

ISRAEL HIGH-TECH & INVESTMENT REPORT

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High-tech hit hard by recession



In parallel with American recession Israel's economy is feeling the recessionary pains. Israel has probably the highest number of foreign controlled research and development facilities.

These include such well-known names as Microsoft, Google, IBM and Hewlett Packard, among others. As these companies have fired personnel in other parts of the world, the same fate has befallen the local entities.

During similar periods, in the past, one of the main worries was that highly qualified personnel would leave the country for greener pastures in the United States. This time engineers, physicists and other highly skilled personnel need not look overseas. As the situation there is not any better. However, it is not only the technical personnel that are suffering. The service professions such as lawyers and accountants are feeling the pinch.

Perhaps the greatest damage is the one suffered by the country's venture capital industry. At one time the venture capitalists were used to returning 25% a year to its investors. Rumors are being spread that this year venture capital firms will announce negative returns. That being the case they will probably find it difficult to raise new funds.

Exports have fallen sharply and with them further cuts in personnel. An exception is the pharmaceutical field where exports have actually grown. This is due to the stellar performance of Teva pharmaceuticals, which continues to expand its overseas activities. We also learn that the only field of technology to be prospering is biotechnology. Money continues to flow into this field.

Solar energy is also a favorite field and rumors are

circulating that the German multi-national Siemens is in negotiations to acquire Solel. which in a few short years, has become a global leader in building solar thermal fields.

If economists' predictions are on target, the global recession will end sometimes in the middle of 2010. Employment will pick up once again and hopes are for a return to better times.



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Alvarion in US \$100m. WiMAX deal

WiMAX solutions developer Alvarion Ltd. (Nasdaq: ALVR; TASE: ALVR) won a contract to take part in a major US wireless broadband deployment, spanning 17 states and reaching 6 million people.



Alvarion said the deal is worth \$100 million over five years. However, market sources estimate it may reach as high as \$150 million. It is the largest contract in Alvarion's history.

Alvarion announced that it was selected by US broadband wireless operator, Open Range Communications Inc., for the largest Rural Utilities Service (RUS)-funded deployment so far in the US. The network will span 17 states and 546 rural communities.

With the new broadband wireless network, Open Range will begin offering 4G services to un-served and underserved customers across rural America in the fourth quarter of this year. Alvarion will provide radio access equipment, customer devices (CPE) and systems integration for Open Range's broadband wireless network.

Open Range uses WiMAX technology to deliver wireless broadband to un-served and underserved American communities. The firm plans to deliver portable and eventually mobile voice and Internet services to customers within its WiMAX footprint. Alvarion has reported five deals in June, including the current one. It recently reported a deal in Taiwan, and earlier reported deals in Nigeria, Norway, and Papua-New Guinea.

Israeli scientists show bacteria can plan ahead

Bacteria can anticipate a future event and prepare for it, according to new research at the Weizmann Institute of Science. In a paper that appeared today in Nature, Prof. Yitzhak Pilpel, doctoral student Amir Mitchell and research associate Dr. Orna Dahan of the Institute's Molecular Genetics Department, together with Prof. Martin Kupiec and Gal Romano of Tel Aviv University, examined microorganisms living in environments that change in predictable ways. Their findings show that these microorganisms' genetic networks are hard-wired to "foresee" what comes

next in the sequence of events and begin responding to the new state of affairs before its onset.

E. coli bacteria, for instance, which normally cruise harmlessly down the digestive tract, encounter a number of different environments on their way. In particular, they find that one type of sugar – lactose – is invariably followed by a second sugar – maltose – soon afterward. Pilpel and his team of the Molecular Genetics Department, checked the bacterium's genetic response to lactose, and found that, in addition to the genes that enable it to digest lactose, the gene network for utilizing maltose was partially activated. When they switched the order of the sugars, giving the bacteria maltose first, there was no corresponding activation of lactose genes, implying that bacteria have naturally "learned" to get ready for a serving of maltose after a lactose appetizer.

Another microorganism that experiences consistent changes is wine yeast. As fermentation progresses, sugar and acidity levels change, alcohol levels rise, and the yeast's environment heats up. Although the system was somewhat more complicated than that of E. coli, the scientists found that when the wine yeast feel the heat, they begin activating genes for dealing with the stresses of the next stage. Further analysis

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showed that this anticipation and early response is an evolutionary adaptation that increases the organism's chances of survival.

Ivan Pavlov first demonstrated this type of adaptive anticipation, known as a conditioned response, in dogs in the 1890s. He trained the dogs to salivate in response to a stimulus by repeatedly ringing a bell before giving them food. In the microorganisms, says Pilpel, "evolution over many generations replaces conditioned learning, but the end result is similar." "In both evolution and learning," says Mitchell, "the organism adapts its responses to environmental cues, improving its ability to survive." Romano: "This is not a generalized stress response, but one that is precisely geared to an anticipated event." To see whether the microorganisms were truly exhibiting a conditioned response, Pilpel and Mitchell devised a further test for the *E. coli* based on another of Pavlov's experiments. When Pavlov stopped giving the dogs food after ringing the bell, the conditioned response faded until they eventually ceased salivating at its sound. The scientists did something similar, using bacteria grown by Dr. Erez Dekel, in the lab of Prof. Uri Alon of the Molecular Cell Biology Department, in an environment containing the first sugar, lactose, but not following it up with maltose. After several months, the bacteria had evolved to stop activating their maltose genes at the taste of lactose, only turning them on when maltose was actually available.

"This showed us that there is a cost to advanced preparation, but that the benefits to the organism outweigh the costs in the right circumstances," says Pilpel. What are those circumstances? Based on the experimental evidence, the research team created a sort of cost/benefit model to predict the types of situations in which an organism could increase its chances of survival by evolving to anticipate future events. They are already planning a number of new tests for their model, as well as different avenues of experimentation based on the insights they have gained.

Pilpel and his team believe that genetic conditioned response may be a widespread means of evolutionary adaptation that enhances survival in many organisms – one that may also take place in the cells of higher organisms, including humans. These findings could have practical implications, as well. Genetically engineered microorganisms for fermenting plant materials to produce biofuels, for example, might work more efficiently if they gained the genetic ability to prepare themselves for the next step in the process.

Israel reclassified as developed market by MSCI

Israel will be included in some of the most widely-tracked global equity indices.

MSCI has reclassified Israel as a "developed market", from its current emerging market status. The change will come into effect as of May, 2010.

Israel will be included in some of the most widely-tracked global equity benchmark indices, the MSCI World Index and the MSCI EAFE (Europe, Australasia, and Far East) Index.

GlaxoSmithKline purchases Protea vaccine

The agreement also includes royalty payments to NasVax, which could reach hundreds of millions of dollars.

Pharmaceutical giant GlaxoSmithKline (NYSE; LSE: GSK) has purchased the rights to a vaccine developed by Protea Vaccine Technologies Ltd., which is fully owned by NasVax Ltd. (TASE: NSVX).

As part of the agreement NasVax will receive an immediate payment of €2.75 million. Over the next two and a half years GSK will have the option to purchase the full rights to the product for an additional €17 million. If certain milestone achievements are realized then GSK is committed to take up the option.

The agreement also includes royalty payments to NasVax which could reach hundreds of millions of dollars.

Protea developing novel vaccine

Protea is developing a protein based universal vaccine for *Streptococcus pneumoniae*, a bacteria found in most people, and which is potentially harmful and cannot be treated with antibiotics. Vaccines against the bacteria already exist and have annual sales of \$6 billion. Protea claims that its vaccine is cheaper and more effective against a wider range of bacteria strains.

Last year Biomedix Incubator Ltd. (TASE: BMDX), which controls Protea and NasVax, decided to merge.

Protea's vaccine is still in the pre-clinical human trial stage. However, animal models are considered a

relatively good indication of success in this sector.

ETView



Airway management ranks among the highest priorities in clinical care.

Timely, effective and decisive airway management makes the difference between life and death.

ETView was founded in 2004, with the mission of improving patient health and lowering the high costs of medical care. Featured on the show ER as an innovative medical device, the TVT is an endotracheal tube embedded with a miniature camera and light source that provides an effective and safe solution for enhanced airway management and difficult intubations.

The TVT is improving the quality of medical care wherever intubation is performed.

In addition to the clinical applications of the TVT, ETView's Intubation Trainer is a modified version of the TVT used for teaching and refreshing the intubation skills of medical students, EMS personnel and hospital staff.

ETView has distribution in Spain, Austria, Italy, Turkey, Greece, and Israel. The TVT is in clinical use in over 40 hospitals.

Israeli startup reinvents process for ethanol production

HCL-Cleantech uses a modified Bergius process to cost-effectively turn wood chips, corn stover and other cellulose materials into ethanol. The Israeli company said the method, which can extract as much as 97% of sugars from cellulose sources, allows 42% of the concentrated hydrochloric acid solution used in converting biomass into sugars to be recycled.

Israel pioneers hybrid solar/natural gas technology
A small kibbutz in Israel has installed the world's first solar-hybrid power plant to supply all their energy needs. Composed of 30 solar reflectors and one kooky-looking "flower" tower, the plant can switch to gas-powered turbines after dark to keep the system producing power 24-hours a day. The best part is that the plant takes up a relatively small amount of space for its output and can power remote areas that are not connected to larger grids.

The 1982-Knoxville-World's-Fair-like-sunsphere is the key to how the system works. The 30 efficient heliostats track the sun throughout the day and bounce the sun's rays directly at the tower. Inside the tower a solar receiver converts the focused rays into solar thermal energy that powers a mini-turbine. Whenever there is cloud cover or the sun sets, the turbine can be run off biodiesel, natural gas, or bio gas, keeping the process side of the turbine still quite green.

The first plant in Israel will flip the switch on June 24, powering 70 homes. The company that created the technology, Aora, hopes to expand to other off-the-grid towns in the future. Combined with smaller nuclear reactors, these two technologies could help power the developing world.

Hebrew University research leads to advanced trials of new cancer treatment

Research by a Hebrew University of Jerusalem professor has led to the development of a product that has been shown in clinical trials to be successful in halting the growth of various types of cancer cells.

The research, conducted by Prof. Avraham Hochberg of the Silberman Institute of Life Sciences at the university, has won for him first prize among faculty members for this year's Kaye Innovations Awards, which was presented on June 9 during the annual Hebrew University Board of Governors meeting.

Prof. Hochberg was successful in isolating the H19 gene in humans and determining that it is significantly expressed in over 33 different forms of cancer, including superficial bladder carcinoma and pancreatic, ovarian and metastatic liver cancer, while laying dormant and non-expressed in non-cancerous cells.

Research has also demonstrated that the H19 gene plays a significant role in the tumor development process by enabling tumor cells to survive under stress conditions, such as low serum and low oxygen levels, that are typical conditions of the environment in which cancerous cells develop. This survival supports the growth of the tumor and the development of metastases.

The research and understanding of the origin of cancer and metastases has progressed significantly in recent years. In light of scientific breakthroughs

in cancer research, and the role of the H19 gene in such processes, it is believed that an anti-cancer drug based on suppressing the expression of the H19 gene has the potential to provide benefits that are competitive with existing treatment methods.

Prof. Hochberg's research was patented by Yissum Research Development Company of the Hebrew University. In 2005 Yissum established BioCancell Inc., to which it licensed the technology. The company is now traded in the Tel Aviv stock exchange (TASE). BioCancell's leading product, BC-819, has demonstrated efficacy in clinical trials (now in an advanced stage) in Israel and the US for the treatment of human bladder, pancreatic and ovarian cancers.

Israel ranked 9th most innovative country

According to an updated ranking of an Economist Intelligence Unit report called "the world's most innovative countries," Israel is rated the ninth most innovative country globally in 2008, and is forecast to rise further to win the eighth position sometime between 2009 and 2013. The innovation index ranks 82 countries based on their innovation capacity and forecasts their performance through 2013. The new rankings largely confirm the forecasts of the original research done in 2007. The forecast for 2009-13 takes into consideration the severe business downturn and the global economic crisis, which will have a negative impact on countries' long-term ability to innovate. According to the Economist, the current financial turmoil is expected to affect innovation worldwide through a reduction in significant drivers of innovation such as investment in research and development (R&D), spending on training and education and the quality of information and communications technology (ICT) infrastructure. The crisis will also have a negative impact on other aspects of the environment that enable innovation globally, including access to finance for firms, conditions for entrepreneurship, and economic and political stability. Recent data shows, however, that Israeli innovation continues to be boosted by a steady flow of foreign direct investment, which reached a near-record high of over \$10 billion in 2008. The Israeli market also continues to be a highly favored destination for some of the world's most successful companies. According to the Israeli media, in June alone visits were made by among others Hewlett Packard CEO Mark Hurd, Oracle President and CFO Safra Catz, Dell CEO and Founder Michael Dell, and chief software architect at Microsoft Ray Ozzie.

Unmanned aerial systems (UAS) technologies unveiled at Paris

Israel is highlighting its world leading unmanned aerial systems (UAS) technologies with a number UAVs making their debut at the 48th Paris Air Show. The total annual sales of Israeli UAVs and related systems are soon expected to reach \$1 billion.

Unmanned helicopters and urban mules



A new Vertical Take-off and landing UAV (VTUAV) making its debut here is the MULE, developed by Urban Aeronautics. MULE introduces a revolutionary capability for battlefield logistics 'push' and casualties evacuation, supporting land forces and

amphibious operations. The PICADOR, also unveiled here is developed by Aeronautics Defense Systems. This small unmanned helicopter is a designed for naval and land-based applications. The Picador can carry multiple payloads up to 180kg in weight on missions of 5-8 hours at a range of 200 kilometers. Another VTUAV development currently underway at IAI is the Naval Rotary Unmanned Aerial Vehicle (NRUAV). Modified with a full suite of automatic flight and mission control system, NRUAV will be able to deploy autonomously from the ship deck, on missions of up to 6 hours, at distances of 120 km from the launching vessel. The unmanned helicopter will function like an 'elevated mast' extending the vessel's coverage over a much larger area, providing early warning and detection of aircraft, and cruise missiles, surface vessels and even subsurface activity.

Medium Altitude, Long Endurance Platforms

Two Israeli companies are showing MALE (Medium Altitude, Long Endurance Platforms) UAVs. Israel Aerospace Industries is displaying the Heron TP, currently being evaluated by a number of European countries for strategic ISR roles. Heron TP is the largest UAV built in Israel to date. With maximum takeoff weight of 4650 kg, the 14 meter long aircraft is designed to operate at altitude of 40,000 ft and carry over 1,000 kg of mission payload sensors.

The aircraft is equipped with multiple datalinks, supporting line-of-sight (LOS) and satellite communications. Aeronautics Defense Systems is unveiling the twin-engine 'Dominador II' long endurance UAV that can carry payloads up to 400

kg weight, based on an unmanned version of the D42 custom built by the Austrian Diamond Aircraft company. The 1.785 ton twin-engine unmanned aircraft is designed for maximum operational ceiling of +30,000 ft. and mission endurance of 28 hours. It is equipped with triple redundant avionics, line of sight and satellite communications systems. The unmanned D42 is fitted with four different cameras providing remote operators and pilots full situational awareness.

Several companies are unveiling systems developed for these MALE UAVs – RAFAEL Advanced Defense Systems is introducing a new reconnaissance payload designed for UAV, providing highly detailed, wide area coverage in visual and Infra-Red (IR) spectral bands. Carried by MALE UAVs, such as Heron TP, Reaper, Heron or Predator, Rafael's RECCE-U payload can operate simultaneously and independently of the platform's other payloads, enabling operators to increase UAV mission utility without increasing sortie rate. The platform is certified for flight under all weather conditions. RADA is unveiling at the air-show a new family of UAV avionic systems, designed for small, medium and large UAVs. The company displays its distributed avionics architecture, comprising engine and payload interface controllers, electrical power management and engine control units, supporting comprehensive and scalable UAV applications. RADA is also introducing the MAVINS, its latest 'All-in-one Modular Avionics and INS' (MAVINS) weighing only one kilogram, and designed for small and compact platforms.

HERMES 450B (Watchkeeper) – Elbit Systems' Hermes 450 is the mainstay of Israel's Defense Forces UAV force. The same model is currently supporting British forces in Afghanistan. The British forces will also employ a modified version known as Watchkeeper, developed in cooperation with Thales UK. A new member of the Hermes family of UAVs is making debut at the exhibition. Hermes 90 is designed for close-range class UAV system, supporting tactical, mobile land forces with real-time intelligence, surveillance and reconnaissance services in day or night as well as under restricted weather conditions. The Hermes 90 uses the new MicroCompass multi-sensor payload developed by Elbit Systems.



Small UAVs
Aeronautics will also be showing several versions of the Orbiter, an electrically powered Orbiter

MUAV measures about one meter in length and sustains an operational endurance of up to 4.5 hours, utilizing enhanced wing extensions. A larger configuration currently in development will have mission endurance of 7 hours, carrying the new T-STAMP multi-sensor payload developed by Controp. The Orbiter is designed for operating at altitudes up to 18,000 feet. The company has recently announced a teaming agreement with US based AAI Corporation, (an operating unit of Textron Systems), to market the Orbiter Mini-UAV (unmanned air vehicle) system jointly to U.S. and select international customers, including Israel, under foreign military sales. Among the smallest Israeli micro UAVs making their debut at the Paris Air Show is the Micro-Falcon I, designed for carrying and operation by a single operator. Weighing 6 kg, MicroFalcon on display here carries the MicroBat 275 electro-optical payload developed by Bental Industries. This lightweight payload is expected to extend the mini-UAV's endurance to two hours.

Israeli military develops robotic battlefield serpent spy

A robotic camera snake that mimics the actions of the actual reptile has been developed by the Technion-Israel Institute of Technology for surveillance use on the battlefield

When it comes to battlefield surveillance, why walk, when you can slither past your enemy unseen? Animals, reptiles and insects are set to take new roles on the battlefield - and all without a trainer in sight.

Now, with a bit of help from Israeli researchers at the Technion-Israel Institute of Technology, a robotic surveillance camera disguised as a snake can be controlled remotely by soldiers to seek out enemy insurgents hiding in tight spaces, where airborne drones aren't as useful.

According to press reports, the camera snake looks more like a cuddly Jim Henson puppet than the latest battlefield robot.

The machine gains its movement from a series of interconnected joints that help pull it along the ground, in a method similar to that of the way a snake moves. Rough surfaces that would normally be too difficult for bots on wheels are perfect for this all-terrain cyborg snake.

In an earlier Ben Gurion University project, researchers experimented with a slew of robotic machines, each with unique animal talents and each modeled carefully after the real thing.

It's thought that the robot snake will be most adept to climbing through holes, tunnels and bunker spaces too difficult for soldiers to pass. It's also likely to have considerable humanitarian roles for use in locating survivors in earthquake and bomb debris.

Man's best friend? BigDog gets the nod as the strangest battlefield dog in the US military

However, it's not the first time military units have experimented with robot animals in the battlefield. A robot dog that walks just like man's best friend (named BigDog for its bulky size), has been unveiled by military research group DARPA in recent times, while autonomous insect bots are being developed with micro cameras on board as the ultimate in covert surveillance.

In a case of art imitating life, the latest Terminator Salvation film also features a bunch of robotic serpents. Is that what the military ultimately have in mind?

Ahead of ILSI-Biomed, Israel's Chief Scientist's Office Announces NIS 480 Million Investment in Life Sciences Over Last 7 Months – An Increase of 50% Above Last Year

Since November 2008, the research committee has reviewed 140 life science projects submitted by 87 companies

ILSI-Biomed Israel Conference, Israel's premier life sciences event, announced today that between November 2008 and May 2009 the Chief Scientist's Office (CSO) in Israel has approved NIS 480 million in grants to life science projects. The CSO awarded NIS 235.8 million to biotech projects, NIS 155.7 million to medical device projects and NIS 88.5 to pharmaceutical projects.

These figures represent an increase of 50 percent in comparison to the same time period last year. The CSO committee responsible for the allocation of the grants examined 140 projects submitted by 87 companies.

Over the last two years, the CSO has allocated

approximately 27% of its funds to life science projects, a significant increase from 2000, when it distributed only 14% of its available funds to life science projects.

The Chief Scientist also announced that in 2008 the CSO distributed NIS 329 million in R&D research grants, with NIS 147.3 million going towards medical device projects, NIS 140 million towards biotechnology initiatives and NIS 84.7 million to pharmaceutical projects.

Yissum Research has introduced a new compound for the treatment of osteoporosis



Professors Itai Bab and Raphael Mechoulam, from the School of Pharmacy at the Hebrew University of Jerusalem, invented a new drug candidate

for the treatment of osteoporosis that both inhibits bone resorption and stimulates bone formation. It activates the cannabinoid receptor (CB2), which is involved in the regulation of bone remodeling and in slowing down and rescuing bone loss. Importantly, this drug has no psychoactive effects. The new drug was successfully tested in preclinical trials.

"As our society continues to age, osteoporosis is becoming a major concern and impairing the life quality of millions," remarked Yaacov Michlin, CEO of Yissum. "Unfortunately, the battle against this disease has not yet been won. The new invention helps answer an urgent need for drugs that can encourage bone formation, bringing us a big step forward toward conquering this disease."

Osteoporosis is characterized by an imbalance between bone formation and resorption resulting in net bone loss thus weakening the skeleton and increasing susceptibility to fractures. Most anti-osteoporotic drugs in clinical use are anti-resorptive and used mainly to prevent postmenopausal bone loss. Use of Parathyroid Hormone (PTH) (1-34), the only clinically approved bone anabolic agent, is restricted to 18 months, because of bone cancer risk and possible development of tolerance. Therefore, this new drug, which has a bone anabolic effect with potentially fewer side effects, answers an unmet medical need.

Osteoporosis is the most prevalent degenerative disease in developed countries. The number of patients is expected to increase to 50 million in

2015. One in three women and 1 in 5 men over 50 will experience osteoporotic fractures. In fact, the combined lifetime risk for the common osteoporotic fractures is approximately 40%, equivalent to the risk for cardiovascular disease. Osteoporosis takes a huge personal and economic toll. In Europe, the disability due to osteoporosis is greater than that caused by most cancers. The global market for drugs for the prevention and treatment of osteoporosis is approaching \$10 billion and is growing rapidly.

India to adopt Israeli method to increase mango yield



India will soon adopt an Israeli technology to rejuvenate mango trees and will increase the productivity of the crop. The National Horticulture Board (NHB) had placed orders for two Israeli Canopy Management Pruning

Machines, which could mechanically rejuvenate trees in large areas, said Bijay Kumar, managing director, NHB.

The first machine would arrive very shortly and would be given to the Indian Institute of Horticultural Institute, Bengaluru. The other would arrive in June and would be given to the Central Institute for Subtropical Horticulture, Lucknow, for better acclimation, Kumar added.

Research by Hebrew University holds promise for novel oral anti-diabetic drugs

Promise is held out for the development of novel oral drugs to control blood glucose levels in diabetes patients as the result of research by a Hebrew University of Jerusalem scientist.

For his groundbreaking work, Prof. Shlomo Sasson of the Hebrew University School of Pharmacy has been named one of the winners this year of the Hebrew University's Kaye Innovation Awards.

Type 2 diabetes is a worldwide epidemic, predicted to affect over 380 million people within the next 20 years. High blood glucose levels that lead to severe complications in various organs and tissues characterize this disease. The disease usually results from insufficient secretion and function of the pancreatic hormone insulin that regulates glucose metabolism in peripheral tissues, such as skeletal muscles, fatty tissues and the liver.

Pharmacological anti-diabetic therapy aims at a strict regulation of blood glucose levels to prevent such complications. However, because current oral anti-diabetic drugs often fail, many patients need daily injections of insulin to control their glucose metabolism and reduce blood glucose levels.

The global diabetes therapy market is estimated at around US\$26.3 billion in 2009. By 2013 the market is expected to grow to around US\$34.5 billion.

Recent work on the molecular mechanisms that regulate glucose transport in skeletal muscles has identified new potential targets for anti-diabetic drugs.

In his research, Sasson, with his colleagues and students, made a unique discovery that high levels of the carbohydrate D-xylose increased the rate of glucose entry into skeletal muscle cells in a non-insulin-dependent manner. They then used it as a prototype molecule for the planning and synthesis of chemical derivatives that may act as potential drugs to lower blood glucose in type 2 diabetic patients.

Some of these derivatives increased significantly the rate of glucose transport in skeletal muscles at very low concentrations. This effect was not achieved by mimicking the classical pathway of insulin action, but by activating the enzyme AMP-activated protein kinase (AMPK). When activated, this enzyme increases the rate of glucose transport in skeletal muscles in the absence of insulin. Therefore, compounds that activate this enzyme can be effective in insulin resistant type 2 diabetic patients or in those that fail to respond to conventional drug therapy. This makes AMPK an extremely attractive target in the development of novel anti-diabetic drugs.

One of the lead compounds developed by Sasson and colleagues effectively reduced blood glucose levels in various animal models of diabetes. This discovery indicates the great potential of these novel derivatives to serve as the basis for development of new drugs to normalize blood glucose levels in diabetic patients.

Israel's defense industries

Israel produces a wide range of products from ammunition, small arms and artillery pieces to sophisticated electronic systems and the world's most advanced tank.

Having to fight five major wars in its first four decades, Israel built a comprehensive standing army – the Israel Defense Forces (IDF) – and furnished it with an arsenal of highly advanced military hardware. The government, which owns three major defense firms, also encouraged the formation of private companies to equip the IDF. The development of a sophisticated defense industry inevitably led to exports, which today account for a majority of its revenues and allows the country's defense industry to compete against some of the largest companies in the world for foreign contracts, in addition to producing many of the arms needed for Israel's own defense.

Faced with a shrinking market for military hardware over the last decade and a half, Israeli defense concerns have made a concerted effort to employ their research and development teams in devising products for non-military markets and, more frequently, in adapting defense technology for civilian applications. Indeed, many of the most innovative products developed by Israel's civilian high tech industry, especially in the field of telecommunications, trace their origins to military technology.

The modern defense industry in Israel was set in motion in the early 1920s. Faced by an increasingly hostile Arab population, the Jewish community began to manufacture homemade hand grenades and explosives. In the early 1930s, members of the Haganah (the pre-state Jewish underground defense organization) set up clandestine small arms factories, which became the Israel Military Industries (IMI) in 1948. In the first two decades after independence, IMI produced many of the basic weapons used by the IDF, including the Uzi sub-machine gun. The more costly aircraft and other advanced weapons were procured from foreign suppliers, principally France.

The major catalyst for Israel's metamorphosis from a small-arms manufacturer to a producer of sophisticated military systems came after the 1967 Six-Day War. During the war, France imposed an embargo on arms sales to Israel, including the Mirage planes already on order from the Dassault aircraft factory. When the United States became the primary supplier of combat aircraft, Israel began to develop its own production capability. The government-owned Israel Aircraft Industries (IAI), founded as a maintenance facility in 1953, soon began developing and assembling a variety of its own aircraft, including the Kfir – a replacement for the Mirage – as well as the Arava and Nesher planes. At the same time, IAI's contacts with US suppliers advanced from

subcontracting jobs to joint ventures with Boeing and Lockheed-Martin. As a result, employment at IAI grew rapidly from 4,000 to a peak of 14,000 in the late 1980s.

The growing sophistication of Israel's defense industry gave it the confidence to develop an all-Israeli military aircraft, the Lavi. Over the first half of the 1980s, IAI developed avionics, electronics and weapons systems for the aircraft, and by 1986 the first prototype had taken to the air. However, the government concluded that it was unable to finance such an ambitious undertaking, and the project was canceled a year later. Shorn of the Lavi, IAI began to develop a variety of products in the military and civilian spheres – such as advanced radar systems, precision weapon systems, unmanned air vehicles (UAVs) and commercial and military aircraft conversion – many of which were based on the technology developed during the Lavi project.

There are approximately 150 defense firms in Israel, with combined revenues of an estimated \$3.5 billion. The three largest entities are the government-owned IAI, IMI and the Rafael Arms Development Authority, all of which produce a wide range of conventional arms and advanced defense electronics. The medium-sized privately owned companies include Elbit Systems and the Tadiran Group, which focus mainly on defense electronics. The smaller firms produce a narrower range of products. In all, the industry employs close to 50,000 people, all of whom share a commitment to high levels of research and development and the ability to make use of the IDF's combat experience.

Israel's defense exports are coordinated and regulated through SIBAT – the Foreign Defense Assistance and Defense Export Organization – which is run by the Ministry of Defense. SIBAT's tasks include licensing all defense exports as well as marketing products developed for the IDF, from electronic components to missile boats and tanks. Each year, SIBAT publishes a defense sales directory, an authoritative guide to what the industry has to offer.

Despite their far-reaching client base, even the biggest local firms are relatively small players in the global defense market. With increasing competition from the major world aerospace players, Israeli companies tend to specialize in niche markets, or have sought to combine forces through mergers or joint marketing efforts. In addition, declining global defense spending has provided them with

new opportunities as foreign governments seek to upgrade their existing arsenal rather than buy new equipment. This policy is typified by the Phantom 2000, a sweeping modernization of the F-4 aircraft that Israel acquired from the US in the early 1970s.

In the wake of the Lavi's cancellation, IAI diversified and expanded with funding from the United States, developing the Amos and Ofeq satellites and the world's first operational anti-missile missile system, the Arrow. IAI's unmanned air vehicles (UAV or pilotless aircraft) systems, including the Hunter, have now become standard for military establishments in many countries around world. The company is also engaged in the repair and maintenance of aircraft and helicopters, and in upgrading aircraft with state-of-the-art avionics. It also designs, develops and manufactures naval and ground systems, electronic warfare and radar equipment and missiles. Company sales in 2000 amounted to \$2.18 billion, of which exports accounted for \$1.7 billion. In the same year, IAI signed some 1,600 new contracts worth approximately \$2.6 billion.

Israel Military Industries (IMI) was founded in 1933, as a secret small-arms plant. After the establishment of the State in 1948, it was operated by the Ministry of Defense, developing and manufacturing assault weapons - from the classic Uzi sub-machine gun to the Tavor assault rifle - heavy ammunition, aircraft and rocket systems, armored vehicles like the Merkava tank, and integrated security systems. In 1990, IMI was converted into a government-owned company. Altogether IMI manufactures some 350 products and employs over 4,000 people. In addition to Israel and the US, IMI has distributors in a number of countries, including Norway, Belgium, the Philippines and Greece. Some 60% of its revenues, worth approximately \$550 million, come from exports.

The third government-owned defense firm, the Rafael Arms Development Authority, developed and now manufactures Python and Popeye "smart" airborne missiles, both of which have co-production agreements with major US aerospace companies. In addition, its products include such varied categories as passive armor, naval decoys, observation balloon systems, acoustic torpedo countermeasures, ceramic armor, air-breathing propulsion, and air-to-air, air-to-surface and surface-to-surface missiles.

Elbit Systems, based in Haifa, develops, manufactures and integrates advanced, high-performance defense electronics systems, focusing on upgrade programs for aircraft and armored vehicles. The company also

manufactures command, control and communication (C3) systems, and upgrades in weapons platforms and electronic systems and products for both Western and former Eastern bloc countries. In 2000, Elbit Systems merged with another major private-sector defense concern, El-Op Electro-Optics Industries Ltd, and combined sales reached \$591 million, up from \$436 million the previous year.

The second major private sector defense firm is the Tadiran-Elisra Group, whose subsidiaries specialize in defense electronics. The group's Elisra Electronics offers a range of electronic warfare systems for the military, including radar warning systems, active countermeasure systems, comprehensive self-protection systems, ESM and ELINT systems, and sophisticated communication links complemented by extremely lightweight components and super components. It employs a staff of over 800, two thirds of whom are engineers. Tadiran Electronic Systems designs and produces a wide range of military applications, including intelligence, reconnaissance and electronic warfare and specialized naval communication systems, all tailored to customer specifications. Tadiran Spectralink specializes in pilot-rescue electronic equipment while BVR Systems develops innovative flight simulators for fighter pilots. The group, which is controlled by Koor Industries, announced sales of \$284 million in 2000.

In addition to Elbit and Tadiran-Elisra, there are scores of smaller, more specialized defense firms in the private sector, including: Cyclone Aviation, which upgrades helicopters and makes aircraft components; Urdan Industries, which through its Associated Steel Foundries makes many of the components of the Merkava tank; Magal Security Systems, whose products include sensors for security perimeter fences and explosive-detection devices for airports and other public facilities; BVR Technologies, which produces airborne collision-avoidance security systems, trainers for pilots and for the use of "smart" weapons, and a variety of simulators for combat training and pilot debriefing; the Elul Group, a complex of companies which specialize in development and coordination of defense business for Israeli firms abroad, and for international firms in Israel; RSL Electronics, which produces both airborne electronics systems for airplanes and helicopters and muzzle-velocity radar for field artillery; and Soltam, which makes both mortars and heavy artillery pieces as well as Israel's most popular line of stainless steel kitchen equipment.

Since the end of the Cold War, the global defense industry, including the IDF, has had to cope with declining military spending. In response, many private companies have either merged or reduced staff, or diversified into civilian markets, with some companies fully spinning off their civilian activities into separate businesses. Many of the high technology products designed by Israeli companies for such areas as the Internet, medical electronics and robotics, are based on technology originally developed by the IDF or the defense industries. Friendly Robotics is one notable high-tech start-up that traces its origins to the army. Its top executives worked in army technology units and the company's robot lawnmowers are based on advanced missile guidance technology, providing accurate positioning and navigation functions to perform its tasks. Among the few private sector defense firms with civilian activities, Elisra designs, develops and produces electronic and microwave applications for the commercial market.

In 1968, IAI acquired the rights to manufacture the Jet Commander executive aircraft from the US company Rockwell, which eventually evolved into the IAI's Astra. In the 1990s, IAI began producing the Galaxy executive jet in partnership with the Pritzker family of Chicago. In April 2001, the international aerospace firm General Dynamics contracted to purchase the Galaxy firm for approximately \$600 million. In addition, in the late 1970s Bedek, a division of IAI specializing in aircraft maintenance, began overhauling and refitting Boeing 707 airliners, and today the upgrade of commercial aircraft has become a major business for IAI. The civilian content of the new contracts signed in 2000 was worth \$1.1 billion, or 42% of total new contracts. IMI has fewer civilian businesses but has developed technology for electronic wallets and computerized payment systems.

Rafael develops military technologies for civilian use through its Rafael Development Corp., a joint venture with the private sector Discount Investment Group. One of these projects used miniaturization and guidance techniques to produce a transmitter and camera the size of a vitamin capsule. The capsule is swallowed by a patient and pictures of the gastrointestinal tract are then taken by the camera for use by diagnosticians, substituting for invasive diagnostic procedures. The system, which was developed by Given Imaging, was the brainchild of a missile guidance expert.

Hebrew University researchers discover method to neutralize tumor growth in embryonic stem cell therapy

Researchers at the Hebrew University of Jerusalem have discovered a method to potentially eliminate the tumor-risk factor in utilizing human embryonic stem cells. Their work paves the way for further progress in the promising field of stem cell therapy.

Human embryonic stem cells are theoretically capable of differentiation to all cells of the mature human body (and are hence defined as "pluripotent"). This ability, along with the ability to remain undifferentiated indefinitely in culture, make regenerative medicine using human embryonic stem cells a potentially unprecedented tool for the treatment of various diseases, including diabetes, Parkinson's disease and heart failure.

A major drawback to the use of stem cells, however, remains the demonstrated tendency of such cells to grow into a specific kind of tumor, called teratoma, when they are implanted in laboratory experiments into mice. It is assumed that this tumorigenic feature will be manifested upon transplantation to human patients as well. The development of tumors from embryonic stem cells is especially puzzling given that these cells start out as completely normal cells.

A team of researchers at the Stem Cell Unit in the Department of Genetics at the Silberman Institute of Life Sciences at the Hebrew University has been working on various approaches to deal with this problem.

In their latest project, the researchers analyzed the genetic basis of tumor formation from human embryonic stem cells and identified a key gene that is involved in this unique tumorigenicity. This gene, called survivin, is expressed in most cancers and in early stage embryos, but it is almost completely absent from mature normal tissues.

The survivin gene is especially highly expressed in undifferentiated human embryonic stem cells and in their derived tumors. By neutralizing the activity of survivin in the undifferentiated cells as well as in the tumors, the researchers were able to initiate programmed cell death (apoptosis) in those cells.

This inhibition of this gene just before or after transplantation of the cells could minimize the chances of tumor formation, but the researchers caution that a

combination of strategies may be needed to address the major safety concerns regarding tumor formation by human embryonic stem cells.

Cellulosic technology investment

HCLTwo venture capitol companies have invested in an Israeli company with technology for converting cellulosic materials into fermentable sugars.

Burrill & Company and Khosla Ventures announced their investment in HCL CleanTech, which has “developed a proprietary technology to make an old, industrially proven German process converting lignocellulosic biomass to fermentable sugars economically very attractive.”

“Accessing cheap sugar locked in biomass is one of the greatest challenges now faced by those pursuing renewable fuels and chemicals. HCL CleanTech’s technology represents a step change in accessing these sugars, and drops into the pretreatment step of any fermentation-based process or chemical reforming technique which starts with oligosaccharides,” said Burrill & Company Director, Greg Young. “We are eager to see this proven at scale, at which point it becomes immediately relevant to adjacent industries aiming to use biomass as a feedstock.”

Cancer-Fighting Robot to be Unveiled at ILSI-Biomed Israel Conference

A miniature crawling robot (ViRob) with the potential to treat lung cancer by performing precise medical procedures inside the human body, was introduced for the first time at the conference set to take place June 15-17 in Tel Aviv, Israel.

The ViRob can navigate and crawl in different spaces within the human body, including blood vessels, the digestive tract, and the respiratory system. In addition, the robot’s unique structure gives it the ability to move in tight spaces and curved passageways as well as the ability to pause within the body, making the breakthrough technology ideal for performing minimally invasive medical procedures.

“This robot is a major breakthrough in the biomedical industry as it allows doctors to access inaccessible areas in the body with minimal invasion,” said Prof. Moshe Shoham from the Medical Robotics

Laboratory in the Israel Institute of Technology. “The technology enables a centralized treatment without scattering materials to unnecessary areas in the body. Unveiling our technology at Israel’s leading biomedical conference positions ViRob as the leading technology in the Micro-robots for medical use industry.”



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