diodes and transistors.

What makes nanobelts more effective sensors?

With a small sensor you can tell even the slightest change. You can detect at the part per billion level. All these materials are functional materials-mostly semiconductors. If you have any foreign molecule, its conductivity changes dramatically.

What problem keeps you up at night?

Well, research in nanotechnology is extremely competitive. It is a great challenge to continuously remain as a leader in the field. Every day I'm thinking about how to keep our research at the cutting-edge in the field now and in the future.

Take us out five years. What will nanobelt technology be capable of doing?

I expect to see a sensor that is the whole package, including the electronics and sensors that are all integrated into a unit so small that it can work in situ. I want to swallow this unit, have it circulate through my body, take information in, and give me a diagnosis. I'd like also to make high power transistors for nanoelectronics and to utilize nanobelts to detect toxic gases and chemicals with extremely high sensitivity and selectivity. I expect a device used in people's daily life. The goal is to make this adoptable and cheap, so that you can integrate it into existing products without raising the price. Low cost is the key. However it ends up, it must reach people cheaply.

But for the next few years I must work towards a novel device, be able to characterize its performance, and then integrate it with biological sensors and microelectronics. From there we must come up with the system to make these sensors biologically selective and test them in real biological environments.

Many admire your work but whose work do you admire?

The most admired work to me is Professor Charles Lieber's work at Harvard University. His work is innovative and creative and represents the forefront in the field I am interested in.

Is There Hope for Immunicon?

For a company that was founded more than two decades ago in 1983, the story of **Immunicon Corporation** [IMMC] is still in the early chapters. Since last year's IPO, the company's sub-stellar share performance illustrates the potential disconnects between those who invest in nanotechnology and businesses that apply it.

Based in Huntingdon Valley, Pennsylvania, Immunicon sells instruments and kits that use magnetic nanoparticles to provide rare cell analysis for novel clinical diagnostics and disease management tools. Its primary focus has been on cancer diagnostics.

Early detection of cancer is critical since it can spread quickly if malignant cells break away from a tumor and enter the lymphatic system or the bloodstream. These so-called circulating tumor cells (CTCs) can then lodge in other organs or tissues, causing new tumors to form. More established diagnostic methods, including conventional blood tests and diagnostic imaging modalities (CAT, MRI and PET scans) provide limited information and do not efficiently track disease progression and response to therapy.

Immunicon's CellTracks system offers the potential for a faster and more complete diagnosis, enabling improved staging and selection of primary therapy. At the core of its technology platform are 25-100 nm magnetic particles called ferrofluids. These particles bond with cancer cells in a blood sample and separate the cells for detection with the help of a magnetic field. In trials, Immunicon's technology demonstrated it could detect one cancer cell among billions of blood cells.

The speed and accuracy of the CellTracks Analyzer reduces the time and subjectivity required to collect and interpret data from a CAT/PET scan, resulting in a greatly increased chance of accurate and early detection. Immunicon has focused on detecting metastatic breast cancer and, to a smaller degree, endothelial cells, which play a key role in the development of cardiovascular disease.

Immunicon has help from some very big friends. The company signed a development, license and supply agreement with Veridex, a diagnostics subsidiary of **Johnson & Johnson** [JNJ], and also landed an exclusive reference lab marketing agreement with **Quest Diagnostics** [DGX] in the US. It established a similar relationship with SRL in Japan.

If the company achieves even marginal success in its market, it could establish a valuable foothold in a high growth industry. "The broader diagnostics industry is worth $25 billion worldwide in products alone, and that's been growing 6%-8% steadily for the past four to five years," observes Benner Ulrich, an analyst at UBS. "The cancer diagnostic segment is one of the higher growth areas." Last May, UBS initiated its coverage with a "neutral" rating and a $9 price target.

Great potential but many variables

Despite the value of Immunicon's technology and partnerships, the performance of its stock has been abysmal. Immunicon shares debuted on Nasdaq in April 2004 at $8 and have fallen steadily over the past year, now trading just above a 52-week low near $4.

"I don't know who the IPO buyers were, but this is a diagnostic business, not a nanotech business," says Adam Chazen, an analyst for Pacific Growth Equities who initiated coverage of Immunicon in September with an "overweight" rating. Chazen says IMMC's fair value is at least $4 per share and could rise 50% to $6 over the next year.

Most analysts agree with Chazen that Immunicon is a solid player in diagnostics, and they expect its value to rise as the company continues to expand and accelerate its sales.

"We believe Immunicon is quickly approaching the inflection point where it should see device orders grow rapidly, thereby increasing kit sales,"says Legg Mason analyst Edward Nash, who has a "buy" rating on the stock. "Our anticipation is that the first half of 2006 is when we'll begin to see the strong growth. Introducing a new technology takes time to educate physicians - as well as the investment community - to its unique advantage."

The labs buy the technology, but doctors drive sales. "The rate of adoption will determine our success," says Immunicon CFO James Murphy, who expects sales to accelerate following upcoming clinical trials for metastatic colorectal and prostate cancer. Assuming trials go as planned, Murphy said the company expects to launch new diagnostic products for colorectal cancer in 2006 and for prostate cancer in 2007.

UBS's Ulrich cautions that Immunicon's technology remains unfamiliar among most community cancer clinics, which handle 70% of patient volume. "They need more data on how their technology is effective in treatment."

In short, the technology hasn't dovetailed yet into clinical practice. Nor have doctors been asking for it yet in large numbers.

Time is an issue. Ideally, Immunicon wants to ramp up sales revenue before it runs into a cash crunch. Last quarter, Immunicon reported $54 million in cash on its balance sheet. The company says it's enough to run the business for two years without any additional financing.

"It's been about a year since we launched the product and Veridex is taking a very systematic approach to marketing," said Immunicon's Murphy. "We are seeing revenues increase and believe that gross profits from sales will become a significant driver before that money is gone."

By UBS's most recent estimates, the company's solutions address a market opportunity of $205-$215 million annually for instruments and reagents targeting metastatic patients. Future applications, such as screening for recurrence, may approach $300-$305 million in annual kit sales.

For a company with a market capitalization not much more than $100 million, a half-billion dollar market potential is still a great opportunity. Immunicon's unique nano-enabled technology has created believers, but it needs to start creating profits and more sales.

Nano in the News

MIT Launches Global Nanotech Initiative

Leaders of 10 research universities from around the world (including Harvard, Max-Planck Institute, Chulabhorn Research Institute) gathered at MIT to launch an international collaboration to use nanotechnology tools for global health and medical research. The collaboration, called GEM4, or Global Enterprise for Micro-Mechanics and Molecular Medicine, represents an ambitious effort to apply global sourcing principles to research at the intersection of engineering and life sciences. The schools have contributed several million dollars toward the project.

Companies to Watch

Porton Plasma Innovations Limited

[private]

www.p2ilabs.com **+44 (0)1980 556 496**

Wiltshire, United Kingdom

Chief Executive: Quentin Compton-Bishop

What it does: Plasma-enhances materials for advanced liquid-repellence

Porton Plasma Innovations (P2i) is a joint venture forged last year between the U.K. Ministry of Defense's Defense Science and Technology Laboratory and Porton Capital, a venture capital firm dedicated to commercializing military technology for civilian markets. P2i's technology was developed when the M.O.D. was looking for a way to create a fabric for soldiers' protective suits that would keep out dangerous chemicals while preventing heat stress. The resulting technology was a patented plasma-enhancement process by which materials of virtually any kind can be made extremely liquid-repellant.

P2i is the sole licensee of the technology, and they are free to commercialize it any way they want. P2i can take any product--from a dress to a biomedical filter--and treat it with a nanometers-thick liquid-repellant plasma. The plasma is more or less undetectable, so it can be used even on high-end fashion items. More importantly, it's the nanoscale control that produces a highly effective coating.

Usually, companies that treat, say, clothing with liquid-repellants do so by dipping the fabric into a chemical wet process, then cure the chemical and remove the water--an energy inefficient technique that affords little control over the coating application. At P2i, they place the product in a vacuum chamber, remove the air, and introduce a chemical vapor that is delicately energized with radio waves--a process that allows them to evenly cover every bit of surface area. The treatment lowers the surface energy of the material, meaning that when a liquid comes into contact with the object it will beads but won't actually wet the surface. Hold the finished product under a running tap, and the water bounces off. The same is true for oils and alcohols. P2i-treated products are three times more liquid-repellant than Teflon.

P2i is penetrating several markets simultaneously--working with fashion and footwear companies to make their products liquid- and stain-repellant; the biomedical industry for filters used in protein precipitation, DNA analysis and drug screening; the electronics industry for small parts like telephone microphones; and basically anything that shouldn't get wet. Products coated in P2i's plasma can handle up to a meter of water above them and can be used in all weather conditions. "It's very diverse," says CEO Quentin Compton-Bishop. "We have a lot of companies around the world showing interest, not only those who make finished products but also base materials, like membranes for fuel cells. So we see ourselves being both at the finished product end and in raw materials."

P2i plans to have companies send samples of materials that they'll treat and send back. Eventually they hope to sell the companies equipment to treat their products themselves, lend them tech support, and take royalties. P2i just received their second round of funding (of roughly $4.5 million) in July led by Porton Capital, which they're using to scale up production, establish a bigger development lab, hire a core product development team, and move to a new site within a few months.

P2i is currently discussing a letter of intent with one of the world's leading airlines, running a three-month flight trial for P2i-treated seat covers. The company also claims to be working with prestigious fashion lines and with the UK's Porvair Filtration Group, which manufactures filters for various industries.

Reactive Nanotechnologies Inc.

[private]

www.rntfoil.com **410-771-9801**

Hunt Valley, Maryland

Chief Executive: Joseph Gryzb

What it does: Nanolayered foil that enables room-temperature soldering and joining, defense apps

In 2001, Tim Weihs and Omar Knio joined forces to solve an emerging industrial problem: how to attach things. In certain areas of microelectronics, for example, it was becoming increasingly difficult to use conventional soldering techniques because they produce heat that could damage delicate circuitry.

Combining certain materials--such as applying ceramic armor to the metal of a military vehicle or aircraft-- has also been a challenge for traditional welding, especially in cases requiring great strength, heat-resistance or both. Metals and ceramics expand and cool at different rates, weakening their bonds.

Knio and Weihs, then Johns Hopkins researchers, developed a metallic foil that works like a molecular welder. Made of thousands of atomic layers of alternating nickel and aluminum, the foil is placed where two structures need to be joined, and ignited with a spark. It then generates a very hot (1,500 degrees Celsius) but very localized reaction. The intense heat lasts less than 10 milliseconds and fuses the surfaces together, yet only affects a small area, leaving nearby fragile components safe.

The pair formed Reactive Nanotechnologies (RNT) in Baltimore and raised their first money in 2002. In November, 2004, Joseph Grzyb joined the company as chief executive from **RF Micro Devices** [RFMD], where he was general manager of the company's largest division.

If RNT can make enough of their welding wonderfoil, the material could eventually challenge laser welding, which costs about $10 per inch, as a high-tech solution of choice for manufacturers' thorniest joining problems.

In the meantime, Grzyb notes that because the company's nanostructured foil is so "energetic," it also may have applications in rocket motors or oil exploration. It may also be useful for "controlled ignition" in circumstances such as military vehicles or aircraft packed with high explosives where limited heat or flammability is essential. The company is working with the U.S. Navy on "structural energetics." The foils could be incorporated into the casing for a bomb, rocket or torpedo, essentially making more of a weapon's structure part of its explosive power.

With a $10 million third round of funding complete, RNT plans to produce the materials itself, and has purchased and customized several million-dollar pieces of sputtering equipment to begin commercial manufacturing. One challenge it will face if demand ramps up is evolving from batch processing to a more continuous process, such as a roll-to-roll method.

While RNT hasn't yet named any corporate partners or customers, Gryzb does say it has a strategic alliance in place with Indium Corp., a manufacturer of industrial solder, and a few joint development agreements. Moreover, he said the company has won about $4.1 million in grants from NIST, NSF, and the Army Research Laboratories.

The investors through three rounds include Toucan Capital, Silicon Alley Seed Investors, Sevin Rosen Funds, Silicon Valley BancVentures and two state investment groups -- Maryland DBED and Maryland TEDCO.

Follow the Money

A monthly look at who in nanospace is getting funding and who's giving it.

Government Funding

National Institutes of Health (National Cancer Institute)

Funding: University of North Carolina, Chapel Hill; UCSF, Emory-Georgia Tech, MIT-Harvard, Northwestern University, Caltech, Washington University
Funding Announced: 10/3/05
Funding Amount: $26.3 million
Notes: The National Cancer Institute (NCI), part of the National Institutes of Health (NIH), announced the implementation of a major component of its $144.3 million five-year initiative for nanotechnology in cancer research. First year awards totaling $26.3 million will help establish seven Centers of Cancer Nanotechnology Excellence (CCNEs). CCNEs are multi-institutional hubs, which will focus on integrating nanotechnology into basic and applied cancer research and providing new solutions for the diagnosis and treatment of cancer.

National Science Foundation

Funding: Arizona State University
Funding Announced: 10/11/05
Funding Amount: $6.2 million
Notes: ASU will create a Center for Nanotechnology in Society, the largest in a network of newly funded NSF activities on nanotechnology and society, including a second center at the University of California-Santa Barbara and additional projects at Harvard University and the University of South Carolina. The network will support research and education on nanotechnology and social change, as well as provide educational and public outreach activities and international collaborations.

United States Senate

Funding: University of Texas (UT) at Arlington, UT-Austin, UT-Brownsville, UT-Dallas, UT-Pan American, Rice University and University of Houston,
Funding Announced: 9/30/05
Funding Amount: $15 million
Notes: Senator Kay Bailey Hutchison (R-Tex.), a member of the Senate Appropriations Committee, announced the 2006 Department of Defense Appropriations bill has been approved that includes $15 million in new funding for the Strategic Partnership for Research in Nanotechnology (SPRING), a consortium of Texas Universities. This funding will continue the consortium's work to establish a collaborative network of well-equipped research centers to rapidly develop and promote nanotechnology.

Nanotechnology Victoria (Australia)

Funding: Monash University & RMIT University
Funding Announced:
Funding Amount: $1.02 million
Notes: : Nanotechnology Victoria, an Australian government/university consortium which funds nanotechnology research, is investing $1.02 million towards the joint purchase of a field emission gun-transmission electron microscope (FEG-TEM) and a field emission gun-scanning electron microscope (FEG-SEM), tools essential for determining the atomic structure, composition and bonding of new materials.
The total investment package, including installation facilities and operation, will be around $5 million. In March 2005, Monash University approved the construction of a building to house current and new microscopy and related analytic tools, including the NanoVic microscopy package. The building, referred to as the Electon & Magnetic Microscopy Facility (EMMF), will cost around $10 million, and is scheduled to be completed in April 2006.

M & A

Target: Quantum Dot Corporation

Acquirer: **Invitrogen** [IVGN]
Date: 10/6/05
Notes: Invitrogen Corporation announced the acquisitions of Quantum Dot Corporation and the BioPixels business unit of BioCrystal, Ltd. The acquisitions of Quantum Dots and BioPixels bolster Invitrogen's Molecular Probes business as a supplier of advanced labeling and detection technologies. These biological labels are used to understand cellular processes, molecular interactions, and other factors essential to diagnosing and treating disease. While the acquisition price wasn't disclosed, industry insiders said this transaction mirrored Invitrogen's previous acquisition of Genicon Sciences, a venture-backed startup which raised over $35 million and was sold for considerably less. Quantum Dot Corporation was backed by Versant Ventures, Abingworth, MPM, Fraiser, Schroder Life Sciences, and CMEA Ventures.

Nano in the News

Ford, Boeing and Northwestern University Team on Nanotechnology

Ford [F] announced that it is forming an alliance with Boeing [BA] and Northwestern University to develop commercial applications for advancing several transportation technologies, such as clean-burning hydrogen fuel for cars. Among the areas of interest to Ford are hydrogen-fuel storage and boosting power in batteries used to help drive hybrid vehicles. Other areas of interest include specialty metals, thermal materials, coatings and sensors.

The Nanosphere

Company [symbol]	Technology	Coverage Initiated	Current Price	52 Week Range	Market Cap ($mil)	Buy/ Hold/Sell
Intellectual Property Incumbents *Leading researchers in nanotech, with big potential for spin-offs and revolutionary breakthroughs.*						
IBM [IBM]	Nanoscale storage and nanotube transistors	3/02	$83.36	$71.85 - $99.10	$133,030.00	Buy
Hewlett-Packard [HPQ]	Molecular transistors and switches	3/02	27.48	17.59 - 29.51	78,730.00	Buy
Instrumentation *Tools that allow researchers to view and manipulate nanoscale matter.*						
Veeco [VECO]	Atomic force microscopes	3/02	15.84	12.83 - 21.52	474.23	Buy
FEI [FEIC]	Focused ion and electron beam microscopes	1/03	18.85	17.66 - 25.78	634.53	Buy
Materials *Companies producing nanoscale materials with novel properties that have applications across a wide range of industries.*						
Symyx [SMMX]	Novel materials discovery	3/02	25.93	21.47 - 32.20	854.45	Buy
Modeling *Companies developing software to visualize, model and simulate matter and activity at the nanoscale.*						
Accelrys [ACCL]	Molecular rendering and analysis software	3/02	6.80	4.73 - 8.16	173.28	Buy
Platform Technologies *Companies that have corralled key intellectual property that will be the foundation of future developments.*						
Nanosys [private]	Nanowires and nanostructure-enabled devices	3/02	n/a	n/a	n/a	n/a
NVE Corporation [NVEC]	Spintronics-based MRAM	7/03	13.73	11.50 - 38.20	62.83	Buy
Investment Firms *Companies that are investing in promising early-stage nanotechnology startups.*						
Harris & Harris Group [TINY]	Non-volatile RAM, drug delivery, nano-optics	5/02	10.83	10.01 - 16.80	186.80	Hold
Nanobiotechnology *Companies that are working at the intersection of nano- and bio-technology.*						
SkyePharma [SKYE]	Nanoparticle solubilization for drug delivery	8/02	6.88	6.24 - 13.64	432.00	Buy
Flamel Technologies [FLML]	Nano-encapsulation for drug delivery	8/02	19.52	12.01 - 21.99	436.27	Hold
Immunicon [IMMC]	Nanoparticles for medical diagnostics	5/04	3.97	3.40 - 9.06	109.13	Buy
Starpharma [SPHRY]	Nanoscale dendrimers	1/05	4.70	3.30 - 9.40	51.66	Buy

Word on the Street

IBM: IBM handily beat Wall Street's profit expectations, but came up light on revenue estimates. Excluding one-time items, IBM reported Q3 earnings of $1.26 per share, up from $1.03 in Q3 2004 and besting analysts' consensus estimates of $1.13. The sale of IBM's PC unit to Lenovo reduced IBM's top-line to $21.53 billion from $23.35 billion in Q3 2004 and below Street projections of $21.71 billion.

HPQ: HP shares were lower as chief printing competitor **Lexmark** [LXK] slashed its earnings outlook on weaker demand and aggressive pricing, trimming LXK's market cap by 25%. HP has looked to claim market share, but the strategy will reduce the margins in its crown jewel printing business.

VECO: Veeco fell after delivering better than expected third quarter earnings ($0.14 per share, versus consensus of $0.12), but came up short on revenues ($100 million, versus consensus of $104 million). Veeco also guided lower for its Q4, projecting a range of $0.13-$0.19 in EPS on $100-105 million in sales, below the Street's expectations of $0.20 on $109 million in revenues. WR Hambrecht lowered Q4 projections, but raised its 2006 EPS estimate from $0.88 to $0.93 on stronger gross margins, cost controls and strength in the storage market. Veeco is currently trading at 17x WR Hambrecht's 2006 EPS projections. We think the company is a good value.

FEIC: FEI slipped after missing analysts' previously reduced top-line projections by 22%. Its restructuring has not yet run its course. Q3 2005 revenues of $97 million fell woefully below consensus estimates of $118 million. Weakness was across the board and was attributed to overall slack demand. FEI issued Q4 2005 guidance of a GAAP loss of $4-8 million on $100-105 million in revenues. Analysts' consensus had been at more than $118 million.

SMMX: Symyx Technologies reported Q3 revenues up 62.2% YoY to $31.7 million, above the $29.5 million estimate. EPS was $0.19, well above analysts' $0.13 consensus. Symyx also showed a marked improvement in margins, with Q3 2005 operating margins of 28.4% vs. 19.8% in the previous year, while gross margins were 88.9%. Management raised full-year 2005 EPS guidance from $0.40-$0.45 to $0.45-$0.47 (consensus estimates had been at $0.44) while trimming 2005 revenue guidance from $108-$118 million to $108-$110 million (consensus estimates had been at $111.55 million). The lowered revenue guidance reflected a change in recognizing software license revenues that pushes revenue into 2006 instead of a lump sum in the fourth quarter. Symyx is currently trading at 48x Thomas Weisel's 2006 EPS estimates of $0.54. Current prices provide an attractive entry point.

ACCL: Wall Street expects Accelrys will lose $0.13 per share on $17.2 million in revenues when the company reports its Q2 2006 on November 3. ACCL hired Richard Murphy as its SVP of worldwide sales and services. Murphy was previously SVP and chief sales officer of **MSC Software** [MNS]. Additional sales help will be needed to capture the market opportunity, as Lux Research projects CAGR of 29% through 2010.

NVEC: NVE generated diluted EPS of $0.08 on revenues of $3.05 million in its Q2 2006. The company produced higher revenues ($3.1 million) and higher after-tax profits ($0.09 per share) last year. NVE's cash and equivalents increased to $9.39 million. It also announced additional funding from the U.S. Navy to continue developing the deep sub-micron vertical transport magnetoresistive random access memory, or VMRAM, bringing total VMRAM funding to more than $600,000. Despite the Navy funding, the company has not inked any new commercial MRAM partners, and investors' patience has worn thin. The company has solid technology and intellectual property, but execution and shareholder updates are lacking.

TINY: Harris & Harris Group's main holding **Nanometrix** [NURO] continued its moonshot run, surging to $36 per share (up from $8 late last year). The stock's performance will create a large bump in TINY's Net Asset Value (NAV), but also lowers the fund's leverage to nanotech.

SKYE: SkyePharma shares continued to sink, losing another 7% after delivering news last month of a deeply discounted rights offering and wider 1H losses.

FLML: Flamel has risen in the midst of a turnaround brought about by hedge fund investor Oscar Schafer and made several restructuring moves. Flamel announced that shareholders elected three new directors: Frederic Lemoine, who currently serves as the Chairman of the Supervisory Board of Areva, a world-leader in the nuclear industry; John L. Vogelstein, Vice Chairman of Warburg Pincus and Stephen H. Willard, Flamel's CEO. The company also announced the appointment of the aptly named Michel Finance to the post of Executive Vice President and CFO. Finance was previously Senior Vice President and Corporate Controller for **Aventis Group** [AVN], reporting to the Vice Chairman of the Board.

IMMC: Pacific Growth Equities initiated coverage of Immunicon with an Overweight rating. For more information on the company, see *Is There Hope for Immunicon?*, p5.

SPHRY: Starpharma was flat despite a landmark announcement that the company's VivaGel (a vaginal microbicide against sexually transmitted infections) product was awarded $20.3 million in development funding by the US-based National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH). VivaGel has already been successfully tested in a number of studies including a Phase I human safety trial. The new funding will help accelerate the progress of VivaGel to market as it provides the funding to start large-scale efficacy trials.

*Stock prices as of October 25, 2005

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