ISRAEL HIGH-TECH & INVESTMENT REPORT

A MONTHLY REPORT COVERING NEWS AND INVESTMENT OPPORTUNITIES

JOSEPH MORGENSTERN, EDITOR

April 1992 Vol.VIII. Issue No.4

ISSN 0334-5307

From the Editor's Desk

The Entrepreneur and the Venture Capitalist

The shekel, the coin of the realm in modern Israel, was originally a unit of weight, and refered to coins of gold or silver. Modern Israel has enough shekels, or their hard-currency equivalent, to finance its payments for approximately 13 weeks. Not surprisingly, many claim there is little capital available for entrepreneurial activity.

But 1992 and 1993 promise to be the Years of Investment -Fund Activity. Meaningful pools of capital will soon be seeking investment opportunities.

Joining well-known names such as Athena Venture Capital are new players such as Evergreen, backed by Canadian money. Last year, Evergreen reported a $1.0 million profit to its foreign investors . The limited partnership (established in 1987) has raised $8.5 million, and by the end of 1991 had $15 million in assets under management. Spurred by what is perceived as a window of opportunity, other groups are also entering the marketplace. These programs offer from $15 million per year to longer-term affairs with projected totals of up to $100 million.

There must be more than 1,000 inventors and/or small concerns in Israel with good ideas but little capital. Among these there are at least several score with the potential to become winners such as Scitex and ECI Telecom. More money than ever will be made available to them, if they can meet the stringent requirements of the investment bankers and venture capitalists. And if the government can be persuaded to just stay away and let Nature take its course.

We continue - so far in vain - to advise our politicians to refrain from getting involved in the activities of entrepreneurs. Government guarantees for investments organized by investment bankers, venture capitalists or promoters often bring more problems than they are worth, and can just as easily hinder growth as hasten it. Governments should govern, and not behave as either seducers or hucksters trying to attract foreign investors by hook or by crook. But those in the government who concern themselves with such things seem to have concluded that they should participate in anything that promises to be highly profitable.

So we have a situation in which the government is to extend an ironclad guarantee for 80% of an original investment if there are no profits after seven years. This has convinced at least two investment groups to create funds. A first-time investor and a founder in one of these funds is the megabuck conglomerate known as the Fairchild Corporation, described elsewhere in this issue.

The Talmud deals with legal and practical aspects of life. When it comes to advice for business investors, it suggests that venture capitalists do more than just contribute money, but should remain involved in the operation and growth of the new enterprise. Investment fund managers could benefit from this approach. Companies with good ideas may then find that venture capitalists can bring much more to the table than money. International contacts and financial expertise are just starters.

"After two consecutive years of vigorous increases in gross investment [25% and 45% in 1990 and 1991 respectively], such investment will remain unchanged," predict Bank Hapoalim economists. But they see a 10% advance in capital investment.

If growth and job creation are to be achieved, this could be the critical element in Israel's longer-term economic health.

In this Issue

Subscription: I year $150.-. Bulk copy and reprint information available on request

Circulation Offices: Israel Publications Inc., 47 Byron Place, Scarsdale, N.Y. 10583, USA.
Attention: Mr. Robert M. Bruckenthal Tel.: 914-723 8321 Fax: 914-723 8340
Editorial Offices: Asia House, 4 Weizmann Street, Tel Aviv 64239, Israel
Tel: 972-3-6979817 Fax: 972-3-6919788

New Logo

The readership of this publication continues to express a deepening interest in investment opportunities. While continuing to highlight Israel's research and development strengths, and maintaining coverage of its most visible public and private science-based industries, broader coverage is now being provided for startups and emerging growth companies. The new wave of financing activity will be more carefully scrutinized, as the activities of the investment funds and their managers will be featured on a regular basis.

Due to the new emphasis, the name of this publication is being modified to reflect the additional focus. From now on we'll be known as the Israel High-Tech and Investment Report.

A Partial Guide to Israeli Investment Banking and Venture Capitalism

If the efforts of a new breed of venture capitalists now active in Israel succeed in identifying fruitful investments, then 1992-1993 may become known as the period when this type of activity finally takes root in this country.

Among the American venture capitalists active in Israel is Frederick Adler. Brilliant, flamboyant, unrelenting and abusive are just some of the terms used to describe Adler. Yet it was he who forged personal ties with Israelis such as Tolkowsky, Galil and Suhami. Israelis follow Adler because he has proved that one can take $115,000 and create a personal fortune of $20 million.

Companies such as Scitex Elscint, Fibronics, Optrotech and BioTechnology General have been "touched" by Adler's investment strategies. Adler's qualification for local science-based industries is his ability to serve as a small or lead investor in capital formation. His propensity for intense, active participation has led him to companies which were on the way to oblivion, or just weren't heading anywhere at all. Board participation, sometimes ruthless, pushed local entrepreneurs to higher levels of achievement. If Adler stayed the course, these companies were taken public, and opportunities for economic success presented themselves.

In the mid 1980s, while Elscint nearly collapsed and Scitex was in trouble, Fred Adler decreased his participation in Israeli financing, but his favorite remains BioTechnology General. On a recent visit, Adler warned that the government of Israel has to create conditions conducive to the growth of venture capital in Israel, "in a capitalist manner," and minimize involvement in investment policies of the managers of government-supported venture funds.

Though Adler shows no signs of reentering the scene with new investments, his interest in 1984 spawned the Athena Venture Capital Fund, which was led by Adler's long-time friend and associate Dan Tolkowsky, along with son Gideon and Yadin Kaufman, who together formed Tolkowsky & Co. - Israel's first and foremost venture capital company.

A good portion of Athena's $24 million was invested in fledgling Israeli concerns such as Rosh Intelligent Systems, Gilat Communications and Mercury Interactive. Athena has also invested in Efi Arazi's Electronics for Imaging (see separate item).

Dan Tolkowsky speaks of funds held in reserved to back up initial investments as companies begin to reach the market place. The Tolkowsky group, with its years of experience, may be expected to expand its activities locally as more venture capital comes to Israel.

The Discount Bank Investment Company was a pioneer in high-technology investments, but after Dan Tolkowsky left it in the mid 1980s, the view at the top became considerably less risk oriented. However, as Dov Tadmor - Discount's General Manager and the man who replaced Tolkowsky - became involved in such successful DBIC holdings as Scitex, he was able to consider investing in pre-prototype projects. Discount's small investment of $200,000 in Pharmos Corporation is a distinct indication of this renewed sense of adventure. If DBIC is happy with its Pharmos investment, the group could develop a greater appetite for putting funds to work among Israeli startups.

Last year DBIC nearly $50 million. The companies in the group exported $1.4 billion in 1991 representing one third of all high-technology export from Israel that year.

Blech &Co. Investment Bankers is one of the most dynamic firms in the United States specializing in biotechnology. In the past seven years the firm has committed more than $700 million in a broad bouquet of biotechnology companies. David Blech, who at 36, is one of the youngest individuals to appear on Forbes' list. Blech has invested more than $20 million in Israel including in BioTechnology General, Fidelity Medical and Pharmos. Recently he invested $3 million in Neoprobe an American company which includes an Israeli surgeon and a part of its clinical may be carried out in Israel.

Evergreen Canada-Israel Investments

Evergreen last month launched Israel's first-ever healthcare fund.

The offering, when complete, will raise $ 15

million. The 30 units, each of $500,000, are being offered to Israeli institutional investors, including insurance companies. The Healthcare Fund will at some future date go public.

Evergreen's founder Yaacov Burak until last year invested only in low-tech and no-tech enterprises. His initial investments in this country's healthcare industry were carried out in the past six months, and include Healthcare Technologies and Pharmos Corp.

Evergreen's funds come from a private group of Canadian investors who have discovered that investing in Israel does pay. For the year ending January 31, Evergreen will be paying cash dividends to its shareholders.

The Fairchild Way

'Innovation and technology will flower in Israel in the next five years," predicts Brig. Gen. H.R. Johnson USAF, Senior Vice President, Business Development of the Fairchild Corporation.

At the end of a recent visit to Israel, the former pilot and one-time head of R&D for the American Air Force discussed " the Fairchildway" with *IHTIR* and speculated on the prospect of reaping business rewards.

Venture capitalists investing in high-risk projects often prefer a hands-on approach, which means they accompany a young company from its early stages. As well as financing the company, they will assist at later stages in finding marketing outlets.

The uniqueness of the Fairchild approach is that Fairchild not only provides capital for investment in suitable projects, but tries to utilize its presence in 60 countries to develop markets for the company it finances.

"We try to find companies with sales up to $4 million who exhibit an 'unfair advantage' such as a breakthrough technology," said Johnson, who was one of the founders of Telebit, a Silicon Valley-based company.

"At the time, the market was being supplied with 300 or 1,200 baud computer modems. We developed and brought to market a modem which transmitted at 12,000 baud. This 'unfair advantage' allowed Telebit to sell $45 million worth of these modems."

Fairchild has already issued several letters of intent in Israel.

"One company chosen for investment has developed a silicon manufacturing system. They could not determine whether the product could be sold profitably. We did the investigation, since we have access to the market, and became convinced that the technology is truly a breakthrough."

The fund, when fully subscribed, will have $20 million. Investors will be protected by a government guarantee for 80% of the original sum raised, should the fund fail to make a profit after seven years. Managing the local fund Teuza is Haifa based Avi Kerbs

Hambrecht & Quist Initiates Activity

Israeli entrepreneurs trek to San Francisco to attend H&Q conferences, where one can learn what is going on internationally in high-tech and life sciences. H&Q for nearly 25 years has been active in investment banking. It is credited with taking part in managing more than $600 million, and raising nearly $10 billion in public offerings. H&Q has invested in two Israeli firms: Mercury Interactive (Israel) and ART. Meir Arbel is managing the unit.

New Comprehensive Stock Table

You are being introduced with this issue to a new statistical table which we hope will become a valuable tool for monitoring some of Israel's leading companies. Prepared by the American Stock Exchange and including data considered critical to effective analysis, the "table" should be consulted in connection with items appearing in the body of the newsletter.

Publicly traded companies with a "critical mass" in Israel, and whose shares are registered for trading in the United States, are noteworthy for two reasons.

One is that this group of 37 companies (at last count) produce some of the leading technologies and products developed in this country, and their sales include a major export exponent. This product visibility extends not just to the major export markets, but in some instances to more than 40 countries. Some of these leaders are:

BioTechnology General; human growth hormone.

InterPharm Labs; interferon.

BVR Technologies Technologies; simulation.

Comverse Technology; the electronic office.

ECI Telecommunications; voice and fax compression for telecommunications.

Elbit Computers; defense and medical electronics.

Elron Electronic Industries; investments in hi-tech.

Israeli-Related Companies Publicly Traded in the United States*
March 12, 1992

	Ticker Symbol	Company Name	Marketplace	Mkt. Value ($mil)	Sales ($mil)	Price/ Earnings	Price/ Sales	Price/ Book	Share-holders' Equity	Profit Margin (last 12 mos.)	Year-to-Date Stock Performance			
											High	Low	Close	% Chg
1	AIP	Amer. Israeli Paper Mls -Ord	AMEX	176.0	273.0	13.9	0.6	1.6	116.8	4.6	49.25	40.75	46.25	12.5
2	AIS.A	Ampal American Israel -Cl A	AMEX	94.8	67.5	NE	1.9	1.0	108.5	NE	5.88	3.25	5.38	43.3
3	ARYTF	Aryt Optronics Ltd	NASDAQ	6.6	NA	NA	NA	NA	NA	NA	1.63	0.88	1.31	27.2
4	BTGC	Bio Technology General Corp	NASDAQ	203.6	3.4	NE	58.0	11.6	18.5	NE	11.75	8.38	9.38	8.7
5	BVRTF	BVR Technologies Ltd	NASDAQ	17.0	NA	NA	NA	NA	NA	NA	6.13	3.25	5.25	50.0
6	KML	Carmel Container Sys -Ord	AMEX	17.0	68.1	NE	0.2	NA	10.7	NE	7.25	5.38	6.75	8.0
7	CMVT	Comverse Technology Inc	NASDAQ	161.1	20.1	62.5	8.6	11.4	14.8	10.8	1.47	0.56	1.25	110.4
8	DSSI	Defense Software and Sys Inc	NASDAQ/NMS	21.0	NA	NA	NA	NA	NA	NA	13.75	9.00	10.50	NA
9	ECILF	ECI Telecommunications -Ord	NASDAQ/NMS	785.6	114.0	28.2	6.8	14.2	112.8	24.1	61.50	45.25	52.50	10.5
10	ELBTF	Elbit Computers Ltd -Ord	NASDAQ/NMS	496.3	399.1	19.8	1.2	3.3	168.5	6.2	32.00	24.25	30.25	21.6
11	EIF	Electrochemical Indus Frutar	AMEX	40.9	128.3	9.5	0.3	1.1	38.8	3.5	2.00	1.31	1.75	21.7
12	ELEIY	Elite Inds Ltd ADR CA NIS 1	OTC	116.9	NA	NA	NA	NA	NA	NA	NA	NA	11.50	NA
13	ELRNF	Elron Electronic Inds -Ord	NASDAQ/NMS	287.9	99.2	15.0	2.9	3.0	111.6	19.3	19.50	14.38	17.88	17.2
14	ELT	Elscint Ltd -Ord	NYSE	409.0	185.1	23.4	2.1	7.0	64.9	8.6	6.00	4.75	5.38	13.2
15	ROBOF	Eshed Robotec	NASDAQ	35.5	7.9	18.8	4.4	4.4	8.6	22.9	4.13	2.75	3.94	23.5
16	ETZ	ETZ Lavud Ltd -Ord	AMEX	31.6	98.2	7.4	0.3	1.8	15.8	4.0	11.50	7.38	9.06	20.8
17	FBRX	Fibronics International Inc	NASDAQ/NMS	47.8	55.0	NE	0.9	1.9	24.1	NE	10.88	7.25	7.38	1.7
18	FMSI	Fidelity Medical Inc	NASDAQ	40.9	5.9	NE	7.2	33.6	1.0	NE	12.25	8.50	9.63	-12.5
19	GALAF	Galagraph Ltd -Ord	NASDAQ	4.2	0.9	NE	11.0	91.5	0.1	NE	1.63	0.97	1.28	30.2
20	GOTK	Geotek Industries Inc	NASDAQ	13.0	30.5	NE	0.3	0.9	15.6	NE	2.44	1.63	2.09	13.6
21	HCTLF	Healthcare Technologies Ltd	NASDAQ	6.2	2.4	NE	3.1	3.6	1.7	NE	1.63	1.25	1.47	4.4
22	IDANF	Idan Software Ind Isi Ltd	NASDAQ	8.0	0.3	NE	23.8	6.2	1.3	NE	1.44	0.69	1.25	53.9
23	IICR	IIC Industries Inc	NASDAQ	32.2	3.2	13.9	10.1	0.6	51.1	73.0	24.50	20.50	22.63	0.6
24	IISLF	IIS Intelligent Info -Ord	NASDAQ/NMS	104.3	44.7	20.6	2.3	4.1	26.5	11.3	27.25	17.75	25.50	40.7
25	IPLLF	Interpharm Labs Ltd -Ord	NASDAQ	251.0	34.0	46.3	7.4	16.2	15.5	16.1	56.00	39.50	40.25	-9.0
26	ILDCY	Israel Ld Dev Ltd	NASDAQ/NMS	74.4	34.0	NE	1.9	0.8	105.0	NE	13.00	10.00	12.25	14.0
27	ISTEF	Istec Industries & Tech Ltd	NASDAQ	7.5	0.0	NA	NA	7.9	0.9	NA	1.75	0.81	1.53	68.9
28	LANTF	Lannet Data Communications	NASDAQ/NMS	254.1	NA	NA	NA	NA	NA	NA	29.75	16.50	25.13	44.6
29	LAS	Laser Industries Ltd -Ord	AMEX	26.5	31.2	512.5	0.9	26.2	1.0	0.1	5.75	3.38	5.13	41.4
30	MGICF	Magic Software Ent Ltd -Ord	NASDAQ	31.8	NA	NA	NA	NA	NA	NA	9.50	7.50	8.88	14.5
31	OPTKF	Optrotech Ltd -Ord	NASDAQ/NMS	91.8	72.9	82.4	1.4	2.6	33.6	1.2	16.63	12.63	14.00	5.7
32	OSHSF	Oshap Technologies Ltd	NASDAQ	26.9	35.7	64.3	0.8	2.4	14.3	1.0	5.63	3.88	4.50	-2.7
33	IEC	PEC Israel Economic Corp	AMEX	297.9	11.0	11.8	27.3	1.5	205.6	231.5	21.25	15.00	19.13	26.4
34	RADIF	Rada Electronic Inds	NASDAQ/NMS	28.8	26.5	50.9	1.0	2.2	11.3	2.2	8.25	7.00	7.13	-8.1
35	SCIXF	Scitex Corp Ltd -Ord	NASDAQ/NMS	1501.9	430.2	15.1	3.5	6.3	325.9	23.4	44.00	34.88	40.88	15.1
36	SPILF	SPI Susp & Parts Inds -Ord	NASDAQ	2.5	19.3	NE	0.1	0.3	8.2	NE	1.13	0.50	0.75	-14.3
37	TAROF	Taro Vit Inds Ltd	NASDAQ	67.7	NA	NA	NA	NA	NA	NA	12.50	5.88	11.38	87.6
38	TEVIY	Teva Pharm Inds -ADR	NASDAQ/NMS	537.6	321.0	23.9	1.7	3.4	179.0	7.3	28.38	16.50	23.63	25.2
		Total		6,358.2	2,622.3									

*U.S. registered securities with critical mass in Israel. NA= not avaliable, NE= negative earnings

Source: FactSet Data Systems Inc. Provided as a courtesy to the Israel High-Tech Investment Report by the American Stock Exchange.

Elscint; medical imaging.
Eshed Robotec; teaching robots for industry.
Fibronics International; optical fiber systems for local area networks.
Fidelity Medical; medical imaging.
Healthcare Technologies; novel diagnostic kits.
IIS Intelligent; computers and peripherals.
Lannet Data; intelligent hubs for local area networks.
Laser Industries; laser surgery.
Magic Software; computer programs.
Optrotech; testing of printed circuit boards.
Oshap; expert systems.
Rada; aerospace computers.
Scitex; computer graphics.
Teva Pharmaceuticals; drugs.

These companies are monitored by *IHTIR* , and contact is maintained with their corporate personnel. This allows for the formation of this publication's insights as to their technologies and corporate development plans.

We are told from time to time that shrewd businessmen have applied these insights for their personal investment programs, and to establish business contacts. Looking back over just the past three months, the performance of some of these companies' shares has been outstanding. Brig. Gen. H.R. Johnson, USAF, and Senior Vice President of Business Development for the Fairchild Corporation, said during a recent visit here that the Fortune 500 companies should be made aware of the track records of these Israeli firms.

ISRAELI COMPANIES ON WALL STREET

Why does the financial reportage season run into late spring? It is nearly April and some of the companies whose shares are traded publicly are only now announcing results for 1991. It should be noted that Israeli companies, for numerous reasons, tend to be among these "late announcers."

Common explanations tend to mention the time needed to close out balance sheets in Israeli shekels and U.S. dollars, and the delays resulting from slow reportage from overseas operations.

The lack of strict and uniform practice in the timing of reportage may result in an inability to compare the results of Israeli companies with those of their American counterparts. To stretch the point a bit, an Israeli , Japanese or Malaysian company may be announcing end-of- the- year results while their American counterpart is getting ready to announce the next quarter's results.

All this is to assure you that this report is timely; when it appears not to be so, it is due to the practices mentioned above. Whether Israeli, Japanese or Malaysian (and we do not include the fledgling Polish stock exchange), there is little reason for not insisting on more timely announcements of results. If a company is clever enough to compete on the worlds' markets, it should be sufficiently sophisticated to get its financial reportage flowing smoothly.

Teva Pharmaceuticals was not being bashful when it announced it financial results on February 26 . Teva is moving towards its goal of exporting more than it sells locally. In the past two years its exports advanced by 10%, and account for 47% of the firm's 1991 sales of $321 million.

Teva also reported $23.3 million in net profits. The net margin of 7.3% on sales could have been even higher had its number-one Israeli customer, the General Health Fund, not continued to be in financial difficulties and as a result reduce customary inventory levels.

Teva's fully owned American subsidiary, the Lemon Company, has in the past four months obtained FDA approval for a new generic form of Lidex, an anti-inflammatory ointment, and for the generic form of Tavist, an antihistamine.

In 1990, according to our study of Israel's pharmaceutical industry, Teva's sales represented 39% of Israel's total pharmaceutical sales.

Though the figures are not final for last year, it has been an excellent one for some of the country's pharmaceutical and biotechnology companies. InterPharm Laboratories, interferon producers, earned $3.5 million in the first three quarters of 1991, and expects net profits to exceed $5 million for

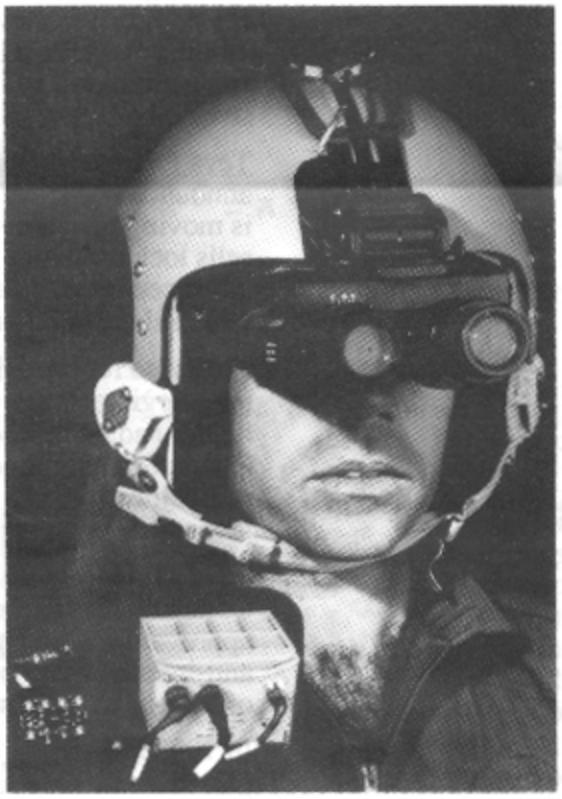
Israel High-Tech & Investment Report Index*

106.40 **-1.40%**

*ISRAEL HIGH-TECH & INVESTMENT REPORT INDEX is a weighted index made up of the shares of leading high-tech companies.
BASE=100 AS OF Jan 10, 1992

all of 1991. It is no secret that Teva has been looking for an entry into the EC market. Recently it announced its commitment of $7.7 million in acquiring an Italian bulk chemical producer an a marketing company. The two entities has $12 million sales in 1991.

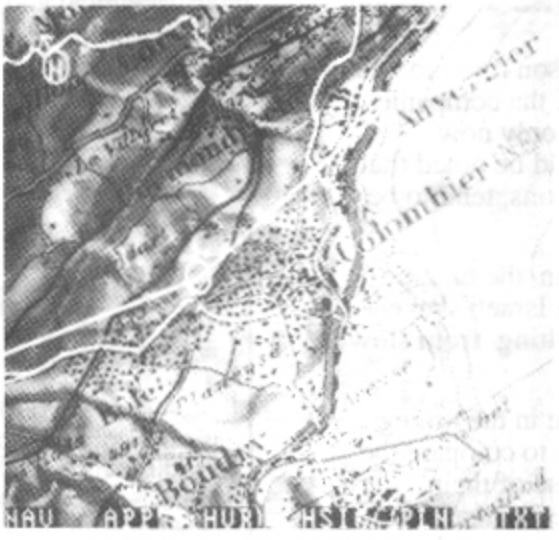
Elbit Ltd., Israel's publicly quoted defense company, has announced results which exceeded expectations. Total sales and net margins of $409.6 million and $35.5 million were up by 13% and 61% respectively from 1990 results. A closer look at the figures shows that Elbit's management efforts aimed at moving away from defense electronics have resulted in major contributions from medical instrumentation. Elscint's contribution to Elbit's results was more than $18 million. However, of that total only $9.5 million was from its net income, with the balance being a non-operating one-time profit from Elscint's American public financing. A look at the $503 million order backlog indicates that Elscint's medical imaging sales comprise more than 12% of the total.



A leading defense producer moves from defense to civilian markets

Elbit's performance and future prospects appear very bright. Four fifths of the company's products are sold on international markets. Its top management is highly experienced, and continues to draw on some of the best engineering talent available.

However, the most exciting news last month came from Scitex which announced that International Paper (IP), the American paper giant, is about to execute an investment in Scitex of $209 million in a private placement. This would make it the single largest foreign investment anyone can recall. The money would be realized by Scitex for an 11% holding.



The per share price came to $44, and the shares of Scitex immediately following the announcement jumped from $38 to the 40s.

On paper, and based on logical economic expectations, the inclusion of IP as a partner should be constructive for both firms. IP's will acquire some of the luster from investing in leading-edge technology, and Scitex should benefit from a relationship with a leading international paper company.

On the strength of the adding of a valued investor Scitex valuations could move up strongly.

Laser Industries, in a pleasant surprise, reports that it has moved into the black. Though modest, the $33,000 profit earned for 1991 compared favorably with a net loss of $4.05 million in 1990. Last year's sales were down to to $31.2 million from $32.9 million in 1990.

A portent of future prospects was revealed in its fourth quarter 1991 earnings of $303,000. Laser surgery, in which the company is known as a pioneer, should continue to expand. New applications abound, and become the focus of intense competition. This is the case with laser dental surgery, which in the United States carries an important profit potential. The ability to excel in niche laser surgery product areas could fuel further growth. If Laser Industries if it is to expand will require additional capital. A new financing issue could solve this problem

BioTechnology General, which did not have profits in 1991, is expected to generate some in 1992 for the first time in its 11-year history.

Hanifen Imhoff, the Denver Colorado-based firm listed on the New York Stock Exchange, is especially optimistic as to the

company's prospects. "The company should begin generating significant revenue in 1992 from sales of Eskatrope, the recombinant human growth hormone first cloned and expressed in 1980 and licensed to Smith Kline and Beecham in 1988. BTGC will initially earn royalties and manufacturing profits on SKB Eskatrope sales throughout the EEC. We project these revenues to BTGC at $5.4 million in 1992, increasing to $65 million from several marketing partners by 1996."

Optrotech Ltd. has generally excelled at refining and improving its technology for the printed circuitboard market. Last year it spent $7.8 million of its total sales of $72 million on research and development. Overall net profits of $1.5 million were up by $400,000 on 1991 sales, which were nearly 10% less than those of 1990.

Fibronics International is surely both a pioneer and world leader in FDDI and data communications. It is also one of the fastest -growing companies in its field. Yet profitability is elusive. Management has announced that a loss of $1.5 million on sales of $16 million in the last quarter of 1991 is being projected. Some of the reasons for the disappointing results are recessionary markets, high costs in new product introduction and apparent inventory markdowns. The announcement for 1991 when it came proved to be a shocker with the news that Fibronics lost $3.3 million.

Elscint Ltd. Reports from Haifa indicate that the company's management is looking to diversify activities. The generally formal announcement of its business results expressed a commitment to "innovation and upgradability". The latter is easier to achieve than the former. The management team of Messrs Parag, Inbar and the most recently added Zvi Meir will be concentrating in taking the company into new directions. In 1991 Elscint earned $17 million on revenues of $191 million.

Healthcare Technologies, Israel's premier diagnostic kit manufacturer, has signed a first- ever deal with unnamed Japanese firms. Valued at $200,000, the joint venture will result in a special product for Japan based on HCTL's chlamydia technology. The Japanese have been granted exclusive sales rights, with manufacturing continuing in Israel.

A Lenseless Microscope

Seeing the unseen is simple, according to the world view of Aaron Lewis. "The real idea is to see single atoms," says the 46-year-old Hebrew University physicist. During six years at a modest laboratory in the Graduate School of Applied Science and Technology in Jerusalem, the Calcutta-born professor has developed a technology which has been awarded 13 patents. Two Israeli high-tech firms, Galai and KLA, are applying the technology to improve their products, and individuals and institutions in various parts of the world are expressing interest in co-working. Among these is the Beckman Laser Center at Irvine, California.

Two years ago, *IHTIR* was among the first popular science publications to publish Prof. Lewis' work. That year Science published an article indicating that the Aaron Lewis group has succeeded in producing a spot of light only 2 millionths of an inch wide, and narrower than the lightwaves which formed it.

The concepts developed are not new; the idea was first published in 1928 by Singe. It was set aside when Prof. Albert Einstein said it was "impossible." But Prof. Lewis contends that there are no physical limits to resolution.

Most advanced light microscopes can make objects visible which are approximately the size of the shortest wavelength of visible light - about 400 nanometers. The electron microscope allows the resolution of objects the size of molecules, since electron waves are shorter than light waves. But even the electron microscope has serious limitations, one of which is that it cannot be used to examine live cells, since electron beams kill living matter.

So how does one create what Aaron Lewis calls the "smallest light source in the world"?

This was demonstrated with the use of a glass pipette "thinned out" to micro proportions. The microscope beams an excimer laser down the pipette, the tip of which is filled with fluorescent dye embedded in a plastic matrix. The laser causes the tip to glow, and a sub-wave light beam is created which is shorter than normal light waves. These beams, when used to scan objects, make it possible to see things smaller than those seen before.

Who benefits from this technology?

While researchers will enjoy the capabilities offered by the "lenseless microscope," its developers are already working on applications such as the use of the finely focussed laser beams to open egg cells which resist the entry of a sperm. This development is already undergoing human trials.

Ophthalmic surgery may become possible on previously inoperable membranes at the back of the retina. The technolgy could also allow for the storage of more information per square inch in optical memories. Current technology allows for the storage of an entire encyclopedia on single compact disks.

Lewis, educated in the U.S. , immigrated to Israel in 1986. He strongly believes that Jerusalem offers the right atmosphere for the development of science-based industries, and it is likely that he will use an ever greater percentage of his time to come up with applications. The Nanoptic Company, whose activities are now being planned, will serve as the vehicle for such commercialization. The company will be located on Jerusalem's Hotzwim, in a science-based industries park where leading firms such as Intel are operating.

An Interview with the President

Prof. Haim Harari contends that commonly used figure of Government's research and development expenditure as a per cent of the Gross National Product figure is not as revealing as using absolute figures. It is more important to compare total expenditures on research and development with those countries similar in size to Israel.

Which areas of Weizmann Institute research are most likely to aid Israeli industry? Pharmaceuticals and computer electronics are expected to lead the way, with two major agreements about to be signed. Yeda Research and Development which commercializes Institute developments has contributed $7 million last year to the $100 million annual Institute budget. Commercialization of research leading to projects in code encryption and recombinant interferon have been major success areas.

Scientists Focus on Pollution, Fungi, Herbicides

The wisest strategy for combating pollution is to prevent it in the first place. Since one of the main sources of water and soil pollution is the widespread use of agricultural chemicals, institute scientists are developing innovative non-polluting approaches. These range from new methods of organic farming to the use of genetically engineered, disease-resistant crops.

Synergy for Reducing Herbicide Use

Prof. Jonathan Gressel and Dr. Yoseph Shaaltiel of the Department of Plant Genetics, in collaboration with Dr. Abraham Warshawsky of the Department of Organic Chemistry, have developed an approach that could dramatically reduce the amount of herbicide required to kill weeds. The technique is based on the use of chemical chelators which remove the copper and zinc used by certain enzymes in weeds to counteract the effect of herbicides. When the metal-binding chelators are applied simultaneously with a herbicide, the resulting synergy knocks out a weed's defenses against herbicides. Greenhouse experiments indicate that this mixture could prevent weed growth with only a quarter to half as much herbicide as is ordinarily needed. Moreover, the approach is likely to delay the appearance of herbicide resistance by five to 15 years.

Biological Control Agents: The Attack of the Killer Fungi

In a different effort aimed at partially replacing chemical herbicides, Prof. Gressel is trying to get fungi to attack weeds. Very high levels of inoculum are usually required for this, making such approaches uneconomical. Gressel and his team first ascertained what defenses a plant uses, and discovered the metabolic pathways involved. They then added very small amounts of chemicals known as immunosuppressants to block these defense pathways, allowing infection of the weeds with less than 1% of the inoculum previously required.

Combating Herbicide Resistance

Herbicide resistance causes farmers to use ever-increasing amounts of chemicals in order to destroy the ever-sturdier species of weeds that evolve in response to the herbicides. One new and worrisome aspect of this vicious circle is cross-resistance, in which resistance to one herbicide automatically endows a weed with resistance to others. In an effort to understand the mechanisms behind cross-resistance, Prof. Gressel, in collaboration with researchers at Tel Aviv University, has developed an experimental model to test his hypothesis that cross-resistant weeds have learned, through evolution, to mimic the biochemical defense mechanisms normally employed by crops (in this case, wheat) to degrade herbicides. Their research should promote the development of new strategies to combat this phenomenon.

In addition, Prof. Gressel and Prof. Lee A. Segal of the Applied Mathematics and Computer Science Department are developing mathematically based strategies for preventing rapid development of herbicide resistance. Their approach draws on mathematical models and agronomic procedures to calculate the optimum amount and type of herbicide that should be applied to a field, as well as the best time to apply it. This method can also be helpful in eliminating herbicide resistance after it has already appeared.

Promoting Genetic Resistance to Pathogens

Over the years, great efforts have been made to breed higher-yielding strains of crops. In the process, however, other traits have been lost, among them resistance to many pathogens. As a result, today's

cultivated crops are less hardy than their wild progenitors. One strategy for reducing dependence on agricultural chemicals is to restore these lost genes.

Dr. Robert Fluhr of the Department of Plant Genetics is searching for specific "lost" genes which once endowed plants with resistance to fungal disease. Once these genes are isolated, the next step will be to implant them in the desired crop. In searching for genes, most scientists study whole proteins whose function is known. Another approach, employed by Fluhr, is to zero in on individual genes using genetically based knowledge of their location, irrespective of their perceived functions. This is especially useful when studying resistance traits about which little is known, and should be effective in directly identifying the genes responsible for disease resistance in plants. By restoring a plant's natural resistance to fungal disease, farmers could reduce their reliance on fungicides, which destroy not only disease-causing fungi but also many useful soil organisms.

In a successful example of this approach, Prof. Moshe Feldman of the Department of Plant Genetics has used advanced cytogenetic and breeding techniques to endow cultivated wheat with the natural resistance to leaf rust enjoyed by a hardier wild strain.

More Efficient Use of Nitrogen

One way to decrease groundwater pollution is to reduce the use of nitrogen-based fertilizers. This could be done by inducing plants to use available nitrogen more efficiently, or by breeding plants that could produce their own nitrogen. Two teams of Weizmann Institute scientists are involved in such efforts.

Genes that increase the efficiency of a plant's nitrogen uptake have been transferred from wild wheat to cultivated varieties by Prof. Moshe Feldman and Dr. Eitan Millet of the Plant Genetics Department. Some of these new lines use 65% or more of the available soil nitrogen, as compared to the usual 50% utilization rate, thus reducing the amount of leftover nitrogen that can percolate into groundwater.

Studies that may enable plants to produce their own nitrogenous fertilizers are being carried out by Prof. Ada Zamir of the Department of Biochemistry. She is investigating how specialized bacteria are able to produce ammonia – a source of fertilizer - from the air. Zamir hopes to use genetic engineering to define the conditions for the transfer of this property to other organisms. Her studies on the formation of the enzyme required for nitrogen fixation suggest that certain molecules in the host play an indispensable role in inducing the expression of transferred genes and in activating their products. This may have important implications for other genetic engineering efforts.

Deforestation and Climatic Change

Large-scale deforestation in the Amazon Basin is likely to change both the local and the global climate, raising regional temperatures and changing precipitation patterns. This would affect not only the ecology of the Amazon Basin, but also that of central Brazil where, even now, rainfall is barely adequate.

Prof. Joel Gat of the Department of Environmental Sciences and Energy Research is taking part in a United Nations project to investigate this problem. His contribution has been to apply isotopic methods to gather data on stable hydrogen and oxygen isotopes in rain and river water, as well as in atmospheric moisture. These measurements permit the quantification of the water balance and recycling of water in the system. On the basis of these data, researchers are able to construct theoretical models of the water movement in the Basin, and evaluate the long-term effects of deforestation on climate and hydrology in the region.

Courtesy of the Weizmann Institute

IHTIR on Middle East News Network

We are now part of an electronic news network which covers economic developments in the Middle East. The Washington based Middle East News Network service utilizes the latest satellite technology to beam in its information to a growing list of customers. The internationally know Pasha Publications recently used from the network an article titled Space and the Gulf War appearing in IHTIR's February issue.

The Fallacies of the ME Water Politics

A year ago an international conference was scheduled to take place in Turkey. Its topic was the Middle East Water Crisis. Regrettably due to regional national animosities the conference never took place. The organizers had planned for an airing of the "water problems" being experienced by Middle East countries. By cooperating in the sphere of water resources a basis for peaceful coexistence in the region could be formed, it was stipulated.

Israel's Water Commissioner Professor Dan Zaslavsky refutes the supposition that water represents a regional problem or a basis for war. "Nonsense", says the Technion Institute of

Technology Professor who was appointed Israel's Water Commissioner when the country's water supply reached critically low levels in 1991. "Water can not be the cause of war in the Middle East as of the countries in the region only Jordan and Israel are short of water. "It will become public knowledge in the near future that Jordan and Israel have 'water relations', states Prof. Zaslavsky.

Only as recently as two years it became apparent to many Israelis that the country's waterresources were being squandered both by the private and agricultural sectors. If the annual rainfall would be less than average Israel's water reserves would reach critically low levels.

A strict program aimed at cutting back water consumption was put in action. Before the results could be felt at the beginning of 1992 Israel's water deficit which was equivalent to 75 million cubic meters or eighteen months consumption.

Unexpected snow and subsequent flooding in most of in the Middle East occurred in February and March. Israel's northern area and Jerusalem especially felt the brunt of snow storm and rain flooding but it was enough to reverse the water deficit to acceptable levels. Added to the supply were quantities of water saved by public's response to a national awareness program. This totalled some 6% of the annual usage.

With the water supply stabilized the farmers argue that the 1991 water allocation of 575 million cubic meters of fresh water be increased to 695 million.

Prof. Zaslavsky disagrees. With a view to the future and to the expanding water needs due to the wave of new immigrants he is calling for a greater usage of brackish water by the farmer. One long term avenue which related to greater use of "brackish" water for agriculture is desalination.

If desalination is the route then I.D.E. Technologies Ltd is a natural resource. The company, a member of the Israel Chemicals group, in 1991 exported more that $40 million of desalination units. I.D.E. Technologies among will supply Greece and Thailand with desalination units. Israel has as yet to order any of the desalination units which are internationally acclaimed, and have won for the company the Outstanding Exporters' Prize.

"Recycling" water or using waste water which has received specialized treatment is a solution supported by such well known experts as Prof. Yona Chen, of the Hebrew University's School of Agriculture. "With proper management in the use of secondary and tertiary treated waste water could be used for growing orchard fruit including oranges.

Mexico and Israel May Hatch New BIRD

Israeli entrepreneurs should be casting an eye towards Mexico, as the prospect of increased economic activity between the two countries appears imminent.

Less than six months after an Israeli delegation visited Mexico to develop business ties, prospects appear favourable for the formation of an organization similar to the BIRD (Israel-U.S. National Industrial Research and Development) Foundation. The latter is considered by American and Israeli leaders alike as one of the most successful bi-national projects anywhere.

Dr. Ed Mlavsky, BIRD's chief in Israel, said: "It is very clear to me that there is much to be gained for both countries from a close relationship between Israel and Mexico in high technology".

Scitex Founder Predicts a Revolution

At the Seybold Conference in Boston, Efi Arazi's company, Electronic for Imaging (EFI) unveiled its device-independent color management technology.

Users are said to be able to achieve consistent, high-quality color across desktop color platforms.

EFI is signing up some of the best-known copier and peripheral manufacturers - such as Adobe, Kodak, Canon and Toyo - to the patent owned by MIT and licensed exclusively to EFI.