

# ISRAEL HIGH-TECH REPORT

A MONTHLY REPORT COVERING NEWS AND INVESTMENT OPPORTUNITIES

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December 1991 Vol.VII. Issue No.12

ISSN 0334-5307

From the Editor's Desk

## UNSHACKLING THE SHEKEL

Though he first made a show of offering his land "for free," Efron the Hitite finally demanded and received the outrageous sum of 400 silver shekels from Abraham before he would part with the Cave of Machpela, where all the patriarchs were to be buried. The shekel was a strong currency then, and remained so throughout the First and Second Temple period...thanks in large part to a divinely ordained economic system (described in the Talmud) that made the currency internationally attractive, ensured annual opportunity for all segments of society, kept prices and wages fair, encouraged investment, and controlled inflation. The wheels of faith and history must turn a little further before this system can be re-established, but nearly 2,000 years later the shekel is again the currency of Israel. The modern Israeli shekel, however, is not yet freely convertible.

The American administration, the International Monetary Fund and various economists, including Nobel laureate Milton Freedman, have recommended that Israel liberalize its foreign currency regulations. The Bank of Israel and the Ministry of Finance, taking the criticism to heart, recently announced "another stage in the liberalization of the foreign exchange and capital markets."

Conceding that the shekel is not yet ripe for free convertibility, the Governor of the Bank of Israel nevertheless announced that Israelis may henceforth maintain foreign currency accounts based on income of funds brought in from overseas. So the Children of Israel can now invest in international securities other than those listed on the Tel Aviv Stock Exchange, not to mention Treasury notes and other instruments on international capital markets.

The shares of such companies such as IBM, Digital, Hewlett Packard, Mitsubishi and Honda will thus be within reach of the private investor. As in other westernized countries, a capital gains tax (35%) is imposed, and 5% will be deducted at the time of the sale of securities through the banking system.

Investors in securities on the Tel Aviv Stock Exchange pay no capital gains tax, and so are

unlikely to rush into foreign markets. Yet such investment will gradually take place, making the international investment process more of a two-way street.

Guidelines for Israeli businesses investing directly abroad through share capital has also been liberalized, and local concerns can now commit up to 40% of their own equity in this way.

These and other steps are certainly confidence builders, and prove the Treasury is in fact accelerating its liberalization program. Yet international investing and the transfer of capital outside Israel's borders will be propelled by market pressures as much as by the initiative of the Treasury or the Bank of Israel.

In the high-tech field, joint ventures and the formation of American-based companies for the purpose of investing in fully owned Israeli subsidiaries are accepted practices. However, Israelis currently have difficulty in obtaining permission to invest in overseas entities, even if the main focus of their activity is in Israel.

The local capital market is not yet mature enough to offer adequate alternatives to index-linked bonds, foreign currency bonds and shares. Institutions and corporations will be given new alternatives in the form of the Euro dollar and Eurobond market.

Individual investors are not being encouraged to gamble. The Treasury, in conjunction with the Tax Department, intends to impose enough safeguards by means of taxation: 35% on interest/income dividends and on capital gains. To make sure the tax is

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collected, it is likely that banks acting as foreign currency dealers and providing brokerage services will be asked to deduct 5% from each security sale, whether it was sold with a profit or not.

Yet there is much to be done. Administrative restraints are still the order of the day.

While foreigners are being offered the possibility of direct investment in Israeli firms, Israelis may be denied the same opportunity. Companies are sometimes set up only to channel investments. It is a good way to raise capital. However, foreigners may be reluctant to commit larger sums to Israeli investments if they note that shares of foreign companies are offered to them only on a discriminatory basis. They can invest, but the Israeli private individual cannot. Bank of Israel approval in such cases is generally required.

The recent steps towards "liberalization" are bringing Israel more in line with the practices of western European countries. Progress in this area is likely as international trade broadens and the business community tends to become more international.

#### HEALTHCARE INDUSTRIES ARE IN THE PINK

Israel's healthcare exports have increased at an annual rate of 20-25% since the mid-1980s. This growth has been achieved by the transfer of university and institutional research to industry. From there it takes the quantum leap from local to overseas markets.

Nowhere was this more evident than at the recently concluded Medax 9, Israel's 8th International Exhibition of Medical Technology. This showcase for Israeli medical technology was attended by more visitors and exhibitors than expected, according to Mira Richman, director of Healthcare and Electronics at the Israel Export Institute. While the impact of these exhibitions is generally only felt months later, Ms. Richman reported that at least one Israeli company made a sale the first day.

The exhibition was run in parallel with Israel's 8th Medical Week and the 15th World Congress of the Israel Medical Association.

With more than 200 foreign visitors on hand, exhibits spanned the spectrum of healthcare industry products, from conventional surgical dressings to products based on state-of-the-art biotechnology.

What is new and interesting?

Israel has two nuclear research and development centers. They are in close contact with Israeli universities and the International Atomic Energy Agency, according to Scientific Research in Israel,

published by MOST (Israel Ministry of Science and Technology).

At one of these centers -- the Nuclear Research Center-Negev (NCRN) -- equipment includes a natural uranium-fueled, 25-megawatt reactor.

With the first Madrid peace parley now history, the proliferation of atomic, biological and chemical weapons is bound to occupy further bilateral meetings. Whatever Israel's defense capabilities, at Nuclear Research Center-Negev, it is "bullets for peace" -- projects with industrial and healthcare applications. The transfer of research, products and processes developed by NCRN is the responsibility of Rotem Industries.

Radiotherapy is one of the major methods of treating cancer. Controlled doses of radiation are used to destroy malignant cells. These doses are administered either by irradiating the area of a tumor externally or by implanting radioactive pellets or needles inside the tumor.

Though radiotherapy is more than 40 years old, pellets were not used until the 1980s. The brother and sister team of Pierre and Marie Curie were trailblazers in the field. They developed the use of radon, a naturally occurring isotope, and applied it with needles in treating skin, uterus and cervix cancers. The Curie-developed radiation technique became obsolete when the discovery by Roentgen of X-rays offered an alternative to radon needles, the use of which caused emission of noxious gasses.

The application of Cobalt 60 isotope followed, but was in turn replaced by the linear accelerator, a device still commonly used internationally and in the oncology departments of Israel's major hospitals. The use of the linear accelerator is widespread, due to its ability to deliver high dosages in short spans of time. Benefits include reduced side effects.

About a decade ago, Minnesota Mining & Manufacturing (3M) -- a giant American firm whose specialty is adhesive tape and abrasives -- introduced implantable radioactive pellets. The staff of NCRN, with a wealth of experience in supplying isotopes for nuclear medicine, concluded a \$300,000 research and development program which resulted in an improved implantable pellet. Dr. Sorario Chaitchick, head of oncology at the Tel-Aviv Medical Center, Ichilov Hospital, uses the NCRN seeds to treat pancreas, lung and brain cancers.

"The use of Iodine-125, with its half life of 60 days, results in a 36% survival rate after 260 weeks. The NCRN product is delivered to us within two hours of placing the order. Permanent implantation offers a

number of advantages, including shorter hospital stays. NCRN, using robotic techniques, produces iodine implantation seeds made of a welded titanium capsule 0.8mm. in diameter and 4.5mm long. The capsule contains Iodine 125 adsorbed onto a silver rod, which also acts as an X-ray marker. The Iodine-125 has radiation energies of 27 and 35 keV. NCRN's production methods are such that the seeds are never touched by human hands.

"This method is known as 'soft radiation,' and its key advantage is that it eliminates the radiation of healthy tissue. Patients so treated need not be isolated to protect others from radiation risk."

Rotem Industries Marketing Manager Aharon Levi says Iodine-125 implantation seeds have been in use in Israeli hospitals for more than a year, and have been licensed by Israel's Ministry of Health for permanent implantation. The average treatment requires 40 seeds, according to Dr. Chaichick. NCRN charges \$30 a seed for local users. This price includes an 18% value added tax.

At NCRN, exports are beginning, but total sales are still less than \$500,000. However, Levi expects to increase sales to several million dollars a year.

## ISRAELI COMPANIES ON WALL STREET

### What they are Saying?

The news of Robert Maxwell's untimely death reverberated throughout the world. A late-in-life attachment to Israel resulted in investments in the local media (Maariv, Keter), computer graphics (Scitex) and pharmaceuticals (Teva). Less than two months ago he cashed in his investment in Scitex -- a net profit of over \$200 million in less than three years! The day after confirmation of Maxwell's death, Scitex announced superb three-months results. The company earned \$25.7 million on sales of \$110 million.

On the strength of the death announcement, however, Scitex shares slumped by more than \$1.25. It is assumed that investors sold Scitex believing Maxwell was still a shareholder.

TaroVit has been "talked up" by financial advisors in the local banking system. A speculative rise has brought its market valuation to an exaggerated \$33.9 million, according to statistics provided by the American Stock Exchange.

The shares of BioTechnology General advanced sharply to \$9.50 in the aftermath of the

announcement by the Governor of the Bank of Israel Jacob Frenkel that Israeli residents would be able to buy any security traded on a recognized foreign stock exchange. Israelis were credited with a small buying spree. BTG followers are awaiting confirmation for BTG's human growth hormone (hgh) in Europe.

Healthcare Technologies made a strong corporate presentation. HCTL is in the process of seeking \$3 million by way of the private placement of a package of a share and a warrant at \$1.50.

Pharmos Corp. has successfully completed the first closing of its private placement. PEC Israel Economic Corporation concluded an investment in Pharmos. Based in New York City, PEC has been engaged in the financing and management of Israeli enterprises for the past 65 years. PEC's acquisition of an interest in Pharmos is in line with its policy of involving itself in the early development of Israeli companies. PEC is a subsidiary of IDB Bankholding, one of Israel's largest private business enterprises.

Eshed Robotec share prices on NASDAQ are below that of the Israeli listed shares. With recent prices of about \$3.00, investors are eagerly awaiting third-quarter results to see whether they are in line with expectations. Eshed Robotec continues its strong sales momentum; the company's learning robots are finding a rapidly expanding niche in the retraining of employees. Our estimates are that for all of 1991, Eshed will sell in excess of \$8 million, and continue to entrench itself as a world leader in educational robots and vision systems. Margins can be expected to improve.

The U.S.-based firm of Lehman Brothers continues to be a major force in the underwriting of Israeli companies on Wall Street. Recently, Lehman completed sales of 2.16 million shares of Elbit, 4.95 million shares of Teva, 7.12 million shares of Scitex and 4.14 million shares of Lannet Data. The total realized was \$400 million.

As Israel moves towards privatization of its National Medical Services, Teva continued to expand its overseas sales at a somewhat faster rate than local sales, perhaps because the Histadrut General Health Fund, Teva's largest customer, is experiencing "increased financial difficulties." Exports now amount to 47% of the company's nine months sales of \$237 million.

Teva has started Phase III clinical trials for its COP-I, a multiple sclerosis drug. FDA approval will be sought in 1994.

ECI Telecom appears to be well positioned to

## Israeli Companies on Wall Street

Selected income and earnings summaries for the quarters as noted, unless otherwise indicated. Nearly all of these companies are intensively export oriented. Prices are as of November 16, 1991 and the price changes relate to those a month ago.

<u>Company</u>	<u>Revs</u> (in \$ mil.)	<u>Net Income</u> (in \$ thou.)	<u>Price</u> (in \$)	<u>Net</u> <u>Change</u>
ELBIT COMPUTERS Defense electronics ELBTF OTC	196,067 Q1-Q2	10,409	26.500	-0.250
ECI TELECOM Telecommunications ECILF OTC	79,462 Q1-Q3	19,076	40.250	-3.000
ELSCINT Medical imaging ELT NYSE	137,740 Q1-Q3	11,094	4.500	-1.125
FIBRONICS Fiberoptics FBRX OTC	37,900 Q1-Q3	(1,080)	6.875	+0.625
INTERPHARM LAB. Biological products IPLLF OTC	25,200 Q1-Q3	3,400	53.250	+2.250
LASER INDUSTRIES Surgical lasers LAS ASE	8,605 Q1	81	4.125	+0.375
OPTROTECH Electro-optical systems OPTKF OTC	53,647 Q1-Q3	862	17.000	-0.500
SCITEX LTD. Computer graphics SCIXF OTC	313,000 Q1-Q3	72,800	33.250	-2.250
IIS INTELL. Computer peripherals IISLF OTC	20,830 Q1-Q2	2,630	17.750	-0.250
TEVA PHARMACEUT. Pharmaceuticals TEVYF OTC	236,940 Q1-Q3	16,190	17.375	-0.125
ELRON ELECTRON. ELRNF OTC	26,500 Q1-Q2	13,600	16.875	+0.875

maintain its strong performance. While its traditional DCME equipment still enjoys strong demand, its fax multiplication lines are also moving at record levels, with the market only being scratched. (See "Talking for 70 billion minutes"). Wall Street-based analyst reports continue to recommend the purchase of ECI shares at current prices. The November 15th 120-point drop had no effect on the price of InterPharm shares. In fact, they were somewhat higher on the day. Nevertheless, many biotechnology and healthcare prices tumbled that day by as much as 20%. Major losers were Immunex and Chiron. The falls were inspired by analysts who pointed to very high rises achieved by shares in this sector, in 1991.

#### **SYNCHRONOUS DIGITAL HIERARCHY (SDH) & ECI TELECOM**

SDH is an emerging technology that makes it possible to combine different types of digital information (i.e., voice, video, data, text, graphics) for high-speed transmission over a fiber-optic line. Many believe SDH will be the network architecture of the future, and expect it to be the first step toward local (fiber-to-premise or fiber-to-curb) ISDN capability. SDH is also expected to be the precursor to broadband ISDN, which could enable video communications and high-definition television programming to travel over telephone lines.

SDH is a very efficient way of multiplexing and demultiplexing information, making it possible to efficiently manage and supervise the flow of many types of information traveling at different speeds through the network. It also has "drop and insert" capability, which increases user access to the network.

ECI has recently received a major SDH contract from the Bundespost in Germany. The systems ECI ships under the contract will be among the first of their kind in the world.

#### **TALKING FOR 70 BILLION MINUTES**

The growth of international telecom traffic over the past few years is part of the evidence that EC countries are becoming increasingly integrated. Germany leads the European telecom league, with 2.4 billion minutes of international telephone calls last year. It was followed closely by France and the UK, with just over 2 billion minutes each. This is clear proof that pan-European business is a growing reality.

Traffic is forecast to continue to double every four years; the total volume of international telephone calls will grow to 70 billion minutes in 1995.

The international community is slowly overcoming the technical and regulatory problems that even now make calling another country a nerve-wracking experience. A key concept in this process is the Synchronized Digital Hierarchy (SDH) standard, which has been adopted in Europe, the U.S. and Japan.

Using SDH, all telecom traffic -- telephone calls, data transfers between computers, and video conferencing transmissions -- are transferred in the same digitized form on high-capacity fiber optic cables. A single network replaces the variety of services users currently have to rent, such as the networks for voice and fax transmissions or expensive leased circuits for high-volume data transfers.

SDH offers users considerable flexibility. There is no need to lease a dedicated circuit or sign up for a special service such as the packet switched network. Instead, fiber optic cables will allow users to request capacity only for the time it is needed.

For example, bank branches which need to transfer large amounts of data on financial transactions to central data-processing computers at the end of each day's business can request the capacity for just the few minutes needed. No longer will a bank have to choose between leasing a high-capacity circuit required for only five minutes a day, or using a low-speed networking service such as packet switching, with data transfer taking three or four hours. The user will be able to request any service at any time.

"It will just take an instruction from the central management system to change the class of service," says a transmission system engineer at AT&T Network Systems in the Netherlands. "The phrase 'service on demand' takes on a new meaning -- the problem of responsive service provisioning can be separated from the problem of installing and maintaining the physical media."

*Paul Gannon, European Oct. 91*

## **INDUSTRY OVERVIEW**

#### **The Computer Industry In Israel**

Intel Israel is one of the most advanced software companies in the world. Israel's computer professionals are excellent at creative thinking, and have vast amounts of experience with sophisticated computer and software technologies.

Many of the world's largest software and hardware vendors, (IBM, Digital, Hewlett Packard, Motorola,

Intel, National Semiconductor, Microsoft, Sterling and others), aware of the talent and creativity of Israel's computer experts, have formed local R&D bases for software and hardware research. Software products developed by Israeli industry are used around the world in areas such as banking, agriculture, medicine, high-tech industries and education. The applications cover managerial systems, logistic systems, finance, medical systems, CAD/CAM, education by computer, artificial intelligence, telecommunications and others.

It is believed that Israeli companies can be a reliable bridge for offering services and products to the Eastern Bloc as well as to the Third World. Not only does the country have technological advantages, it is also rich in recent immigrants from the Soviet Union, people who have mastered the Western discipline of software development and who are experts in the cultures and languages of the Eastern Bloc. There is no other country in the world which has these advantages.

Israel has overcome its small population by producing \$400 million in software every year, specializing in adopting computerized systems in order to cope with manpower shortages and the concomitant necessity to be efficient and productive. People who have graduated from the country's universities and the Haifa Technion are leading lights in the development of the most sophisticated technological projects, such as offshoots of the Lavi jet fighter, medical scanners and simulators, software tools for computers, data bases and artificial intelligence products.

An analysis of total production figures for the high-tech and electronics industries in Israel proves that at least one third belongs to the software portion of the product. This is the real added value of system integration and the product itself.

Software is the country's fastest growing export industry. From only \$11 million in 1986, exports increased to \$25 million in 1987, \$90 million in 1990, and it is anticipated that this year's exports will reach at least \$120 million.

The Israeli software industry has matured, and is ready to collaborate with its counterparts around the world.

*Amiram Shore, Chairman, Israeli Industry Software Houses*

#### SOFTWARE EXPORTS UP

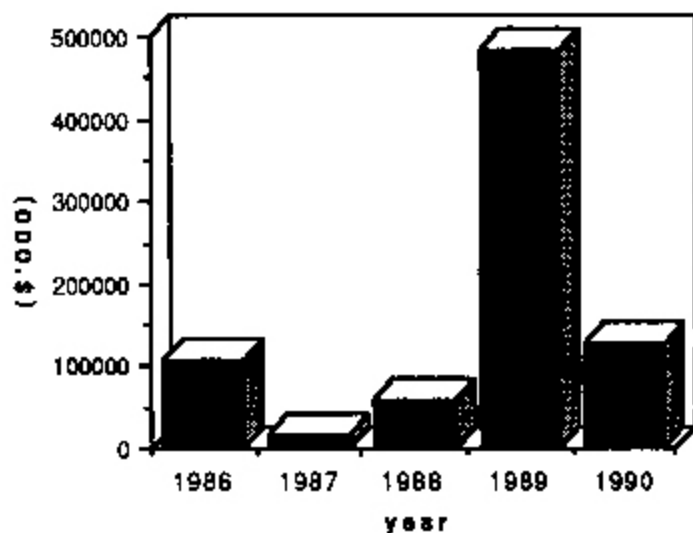
Exports of software in 1991 are expected to total \$120 million -- a 40% increase over last year's figure. Electronic and Software Chairman Akiva

Meir of the Manufacturers Association said electronic industry exports are estimated to total \$2.25 billion -- an increase of 5 to 9% over 1990. Exports of defense-related industries declined by 26.6%, while exports of non-defense industries increased by 12.8% to \$819 million. Defense items constituted 30% of all exports, compared to 39% in 1990.

**Which sectors of the Israeli economy have drawn the greatest foreign investment in the past five years?**

KPMG Peat Marwick and Kesselman & Kesselman recently published a detailed survey of 110 companies. The aim of the survey was to obtain a comprehensive picture of foreign corporate investment in the Israeli economy. Electric and electronic plants drew the greatest foreign investment. In second place were hotel and other tourist projects.

The survey was the first of its kind, and provided a profile of foreign investment in Israel at a time when such investment has skyrocketed from nearly \$180 million in 1986 to more than \$375 million in 1990 -- a jump of 180%.



Investments in the Electric & Electronic Industries

#### THEORETICALLY RESEARCH SEEKS TO MOVE FROM THE LABORATORY TO THE MARKET PLACE

Manipulating Nature for beneficial purposes is what biotechnology is all about. But surely, man has been manipulating Nature ever since he began to plant crops in the Middle East thousands of years ago. Our forefathers gathered and grew the same wild wheat

that can be found in the Galilee today. This wheat has a brittle head, and the seeds ripen one at a time and fly off. Somewhere along the line, people started finding wild wheat in which the head did not shatter, with the seeds ripening at the same time -- perhaps a random mutation. Our forebears must have eagerly grabbed this miracle plant for cultivation. This "manipulation" led to the first domesticated wheat -- the ancestor of modern bread wheat.

No such happy natural transformation favored the Asian crop, sesame. Up till now, its potential was limited because it had to be picked by hand throughout the growing season. It wasn't until Prof. Ashri of the Hebrew University's Faculty of Agriculture successfully engineered a new variety of sesame that the grains matured uniformly, making mechanized harvesting possible. The mutation developed by Prof. Ashri breeds true, and has proved stable in India, Korea, Sri Lanka, Texas and Israel. Now he is trying it out in Thailand.

Sesame seeds are rich in top-quality oil (50%), and its meal is high in protein (25%). It is resistant to heat and needs no irrigation, making it a valuable crop in many Third World countries.

There is now good hope that sesame, a Cinderella among crops, may turn into a princess.

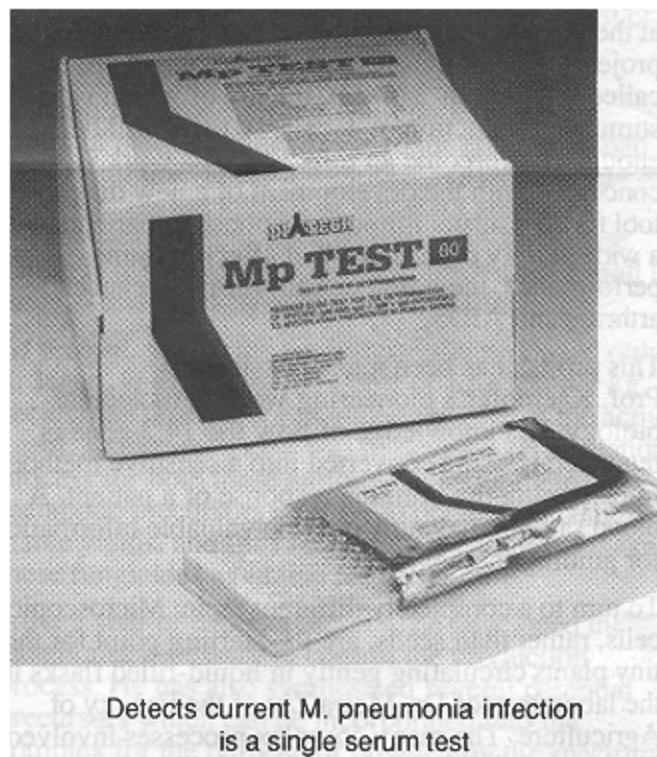
So what is new about biotechnology? Why is it causing such a revolution? Quite simply, for the first time, manipulations are taking place at the micro level, at the very core of life. Biotechnology deals with cells, each of which contains the complex biological package needed to perpetuate its own kind. It deals with molecules, the smallest units containing the full range of properties of any given chemical substance. The door to this micro-world has been opened by spectacular advances in science over the past few decades, with a future that cannot yet be fully apprehended.

Today there are about 100 Hebrew University biotechnology projects in progress, some in their very earliest stages and some already being commercialized. These range through medicine, agriculture and veterinary medicine to bio-products for industry.

In 1985 there were already 16 such companies in Israel. Hebrew University scientists are working with a number of these concerns, and the university has a large stake in two of them.

It is becoming increasingly clear that the work of universities and biotechnology companies is complementary. University scientists, with their interest in basic research, have both the intellectual

capacity and the desire to explore the how's, why's and wherefore's connected with biological processes. As regards both equipment and expertise, biotechnology companies hold the keys for mass production. Thus the approach of university scientists is crucial in guiding biotechnology companies through the many processes required to arrive at a marketable product.



Detects current *M. pneumoniae* infection  
is a single serum test

The projects under development are as varied as their scientist-creators. For instance, Prof. Raymond Kaempfer, who heads the Department of Molecular Virology in the Faculty of Medicine, has been studying the regulation of gene expression. A molecular biologist, he became interested in the body's immune system, which is still far from understood. Humanity's total dependence on our

Israel High-Tech Report Index\*

**359.68 - 4.68 %**

\*ISRAEL HIGH-TECH REPORT INDEX is a weighted index made up of the shares of leading high-tech companies.  
BASE=100 AS OF Sep 30, 1984

immune system has been tragically demonstrated by the ravages of AIDS, in which a retrovirus systematically destroys T-cells. These T-cells (there are several kinds, each originating in different systems within the body) constitute the main line of defense against disease. Each type is activated to fight a specific invader, whether it is bacteria, protozoa, cells taken over by viruses, or those associated with cancer.

Prof. Kaempfer is engaged in basic research, and is at the same time developing several biotechnology projects. One of these concerns an elusive protein called interleukin-2 (14.2), the job of which is to stimulate production of T-cells so there will be enough to overcome an infection. His work is concerned with the development of a new diagnostic tool for measuring immune response in patients with a wide variety of diseases that affect immune performance, including certain forms of cancer, arthritis and AIDS.

This project has been made possible by Prof. Kaempfer's pioneering work in molecular biology. His knowledge of how the 14.2 gene is regulated is being converted into a sensitive method for assessing the immune response of a patient. A blood sample may now provide valuable information for guiding therapy.

To turn to a completely different topic: Microscopic cells, rather than seeds, are the starting point for the tiny plants circulating gently in liquid-filled flasks in the laboratory of Dr. Meira Ziv of the Faculty of Agriculture. The many complex processes involved in culturing these plantlets are performed by hand, is labor-intensive and therefore expensive. Dr. Ziv has developed techniques for the large-scale cell and tissue culture propagation of such plants, to the extent that a biotechnology concern in Israel has taken her project for scaling up and commercial development.

Dr. Ziv's experience in the cloning and mass production of plants has demonstrated that these new plants are uniform, of high quality, and free from disease. The technique is especially good for production of new varieties and difficult-to-propagate species.

There is another important stage in the production process being dealt with in this project. When the tiny plantlets are removed from their aseptic liquid culture and transferred to the greenhouse or field, they are apt to suffer from shock. This sometimes leads to heavy losses — raising the price yet further.

The system under development includes a "half-way house" for acclimatization to the outside world. In

the acclimatization stage, the plantlets are hardened, enabling them to fully develop their leaf and photosynthetic systems, thus greatly increasing their chances of survival. There is little doubt that this method of cloning and mass production will become standard practice in agriculture. Cooperation with industry is essential in order to develop this system. It is appropriate that it should be done in Israel, with its ready market for innovation among technology-oriented farmers.

This project illustrates the double challenge that researchers in biotechnology must face. It is not enough for the science to be brilliant. The final product has not only got to be better, but it must be able to compete economically with existing products, whether it is a plant, a bio-insecticide, or a plant-derived enzyme for the pharmaceutical industry.

The two projects cited above make use of recombinant DNA and cell tissue culture techniques respectively. These, together with cell fusion techniques, form the mainstay of the biotechnologist's tool kit.

It is estimated that 10 million cells would fit on a pin head. In each of these cells there is a still more minute nucleus. The nucleus contains the chromosomes (23 pairs in human beings), and the chromosomes contain the DNA molecules and genes (an estimated 50,000 genes for human beings). Recombinant DNA technology permits scientists to combine pieces of the DNA of one cell with that of another (gene splicing), so that characteristics of one organism will blend with those of another. Thus it has been possible to construct micro-organisms that produce human proteins such as insulin and interferon, and to create rabbits which synthesize human hemoglobin. Cell-fusion techniques permit scientists to join two different kinds of cells to create new combinations of chromosomes for reproduction.

This micro world of DNA and genes has given rise to a new discipline - molecular genetics. Three years ago, the Hebrew University's Faculty of Medicine set up a Department of Molecular Genetics. The recently published Cambridge Encyclopedia of Life Sciences says: "Molecular genetics uses the techniques of the chemist and the biochemist, and the logic of the geneticist, to attempt to provide an understanding of these biological phenomena."

In a current biotechnology project with a leading Israeli company, the HU team has developed procedures for harnessing the bacterial regulators for high-level synthesis of bovine growth hormone. The



pure hormone achieved has been shown to increase milk production considerably. Team leader Prof. Oppenheim considers it likely that for each desired protein or substance, it will be necessary to manipulate the control system that drives the gene expression of the substance wanted.

Among scientists with a long record of applied research is Prof. Moshe Shilo, who heads the Division of Microbial and Molecular Ecology in the Alexander Silberman Institute of the Sciences. Prof. Shilo is an aquatic microbiologist whose studies have ranged over every type of water body in Israel, down to the hypersaline Solar Lake in Egypt, where he discovered microorganisms new to science. Since the health of a body of water depends on the balance of life within it -- from fish down to microorganisms -- Prof. Shilo's expertise was frequently called upon to solve the many problems arising in fish ponds going over to intensive production. He is currently working with Israel's national water company, Mekorot, on the maintenance of water quality in Israel's reservoirs. Throughout these applied tasks, blue-green algae (cyanobacteria) have played an important role in his research.

He has studied dozens of species of these rapidly-proliferating algae, which appear in one form or another in most countries of the world, and are often a considerable nuisance. Some of them clog pipes, and cause drinking water to taste and smell bad. Others can kill cattle and cause human intestinal problems. The blue-greens also interfere with water recycling by forming a compacted layer over the surface of the sandy bottom of purification ponds, thus hindering seepage to the aquifer.

Prof. Shilo knew from the outset that the only way to control these microscopic, unicellular organisms was to gain a thorough understanding of their biology. It is this understanding which led to his present project. Part of the process of converting wastewater into a usable commodity is the clarification of murky water. Chemical flocculants, which pose a considerable threat to the environment, are used for this. Prof. Shilo discovered that with suitable manipulation, a species of the blue-greens might serve this purpose, with the advantage of being biodegradable.

The use of algal biomass for various purposes is not new. But the problem with cyanobacteria is that they are prohibitively expensive to harvest. Fortunately, Shilo's group had devised a cheap harvesting method, which made it possible to start this project. Following experimentation as to the optimal strain of cyanobacteria for this purpose, the group has come up with a bioflocculant which operates well in a wide range of water conditions and is expected to be

effective in precipitating both organic and inorganic particles. This bioflocculant has been successfully tried in solar ponds, where maximum clarity is essential.

Another product extracted by Prof. Shilo from the cyanobacterial brew is a bioemulsifier which gives promise of being suitable for industrial purposes.

A more direct route to biotechnology is that taken by Dr. Sergei Braun, a chemical engineer specializing in enzymology, who heads the Biotechnology Unit of the Department of Biological Chemistry in the Silberman Institute of Life Sciences. He has developed a process which will hopefully put a group of natural fungicides onto the economic map for agriculture. These antibiotics, polyoxins and nikkomycins are known as powerful antifungal agents which inhibit the enzyme chitin synthetase. Chitin is the major component of the hard cell wall in fungi -- and in many insects and shellfish.

At present, polyoxins are industrially produced only in Japan, at the prohibitive cost of \$20-\$30 per kg. for a crude product containing only 10% of the active agent. Dr. Braun's idea was to devise a fermentation process for both these antibiotics, using their metabolic precursors in order to obtain high and stable yields, and thus reduce costs enough to make these fungicides available for agriculture.

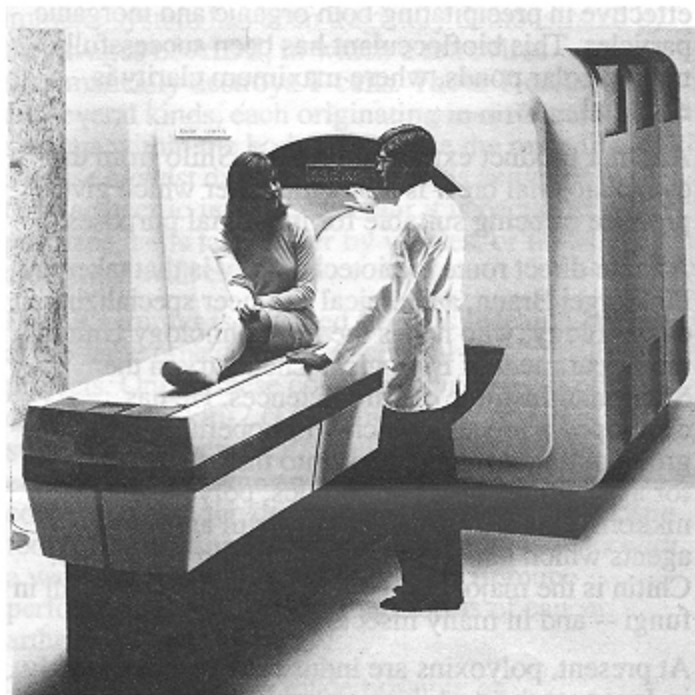
After a year of experimentation, he developed the techniques necessary to control the production process. He has also synthesized several potential precursors which can be incorporated into the complex for the purpose of broadening the spectrum of these antibiotics. He is now scaling up the production process.

And now for a brief outline of a few of the projects in medicine, agriculture and biotechnology:

### Medicine

As far as biotechnology projects are concerned, an area of strength is the development of genetic probes for rapid diagnosis. This is important enough in itself -- especially in the case of hard-to-diagnose conditions, since it enables the correct therapy to be used from the outset.

Equally important in the long term is that the kind of understanding acquired and the types of techniques being developed pave the way for drugs that can be delivered to a specific area of the body. Since many drugs, especially those effective against cancer, are highly toxic, such targeting may permit the delivery of far smaller quantities directly to a tumor, thus minimizing damage to the rest of the body.



Elsclint's Gyrex V  
Magnetic Resonance Imaging System

### Genetic Diseases

Among the probes that have been developed is one for the safe prenatal detection of genetically transmitted blood diseases --  $\beta$ -thalassemia and Sickle Cell Anemia.  $\beta$ -thalassemia is characterized by a deficiency of the  $\beta$ -globin chains of hemoglobin in the blood.

The disease, prevalent among certain groups of Jews and Arabs in Israel and in neighboring countries, is usually fatal. Up till now, the only prenatal test available involved the risky procedure of fetoscopy.

Prof. Gad Glaser of the Department of Cellular Biochemistry is employing the new test for the prenatal diagnosis of thalassemia among Jewish and Arab families. This is the only center in the country where such work is being carried out.

*Scopus, Hebrew University*

### AIDS CLINICAL TRIALS BEGIN FOR HYPERICIN

The start of human clinical testing of a drug expected to help battle AIDS is underway at New York University Medical Center. The drug, VIMRx, a form of hypericin, was developed by VIMRx Pharmaceuticals of Stamford, Conn., as a therapy for a broad range of viral and retroviral diseases. Phase 1 clinical trials, conducted by Drs. Fred

Valentine and Howard Hochster at the Medical Center, are being sponsored by the National Institute of Allergies and Infectious Diseases. Earlier lab studies by researchers Daniel Meruelo and Gad Lavie of the Medical Center have shown hypericin to be effective in preventing the spread of human immunodeficiency virus (HIV) from infected to uninfected cells. The drug was produced by VIMRx under a research and license agreement with both the Medical Center and Yeda Research and Development Co., the commercial arm of Israel's Weizmann Institute of Science.

The synthesis and chemical development of hypericin were performed by Profs. David Lavie, Yehuda Mazur and their co-workers in Weizmann's Department of Organic Chemistry. Some of the findings of Meruelo, Lavie and Mazur and David Lavie were published in the Proceedings of the National Academy of Science in 1988 and 1989.

VIMRx has been granted exclusive rights to the drug and all its applications developed at both institutions. Richard Podell, president of VIMRx, said that in addition to its anti-viral and anti-retroviral properties, hypericin offers the promise -- based on animal tests -- of minimal toxicity at potentially therapeutic dose levels. Unlike AZT, DDI and other related therapeutic agents being used to help AIDS patients, hypericin is not an inhibitor of reverse transcriptase.

This distinction in the mechanism of action, Podell said, might lead to hypericin's use both as a stand-alone therapy and/or in an improved combination at lower dose levels. "Drug tolerance and safety of hypericin in humans will be determined during the Phase 1 clinical trials," Podell added.

### WEIZMANN RESEARCH AIDS KIRYAT SHMONA INDUSTRY

Keeping mushroom soup tasting like mushrooms, roses looking rose-colored and ambergris smelling like ambergris are among the tasks performed by the Arogal firm in Kiryat Shmona -- tasks in which it is aided by the Weizmann Institute of Science.

Kiryat Shmona is a development town of 18,000 near the Lebanese border, and Arogal is one of over 50 industrial companies established in the Upper Galilee and Golan region in an effort to develop that sparsely settled part of Israel.

Dr. Jacob Vaya, a chemist at Arogal, is spending his sabbatical year at the Weizmann Institute, where he is studying techniques for the synthesis of natural compounds with unique tastes, colors and odors. Arogal is the only plant in Israel that produces such compounds, which are important to both the food and the cosmetics industry.

Working with Prof. Mario David Bachi and his group in the Organic Chemistry Department, Dr. Vaya is developing synthetic methods for converting sclaveol -- a substance extracted from sage -- into ambrox (a form of ambergris), whose aroma is highly sought after by perfume manufacturers. The complex molecular structure of sclaveol and related compounds makes them challenging targets for organic chemists.

Aragol was set up by the Galilee Technological Center (Migal), a research institute founded 12 years ago by kibbutzim in the area in partnership with Israel Chemicals Ltd. Besides engaging in research that can lead to the establishment of technologically oriented local industries, Migal provides such industries with ongoing R&D support and quality control. In his work at Aragol, Dr. Vaya isolates and characterizes the natural essences that give certain plants their commercially desirable properties, and then refines these properties. In a related project, he attempts to regulate the biosynthesis of some secondary metabolites in plants in order to increase the level of such fragrances.

#### INTERNATIONAL TECHNICAL SYMPOSIUM

Some of the subjects covered at the recent International Diamond Technical Symposium in Tel Aviv are as follows:

- A review of traditional sawing, drawing attention to considerations needed for marking stones and techniques used for optimizing the sawing process.
- An overview on the state of the art in bruting.
- A review of the techniques developed to enable satisfactory machine bruting of makeables and fancies.
- The qualities and techniques needed to produce diamonds of "good make," with a discussion of polishing difficulties and how they may be avoided, and a review of tangs available.
- A review of the polishing machinery currently available, and a discussion of possible machine errors and how to avoid them.
- A survey of scaife technology, taking into account manufacturing techniques, powders, scaife metallurgy and the dangers of using scaifes at high speed.
- A look at techniques and methods for polishing large stones based on findings derived from polishing the Centenary Diamond.

## RECENT DEVELOPMENTS

### TEKELEC U.S. SELLS NICE SYSTEMS

Tekelec, a world leader in the development and marketing of communications test equipment, reports that since it began marketing the ChameLAN-100, developed by NICE Systems in Israel, sales have totaled \$4 million. NICE has until now been active solely in the defense market.

According to Benny Levin, president of NICE, the success of this first project with Tekelec, a \$50 million company, is a milestone in the company's efforts to enter the commercial market.

The product has been sold to firms such as IBM, Boeing, Lockheed, universities and research institutes.

### NYNEX TAKES RTS SOFTWARE

NYNEX (the New York New England telephone company) subsidiary, The Data Group, will market "Serviceware," a computerized management system for maintenance companies developed by RTS of Jerusalem. One million dollars will be further invested to adapt the system to the American market.

The project is funded by the BIRD Foundation. The Data Group decided to adapt the RTS system based on fourth-generation application generators, since it is the most advanced available.

Shmuel Hacoen, RTS managing director, said RTS will receive \$5 million in license fees from estimated sales of \$20 million forecast by The Data Group and NYNEX experts.

The system is designed to enable companies maintaining large installations of electronic equipment, such as computer or telephone companies, to offer an efficient level of service for callers requesting assistance as well as the actual servicing, including all related functions, spare parts, billing, etc.

### TOSHIBA OPENS DESIGN FACILITY

Toshiba, the Japanese electronic giant, has opened a facility in Israel to design components using ASIC technology.

The facility will be managed by Moledet, a company established in 1988 by former air force personnel who specialize in the development of electronic warfare systems. ASIC technology enables miniaturization of components, and replaces many conventional chips with cheaper ones offering shorter access times and greater storage capacity.

# KEEP YOUR FINGERS ON THE PULSE OF ISRAEL'S TECHNOLOGICAL PROGRESS

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