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Summer 2004

Accelerating Israel's Industrial Activities in Nanotech

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## Nano Functional Materials Consortium is 'A Big Success'

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*MAGNET's Nano Functional Materials Consortium is leading the way to successful nanotech industry-research partnering in Israel.*

**NOTHING IS MORE** important to the success of Israeli nanotech than collaboration. And as things go, nothing is more difficult. But Israel's Nano Functional Materials (NFM) consortium is beginning to make R&D collaboration between some 26 independent companies and research groups look easy.

The NFM consortium's goal is to lead the creation an Israeli infrastructure for developing various types of nanoscale materials, called nanoparticles, especially those materials resulting from advances in chemistry. The NFM is busy seeking new ways to fabricate and use nanoparticles in a broad range of industrial processes and products.

Nanomaterials fabrication is seen as a key to bringing the benefits of nanotechnology to common products – like inks, coatings, plastics and fibers. Combining these existing materials with newly-devised nanomaterials during manufacture can dramatically improve the performance characteristics of a product.

The consortium is comprised of 14 Israeli companies (some of whom are major players in their respective industry sectors) and 12 research groups based in three leading Israeli academic institutions.

"It has been a big success," said Efat Bareket, Director of R&D at [B.G. Polymers Ltd](#), a consortium member. "It's not just that we've benefited from the government funding that was received so far." Bareket added that the consortium's format creates very useful partnerships -- especially those between industry and academia -- that otherwise would simply not exist.

"The NFM has brought us many, many partners." Bareket said. "It has really been a perfect spider's web of connections for us."

Dr. Rivka Goldscher, the Program Manager for the consortium, is particularly enthusiastic about the quality of collaboration that is being achieved. The NFM is the first program of its kind in Israel. "It's unbelievable that this has never been done before in this industry," Goldscher said.

"We're working hard. With so many members, it's not easy to do the networking, but we are doing it!" Goldscher noted that most of the consortium's work still remains unpublished, but academic articles are in the process of being written, and several related patent applications have already been submitted. In addition, the NFM has also become a participant in two different FP6 program funding applications, sponsored by the European Community.

*"We're working hard. With so many members, it's not easy to do the networking, but we are doing it!"*

*Dr. Rivka Goldscher,  
Consortium Program Manager*

So far, this collaboration has been achieved via regularly-held technical seminars and poster sessions, where consortium members are able to review ongoing research and discuss its applicability. The NFM is also in the process of creating an intranet portal that can be used to share real-time information.

A quick look at the list of [consortium members](#) provides an idea of the range of topics being explored by the NFM.

Working alongside Goldscher is Dr. Eynat Matzner, the Technology Manager of the NMF, and Dr. Fernando de la Vega, Consortium Chairman. De La Vega is also CEO of [NanoPowders Industries Israel](#), a world leader in the emerging industry of nanometals.

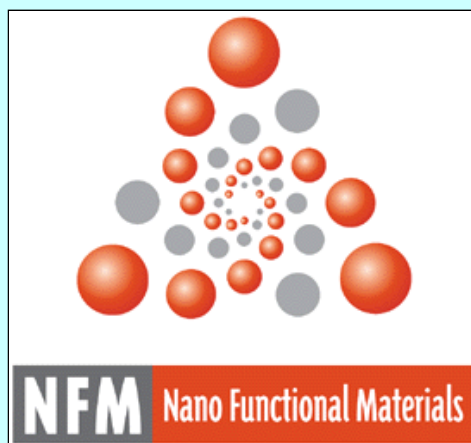
In addition to collaboration internally, the NFM consortium is also interested in expanding its activities globally, through programs such as Europe's FP6, and also through joint research projects. Although not a primary objective at the moment, the NFM is also ready to entertain proposals from research groups and commercial firms located outside of Israel. NFM representatives have also appeared at key international conferences to promote Israeli nanotech capabilities, as well as the research and business interests of consortium members.

BG Polymers -- which currently sells proprietary nanomaterials for flame retardant and textile applications -- has also benefited from the consortium's outward-looking goals. As a result of its association with the NFM, the company was able to present its product line to a very receptive audience at the recent [EuroNanoTex](#) conference held in Barcelona.

"We received many requests after our presentation, including requests for strategic partnering in the industry," Bareket said. BG Polymers is currently holding talks with a leading company in the nanotextiles industry as a direct result of the conference.

The consortium has been active for over two years and is funded entirely by the [MAGNET](#) program, run by the Israeli Office of the Chief Scientist. Pre-competition industry consortiums like the NFM are the main focus of MAGNET's activity. The NFM is operating on a frugal \$4.5 million worth of funding annually for its initial three years. Goldscher and others hope to extend the NFM program for an additional two years.

For more details about the consortium's activities, to propose a joint research project, or to explore membership, contact Consortium Chairman



### **Industrial Partners**

**Ahava Dead Sea Labs** -- Novel formulations for health and beauty products based on Dead Sea minerals.

**B.G. Polymers Ltd** -- Water-based nanoacrylic, styrene-nanoacrylic and vinyl acetate-nanoacrylic copolymers.

**Carmel Olefins** -- Nanotechnology for polyolefin plastics (polyethylene, polypropylene).

**Cerel** -- Technology enabling precise control over nanoparticle deposition on different substrates.

**DSBG** -- Development of nano-sized bromine-based fire retardants.

**El Op Industries** -- Super polishing slurries based on nanoparticles, optical switches based on nano-sized semiconductors.

**Kafrit** -- Dispersion of nanofunctional materials in radiation blocking and fire retarding thermoplastics.

**Makhteshim** -- Nanoparticle development for insecticide and fungicide plant protection products.

**NanoPowders Industries Israel** -- Nanometal powders synthesis, dispersion and application technologies.

**Nano-size** -- Ultrasound applications for of ultra-fine grinding of organic and inorganic materials.

**Nilit** -- Use of nanoparticles in nylon fibers to achieve superior performance in a variety of applications.

**Scitex Vision** -- New generation ink development based on nano-sized pigments and polymers.

**Sol-Gel Technologies** -- Sol-gel encapsulation for applications in electronics, cosmetics, printing and

Dr. Fernando de la Vega.

agriculture.

**Solubest** -- Nanopolymer coating processes to safely disperse a broad range of organic and inorganic materials in water.

**Academic Partners**

**Bar Ilan Research & Development Company**

**Yissum (Hebrew University)**

**Samuel Neaman Institute (Technion Institute)**

## Doing Business: In the Nanotech Jungle, a Tiger Awaits

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*El-Mul's 'E-Beam-on-a-Chip' nanosystem leverages 12 years selling advanced particle detectors to the world's top tool manufacturers.*

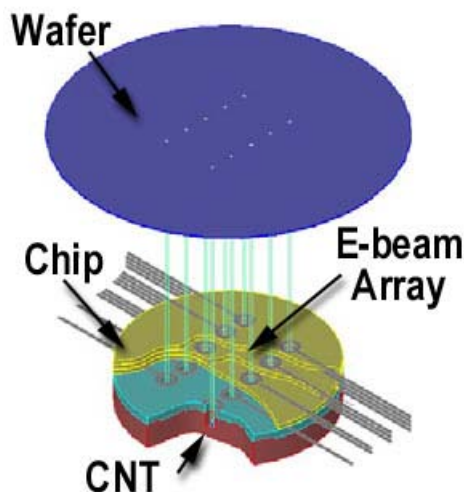
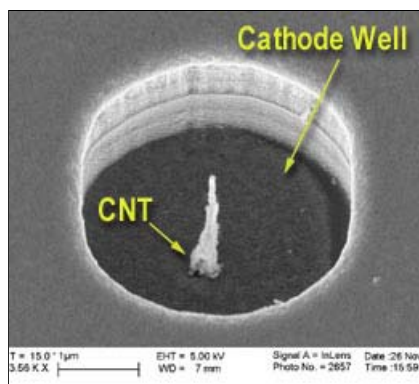
**I**T'S NOT AN EASY trip to [El-Mul Technologies](#). To arrive at this small firm's facilities near the Soreq Nuclear Research Center, we must leave the bustling high-tech centers of Israel behind and drive well off the beaten track.

But meeting with El-Mul's team of managers and researchers quickly dispels any doubts about the future of this seeming off-road company. They've got a tiger by the tail and they know exactly how to tame it. El-Mul is in the final development stages of a proprietary electron beam field emitter (FE) made from a single [carbon nanotube \(CNT\)](#) that can solve some expensive problems for one hungry big bear – the semiconductor industry.

CEO Dr. Armin Schon is calm, direct and confident about El-Mul's move into the nanospace. His company's pioneering work in the development of particle detectors has quietly earned El-Mul the confidence of top semiconductor tool and analytical instrument firms since 1992. This is not about jumping on the nano-bandwagon, it's about a decade of steady progress, working closely many of the same firms that are enabling nanotechnology today.

CNTs have been studied for their potential use as FEs, because of their optimum characteristics such as inherent high brightness, low temperature, low voltage operation and comparatively long life. But limitations to using CNTs have been found also, for which El-Mul now offers a practical and far-reaching solution.

El-Mul's new E-beam FEs are based on a unique, patented design: a multi-walled CNT is grown in place, embedded inside a tiny [cathode well](#). The well structure enhances output E-beam brightness and optical quality, making it dramatically superior to conventional E-beam techniques used today. Placed in [multiple arrays](#), these proprietary FEs can operate together with other active or passive electron-based devices, such as El-Mul's ultra-fast particle detectors. The result is a system-level E-beam solution that resides on a single chip.



El-Mul's patented cathode well containing a single CNT (left), alongside one possible 'E-Beam-on-a-Chip' solution (right).

### **Nanosystem on a Chip**

The "E-Beam-on-a-Chip" concept arrives at a very opportune time. Semiconductor manufacturing is moving swiftly into its next generation. Industry giants like Intel, IBM and Texas Instruments are investing billions of dollars into new or upgraded fabs that will enable process technologies in the 65 nanometer range. While the new range brings uninterrupted advances for producers and consumers alike, it also brings current manufacturing know-how to its limits.

El-Mul's system addresses several key challenges facing semiconductor and advanced microscopy equipment makers:

- **Effectively integrating electron microscopy (EM) and electron beam lithography (EBL) processes into next generation manufacturing lines.**

Before semiconductor size dipped into the nanometer range, device production and inspection could be done economically "offline" -- that is, in a nearby facility dedicated to housing fussy, expensive, environmentally-stringent EM or EBL equipment. But as device size decreases, manufacturers must find more economical means to perform EM and EBL tasks, and they must avoid moving semiconductor wafers offline during the manufacturing process.

El-Mul's system-on-a-chip (SoC) approach enables highly-customized EM and EBL techniques to be embedded directly into standard fab equipment, reducing costs and making these processes part of the manufacturing line in order to eliminate excess wafer handling.

- **Breaking through the optical resolution barrier of conventional lithography.**

Conventional optical-based lithography processes restrict the minimal feature size of today's semiconductors to the resolution attainable by current optics. This diffraction-based problem represents a serious barrier as manufacturers design more nano-sized features. E-beam lithography is not subject to optical diffraction problems, but has been shown as problematic to semiconductor manufacturing due to insufficient brightness and excessively wide energy spread.

Schon noted that while there are other types of non-optical FEs being developed, they will be suitable for only small fragments of the market.

El-Mul's patented approach -- embedding the CNT inside a cathode well -- creates a electron source FE similar to that of a gun, combining high E-beam brightness with a narrower energy spread for near-laminar results. In addition, El-Mul's design requires less stringent vacuum conditions as compared with conventional E-beam lithography, as well as reduced ion-emitter interference.

### **A Young Set of Markets**

Of course, El-Mul's tiger is just a cub. Schon and colleagues are purposefully offering a solution that can be customized to fit the needs of many markets. It can also be readily adapted for OEM use in leading edge products developed by El-Mul's current customers.

Aside from its enormous potential in next generation lithography and metrology tools for the semiconductor industry (with projections of a \$10 billion market here), Schon and his sales team have a long list of applications for their product concept in other industries. At the top of that list are near-flat CRT and field emitter displays, as well as MEMs-based consumer electronics devices and vacuum electronics. Some interesting applications have also been targeted in the biological and medical fields.

*El-Mul is purposefully offering a solution that can be customized to fit the needs of many markets and manufacturers.*

Development costs for the E-Beam-on-a-Chip solution are being covered in part by some \$1 million in funding from the Israeli Office of the Chief Scientist, European Community R&D programs, and private investors. With product rollout, El-Mul will be seeking additional funding also.

### **Proven Detector Solutions**

El-Mul's 12 years as a successful developer and manufacturer of advanced particle detection devices is crucial to introduction of the firm's chip-based nanosystem. The new product line will add active E-beam capabilities to a highly reputable product line that currently includes only passive devices, like El-Mul's Silhouette and OptiMax time-of-flight detectors and its ScintiMax inorganic scintillator.

Particle detectors represent a relatively small and specialized market, currently amounting to about \$50 million in worldwide sales annually. El-Mul has built strong relationships with its customers, which include industry leaders like the prestigious [Carl Zeiss NTS](#) in Germany, as well as various semiconductor tool manufacturers. Especially demanding customization projects have been executed with great success for multinationals like [Toshiba](#) and [Agilent Technologies](#).

Even with tough competition from detector industry giants such as the US-based Burle Industries and Japan's Hamamatsu Photonics, tiny El-Mul has succeeded in selling its detector product line as an all-around faster, brighter, more sensitive and more flexible set of solutions. El-Mul's proven ability to customize its detectors as OEM products has brought both profitability and loyalty. In 2003, detector revenues reached \$2 million, with over 250 units sold.

With its planned 2005 release, the E-Beam-on-a-Chip solution is likely to get serious attention from El-Mul's existing customers, as well as a whole new range of potential customers who are seeking a reliable, economical breakthrough in E-beam technology. There are those who say that nanotech is a jungle of solutions waiting for applications. If El-Mul's experience in the particle detector jungle is any indicator, chances are good that their tiger will be the first to pounce.

For more information on El-Mul's products and plans, contact [Dr. Armin Schon](#).

## **Commentary: Waiting for Nanot (with apologies to S. Beckett)**

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*'But yesterday evening it was all black and bare. And now it's covered with leaves.'*

*from Waiting for Godot, by Samuel Beckett*

**By Bob Rosenbaum**  
Director, Small Advantage Consultancy

**ON MY ROUNDS** recently, I bumped into a colleague, an influential figure among those who are stoking the Israeli nanotech engines. He hadn't heard from me in a while, he said, and wondered if perhaps I had fallen asleep.

I laughed. Even now, I laugh as I am reminded of Beckett's marvelous play, [Waiting for Godot](#), wherein a small cast of tramps and gentlemen amble about looking and waiting for a character who in fact never arrives. We see them joking, arguing, sleeping, contemplating suicide, and overall just entertaining one another -- ever faithful that the celebrated Mr. Godot will arrive "surely tomorrow," as his youthful messenger repeatedly vows to them, day after day.

Especially over the last year as an active nano-marketer, I have met some of the most interesting and challenging people of my career: scientists, investors, researchers, brokers, lawyers, CEOs, and those who really defy description. Israel is an excellent stage for such a diverse troupe! After all, our little theater has everything to offer: the latest technological innovations, excellent capital gains, watchful world interest -- even opportunities for spiritual growth.

But I must tell you frankly, I have not met Mr. Nanot.

It's true. Not one person has offered me or anyone else here \$100 million to invest in Israeli nanotech development. In fact, most of the people I have encountered were hoping I'd write *them* a check.

*Not one person has offered me \$100 million to invest in Israeli nanotech development.*

There is this global tendency to build grand nano-castles in the air while awaiting some sort of ground-breaking scientific advancement, or the appearance of some invincible new application, or the magic IPO that will return the stock market to its golden era of growth.

All this in spite of innumerable articles and speeches regarding the infancy of nanoscience and the long-term nature of nanoinvestment. We keep saying it over and over again: this is not the Internet. You can't do nanotech in your garage on weekends over a couple of beers with your college friends. (Well, maybe you can, but it must be a very clean garage.)

Consider this: in the last year every major state in North America, and practically every major developed country in the world, has formally declared its intention to become a center for nanoresearch and nanobusiness, in hopes of attracting researchers and investors (if not the day's headlines). In fact, it's hard to find any historic human endeavor that has been embraced so broadly as this move to nanotech, even if only in words and hype until now.

### **A Little Nano-Truth**

So where is Mr. Nanot? What can be delaying his arrival?

The widespread and sometimes passionate public debate on nanotechnology is what some pop culture experts would call an 'extreme movement', that is, a phenomenon notable for its intense duality. For example, our current concept for 'nano' fits all of these statements, extreme as they are:



### **Building Bridges to the Israeli Nanotech Business**

Like the rest of the world, we are still working on composing a common language for this emerging toolset called nanotechnology. At this moment, Israel is mainly involved with building bridges -- scientific, academic, business, political and otherwise.

**Where to collaborate.** Israel offers investors, researchers, businessmen and other nanotech stakeholders the world's most diverse, yet geographically concentrated collection of advanced research and intellectual property, together with Israel's youthful outlook, our ability to adapt, and our talent for working easily and effectively with people from countless other cultures and sensibilities.

The real problem here is one of diversity. Where do you lead a private investor who wants to invest a cool \$10 million into Israeli nanotech? Do you point to one of the handful of companies that are actually

Of course, this duality tends to raise the whole subject of nanotechnology to the level of myth. And while creating and nurturing myths can be entertaining (and even lucrative for some), we would do best to remember that nanotech exists today as a result of the personal and professional commitments of people -- ordinary or extraordinary -- who have worked methodically to characterize and manipulate the physical world for the last 200 years. At that time, a largely self-taught British scientist named John Dalton formulated the atomic theory, which introduced the concept of atomic weights, and remains today the foundation for our understanding of modern chemistry and physics. It's worth noting, by the way, that Dalton was not a chemist but a weatherman.

It is this continuum of brilliant scientific, multidisciplinary research that should be emphasized to investors and students today, and not the promise of some mythical nano future.

If we must contend with extremes and duality, then let's at least remember a key principle in teachings of the East: forever embedded in the Yin is a little piece of Yang, and visa versa, naturally. What is nanotech? What will nanotech bring to our lives and to our world? The truth is to be found somewhere between the extremes.

*The continuum of brilliant research should be emphasized, not some mythical nano future.*

selling products based on nanotechnology? Do you make introductions with government and industry representatives, eager to build a nanoscale infrastructure? Or do you provide intellectual property contacts at one of our six impressive institutions for learning and research? In fact, you lead the investor to each of these places, for Israel has them all.

**What to collaborate.** The Israeli National Nanotechnology Initiative (INNI), a government-appointed steering committee, is encouraging Israeli research and business stakeholders to economize and restrict the focus their activities in nanotech. But facts on the ground show that nanotech stakeholders are busy moving in every possible direction.

What we can already say is that Israel has uniquely strong capabilities and interests to exploit nanotechnology R&D in the following areas:

- **Water.** No country in the world has a stronger motivation to provide a solution to the shortage of clean water than Israel. One practical bridge to this industry in Israel is the upcoming [NanoWater 2004](#) event.
- **Energy.** No country in the world has a stronger motivation to create new sources of clean energy than Israel. Together with environmental and water conservation industries, the value of this market is projected to reach \$55 billion by 2010.
- **Medicine.** Israel stands tall among pioneers in the life sciences and currently is a partner in two of the most exciting nanobio R&D programs in Europe. The value of this market is projected to reach \$35 billion by 2010.
- **Materials.** When it comes to advanced materials and associated tools, Israel is considered a leading center for innovation. The value of this market is projected to reach \$378 billion by 2010.
- **Defense and Security.** Last but not least, even for its small size, Israel's reputation for innovation and quality in these industries remains unchallenged. The value of this market is projected to reach \$286 billion by 2010.

**How to collaborate.** Israel requires investors who recognize the need for leadership, decisive action, and risk-taking. We may lack commercial infrastructure, such as testing facilities and fabrication plants, but Israel's impressive R&D, IP and applications development capabilities are worth more than gold.

The going rule for creating successful nanobusiness today -- not just in Israel, but

### ***Israel's Road to Nanotech***

Amidst all this passion and myth, Israel has remained somewhat aloof. To be sure, from an R&D perspective we are squarely among the nations that are leading the way into this new era, though the sum total of Israel's national and private investment in the nanospace amounts to a trivial figure in global terms, one that could hardly sustain growth for a small Silicon Valley startup. Mr. Nanot might consider such paltry sums as a sign of poor planning.

But such a conclusion would be incorrect. Though small in global terms, Israel actually contributes a very respectable proportion of its gross domestic product (GDP) to nanotech research. Mr. Nanot would also need to learn about the Israeli 'bang-for-your-buck' factor. We know how to squeeze more world-class research out of a dollar than any other country – just ask the US military, one of Israel's loyal customers.

And this tidy sum is being invested with a huge dose of skepticism, not at all like the relatively unbridled nanotech funding efforts seen in the US, Europe and the Far East. (There are even half-serious remarks circulating about handing out little blue collection boxes for nanotech, like those which brought so many dimes and nickels to the Jewish National Fund in the 20th century.) Mr. Nanot might interpret such skepticism as a sign of self-doubt over Israeli capabilities and our future in the nanospace.

*Skepticism is a national sport in Israel. We are the toughest skeptics you'll ever meet.*

But again, this conclusion would be incorrect. Skepticism is a national sport here in Israel. We are the toughest skeptics you'll ever meet. Where an American investor might get carried away by all the hype and potential of a nanotech-based product, an Israeli simply shrugs and asks who will pay to advertise a product that doesn't exist yet.

Such an attitude often makes us our own worst enemies, especially when a busload of venture capitalists arrives from California to assess an Israeli firm's marketability. When the Israeli CEO starts a very loud argument with the lead VC (who sponsored the trip in the first place and, let's face it, might even be Mr. Nanot himself), well, it's not the pretty picture that investors like to see.

So, with precious little local R&D funding, and little or no talent for product marketing, what can Israel possibly do to stay in the nanotech game, a game comprised of R&D and marketing?

First, let's not wait for Mr. Nanot.

Israel can and should concentrate on what even our toughest foreign investors (companies like Intel, IBM and Motorola) agree Israel does best in high tech, namely, [collaboration](#).

Collaboration is a prerequisite to success in nanotech. And we're good at it. Even with our limited resources, successful collaboration has brought Israel to the forefront of high tech and continues to help us maintain the high calibre of our technological knowledge and innovation.

*Collaboration is a prerequisite to success in nanotech. And we're good at it.*

Far from being a visionary, I am only a strategic marketing consultant

the world over – is not to ask 'where's the exit?' but instead 'where's the value?'

Thinking about collaboration in the Israeli nanospace? Feel free to contact [Bob Rosenbaum](#) for additional guidance.

for Israeli high tech, at best only one of Beckett's more humble players. But having already cautioned against unreal expectations and mythology, I will tell you: we've got the real nano-stuff here in Israel.

We may not be the largest or first or best-funded of nanotech centers, but Israel most definitely has the researchers, the innovators and the global business leaders to profit from nanotech commercialization.

Whenever Mr. Nanot does arrive, very few analysts would be surprised to see him land in Israel.

## NanoEvents

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### ■ **What's Small and Wet? NanoWater 2004 Amsterdam**

While many people simply go to a local water park to escape the oppressive summer heat, there are those who are engaged with water in a more pragmatic way. Tim Harper is one such person. Along with his colleagues at [Cientifica](#) and the [European NanoBusiness Association](#), he has organized [NanoWater 2004](#), a one-day conference dedicated to promoting nanotech-based solutions for our growing earthly water problems.

Harper, along with Canadian businessman Uri Sagman and Andreas Agricultural Trust Director Samuel Pohoryles, is a key mover behind Israel's Nanotechnology Clean Water Initiative, detailed in a previous newsletter [article](#). They were inspired and assisted by Former Prime Minister Shimon Peres, who also sees water remediation as a promising focal point for nanoresearch. (See also [related information](#) on new Israeli water research funding).

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**Flash:** [Nanotech Advantage Israel's publisher, Small Advantage, has become an official NanoWater 2004 sponsor.](#)

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NanoWater 2004 will be held on September 27th in Amsterdam. To tie the initiative into longstanding commercial endeavors, NanoWater is planned to coincide with Europe's largest water industry trade show, [Aquatrade](#). By linking the two events, Harper told [Nanotechnology Now](#) editor Rocky Rawstern, "We hope to find out where the economic sweet spot is."



*"If we can drive down the cost of water treatment by just a few percent, the effects will be global."*

*Tim Harper, CEO, Cientifica*

"If we can drive down the cost of water treatment or desalination by just a few percent, the effects will be widespread and global," Harper said. "We are very close to the tipping point, and NanoWater is designed to give the industry the nudge it needs."

The conference will feature speakers from leading water industry firms and research institutes, from nanotech firms engaged in water filtration, desalination and recovery, and from the financial community. You can register [here](#) for NanoWater 2004.

### ■ **US-Israel Group Inaugurates International Nanobiotech Video Seminars**

With two video conferences already held, the US-Israel Technology Foundation ([USISTF](#)) has begun a series of seminars and workshops intended to foster collaborative exchange and to promote strategic partnering among US and Israeli concerns that are involved with nanobiotech.

In the US, the video conferences are being organized and managed by the Chicago Microtechnology-Nanotechnology Community ([CMNC](#)), a group that primarily represents business and research interests in Chicago and the central US states. In Israel, Tel Aviv University is providing the necessary resources and facilities.



*"We feel that working closely with Israeli firms will strengthen our position."*

*Neil Wyant, CMNC Series Organizer*

"We sense that this series is a real good fit," said CMNC Director Nik Rokop. The CMNC's goal, according to series organizer Neil Wyant, is to create grass-roots knowledge and connections that can be used by nanobiotech start-ups on both sides of the ocean. "We really want Chicago to become a hub for nanotech, and we feel that working closely with Israeli firms will strengthen our position."

The first conference, held in March and entitled [Nanobiotechnology In The US and Israel](#), provided an overview of nanobiotech activities in both countries. In June, a second video conference was held entitled [Applications of Nanobiotechnology](#), and featured commercially-promising nanobiotech applications from four companies. It was attended by nearly 100 people in three separate conference locations.

To date, each conference has featured key presentations from participating firms and institutions in both the US and Israel, as well as opportunities for detailed Q&A from attendees.

Although Rokop, Wyant and Tel Aviv University-side organizer Yoram Shapira -- who directs the Wolfson Applied Materials Research Center -- each expressed satisfaction with the video conferences so far, they are also discussing ways to spark more interaction among conference attendees as well as create contexts for continuing communications outside of the video conference framework.

For additional information, contact series organizer [Neil Wyant](#).

#### ■ **TAU Technology Foresight Institute to Host Nano2Life Workshop**

With the European Commission's nanobiotech R&D program, [Nano2Life](#) well into its first year, activities are also ramping up at Tel Aviv University's Interdisciplinary Center for Technology Analysis and Forecasting ([ICTAF](#)). The ICTAF is in part responsible for determining the future focus of the Nano2Life program, through the program's Technology Foresight and Strategy workgroup.

In early September the ICTAF, along with TAU's [Research Institute for Nanoscience and Nanotechnology](#), will host workgroup members from 18 European countries, and present some preliminary findings from survey work now underway.

"We don't have a set goal, like some other workgroups," said Aharon Hauptman, a senior researcher at ICTAF who is involved with the Nano2Life program. "We're playing more of a developmental role and addressing issues that are not based in pure science."

*"One of the problems is the lack of a common language among researchers in nanobiotech."*

*Aharon Hauptman, Senior Researcher, ICTAF*

Among nanobiotech topics to be discussed are ethical and legal issues, public acceptance and communications problems. "One of the problems that appeared frequently in our initial survey is the lack of a common language among researchers in nanobiotech," said Hauptman. There has simply never been an opportunity for researchers from so many disciplines to work together before, Hauptman explains. This situation demands that a special effort be made in cross-disciplinary awareness and education.

Another finding of the survey is that many researchers are explicitly concerned with identifying and developing useful applications for their work in nanobiotech.

The preliminary survey by ICTAF included some 50 European and Israeli nanobiotech researchers. ICTAF is also charged with compiling an expert report, reflecting the state-of-the-art in nanobiotech, which can be used to help guide Nano2Life activities over the next several years. A stated goal of the Nano2Life program is the creation of a European Institute for Nanobiotechnology (EIN), which can play a determining role in the advancement of global research and commercialization.

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A previous newsletter [article](#) details TAU's roles in other workgroups of the Nano2Life program.

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Nano2Life is a network of excellence, part of a larger effort by the European Commission to advance Europe's interests

in nanotechnology, called NanoMatProd (NMP). The NMP is a broad-reaching program that specifically focuses on the transition from nanoscience to knowledge-based products and services, and on breakthroughs in new applicable knowledge. The EC has allocated 1.3 billion Euros to the NMP through 2006.

### ■ **Israel-Netherlands Event Matches Industry Giants with Start-Ups**

A one-day nanotech matchmaking event between Israeli and Dutch companies held in Amsterdam proved to be a popular event, drawing over 50 Dutch firms and more than a dozen Israeli firms.

Some 130 people attended the April event, entitled [The Revolution of the Tiny](#), which was organized by the Organization for the Promotion of Trade Israel Netherlands (OPTIN) in collaboration with the Israeli Industry Center for R&D ([MATIMOP](#)).

The event was specifically geared to establishing strategic partnerships between stakeholders. Over 100 matchmaking meetings were arranged, according to conference organizer Jennifer Peersmann, who is also director of OPTIN, headquartered in Amsterdam.

*"Our aim was to give companies an opportunity to promote their R&D and establish joint ventures."*

*Jennifer Peersmann, Director, OPTIN*

"That was our aim, to give Israeli companies an opportunity to promote their R&D and establish joint ventures," Peersman said. For Dutch companies, Peersman said, the opportunity was equally interesting. "Their main interest is interacting with Israeli companies, because they know the potential for success in Israeli high-tech. And they are currently in a race to find the most exciting technologies."

Dutch attendees included industry giants Philips, DSM, Unilever and Akzo Nobel. Also attending were representatives from major Dutch and Israeli research institutions.

Enough excitement was generated by the matchmaking event to spawn an effort to publish a business-oriented [nanotech booklet](#).

## NanoBusiness

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### ■ **Is Israel's High-Tech Incubator Program in Danger?**

The US-based nanoindustry magazine [Small Times](#) has reported that the budget for Israel's publicly-funded [Incubator Program](#) stands to be slashed once again in 2005, threatening the program's existence.

The [article](#) includes statements from leading Israeli figures, as well as managing program director Rina Pridor, who predicts that the program will not be viable under the operating budget proposed. Since 2003, program funding has fallen from \$40 million to \$18 million or less.

Israeli incubators are expected to be instrumental in helping to promote commercialization of nanotech-related IP at leading Israeli research institutions. Without sufficient government support, this innovative program of 24 centers distributed throughout Israel cannot continue its privatization efforts. To find out how to help, contact [Rina Pridor](#).

### ■ **It's Official: Israeli Economy Returns to Health**

With Israel's Treasury now predicting gross domestic product (GDP) growth of 3.8% in 2004, everyone agrees that the recession that began in 2001 has ended.

Figures released in July also a 17% increase in high-tech export sales in the first half of 2004. Though this value does not match the increases seen in the European Union and the US, it is a sign that Israel is continuing to benefit from the global high tech recovery.

The Treasury currently foresees GDP growth of 2.9% in 2005, as well as a continued increase in local investment.

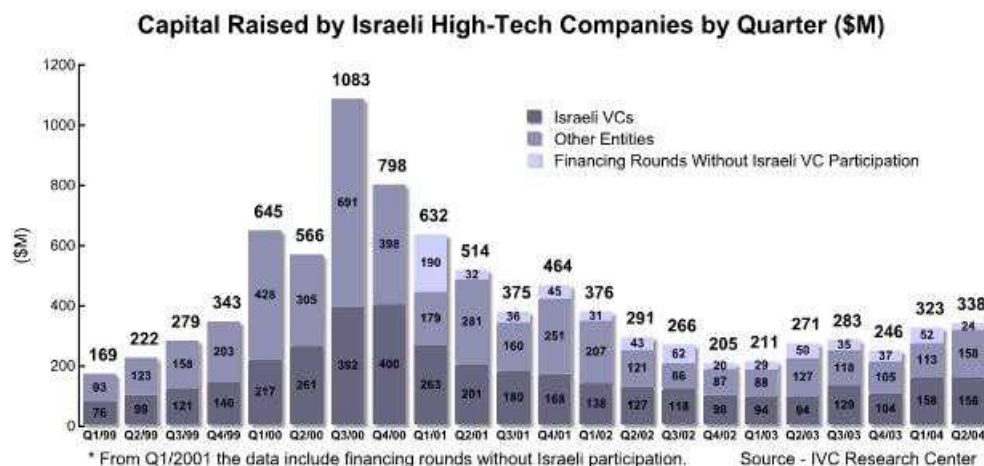
### ■ **IVC Reports 37% Increase in Israeli Venture Capital Raised**

In its recently issued 2nd quarter report, the [Israel Venture Capital \(IVC\)](#) Research Center reports that Israeli high-tech

firms have raised 37% more venture capital in 2004 than for the same period in 2003.

"We expect that the amount of venture funding raised in 2004 will be 20% greater than that raised in 2003, and will reach \$1.2 billion," said Efrat Zakai, Director of Research at IVC.

The Israeli Telecoms sector has shown the largest growth so far in 2004, accounting for 36% of all capital invested. Conversely, the Life Sciences sector has quieted down some since its impressive showing in 2003.



IVC conducts quarterly surveys in cooperation with the [Israel Venture Association \(IVA\)](#), and maintains a database of over 4,000 Israeli high-tech companies, VC funds, investment companies and technology incubators.

#### ■ **Israel-Netherlands Trade Organization Plans Nanobusiness Booklet**

Following on the success of their [nanotech matchmaking event](#) in April, the Organization for the Promotion of Trade Israel Netherlands (OPTIN) plans to publish a booklet to promote Israeli-Netherlands nanobusiness and nanoresearch ties, entitled, "The Revolution of the Tiny: Dutch and Israeli High-Tech Nanotechnology."

The booklet will feature market overviews, perspectives, profiles and listings for businesses, universities and institutions. About 4000 copies will be distributed, most of them free of charge, according to OPTIN director Jennifer Peersmann. Distribution will be made in the Netherlands, Israel and Europe.

To order a listing in the booklet, or to publish an advertisement, contact [Jennifer Peersmann](#).

#### ■ **ApNano Materials Enters into Agreement with US-based Hatco Corporation**

[ApNano Materials](#), the start-up featured in a previous newsletter [article](#), has recently signed a joint technical agreement with [Hatco Corporation](#) to develop nanoparticle-based lubricants for aviation, refrigeration and other high-performance applications, based on ApNano's patented NanoLub solid lubricant. Hatco is a supplier of aviation fuels to the US Air Force.

ApNano CEO Aharon Feuerstein noted that the agreement will enable both companies to develop a wider range of products. Hatco CEO Alex Kaufman added that "this endeavor will position Hatco as the leading company in the high technology sector of the lubricants market, and will bring many new lubricant solutions to our customers."

The Israeli company is already working closely with the German automaker Volkswagen on automotive lubricants using NanoLub, a substance comprised from spherical inorganic nanoparticles that are produced using a patented process. Hatco is the world's leading producer of synthetic lubricants and basestocks for aviation turbine engines and non-ozone depleting refrigeration systems.

ApNano has also announced that NanoLub recently underwent aerospace durability testing, in accordance with international specifications, by the Space Technology Division Materials Group of the Soreq Nuclear Research Center in Israel. The tests showed that NanoLub easily surpassed the minimum outgassing requirements for use in space applications.

The company is currently seeking up to \$4 million in new investments in order to build a semi-industrial production facility for NanoLub. For more information, contact [Niles Fleischer](#).

#### ■ **Israeli Nanotech Business Database Continues to Grow**

The [online database](#) created late last year by the [The Israeli Nanotechnology Trust](#) is currently the most organized,

informative and reliable source of information on nanotech-related business ventures and current research in Israel.

You can search the database for information on specific Israeli companies, applications or research projects. The site also provides a means to add your own [business details](#) or [research details](#) to the database.

*You can search the database for information on specific Israeli companies, applications or research projects.*

The Trust is involved in numerous efforts to increase public and private funding for nanotechnology in Israel, with particular focus on projects that benefit water quality, health, energy and the environment. Recently, the [Peres Center for Peace](#) assumed responsibility for fundraising efforts of the Trust, which continues to be managed by [Einat Wilf](#).

Database maintenance will be continued by the Israel National Nanotechnology Initiative (INNI), which is also responsible for disbursement of government funds for Israeli nanotechnology R&D. For additional information about the database, contact INNI Secretary [Meir Weinstein](#).

## NanoResearch

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### ■ **\$500,000 National Funding Available for Israeli Nanotech Water Research**

The Israeli Office of Trade and Industry and MAGNET, with the Office of the Chief Scientist, have recently issued a [call for water remediation research projects](#) that exploit nanotechnology, providing a total initial budget of US \$500,000 to participants.

The program, called 'Nataf' is intended to attract Israeli chemists, physicists and biologists and other researchers who have not worked previously in the area water remediation. It provides up to \$25,000 per year per researcher. The current call can support up to 20 research projects. According to MAGNET officials, only a handful of proposals have been received as of this writing.

"The idea here is different from other MAGNET programs," said Kalman Kaufman, who is a member of the Israel National Nanotechnology Initiative (INNI) and one of Nataf's principal organizers. "Nanotech is a technology currently in search of applications. As quickly as possible, we want to widen the circle of Israeli researchers who are looking at the difficult problems in water remediation."

*To encourage applications by new researchers, Nataf provides exceptionally fast proposal evaluation time.*

To encourage applications by new researchers, Nataf provides exceptionally fast proposal evaluation time (1 month or less) as well as 100% project funding. No closing deadline has been set for the current call.

Kalman said that proposals which exhibit interdisciplinary innovation, heightened scientific risk, and original thinking will benefit from special consideration.

Nataf is in large part the result of the [Nanotechnology Clean Water Initiative](#) that was started late last year by Canadian businessman Uri Sagman, Andreas Agricultural Trust Director Samuel Pohoryles and former Prime Minister Shimon Peres. Five Israeli research institutions have become involved in this effort, which has also led to additional interest from stakeholders in the US and Europe.

### ■ **Georgia Tech Announces Cooperative Research Program with Israeli Institutions**

A small team of researchers and administrators from the Georgia Institute of Technology arrived in Israel in May to promote mutual collaboration on nanoscience-related projects. Among the Israeli institutions visited were the Hebrew University, the Technion, Weizmann and Ben-Gurion University.

Their visit marks the beginning of a cooperative effort to ensure that both Georgia and Israel are among the leaders in nanoscience. In June, the visit was followed-up by a [joint public announcement](#) that was reported far and wide.

Georgia Tech recently received state allocations and gift amounting to \$81 million, specifically for the construction of a 160,000 square-foot Nanotech Research Center in Atlanta. Although no specific nanotech research areas were outlined in the joint announcement, Georgia Tech is home to the world-reknowned Center for Computational Materials Science, directed by Israeli-born [Uzi Landman](#). Landman also acted as guide for the Georgia Tech delegation while they were in

Israel.

### ■ **Draft Israel Nanotechnology Law Languishes in Prime Minister's Office**

Before completing her work as Chairperson of the Knesset Committee on Science and Technology, Knesset Member Meli Polishuk-Bloch succeeded in briefing Prime Minister Ariel Sharon on the Committee's recommendations concerning the funding of nanoresearch and nanobusiness in Israel.

*No serious funding amounts or implementation dates are on the table.*

While everyone is talking favorably about a bill to support additional allocation of resources to nanotech development in Israel, Polishuk-Bloch said in a recent interview, no serious funding amounts or implementation dates are on the table.

Following their meeting in late June, the Prime Minister encouraged Polishuk-Bloch to meet with appropriate people in his office in order to promote the issue. Polishuk-Bloch commented that Israeli nanotechnology was only one of the issues discussed in her meeting with the Prime Minister, however.

In late July, Polishuk-Bloch left the Science and Technology committee to become Chair of the Education committee. It is not yet clear whether nanotech will be given priority by her successor on the Science and Technology committee, Knesset member [Lea Nes](#). Further complicating this situation is the recent switch by the previous Science and Technology Minister, Mody Zandberg, to the Ministry of Infrastructure.

A special hearing was held last December to explore the state of nanotechnology development in Israel. Science and Technology Committee members heard from the directors of leading research institutions as well as from members of the Israeli National Nanotechnology Initiative.

### ■ **Wolfson Foundation Grants £3 Million for Research Laboratory Upgrades**

The British Wolfson Foundation recently allocated £3 million to be split evenly among the six major Israeli research universities over a three-year period. The funds are earmarked for nanoresearch equipment purchases.

The program is administered under the auspices of the Royal Society, and is aimed at "promoting informatics research of the highest quality in the fields of biology, chemistry and medical science," specifically to fund the renovation and modernization of research laboratories which are used for nanotechnology.

Nanoresearch institutes at the Hebrew University, the Technion, Tel Aviv University, Bar Ilan University, Ben-Gurion University and Weizmann will each receive £500 million over the next three years.

The Wolfson Foundation's overall aim is "to advance the progress of health, education, the arts and humanities."

### ■ **Hebrew University Group Develops Conductivity Solution for Semiconductor Nanocrystals**

A group led by Prof. [Uri Banin](#) at the Hebrew University's Department of Physical Chemistry has succeeded in the creation of [self-assembling, gold-tipped nanocrystals](#), thus enabling electrical conductivity among vast numbers of these objects. Using a chemical process, the group added dumbbell-shaped gold tips to each nanocrystal, dramatically increasing their penchant for connectivity.

Semiconductor nanocrystals are among the most interesting inventions coming out of nanoresearch in recent years. By changing the shape, size or substance of these nanoscale crystals, useful new properties or behaviors can be elicited.

Improved control over crystal structure and conductivity means that nanocrystals can find their way into common manufacturing techniques and so be exploited inexpensively. The group's breakthrough findings were recently published in the journal [Science](#).

It is worth noting that Banin is a founding member of the Scientific Advisory Board at [NanoSys](#), the much-publicized Silicon Valley company which is currently completing a controversial IPO.

### ■ **Weizmann Institute DNA Computer May Suppress Cancer Genes**

Using current DNA sequencing and diagnostic marker techniques, Prof. [Ehud Shapiro](#) and colleagues from the Department of Computer Science and Applied Mathematics and the Department of Biological Chemistry at Weizmann Institute have created a [molecular computing device](#) that is capable of recognizing a specified cancer-causing DNA sequence and then "releasing" an appropriate anti-cancer model sequence to act as a therapeutic device.

The group's research, published recently in [Nature](#), details the complex mathematical and computational workings of the DNA molecule, which was shown to work well in principle during in vitro experiments.

The DNA molecule's ability to autonomously "walk through" entire protein sequences means that it can be programmed to search according to a given diagnostic rule, apply logic to what it finds, and selectively activate or deactivate molecule sub-sequences, as required. Weizmann's experimental system also provides a checks-and-balances approach, to eliminate errors and prevent mishaps in treatment.

Although in vivo research is not feasible with the molecule currently being used -- and may not be feasible for decades -  
- Shapiro foresees such DNA-based computers as the basis for future treatment of genetic and viral-based diseases.

## Advisors and Resources

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**Nanotech Advantage Israel** is privately owned and published. Among those people who have contributed of their knowledge and experience to support this initiative are: Brian Berkowitz, David Brinn, Noel Elman Niles Fleischer, Shuly Galili, Rivka Goldscher, Tim Harper, Aharon Hauptman, Dexter Johnson Melanie-Claire Mallison, Ron Maron, Adolfo Nemirovsky, Jennifer Peersmann, Saar Pilosof, Antonio Regalado, Nik Rokop, Yosi Shacham-Diamand, Yoram Shapira, Yair Sharan, Armin Schon, Hanan Sher, Clemi Slonim, Gerry Stoch, Chaim Sukenik, Adi Volnitzer, Einat Wilf, Neil Wyant and Erika Yanovich.

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## About Nanotech Advantage Israel

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***Israel is among the most fruitful producers of knowledge and innovation in advanced research and technology. Israel's tradition of academic excellence is widely known, and its high standing among countries producing leading edge applications in telecoms, semiconductors, IT and biotechnology has brought unprecedented profitability. Already a well-spring for nanotechnology, Israel is now becoming a world center for nanotech-enabled products and applications.***

The **Nanotech Advantage Israel** newsletter, founded in 2003, is published to heighten awareness of the special abilities and characteristics of the scientific and business communities in Israel, and help to accelerate the development of nanotechnology as a key industry enabler in Israel. Nanotech Advantage Israel is published periodically by Bob Rosenbaum and the Small Advantage consultancy.

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