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MEETING

of

BIOTECHNOLOGY DEVELOPMENT TASK FORCE

"Ways in which the State and private sector
can encourage the investment in and the financing of
the biotechnology industry in New Jersey"

LOCATION: Room 319
State House
Trenton, New Jersey

DATE: October 8, 1993
11:00 a.m.

MEMBERS OF TASK FORCE PRESENT:

Assemblyman Robert W. Singer, Chairman
Assemblyman Anthony Impreveduto
Assemblyman Joseph J. Roberts, Jr.
Ira Weisberg
Dr. Abraham Abuchowski
James Watkins
Joseph S. Roth

New Jersey State Library

ALSO PRESENT:

Walter C. Kowalski, III
Office of Legislative Services
Aide, Biotechnology Development Task Force

Hearing Recorded and Transcribed by
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ROBERT W. SINGER
Chairman

New Jersey State Legislature

BIOTECHNOLOGY DEVELOPMENT TASK FORCE
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TASK FORCE NOTICE

TO: MEMBERS OF THE BIOTECHNOLOGY DEVELOPMENT TASK FORCE

FROM: ASSEMBLYMAN ROBERT W. SINGER, CHAIRMAN

SUBJECT: **TASK FORCE MEETING - October 8, 1993**

The public may address comments and questions to Walter C. Kowalski, III, Task Force Aide, or make scheduling inquiries to Cynthia D. Petty, secretary, at (609) 984-0445.

The Biotechnology Development Task Force will meet on **Friday, October 8, 1993 at 11:00 AM in Room 319 of the State House, Trenton, New Jersey**, to discuss ways by which the State and the private sector can encourage investment in and the financing of the biotechnology industry in New Jersey.

Testimony will be limited to invited guests.

Issued 09/30/93

TABLE OF CONTENTS

	Page
Edward Ehrenberg Executive Vice President Business Operations, and Acting Chief Financial Officer Enzon, Inc.	2
Gordon V. Ramseier President, and Chief Executive Officer OncoTherapeutics, Inc.	12
Peter Schied Vice President, and Chief Financial Officer Transell Technologies	20
Ronald R. Hahn Early Stage Enterprise, and Senior Advisor UI USA, Inc.	34
Kurt Barkley Vice President, and Manager Public Finance Department Sumitomo Bank Limited	34
Barbara W. McConnell Commissioner New Jersey Department of Commerce and Economic Development	40
Caren S. Franzini Deputy Director New Jersey Economic Development Authority	46
Peter D. Hutcheon, Esq. Norris, McLaughlin & Marcus	61
Barbara Hauter Harlingen Associates	65

TABLE OF CONTENTS (continued)

	Page
Jay J. Brandinger, Ph.D. Executive Director New Jersey Commission on Science and Technology	73
Joseph J. Seneca, Ph.D. Vice President Academic Affairs Rutgers, The State University	85
Peter R. Day, Ph.D. Director Center for Agricultural Molecular Biology Rutgers, The State University	89
Andrew B. Rudczynski, Ph.D. Associate Vice President Research Administration Rutgers, The State University	91

APPENDIX:

Statement submitted by Edward Ehrenberg	1x
Statement submitted by Jay J. Brandinger, Ph.D.	20x
Statement submitted by Joseph J. Seneca, Ph.D.	25x

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ASSEMBLYMAN ROBERT W. SINGER (Chairman): Ladies and gentlemen, we're going to start the hearing now, so we can get started at some reasonable time.

Call the role, please.

MR. KOWALSKI (Committee Aide): Mr. Ira Weisberg?

MR. WEISBERG: Here.

MR. KOWALSKI: Mr. James Watkins?

MR. WATKINS: Here.

MR. KOWALSKI: Mr. Joseph Roth?

MR. ROTH: Here.

MR. KOWALSKI: Dr. Abraham Abuchowski?

DR. ABUCHOWSKI: Here.

MR. KOWALSKI: Assemblyman Roberts?

ASSEMBLYMAN ROBERTS: Here.

MR. KOWALSKI: Assemblyman Impreveduto?

ASSEMBLYMAN IMPREVEDUTO: Here.

MR. KOWALSKI: Chairman Singer?

ASSEMBLYMAN SINGER: Here.

Thank you.

Good morning. I want to welcome everybody to the second meeting of the Biotechnology Development Task Force. It is very rewarding to see the level of interest and support we have here today.

At our first meeting on September 20, the Task Force began examining the overall status of the biotech industries in New Jersey. Task Force members listened to the industry's representatives discuss issues of concern in how New Jersey has set and measures up as a host to these companies.

Today, we will be looking at the most pressing issues facing the biotech industry today, and that is financing. In a report on the biotechnology industry which was recently released by Ernst and Young, it was concluded that of all the challenges facing the industry, financing is the most constant and pressing. Many companies have less than two years of cash

on hand and have expenditures that exceed revenues. The public financing markets, which in the past have contributed the majority of the financing resources for the biotech industry, have left the industry in the past two years. In addition, there are more companies than ever that need the financing.

Other states are working to fill the gap, and have turned their emerging growth industries to their borders. For example, two biotech firms borrowed -- two new companies to produce their manufacturing in Rhode Island and New Hampshire through industry revenue bonds guaranteed by the State in order to foster economic development. New Jersey must remain competitive. It cannot rest on its proximity to major pharmaceuticals and the science community. If the State does not do this, we will find ourselves in a poor position for this area.

I would again welcome the testimony today concerning financing. The first person to make a presentation to us today is Ed Ehrenberg, Executive Vice President of Enzon.

E D W A R D E H R E N B E R G: Good morning. I am Ed Ehrenberg, Executive Vice President of Business Operations, and the Acting Chief Financial Officer of Enzon. Enzon, as some of you may know, is a biotech company developing advanced therapeutics for life-threatening diseases for the application of its proprietary technologies, pegnology, and single-chain antigen bonding proteins. The company's drug development focuses on genetic diseases, cancer therapy, and blood substitutes. The company also pursues commercialization of its technologies through strategic alliances. We are headquartered in Piscataway.

At Enzon I am responsible for overseeing a budget of $35 million annually for a company of 205 employees. As the CFO of an emerging development-stage company, one of my primary responsibilities is securing adequate financing for operating functions and further research and development.

I appreciate the opportunity to speak to you today on the subject of biotechnology development. I believe that biotech holds substantial potential for the economic development of New Jersey. Other states, including our immediate neighbors and even foreign countries, are aggressively competing for the same technologies. Enzon is actively being solicited to consider relocating its facilities. Many of these states have already invested significant funds to promote economic development, and are offering public sector incentives to attract emerging industries.

If New Jersey is to remain competitive, I believe that its leaders in both the public and private sectors should take the initiative to identify and foster those technologies and industries, such as biotech, that can hold the greatest potential to take advantage of New Jersey's natural strengths. A comprehensive plan can be implemented to encourage the establishment and growth of these industries.

I would like to highlight some of the challenges that biotech firms are facing in today's environment. To set the stage, I shall begin by describing some of the reasons why the State of New Jersey should value biotech, and why a biotech company should in turn value the opportunities presented by New Jersey. Although there are natural synergies between the State and the biotech industry, it hasn't been all smooth going.

The State of New Jersey has been the center of the pharmaceutical industry in the United States and, some would argue, the world. That foundation has been developed by the major pharmaceutical companies in New Jersey as a natural stepping-stone for the biotech industry. However, merely capitalizing on the base that the pharmaceutical companies have already established will not be enough to bring New Jersey's biotech industry to the forefront. Action is also required by the State to attract new biotech companies and to keep those currently headquartered in New Jersey.

One of the greatest challenges facing the biotech industry is securing adequate financing for products that require many years and many millions to develop. We will talk a little about it in a moment. Given the fact that the United States' capital market for biotech collapsed this year and is not expected to recover soon, biotech companies are being forced to seek alternative forms of financing or severely cut expenditures. You see some of our New Jersey companies have already done that. They have felt the crunch and are actively exploring other means of financing. Corporate strategic alliances, funding in the foreign capital markets, and financial assistance packages offered by individual states are all being considered.

An investment in the drug development activities in New Jersey companies today will realize thousands of jobs and millions in revenue in the near term. I am proposing that the State of New Jersey consider specific recommendations to turn this industry into an engine of economic growth for the State.

Why should New Jersey value biotech companies? Well, we are a high-tech and a growth industry. The number of biotech companies in the last 10 years has grown from 300 to some 1300 companies. We already employ almost 10,000 in the State; pharmaceuticals employ 50,000 -- the kinds of jobs we know are very high skilled in both technology and science.

Biotech is an evolution of pharmaceuticals and has strong ties with the pharmaceutical industry and academia. You'll hear later about some of the work going on in the -- Rutgers and other places of the State. We are an environmentally clean industry.

Just to talk about some numbers: There are about 15 companies averaging 200 employees -- about Enzon's size. That's 3000 people. We attract a few companies, and the average company today that is profitable in biotech has about

2000 employees -- the companies like Amgen, Genentech, and so on. If they did that, we would end up with 50,000 people in this State -- equal to pharmaceuticals -- in biotech. If you look at the derivative employment that is from all the services that go along in supporting the industry, the potential employment associated with biotech is 200,000 people. So we are talking about a significant number.

Why should a firm value New Jersey? Why should they be here? Just being close to the major pharmaceutical houses and other biotech companies is a very significant advantage to biotech companies in terms of alliances, in terms of technology transfer. We have a very skilled labor pool here in New Jersey. Enzon group doubled the year before last and doubled the year before that in size. We've been able to attract and find the people we need, and those from out of state were very happy to come here. The biotech firms will have exposure to new technology via The Center for Advanced Biotech and Medicine at the New Jersey universities. We're close to the capital markets. We have an established business infrastructure. As someone who has just moved to New Jersey about 16 months ago, I can attest that there is a very high quality of life in this State, and we can attract anybody we want.

But the challenge is that we've got to be competitive with what other states are doing. Just to place where we stand here in New Jersey in regard to biotech, we are number three in biotech and number one in pharmaceuticals. California has 34 firms; in Massachusetts, 22; in New Jersey, 14 biotech companies right now. In pharmaceuticals we have 14, and we really lead the nation in the number of pharmaceutical companies.

If you look at the material on the 14 firms that are opting for New Jersey, a couple of interesting things appear in terms of where the location of these firms are. First of all, most of the firms gather around universities, and you see that between New Brunswick and Princeton, you have quite a few firms

who have chosen-- So that is a significant plus that we have going for us in the State -- the quality of our education. The other interesting thing is that while they're clustered around the universities, there are biotech firms in virtually every county throughout the State of New Jersey, and the same with pharmaceuticals.

To understand the issues with biotech, you've got to look at the characteristics of the industry. The key characteristic is the lengthy timetable for drug development, because when you are dealing with the FDA and with drugs that go into people-- We have unique facilities' needs beyond just factory shells. We require an enormous amount of financing because of the interval that it takes to develop drugs, and have been using the equity markets -- and that 1993, it's a bad year for us here in the State and throughout the country in terms of financing biotech.

The timetable for drug development averages 12 years: 3.5 years to develop the drug, 6 years to get it through trials in human beings, and then 2.5 years on the average to get it approved, so there is an enormous amount of time. To give you a feel for the amount of money per drug, it's estimated that it takes a pharmaceutical company $230 million from start to finish of this 12-year cycle, and it takes an average biotech company $125 million from start to finish. So not only is it lengthy, it is very, very costly to develop the drugs and to get them through the approval process.

In terms of facilities, what is kind of unusual -- and you'll hear from facilities people later -- we need lab space during the preclinical time. We need animal facilities to conduct studies. During clinical trials, we need laboratories. Then as we are scaling up manufacturing early on, we need plants to do fermentation, purification, and filling. Then manufacturing, again, which is fermentation, purification and filling, which are unique kinds of

technologies associated with the development of protein, which is what biotech is all about. So there are different kinds and very, very varied, as opposed to basic manufacturing.

UNIDENTIFIED SPEAKER FROM AUDIENCE: Excuse me.

ASSEMBLYMAN SINGER: Yes?

UNIDENTIFIED SPEAKER FROM AUDIENCE: We have a class that is on tour -- an advanced placement high school government class. They were wondering if they could come in and watch, or whether they could come in to observe.

ASSEMBLYMAN SINGER: Yes, they can come in.

Continue.

MR: EHRENBERG: Shall I continue?

ASSEMBLYMAN SINGER: Yes, please forgive the interruption.

MR. EHRENBERG: Talk about money and financing, and the difficulties that the biotech companies have had. There is a chart of total offerings in the funding of biotech, and 1993 is almost an all time low in terms of the money that has been able to have been raised. It's $759 million. It hit a peak $4.2 billion in 1991. So money has dried up in terms of the offerings.

If you look at the companies that are now profitable in our industry, there are only five that have reached profitability. They've averaged 11 years to do it -- roughly the amount of time it takes to get a drug approved, because you can't make profit until you can sell it -- and each company has had to raise $400 million dollars on the average to reach that point, with a high for Genentech of almost $900 million. So very, very significant dollars are required.

The stock market during 1993 was particularly bad for biotech, and the stock has dropped significantly in the index by almost 20 percent beginning in February. There are two things, I think, we ought to be aware of that have caused the collapse of the financing capabilities of the industry. One is

a couple of biotech leaders have had product difficulties -- companies called Centocor and Cytogen in particular. But more importantly has been the advent of the concern about the national health planning that is going to be coming out of the government and is now under consideration by the Congress. That's acted as a tremendous deterent on potential investors in the industry, since they don't know what kind of outcome they are going to get for running a risk. It's tough enough to run a risk with a company whose drug will or will not work, and now you have to run a risk with a company as to what the pricing is going to be and other kinds of controls. So it's really a double whammy.

I just put down three examples of what has happened to biotech firms here in New Jersey. We at Enzon had to cut our staff by 18 percent this year. We've had to just tighten up in every area, focus on our two key product areas, put things on the shelf, and generally get focused as much as we can because of the difficulty in raising money. Cytogen has announced that they are cutting their staff by 28 percent -- significant reduction of staff. DNX in Princeton said they are going to terminate their blood substitute work, because they cannot obtain backing for those efforts. So here we have three New Jersey companies, in an area where we had all this growth in these past several years, forced during 1993 to cut as opposed to grow because of the financing issues.

Just to talk a little about what other states are doing, just some examples from the financial end: The State of Rhode Island is providing 100 percent moral obligation for bonds. In our State the EDA has 20 to 30 percent backing for bonds. The Rhode Island Port Authority raised $30 million for Alpha-Beta. You are going to hear from the Sumitomo Bank, which is the financier for that effort. The States of California and Wisconsin are investing in biotech firms through their pension funds. Both California and Wisconsin own Enzon

stock. Wisconsin is one of our largest holders. The Wisconsin pension fund owns 9 percent of Enzon, and I should mention that New York and Colorado pension funds also invest in biotech. So that's on the financial side.

As far as facilities, everybody is doing something. The State of Massachusetts has a biotech research park in Worcester. BASF is constructing a biotech research center there. There is a division of BASF called Knoll located in Parsippany -- or in Whippany. So, while pharmaceuticals are remaining in New Jersey, for biotech they are not going to invest in New Jersey; they are investing in Massachusetts. The State of Maryland has authorized state funding for a wire processing manufacturing facility. I just made a visit to San Francisco and learned that the City of San Francisco is considering putting up a biotech center in the Presidio, a former military base. So people are moving ahead in trying to seek ways to keep this growing industry in their locations.

In terms of recommendations, our suggestion is that our State has to meet competitive market conditions. We have to improve the bond backing to whatever levels are done by our neighboring states, create loan pools for emerging companies to assist them.

Flexible lending rules: We have regulations that prevent spending within the same municipality. We have a whole group of regulations which are good on the surface, but which are difficult for companies to live with. We've got to offer grants for clinical studies for work to be done at Jersey hospitals. The NIH has grants.

We suggest that the State of New Jersey consider the health problems of the people here, and use New Jersey hospitals for that purpose. We have got to continue having cooperation between universities, pharmaceutical companies, venture capitalists, and so forth. I think this State is in a unique position to be an honest broker. Those of us who are out in the competitive world, it's hard to get together with people. The State can encourage those efforts.

In terms of facilities and services, we talked about that. There is a shortage in the State for filling, fermentation, and purification -- which are the essences of protein development and the essences of biotech -- incubator laboratory space that small, growing companies could share. Animal testing facilities are a very big part of what we have to do. We have to follow good laboratory practices. These are all prescribed by the FDA. We need a research park where many of these companies can gather.

We recommend that the rules be modified for the pension funds to invest in biotech companies. We are talking about huge sums of moneys available, and relatively minor seeding funds that would pose no great risk to the pension funds should be considered. We are always balancing risk against job creation, but I think a little bit of money can go a long way in regard to this.

We have to continue our efforts in education. I think New Jersey is moving forward in promoting math and science, and awarding grants and fellowships to students.

The tax structure has to be reexamined to provide competitive investment capital gains. I know that efforts have been ongoing here, but we've always got a balance of short-term revenue issues of the government against the long-run revenue potential of industries that can grow. So it just needs constant attention. We have to monitor the regulations of the Department of Environmental Protection and Energy to ensure balance between public and private needs. Again, we can't overburden the young, growing companies with regulations, but we can protect, I think, our environment, at the same time while being sensitive of the needs of these companies.

We talked about facilitating interaction with biotech companies, industry, and government. So on the business side, again, the government can be a broker -- an honest broker -- and on the technological side the same, sponsoring technology

transfer and information exchange through symposia and conferences that bring together biotech and pharmaceutical companies, as well as research and medical organizations and investors.

Finally, since it is such an array of recommendations, we suggest the establishment of a permanent biotech commission to implement the proposed recommendations. I think it requires a special effort. We have fledgling companies. There is a lot to do, but in our judgment there will be tremendous payoff for the State, and the people of this State.

Thank you very much.

So long, Chairman.

ASSEMBLYMAN SINGER: Before you leave, Mr. Ehrenberg-- Questions from the Committee members?

Joe.

ASSEMBLYMAN ROBERTS: Mr. Chairman, thank you.

Just one question: Among the fine presentation you made, which I appreciate very much, is this suggestion about State grants for clinical studies in New Jersey hospitals. Do you know what other states do in that area?

MR. EHRENBERG: I do not have that information available to me. I can get it for you.

ASSEMBLYMAN ROBERTS: Thank you, it's a great suggestion. Thank you.

ASSEMBLYMAN SINGER: Any other comments from the Committee members? (no response)

I just would like to thank you for your ongoing help on this issue. You have been a world of information to me. I appreciate the fact that your company has allowed you to make such a fine presentation. We appreciate your help very much, nice presentation.

MR. EHRENBERG: Thank you very much.

ASSEMBLYMAN SINGER: Are you getting set up for the next presentation?

G O R D O N V. R A M S E I E R E: Yes.

ASSEMBLYMAN SINGER: Okay.

(Pause for setting up of slide presentation)

ASSEMBLYMAN IMPREVEDUTO: For those folks that just came in from the high school, things aren't much different here in Trenton. You see the overhead projector here, which I guess you've seen in your high school. So it's just like being in class.

ASSEMBLYMAN SINGER: Does that mean they get credit? (laughter)

ASSEMBLYMAN IMPREVEDUTO: Assemblyman Singer is going to give you one credit for this course.

ASSEMBLYMAN SINGER: The next gentleman that is going to be testifying is Gordon Ramseier.

Gordon, before you start your presentation, first of all, thank you for coming today.

I just would like to welcome the youngsters from the high school. Let me just explain briefly what you are listening to today. This is the Biotechnology Task Force. We are listening to testimony on finances from the industry, and representatives from the private sector -- from the Banking Commission, will be testifying. Lastly, this afternoon we will be listening to representatives from the government. We appreciate you taking time out of your tour to listen to us. I wish it was a little bit more racy subject for you, but biotechnology is certainly the upcoming industry of the '90s, into the year 2000. That should be of some interest to you.

So we do welcome you.

ASSEMBLYMAN IMPREVEDUTO: Mr. Chairman, not youngsters. They're young ladies and gentlemen in high school.

ASSEMBLYMAN SINGER: Thank you.

Assemblyman Impreveduto, being a teacher, refers to you as young gentlemen and ladies.

Do you feel better about that, Tony?

ASSEMBLYMAN IMPREVEDUTO: Yes.

Gordon, do you want to start?

MR. RAMSEIER: Pardon me for bringing-- I wasn't aware-- I probably should have brought hard copies, but I brought overhead slides. I hope you will bear with me while I show you a few things on those slides. I guess I'll have to walk around. I don't know if you will be able to hear me on the microphone.

UNIDENTIFIED SPEAKER FROM AUDIENCE: You'll have to take the microphone with you.

MR. RAMSEIER: Take it with me -- the whole thing? Okay.

I'm Gordon Ramseier. I am the President and the CEO--

UNIDENTIFIED SPEAKER FROM AUDIENCE: Mr. Ramseier, I'll put them on for you if you want, so you don't have to-- Do you want to give me the slides?

MR. RAMSEIER: Okay.

ASSEMBLYMAN SINGER: Gordon, be careful. He's from the pharmaceutical company. Are there any trade secrets in that? I want to make sure. (laughter)

UNIDENTIFIED SPEAKER FROM AUDIENCE: You found me out.

MR. RAMSEIER: No, I'm better off moving around a little, because I may want to point to some things on the slides.

As I said, I am the President and CEO of OncoTherapeutics. We are probably useful in this testimony. We are very much a contrast to the company you just heard from, Enzon, in that Enzon is a much more mature company.

OncoTherapeutics is located in Cranbury, New Jersey. We are developing imunotherapeutic methods for the treatment of cancer. We have some very exciting therapies that are in the beginning stages of human clinical trials. OncoTherapeutics is not a native New Jersey company. It was founded in Minneapolis, Minnesota at the University of Minnesota, and in

January of this year we moved the company here. To be precise, we moved three people here. That's how small the company was in January. We began the process of building the company in New Jersey.

The reason for moving to New Jersey from Minneapolis: You might immediately guess weather, but it wasn't. The reason for moving to New Jersey was very simple. New Jersey possesses, in terms of pharmaceutical development technical skills, the richest motherload of people in the United States. This is where the action is if you're looking for people to hire in an emerging company to develop drugs.

Drug development is an extremely complicated science involving a lot of regulatory issues. We are very grateful to all of the money that has been expended by the significantly powerful pharmaceutical industry in New Jersey in training; investing heavily in the employees which we are able to hire when we set up a company in New Jersey.

I thought I'd take a few minutes to talk a little generally about financing. How does a company like ours finance itself?

I'll take my microphone, and I'll go over to the overhead projector.

This somewhat complex looking, but not very complicated slide is designed to depict the emergence and evolution of a biotechnology company in sort of a typical sense. Right down the middle in the circles, I've tried to capture sort of the basic stages of development, where a biotech company at the seed level-- That's the level where a scientist and an idea, and maybe somebody with some management acumen decides, "We ought to form a company. Now, who's going to give us enough money to figure out if it can be done?" This is the very early stage. This is small amounts of money. Most of it comes from the venture capital source indicated on the right of this chart.

The company goes through the process of proving that its technology, at least in the laboratory and hopefully even in some form of in vivo modeling, does what the technology was hoped to do when the company was formed. That's the proof of principle stage, and that can take up to -- can be done very quickly, in some cases can take several years to do, again, consuming more money, most of which comes from the venture capital side of the coin. Then you see the early clinical, the beginnings of human testing; the late clinical, which is where hopefully human testing is beginning to succeed. Finally, way down at the bottom is the thing called commercialization. That's where the company makes money. That is usually about 10 years from the time that the company is actually founded.

During all that time, the company has to wander through this morass of potential financing sources to try and find the money to last that long, because this company, 10 years out, hasn't made a dime yet -- the prototypical company. Institutional investors, corporate partners, like the major pharmaceutical companies, who actually in recent months have been the largest source of financing for the biotech industry through partnerships-- It's a long trip.

Now, why should New Jersey be particularly interested in an industry that loses money for 10 years? What is good for New Jersey in that? Well, one obvious point is that after that period of 10 years, you hope it's going to make quite a sizeable amount of revenue. But in the process of doing that, I think there is a very important point. While all this financing is going on, all these groups of people, eager to finance this industry as these companies grow-- We may not make money, but we spend a lot. We spend a ton of money. We pay a lot of salaries.

ASSEMBLYMAN SINGER: Now you sound like government. (laughter)

MR. RAMSEIER: I was thinking of running for office.

ASSEMBLYMAN IMPREVEDUTO: Only Republican government. (laughter)

MR. RAMSEIER: I won't fess up to any affiliation.

I won't share entirely the previous speaker's pessimism -- or I won't say pessimism, but disturbance with the financial markets in biotech today. The biotech industry remains vibrant. Financing is difficult in today's immediate environment. It's difficult to raise public financing for biotech companies for a number of reasons, ranging from bad news from some companies with high-profile products, which don't reflect the rest of the industry entirely, as well as concerns about the health care financing issues that the Clinton administration is dealing with. And I don't want to get into any of those issues.

The fact of the matter is, the biotech industry is big, maybe bigger than you think. Even in New Jersey I think it may be bigger than you think. It's growing. It is the future of health care. It will be financed, will grow. If New Jersey continues to play a key role as it has in the past, it will grow vibrantly in this area.

I have to admit here that I think there is a speaker later on from Ernst and Young, and I am probably stealing half of his material, because this is out of an Ernst and Young publication. But there is some very good, recently published information about the industry.

This reflects the year from July 1 of last year to June 30 of this year, in terms of the money that went into the biotech industry and where it went nationally. Five billion dollars in investments went into the biotechnology industry nationwide. Venture capital, private financings, then you will notice initial public offerings is a relatively small number, as well as follow-on offerings, because the public market has been in a bit of a slump. But I don't believe that slump is going to continue forever. Strategic alliances with

pharmaceutical companies comprise the big number in the recent year, and then there is something up there called creative financing. You see creative financing when the public market starts to stink. That's when people start figuring out funny ways and other ways to raise money.

The industry is big. Companies raise their money.

I apologize for the quality of this, but it's copied from a colored chart. You lose some of the tone. (referring to slides)

The differentiation from left to right in the bars in each of the categories here is small, medium, and large company, and reflecting percentage of their financing that comes from various sources. As you'll notice, small companies tend to be in that venture capital category. They raise private financing, and most of their money comes from that source. Larger companies tend to develop more of their funding from the public and from operations. It is really a transitional set of events. Companies go from the private market to the public market.

I said the industry is big. By Ernst and Young's count, this is the number of companies formed throughout the last 20 years in the biotech industry, an awful lot of them formed in the 1980s. As you'll see, the number sort of gets a little bit smaller in more recent years. This is reflecting a little of the financing climate that exists today. It's also reflecting the fact that if you count all of that up, there are several hundred biotech companies. The industry is at a point where it's probably got to do a little consolidating and putting a few things together before it starts growing too many new companies. But they will continue to arise.

Here's what happened to the stock market for biotech. This reflects, on a monthly basis, the amount of IPOs and other public financing done since January of 1991. As you can see, other than January of this year, the past year -- almost a year and a half -- has been relatively low activity for the

industry. But as you'll see, historically this looks a lot like the Alps. There is a lot of variability up and down, and I predict that if you extend this graph out a little further, you're going to see another one of the upticks not too far in the future. I think my point in this is just to not -- while we do have some financing difficulties in the industry at this point in time, I don't want to create the impression the industry is in trouble. Because if it was, I'd be doing something else for a living, believe me.

In order to not take too much of your time, I've got one other thing that I wanted to talk about a little bit, and that is biotech and New Jersey. This is Ernst and Young's count of biotech companies in the United States. If you'll look in the center, northern New Jersey and Philadelphia/southern New Jersey are two categories that would encompass roughly this area. You add those two together and you will come up with about the fifth largest -- I am sure somebody else-- I think someone said we were the third largest, but if you are counting all of the companies in this area of geography in New Jersey, there are roughly 100 biotech companies. Not 10 or 20, there are a lot more of them than you may think -- some of them very new and emerging.

You can see how big the industry is in places like San Francisco; in New England, that's primarily Boston; Mid-Atlantic is really primarily the Washington Corridor; Gathersburg, Maryland, Rockville Corridor; San Diego, where I came from, is a very large enclave. But New Jersey, in aggregate, is way up there. It probably ought to be a lot higher, and in the future it may well be as companies move toward the development end of the spectrum, as my company is headed. The attraction of the skill base that exists in New Jersey for pharmaceutical development is very hard to resist.

Last picture: Again, somewhat incomplete data, but I'd like to call your attention to the Philadelphia/southern

New Jersey line on this chart, which presents some summary financial characteristics for the biotech industry by region. This is sample data. They're sort of treated as bigger than a breadbox, smaller than a garage kind of numbers. They're not really hard and firm, but they are very illustrative. If we take the Philadelphia/southern New Jersey, which is the only New Jersey location that's represented on this chart, I call your attention to a couple of things. This number right here, $1,000,000,061 is what is the estimated total assets in southern New Jersey biotech companies, a fairly sizeable amount of investment in the industry.

Net income: negative $361 million, losing money. Now, of course, all that lost money wasn't lost to the State. That money went into spending for the development of these companies, a large portion of which was in the employees of these companies, who are trying to make these products happen. But at the same time we were losing $360 million in this region, we were spending $270 million on research and development, which was significantly greater than sales.

The industry is a little hard to put one's finger on, but it's not small. This is a significant industry. It's employing quite a number of people. You look at my company as a microcosm, we have 13 people employed at this point. We'll have 20 by the end of the year. Of those 13 that are currently employed, 11 of them have advanced degrees -- master's degree or higher -- and 7 of them have either a Ph. D. or M.D. So it's a high-quality employment base of strong people; the kind of people you want to drive an economy going forward.

My argument is that biotech is really good for New Jersey. New Jersey is good for biotech, and could become even better if some of the kinds of recommendations that have been brought forward in the previous presentation and others that are mentioned are taken seriously. New Jersey has the ability to become one of the major centers ongoing for a long, long time in this industry, and it will be good for the State.

Thank you.

ASSEMBLYMAN SINGER: Thank you, Gordon.

Any of the members have any comments or questions for Gordon? (no response)

Gordon, thank you very much for the fine presentation. I appreciate you taking the time.

Just one quick question for you, though, Gordon. Are you satisfied that you moved to New Jersey?

MR. RAMSEIER: Absolutely.

ASSEMBLYMAN SINGER: Thank you. I'm glad that you have a positive bent.

Next speaker, Peter Schied.

P E T E R S C H I E D: Good morning. My name is Peter Schied. I'm the Chief Financial Officer of Transell Technologies. We are in Monmouth Junction, New Jersey. Transell was formed about a year and a half ago out of technology that was produced or discovered at Princeton University. We have several core technologies, and we are located in Monmouth Junction. Our two core technologies are intended to solve some fundamental problems that have existed in the pharmaceutical industry.

One is, we are a drug delivery or drug transport technology company. In other words, the pharmaceutical industry has had great success in getting its compounds into the body so that they work. However, the new compounds, particularly things like gene therapy, which are the compounds and therapies of the future, have very extraordinarily difficult delivery problems that cannot now be solved with existing technologies. We have one technology that will deliver a whole series of therapeutic entities or new drugs into the body in ways that have not previously been possible. We are going to enable, then, some of the new drug delivery -- drug compounds to fulfill the promise that they have.

Our second is that we have the technology that is going to be producing drugs themselves; individual new therapeutic entities that are going to be based on carbohydrates.

The significance of those technologies is that they affected the way we made our decision as to why to locate to New Jersey. The purpose of my comments this morning is to give you an example, a case study of why we are here. We are the very kind of company that you want in New Jersey. First of all, as I mentioned, we were started up about a year and a half ago, based on technology from Princeton. We are here principally because, as the previous speakers have said, New Jersey is a locus of activity. It is an enormously attractive labor pool of people who are highly skilled in this particular discipline. That is an asset that you have that must be leveraged. It is an asset that other people in the country would die to have, and you have it today if you can leverage it properly.

We also were able to get what is something that is very unique to us, which is new facilities or facilities that are consistent with the laboratories that we need to run our business. We found, however, some very unique facilities that were relatively inexpensive, and there probably is not another one like that to be matched in this area at the current time. Since our operations began, we expect-- We are currently at about 13 people. We expect to have 25 by the end of this year. We are spending at the rate of about $6 million a year in New Jersey, and we will double not only the head count, but the spending each year for the next two or three years.

We expect to be profitable in a five- to seven-year time frame, and my task as the Chief Financial Officer over the next five to seven years is to raise upwards of $300 million to $400 million. In order to do that -- that is a very daunting task. We all have our mortgages to face, but try to raise $300

million to $400 million on a technology that is brand new. It's a hard job, but we face it. We take it because we believe in the technology and we believe in this particular industry.

The problems that we face are what I wanted to share with you this morning. In starting up our company, we are driven principally by the investors who've seeded our company. As the slide that you saw earlier showed, we are venture capital backed. Our fundamental initial financing comes from venture capitalists. In order for us to raise, let's say, the second and third round of financing, we are going to do that on the basis of proving that our science works. What we need, then, are facilities that don't cost us an enormous amount of money in order to prove that that technology works and to get the next round of financing. You can't go public at this point in time until you have an enormous amount of science down and resolved to convince people to invest in you further.

As was previously shown, biotechnology is an extraordinarily time- and money-intensive business. People invest in it because our technology can be proven. What we found when we were looking for financing within the State to support the facilities that we required was that there were virtually no State initiatives that would assist us in either the location of facilities, or in financing the expansion of those facilities. The way that we found the information necessary was purely by networking within the existing industry. That doesn't work. That doesn't compare well with what exists in other states. Across the Delaware River in Pennsylvania you have the Ben Franklin Fund -- which I will come back to later -- which is a model that perhaps you might want to look for in terms of providing the core of information that companies need in order to get facilities in order to grow.

Those facilities that I am talking about are laboratories. After the building, or the shell of a building, has been constructed, normal office space will take somewhere

in the order $15 to $20 a square foot to build out. Our laboratories are going to cost-- We need approximately 10,000 to 15,000 square feet at a minimum. Our laboratories are going to cost between $100 and $150 a square foot to build out. That is before we put people in them, and that is before we put in the laboratory instrumentation. Laboratory instruments will cost perhaps another $50 a square foot, and the employees that we are hiring and do have on staff -- most of whom have Ph. D.s -- cost at least three to four times your average employee. So as you can imagine, it is an extraordinarily expensive operation.

Secondly, after we found the facilities, then we had to get permits to run that building and to run our operations. There was no one good place that we could go to to find out what the regulatory compliance issues were that we had to face, where we had to resolve. It was our job to find out what we needed to do in order to pay the taxes and to operate our business. You can make that job a lot easier very simply. What I am saying, then, is facilities to us -- in addition to capital, and it takes capital to get those facilities -- was probably the single most difficult operation that we faced after we got our initial seed capital, so that we could continue the operations of this business.

In addition to that, once one does have a facility, once you do have an operation that is running, it is extraordinarily difficult to move. You simply are not going to uproot your facility and move to another state unless that state provides extraordinary incentives to do so. So if you want to attract new companies like us -- and we are exactly the kind of company that exists today, and that you want to have as a good corporate neighbor and partner -- I think it is important to provide some type of incubator facilities, laboratories so that seed businesses can come out of the

universities and get their first year or two of laboratory operations and science done; so that they can attract the next round of financing.

I think it is also important to get some type of additional laboratory spaces in a business park in place, as well. Here the State can provide some type of indirect credit support, rather than direct credit support if that's not politically doable. But the requirement is that we get facilities that are not going to consume every last dollar that we raise in our first or second round of financing. That's one of the key take-home messages here. We can't raise money and put that money into facilities. We have to put it into science if we are going to be competitive in getting our follow-up rounds of financing.

I think the local municipalities or localities have to be customer driven, and by that we mean that there has to be some type of at least a one pager of people to contact, so that you can comply with the local regulations, know who to contact and get your business operational. It's extraordinarily difficult to be in, let's say, a brand-new laboratory and not know who to call, but to pick up your telephone book and to start the process. There has to be a one pager; there has to be an easier way.

We think that the expansion of an EDA financing opportunity to help emerging companies is extraordinarily important as well. Right now, most EDA- or small business-type of financing requires that the company have some type of credit support; in other words, already be somewhat creditworthy. For an emerging company, obviously facing seven to eight years of loss operations, you don't pass the taste test in terms of being a creditworthy facility. That's why the previous recommendation as to putting upwards of 2 percent, which other states do, into the funding of the start-up companies in some way would be very helpful.

Obviously, what these recommendations and our examples try to help you understand is that if you are going to compete, to continue to attract companies to this naturally attractive area, you have to match the competition that exists in other states throughout the country. The Ben Franklin partnership, for example, is a model that you might want to look at.

Thank you.

ASSEMBLYMAN SINGER: Are there any questions? (no response) I have one. Do you think that incubator companies would be best sought to be part of the university systems? In other words, may be owned by them and leased out to incubator companies? You say your start came out of Princeton?

MR. SCHIED: Yes.

ASSEMBLYMAN SINGER: Is that the best direction to go? Do you see them as freestanding types of facilities, maybe owned by the State or entrepreneurs as such?

MR. SCHIED: I think it would be better if they are owned or at least somewhat indirectly financed by the State as opposed to universities, for several reasons: One is if you are attached to a university, then the university is going to -- you're going to have an obligation to pay a royalty to that university for technology that was not really developed further within that university. So you are giving something away that they haven't paid for.

ASSEMBLYMAN SINGER: What if we didn't do that? If, in other words, the university leased out to incubator companies to use the facility, but didn't take the royalties?

MR. SCHIED: Right.

ASSEMBLYMAN SINGER: But the other side would be that they didn't have the use of incubator companies. They could use them for their own purposes.

MR. SCHIED: Then it would work. If you can sever the royalty relationship or the obligation from occurring, then that would work. It happens, for example, in Chicago. The

University of Chicago Medical School -- or the University of Chicago has created several business incubators in Cook County to help businesses get started, and it has been very effective.

ASSEMBLYMAN SINGER: What we heard in one of the other roundtable meetings that was very interesting to me was, a California-based company was talking about coming into New Jersey and buying excess lab space that one of the pharmaceuticals was going to sell to them, and turn it into leasing for incubator companies. I was saying if an investment company from California wants to do that, why wouldn't it make sense either to go to the pharmaceutical company and say, "Look, you might want to donate or lease those labs to our university," and maybe they would turn around and be the emphasis for the incubator companies, or maybe we could encourage some investment from the State to maybe do the same thing? Would that be a feasible--

MR. SCHIED: That would not only be feasible, it would help the company go from, let's say, the earliest stage to a much later stage, so that it could then attract and get the science done; so that it could then attract the corporate partners to participate in the further investment. The answer specifically to your question is, yes, that would work.

MR. WEISBERG: I have two questions.

ASSEMBLYMAN SINGER: Yes, Ira.

MR. WEISBERG: In your experience with venture capital funding, don't they often place restrictions on the use of funds against facilities versus development of technology? So if the State provided facilities support, would that help in the VC funding?

MR. SCHIED: It would help the VC funding, and that is exactly the point that I think needs to be made. If you take-- Let's suppose the typical first round of financing is somewhere in the order of $5 million to $7 million. In that first round of financing, if you spend-- I can give you a

horror show of a company that was recently our neighbor and was going to take 60 percent of its first round of venture financing capital and put it into the building for the creation of laboratories in an already existing building shell. That was not successful when the venture capital firm said, "No way." Therefore, the company had to leave. It had to leave New Jersey. That is a very-- That is an example that exists today.

The point of it is that you've raised a very good point; that the venture capitalists don't invest in bricks and mortar, they invest in science. So it is absolutely critical for a new company to husband its capital, and put that in the form of developing its science. Let the science live, not the bricks and mortar.

MR. WEISBERG: One more question. You mentioned the Ben Franklin Partnership a couple of times in your presentation.

MR. SCHIED: Yes.

MR. WEISBERG: Could you maybe describe what the structure of the funds, how it works, the restrictions?

MR. SCHIED: Will do. One of the aspects-- There was another question earlier about: Do other states provide funding for clinical support? Yes, the University of Texas does for some of the-- They actually have a very aggressive program to partially pay for some clinical studies that are done within the state, and then the state institutions that are somewhat state supported.

Ben Franklin is a hierarchical system that has several components to it. First, in the entire concept they provide an incubator that's allied to the University City Science Center down on 36th and Market Street. It's an old building that was retrofitted and has incubated many, many new businesses -- Centocor, for example, being one. That has three other levels of investment by this organization -- call it Ben Franklin -- in various types of funds for different -- for technologies

that are at various stages. They will put $25,000 to $50,000 in just an idea -- a seed idea that someone must develop further in their laboratory. If it is successful, then they can go into Stage II funding, and then subsequently Stage III where they will get some type of commercial funding alliance as well.

So it is a regimented process. It is one that has been successful, and it has been in existence for, I think, about eight to ten years. Do not hold me to that number.

MR. WEISBERG: And what is the source of those funds?

MR. SCHIED: Pardon me?

MR. WEISBERG: The source of those funds are what?

MR. SCHIED: The source of those funds are-- Some of it is now self-generating, in the sense that people who are -- who have been successful have to pay some of it back, but they only pay it back on the basis of the success of their idea, not as a loan guarantee or a loan obligation. The rest of the money is paid largely by the State.

MR. WEISBERG: Through tax revenue or through other vehicles?

MR. SCHIED: I can't answer that, but my understanding is that it is revenue-based funding.

ASSEMBLYMAN SINGER: Tony.

ASSEMBLYMAN IMPREVEDUTO: Yes. I guess this is a good time to throw this on the table. I apologize since you don't have a copy of this, but everyone at the table here should. There is a bill that was introduced back on June 14, and it's Assembly Bill No. 2706, by Chuck Haytaian -- Assembly Speaker Haytaian and Minority Leader Joe Doria. I'll pass this out, because our staff had looked through some things out there to see what was available and in the hopper already that we can use as a model or a guide to some of the things that we are looking at now.

If you look at the statement, on page 4 it talks about establishing a mechanism to allow the State to assist in the development and commercialization of cost-effective environmental energy technologies. So this is something a little different than what we are talking about. But the model is here. The model provides that the State Treasurer, and in this case, somebody that we don't want any part of, the Department of Environmental Protection and Energy, -- acting on behalf of the State will enter into a memorandum agreement with the New Jersey Corporation. That would set up a New Jersey Corporation for advanced technology; a private corporation to be established to advance the technology development in this State.

Something like this may be the model that we are looking to do to have that Ben Franklin concept, or set up those laboratories that we're talking about as an incubator for the start-up business. I think this is the kind of thing we need to look at. These things are in the hopper. We need not reinvent the wheel. We can take things that are there. I mean, certainly, Assemblyman Singer and myself have absolutely no problem with finding out why and putting in legislation as necessary. I think Bob has already talked about that, about the funding from our pension fund to purchase stock in public corporations in the biotechnology field.

There are a lot of things we can do to help. You also need to help yourself a little bit. You're doing that now. We can help our end of it in certain things that we can do. We want to keep the industry here; we need to help it here. I suggest when you talked about -- I think it was you -- about the permitting process-- We joked the last time around about setting up what I call, "the rabbi for the permits", somebody to follow that permit through, through DEPE or whomever it is you need to have.

ASSEMBLYMAN SINGER: Be careful, Tony, monsignor. (laughter)

ASSEMBLYMAN IMPREVEDUTO: But probably what we do need is a business advocate.

MR. SCHIED: Yes.

ASSEMBLYMAN IMPREVEDUTO: You know, someone who you can call and say, "Hey, look. This is what I am looking to do. What do I need?" That person would be there to find out those answers for you. You know, "What permits do we need to have? What department do I go through?" You know, we have a public advocate, maybe we need a business advocate to make the atmosphere in New Jersey something that would help to attract not only biotechnology firms, but certainly other businesses.

MR. SCHIED: It has a broad application.

ASSEMBLYMAN IMPREVEDUTO: Yes, and it would become a one-stop shopping kind of place.

MR. SCHIED: I think what you just described in those two initiatives convey a message that probably needs to be made, which is that there must be an alliance between corporation and business. It has to be politically correct to be probusiness. Businesses pay the host of the taxes. You have an enormous asset in terms of the reputation of this area to attract the very kind of business that we are. The more that any state can do to make it friendly to do business, to make it easier to do business, will make that business more likely to come to your area. Once it's there, it probably won't leave.

ASSEMBLYMAN SINGER: The only thing that is-- Certainly this bill we can look at. We also have that, Tony.

But I have one concern. We talk about one-stop shopping. If we don't have someone who is strictly responsible, for example, for biotechnology, and you call up and you say, "I'm a biotechnology firm considering to come to New Jersey. What do you have?", you get a load of things that

cover everything from if you're going to be a garbage hauler, onto you're going to build an automobile. You have got to be specific to the industry. There has got to be someone who understands--

ASSEMBLYMAN IMPREVEDUTO: I agree with you, Bob. When I produced this, I didn't mean that this bill would be the mechanism by which this technology or this Commission would use it as the springboard for the industry. What I am saying is that we may need to set up something like this for the industry.

ASSEMBLYMAN SINGER: Right, there has got to be, if you make a call and you're a biotech firm, you're handled as a biotech firm and the understanding-- By the way, we have to take that to the next industry, and the next industry, and next industry and stop using that broad-brush approach to everybody, saying, "Yes, we have a Department of Commerce, and we'll send you a brochure." I think we heard it in testimony at the last hearing that someone said, "Yes, you call up and you say, 'I am a biotech industry. I want to move to New Jersey. Send me something'". They get a huge package, but you can't find anything in that about the biotech industry. That doesn't help you.

Whereas, if you call up the State of Pennsylvania and say, "I am a biotech firm, and I want to move to Pennsylvania," I get a packet about biotechnology, period; nothing else but what I have to hear and what I have to know. There is someone there when I pick up the phone and call Pennsylvania and say, "Gee, what are the regulations if I am a biotech firm?" They don't say, "I have to get back to you, because I don't know." They know. "What are the opportunities?" "Well, there is the Ben Franklin Institute. There is everything else for you right here."

So what I am saying is, we have to become more specialized and become competitive in that marketplace.

ASSEMBLYMAN IMPREVEDUTO: One other question, and certainly I guess, Joe, this goes to you. What's the relationship -- business relationship, if any -- the general relationship between the biotechnology firms and the pharmaceutical industry? Is there a good relationship there? You know, is it a competitive thing where if they do well, we'll do bad? I mean, is there something here that the pharmaceutical industry is going to get involved with in order to help these kinds of firms? I don't know.

MR. ROTH: Well, the previous speaker showed that the pharmaceutical industry is heavily invested in the biotech pharmaceutical development, drug delivery systems, and so on -- upwards of $3 billion. Again, that is a business decision usually, and I don't know what the restrictions and structures are of those types of investments. I guess one of my concerns would be: Are there governmental restrictions that might need to be changed that prevent even further investments by the major pharmaceutical--

ASSEMBLYMAN SINGER: Antitrust.

MR. ROTH: Maybe antitrust or just State laws that, you know, prevent it, or maybe there are tax incentives to increase that kind of funding that need to be looked at.

MR. SCHIED: I think there are two levels to respond to that. First, from a biotech side, let's say there are no impediments -- legislative or other tax, etc., antitrust. There are just no impediments that prevent or otherwise hamper the ability of, let's say, the large PMA-type companies to obtain technology from the biotech companies. Quite the contrary, it is with roughly 60 percent of the financing in the past year, and that's fairly--

The large pharmaceutical companies have, for many years, been in-sourcing new technology from the biotech industry. It is a way for the pharmaceutical industry to leverage its money by letting somebody else take the very

high-risk, initial investment to bring technology along to the point that it is proven, perhaps in human clinical testing. At that point the pharmaceutical industry has been extraordinarily positive, historically, in buying into that investment in several different ways.

ASSEMBLYMAN IMPREVEDUTO: My question then becomes, you know, as the biotechnology industry grows and as you -- each individual company develops some type of product that becomes profitable, are you then assimilated? I mean, do they eat you up? Does the pharmaceutical group say, "Okay. This is something I want, and I am going to buy you out?"

MR. SCHIED: That's a great question, because it goes to the heart of why people probably start here. Once, let's say, a biotech company has a patent, there is no way that someone can get-- Take that back. If your patent is well-done, you have that franchise. The franchise is yours to exercise and is ours to decide whether or not we want to prosecute it ourselves, or whether we want to let or have another pharmaceutical company participate in that. It may be in our mutual interests as a win/win, where we will ask a pharmaceutical company, or they will ask us, because there is a meeting of-- There's a win/win. It meets both of our needs to share that commercial development.

In other words, let's say that it cost you $200 million to bring a product to commercialization. It might cost another $200 million to get it marketed properly. It is that $200 million which frequently the pharmaceutical industry can best provide, because it buys a lot of people. It buys the marketing skill that they already have in place, and we don't have to go out and duplicate. Moreover, we can't use it effectively. We are not going to put a 400-person sales force in place for one product. It just isn't going to happen.

ASSEMBLYMAN SINGER: I thank you very much for your presentation and your time in answering several important questions. Thank you for coming today.

MR. SCHIED: My pleasure. Thank you.

ASSEMBLYMAN SINGER: We now move away from the representatives of the biotech industry, into the representatives of the private sector -- into financing. The first gentleman that I would ask speak is Kurt Barkley, Vice President for Public Financing with Sumitomo Bank.

Ronald Hahn, are you still here? Ronald, can you wait a few minutes, or do you have to run out?

R O N A L D R. H A H N: No problem.

ASSEMBLYMAN SINGER: First of all, Kurt, I want to publicly thank you for our conversation on the phone.

When I was trying to reach out to find out what would happen with Rhode Island, Mr. Barkley was kind enough to give me some insight as to how that financing came about -- I know Pat Mayard is in that from the Port Authority, because they're the deep pockets we look at sometimes -- and explained to me how Rhode Island put together their financing with their Port Authority.

Did you hear that, Pat? "Their Port Authority."

Thank you.

K U R T B A R K L E Y: Good afternoon. I am Kurt Barkley, Manager of the Public Finance Department, Sumitomo Bank, New York Branch. I would like to just briefly describe to you the Rhode Island Port Authority transaction, in which we were involved. It was done in February of 1993.

Alpha-Beta Technology, which is headquartered in Worcester, Massachuetts, needed $30 million to build a manufacturing facility. The Rhode Island Port Authority and Economic Development Corporation heard of Alpha-Beta's needs, approached them about building the facility in Rhode Island and doing the financing through the Rhode Island Port Authority.

Thirty million dollars in bonds was issued in February, 1993, backed by the moral obligation of the State of Rhode Island and a letter of credit from Sumitomo Bank.

Sumitomo Bank was able to issue the letter of credit because of the 100 percent Rhode Island moral obligation backing. The moral obligation pledge of the State of Rhode Island works as follows: In the event Alpha-Beta fails to make debt service payments on the bonds, a service reserve fund is hit. After that hit occurs, the Authority approaches the state Legislature and says, "Please, appropriate moneys to replenish the Debt Service Reserve Fund." If the appropriation is not made, then the Sumitomo Bank letter of credit is hit; therefore, ultimately the bond holders are protected by the letter of credit.

Moral obligation bonds are sold for economic development purposes in other states. They are fairly common. For instance, the Finance Authority of Maine sells them, and the New York Urban Development Corporation sell them. Of course, the advantage to this transaction for Alpha-Beta was very low-cost financing, and the advantage to the State of Rhode Island was that they built the facility in Rhode Island versus somewhere else.

There is a flow diagram. If you have any questions, I'd be happy to answer them.

ASSEMBLYMAN SINGER: Kurt, I have a couple of questions. I was very interested in this transaction, only because Alpha-Beta had really no product. I mean, in your public financing didn't you find that unique; that a state would guarantee $30 million in bonds to a company that didn't have a technology, and was really a true entrepreneur company coming into the state. I am a little bit amazed. I normally think of a state saying-- For example, Mercedes Benz, as you know, is moving out and moving down to Alabama. They are going to be a manufacturing facility. I can understand the state

saying "We are going to guarantee $100 million for your building of a plant. It's a fixed asset." I am more familiar with other things of that sort, as opposed to a biotechnology company who does not have an approved product coming into a state and guaranteed $30 million of bond money. Have you found that any other place in the country?

MR. BARKLEY: Frankly, this is the first biotech deal that we have done out of the Public Finance Department. I am not that familiar with similar transactions that have been done in the past. We viewed the "moral ob" backing of Rhode Island as an aggressive way of building their biotech industry.

ASSEMBLYMAN SINGER: I guess the next question I have is, if they do it for $30 million for Alpha-Beta, what's the next one -- another $30 million, another $30 million? In other words, where does it stop?

MR. BARKLEY: Well, actually they are planning-- I believe they are planning on continuing to pursue these types of financings -- backing bonds whose proceeds will be used for biotech companies. What amounts, I don't know.

ASSEMBLYMAN IMPREVEDUTO: Is the State of Rhode Island getting anything in return for that from the company -- from Alpha-Beta?

MR. BARKLEY: Taxes.

ASSEMBLYMAN IMPREVEDUTO: I mean, just ordinary-- There is no equity position? There is not anything?

MR. BARKLEY: I believe there was a-- I believe the Authority was given a certain amount of equity in the company.

ASSEMBLYMAN SINGER: But they were given a certain amount of equity in the company -- the Authority?

ASSEMBLYMAN IMPREVEDUTO: Yes, but your point is well taken, Bob.

ASSEMBLYMAN SINGER: What I am curious about is, you know, if that would fail -- and I certainly hope they don't -- but if they would fail, I would just wonder how the Legislature

would appropriate $30 million of taxpayers' money to pay back a loan for a company -- bonds for a company that has no technology yet, no approved drug on the market, and not be, in my mind, a scandal or some type of an investigation beyond how they allowed that to happen. I would only tell you that if we did something like that here and the company failed, there would be a picture of Assemblyman Roberts, Assemblyman Impreveduto, and Assemblyman Singer outside of the building. (laughter)

ASSEMBLYMAN IMPREVEDUTO: No way, the post office, because it's going to be illegal.

ASSEMBLYMAN SINGER: That becomes just an amazing factor. I just--

ASSEMBLYMAN IMPREVEDUTO: I have another brief-- Would your company, Sumitomo Bank, have advanced that money without the backing of the State?

MR. BARKLEY: I am sorry, what do--

ASSEMBLYMAN IMPREVEDUTO: Would your bank have advanced that money without the backing-- Would you have given that loan without--

MR. BARKLEY: Oh, no.

ASSEMBLYMAN IMPREVEDUTO: You know, quite honestly, I am not going to ask you why, because I think we all know why. It was a high risk and there is nothing there to support it.

My other question is, you spoke about the moral backing of the State. Is a moral backing different from a legal backing? I mean, is there--

MR. BARKLEY: The strongest backing of a state, as you're probably aware, is a general obligation pledge to full faith and credit. You can have a tax revenue pledge. The "moral ob" is viewed as less secure, in that it is simply subject to appropriation.

ASSEMBLYMAN IMPREVEDUTO: So the state's guarantee of these bonds was based on an appropriation, and not in fact--

MR. BARKLEY: Exactly, it's not even a guarantee. You can't call it a guarantee. It's just a moral obligation pledge backed by the appropriation risk of the State of Rhode Island.

ASSEMBLYMAN IMPREVEDUTO: Okay, so let's take that a step further. So in fact, then, if appropriation is not-- If the company goes belly up and an appropriation is not made, who takes the hit?

MR. BARKLEY: We do -- Sumitomo Bank.

ASSEMBLYMAN IMPREVEDUTO: So the bank takes the hit.

MR. BARKLEY: Yes, yes. Moral obligation debt is fairly common in public finance. New York State has issued a lot of it. I would guess that probably 50 percent of the states have issued some sort of moral obligation debt. If, in fact, a state fails to honor that "moral ob", the markets feel as though it would be a detriment to their future ability to access the capital markets.

ASSEMBLYMAN SINGER: In other words, they didn't make the appropriations; they didn't give you the money; you'd have no other recourse?

MR. BARKLEY: Correct.

ASSEMBLYMAN IMPREVEDUTO: We'll take that deal.

ASSEMBLYMAN SINGER: We'll take that deal? You now like that deal? (laughter)

ASSEMBLYMAN IMPREVEDUTO: How much do we need? Who wants to build?

ASSEMBLYMAN SINGER: Are there any other questions? Yes?

MR. ROTH: Just curious, this Alpha-Beta facility is manufacturing, or is it an R&D facility?

MR. BARKLEY: Manufacturing.

MR. ROTH: So there are others. There are no restrictions as to this type of funding, whether it be a pure R&D facility or a pure manufacturing.

MR. BARKLEY: Correct.

MR. WEISBERG: Who's really at risk here, though? Is it the taxpayers, or is it the bank? Ultimately, who's at risk?

MR. BARKLEY: Well, it's the taxpayers and the bank. Sure.

MR. WEISBERG: Shared risk, or it could go either way?

MR. BARKLEY: Well, the first line of defense is the taxpayers, and the second is the bank. The ultimate risktaker here is the bank.

ASSEMBLYMAN SINGER: Ira, understand one thing. If the State refused to act on this, not only would it affect its economic bond issues of that sort, it would also affect its bond rating. There would be a lot of questions about anybody dealing with the State.

MR. WEISBERG: Oh, I understand.

ASSEMBLYMAN SINGER: So I have to tell you, even though you may be on the line, you're not really on the line, because the State's credit is on the line with that. So it's really--

MR. BARKLEY: Absolutely, right.

DR. ABUCHOWSKI: Who ends up owning the facility if the money is not returned?

MR. BARKLEY: The bank does have a lien on the property, and we could seize the property.

DR. ABUCHOWSKI: This allows them to purchase and construct a facility, and then there is a lien on the facility for the bond itself.

MR. BARKLEY: Right. Actually, the Rhode Island Port Authority has a lien on that property -- a mortgage -- and in turn, we have a pledge of that lien also.

DR. ABUCHOWSKI: Is the $30 million the mortgage or-- The $30 million doesn't pay for the entire facility?

MR. BARKLEY: It did. It paid for land acquisition, for the construction facility, for issuance costs.

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DR. ABUCHOWSKI: Okay, so where is the mortgage? Why is there a mortgage when they paid for the whole thing? I'm just trying to reconstruct everything in my mind.

MR. BARKLEY: The mortgage is part of the security package for the Authority, and in turn, the bank has an assignment of that security.

DR. ABUCHOWSKI: Thank you.

ASSEMBLYMAN SINGER: Any other questions? (no response)

Thank you very much. We appreciate the help you gave us. Thank the bank.

I am going to go a little bit out of order since the Commissioner has just come in.

Commissioner McConnell.

COMMISSIONER BARBARA W. McCONNELL: Thank you, Chairman Singer, members of the Committee. Thank you for the opportunity to speak with you this morning, and to share with you our Department's commitment to the biotechnology industry in our State.

For the past two years, as I have traveled across the State, I certainly have had the privilege of working with and visiting many of our biotech companies. It's a very exciting time for this important industry segment. I certainly am proud of the outstanding accomplishments that these companies have made not only to our economic growth, but to the advancements of important medical breakthroughs.

So I commend this Committee for these hearings, and for looking into this important industry and this issue to determine what maybe the State can do additionally to help the growth and expansion of the biotech industry in our State.

During my visits to Enzon, for example, I continue to be impressed by their newest lifesaving drugs for immune deficiency diseases, and the exciting advancements that are being made in other fields. I understand that this Task Force

has heard success story after success story from companies such as Interferon and Liposome, all making important advancements in combating critical illnesses and ensuring the health and well-being of people around the world.

The Department of Commerce is certainly committed to creating an environment that is conducive to growth, advancement, and profitability of the biotech industry, both now and in the future. Certainly, New Jersey is proud to be home to major pharmaceutical companies and major universities. While this is one of the main reasons that biotech companies choose to locate in our State, we are not satisfied in assuming that this alone will guarantee the growth of this industry.

It's important to note the State's opportunity for economic growth in this industry. Our 1992 report by Ernst and Young showed that 17 percent growth in sales and 23 percent job growth was realized by these small companies between 1991 and 1992. And I am sure that you've heard the statistics already that New Jersey ranks second in the nation as the home to the biotech industry.

A new economic impact analysis that was conducted by the Port Authority of New York and New Jersey certainly underscores the importance of this industry on our region. The biomedical complex industry generates 515,000 direct jobs, $39 billion in regional sales, and $14 billion in personal income. Further, this direct economic activity generates an additional 240,000 jobs, $24 billion in sales revenue, and $6 billion in personal income through indirect and induced efforts. I am pleased that the Port Authority has authorized a more in-depth study for the next 18 months, and I am certain that it will prove what we already know, that biotech is big business in our State.

Our Department, the Department of Commerce, has in place numerous programs and services to attract and retain business in New Jersey. We are working with several biotech

companies to ease the regulatory process through our one-stop permitting assistance programs; through the workforce training programs that have been enacted by this Legislature, that as you know are rated number two in the country for State dollars expended to complement our highly trained and skilled employee work base.

The Legislature and the Governor recently enacted a comprehensive package of tax incentives emphasizing, again, the importance of research and development investment tax credits. I believe that that package of bills, while it may not be certainly the total answer to the biotech industry's financial needs, but it's an attractive package, and one that we believe will certainly enhance New Jersey's position in attracting not only biotech companies, but other types of manufacturing facilities to our State.

This morning, as you know, Dr. Jay Brandinger, of the Commission of Science and Technology, will be highlighting science-related programs offered by the State. As you know, the Commission on Science and Technology is an "in but not of" the Department of Commerce, so we work very closely in coordinating those programs. I know that Caren Franzini, of the Economic Development Authority, is here and will be also highlighting the work of that Authority, which is working with a number of biotech firms in their efforts to obtain much needed capital.

This industry, as all of you know, is extremely complex, and although the environment in this State is greatly improved, I am committed, as you are, to doing more. I certainly welcome the dialogue of this Task Force, and the dialogue that you have provided by hearing from numerous people, both within the industry and government representatives.

As I started my remarks, over the last 24 months, I too have heard many ideas and suggestions for new initiatives. So using the resources of our Commission on Science and

Technology and the Economic Development Authority, and in cooperation with other State agencies, the Legislature, and the industry, the Department of Commerce is trying to provide the leadership and coordination to enhance the work of this important industry sector, to ensure its growth and the economic growth of the State.

I thank you for the opportunity to appear before the Committee, and I look forward to your recommendations and working with you in the months ahead. We have targeted this industry as certainly an emerging growth industry, and recognize that much more needs to be put in place to truly make New Jersey number one as an attractive place to do business.

So, as Commissioner of Commerce, I certainly look forward to your recommendations and helping to facilitate those.

Thank you.

ASSEMBLYMAN SINGER: First of all, Commissioner, thank you for taking time out of your schedule. I know it is very busy this time of year.

You know, we've been talking about a number of initiatives, as we heard in our last Task Force meeting. I wanted to share one thought with you, and certainly not as criticism. I want that up front. I am not criticizing your Department or the way it functions at all, because you certainly know better than I do in the last cutbacks, your Department took it on the chin probably more than any other department, and you just can't function without the bodies. We appreciate that, and we've worked well with you for the last two years. Of course, your record on business and business development is quite well-known in the State.

COMMISSIONER McCONNELL: Thank you.

ASSEMBLYMAN SINGER: Our concerns, though, are that we are going to have to do things a little bit different in the competitive marketplace in the future. Hopefully, it's a Task Force on one industry, and there are going to be 30 other task

forces in the next several years specifically for industries that have a problem in dealing with their problems. But one of our concerns is that, for example, if I call up the Department of Commerce and say, "I am a biotech company, and I want to move into the State of New Jersey," they send me a packet, but the packet is not a biotech packet. Whereas, the--

COMMISSIONER McCONNELL: Exactly.

ASSEMBLYMAN SINGER: Whereas, Pennsylvania sends me a biotech packet. We are going to have to be, to be competitive in the marketplace in the future, specific to that particular industry, so when that person calls up and says, "I am a biotech," they get 50 pamphlets on biotechnology -- whether it's from Rutgers, Princeton, from people dealing in the field, from financing, or whatever it might be -- so that they can say "Yes, we really are on top of it." That is something I know you're starting to put together now, but this is just one of many aspects that we are going to have to do there.

By the way, we are just talking about pharmaceutical biotechnology. There is agricultural biotechnology, which is a whole other area, and of course, we have the chemical industry, which uses biotechnology to do some of their cleanups, which is another whole aspect of biotechnology we haven't touched yet.

But I wanted to share that with you; that we want to work with you in that aspect of it. You may come back to us and say, "Look, we are going to need some more money to do that. I am going to need some more people." I'll be the first one to say we'll do that for you if we can.

COMMISSIONER McCONNELL: I really appreciate that comment, Mr. Chairman. I didn't mention that in my remarks, but I want to assure this Committee that we recognize the importance of targeting our marketing message to specific industries, and certainly the biotech industry is number one on our list. We are in the process now of compiling the kind of information and message that we need to convey to that

industry, not only to those companies that presently exist in New Jersey, to convey to them what services, programs, and assistance might be available, but also to convey that message to prospective companies outside of our State.

I'm familiar with what Rhode Island has done, and some other states to target that industry specifically. I have all of their materials. We are working with the industry itself to find out what kind of message would be attractive and impressive to them.

So I assure this Committee that we understand the importance of that, and it will be one of the first targeted marketing messages that we come out with.

Additionally, I also agree with you that there are other industry-specific sectors that we need to do the same thing with, with regard to our marketing message for attraction purposes, whether it's the electronics industry, the food processing industry, or what have you. Many of these industries are looking for the same type of thing, but in the biotech field, as you know, there are some specific incentives, programs, and needs that this industry has that perhaps other industries don't. That is what we are trying to pull together.

ASSEMBLYMAN SINGER: We found out at the last hearing that, for example, one of the biotechnology companies was traveling to Pennsylvania to use a special type of equipment. They found that Rutgers has three of those type of equipment right here in the State. Therefore, again, in that offering we've got to be able to catalyze what we have here in the State, what's available. That x-ray equipment is in the State of New Jersey. They didn't have to go to Pennsylvania to have it done. What I'm saying is, those are the kinds of things that are important to the industry that I don't blame them. I mean, we talk about it and we are going to have to do it.

COMMISSIONER McCONNELL: Right. Just to give you an example of several things that I think that we need to do: One of the issues on business attraction is what laboratory space do we have available in the State, for instance. As you know, the Department of Commerce has a data bank of all industrial sites that might be available. If a company calls me -- not a biotech company -- and says, "We need a facility. We want a facility of 500,000 square feet. We want it in a certain location, and here are some of our specific needs," we can go through that data bank and we can pick out 12 to 15 sites that might be attractive to that particular company. But what we don't have, and I think one of the needs of the biotech industry, is laboratory facilities. Now, I know that they exist, but we don't have a listing of those.

So that is one of the things I'd like to put together in our Department -- is to begin to bring our data bank up-to-date. Also that then can be put on our marketing piece to say that we can help identify specific locations for these companies. That's one example. I think we also need -- and I don't know how the Department of Commerce fits into that, but certainly as a partner in some coalition, even with the Legislature and other agencies -- is to encourage greater growth through some of our medical facilities in the Phase I, Phase II, Phase III trial -- clinical trial that we are doing here.

So I think that there is much that we can do. We want to identify what we have now that we can offer, what additionally we need to do, and target that industry for growth.

ASSEMBLYMAN SINGER: Thank you for being so patient here.

C A R E N S. F R A N Z I N I: Thank you.

Good afternoon, I'm Caren Franzini, with the New Jersey Economic Development Authority. As many of you know, the EDA is the State financing entity to help businesses across

the State. We have developed several programs over the past couple of years to make financing more acceptable to businesses in New Jersey, especially with the regulation -- the Federal regulation on our banks. What I'd like to do is talk about some of those programs and how we work with the biotech industry indirectly, and not perhaps directly.

I think as important in helping biotech firms is helping those firms that are relating to them, and grow as a result of them. One of our programs is called the Statewide Loan Pool for Small Business, where we are in partnership with 57 banks in the State. The EDA provides 25 percent of the financing, the bank provides the balance, and we also provide a guarantee. We recently helped a firm -- actually in Camden -- that's in a biotech lab, and this is a firm that develops diagnostic test kits for the biotech industry. This is a type of example of how the EDA can best help those companies that have a product that is already in the marketplace.

That is where we see we can continue to grow. This particular company has a market. They have someone willing to buy the product, so we can go and talk to the purchasers of the product saying, "Do you, in fact, have sales?" We can lend against those sales that are enhanced, and we provide the financing. We closed on this. It's a $500,000 financing to a company in Camden.

Another company we helped does some research, but also has development and supplies to biomedical laboratories in the State and across the country. This is a $1.3 million financing to prior and renovated buildings. Again, we did this through one of our new programs, called the Composite Bond Program. We pulled together several companies, 20 at a time, going to the public marketplace, to take access to the low interest rates available in the public marketplace. This financing closed and the company is doing very well. Again, it's an example of a company that has a product to sell.

We have met with several companies -- I think including the representatives from EDA, with the chairman -- to help finance companies that are still in the R&D stage. I'll be very honest with you. It is very difficult to finance those types of companies that are strictly working with venture money and do not yet have a product with an end line to actually selling something in hand today.

Well, we are starting to talk to companies, and we find out -- what we find out is that many companies can have the venture money available in New Jersey for the R&D -- for the research -- but they need money for tenant fit out. They now need to start opening a lab. It's very expensive to fit out lab space -- $300 a square foot. Our venture capital money is better spent on research and not debt financing.

What we are starting to explore with some companies are different ways to give the EDA and banks a little more security in the financing. We are now talking to one venture capital company. We met with the product, and we are asking them to actually provide a guarantee on the financing. So what we are doing now is exploring different niches in the marketplace to actually help companies that aren't yet marketing, but are still in the research and development phase. It is a very difficult financing.

Everyone that comes to us brings the example of Rhode Island -- the Alpha-Beta company. I think every biotech firm that I have met with has talked to me about that. But in that case, the State of Rhode Island had a $30 million moral obligation to back that financing. That is a-- The EDA is not backed by the State of New Jersey. Our financing is self-sufficient, and we do not have the State guarantee behind us. It's just the resources of EDA, so it's a totally different kind of financing that was done in Rhode Island. The state really came up to the plate in a different role.

What we are trying to do is find out where the State does not have to use its own balance sheet, where EDA can come in working with banks to help those companies. It's a struggle, but we are out to look for creative ideas. In fact, we've met several times with biotech firms telling us, "Give us some ideas that other states have used, and we are willing to steal them and make them work for New Jersey businesses." But I think the latest idea of helping -- of having either the venture companies themselves, or even landlords of buildings provide some guarantees to the financing for tenant fit out is the way to go.

ASSEMBLYMAN SINGER: Caren, there is one thing I'd ask you to look at that we discussed. We've been discussing a filling plant being built in the State with a group of biotech companies coming together. It might require far more than a 25 percent guarantee by EDA, which you can do through other sources. It might be four or five companies. Again, we are talking about fixed assets. We are not talking about for R&D. We are talking about for a facility. The concern being, if you look at the balance sheet of probably the five companies, every one loses money every year. Based on that type of sheet, there is no bank that is going to loan the money.

So I would ask you to go back and take a look at that, to see if four or five companies sat down together with you and said, "Look, we want to build a filling plant. Yes, the guarantee would be the facility itself--" So in other words, if something went wrong, you'd have the facility. But they might want to consider doing something creative in that area.

The plant would cost probably upwards of $20 million. And by the way, that's part of the problem too. The $500,000 or the $1 million for most of these companies is a drop in the bucket. I mean, they can't even see that. The $20 million facility is what they are talking about. The Sumitomo Bank

told me they won't even look at a deal for under $20 million. I mean, it's just not in their realm. So there are banks that are willing to look at bigger deals.

But I am saying to you, if you walk in and say, "We'll guarantee 25 percent of $2 million," I mean, they are going to say "What are you talking about?" I'm saying you might have to be creative in this. You may have to come back to me and say, "We could do it, but the State would have to be part of the thing." But I'd like us to start to be creative with that, and I think the filling plant, which we've talked about with numerous companies here, is something that is a fixed asset. And whether-- And by the way, based on pro forma-- Because it wouldn't be used just by one company, all companies can be in a profit basis within a year.

DR. ABUCHOWSKI: A couple of years.

ASSEMBLYMAN SINGER: A couple of years, not a 20-year payback of starting to make money. But that might be something that any pharmaceutical company might buy into to have something done, or any biotech would want to have their operations done there. So that's something that I think we can look at, and maybe come back with something creative on that aspect.

MS. FRANZINI: I would be more than happy to sit down with the companies to look into it. As you said, it's going to take extraordinary effort, and we might have to come back and say, "In the case of Rhode Island, the State of Rhode Island had to come and provide the moral obligation. That is why the bank was able to sell the debt, because they didn't rely on the companies, they relied on the state."

ASSEMBLYMAN SINGER: If we had EDA involvement, and the EDA said, "This is a good idea. We can only do so much. We need help in other things," that would help us sell that project. Because if you were comfortable with it and said,

"We'd like to do it. We just can't do this part of it," it gives us a reason to turn to maybe the State and say, "Wait a second. Maybe we just have to guarantee it."

MS. FRANZINI: Okay.

ASSEMBLYMAN SINGER: Which means you don't have to come up with the cash.

Does anyone else have any questions?

ASSEMBLYMAN IMPREVEDUTO: Yes, I do. Going back to that Rhode Island thing and the moral obligation, do you know offhand if the moral obligation affects the state's Bond "A" rating and bonding capacity?

MS. FRANZINI: In terms of specifics of bonding capacity, I am not sure, but I know that the rating agencies look at how much more obligation debt the state has on its books. So it is definitely an impact when you go to the rating agencies for a rating.

ASSEMBLYMAN IMPREVEDUTO: Okay.

ASSEMBLYMAN SINGER: I thank you. We thank you, and we are going to be setting up a meeting with you.

MS. FRANZINI: Thank you very much, Chairman. Please do.

ASSEMBLYMAN SINGER: Thanks a lot.

I apologize to those people who are on the list. We are going back to the list.

Ronald Hahn, with Early Stage Enterprises. Thank you for your patience with us, Ron.

MR. HAHN: Good afternoon, I am Ronald Hahn. I've been a resident of Princeton, New Jersey for 15 years. I have had approximately a 25-year career financing emerging businesses around this country. In recent years, I've had a significant amount of experience financing the biotechnology industry. I am currently Senior Advisor to UI USA, Inc., which is part of the merchant banking group of Criti Agricole -- a very large French financial institution, specifically on health

care and in particular, biotechnology in the United States. I am also a member of the Board of Directors of Synaptic Pharmaceutical Corporation, which is a biotech company located in Paramus, New Jersey; Protein Data Bases, Inc., is a producer of analytical computer software for the biotech industry, located in Huntington, Long Island; and Health Risk Management, Inc., a managed care company located in Minneapolis.

I am currently organizing Early Stage Enterprises, which is a seed capital investment fund focused on financing early-stage businesses principally in New Jersey. The project is supported by local venture capital groups as a complement to their existing financing activities.

As I understand, the purpose of this Task Force meeting is to discuss ways by which the State and private sector can encourage the financing of biotechnology in New Jersey. I think the first question I ask myself when we talk about ways of encouraging financing: Is that a reasonable thing to be doing in the State of New Jersey? I think there are several reasons why it happens to be. As others have discussed, 10 of the world's largest 18 pharmaceutical companies have facilities in New Jersey. Princeton University, in particular, but also other academic institutions in the State have an excellent reputation in biotech.

The State has a number of successful biotech companies which provide role models for new biotech company formation. Although there is never enough money available, there are excellent sources of venture capital in the State with a strong interest in biotech. There is an excellent pool of experienced pharmaceutical industry executives in this State, which means that biotech companies can have those resources available for hiring as they progress.

My conclusion is that there is the necessary infrastructure in New Jersey for New Jersey to become an important center for the commercialization of biotechnology.

Without this infrastructure, I really think State programs supporting biotech would be a waste of effort. Because of it, New Jersey should act aggressively to support biotech.

We certainly, as an aside, in the financing business often see opportunities to locate companies in Iowa, or in Utah, or Rhode Island for that matter. The answer is, if people are going to give you a lot of free money, you're going to consider that pretty seriously. But in terms of the basic business infrastructure necessary to make biotech companies a success, there is a commercial matter: New Jersey is a far better place to be.

What can the State and private sectors do to help? I think we need to make a couple of observations about the business. I think many that have been testifying earlier have made these observation, but I'll repeat a couple of them. On average, it takes more than $200 million to bring a new drug to market. That's a lot of money. In addition, for every successful drug, there are many failures.

The conclusion then is, there are a lot of high financial risks associated with investment in biotechnology. To attract large amounts of required capital, very high potential rates of return on capital will be required to compensate for that high risk. In addition to that, to be successful, almost all biotech companies will develop strong collaborative relationships with large pharmaceutical companies. Large pharmaceutical companies are a source of capital and expertise, which complements the expertise of the biotech company. My conclusion is that biotechnology companies need large amounts of high-risk capital and pharmaceutical industry collaboration as two principal ingredients to their success.

Specifically, then, how can the State help biotech companies deal with their capital requirements and needs for collaboration? The following are important ways the State can

help. The objective is to make the environment as conducive as possible, emphasizing the State's competitive advantages.

First of all, New Jersey must make sure that what we offer is competitive with other states. It seems that practically every state wants to be on the biotech bandwagon. Issues like the following are often raised by biotech companies as they consider where to locate. Other states have addressed some of these issues, and New Jersey needs to have answers regarding some of these.

First of all, with respect to tax policy, typical questions to ask are: What type of investment tax credits can I have for investing money in this State? Is there a real estate tax abatement program? Will we have the ability to use net operating losses to offset income for income tax purposes in the State?

With regard to environmental policy, biotech companies produce hazardous waste -- both chemical waste and radioactive waste. I was talking with the people at Synaptic Pharmaceutical. They are actually sending their waste to an approved disposal site in South Carolina. We all recognize, as citizens of this State, the importance of having strong environmental laws, and I think New Jersey has been a leader in that regard. At the same time, I think we've got to have solutions to the problem of what new businesses are going to do to solve their waste problems. We can't just give them a problem. We have to help solve it.

Industrial parks: The typical biotech company will ask the question: Are there industrial parks geared to biotech, possibly located near university resources to enhance the possibility of sharing facilities? Synaptic Pharmaceutical, for example, really didn't have that advantage. Fortunately -- and I think you will find this is true in most biotech companies -- it's nice to have set-up

facilities. But what really happens in the world if you don't have those? You have limited capital; you can't buy every piece of equipment.

Our technology actually came out of Columbia University, and because of contacts at Columbia, we were able to get access to certain bits of equipment that we simply couldn't afford to have -- also, laboratory space on a very interim basis, and so forth. So these things happen, but certainly the State could help facilitate that if there was a program on having industrial parks that would be geared towards biotech.

I think the idea of small business incubators is another one that needs to be dealt with. Again, to start a technology-based business right out of a university setting, oftentimes you want to do some proof of concept things that really require facilities that can easily be shared with other companies. You don't have to own all of these facilities. I think an incubator program would be very valuable, with an orientation towards biotech, the equipment and laboratory space that is required.

Other questions: Are there State SBIR programs that mirror the Federal program? I think this can be an important adjunct to the financing sources.

Something that has come up a number of times in this meeting, and I will reiterate: When I have made a couple of calls in connection with preparing for this meeting, companies in this State will tell you we just don't know what are the programs the State has. We don't know what is available. I was just told yesterday, for example, one company believes there is an SBIR support program in the State that existed at one time, didn't exist for a while, and now exists again. There is no newsletter of events that could be sent to biotech companies to inform them of exactly what is going on. That would be very useful. Certainly other states do have

newsletters. We all get them. They are all nice and glossy, and it's very helpful. You know who to call, and you know where to get information.

The programs that I mentioned are desirable and can make New Jersey more competitive in attracting biotech activity, but they're only a small part of the success equation. I really think that when you think about public policy issues, you need to recognize that. Ultimately, I think the best way to describe how companies are located and financed by venture capital, they tend to be in right spots. But the best story is, I financed a company once that was founded by a person with his Ph. D. in economics from MIT, and he used to talk about the significant amount of economic analysis he did to locate his company. It just happened that he located it in Princeton, New Jersey, where he lived. I think you're going to find that that happens a fair amount.

There are other things, however, that we should focus on that are of central importance to supporting biotech activity. Ways need to be found to facilitate biotech interaction with the pharmaceutical industry. The number of pharmaceutical companies in the State is New Jersey's real competitive advantage. An active program to give biotech companies better access to the State's pharmaceutical companies would be a valuable resource which other states could not duplicate. The State and private industries should cooperate to provide this access.

It may surprise you, but if you think about it, it shouldn't. The people who found biotech companies often have more science skills than business skills, and that has been a historical problem of the industry. Those science skills mean that the people who found these companies are very well connected with the scientific community in which they're involved. They know who the key scientists are around the world. They probably know central -- the major corporations

that are doing work in their field, and they probably have scientific contacts at those companies. What they don't have are business development contacts with those companies.

At Synaptic Pharmaceutical -- which I believe will be one of the most successful biotech companies financed not only in this State, but in this country -- we found for the first 18 months that we were floundering around trying to find out how to approach large pharmaceutical companies. We typically financed-- We typically approached through the scientific contacts that we had, and typically that went nowhere. There was a lot of interest expressed, but there was no business development person who coordinated that science with the business goals of the corporation. That is a central requirement.

We have the companies here in this State. There ought to be a way that when a company is founded in the State, that they can access the right people in the pharmaceutical companies, so that they can get meetings, talk about their science, and get something to happen. I'm in the business oftentimes of making those contacts. It is a rare case when that is a rifle shot approach. Usually we spend a lot of time trying to find the right spot in those companies to make our point.

Others have mentioned this, but I will mention it again. I think that the State really has come to a point when it needs to open its pension funds to alternative investment, including venture capital partnerships, and invest in biotech. New Jersey remains one of the few states in the U.S. that does not permit investment in venture capital. In addition, pharmaceutical companies in the State with a vested interest in biotech should also find ways to support biotech-focused venture investment. I don't mean it as a criticism of pharmaceutical companies. I don't think one should think of it in those terms. But I think that most observers of

biotechnology would say that technology exists in two places: It exists in universities, and it exists in small companies. It probably doesn't exist -- there are exceptions -- but it doesn't exist, to a small extent, in large companies.

Yet there is a natural synergism between the science of small companies -- the molecular biology -- and the chemistry capability, the clinical trial capability, the marketing capability of large pharmaceutical companies. This is a natural alliance. I don't think it means these companies will not be independent companies over the long term. There are going to be projects that you collaborate on, and there are going to be projects that you don't collaborate on. The successful companies will have some of both.

But there has to be ways where we can bring money through venture capital to these companies at an early stage. That money needs to come not only from State funds, but it needs to come from corporate funds as well. I think in saying that, venture capital is an asset class in this country for most major institutions investing money. It is not an alternative investment, where your expectation should be that you lose money. It's an expectation that you should make money. It should not be a huge proportion of the pension funds of the State, or for that matter, the pension funds of any large corporation. But venture capital should be part of the investment program of the State.

I would also say that the State needs to find ways to support the establishment of seed capital investment. Other states -- locally most notably Pennsylvania -- have significant amounts of seed capital available for early-stage businesses. To be successful, this must be a combination of state and private sector resources. The State Pension Fund in this State should consider participating. In my own experience of trying to raise seed capital funds, which to some extent would go into biotechnology, I've looked at the Pennsylvania example. Seed

capital funds there, I would say on average, are getting more than half of their funds committed by the State Pension Fund and also private sources within the state. But that is a significant amount of money, and it's the area of capital that isn't available today.

If you look at the national numbers, seed capital funding, although it was increasing during the '80s, has declined rapidly and is at half the peak levels it was in earlier times. That's a function of the venture capital industry moving to later-stage financing as they have gotten more and more capital, and more pressure for short-term results. Seed capital is a fundamental part of the process of financing small businesses, and it needs to be supported.

The last point I would like to make today is in sharp contrast to an earlier testimony; that is, the importance of the State and the private sector supporting innovation in the free market system. Capital, I guarantee you, will not flow, and collaboration will not be possible in an environment where its return on investment is controlled by government fiat. Washington's bashing of the pharmaceutical companies and threats of price controls have already significantly reduced the availability of capital to biotech. There is no question about the fact that this is happening. There seems to be little understanding about the concept of risk and return in the investment cycle.

I think that if this continues, biotechnology -- a science with incredible power to do good and to actually reduce the cost of health care in this country -- will fail as a commercial venture. The capital requirements are simply too large. That risk is very real today, and the public and private sectors of this State have a lot at stake. We must do everything possible to influence Federal policy so that it will accommodate investment in the biotech revolution.

Thank you for inviting me to be with you today.

ASSEMBLYMAN SINGER: Thank you so much.

Does anybody have any questions? (no response)

Thank you for being so patient. I'm sorry we kept you waiting.

MR. ROTH: Oh, I'm sorry. I asked earlier-- You mentioned there are ways to facilitate interaction between biotech and PMA companies. Do you feel that there are obstacles in that path? I know that many companies do have a collaborative agreement, as you stated.

MR. HAHN: Yes, I think-- My point really is this: Many biotech companies simply just don't know where to call. So who are they going to call? They are going to call a scientific colleague, somebody they have met at a conference at some point. That person is in a research lab. He has no concept of the business development and planning of the corporation. He probably doesn't know where to direct-- He may even invite the company to come and visit. He'll get the head of his lab to come to that meeting and that is all great, except that we find out later, "Well, it's really not part of our corporate plan." Well, that is a very inefficient system.

All I am really saying is that biotech companies need the help of whatever resources in the State that we can find, so that they can call someplace and say, "Look, I want to talk to whoever it is in the pharmaceutical company, because I know they are doing work in our field," and that there would be a way to direct that to the right person in that company, as opposed to starting at a level that is the wrong level and nothing ever happens.

It took 18 months for Synaptic to sign its first arrangement with Eli Lilly. Eli Lilly was the most logical candidate. It took us 18 months to find them. So that shouldn't happen.

Thank you.

ASSEMBLYMAN SINGER: No other questions? (no response)

Thank you.

Peter Hutcheon, Esq., thank you so much for being patient with us.

P E T E R D. H U T C H E O N, E S Q.: Thank you all for the opportunity to come and share a few pieces of information and views with you. My name is Peter Hutcheon. I am basically a business lawyer. I practice in Somerville, New Jersey, with Norris, McLaughlin & Marcus. I previously served as the Chairman of the American Bar Association, Section of Science and Technology, and as one of the eight lawyer members to the Joint ABA and American Association for the Advancement of Science -- a body called the National Conference of Lawyers and Scientists.

Although I regard myself primarily as a business lawyer, many of the businesses I have represented and continue to represent in my professional career are in or serve the biotechnology industry. I think I can speak from some personal experiences about some of the things that affect the way in which biotechnology companies are begun, and the way in which they grow and sometimes unfortunately leave. You've heard an awful lot of other testimony, and I will try to stay off of things you have already heard enough.

I'll share one story with you, though. We have a client now who is looking very seriously at setting up a major pharmaceutical -- biotech pharmaceutical operation in the Baltic. For him it was critically important that the owning entity be a New Jersey corporation, because internationally and throughout most of this country, New Jersey has a kind of automatic legitimacy because of its position as the leading home of pharmaceutical and biotechnology companies. I think that is an important asset that you are clearly intent on preserving. It's an important asset for all of us to have available for not only ourselves, but for future generations in this State.

Capital sources are difficult to come by, and the most difficult of all -- as the person who testified immediately before me said -- is seed money, venture money, start-up money. It is a lot easier to talk about what to do with a company that needs to ramp up; that has a product that it needs to raise $200 million to show that it has a successful drug that can be marketed, than it is for three people to walk in the door and identify themselves as a couple of scientists with a notion, and they need about $500,000 and a place to tinker. That's some of the most difficult money to raise of all.

There are some things I think that the State could do to facilitate some of this that would not involve enormous amounts of resources, but require some intelligent planning and some continued attention to execution. Those are State-sponsored venture fairs. Those things are done now in the private sector, but there is no reason why the State couldn't demonstrate its commitment to the biotechnology industry by organizing and running on a periodic basis an opportunity for new venture ideas to make presentations to other participants. This would involve relatively limited facilities and capital resources, a little bit of advertising, and frankly would evidence, in my judgment, a commitment to the industry in this State that would speak volumes symbolically above and beyond any cost.

A second thing that can be done is the idea about using the pension money, and use it not simply as a passive commitment to assist the industry, but as a leader; to take a piece of the New Jersey Pension Funds and say we will commit this to a fund for this kind of investment so long as, and in conjunction with, private sector money; to use it as a matching inducement to raise money from others, so that it has a multiplier effect immediately at the outset that makes the fund bigger, and will make the opportunities that can -- the available opportunities for that fund greater. I don't think,

again, that it involves anything more in terms of the amount, but it does involve some skill and thought process about how it's done. It says to the industry and to the people at large, "We want the business to be here. New Jersey is committed to supporting this industry."

There are a couple of other things that are much more mundane, but I think deserve to be looked at. One of them is in the area of the State securities laws. The start-up company, if it is raising money from venture capital funds or from banks -- although in this day and age I think money from banks is about as likely to come as my winning the next pick-six lottery -- or from some other institutional source, there is not -- are available exemptions from the State securities laws of restrictions on the issuance and sale of securities.

But to the extent that one is raising seed capital, as is often the case, from friends, neighbors, or whoever, there are some real complexities to our statute that I think were, frankly, unintended when the 1986 amendments were passed. So the private placement exemption in our State, it can be done under three different contradictory provisions; two of which do not have an ancillary problem, but the third does. In some cases, to the point where in order to make sure that the exemption is fully available, it's necessary for the entrepreneur -- those three scientists I mentioned -- to go out and hire a broker dealer to sell the securities and receive a commission solely because of the complexity of the exemptions.

That is something that could be fixed without any significant cost, and I believe without any significant risk to investors, that they would be exposed somehow or other. This is simply a matter of rationalizing the exemption for private placements under our statute.

Secondly, in a related area, last year the Securities and Exchange Commission -- the Federal body that oversees the

regulation of securities -- recommended a whole series of things that they called small business initiatives. One of the principal areas of development was the increased use of something called regulation "A" or reg "A", offering -- which, by the way, has nothing to with Caribbean music, which I learned early in my career. The first time I thought that, I had a senior fellow corrected me on the spot. The problem in New Jersey is that it is not possible to use a regulation "A" offering to raise money on a coordinated registration basis, because of a prohibitive provision in our statute. So in a certain sense, we create an additional layer of regulation that may not be necessary in any rational way. I believe it is something that can be fixed easily, inexpensively, and without any significant risk to the investment community.

Similarly, in the area of tax policy, New Jersey has-- Let me step back. Many times companies organize, and after they will begin to function they organize a holding company, which may receive dividend income or even royalty income, because it will make sense to have a series of different ventures owned by a single parent company. In New Jersey, the income that flows to the parent company has a limited exemption from the State tax, and there is a complex qualification test. That is why it is my professional experience, and I think, frankly, the professional experience of almost any business lawyer in the State, that if and when it becomes time to form a holding company, you form it in Delaware, because in Delaware there is 100 percent exemption for passive income and there are no qualification tests.

I have no capacity to evaluate the amount of revenue involved for this State, but I cannot believe that it is a substantial number. I think that this is simply an anachronism of a prior time that could be fixed, where there ought to be a net economic benefit to the State.

I think the question of research and development credits is a difficult one. It is something that should be monitored and considered carefully. It is that and the possibility of using net operating losses as an offset that are two areas of tax policy that are particularly important for this kind of industry, because they eat capital, and they eat capital at a time when it is not possible to determine whether the child will live. It is a way to use public policy to assist in dealing and digesting with the risk inherent in the enterprise.

I think those are some of the key areas that I would stress. I congratulate you. Thank you very much, as a professional practicing in this State, for taking the time and effort to spend on this, which I think is very, very important. It's more important, in some ways, than some of the things that get much more publicity, because this is the kind of long-term commitment to our economic well-being that will ensure that our children will have jobs.

I thank you very much.

ASSEMBLYMAN SINGER: I have to tell you that I thank you for some of your comments, because we are going to look into some of those more simplistic things we can do, and maybe get pension funds to invest in venture capital. But they are very valid things.

Does anybody have any questions? (no response)

Again, thank you for being so patient.

MR. HUTCHEON: Thank you, it was a pleasure.

ASSEMBLYMAN SINGER: Barbara Hauter. Barbara, thank you for being patient.

B A R B A R A H A U T E R: I want to thank all of you for being patient. I think you're probably getting an awful lot of information thrown at you. Sometimes three or four of us are throwing it at you.

I've been listening so keenly that I haven't been able to edit my own remarks, but I'll do my best not to restate some things that others have said. I have about three or four things that are, I think, very important that haven't been said. Maybe I'll underline them or bang on the table or something to get your attention when I want you to really pay attention, as opposed to just being polite.

My name is Barbara Hauter, and at the moment, I have a business that finds real estate space for biotechnology companies, so I am very often the first person or the second person they see in the State. I've got some bad things to say about what has happened here, and I've got some good things to say about what has happened.

I am not here officially, because I used to work for a major real estate developer. But because I did it for six years, I may have some things that will shed some light on their views as well, and I'll try to say them. I'm going to talk primarily about the early-stage company, because that is the company I generally see. I am going to make a very simplistic comment: If they start here, they probably want to end up here. If they don't start here, you'll never see them again.

About eight years ago I was working with a company called Ecogen, that started in Princeton. It's now in Bucks County. It's not there because Pennsylvania has better economic programs or anything sexy; it's there because they found a building. That is really one of the critical things I want, of course, to talk about, because my interest is real estate.

Let me just spend two minutes on what these people need. You heard something about it from the Transell man, who talked about moneys involved, which are enormous, as I think you've begun to hear. It's driven by their need for laboratories and for manufacturing facilities. You've all seen

laboratories. You can imagine about the cost of them. They've got hoods; they've got benches; they've got sinks. What you don't see is where the money goes: plumbing to accommodate all the water they need in the process and the waste facilities; enormous heating, ventilating, and air conditioning; the mechanical and electrical systems to drive these. The air that comes in just once has to be conditioned beforehand, sent through, and goes out again. These are enormously expensive, and they are very difficult to accommodate in a general building.

A lot of people have said, "Well, you know, there is so much extra space in New Jersey. There is so much real estate. Surely we can put these facilities in some of our office buildings." It's not the case unfortunately. They don't have the ceiling heights. They don't have the support. They can't handle the mechanical and electrical. So we have to look to buildings that-- Obviously, build-to-suit are terrific, but generally companies are looking for facilities which they can retrofit the building.

Peter Schied gave a very good example. He talked about the fact that it's about $100 a square foot. That's a minimum number. It can go up to $300 a square foot. That's just talking about the research facility. Obviously, manufacturing is more expensive. You've got a very good primer in the first presentation that was made, and you see the facilities' needs. As the company gets larger, its real estate requirements of course are more substantial. But even a little company -- and maybe this is an important point to make -- a little biotech company needs 10,000 square feet very often.

These are not companies-- They start with the three people he mentioned, but when they scale up, they need 10,000 usually to begin with. If you're talking about $150 a square foot, which is conservative, that company needs $1.5 million just to fit out its space. That's more money than the

developer or the owner has put into the land, the approvals, the financing, the bricks, the mortar, everything else. He's got a building; he's ready to go; and in comes this guy who says, "I want you to spend twice as much as you've already spent to put me in." Not usually likely to happen. We are talking in order of magnitude of $1 million or $2 million.

As I said, they can't go into an office building. They can go into one-story buildings-- And here comes one of the, I think, important things that I want to say: When I worked for a developer, we were under the impression that every single tenant needed something unique. As a company grows and becomes more specific that is true, but in the early stages, companies' needs are somewhat fungible.

There is a very prominent local architect who said to me, "Barbara, it's simple. A molecular biology lab is a molecular biology lab, is a molecular biology lab." He said, "Think of it like a house. Your rooms are more or less the same. Yes, your furniture differs from your neighbors. The equipment will change, but per industry, the initial requirements are quite similar." That comes back to a very important point that I want to make in a minute.

Peter Schied said that he was lucky to find existing space, and he is not paying very much. I didn't represent Peter, but I know how much he's paying and I think it would curl your hair to tell you. This is not cheap space, but he was very glad to find it because somebody else had already improved it, and he didn't need to go through that process.

So here is this company; it's got the need. What does it do? If they are very, very lucky, they find existing space. I leaned over and said to Barbara McConnell, "The reason that your organization doesn't know where there are 15 or 20 spaces is, I promise you, in the State of New Jersey there are not 15 or 20 available labs." I don't think there are 5, and I do this for a living. People always say, "Hey,

how about Exxon?" Yes, Exxon had some extra space; it's all leased. The man who sat next to me just took 37,000 square feet. He is paying a very great premium to get in there because he was able to get in without the hassle.

A lot of other companies have facilities. Do we have someone here from Schering-Plough? (no response) Schering-Plough had 350,000 square feet in Bloomfield, 250,000 of which was lab. They tried to sell it to another company. They were not able to do so, and they recently donated it to the City of Bloomfield.

One might talk about an incubator there. The facility is there; the equipment is there. No biotech company can go in and buy that facility, even at the cheap rate that they are offering. It is $8 million. They don't need it, of course, and they don't begin to have the cash. Furthermore, they can't operate it. It was designed for one company. It doesn't have different systems. If you want to go in there for 10,000 square feet, you have to heat 250,000 square feet, and you have to pay taxes on it too. Schering-Plough would be quick to say they are not in the real estate business. That goes for some of the things we talked about before, about people coming in professionally and dealing with these. I think that is a very interesting idea that we have coming up.

Okay, so you can't find your existing space. What do you do? You go out and you find a building that's suitable. You've got to find it. You've got to negotiate a lease, because of course these companies are never buying. You've got to design your improvements and build them. The process never takes less than six months. It often takes 12 to 18 months. You can imagine what that does to a company that's ready to go; that may have hired two or three of its scientists. They're burning up their cash. They can't afford not to be operational. So they beg, they borrow, and they steal. They find some space somehow, somewhere, and then they go ahead and get this built.

Next problem, of course, you've got to find a building owner willing and able to fund those improvements -- willing and able. You've got to get a guy who believes in biotechnology. This is where my experience in the development field comes in. We didn't encourage companies like that in our buildings. We thought, mistakenly, that they were not stable. We were dead wrong, as the Ernst and Young study shows. Very few of these companies go under, but we didn't know that then. And the biotech industry hasn't done a good enough job of telling the world what it does.

We also thought -- as I said, I think this is the most important thing -- that these spaces were unique to each company, and we thought that if we built for one, another one couldn't use the space. I think that's probably the most important thing I've learned in the last year and a half -- is that these spaces have value for other people. You heard Peter Schied say that he took his space. As I said, Medarex, the other company, took space. If these spaces were not valuable, there would be a lot more on the market, and as I said, there are virtually none there now.

But even if you convince a developer that he should put his money in, his banker probably won't let him do so, and with a lot of good reason. I don't need to tell you why banks are reluctant to lend. This gets back to the question of guarantees. I think maybe one of the most encouraging things I heard you say was to ask Caren Franzini if she needs some support, to ask for it. Because if the State were able to do moral obligation guarantees so that companies who are able to find the money, but who are unable to provide the guarantees could look to the State, it would be an enormous help.

The State will not lose money, because as I said, and someone else used the phase, these are fixed assets. This isn't money that gets poured down the drain. This is money that gets put into facilities. Those facilities can be used

again by somebody else if the company is one of those statistically improbable ones and goes out of business. The space can be used again.

So let me finish up, and do as everyone else has done and make a couple of suggestions to the State. I'd like some of the same things. I'd like there to be a single place that one could go for information. I recently found out, as a result of my being at the last Task Force meeting, that the State does have a single source for getting questions on permits. I've had some very good results as a result of my coming to the Task Force meeting. Again, I wasn't aware of that until I came there.

The other thing is that we talked about the real estate before. There is no single source, unfortunately, in New Jersey. There is no multiple listing service. There is no way of getting the information. I'd like to see that information not only coming from the State, but there be as well, a way that someone who needed something that was not specifically just real estate--

An example of that, something that happened to me the other day: I took a client over to see the space of a company that is having some trouble, and the space is on the market. They were talking about use of animal rooms, which is what they needed. Well, they couldn't do a deal in animal rooms, because the one company needed this room. On the other hand, it had excess capacity, and in front of my eyes they struck a deal where the one company would do the work for the other. They needed me as a real estate person to bring them together. At this point, they shouldn't have had to. They should have had a way to talk to each other.

Let me go back and say that the idea of incubators, I think, is a critical one. I want to say that the State has put some support behind incubators; that I would like to be on record as saying, "They have very little value as currently in

New Jersey State Library

existence." I had to find some incubator space recently for a client, and I called the Stevens Incubator, NJIT, and Rutgers. Stevens and NJIT have no wet labs in their incubators at all. I was told by the -- let me make sure I get this right -- by NJIT that because the company I was representing was already in existence and just needed some temporary lab space to get them through from the time they were a small company to a bigger company, they didn't even qualify. He didn't want them in the incubator under those circumstances.

At Rutgers, there is some lab space. They've been very useful. It's not enough; there needs to be more. The people who start these companies very often come out of the major New Jersey pharmaceutical companies. They don't know where to go to find a lot of things. They could benefit from the help, and I would really like to see the State be more active. I'd love to see the technology centers. In fact, I am going to stay afterwards, because I hope I'm going to hear that some of the technology centers may, in fact, have some space for some companies to grow. My understanding is some, like Envirogen, have in fact started here. I've not been able to find any short-term space for biotechnology companies I've represented. That would be, I think, a very important thing to help.

Last of all, I would most like to see the loan guarantees, so that these companies could get their space built out by having the State behind them; so that they would be able to guarantee banks they would lend them.

The last point I want to make is that they -- these companies -- while they are obviously very interested in conserving cash, are not without the ability to pay good, solid rents for these spaces if they were available. They don't come to you as beggars. They come to you as people with good, solid business plans and the ability to pay for something if only we could get it created.

Thanks.

ASSEMBLYMAN SINGER: Any questions? (no response)

Thank you.

MS. HAUTER: Thank you.

ASSEMBLYMAN SINGER: Dr. Jay Brandinger, Executive Director, Commission on Science and Technology. Doctor, thank you for being patient with us.

J A Y J. B R A N D I N G E R, Ph. D.: Thank you, Mr. Chairman. As you've pointed out, I am the Executive Director of the New Jersey Commission on Science and Technology. In a certain sense, I am not really quite sure whether there is need for my testimony. But I do have formal testimony, and I do want to provide it to you.

In a certain sense, the State has been extremely foresighted in the things that it's done by creating the Commission. Because of the State's investments, we are sitting here today; we are looking at an emerging biotechnology industry. So, in a certain sense, we've done our job -- not completely. But I just wanted to up front start by saying much of what the State has done has been to stimulate why we are here.

The Commission programs have long recognized the potential importance, diversity, and growth opportunities of biotechnology in the State's economy. During the last eight years, the Commission, with its directed instruments, has provided, along with private and Federal organizations, operating and capital support for biotechnology research and infrastructure totaling more than a quarter of a billion dollars. Companies that have received support from these programs include: Enzon, Interferon Sciences, Cytogen, Protos, Medarex, Envirogen, Ethicon, Tricon Associates, and EniChem, just to name a few.

These programs have been focused at Rutgers University and the University of Medicine and Dentistry of New Jersey,

which jointly administer our flagship Advanced Technology Center for Advanced Biotechnology and Medicine. In addition, the Commission has provided capital support to the highly successful molecular biology program at Princeton University, under the direction of a world-renowned scientist, Dr. Arnold Levine.

In your package, you have at the back end a series of attachments, and I will be referring to them.

In Attachment 1A are highlighted the various academic industry collaborations facilitated by State investments in infrastructure. Large pharmaceutical, chemical, and food processing companies make significant, strategic investments in biotechnology, and are also a rich source of entrepreneurial talents and spin-off activities. It is not by accident that Merck, Bristol-Myers Squibb, Sandoz, Hoffmann-La Roche, Johnson & Johnson, Schering-Plough, Hoechst Pharmaceuticals, American Cyanamid, and Janssen are here in the State of New Jersey, expanding their R&D facilities, and maintaining close association with our centers.

One of the things that was mentioned previously was the need to access the business-oriented parts of the pharmaceutical companies. I'd like to point out that Dr. Roy Vagelos, Chairman and CEO of Merck, is the Chairman of the Scientific Advisory Board of our Center for Advanced Biotechnology and Medicine. Many of the companies named are represented on the Board. Dr. Gramlich, President of American Cyanamid's R&D, played an important part in the formation of the Agricultural Biotechnology Center, helped recruit Dr. Peter Day, who is here today -- its Director from England -- and continues to be on the Ag Biotech Advisory Board.

Many of these large companies are listed in the resumes of key researchers and managers of new biotechnology companies in New Jersey.

Attachment 1B compares Merck & Co., a pharmaceutical company, with the cumulative picture for small U.S. biotechnology firms in 1992. This was reported by Ernst and Young. What is not shown is the 17 percent sales and 23 percent job growth these small biotechnology companies have had between 1991 and 1992. It should come as no surprise that according to The New York Times, January 1992, in an article entitled "Biotechnology Companies Find a Home in the State," we were ranked number two behind California and just ahead of Massachusetts.

In Attachment 1C, Ernst and Young have provided the regional distribution of biotechnology firms. As usual, New Jersey data are mixed with both New York and Philadelphia. When separated and aggregated, we have 179 companies, clearly establishing our region's number-two ranking. Moreover, if one considers data collected by the New Jersey R&D Council, in 1991 for both R&D dollars invested and sales revenue generated by biotechnology related products, processes, and services, New Jersey ranks number one.

While much of the Task Force testimony has focused on human health applications, the Commission's view of biotechnology is broader, covering not only biotechnology and medicine, but also agricultural molecular biology and advanced food technologies.

Attachment 1D shows the relative distribution of companies by focal area, with most biotechnology companies developing therapeutics. Yes, we believe that biotechnology is important to New Jersey, so much so that 40 percent of our total Commission's grant budget is focused on biotechnology applications. For every one dollar the State invests, there are an additional two dollars invested by industry and the Federal government.

Attachment 1E shows a pie chart distribution of the Commission's support by technical thrust area. From the Commission's perspective, given the number and strength of the

State's large pharmaceutical firms, the focus is not so much on attracting biotechnology companies, but rather the creation of an environment conducive to the growth and ultimate profitability of such new companies. To illustrate, consider Attachment 1F, which lists some of the key New Jersey industry collaborations with the Center for Advanced Biotechnology and Medicine.

I'd like to return for a moment to Attachment 1E to highlight that the Commission maintains three other thrust fields in advanced materials, environmental technologies, and information technologies. Both the material and environmental fields have overlapped with biotechnology in remediation, pollution prevention, and greening of manufacturing processes, which is a priority of both State and Federal governments. In addition, information technologies are the key to the delivery of affordable health care without the mountains of paper it takes today.

Now that I hopefully have piqued your curiosity, I would like to spend a few minutes describing our programs and resources available to biotechnology start-ups and growth companies. Through two State bond issues in 1984 and 1988, capital support has been provided for the construction and equipping of three major biotechnology facilities. These facilities collectively cost $125 million, of which $40 million was provided by the State, and $85 million was provided by other nonstate sources. These three facilities are: the Center for Advanced Biotechnology and Medicine, that is sometimes abbreviated CABM; the Lewis Thomas Molecular Biology Laboratory at Princeton University; and the Center for Agricultural Molecular Biology at Rutgers Cook College in New Brunswick.

These capital investments have added more than 300,000 square feet of well-equipped, state-of-the-art biotechnology facilities, and serve to attract talented scientists to our

institutions. I've already mentioned Dr. Arnold Levine, who heads the Princeton Molecular Biology Department. But there is also Dr. Jo Messing, as Director of the Waksman Institute; Dr. Aaron Shatkin and Dr. James Siebold, as Directors of CABM and the Clinical Research Centers respectively, and their talented staffs.

This building of biotechnology infrastructure with bricks and mortar and world-class scientists provides the basis for enduring academic/industrial collaborations, a prerequisite for partnering and successful technology transfer -- a major Commission goal. Our ATCs have both formal and informal mechanisms to accomplish bidirectional technology transfer, including seminars, papers, short courses, and consortia, all overseen by industrial members.

Direct interchange is available by having students and faculty work on-site in industry, as well as the provision for visiting industrial scientists to work at our centers. While our Asian and European friends often take advantage of this opportunity, most domestic companies do not. This is an important area for further discussion, since it can provide access to resources that small- and medium-sized companies cannot afford.

Consider, for example, CABM can provide access to the Cell and Cell Products Facility at the Rutgers Waksman Institute and the Clinical Research Center at Robert Woods Johnson University Hospital in New Brusnwick. In addition, CABM has other capabilities which it can make available to small companies, including equipment and expertise in DNA synthesis, protein microsequencing, monoclonal antibody production, cell sortation, and biomolecular computation.

For our part, the Commission has increased the focus on technology transfer by shifting 10 percent of the ATCs -- that's our Advanced Technology Centers' grants budget -- into a Technology Transfer Merit Program that competitively awards

Centers' collaborations with individual New Jersey companies. We have reinstituted the Innovation Partnership Grants Program, which links individual faculty members and their industrial counterparts on common projects. This program permits New Jersey companies to apply in-kind services and contributions to access essential R&D academic institutions.

Attachment 2 details recent TTMP and IP awards, highlighting in yellow those related to biotechnology. I can use this for two purposes. Somebody -- and I don't remember the gentleman's name -- said he wishes that there was a publication where you could get some information about what's going on. I present to you an attachment to one of our quarterly reports. It happens to be September 1993, and the first item on this report says, "A new test for Lyme disease emerges from New Jersey's high-tech efforts. The State will fund public/private test and development efforts." This is a program that ties work being done at CABM and Cytogen -- a start-up biotechnology company in the State.

I would also point out that there are other things which are included, which may be of some interest not only to other small companies in New Jersey, but particularly for biotechnology companies interested in venture. There is a New Jersey First Venture Fair on October 13, 1993, in the Meadowlands--

ASSEMBLYMAN SINGER: Doctor, just one thing.

DR. BRANDINGER: Pardon me?

ASSEMBLYMAN SINGER: Who gets this?

DR. BRANDINGER: This is sent very widely throughout the State. It is sent-- We have a very -- I think about a 2000--

Joe, what's the distribution?

UNIDENTIFIED SPEAKER FROM AUDIENCE: (no microphone) For synaptic gases, the gentleman was -- that represents Synaptic Pharmaceutical. They get the--

ASSEMBLYMAN SINGER: But Enzon doesn't get it.

UNIDENTIFIED SPEAKER FROM AUDIENCE: I believe Enzon is on the mailing list. We've got approximately 3000 entries on our mailing list. We are on--

ASSEMBLYMAN SINGER: Let me share one thing with you. The president doesn't see it. I don't know if the executive vice president sees it. I'm only saying to you that this is what we are trying to talk about in business. If it's just sent there in the general mailing to a firm -- for a large firm -- it never gets to the right person just because--

DR. BRANDINGER: It is not just sent to large firms. It is sent to as many of the companies in the State of New Jersey as we can find that have interest in the things that we do. It includes all of the companies, for example, that are associated with our Advanced Technology Centers, Technology Extension Centers, and those that apply for venture funds that we have. What we call venture funds are vouchers that these small companies can have, in terms of buying services at our institutions.

ASSEMBLYMAN SINGER: I understand that. I'm saying to you, if you send it to Enzon and you don't send it to a specific person there--

DR. BRANDINGER: We will add his name to our distribution list. There is absolutely no problem in doing that. Any other company that wants to find out about it and wants to continue to be on this, it is a free mailing that we supply.

I'd also point out, when we look on page 5 of this publication, which has a special section called, "Venture News," one of the things that we highlight at the bottom is our Technology Help Desk, which is 1-800-4321-TEC. At the beginning of this year, at the recommendation of one of our committees, we had, in fact, jointly sponsored, with the New Jersey Small Business Development Center, a help desk. It is a

single number where you can get information on access to funding, access to technology, and access to business information. Sometimes it's a referral, and sometimes it's direct information given directly over the phone.

We have tried, evidently unsuccessfully, to make this information widely available throughout the State. We would entertain any suggestions that you have to help to make sure that what facilities and capabilities we have are provided.

ASSEMBLYMAN SINGER: By the way, Ira, will you give him your listing of execs that you have?

MR. WEISBERG: I'm sorry, of which?

ASSEMBLYMAN SINGER: Of all the executives you have in the industry.

MR. WEISBERG: Actually, he has that list. We have the same list. The original list that we got was from them.

ASSEMBLYMAN SINGER: Do you mail this list?

DR. BRANDINGER: We provided them the original list for their mailing. So we are using-- What we did was, we went through and picked out the companies that were in the biotechnology area, and provided it to them along with the pharmaceutical companies.

ASSEMBLYMAN SINGER: Again, my concern, Doctor, is not in a negative. I'm not questioning the fact that it's mailed. My question is that in mailings like this, as the important piece it is, I'd like to make sure that the right person sees it.

DR. BRANDINGER: Absolutely, and it would be our objective to accomplish that. Any help that we can get to identify who those people are beyond what we've already done, we are open. That is our job. Our objective is that the people understand what we are doing.

One of the other things that was mentioned was access to SBIR grant programs. One of the things that we maintain in the Commission is, we sponsor a consultant in Washington who is

an access point for all small businesses in the State of New Jersey that want to access this SBIR program. I would just identify that if that is not known to the companies in the biotechnology area, certainly I would recommend that the council also notify their membership of the capabilities that we have to help them in this area. It would be interesting to note that in the SBIR program over the last two fiscal years, there have been more than 100 grants of Phase I and Phase II SBIR moneys flowing back into the State, representing approximately $13 million in each of two years, or $26 million coming back in the SBIR program.

So it is a program that New Jersey ranked relatively high in out of all of the states of the Union, in terms of accessing those grant moneys. If there are small biotechnology companies that need that, please, if you know them, let us know. If Ira knows them, let us know. We will certainly make it clear how to access it, first in terms of the Federal agencies that have the money, and then, in terms of the business plans. In order to make sure that they can access with the proper information to apply, we have the New Jersey Small Business Development Center working with us in that. So I think in that sense, I would say we have built infrastructure, and we have programs in place -- maybe not as well-known as we would like-- But I believe that the State has demonstrated its farsightedness in providing a healthy and nurturing environment to grow new high-technology, biotechnology enterprises.

I've also supplied, for reference, copies of our annual report and biotechnology brochures describing Commission-related initiatives. These documents should give you a sense of the depth and magnitude of our commitment to fill the R&D pipeline in biotechnology related products and processes.

In my concluding remarks, I'd like to leave you with the understanding that our job is really not finished. We also understand, just as you've heard, that there are other

financial and facility needs that the Commission is not best suited to handle. These include seed money, patient sources of capital funds, access to FDA best practices facilities, environmental licenses, clinical facilities for Phase I, Phase II, and Phase III testing, standards, and taxation. In these areas, we are working in some of them with the Department of Commerce and Economic Development, the Economic Development Authority, and the Department of Environmental Protection and Energy. But these are very complex issues that really require industry and public cooperation if we are to achieve tractable solutions.

Mr. Chairman, that concludes my formal remarks, and I'd like to give the Task Force an opportunity to ask any questions about this or any other areas that I could perhaps make some contribution to.

ASSEMBLYMAN SINGER: Doctor, on your Commission, is there anyone from the biotechnology industry on it?

DR. BRANDINGER: We have a health care person on our Board who is a Vice President of Saint Vincent's Hospital, who has knowledge about biotechnology and does have knowledge about health care.

ASSEMBLYMAN SINGER: In other words, there is no one directly on the -- strictly a biotechnology person on it?

DR. BRANDINGER: On the Commission Board itself?

ASSEMBLYMAN SINGER: Right.

DR. BRANDINGER: We do not have specifically a biotechnology company on the Board.

ASSEMBLYMAN SINGER: One concern I have -- and it's not a negative concern -- but one concern I have is, all three of the facilities you talk about are all under the auspices, of course, of the colleges of the State. We see no venture into the profit areas on that. Would that be something the Commission would like to look at? In other words, the incubator-type facility -- we are talking about profit motive away from the university settings.

DR. BRANDINGER: Mr. Chairman, thank you for asking the question. It's a big help for me to say something that-- I'd like to correct an impression that was presented earlier about our facilities. When it was pointed out that, specifically, biotechnology companies may not be able to access our incubators at Stevens and NJIT because there are no wet chemistry facilities available, I would like to point out that Sonokinetics, which is in the biotechnology instrumentation area, was in fact started at the Stevens facility and graduated from the Stevens facility.

In addition, we also don't limit the starting of new companies to the incubators. Envirogen, in fact, received very substantial support from Dr. Day's agricultural biomolecular facilities, and in fact, is a very viable and operating company in Lawrenceville, New Jersey. Then I'd like to point out that at the Rutgers incubator, Affinity Technology is a recent graduate of that. I believe currently, Del View Medical is located there. So it is not that these facilities are perfect for the biotechnology organizations, but it is also true that they do, in fact, have some biotechnology companies.

I'd like to make one additional point, which is in the planning stage. There is a science park that is going into Newark. This is a major undertaking by Newark in redevelopment. As part of that redevelopment, there will be an incubator specifically designed for biotechnology. In fact, moneys have been allocated, in part, by the Economic Recovery Fund for the building of those facilities. It is not that we haven't thought about it; we haven't gotten all of our plans completed yet.

ASSEMBLYMAN SINGER: Thank you.

Any other comments?

DR. ABUCHOWSKI: I suspect that all of the companies that you mentioned are outgrowths of technology from the universities themselves; that started at the university, then incubated at the university. Is that correct?

DR. BRANDINGER: Some are that way, and others have had access to the university. The reason that they are there is because the incubators are in close contact with facilities, which include people and equipment, and have found that very desirable linking-- Often these linkages are occurred by the incubator program, which then ties the professor and the company together. Then if it's appropriate for the incubator, it then fits very nicely, because you have the linkage between the university and the company.

DR. ABUCHOWSKI: But one of the other reasons to have an incubator is to attract other companies that are being developed by biotechnologies elsewhere -- other than just at Rutgers, for example -- attract them to the State and give them the opportunity to grow.

One other question I had: Is there a central clearinghouse for the type of facilities, or equipment, or services that are offered by the university for companies for their own particular use?

DR. BRANDINGER: I don't believe there is a central clearinghouse for it. I believe that from the viewpoint of our Advanced Technology Centers, they know what kinds of equipment that they have. For example, in our quarterly report and in our annual report, we always identify who is the key contact point for each of those facilities. The answer is, if you want to know, call the director and he will, in fact, provide you with that information. But as a central, is there an aggregate of all of the equipment that's available within the university environment that might be useful? I don't believe that exists.

ASSEMBLYMAN SINGER: Doctor, thank you so much, and thank you for being so patient with us.

DR. BRANDINGER Thank you.

ASSEMBLYMAN SINGER: We certainly have not saved-- We certainly have the last group to come up. They are very patient. Dr. Joseph Seneca, Vice President for Academic

Affairs, Rutgers University; Dr. Peter Day, Director, Center for Agricultural Molecular Biology; and Andrew Rudczynski, Associate Vice President for Research and Administration.

Gentlemen, we apologize, for as you know, these hearings always go, unfortunately, not the way we best plan. We thought we were going to get out a little bit earlier. But we do thank you for your patience, and I hate to say-- We probably saved the best for last.

J O S E P H J. S E N E C A, Ph. D.: Mr. Chairman, thank you, and I understand very well how these hearings go. We were at a-- I was at a Board of Higher Education budget hearing this morning. Today is Friday; it's testimony day, so it's the whole day.

What I will do, however, is cut my remarks short. I will not read the testimony. I will read parts of it. The testimony is in your material, along with a whole host of information about what Rutgers does in this area. Dr. Day is with me, a Director of one of our centers that is intimately involved in biotechnology and the transfer of that technology to industry; and Dr. Rudczynski is with me, Associate Vice President of the Research Policy, and can respond to specific questions.

Let me just highlight a few, in the interest of time, and perhaps engage in some dialogue with you, because I think there are some issues that have been brought out throughout the day on the role of the universities and what we can do and we should do in this area.

My name is Joseph Seneca, and I am the University Vice President for Academic Affairs at Rutgers, the State University of New Jersey. I'm a longtime student of the New Jersey economy in various other incarnations. I appreciate very much the opportunity to describe the process of technology transfer at Rutgers, and its application to biotechnology industries. At the outset, let me indicate I strongly applaud the foresight

of this Task Force in identifying and supporting the State's twin efforts in fostering biotechnology research -- obviously, a mission of the University -- and in encouraging subsequent commercialization of that research and the fruition of it in the marketplace.

Last week I participated in a planning discussion of economists and public officials at the Port Authority which examined the future of the region. The keynote speaker, Lester Thurow, of the Massachuetts Institute of Technology and former Dean of the Sloan School there -- the business school -- presented a list of 10 industries that the Japanese government has identified as having high-growth potential, and that are priorities for support by the Japanese government in the 1990s and beyond -- with a goal, I might add, of world dominance in those industries. Biotechnology ranked high on that list.

As the New Jersey economy changes under the unrelenting white heat of global competition, we must support this industry. It is our competitive advantage. In order to keep that in perspective, without that support, without that nurturing, no economic advantage remains constant. You just simply have to witness what has happened in this country over the last decade, and witness the current travails of that once global giant, IBM. This Task Force has seized the right issue at the right time and in the right place.

At Rutgers, corporate liaison are what we call our outreach activities to industry and technology. The process of introducing and commercializing our research findings has long been a part of our mission. In 1939, a member of the faculty of Rutgers College of Agriculture entered into a formal agreement with a company in Rahway to study the production of soil bacteria by antimicrobial substances. The faculty member was Selman Waksman, the company was Merck, and within four years of their agreement, the antibiotic streptomycin was discovered.

Streptomycin, the conqueror of tuberculosis, was patented and commercialized by Rutgers. Since that time, Rutgers has received $16 million in royalties on the antibiotics discovered in Professor Waksman's laboratories. This money was used in part to build and endow the Waksman Institute on our campus, which continues to be closely involved in biotechnological research, and remains a source of promising inventions related to agriculture, medicine, and biotechnology. Professor Waksman received the 1952 Nobel Prize for his studies of antibiotics, and it is important for us to remember with pride that Professor Waksman, Rutgers University, and New Jersey were pioneers in technology transfer. This academic year, Rutgers will observe the 50th anniversary of the discovery of streptomycin with a joint industry/University event.

About ten years ago a Rutgers professor, Dr. Frank Davis, started a biotechnology company based on an invention resulting from research he and others performed at the University. Today that company, Enzon, employs over 200 people, and is represented on your Task Force by Dr. Abuchowski, himself a former graduate student of Dr. Davis. More recently, small New Jersey biotechnology companies such as Envirogen, Affinity Technologies, Cytogen, Liposome, and Phytotech are interacting with the University in a wide variety of ways, often utilizing technologies developed at Rutgers.

The University, by fulfilling its mission of research and teaching in public service, also helped small and established biotechnology stay competitive; a theme you've heard many times today. We produce labor force, and we produce students. It is that asset that has become really the key competitive advantage that you've heard throughout the testimony today.

Let me skip over to get down to some of the specifics you asked for in the questions you provided me.

In 1993, Rutgers concluded over 160 industrial research agreements with a total value of $11 million. A recent highlight of these contract negotiations is a research agreement with Sintong Chemical Industrial Corporation of the Republic of China, which provides $5 million over five years in support of studies to be supervised by Professor Chien, of our College of Pharmacy. The agreement includes funds for students, its support, as well as faculty research. The research objectives include the design and development of a miniaturized electrotherapeutic system for delivering insulin to diabetics, and the formulation and fabrication of a transdermal contraceptive device. This contract is greater than any past single award to Rutgers from industry in support of the research program of an individual investigator.

Rutgers is also concerned with the development of its intellectual property. The condition of employment required by Rutgers requires faculty members to disclose and assign to the University any ideas that may be sufficiently novel and useful to patent. Rutgers uses a Faculty Patent Committee to help with the evaluation of disclosures, and licensing associates from Dr. Rudczynski's office have a network of industrial connections that assist us in determining whether or not to patent and market a Rutgers invention.

Patents are not difficult to generate if you can afford the legal fees. A United States patent costs between $10,000 and $15,000, and foreign patents can cost many times that amount. Patent costs at that rate will make us poor very rapidly unless they are commercialized. Rutgers licenses companies to produce and market its patented products and processes in return for fees and royalties.

In 1993 -- again, information you requested -- the number of new inventions disclosed to the University peaked at 67 that year. The University processed 33 patent applications and had 15 patents issued. In 1992, Rutgers ranked 14th among

158 universities in terms of the number of patents issued. Rutgers now has a total of about 215 patents and patent applications, of about approximately 40 percent are in biotechnology. The University has issued over 80 licenses to companies to commercialize its patented products and processes, and realized a return on its licensed inventions of about $2.5 million in royalties in 1993 alone.

I'd like to stop there, have Peter Day give you some interesting applications from his own particular Center, and then ask Dr. Rudcyznki to respond to some questions you had concerning our corporate liaison and technology transfer activities.

Peter.

P E T E R R. D A Y, Ph. D.: Thank you, Dr. Seneca.

I'm Peter Day, the Director of the Center for Agricultural Molecular Biology at Rutgers. I just want to mention very briefly some points that are listed in this green folder that I think are being-- The folders are being distributed.

There was some mention of our involvement with Envirogen, which was a start-up company that, in fact, came to us. It wasn't generated at Rutgers. By a curious circumstance the Ag Biotech Center was in space that it didn't fully occupy at the time. We're now bursting at the seams waiting to go into a new building that is under construction. At that time, however, we were able, through the University, to rent some space to Envirogen, which enabled them to start from about 11 scientists working with us then, to about 85 now. That was an extremely valuable connection for us, because it enabled us to recruit an exceptionally able scientist who Envirogen wanted to recruit, and who didn't want to work for industry. He wanted to work with -- in association with them, but from a university base.

This year we generated a new spin-off company to exploit the use of plants in bioremediation of heavy metal contamination in soils and water. This is a very difficult technology by conventional methods, by using plants to accumulate these materials. We think we have some very interesting new technologies to develop. Two patents have been filed, venture capitalists are interested in assisting us, and the company has been established.

Another important development was in South Jersey with the aid of bond issue funding to extend Rutgers Research and Development Center -- Vegetable Research and Development Center. In Upper Deerfield, we have testing facilities that have enabled us to offer industry the opportunity to test genetically engineered organisms in the environment. Cyanamid has conducted three field -- two field trials, and only last week we met with the Citizens Advisory Committee to consider a third field trial that will involve the release of a genetically engineered virus to control insect pests of crop plants.

There are many other instances I could mention, but you know, just coming to a meeting like this generates ideas. Mr. Schied was talking about his interest in new methods of transmitting or introducing drugs. We have a patent pending for an RNA packaging technology, and we have just realized -- prior to today, of course -- that this RNA packaging technology provides a method of introducing messenger RNAs that code for toxins, which may well provide use of a plant virus with some applications in biomedicine. This is the interesting feature about biotechnology, although our applications are primarily with plants, they have much broader applications.

Thank you, Mr. Chairman.

ASSEMBLYMAN SINGER: First of all, thank you all for coming.

Are you going to make a presentation?

A N D R E W B. R U D C Z Y N S K I, Ph. D. : I just wanted to add and echo some of the comments that have been made already. One of the things I'd like to emphasize is that Rutgers is very much interested in working with industry, developing its technologies, and enhancing the ability of faculty and the industrial scientists who carry on research. I think those-- The research that is done at that interface presents some interesting problems for students in many cases. I think that is one of the things that we are very cognizant of, and we put one of our great focuses on -- is to have -- is to train students in appropriate technologies that will become useful to the biotech industry in the State of New Jersey.

The other thing I'd like to emphasize and to reiterate is that the technologies that are developed at the universities are usually at the very, very earlier stages, insomuch that they need to be further developed. Technology transfer doesn't always take place through the more traditional means, such as licensing or technology or the patenting, but it can happen through what I call "elbow-to-elbow tech transfer," whereby one encourages corporate scientists to work in conjunction -- side by side, for example -- with university investigators. That happens at many of our technology -- advanced technology centers, but in other ways also through visiting scientist programs and so forth.

So I'd like to stop there, and I think that I'll take some questions at this point. Thank you.

ASSEMBLYMAN SINGER: First of all, I'd like to thank you all for coming. Dr. Day had the pleasure of being our guest to talk to us for a while about what's going on with his particular group, and we were quite impressed with that.

We have not-- Certainly, I haven't meant to shortchange what has been done at Rutgers, what the Commission has done, and other universities. We've just found through -- from talking with the industry that to some extent they feel

they've been left out a little bit. They're coming in-- I think it was well-said by one of the speakers before. Many of them come in with a scientific background, and with on-the-job training learn to be businessmen. To some extent, in some of the areas they don't feel that their business technology is being used in conjunction with everything else that is happening. They have some specific needs to do that, and those are some of their concerns.

We are trying to find a happy partnership. I am very, very enthusiastic that what we are doing at Rutgers; what more can be done at Princeton that is not being done -- we've talked about that also; that maybe they have not been enough involved in what's happening in the New Jersey biotech industry -- that we can continue being the hub of biotechnology for the country. With the downsizing -- or the new technology today terminology is rightsizing -- of the pharmaceutical industry, we are seeing people in the field that are out of work right now in New Jersey, or will be out of work within the next several years. If we don't meet that need by New Jersey bringing new companies and expanding biotechnology companies, those individuals will leave New Jersey and look for work outside the State.

One of the greatest assets we have is, because of the pharmaceutical giants here, we have the expertise right here in our State which makes entrepreneurs want to come to New Jersey and help develop their products here, because they can get the help they need. Once we lose that extra edge, we're going to find that we are not going to see that there are only three companies in Rhode Island -- two companies -- we are going to see 20 companies. So there are some things that we are going to have to do to push the industry forward a little bit from both State efforts and working with the universities on that. For whoever wants to add to that, or--

DR. ABUCHOWSKI: Yes, I'd just like to say something and then-- As you know, I spent, I guess, 16 years at Rutgers University: minimum undergrad, grad, postdoc, everything there was to do, I did at Rutgers University, including this -- getting Enzon out of it. I think the University has an awful lot to offer, and as Enzon, we have used and still continue to use a lot of the facilities at the University. However, I think that what is available in terms of technology and transfer in contracted research-- There should also be contract services available to the industry, either renting some of the equipment-- What happens is, it's not--

The industry doesn't always know what's available, and that is a criticism. Even for us sometimes, when we want to use something at Rutgers, we really have to go in and dig, see what's available, and find people that we may know within the University to lead us to something, as opposed to going someplace where we can say, "We need X, Y, and Z. Can you help us out? Direct us somewhere within the University?" That doesn't seem to exist, or at least we haven't found it.

So I think that you have a lot more to offer than you are really using, and I would just encourage you to be more of a facilitator to the industry, to allow use of the facilities.

DR. RUDCZYNSKI: I might respond to that by saying that we do have an Office of Corporate Liaison and Technology Transfer whose role is precisely to do that. If you are having troubles-- We get new equipment. That is part of the research that's going on at the University -- is to get the leading edge. So, therefore, new equipment is often purchased, and not everybody-- It's a complex institution. Not everyone knows all of the equipment that is in place. However, certainly that Office -- or you can contact me directly -- will know many of the people who may have a certain piece of equipment, know a technology, or have an interest in the kinds of things that you are doing. So I would encourage you to do that.

One of the things that that Office is responsible for is to encourage scientists to come to the University, as well as to have our scientists go outside and work on collaborative projects, which I think is an effective way of transferring technology, as well as training the students. That's one of our prime missions, obviously.

DR. ABUCHOWSKI: We have used those. We've had, actually, our scientists based at the University and vice versa. I'm just-- I'm not sure how well it is known. That's my point.

DR. SENECA: Well, we're very aggressive in corporate liaison and in involving companies on campus. You heard Dr. Ramseier, with the Advisory Board, on the ATCs. We just signed an agreement with Hoechst Selanese for three years -- $1 million over the three years for graduate student training. Their scientists come here; our scientists go to their labs -- a series of colloquia very much involved in the interface of basic science transfer of knowledge between industry and the University.

ASSEMBLYMAN SINGER: Just one last comment. I know the hour is growing late.

We really haven't touched a lot on Dr. Day's area in our research. As I said, mostly it's been involved with the pharmaceutical aspect of biotechnology. We are hoping, besides coming out of the Task Force with several pieces of legislation-- You know, this Task Force fortunately has a limited time to be in existence, because what happens too many times in government, when you make them -- have task forces go on and on and on, nothing ever comes out of it until everyone has forgotten what the purpose has been.

This has a 90-day window. We will be having one more Task Force meeting, and then generate some positive legislation that the Speaker has certainly encouraged us to do, and will be very favorable to it.

I'm hoping the additional thing that will come out of this is that, from the agriculture aspect of it, when I sit with Assemblyman Roberts on the Economic Development Agriculture Committee (sic) for the Assembly, that that Committee will broaden its base to be agricultural and agricultural biotechnology, which will create an interest and a need in that particular field. So I'm also expecting there to be something along with the Health Committee. There will also be medical biotechnology along with that aspect. If we don't do it separately in that aspect, it's just not going to become an active participant in what goes on here in Trenton as much as it would be.

So I'm going to look to do that. Fortunate or unfortunate, I won't be doing it with the Assembly, but I will see that that will possibly be part of the Senate agenda if I am fortunate enough to be there in several weeks. But I think this is going to be the beginning, not the end, and I think this entire arena hopefully will become very active.

DR. SENECA: That would reflect -- and I applaud that -- the priority the University places on this type of work in Dr. Day's area, and the resources we have committed to it.

ASSEMBLYMAN SINGER: Thank you.

DR. RUDCZYNSKI: If I could just add one thing, I think that one has to not just only look at biotechnology as a subject solely in the fields of traditional medicine and molecular biology, but I think that even in areas as dispersed or seemingly unrelated as fiber optics, for example, or clinical processing, or biopolymers-- All of those areas will have an effect on medical devices and various other forms of biotechnology sensing devices.

So I think one has to have a broad perspective as to what biotechnology is. It encompasses biotechnology, agriculture, medicine, and molecular biology, but it also can derive, serendipitously, information from other fields that may not be related.

ASSEMBLYMAN SINGER: Thank you.

That concludes our hearing today. We will be--

When's the next hearing date, Pat, the 16th? (no response)

All right, thank you very much.

(MEETING CONCLUDED)

APPENDIX

TESTIMONY PRESENTED TO THE NEW JERSEY LEGISLATURE BIOTECHNOLOGY DEVELOPMENT TASK FORCE

By Edward Ehrenberg
Executive Vice President,
Business Operations
Enzon, Inc.

October 8, 1993
Trenton, New Jersey

ENZON, Inc.
Adding time to life®

I am Ed Ehrenberg, Executive Vice President, Business Operations and acting Chief Financial Officer (CFO) of Enzon, Inc. Enzon is a biotechnology company developing advanced therapeutics for life-threatening diseases through the application of its proprietary technologies, PEGNOLOGY and Single Chain Antigen-Binding (SCA) proteins. The Company's drug development focuses on genetic diseases, cancer therapy and blood substitutes. The Company also pursues commercialization of its technologies through strategic alliances. Enzon is headquartered in Piscataway, NJ.

At Enzon I am responsible for overseeing a budget of $35 Million annually for a company of 205 employees. As the CFO of an emerging, developmental stage, public company, one of my primary responsibilities is securing adequate financing for operating functions and further research & development.

I appreciate the opportunity to speak to you today on the subject of biotechnology development. I believe that biotechnology holds substantial potential for economic development in New Jersey. Other states, including our immediate neighbors, and other countries are aggressively competing for the same technologies and Enzon is actively being solicited to consider relocating its facilities. Many of these states have already invested significant funds to promote economic development, and are offering public sector incentives to attract emerging industries.

If New Jersey is to remain competitive, I believe that its leaders, in both the private and public sectors, should take the initiative to identify and foster those technologies and industries, such as biotechnology, that hold the greatest potential to take advantage of New Jersey's natural strengths. A comprehensive plan can be implemented to encourage the establishment and growth of these industries.

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I would like to highlight some of the challenges biotechnology firms are facing in today's environment. To set the stage, I shall begin by describing some of the reasons why the State of New Jersey should value biotechnology and why a biotechnology company should value the opportunities offered by the State. Although there are natural synergies between the State of New Jersey and the biotechnology industry, all has not been smooth sailing.

The State of New Jersey has been the center of the pharmaceutical industry in the United States and, some would argue, the world. The foundation that has been developed by the major pharmaceutical companies in New Jersey is a natural stepping stone for the biotechnology industry. However, merely capitalizing on the base the pharmaceutical companies have already established will not be enough to bring the New Jersey biotechnology industry to the forefront. Action is also required from the State to attract new biotechnology companies and keep those currently headquartered in New Jersey.

One of the greatest challenges facing the biotechnology industry is securing adequate financing for products that require many years and millions of dollars to develop. Given the fact that the United States' capital market for biotechnology collapsed this year and is not expected to recover soon, biotechnology companies are being forced to seek alternative forms of financing or severely cut expenditures. New Jersey companies have certainly felt the crunch and are actively exploring other sources of funding. Corporate strategic alliances, funding in the foreign capital markets and financial assistance packages offered by individual states are all being considered.

An investment in the drug development activities of New Jersey companies today will realize thousands of jobs and millions in revenues in the near term. I am proposing that the State of New Jersey consider specific recommendations that could help develop this industry into an engine of economic growth for the State.

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Why Should New Jersey Value Biotechnology Firms?

- "High Tech" growth industry
- Creation of high skilled jobs
- Strong ties with the New Jersey pharmaceutical industry and academia
- Environmentally clean industry

Enzon, Inc.

Why Should New Jersey Value Biotechnology Firms?

Creation of High Skilled Jobs

	What if...	Number of Employees
Today	15 companies average 200 employees	3,000
Tomorrow	Today's companies become tomorrow's leaders:	
	15 companies average 2,000 employees	30,000
Future	New Jersey draws 10 new companies:	
	10 companies average 2,000 employees	20,000
	Total Potential Employment in 25 firms	50,000
	Derivative Employment (3 times)	150,000
	Total Potential Employment	200,000

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Why Should Biotechnology Firms Value New Jersey?

- Proximity to major pharmaceutical and biotechnology companies
- Availability of skilled labor pool
- Exposure to new technology via Center for Advanced Biotechnology and Medicine and New Jersey Universities
- Proximity to capital markets
- Established business infrastructure
- Quality of life

Challenge To New Jersey

- Become competitive with what other states have to offer

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Why Should Biotechnology Firms Value New Jersey?

New Jersey Ranks #3 in Biotechnology and #1 in Pharmaceuticals

Number of Biotechnology Companies*		Number of Pharmaceutical Companies**	
California	34	New Jersey	14
Massachusetts	22	New York	5
New Jersey	14	California	2
New York	5	Massachusetts	0
All Other	25	All Other	29
	100		50

* Based on "Top 100 Biotechnology Companies" (Public Companies) - Med Ad News 7/93.

** Based on "Top 50 Healthcare Companies" - Med Ad News 9/92

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Why Should Biotechnology Firms Value New Jersey?

14 Biotechnology Firms Opting for New Jersey

- Alteon Inc., Northvale
- Biomatrix Inc., Ridgefield
- Bio-Technology General, Metro Park
- Celgene Corporation, Warren
- Cistron Biotechnology Inc., Pine Brook
- Cytogen Corporation, Princeton
- DNX Corporation, Princeton
- Enzon, Inc., Piscataway
- IGI Inc., Buena
- Immunomedics Inc., Morris Plains
- Interferon Sciences Inc., New Brunswick
- The Liposome Company Inc., Princeton
- Medarex Inc., Princeton
- Unigene Laboratories Inc., Fairfield

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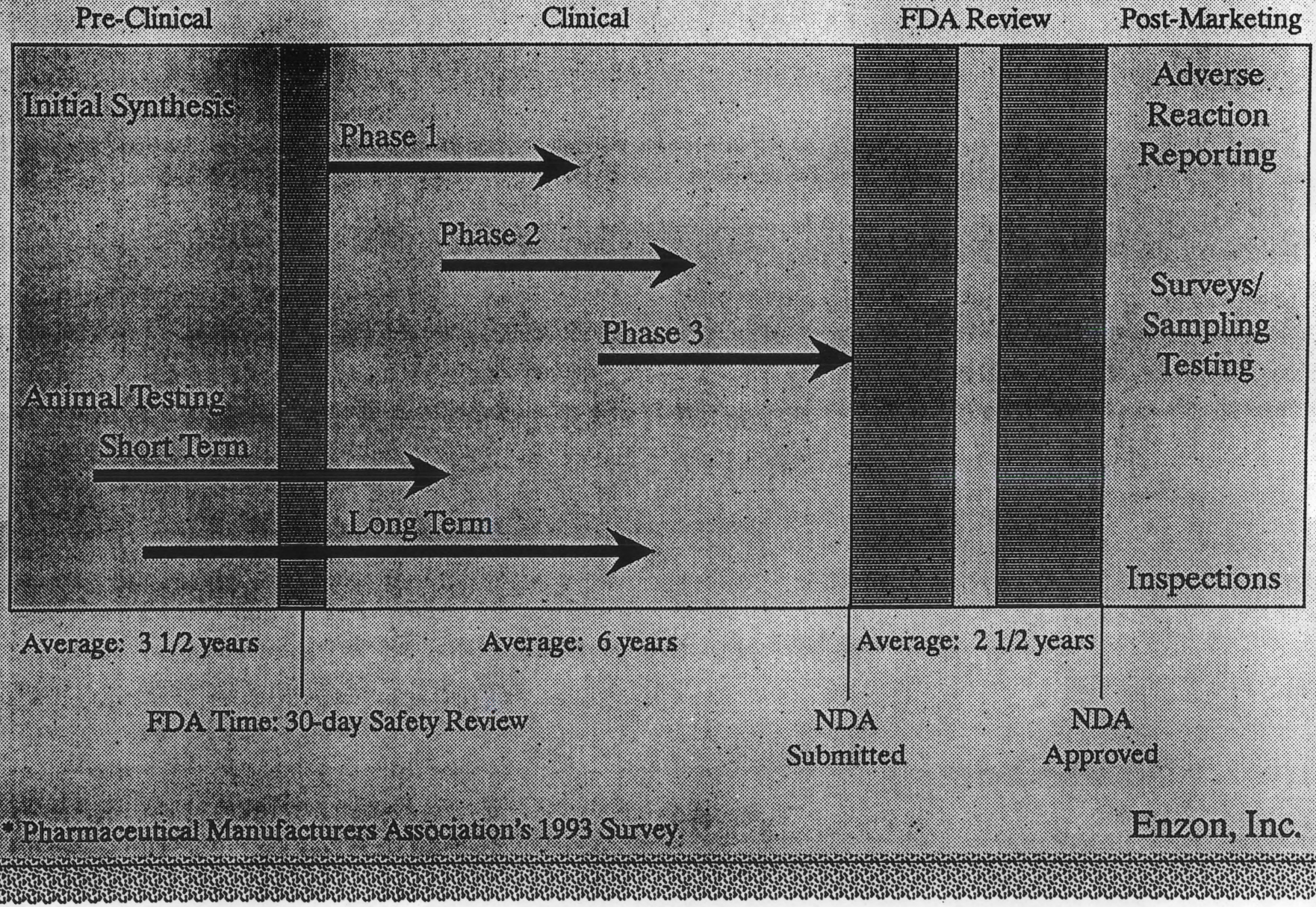
Biotechnology Industry Overview

Characteristics

- Lengthy timetable for drug development
  - U.S. FDA regulations
- Facility needs
  - Federal and state regulations
- External financing requirements
  - Traditionally equity markets
- 1993 financial crunch
  - New Jersey companies are hit

Biotechnology Industry Overview
Timetable for New Drug Development (average 12 years)*



* Pharmaceutical Manufacturers Association's 1993 Survey.

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Biotechnology Industry Overview

Facility Needs of a Biotechnology Firm

Phase of Development	Activity	Facility
Pre-Clinical	Evaluate potential drug candidates	Laboratory space (Wet/Dry)
	Conduct animal studies	Animal facilities
Clinical	Conduct clinical trials	Laboratory to analyze samples
	Scale-up manufacturing	Pilot plant to produce clinical supplies (fermentation, purification and liquid filling)
Post-Marketing	Sell drug upon FDA approval	Manufacturing facilities (fermentation, purification and liquid filling)

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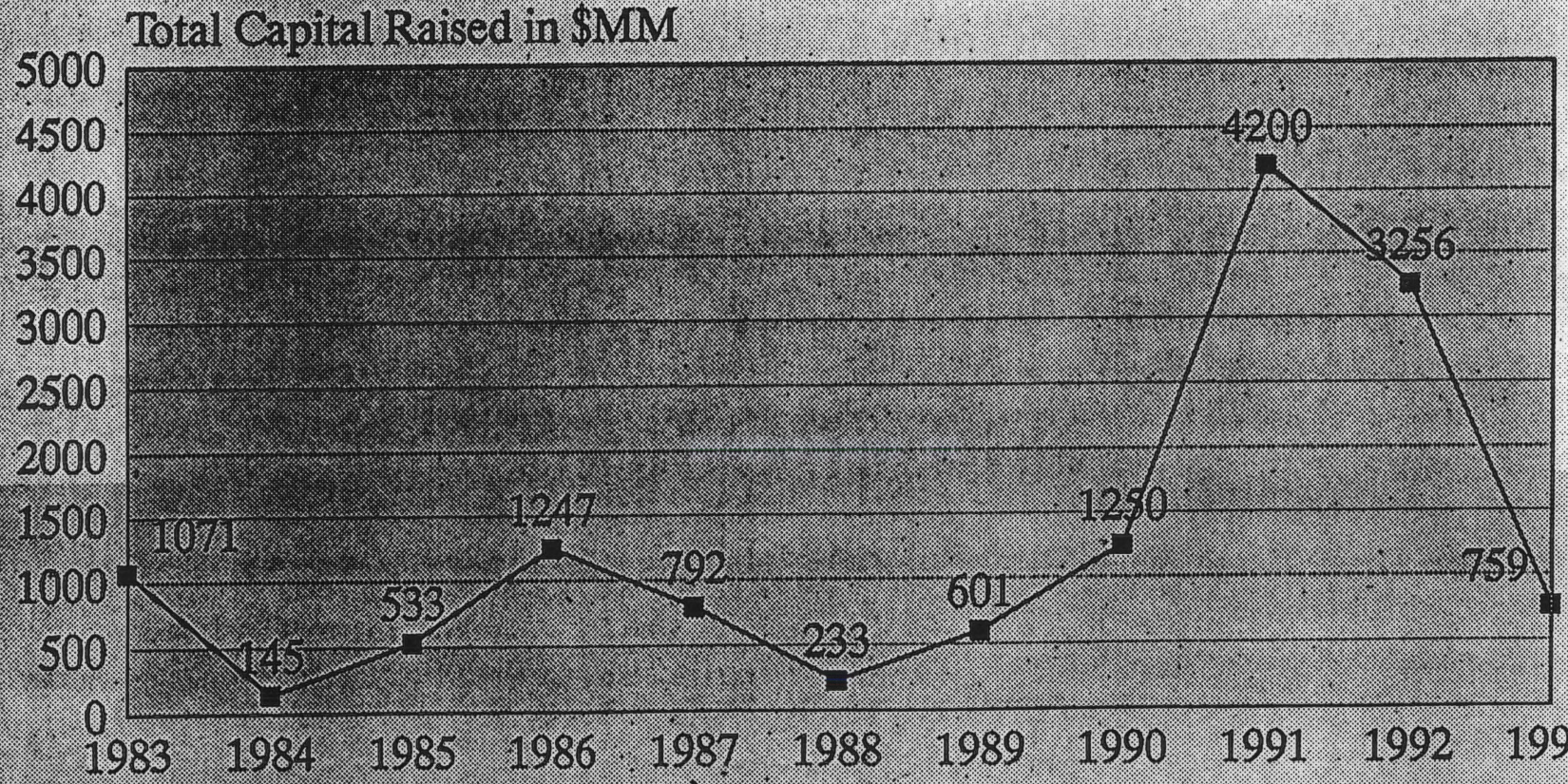
Biotechnology Industry Overview

Total Offerings

(1/1/83 - 6/30/93)



Source - Biotechnology Industry Organization 9/93

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Biotechnology Industry Overview

Profitable Companies

Investment Requirements and Job Creation

Company	# Employees 1992	Years Operation Until Breakeven	External Financing Raised to Reach Breakeven (Millions)
Amgen, CA	2,335	10 years	$ 384
Genentech, CA	2,331	11 years	$ 878
Genzyme, MA	1,486	10 years	$ 392
Biogen, MA	339	11 years	$ 242
Vestar, CA	148	11 years	$ 105
Average		11 years	$ 400

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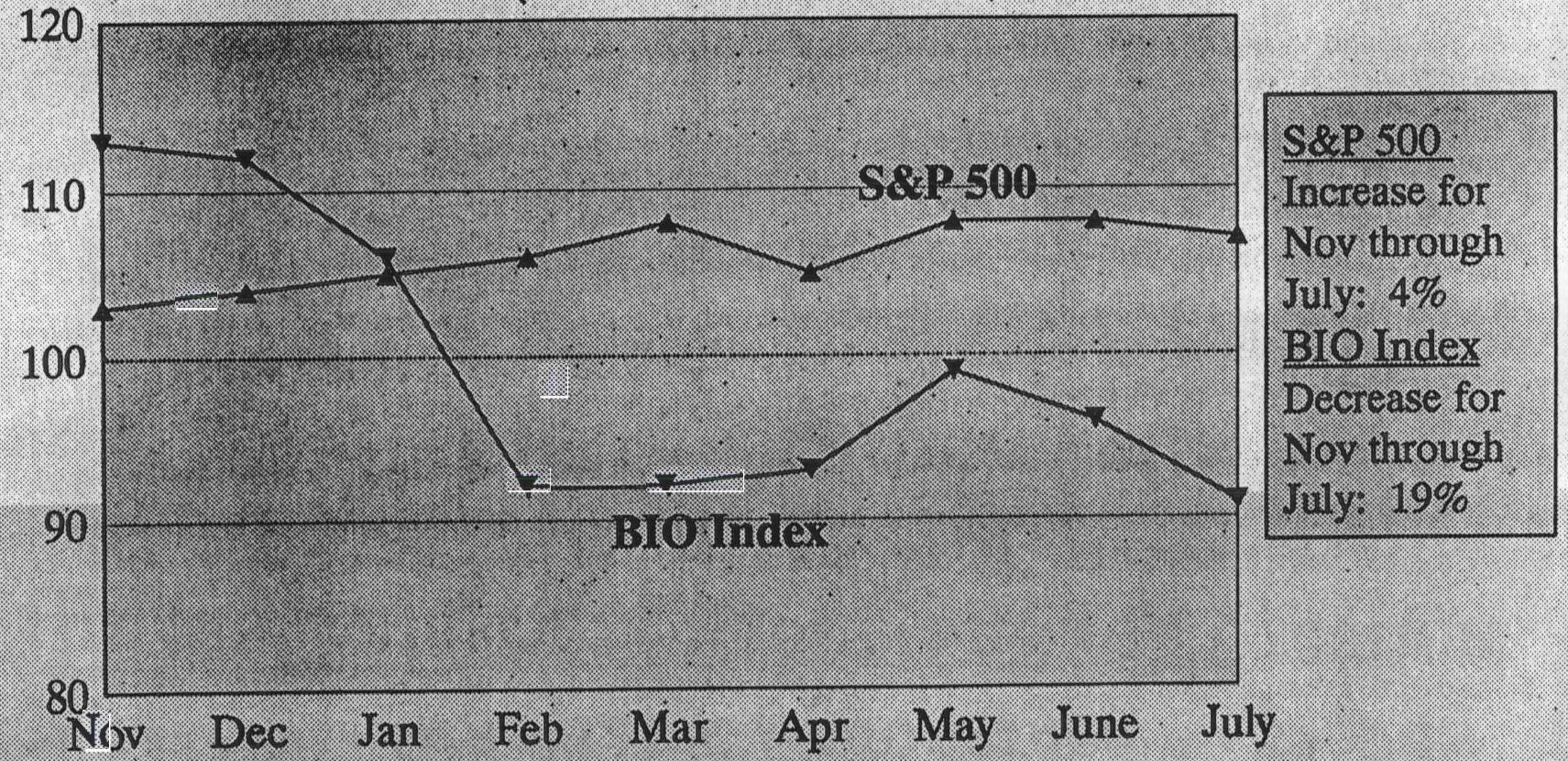
Biotechnology Industry Overview

BIO Index vs. S&P 500

(11/92 through 7/93)



*The S&P 500 and the BIO Index equal 100, starting from October 1992.

Source - Biotechnology Industry Organization 9/93

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Biotechnology Industry Overview

The 1993 Financial Crunch Hits New Jersey Firms

- Enzon cuts staff by 46 (18%)
- Cytogen cuts staff by 58 (28%) in September
- DNX will terminate its blood substitute program and significantly reduce its workforce

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151

What Can New Jersey Do?

Examples of What Other States Offer

- Financial Inducements:
  - The State of Rhode Island is providing 100% moral obligation backing of bonds
  - Rhode Island Port Authority raised $30 million for Alpha-Beta Technologies (MA)
  - The States of California and Wisconsin are investing in biotechnology firms through their pension funds
- Provide Needed Facilities:
  - The State of Massachusetts created a biotechnology research park in Worchester. BASF is constructing a biotechnology research center there.
  - The Maryland legislature has authorized state funding for a bioprocessing manufacturing facility for small companies to share

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What Can New Jersey Do?

Recommendations

I. Meet competitive market conditions by:
   - Improving bond backing
   - Creating loan pools for emerging companies
   - Making flexible lending rules
   - Offering grants for clinical studies conducted at New Jersey hospitals
   - Fostering cooperation between universities, pharmaceutical companies and venture capitalists

II. Organize facilities and services that biotechnology companies can share:
   - Manufacturing facilities for liquid filling, fermentation and purification
   - Incubator laboratory space
   - Animal testing facilities meeting GLP standards
   - Biotechnology research park

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What Can New Jersey Do?

Recommendations (continued)

III. Modify rules to allow the State of New Jersey to invest its pension funds in biotechnology companies

IV. Foster the development of an educated workforce by:
- Promoting math and science in grades K-12
- Awarding biotechnology grants and fellowships

V. Review existing tax structure to provide competitive investment, capital gains, R&D and manufacturing based tax incentives

VI. Monitor the regulations of the Department of Environmental Protection and Energy to ensure balance between public and private needs

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What Can New Jersey Do?

Recommendations (continued)

VII. Facilitate interaction with biotechnology companies, industry organizations, and government authorities to provide companies with information

VIII. Sponsor technology transfer and information exchange through symposia and conferences that bring together biotechnology and pharmaceutical companies as well as research and medical organizations and investors

IX. Establish a permanent Biotechnology Commission to implement the proposed recommendations

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NEW JERSEY COMMISSION ON SCIENCE AND TECHNOLOGY

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New Jersey Commission on Science and Technology

Jay J. Brandinger

Statement
to the
Assembly Biotechnology Task Force

Trenton, New Jersey

October 8, 1993

Good afternoon, Mr. Chairman. My name is Jay J. Brandinger; I am the Executive Director of the Commission on Science and Technology. I appreciate the opportunity to appear before you as you consider the importance of the biotechnology industry to New Jersey and how Commission activities support the technology needs of this emerging industry in research, development and technology transfer.

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Herbert E. Spiegel
Carl E.Van Horn

Jay J. Brandinger
Executive Director

David Hochman
Deputy Director

Commission programs have long recognized the potential importance, diversity and growth opportunities of biotechnology in the state's economy.

During the last eight years Commission directed investments, in concert with private and federal organizations, have provided operating and capital support for biotechnology research and infrastructure, totaling more than a quarter of a billion dollars. Companies that have received support from these programs include: Enzon, Interferon Sciences, Cytogen, Protos, Medarex, Envirogen, Ethicon, Tricon Associates, and EniChem, just to name a few.

These programs have been focused at Rutgers University and the University of Medicine and Dentistry of New Jersey, which jointly administer our flagship Advanced Technology Center for Advanced Biotechnology and Medicine. In addition, the Commission has provided capital support to the highly successful molecular biology program at Princeton University, under the direction of a world-renowned scientist, Dr. Arnold Levine.

In **Attachment 1a**, are highlighted the various academic/industry collaborations facilitated by state investments in infrastructure. Large pharmaceutical, chemical and food processing companies make significant, strategic investments in biotechnology and are also a rich source of entrepreneurial talent and spin off activities.

It is not by accident that Merck, Bristol-Myers Squibb, Sandoz, Hoffman-LaRoche, Johnson & Johnson, Schering-Plough, Hoechst Pharmaceuticals, American Cyanamid and Janssen are here in New Jersey, and expanding their R&D facilities and maintaining close association with our centers. Dr. Roy Vagelos, Chairman and CEO of Merck, is the Chairman of the Scientific Advisory Board of our Center for Advanced Biotechnology and Medicine; many of the companies named are represented on the Board. Dr. Gramlich, President of American Cyanamid's R&D, played an important part in the formation of the Agricultural Biotechnology Center, helped recruit Dr. Peter Day, its Director, from England, and continues on the AgBiotech advisory Board.

Many of these large companies are listed in the resumes of key researchers and managers of new biotechnology companies in New Jersey.

Attachment 1b, compares Merck & Co., a pharmaceutical company with the cumulative picture for small U.S. biotechnology firms in 1992 — as reported by Ernst & Young. What is not shown is the 17% sales and 23% job growth these small biotechnology companies have had between 1991 and 1992.

It should come as no surprise that — according to the New York Times, January 1992, in an article entitled "Biotechnology Companies Find a Home in the State" we were ranked number two behind California and just ahead of Massachusetts.

In **Attachment 1c**, Ernst & Young have provided the regional distribution of biotechnology firms. As usual, New Jersey data are mixed with both New York and Philadelphia. When separated and aggregated, we have 179 companies, clearly establishing our regions number two ranking.

Moreover, if one considers data collected by the New Jersey R&D Council, in 1991 for both R&D dollars invested and sales revenues generated by biotechnology-related products, processes and services, New Jersey ranks number one.

While much of the Task Force testimony has focused on human health applications, the Commission's view of biotechnology is broader covering not only Biotechnology and Medicine but also Agricultural Molecular Biology and Advanced Food Technologies. **Attachment 1d**, shows the relative distribution of companies by focal area, with most biotechnology companies developing therapeutics.

Yes, we believe that biotechnology is important to New Jersey. So much so that forty percent of the total Commission's grant budget is focused on biotechnology applications. For every one dollar the state invests, there are two additional dollars invested by industry and the federal government.

21 x

Attachment 1e shows a pie chart distribution of the Commission's support by technology thrust area.

From the Commission's perspective, given the number and strength of the State's large pharmaceutical firms, the focus is not so much on attracting biotechnology companies, but rather the creation of an environment conducive to the growth and ultimate profitability of such new companies. To illustrate, consider **Attachment 1f**, which lists some of the key New Jersey industry collaborations with the Center for Advanced Biotechnology and Medicine.

I would like to return to **Attachment 1e**, to highlight that the Commission maintains three other thrust fields: in advanced materials, environmental technologies, and information technologies. Both the materials and environmental fields have overlaps with biotechnology in remediation and pollution prevention and greening of manufacturing processes, which is a priority of both state and federal governments. In addition, information technologies are key to the delivery of affordable health care — with out the mountains of paper it takes today.

Now that I hopefully have peaked your curiosity, I would like to spend a few minutes describing our programs and resources available to biotechnology startups and growing companies.

Through two state bond issues in 1984 and 1988, capital support has been provided for the construction and equipping of three major biotechnology facilities. These facilities collectively cost $125 million, of which $40 million was provided by the state and $85 million was provided by other non-state sources. These three facilities are:

The Center for Advanced Biotechnology and Medicine (CABM), jointly managed by Rutgers and UMDNJ in Piscataway. CABM along with the cell fermentation facility at the Waksman Institute and the Clinical Research Center at Robert Woods Johnson University Hospital cost a total of $50 million of which the state contributed $15 million.

The Lewis Thomas Molecular Biology Laboratory at Princeton University. This facility cost a total of $30 million of which the state contributed $5 million, and

The Center for Agricultural Molecular Biology at Rutgers Cook College in New Brunswick. The AgBiotechnolgy Center along with its field trials facility in Upper Deerfield, Cumberland County, cost a total of $45 million of which the state contributed $20 million.

These capital investments have added more than 300,000 square feet of well equipped state-of-the-art biotechnology facilities, and served to attract talented scientists to our institutions: Dr. Arnold Levine to head Princeton's molecular biology department; Dr. Jo Messing as Director of the Waksman Institute; Drs. Aaron Shatkin and James Siebold as Directors of CABM and the Clinical Research Centers respectively and their talented staffs.

This building of biotechnology infrastructure with bricks and mortar and world-class scientists provides the basis for enduring academic-industrial collaborations, a prerequisite for partnering and successful technology transfer, a major Commission goal.

Our ATCs have both formal and informal mechanisms to accomplish bi-directional, technology transfer including: seminars, papers, short courses, and consortia, all overseen by industrial members.

Direct interchange is available by having students and faculty work on-site in industry, as well as the provision for visiting industrial scientists to work at our centers. While our Asian and European friends often take advantage of this opportunity, most domestic companies do not. This is an important area for further discussion, since it can provide access to resources that small and medium-sized company can not afford.

Consider for example: CABM can provide access to the Cell and Cell Products Facility at the Rutgers Waksman Institute and the Clinical Research Center at Robert Woods Johnson University Hospital in New Brunswick. In addition, CABM has other capabilities which it can make available to small companies including: equipment and expertise in DNA synthesis, protein microsequencing, monoclonal antibody production, cell sortation, and biomolecular computation.

For our part, the Commission has increased the focus on technology transfer by shifting 10% of the ATCs' grant budgets into a Technology Transfer Merit Program that competitively awards Center collaborations with individual NJ companies. We have also reinstituted the Innovation Partnership grants program which links individual faculty members and their industrial counterparts on common projects. This program permits NJ companies to apply in-kind services and contributions to access essential R&D at academic institutions.

Attachment 2, details recent TTMP and IP awards, highlighting in yellow those related to biotechnology.

We are continuing to expand our Technology Business Development programs to support small and medium-sized businesses with access to incubators, a one stop information source--Help Desk (1-800-4321-TEC), vouchers to access our Center

resources, support to access the federal SBIR grant program, and bridge loans to reduce the financial problems created by Governmental delays between SBIR Phase I and Phase II awards.

Through these programs, I believe the State has demonstrated its farsightedness in providing a healthy and nurturing environment to grow new high technology and biotechnology enterprises."

Attachment 3, provides copies of our Annual Report and biotechnology brochures describing Commission related initiatives. These documents should provide you with a sense of the depth and magnitude of our commitment to fill the R&D pipeline in biotechnology-related products and processes.

In my concluding remarks, I would like to leave you with the understanding that our job is not finished. We also understand that there are other financial and facility needs that the Commission is not best suited to handle. These include: seed money, patient sources of capital funds, access to FDA best practices facilities, environmental licenses, clinical facilities for Phases I, II and III testing, standards and taxation. In these areas, we are working with the Department of Commerce and Economic Development, the Economic Development Authority and the Department of Environmental Protection and Energy. All of these are complex issues that will require industry and public cooperation, if we are to achieve tractable solutions.

Mr. Chairman, this concludes my formal remarks. I want to thank you and the Task Group for the opportunity to provide this background material and I would be pleased to answer any questions.

Biotechnology Task Force - October 8, 1993

Trenton, New Jersey

Testimony of Dr. Joseph J. Seneca

University Vice President

For Academic Affairs

Rutgers, The State University of New Jersey

My name is Joseph J. Seneca, and I am University Vice President for Academic Affairs at Rutgers, the State University of New Jersey, and long time student of the New Jersey economy. I appreciate very much the opportunity to describe the process of technology transfer at Rutgers and its application to biotechnology industries. My colleagues, Dr. Andrew Rudczynski, Associate Vice President for Research Policy and Administration, and Dr. Peter Day, Director of our Center for Agricultural Molecular Biology, are with me to respond to your questions. At the outset, let me indicate that I strongly applaud the foresight of this Task Force in identifying and supporting the State's twin efforts in fostering biotechnology research and in encouraging the subsequent commercialization of that research.

Expansion of private sector employment and income, and with that expansion an increase in the state's tax base is the only sustainable way to achieve all the public sector goals of better housing, a cleaner environment, more effective K-12 education, and a myriad of other social needs. Without sustained economic growth, a condition which New Jersey has experienced in the past several years, as we struggle in the grip of national and regional recession (I would note that our employment level in August 1993 is the same as it was in early 1985), the public debate on the allocation of scarce resources centers on how to downsize and the resulting traumatic process of how to choose

among many priorities. With economic growth, the process becomes one of increasing resources.

Last week, I participated in a planning discussion of economists and public officials at the Port Authority which examined the future of the region. The keynote speaker, Lester Thurow of MIT, presented a list of 10 industries that the Japanese government has identified as having high growth potential and that are priorities for support by the Japanese government in the 1990s and beyond (support with the goal of world dominance in these industries). Biotechnology ranked high on that list. As the New Jersey economy changes under the unrelenting white heat of global competition, we must support our industries of competitive advantage - in order to keep them in that position because no economic advantage remains constant forever (witness the travails of the once dominant IBM Corp).

This Task Force has seized the right issue at the right time and in the right place. Meaningful support of the infrastructure of biotechnology research and creative assistance of its commercial applications promises high value employment, expansion of economic activity, and the further development of cutting edge research providing the human capital and scientific breakthroughs that are the foundation for private sector business success.

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New Jersey is the biotechnology state with its well-developed interconnections of a large pharmaceutical sector and the State's higher education community. Biotechnology is our comparative advantage, we must keep it that way. The work of the NJCST, the DOCEDE, and the higher education sector to support biotechnology research in New Jersey are all investments in economic growth. Here is a brief description of some of that work at Rutgers and the benefits it brings to all New Jerseyans.

Corporate liaison (our outreach activities to industry) and technology transfer (the process of introducing and commercializing our research finding) are not new to Rutgers. In 1939, a member of the faculty of Rutgers College of Agriculture entered into formal agreement with a company in Rahway to study the production by soil bacteria of antimicrobial substances. The faculty member was Professor Selman Waksman, the company was Merck, and within 4 years of their agreement, the antibiotic, streptomycin, was discovered. Streptomycin, the conqueror of tuberculosis, was patented and commercialized by Rutgers. In total, Rutgers received about $16 million in royalties on antibiotics discovered in Professor Waksman's laboratories. This money was used in part to build and to endow the Waksman Institute, which continues to be closely involved in biotechnological research, and remains a source of promising inventions relating to agriculture, medicine, and biotechnology. Professor Waksman received the 1952 Nobel Prize for his studies

of antibiotics, and it is important for us to remember with pride that Professor Waksman, Rutgers University and New Jersey were pioneers in technology transfer. This academic year Rutgers will observe the 50th Anniversary of the discovery of streptomycin with a joint industry-University scholarly event.

About ten years ago a Rutgers professor, Dr. Frank Davis, started a biotechnology company based on an invention resulting from research he and others performed at the University. Today that company, Enzon, employs over 240 people and is represented on the Biotechnology Task force by Dr. Abe Abuchowski, himself a former graduate student of Dr. Davis.

More recently, small New Jersey biotechnology companies such as Envirogen, Affinity Technologies, Cytogen, Liposome and Phytotech are interacting with the University in a wide number of ways, and often utilizing technologies developed at Rutgers. The University is also a seed bed for faculty entrepreneurs. There are now over 10 companies representing the fruition of work in a wide variety of disciplines which were started by faculty from Rutgers. To assist start-up companies, the University, within the requirements of existing State laws, tries to structure technology transfer and licensing arrangements that are sensitive to the often limited financial resources of the companies. Just as there are notable successes, however, there are often long difficult struggles to bring research to commercialization.

29 x

These difficulties must not deter our joint efforts to bring new technologies to market.

The University, by fulfilling its missions of research, teaching and public service also helps both small and established biotechnology companies stay competitive. The University, through agreements with companies, provides research on leading-edge technologies, trains students for future employment in the biotechnology industry, and otherwise encourages the close interaction of industrial scientists and University faculty to enhance not only the corporate development of products but also to bring to our graduate and undergraduate students cutting-edge research problems. These students, in turn, provide a highly skilled and available labor force that encourages business expansion and location in New Jersey.

For example, the University has a number of formal training programs in Biotechnology. They range from a Biotechnology Training Grant supported by the National Institutes of Health in association with both large and small biotechnology and pharmaceutical companies, to a curriculum major in biotechnology at Cook College, to various short courses available at the Waksman Institute, at our joint Rutgers-UMDNJ Center for Advanced Biotechnology and Medicine, and at the Center for AgBiotech.

30 X

Rutgers University's first organized efforts in corporate research interaction date back to early 1982. Today, our Office of Corporate Liaison and Technology Transfer arranges opportunities for demonstrations by Rutgers professors of their work at industrial research centers, and for reciprocal presentations by industrial scientists of their work at Rutgers. These efforts have established valuable lines of communication: a key example of the benefit of effective liaison is an agreement concluded last year with Hoechst Celanese Corporation of Short Hills which will bring $1 million over 3 years to Rutgers for support of a variety of faculty research projects and of graduate and undergraduate students in the sciences.

Industry support of research projects requires a contractual agreement, and the terms of that agreement must be negotiated so they are fair as well as consistent with University policy. These negotiations include consideration of rights of the professor to publish, rights to inventions, royalty rates, and liability.

In 1993, Rutgers concluded about 160 industrial research agreements with a total value of over $11 million. A recent highlight of these contract negotiations is a research agreement with Sintong Chemical Industrial Co., Ltd. of the Republic of China (Taiwan) which provides $5,000,000 over five years in support of studies to be supervised by Professor Y. Chien of our

College of Pharmacy. The agreement includes funds for students support as well as faculty research. The research objectives include the design and development of a miniaturized electrotherapeutic system for delivering insulin to diabetics, and the formulation and fabrication of a transdermal contraceptive device. This contract is greater than any past single award to Rutgers from industry in support of the research program of an individual investigator.

Rutgers is also concerned with the development of intellectual property - that is the work of faculty creativity. However, the economic benefits to the State of these ideas cannot be realized unless this creativity is developed, patented, and commercialized. A condition of employment by Rutgers requires faculty members to disclose and assign to the University any ideas that may be sufficiently novel and useful to patent. Rutgers uses a faculty Patent Committee to help with the evaluation of disclosures. In addition, Licensing Associates of our Office of CLTT have a network of industrial connections critical to assisting us in determining whether or not to patent and market a Rutgers invention.

Patents are not difficult to generate, if you can afford the legal fees! A U.S. patent costs $10,000 to $15,000, and foreign patents can cost many times that amount. Patent costs at this rate will make you poor unless they are commercialized. Rutgers

licenses companies to produce and market its patented products and processes in return for fees and royalties.

In 1993, the number of new inventions disclosed to the University peaked at 67. The University processed 33 patent applications and had 15 patents issued. In 1992, Rutgers ranked 14th among 158 universities with 19 patents issued, and 36th in 1992 when 12 patents were issued. Rutgers now has a total of about 215 patents and patent applications, of which approximately 40% are in biotechnology. The University has issued over 80 licenses to companies to commercialize its patented products and processes, and realized a return on its licensed inventions of about $2.5 million in royalties in 1993.

Innovations in biotechnology are not limited to the traditional fields of molecular biology and medicine. They can range from such seemingly unrelated technologies as fiber optics, food processing, advanced biomaterials, process chemistry, pharmaceutics, and horticulture. However, at Rutgers, thus far, most commercially successful inventions are biotechnological. They include the "Pegology" procedure which was created by Professor Davis and his colleagues in the Department of Biochemistry and is the basis of Enzon, Inc.; various varieties of asparagus and dogwood developed by Professors Ellison and Orton of the Agricultural Experiment Station; and transdermal drug delivery systems invented by Professor Y. Chien of the

College of Pharmacy. Other promising biotechnology that Rutgers continues to promote for commercial transfer to industry includes biopolymers invented by Professor Joachim Kohn of the Chemistry Department for medical applications; new varieties of apple and apricot developed by Professor Goffreda of the Agricultural Experiment Station; instrumentation for the noninvasive detection of coronary artery disease based on the sonic rather than electrical activity of the heart designed by Professor Welkowitz of the Department of Biomedical Engineering and his colleagues at the UMDNJ; high methionine hybrid corn genetically engineered by Professor J. Messing, an actinomycete restriction enzyme for recombinant DNA isolated by Professor M. Lechevalier, and a method for transforming plastids of higher plants developed by Professor P. Maliga, all of the Waksman Institute, the distinguished Institute which is the legacy of streptomycin. These examples demonstrate that knowledge, its pursuit, its development, and its commercialization offer society enormous benefits.

The New Jersey Commission on Science and Technology provides critical basic infrastructure funding for research in the University's Advanced Technology Centers. It also fosters corporate interactions and facilitates technology transfer. Funding from the Commission for its Technology Transfer and Innovative Partnership Programs also encourages small companies to interact with the University. Many of these are small

biotechnology companies. Rutgers applauds these efforts by the CST and urges increased basic support of research as an important investment in the future of New Jersey.

Mr. Chairman, I have a series of materials describing the details of technology transfer at Rutgers. I leave these with the Task Force. My colleagues and I would be pleased to assist you in any way as you build New Jersey's competitive advantage in this critical industry.

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