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PUBLIC HEARING

before

ASSEMBLY ECONOMIC DEVELOPMENT  
AND AGRICULTURE COMMITTEE

The Establishment of an Institute for Biomolecular Research  
in Agriculture and Environmental Sciences  
at Rutgers, The State Univeristy

October 14, 1986  
Room 449  
State House Annex  
Trenton, New Jersey

MEMBERS OF COMMITTEE PRESENT:

Assemblyman Joseph Azzolina, Chairman  
Assemblyman Jack Collins, Vice Chairman  
Assemblyman John T. Hendrickson, Jr.  
Assemblyman George Hudak

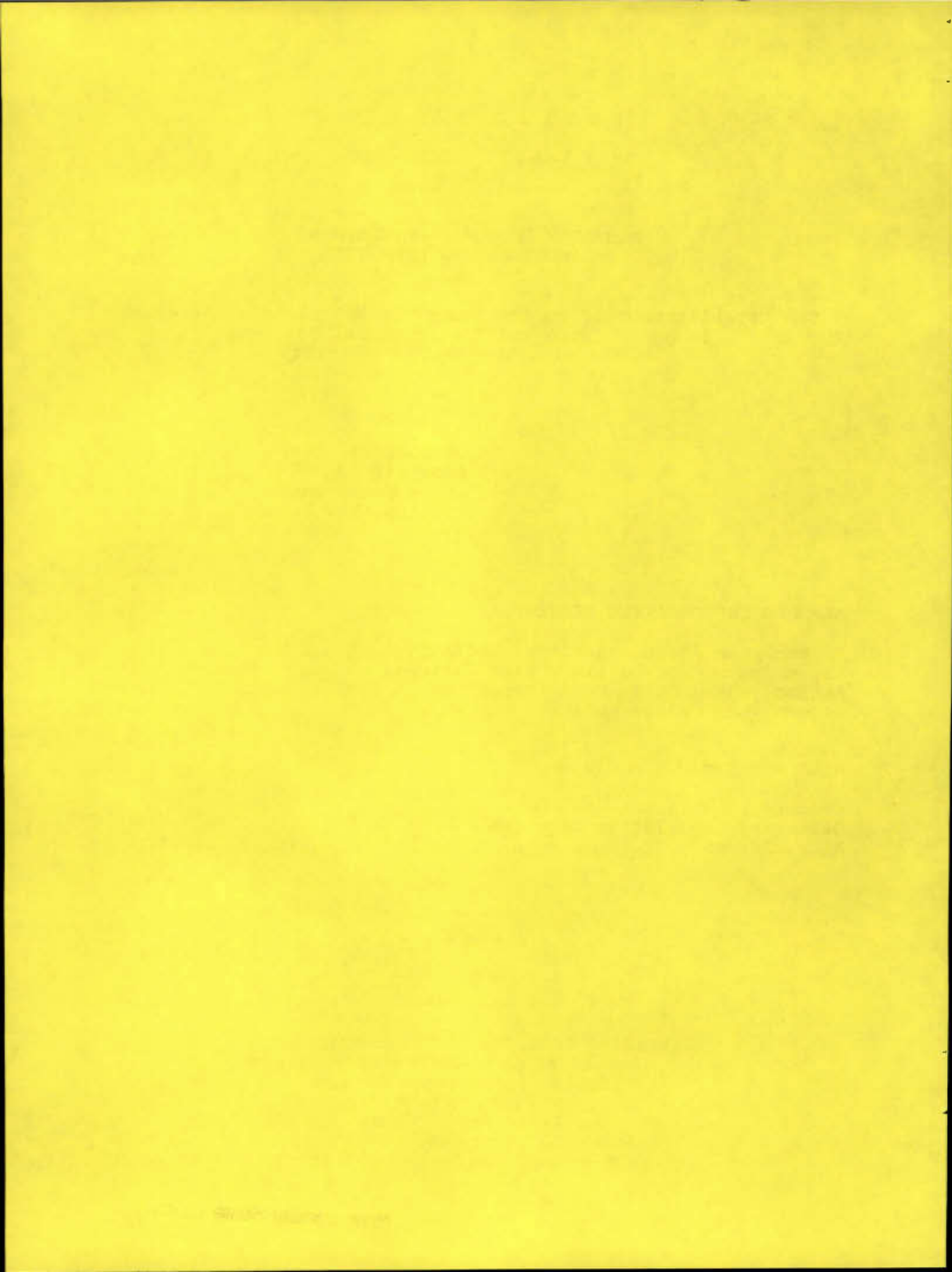
ALSO PRESENT:

Gregory L. Williams  
Office of Legislative Services  
Aide, Assembly Economic Development and Agriculture Committee

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**New Jersey State Legislature**

**ASSEMBLY ECONOMIC DEVELOPMENT  
AND AGRICULTURE COMMITTEE**

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**NOTICE OF PUBLIC HEARING**

**October 2, 1986**

The Assembly Economic Development and Agriculture Committee will hold a public hearing at 10:00 a.m. on Tuesday, October 14, 1986 in Room 449 of the State House Annex concerning the proposed Institute for Biomolecular Research at Rutgers University. The committee will hear testimony on the impact that the institute could have on the State's agricultural sector and on the environment. The institute would be one of the six Advanced Technology Centers being established throughout New Jersey to advance academic-business cooperation in research and development efforts aiding economic development in the State.

Anyone wishing to testify should contact Gregory L. Williams, Committee Aide, at (609) 984-0445.



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**ASSEMBLYMAN JOSEPH AZZOLINA (Chairman):** Sorry for the delay, but you know legislators as such, never on time. Except Jack Collins and I. (laughter) Jack Hendrickson is here. We'll get started in a couple of minutes. But before we start, I'd like to welcome everyone here today. We picked an unlegislative day so we'd have plenty of time to go over this topic. On a legislative day, as you know, we have to rush, since we have about an hour and a half, an hour and forty five minutes. Today we can take whatever time we need.

So I'd like to make a statement before we start. We are meeting this morning to gather information from many distinguished experts in the fields of education, government, and high technology. We are interested in hearing their views on a proposed Institute for Biomolecular Research at Rutgers University, and the impact they believe this center will have on New Jersey's agricultural sector. New Jersey's Commission on Science and Technology has an important responsibility to allocate large amounts of money to fund research and development in areas of high technology, to benefit our State and its citizens. We on this Committee want to make sure that the importance of New Jersey's agriculture R & D, receive appropriate consideration in planning these allocations. That is why we are here; to assure that these funds are being used for the best interest of all New Jerseyans.

I'd like to call on Phil Alampi, who has to leave right away, to make his statement at this time. Phil?

**P H I L L I P A L A M P I:** Thank you, Mr. Chairman, and members of the Committee.

One of the finest reports I have ever seen is Vision 21, "A Strategic Plan for Cook College/New Jersey Agricultural Experiment Station," developed by its very able Dean and Director Dr. Stephen Kleinschuster and his staff.

In this report, the six program thrust areas are these: Intensive Production Agriculture, Food Technology and Nutrition, Marine and Coastal Sciences, Environment, Biotechnology, and Policy and Socioeconomic Impact. These are all excellent, but I want to confine my remarks to the Institute for Biomolecular Research.

The great advances in biology of the past three decades, especially in molecular genetics, has placed within our reach most of the essential tools for solving the major mysteries of living organisms. We now understand the basic processes involved in information transfer within and between cells; and more importantly, we are learning how to modify these processes for useful purposes. The exploitation of knowledge from this science in the fields of agriculture and the environment promises enormous dividends.

With this knowledge and its applications, we can anticipate significantly increasing crop productivity, manipulating the genes affecting developmental regulation, improving the efficiency of animal production, as well as the quality of animal products for human consumption, and improving human nutrition. It can now be reasonably expected that genetic modification of microorganisms and cells will permit us to convert cellulosic materials to feedstock chemicals, improve nitrogen fixation in plants, destroy toxic/hazardous wastes, synthesize organic substances of industrial and agricultural importance, produce products for the food industry, develop monoclonal antibodies to detect bacterial toxins, drug and pesticide residues, and pathogens for plants and animals, increase resistance to disease and adverse environmental conditions. Indeed, these accomplishments are well within our reach.

I would like to make three specific recommendations about the institute. First, in my opinion, the institute should be placed at the Cook/Douglass campus, so the Cook

College lands, greenhouses and laboratories, will be adjacent and available to the institute. This land is precious. It is not being made any more. You can't go to the supermarket to buy another square foot of it.

Secondly, the institute should be the research arms of the New Jersey Agricultural Experiment Station, which has had a world-wide reputation as one of the greatest institutions of its kind, with many outstanding accomplishments.

And third, the director of the institute should report directly to the Dean/Director of the New Jersey Agricultural Experiment Station.

So, members of the Committee, in summary the challenges and opportunities are many. Let us seize them and continue the great record of accomplishments at Cook College. I'd be glad to answer any questions if the Committee so desires.

ASSEMBLYMAN AZZOLINA: Anybody have any questions?  
(no response) No, not at this time. I know you have to leave.

MR. ALAMPI: Yes, thank you very much for this opportunity.

ASSEMBLYMAN HENDRICKSON: It's always a pleasure, Mr. Alampi.

MR. ALAMPI: Thank you.

ASSEMBLYMAN AZZOLINA: Mr. Edward Cohen please, Executive Director of New Jersey Commission on Science and Technology. Welcome.

EDWARD COHEN: Thank you, Mr. Chairman, members.

In responding to your request for some explanation of how a center in Molecular Biology in Agriculture would fit into the Commission's programs, and how it would contribute to promoting the agricultural sector and economic development generally in this State, I thought to divide my response into some five categories. I don't have prepared remarks, and welcome your interrupting me at any time with questions.

First let me explain what the Commission in general is doing in biotechnology, generally. As I'm sure you're all aware, the highest priority of the Commission is in biotechnology. And the center for Biotechnology and Medicine -- whose distinguished director is here, and one of your speakers later this morning -- commands the largest amount of our support, both capital investment from the 1984 bond issue, as well as operating support over the years. Clearly this center -- which as you know is jointly sponsored by Rutgers University and the University of Medicine and Dentistry of New Jersey, and is situated on their Piscataway campuses -- will have two satellite centers: One a clinical research center in New Brunswick at, what was the Middlesex is now the Robert Wood Johnson University General Hospital, and the Cell Fermentation Unit of the Waksman Institute which is going to be adjacent to it, whose Director is also here and one of your guests later this morning.

It therefore is very logical that in considering the establishment of a center in Molecular Biology in Agriculture, that there be very close relationships forged between a center in Molecular Biology for Human Beings -- which is what the CABM is -- and that which would be engaging in work in plant and animal molecular biology, since the underlying sciences draw from the same fundamental sources. In addition -- as I'm sure you're also aware -- the Commission sponsors a center in Food Technology, which is situated at Cook College of Rutgers University. And there -- and I will refer to them later -- there are obviously many good synergies possible between that center also and a possible center in Molecular Biology in Agriculture.

The reasons why biotechnology in all of its various manifestations enjoys the highest priority of the Commission, I think is a function of the State's economy. On the human molecular biology side, as you know New Jersey in many ways has

been described as the drug store of the world. No state is as powerful as New Jersey with respect to pharmaceuticals or related chemical industrial activity, and molecular biology is going to play a very large role in its future. Similarly, we feel that it would be very very important to bring to bear upon our agricultural sector and to create an agricultural industry growing out of activity in molecular biology, directed toward plant and animal development.

The reason for separate centers -- which is another one of the themes I'd like to pursue with you this morning -- is that, although they share a common base science, nonetheless they do branch out -- obviously by their titles -- in different directions in terms of their applications. And it's very important that there be persons specialized in plant and animal as well as human molecular biology and biotechnology, generally to derive the full benefit from their research.

The concatenation of such centers we believe -- at this stage in our process of reviewing the advisability of having such a center in Agriculture -- is one that we feel by reinforcing each other, could thrust New Jersey into the strongest position of any state in the United States, if all of these plans are realized. These co-joint strengths that will be built into -- both physically and in terms of human beings particularly -- into these centers, will result in a critical mass that no other state in the United States can challenge.

The plans for the center in Agriculture at the present time, are as follows: The University has submitted to the Commission -- as is required by the statute that set this in motion -- its proposal for such a center. A peer group was put together by the Commission, composed of very distinguished people headed and chaired by the Director of the Roche Institute, and including some other eminent persons in the field from around the country -- both industry and higher education. That proposal was reviewed in a site visit of

almost a week that took place on the Rutgers campus. Comments were made to the University, and the University is in the process still of resubmitting its response to the questions that were raised. I do not really feel it appropriate at this point to go into some of the details as to what some of the discussion is since they have not been concluded, and it is my earnest hope and expectation that all matters will be resolved, reasonably shortly.

Let me focus now on how I think the center will benefit farmers specifically and the economy generally. The kinds of activity that is coming out of research in molecular biology, molecular genetics today, most of you have seen in one or another popular form. Let me just refresh you to some of the kinds of impact it might have. For instance, building -- staying with let's say the plant side -- building into seed the ability to be somewhat immune to insect infestation, has obvious benefits in terms of crop loss. But has other benefits with respect to the environment in that the need for insecticides is thereby reduced, and clearly costs less. It costs the farmer less.

Building into the seed -- through molecular genetic techniques -- the ability to use less water has obvious effects in terms of the need for water, the cost of furnishing water, and even I believe could be said to have an environmental effect in that less water results in less wash-off.

Building into seed the ability to use more of the land's own nutrients and less fertilizer, has an obvious effect both in terms of expense -- one doesn't need to buy as much fertilizer, or any in some instances presumably -- and of course is less chemical to wash-off in terms of its environmental impact.

You've all heard, in the first flush of these discussion, about the effects of molecular biology on animals. Some very-- What now appear somewhat absurd claims or

expectations that there would be cows as big as elephants and so forth -- and that's sort of silly and a long way away, if ever a reality -- but that doesn't deny that there will indeed be great possibilities for building in characteristics in meats, as is now done in chickens -- by Perdue, who persistently tells us how well he is doing at -- that have very enormous effects both on nutritional qualities, the cost of raising that sort of animal, and the kinds of characteristics of the meat obtained from them; nowadays everyone being very much concerned about cutting out certain types of characteristics that are not seen as so good for the health.

The economy can also benefit more generally, in addition to the individual farmer, from the results of this, in that the development of these strains, be they plant or animal, are really industries. The identification of ways to develop better seed or better livestock are actually industries. They call for not just researchers, but the, in time, production of these materials which can be sold not just in New Jersey but throughout the world. Although at the present time there is a concern regarding surpluses in some of the categories of agriculture, all demographic projections would indicate that there is indeed going to be a rising demand for foodstuffs over the next hundred years or so.

In addition, the ability to produce this sort of plant or livestock product will make the product more competitive. And since on this Committee I know you're all aware our agricultural exportation level has been falling of recent years, precisely in part because of the ability of other nations to undersell us, this sort of thing can give us a high tech, if you will, edge in that regard again, if it's so successful.

ASSEMBLYMAN AZZOLINA: I missed that word just before that. Why haven't we been able to--

MR. COHEN: In terms of exportation?

ASSEMBLYMAN AZZOLINA: Yes.

MR. COHEN: Oh, well to the extent that we can be undersold, by being able to produce better seed or better livestock seed more efficiently, more productively, that is more productive -- it is a better mousetrap so to speak -- you'll be able to sell it better. I believe that I recall at one time the United States was the leading exporter of corn seed, and there was a good deal of our agricultural economy based upon that. That has ended. There are other areas to look into.

I was going to separately talk about how this sort of development would benefit the environment, but as you realize I've been sort of putting it together with benefits to agriculture and the economy generally. Let me just -- because its not perhaps as immediately apparent -- mention some of the interconnections that I see also. And I take note of the fact that Chairman Azzolina, that you yourself are in the food distribution business--

ASSEMBLYMAN AZZOLINA: Right.

MR. COHEN: The kinds of synergies that I referred to before as between an Agricultural center and our Food Technology Center-- Let me refer back to a quotation from our peer group in food technology, when we first brought them together to advise us and direct us in what has now resulted in our Center for Advanced Food Technology. One remark they made was, "Genetic research can be applied to developing crops which fit a new and innovative food processing system. One can develop crops such that downstream they can be better handled in the food processing system." And so the benefits there are very tangible, although not always realized so immediately. That same peer group went on to recommend the need to form links between agricultural research and post harvest research in food sciences. There is some very important and beneficial gains to be made there.

Let me give you some examples, for instance, where major food processing companies have recently adopted a strategy which attempts to better achieve control of raw materials for food processing. It's a wide span by the way, covering both animal and plant products. For instance, Heinz has invested significant resources in the development of tomatoes specifically bred for food processing. Originally, Heinz would purchase from growers, tomatoes selected for weight -- that is, their water content. Then Heinz realized it was paying twice, once for tomatoes which were mostly water, and again when it had to remove this water. And that doesn't even count the transportation costs of shipping tomatoes that are mostly water. Heinz developed a tomato with high solids and pigment content, and temperature resistant flavor characteristics, using these sorts of techniques. And I believe that's something that you've all heard of. And you've all heard, I mentioned before, that Perdue has bred specific characteristics into his chickens, which has become a very significant industry for those parts of the country where he's active.

ASSEMBLYMAN COLLINS: He's moved into all parts of the country. He's just listed in the Forbes 400 for \$200 million worth. So he's done fairly well.

MR. COHEN: That's right. He's done very well, and when you consider that it's Maryland and Delaware and a very slight part of Virginia where he's working, you realize what impact he's had upon the economy of the Delmarva Peninsula. He doesn't do everything there, but he does a great deal there. One of your former colleagues, an old friend of mine, working for the Legislature here, now is a farmer there, and a personal friend of mine whom I go to visit every once in a while, has worked for Perdue. There is no question that is the most significant contributor to the economy of Delmarva.

ASSEMBLYMAN HENDRICKSON: He went in there because he's close to the grain and the feed, wasn't he?

MR. COHEN: Well, yes there are a number of factors that one would have to take into--

ASSEMBLYMAN HENDRICKSON: One distinct one was the grain and feed.

MR. COHEN: But I think most people agree that -- aside from his marketing, which is also a factor -- I mean nothing ever--

ASSEMBLYMAN HENDRICKSON: I'm just saying they couldn't be in New Jersey because the cost of feed is too high. That's why we lost the chicken industry, no? Or one of--

MR. COHEN: That I wouldn't know. I do know that an important aspect of what he's achieved has been a consequence of his developing chickens which are consistently good. And that has been done through breeding.

Another point just to mention, the Danish government food ministry, funding the development of a process which detected on line something called "boar taint" -- taints in pork carcassas. Those of you who are more familiar with these matters than I, boar taint is not heat stable and when you cook it it gives off a bad odor. Working on this, subsequently not only was the Danish government able to get some benefit by being able to eliminate boar taint infected pork and use it for other than direct consumption, but subsequently their research identified animal growth and selection conditions which actually eliminated the boar taint problem all together. And these are the kinds of examples which are very much related to the food industry, and I did want to make that point because I wasn't sure that anyone else would make it.

Let me close by saying that at this point -- since I cannot speak for the Commission because we have not completed our process, and I have not presented a proposal, even a finished peer review report to the Commission -- I could not

say we will do something in this area. That would be premature, and most unfair to the Commission process. However, I can say that thus far our investigations indicate that such a center in New Jersey would be a very significant contributant to both the agricultural sector specifically, and the economic development of the State generally, but if carried out properly can attain the ranking -- I've been assured by members of my peer group -- of the leading Center in the United States, and indeed one that could readily challenge the two best in the world -- which at the present time are located in Germany and Belgium.

I thank you for this opportunity and I'm available for any other questions.

ASSEMBLYMAN AZZOLINA: Yes, how many members do you have on the Commission? Just so we get more familiar with the Commission.

MR. COHEN: The Commission has 16 voting members. They are composed of four cabinet officers, four legislators, and eight persons -- representatives of the public at large -- half appointed by the Governor, and half by the Legislature. There also are two university presidents who serve in an observer non-voting capacity.

ASSEMBLYMAN AZZOLINA: Who are the four legislators?

MR. COHEN: The four legislators from the Senate are Senators Lynch and Ewing, and in the Assembly Assemblyman Albohn and Doria.

ASSEMBLYMAN AZZOLINA: And how about the cabinet members?

MR. COHEN: The cabinet members by statute are: the Commissioner of Commerce and Economic Development, the Chancellor of Higher Education, the Director of the Governor's Office of Planning and Development, and the Commissioner of Education.

ASSEMBLYMAN AZZOLINA: And then the Commission will make the decision where this is going to be located? Or will it be a different group?

MR. COHEN: The Commission has the responsibility for deciding whether the activity should go forward, and in what manner. Clearly the question of locus and the various aspects of the locus issue would be one of those matters that they would look at.

ASSEMBLYMAN AZZOLINA: Is there another group that will make the decision and make the recommendation first, to the Commission or--

MR. COHEN: Well, the Commission itself forms a peer group, composed of outstanding authorities in the field, which makes a recommendation to the Commission, but they don't have the responsibility the Commission has.

ASSEMBLYMAN AZZOLINA: How many are those? How many do you have on that group?

MR. COHEN: On the peer group?

ASSEMBLYMAN AZZOLINA: Yes.

MR. COHEN: At the present time the peer group is composed of about eight people. I have a--

ASSEMBLYMAN AZZOLINA: These are the ones that will make the recommendation where and if this--

MR. COHEN: Yes, but those recommendations will be made on the basis of a whole series of complex factors.

ASSEMBLYMAN AZZOLINA: Oh, I understand that. I'm trying to understand the group. What kind of background the peer group--

MR. COHEN: Well as I said, the Chairman of the peer group is the Director, a member of the National Academy of Science, very distinguished scientist, who is also the director of the Roche Laboratories, the Roche Institute, at Hoffman-La Roche. It includes a very eminent plant molecular biologist, who is at Stanford, another woman is a member of the faculty of

the University of California at Davis. There are two senior Vice Presidents for research from prominent industrial firms--

ASSEMBLYMAN AZZOLINA: In New Jersey?

MR. COHEN: Smith, Kline and French is one, and one is DuPont. We had also advising the peer group, a group of about eight New Jersey research directors, from companies like American Cyanamid and FMC and so forth. So there are some six or seven New Jersey based research scientists as well. Not just scientists but--

ASSEMBLYMAN AZZOLINA: From various companies?

MR. COHEN: Various companies in New Jersey. They are all the companies you would imagine.

ASSEMBLYMAN AZZOLINA: Do you have any other questions, Jack?

ASSEMBLYMAN COLLINS: I have a couple of questions. What kind of time frame are we talking about for a decision to be made, by whomever makes it?

MR. COHEN: Well, at the present time I am awaiting a re-draft of an authorization to distribute to the peer group from Rutgers University of their proposal. I would anticipate that will be available very shortly. I really wouldn't want to put them into a corner on that, but very shortly means it could be a month or less. In addition, because I know you're aware there has been some difference of opinion regarding such matters as locus, it has been agreed that a meeting will be held between the Chairman of the Commission and myself -- Chairman of the Board -- and President Bloustein and Dr. Pond, and that is scheduled now for November 17th. I also would anticipate that it would be entirely plausible that a recommendation would go to our Commission at its January meeting. We have a meeting tomorrow. We meet quarterly, so the next meeting after tomorrow's meeting would be mid-January.

ASSEMBLYMAN COLLINS: There will be a Biomolecular Research Institute in New Jersey though?

MR. COHEN: Now, that as I said, would be premature. My own personal findings and belief is that in the context of everything else we're doing, and what this would call for, that it makes eminent good sense. But I've not yet made that--

ASSEMBLYMAN COLLINS: But it's not tied directly to the bond issue, that there must be a Biomolecular Research-- The money is given to the Commission, and then you people determine in which ways those moneys are to be spent?

MR. COHEN: No, neither.

ASSEMBLYMAN COLLINS: Okay.

MR. COHEN: The bond issue that was passed in 1984, did not explicitly designate any of those funds for a center in Agriculture. However, I was directed at the last Commission meeting to come forward to tomorrow's meeting -- which I am doing -- with an analysis of the various needs that we foresee of the Commission's going beyond the 1984 bond issue. And to also indicate how we would analyze it, to best proceed to raise those funds. I have a memorandum and a recommendation as to next steps going to my Commission tomorrow. And I am hopeful and anticipating support for that. That would include funds for such a center.

ASSEMBLYMAN COLLINS: Do you have a vote on the Commission?

MR. COHEN: No.

ASSEMBLYMAN COLLINS: You yourself no.

MR. COHEN: I'm just a worker.

ASSEMBLYMAN COLLINS: A worker, that's right. A final question. If there were to be a Biomolecular Institute, if that were to come about by the Commission, would it be tied to Rutgers University? Is that a given?

MR. COHEN: Oh yes. That's a given. It would be Rutgers.

ASSEMBLYMAN COLLINS: Okay.

MR. COHEN: There's no question about that. It would be Rutgers.

ASSEMBLYMAN COLLINS: So the question is not if it will be Rutgers, but the locus within the Rutgers system is the question. There's really a bigger question, if there will even be one.

MR. COHEN: Yes.

ASSEMBLYMAN COLLINS: At this time, there's no official decision that there will be one.

MR. COHEN: No official decision but certainly--

ASSEMBLYMAN COLLINS: But the signs are there that it would--

MR. COHEN: The signs look good. The signs look very good.

ASSEMBLYMAN COLLINS: Okay. All right, thank you.

ASSEMBLYMAN HENDRICKSON: Just one question, because I'm a little confused on the bond issue. What are we using those monies for?

MR. COHEN: Oh, the 1984 bond issue you'll recall was for \$90 million, of which \$57 million was under the jurisdiction of the Commission for essentially activities at the graduate level. And \$33 million was under the jurisdiction -- or is under the jurisdiction -- of the Department of Higher Education, essentially for activities at the undergraduate level. Of the \$57 million, tomorrow we will be completing action on either full designations for the last remaining 15 million, or a fairly firm reasonable earmarking of the remainder of the 15 million. But of the 42 million that has already -- and you the legislators have recently authorized our sale of those bonds for some 42 million -- they are roughly \$20 million in biotechnology and medicine, \$9 million in ceramics, \$6 million in food technology, and \$7 million for hazardous and toxic substance management. The next 15 million that was in the bond issue designated for future fields will tomorrow be-- I'm recommending that they be taped down for the following purposes -- there's been some negotiating. I don't want to get a figure wrong, and there's some people sitting behind me--

ASSEMBLYMAN HENDRICKSON: That's all right, just generalize.

MR. COHEN: It would be fiber optics, computer aids to industrial productivity, and the earmarking for advanced manufacturing technology -- centers in each of those fields.

ASSEMBLYMAN HENDRICKSON: Could this Committee be kept apprised of everything as it comes down? Would that be feasible? Could we have this Committee availed of everything as it comes down? I think it's to our benefit to know.

MR. COHEN: I will send you a full--

ASSEMBLYMAN AZZOLINA: Where I'm confused-- Where's the money for this project, if it comes about? I was disrupted a moment ago--

MR. COHEN: As I indicated, I'm bringing-- On tomorrow's Commission agenda, there is a topic in response to a Commission direction of our last meeting, that I analyze what our needs are beyond the 1984 bond issue--

ASSEMBLYMAN AZZOLINA: So you need another bond issue, you're telling me.

MR. COHEN: That's what I am recommending that the Commission authorize me further to explore.

ASSEMBLYMAN AZZOLINA: I was under the impression that this project was going to come from present bond money.

MR. COHEN: Not that was not-- As a matter of fact, when a bill was introduced calling for the creation of a center in Molecular Biology and Agriculture, there was a dollar figure attached to that. That dollar figure was removed during the amendatory process, before the bill left, the legislation was signed by the Governor.

ASSEMBLYMAN AZZOLINA: You're talking a few years down the road then, if you're looking for more money.

MR. COHEN: Yes, but I think the timetable that I foresee is not one that would inhibit proper forward movement on this, given the fact that one has to bring personnel on

board who would be of a leadership quality -- capable of assisting in the design of such a facility. A building must be designed. I am clearly avoiding using figures because the memorandum is only being considered tomorrow at the Commission meeting, but I don't mind acknowledging that it's a positive recommendation that I'm making. I'm hopeful of receiving support.

ASSEMBLYMAN AZZOLINA: Well, are you -- your Commission -- making a recommendation where the Biomolecular Institute will be located before you seek bond money?

MR. COHEN: No. I think that the way I see the schedules working their way out-- A decision to go ahead which would include a decision as to where it is to be located would take place well before one would join the issue of a bond issue.

ASSEMBLYMAN AZZOLINA: So we'll know in advance?

MR. COHEN: Know in advance, precisely. In fact my hope is that the matter will be properly, from a substantive point of view, adjudicated, and from a feeling point of view -- because I know there are strong feelings about this matter -- laid to rest in a manner that I think will hopefully be satisfactory in a reasonable way to all concerned. And consequently I would hope that that problem will be off the docket before when they would have to talk about raising bond funds. It would be very very bad business to reverse the order.

ASSEMBLYMAN AZZOLINA: Yes. You want to get everyone on the same team.

MR. COHEN: Precisely.

ASSEMBLYMAN AZZOLINA: Okay.

MR. COHEN: And certainly, hopefully if this Commission--

ASSEMBLYMAN AZZOLINA: You know what the name of this Committee is I guess, right?

MR. COHEN: The Team. (laughter) The A-Team.

ASSEMBLYMAN AZZOLINA: Okay, any other questions? Mr. Hudak just arrived, the Mayor of Linden. He must have had pressing business in Linden this morning. Welcome aboard. This is Mr. Cohen, Executive Director of the-- Okay. Thank you very much.

ASSEMBLYMAN HENDRICKSON: Thank you.

MR. COHEN: Thank you.

ASSEMBLYMAN AZZOLINA: Okay next is Dr. T. Alexander Pond, Executive Vice President, Rutgers - The State University. Welcome aboard.

D R. T. A L E X A N D E R P O N D: Good morning Mr. Chairman, ladies and gentlemen.

ASSEMBLYMAN AZZOLINA: I use these navy terms, welcome aboard, obviously you know why, I guess.

ASSEMBLYMAN HENDRICKSON: No, you want to tell us Joe, we're not familiar with it? (laughter)

ASSEMBLYMAN AZZOLINA: Should I give my battleship exploits?

DR. POND: Glad to be aboard sir.

ASSEMBLYMAN AZZOLINA: Thank you.

DR. POND: I'm very happy to meet with you this morning to bring you a summary if I may of the thinking at the University on this institute. I'll start out by thanking you and your colleagues in the Legislature for your support of this idea earlier. We have been working over the last some months to update our proposal in response to a legislative invitation that there be planning to create such an institute. And, as Mr. Cohen indicated, we are at the point now of having a proposal all but ready to go. Let me summarize it very briefly for you. I invite questions if I am too brief.

The Institute that we will be proposing to the Commission will be a separately organized research unit of the New Jersey Agricultural Experiment Station. It will have two major purposes, two major components: One is the creation of a

world class program of research and advanced training in the basic molecular and cellular biology which will substantially shape the agricultural and environmental sciences in the years ahead. That is a very large investment in people, and in laboratory requirements. We have completed the resource requirements, estimates, and I'd be happy to discuss them with you if you wish.

An equally important second function however, is the formation out of those resources, and also drawing on the other faculties of Cook College and elsewhere in the University, to form the University/Industry Cooperative Research Center, to couple the strengths of these faculties to industrial problems and needs, for generic research in the agricultural production and processing industries. The center will also conduct substantial continuing education.

As I summarize, this is a very large investment. We expect enormous scientific and regional impact from the investment. I'm not going to try to summarize that for you. I am a humble barefoot physicist. Sitting at my back are a number of New Jersey's leading biological scientists, both from the academy and from industry, and I note that they will be testifying. I will leave those estimates to them. Let me summarize by saying that I am enormously impressed. I think this is a singular opportunity for spectacular results out of interaction of academic strength with regional needs and promise.

The proposal in the months since your legislation invited it, has been strengthened in two very major ways: First of all there is strong new leadership at Cook College in the last year. Dean Kleinschuster, who is also the Executive Director of the Agricultural Experimental Station, will testify later. He has brought very strong leadership, not only to this very important part of the College's future, but he has also -- as Dr. Alampi mentioned earlier on -- fashioned a most exciting

academic plan, which is the environment in which this Institute can flourish.

The other major change in our environment since your legislation has been dramatic progress in building strength in the life sciences in and around Cook College, and the New Brunswick area generally. We have had splendid results which I know some of my colleagues are behind me and will be reporting to you on recruiting at Cook College, in relevant young scientists. Our faculty of Arts and Sciences, located largely at the Busch Campus, has also had a number of successes. You'll be hearing shortly from Joachim Messing, the Research Director of the Waksman Institute, where there are major related developments going forward; and Aaron Shatkin, who is the new head of the Center for Advanced Biotechnology and Medicine. There is also wonderful news highly relevant to recruiting scientists to this institute from the Robert Wood Johnson Medical School. So the life science scene in New Brunswick generally is enormously strengthened in very exciting ways, which make us very confident that provided these resources we will be able to attract the very best people in the world to join this Institute and to assume its leadership.

Mr. Cohen has mentioned that peer review is the next step in this process. We welcome that. We have benefited, I think, from the initial phases of the peer review. We look forward to its resumption. We are quite confident of the results because we have in the meanwhile been testing our plans on leading figures in this business, at the places and of the type that we would have to recruit in order to make it go here. And they confirmed to us the opportunity that we seek.

This project has had for some time now the University's highest priority. It is a step that can bring most marvelous results to our campus, to the States, to the science that it will serve. Let me just tick off a few of the advantages that we see. Because of the high promise that we

see for attracting world leadership in biomolecular research into this institute, we can confidently predict that it will have a much larger effect over a very short period on our ability to recruit in all of our life sciences departments -- in Cook, and also beyond. That is a very large benefit indeed because those are of course the State's major investments in the life sciences and this is an investment which can nucleate very large results there as well.

Likewise in the cooperative research center aspect of the institute activities we can draw on a very large previously standing investment in the skills and experience in statewide organization of the New Jersey Agricultural Experiment Station. The institute indeed is not more than a replay of the old traditional ideas of how one couples the most current scientific results to service in agriculture. And the Experiment Station of course in New Jersey has a hundred years of experience in providing that service.

Perhaps most excitingly, the institute will complete a design that Ed Cohen sketched out for you a moment ago, Commission initiatives, which will, with the institute's approval, spend the molecular biological engagement in the full range of our outward oriented constituencies, from human health/medicine, through agriculture and the environment. The institute is a complement in that respect in its location at Cook and in the Station, to the location of the medically oriented CABM at the Busch Campus in connection with the School of Medicine and the Waksman Institute.

We also have a, to us, extremely important justification for this institute in our undergraduate education programs. The institute will bring a vital science presence to the Cook-Douglass campus of Rutgers University, which is a priority that we recognize needs to be served. The contribution that an institute of this sort can make to the environment for study of an advanced undergraduate student is

most significant. And we are able to assign a considerable priority to that element of the value of this institute.

Finally, if our surmise is correct, the institute will position Rutgers and particular Cook College to take a leading position in what we detect will be a change in the pattern of research support on the Federal scene. We have been strongly engaged of course for many many years in the traditional forms of support for research from the Department of Agriculture, through our land-grant status; and that will continue. We see on the national scene however, a tendency for that department to recognize a need for new investments in research, specifically out of the discoveries that this institute will engage itself in. The institute will be an ideal vehicle to supply indeed national leadership to this tendency, which we think we detect.

To be fully successful, to realize all of its potential, the institute must be intimately related not only to Cook and activities of the Station, but also to the life sciences at large at Rutgers University. While the institute itself, in our recommendation, should be a unit of the Agricultural Experiment Station -- and therefore report to the Dean of the College and the Executive Director of the Station-- We think that there's an essential connection also to the other large investments that the State and Rutgers are making in the life sciences. We therefore propose that the Director of the institute should carry explicitly a University-wide responsibility beyond his directorship, as a special advisor to the President of the University. This is an arrangement that will put him in counsel with the presently other two senior life scientists who have joined us recently to build our molecular biology efforts. Those are Dr. Shatkin and Dr. Messing, whom I hope you'll hear from later in the day. In that fashion we are confident that the Director can fully be effective in the planning, in the resource planning, in the

program planning, and in the critical recruitment which will bring us the great results that this idea promises.

Those are our plans, Mr. Chairman. I'd be happy to respond to questions, if you have some.

ASSEMBLYMAN AZZOLINA: Would you clarify-- I keep hearing, is it Waksman?

DR. POND: Waksman, yes.

ASSEMBLYMAN AZZOLINA: Waksman, rather. What exactly is it? I'm not familiar with that.

DR. POND: Waksman. I characterize this Institute as a separately organized research unit. The Waksman is a separately organized research unit now of some 30 year standing. It's located on the Busch--

ASSEMBLYMAN AZZOLINA: Is that the Busch Campus?

DR. POND: Busch Campus. It is not an academic department, although its members of course have departmental appointments. It grew out of Selman A. Waksman's research program in microbiology. It is now engaged fairly quite widely in biological sciences.

ASSEMBLYMAN AZZOLINA: You say it's a separate Institute. Is it funded by Rutgers too?

DR. POND: It is funded by Rutgers, by the State of New Jersey. It is a unit of the University, but its budget is justified in terms of its research product, rather than a specific instructional engagement; although all of the men do teach and have students.

ASSEMBLYMAN AZZOLINA: And the students are involved?

DR. POND: Yes.

ASSEMBLYMAN AZZOLINA: Any other questions?

ASSEMBLYMAN HENDRICKSON: Just one thing. Is that your testimony? Could we pass it out?

DR. POND: Yes, I am going to pass that out to you.

ASSEMBLYMAN AZZOLINA: Oh I was looking at the whole pile, I thought that was all-- (laughter)

DR. POND: That's a little cheap thrill I was giving you.

ASSEMBLYMAN AZZOLINA: I would say you didn't finish. Okay.

ASSEMBLYMAN HENDRICKSON: Mr. Chairman, if the future people that are testifying-- It's easier for me to kind of follow along. I didn't want to break up while you while you were testifying, But it's easier for us to follow along.

ASSEMBLYMAN AZZOLINA: Thank you very much Dr. Pond.

ASSEMBLYMAN HENDRICKSON: Thank you.

DR. POND: Thank you.

ASSEMBLYMAN AZZOLINA: Okay, Dr. John Fulkerson, Principal Scientist, U.S. Department of Agriculture. John, you look like somebody else I know. I thought you were somebody else when I saw you in the hall today. Welcome.

D R. J O H N F U L K E R S O N: I hope that in spite of that, I'm welcome.

ASSEMBLYMAN AZZOLINA: Oh sure. I know he's a good person. I can't remember now; you look like someone else entirely whom I know. I was going to say what are you doing here today, but I'm glad I didn't. It wasn't him. (laughter)

Are you in New Jersey here, or are you in Washington?

DR. FULKERSON: I'm in Washington D.C., Mr. Chairman. I am Principal Scientist of the Department of Agriculture.

ASSEMBLYMAN AZZOLINA: We welcome you to New Jersey, the Garden State. I hope you came through the garden part of it.

DR. FULKERSON: Yes I did. And I appreciated your kind letter to come and testify at your hearing. I think, with your permission, I had planned--

ASSEMBLYMAN AZZOLINA: Whatever you want to say.

DR. FULKERSON: --just make a couple of short informal remarks--

ASSEMBLYMAN AZZOLINA: Whatever you care to say.

DR. FULKERSON: --and then I'm at your disposal. And as I indicated to Mr. Williams, although I'm here at your discretion, I had planned to leave here and go immediately to Amtrak and back home, unless I was requested otherwise.

ASSEMBLYMAN AZZOLINA: No problem.

DR. FULKERSON: I can shorten my little comments here quite a bit by seconding the words of your first speaker and your third speaker, and your second speaker in those matters that related to biotechnology per se. The workings of your commissions and your Legislature and so forth I have no knowledge whatsoever.

I do want to make it clear that it is a massive issue, in our view, in the Department of Agriculture in Washington D.C., and over the nation. We use the word biotechnology and agriculture in the broadest sense of including all of the food, feed, fiber, and associated natural resources of the nation. We don't use it in the narrow sense of just the tilling of the soil. And as such, that system as you know occupies about one and four tenths billion acres out of the one and nine tenths billion acres in the states. So it's an important issue to the nation. It's an important issue agriculturally, environmentally, and in terms of agricultural industries of the nation.

Some evidence of that importance -- I'm sure I don't have to dwell on much with you -- is that we have had scores of hearings before the Congress, a good many just this year -- Mr. Walgren, Mr. Scheuer, Mr. Fuqua, Mr. Durenberger. We have had, and will continue to have quite a few hearings on this issue. Many of those hearings relate to the regulatory aspects, in terms of clearing the way for the development of this industry, of this biotechnology initiative for the nation. We have many legislative proposals, and there are still some there, on biotechnology and agriculture. We have, and are operating under, an extant Executive order to move forward with

biotechnology. Many states as you know have all ready taken action on biotechnology in agriculture: New York, Pennsylvania, California, Texas, Louisiana, Florida, North Carolina, Ohio, and there are quite a few others.

We also have-- And I personally as well as others work on this issue. It's an important international issue. Japan, Australia, China, an enormous amount of activity in biotechnology in agriculture. In Western Europe, The U.K., France, Germany, Belgium, a large piece of activity in those countries in this area. We feel in the Department, and I do as a scientist, that it is vastly important for our industry. We feel it is vastly important for the defense of the nation. And we have testified in that specific area.

I would like to point out a subtle kind of thing that I think has a lot of merit in regard to your actions here. It was mentioned earlier that we're celebrating the 100th year of the Hatch Act, next year. Rutgers is a part of that huge network over the nation that the Hatch Act helps nurture and bring along; along with other financial initiatives and funding initiatives we're taking on behalf of biotechnology.

Early on in the Federal government -- not just in agriculture, but in NIH, NSF, Department of Energy, all of which also found in biotechnology and agriculture -- It was recognized that -- and pretty well set forth as policy that the bulk of the development in this would occur in the universities and in the institutes and in private structures and in industry in the nation and not be a development within the Federal government. This process was set forward almost ten years ago. And one of the reasons behind it -- which is dear to my heart -- is that the diversity of facilities, the diversity of expertise, literally the power of this possibility lies out here in the nation. It does not lie in a centralized system; because it is also an intellectual undertaking that requires an awful lot of good minds. It's not a spigot, turn off-turn on,

kind of thing. So that we developed over a period of time. And if it really is going to mean anything to our nation, and we provide for our people, so that at least for starts our industry is allowed to drink from the front end of the trough, instead of what we did with the microchip when we passed it up; and many other areas of technology. So that's been a conscious policy within the Federal government and very strongly within the Department of Agriculture, and considerably added to at the beginning of the current administration. Dr. Bentley, who is the Assistant Secretary for Science in the Department of Agriculture and responsible for biotechnology in the department, and a former dean at the University of Illinois, has strongly pushed in this direction.

We do have, and have had as you are well aware, an initiative in biotechnology that was developed by the National Committee on Biotechnology for Agriculture. This is the land-grant system of the nation, and it has a committee on biotechnology which developed a \$70 million initiative, of which a great deal of that was internalized in the government, and became part of the budgeting structure and the competitive grant structure of agriculture; which now goes to the land-grant, private universities, Harvard -- anyone that comes up with the peer type review process to qualify. I would be glad to leave this copy, except it's the last of two that we have in the entire Department. If Mr. Williams would be kind enough to return it to me at your convenience, but the initiative materials are in there.

Also, another facet of the biotechnology program is the realization -- I don't want to get into some of the science involved here, but I will if you choose to under questioning -- has been the realization in agriculture that we would have to have a large assessment process for this biota if it was going to mean anything in the development. And that was detailed out by the same committee in its next report, and I can leave you

this copy if you like Mr. Chairman, sir. And incidentally, Dean Kleinschuster's name was mentioned. Dean Kleinschuster is a member of that national committee today, which is appointed by the land-grant system. He succeeded Dr. Huller, who was Director at Cornell, but became President at the University of California at Riverside. And he has been appointed to Dr. Huller's role on that committee.

The picture I'm trying to paint to you is that not only does this network of agriculture systems over the nation -- the land-grant system-- Rutgers is a part of that huge system. It is essential not only for the development of the research invested in it and its cooperators, whether they're in arts and science institutions or other grant programs, but the fact also that we need a rather large assessment process. And that is also spelled out in the current "Federal Register" of which I am sure you all are quite well aware that is, came out from the Office of Science and Technology a coordinated framework for regulation of biotechnology. It covers the matter of the oversight of the research and the regulation of products. And since you're vitally in that area, I leave you that copy if you'd like, and we can supply you more if you so choose.

The assessment process is also very important. This Institute and the kind of people that it attracts makes it possible to visualize that Rutgers could -- New Jersey -- have a very substantial program in assessing how this biota will work in terms of its development in the industry. I mentioned a number of states that have taken action; and it might be of interest that I say this to you, Mr. Chairman and your colleagues, that whether you are down at North Carolina in the Research Triangle, or whether you're out at Riverside, or whether you're at Davis, or whether you're up in Madison -- all sites of land-grant institutions-- or Berkeley, there are quite a clustering already of industries developed around those

research sites. Therein lies a significant thing to consider, and that is that these university sites nurture the actual development of these industries. In addition, we have taken rather substantial steps in the government, and have plans for additional steps, to enrich that process of the universities and private institutions developing working relationships with universities to further bring this technology to the people of our nation.

In remarking about the assessment I do want to make one kind of point, and just leave this with you to think about later if you'd like. On this little map, in regard to assessment we pointed out in the Congress and other places that the land-grant system, including Rutgers-- There is over 3000 sites here of public lands in which we have looked at the biota, every bacterium, and plant and animal on those lands. In some cases these sites are over a century old. If I wiped out all on here that were less than half a century, you couldn't tell the difference in the number of dots. In other words, the message out to the Congress and to other sources has been, we have indeed in agriculture a land and institution facility that looks at an enormous amount of biota.

We did not miss corn blight. We predicted it seven years before it occurred. It's simply that some people in industry decided that the scientific prediction was wrong, and we've been busy pointing out in many hearings that recombinant DNA gives us an opportunity to do much more higher level and sophistication of predictions of what will happen with these products, so that we can get them out on the land and get them out in society. In many cases they're not going to be on the land at all. But I belong to the group that believes this technology will massively overhaul agriculture in this nation, in a relatively short length of time. I have colleagues who think I'm too short on my time frame. But I believe it will massively restructure agriculture and forestry world-wide,

maybe not in my lifetime, but certainly in the lifetime of my little grandchildren. The reasoning behind this is that it is no longer necessary to visualize model systems that have to be brought to a system. The system is so diverse that the model systems are emerging out of that system. So it is very close to where the problems are, where the people are, where the knowledge base is. And that is the power of our system, and it will bring it on very rapidly.

Another thing is that the changes in techniques have been so rapid in the last two or three years, that we're almost on a long curve of explosion into the development of massive gains in the use of these new techniques. Techniques that we did not have until the elegant experiments of Cohen and Voyer in '73, which of course were based on Mr. Crick and Mr. Watson's work 30 years earlier. This 13 year period has been very very remarkable, and particularly the last part of this 13 year period. We intend-- I did not mean to skim over it but for your record also I'll leave you a budget sheet of what the investment of the USDA itself is in Federal dollars in '86, and estimated 57 with Gramm-Rudman tucked in there. You must keep in mind that the amount in total public dollars is really quite large. Much larger than this, because the State's match, more than match Hatch. I think the average -- and I'd like this to creep into the record because I'm not certain of the exact point, but I think it's about \$4.35 to one that the states come up with on the average. So it's a much larger pool of resources than this. Of course, that runs all the way from something like fourteen to one in California to, some states that have a hard time making scratch for Hatch. But it is an average of about that, so it's a much larger figure and I'd leave that for your record.

Mr. Chairman, I hope I have not rambled here before you and your colleagues. But that's all I planned to say informally.

ASSEMBLYMAN AZZOLINA: Of course you're accustomed to going to hearings in Washington I guess. (laughter) This is a mild hearing compared to Washington.

DR. FULKERSON: Awful lot of them. Awful lot of them.

ASSEMBLYMAN AZZOLINA: That's what I understand. Well any questions?

ASSEMBLYMAN COLLINS: I have a question for you, Doctor. Doctor, fully--

DR. FULKERSON: Pardon me. As a scientist not as a-- I'm not in the administrative department. I'm simply a Senior Scientist.

ASSEMBLYMAN AZZOLINA: But you still go to hearings I guess, right?

DR. FULKERSON: Yes sir.

ASSEMBLYMAN COLLINS: Well you may have taken away my question by going to the scientist instead of the administrator. But let me ask it anyhow. Fully understanding the Chairman's statement that New Jersey is the Garden State, and also accepting that around a technical center such as is proposed here, industry starts to build up and so on. Given both of those, why in your mind, should New Jersey make a move in this direction when we have so many states -- farming states -- where it's the major industry? We have the Federal government involved, the USDA. Why New Jersey? Why should New Jersey want to become one of the top three in the world, as was testified to by Mr. Cohen earlier? Why New Jersey? Why not Illinois?

DR. FULKERSON: Well, I guess, "why" is a desire of a people, but there are some unique things at Rutgers in terms of your location and the climate of your State. There are some unique things in terms of the academic nature of the institution itself. The other part of the "why" lies in the proposition of, you know sort of -- not to be flippant sir -- but why are you a State in the Union? You know, you're part of

a network, and the degree to which you really excel in that in New Jersey will be the degree to which you will enjoy some of the enrichment back. I alluded to at least drinking at the front end of the trough, drinking the fresh water. And I really believe that Rutgers is uniquely equipped, and the Experiment Station here with this kind of assistance to be outstanding. There will be many states in which these developments will not go this far. They will say it's being done by-- So by choice they're going to say, "Well our industries are such that it's great for New Jersey to be out there." I don't know any other answer to that. Maybe you have a better answer than I do, sir.

ASSEMBLYMAN AZZOLINA: It's just that Rutgers is forward looking as always. Right?

ASSEMBLYMAN HENDRICKSON: New Jersey tries to be number one. If I may, Mr. Chairman. You also passed out to us some Federal regulations on the putting together of the bio-- I'd like to get into that a little bit, just what the reasoning was behind that.

DR. FULKERSON: The "Federal Register"?

ASSEMBLYMAN HENDRICKSON: No, you said there's regulatory-- Did I misunderstand you?

DR. FULKERSON: I just left you-- Yes, that's simply an announcement in the "Federal Register" of proposed changes in the oversight of research and the regulation of products out of biotechnology, which I think have a lot of meaning here in the future; and Rutgers is heavily involved in those issues. And this gives you a record of-- These are the proposals. We don't know what that final record will be yet.

ASSEMBLYMAN HENDRICKSON: Oh okay. I didn't quite understand. On one hand you seemed to be very favorable to the states getting into this side. But then on the other side you had the, I understood, regulations or regulatory process.

DR. FULKERSON: No, I only meant to just not fail in your presence to acknowledge that we still have quite a struggle going on in this nation over whether or not we're going to be allowed to conduct this science in a manner in which we feel that the scientific community in this nation ought to be able to conduct this science. That struggle is still going on, and that "Federal Register" is evidence of that struggle. And I think it's coming out now to the place to where we believe that by the close of this year the research system of the nation will be free to continue to conduct research in the manner that we have in the past. I'm alluding here to the kinds of things that Jeremy Rifkin and others have called attention to. Since I've appeared on television with him, I'm quite aware of how tough he is on this issue. But there is feeling about the issue. So I simply wanted to not fail to recognize it; you folks knew this also.

ASSEMBLYMAN HENDRICKSON: Just real quick, I like your statement of "drinking out of the front of the trough." Some of us have it a little different, it relates to the mother and the offspring. (laughter)

DR. FULKERSON: Yes, yes. Also the trickle down process.

ASSEMBLYMAN HENDRICKSON: I think some people are able to guess, I kind of like drinking out of the front of the trough.

ASSEMBLYMAN AZZOLINA: We thank you very much for coming up from Washington. You can catch the next Amtrak back. If we have any other questions we'll surely telephone you.

DR. FULKERSON: I thank you very much.

ASSEMBLYMAN AZZOLINA: Thank you very much.

ASSEMBLYMAN HENDRICKSON: Thank you. Very good, Doctor. Have a safe trip.

DR. FULKERSON: Thank you.

ASSEMBLYMAN AZZOLINA: Okay, Dr-- I'm not sure I got it right, but Joachim Messing? Missing? Messing?

D R. J O A C H I M W. M E S S I N G: Messing.

ASSEMBLYMAN AZZOLINA: Messing? You're the Research Director, Waksman Institute, Rutgers University?

DR. MESSING: Yes.

ASSEMBLYMAN AZZOLINA: Okay, that's a question I asked before. Now you're here. Okay.

DR. MESSING: Thank you very much for giving me the opportunity to speak here.

ASSEMBLYMAN AZZOLINA: No problem.

DR. MESSING: Also, I apologize that I interrupt the speaking order, but I'm giving tonight a plenary lecture at a conference. And so I have to rush from here to the airport.

ASSEMBLYMAN AZZOLINA: That's okay. You want to shift to the middle chair so-- Feel at home.

DR. MESSING: I've been really fortunate to be part of the recombinant DNA development. Actually I was an active member of developing some of the techniques that are the basis of the sciences and the research as well as industrial application. I am now at the Waksman Institute, Director of Research. I just joined the Institute about a year ago, so I'm not that long here in New Jersey.

ASSEMBLYMAN AZZOLINA: Where did you come from?

DR. MESSING: Well I worked for five years at the University of Minnesota at the Twin Cities. Before that I was at the University of California/Davis, and before that at the Max Planck Institute of Biochemistry in Germany in Munich.

I've been very supportive of the new Institute of Biomolecular Research in the Agricultural Sciences. Before I decided to come to join Rutgers, I had indications from your Secretary of Agriculture Brown, from the Chairman of the Commission on Science and Technology, Ed Barr, and from the Governor, Thomas Kean, that they would support the State's

initiatives in biotechnology to span the entire life sciences. When the Governor introduced us to you early this year--

ASSEMBLYMAN AZZOLINA: Oh you were one of them that were standing up there when the--

DR. MESSING: Oh you remember that?

ASSEMBLYMAN AZZOLINA: Yes I do. I do, there were four scientists-- I was going to ask you that.

DR. MESSING: So, I thought I would bring it up.

ASSEMBLYMAN AZZOLINA: Five scientists, I remember that, right.

DR. MESSING: So it introduced that earlier this year, and was proud that the New Jersey State University--

ASSEMBLYMAN AZZOLINA: See, we do listen.

DR. MESSING: --is making ambitious advances toward a stronger internationally renowned scientific program. I felt that all of you would be proud to move our State into the forefront of academic excellence. In order to do so I think we need the vehicle of centers and institutes within the University, and Dr. Shatkin, who is going to testify later on, and I are happy to report to you that your initial investment, that includes the Center for Advanced Biotechnology in Medicine, is gaining important momentum; and that academic institutions in other states, and actually also in even other countries, are directing their eyes to New Jersey.

A sign of our momentum are recent recruitments of Dr. Sidney Pestka, known for his work on interferon, and Dr. Masayori Inouye, known for his work in many areas of molecular biology, to the Medical School -- something that would have been unlikely two years ago. We feel that this impact should extend and include not only medicine, but also agriculture. Therefore, it is of highest importance and most urgent to provide the resources for the Institute of Biomolecular Research in the Agricultural Environment Sciences. That has been signed into law more than a year ago.

Now, through interaction with our colleagues from industry that include some of the executives, it became clear that industry expects the State's University to build an infrastructure that will benefit them as well. These expectations do not include applications of scientific knowledge to product development. It rather emphasizes the importance of the scientific fundamentals, and the training of skilled researchers and technicians. This opinion has been repeatedly brought to us from executives like Mr. James Burke C.E.O. of Johnson & Johnson, Mr. Irwin Lerner C.E.O. from Hoffmann-La Roche, and Roy Vagelos, President (C.E.O.) of Merck and Companies, and many others.

Furthermore, the proposed initiative is not aimed at reducing the support of our current Agricultural Experiment Station or other activities that the State undertakes to support our farmers. As described above, the proposed institute is going to have a very different mission than the Station, one that is concerned more with the fundamentals of the sciences that are basic to agriculture. It has to compliment the initiative that the State undertook in the other areas of biotechnology, and the ongoing work in the Station.

Because of this role, it can not be part of either unit in the University, but needs to be a new and autonomous unit. It should play a similar role for Cook College as the Center of Advanced Biotechnology Medicine does for the Medical School and the faculty of Arts and Sciences and the Waksman Institute at Rutgers. Such a move from your side would be unique in the U.S.A. but not necessarily in the world. Countries like the U.K., West Germany, the Netherlands, and Japan, are far ahead. New Jersey could be a center of such an activity for the entire country. There are many biotechnology centers for medicine in many states. However, an institute such as proposed, I think would be unique. And would put New Jersey in the long-term in the forefront of technology.

However, I also would like to warn you, or give you concern. I cannot give you false hopes for overnight solutions. Major breakthroughs in the animal and plant sciences have occurred in the last decade. However, any realistic commercialization would need more time and more emphasis on basic knowledge. Therefore, the mission of the proposed institute has to be clearly new and different to ongoing programs. We need to attract scientists of similar caliber as we do already in the medical sciences. And we may have to do so by looking to foreign countries, since our nation has not paid attention to this area of basic sciences as other countries in the world have done.

So in conclusion, I recommend funding of a new Institute for Biomolecular Research and Agriculture, for making New Jersey competitive in high technology world-wide. I will be happy to answer any questions you have.

ASSEMBLYMAN AZZOLINA: Any questions from any members?

ASSEMBLYMAN COLLINS: I have a question. You recommend the funding, would you also recommend tying it to the Waksman Institute?

DR. MESSING: No. I said clearly that I view this as a new and independent initiative. I think that this institute will relate to the Waksman, so it's a very strong link. As I tried to point out before that the Waksman Institute as well as the Center of Advanced Biotechnology in Medicine, are working very hard to impact on the development of departments in the faculty of arts and sciences, as well as on the graduate programs, as well as for the equipment of chairmen to the departments in the Medical School. And that's why I was happy to report here that there are already some signs of momentum -- that the plan works. And certainly we would like to see Rutgers benefiting from this momentum, as well as the University of Medicine of Dentistry does at this time. You know how important it is once you get to the moment where you

see an enthusiasm coming up, you would like to maintain this enthusiasm, to really use a window here where, I think, the State really changes dramatically in its State University system. I mean that's why I was attracted to come here, and I think that's also what I can tell you of other people that have indicated an interest in coming here -- a feeling. So it's a wonderful position to be in, I think.

ASSEMBLYMAN AZZOLINA: As we keep improving, Rutgers will become the premier university in the country -- getting there now, right?

DR. MESSING: Yes. Thank you.

ASSEMBLYMAN AZZOLINA: Thank you very much.

ASSEMBLYMAN HENDRICKSON: Just one quick question, and I'm not sure if perhaps it's too deep for us to get into. But I was interested in the Executive Director's comment on the conservation of water in this technology, and is there anything you could add to that. What you would perceive how we could -- other than the drip process?

DR. MESSING: Yes. What I was doing in my last remarks was trying to point out the importance to realize that some of these projects that have been laid out to you this morning, are really long-term projects; and will require far more understanding and knowledge than we have currently.

The methodology of recombinant DNA of the -- is a gene splicing technique -- has facilitated certainly a dramatic impact on biology. But if we go into how to seek quality, which may affect the water or the use of fertilizer, or the use of other agrichemicals, that would certainly require many more efforts in the research area. But eventually one would hope that things like that could be done. Now the institute that I'm the Research Director of, was built on Waksman's discovery of streptomycin. Okay? And he worked in the soil sciences. Who in the hell would have given him a dime for developing a medical product? And here comes somebody who works in an

unrelated area, and discovers a very important compound, streptomycin. It stopped tuberculosis. He got the Nobel prize and an ideal situation arose where the University holds the patent and it was licensed to Merck, and out of the royalties the institute was built. But, would you have predicted that it would have come because you had supported soil sciences? So, I think you have to bear in mind somehow that the directed and applied research that industry is going to carry out is of a different nature than we can perform in our institutes. I think in the long-term we hope to reach that, but if you ask me what is the time frame, I don't know.

ASSEMBLYMAN AZZOLINA: Thank you very much.

ASSEMBLYMAN HENDRICKSON: Thank you very much.

ASSEMBLYMAN AZZOLINA: Dr. Aaron Shatkin, Director of the New Jersey Center for Advanced Biotechnology and Medicine, Rutgers University.

D R. A A R O N S H A T K I N: Thank you, Mr. Chairman.

ASSEMBLYMAN AZZOLINA: Rutgers, the State University, I'm sorry.

DR. SHATKIN: The State University, right. Well it's a pleasure to be here to speak--

ASSEMBLYMAN AZZOLINA: Thank you.

DR. SHATKIN: --because I think this is an opportune moment in science from a variety of points of view. From the point of view of developing new procedures that can have strong effects in a positive sense, not only in the bio-medical sciences and in the life sciences, but also in the agricultural sciences. Rutgers has a long standing tradition of outstanding activity in the area of plant and animal sciences; and I think the developments that are happening now in molecular biology should be applied to strengthen in an even deeper way the activities at Rutgers.

I think that visibility is increasing, both on the national and international scene. People are looking to Rutgers to see what's happening. The graduate programs are being improved. Students are beginning to look to Rutgers, where they formally looked to the University of California and other state universities. I think we need to maintain that momentum, and begin to bring in the latest techniques, the latest approaches to agriculture, by using recombinant DNA technology for developments of scientific importance.

I heard a seminar last week that I wish some of you could have heard, because it certainly impressed me. It was a seminar describing a way to make herbicide resistant plants by making leaf discs, punched out of a leaf of a plant with a paper punch, put into a solution of DNA that had a gene in it that made plants resistant to the herbicide, growing up the plant in tissue culture from those leaf discs, putting it out into the field, and demonstrating that by spraying the field you could kill the weeds, and this particular plant, which had been sensitive to the herbicide, was now resistant. I think the opportunities here are illustrated by that point. There are opportunities to develop plants that are not only disease resistant and chemically resistant, but also drought resistant, cold resistant. I think the opportunities are limited only by our own creativity, our own ideas.

And that brings me to the point of training new students, and cultivating the undergraduate, graduate, and postdoctoral activities that occur now, and will increase at Rutgers in the agricultural -- both plant and animal sciences. As Dr. Messing and Dr. Fulkerson pointed out, this is an intellectual endeavor with long-term effects. I think the investment is long-term, but we're already beginning to see the opportunities that places have taken advantage of, for example in St. Louis at Monsanto where this development I described to you briefly a few moments ago.

So I think timing is very important here. We must act now to begin to develop this center, to bring in new people. Otherwise we're going to fall behind and not maintain the tradition that has been so excellent here at Rutgers. In order to do that, we need a strong leader. Somebody who can come in and build an independent program to complement the existing programs in the life sciences. We already have had expression of interest by individuals with international reputations in the agricultural sciences; people who know both the traditional plant breeding activities, as well as the molecular approaches to developing better plants and animals for agricultural purposes. So I see this as an opportunity for developing creativity for taking advantage of the university structure to develop new ideas by fostering young people's activities in the laboratory, as well as in the field eventually.

Now, one of the things that should be emphasized is that industry of course is interested in these kinds of activities, but they have short-range goals. Our goals should be long-range, preparing ourselves for the opportunities that will arise from the intellectual activities, and the efforts in the laboratory. I think this is a chance for New Jersey to continue to build on a long established tradition. And I would very strongly urge that the State Legislature and other persons who can foster that activity, support this Agricultural Sciences Institute.

Now, somebody asked earlier, how will it help New Jersey farmers? It might not help tomorrow, but I gave an example I think that one could amplify, based on the question of making drought resistant plants, or making disease resistant or cold resistant plants; and I see that potentially in the near future. These kinds of things will have direct effects on helping the farming community. Now in addition one could see -- as was pointed out by another person who testified also -- that companies will build around the intellectual ferment of

the university setting, that we hope to foster by our bringing in new people by developing the opportunities that already exist in the Experimental Station and in the plant sciences and the agricultural sciences in general.

So I'm very optimistic about this. I think it's a fantastic time in science -- that the opportunities are very great. And I hope that we don't miss the boat by getting into discussions that go on endlessly. I think we have to act very soon because people who have interest and are looking our way, will go elsewhere if we don't strike now. So I'm happy to answer any questions or continue if you need with the comments.

ASSEMBLYMAN AZZOLINA: Yes. You're for this going on at Cook College or the institute?

DR. SHATKIN: Well speaking frankly, I think the more important issue is the nature of the program and the person that leads it; because I think if a strong leader comes in and builds an outstanding program, that people will come and interact quite separate from the issue of whether it's at Cook or Busch.

ASSEMBLYMAN AZZOLINA: I mean the Experimental Station, I guess. Same thing?

DR. SHATKIN: Well as I said, to bring in a person with a creative bent, somebody with a strong leadership quality, may require that we provide an opportunity for that person to develop without reporting through standard procedures. And so I was pleased to hear Dr. Pond say that this person who would direct the Agricultural Sciences Institute would have direct contact with the President through that advisory capacity. I think the strengths in the biomedical sciences that is growing on the Busch campus, will be a strong prop, or a strong center for ideas and interactions for the Agricultural Sciences Institute. Now a few miles away could be a comparable center in the Agricultural Sciences in Molecular Biology, if we go forward with this plan and bring in

a strong leader. So whatever it takes to bring in that strong leader, I think we should support.

I think the important thing is that it be part of the University setting, and force the creativity of youth, the activity of the students, and the postdoctoral fellows. I think that we need to be prepared for whatever fundamental findings turn up in the course of activities. And we need to develop the spinoffs of those findings by being prepared, both technically, as well as intellectually.

ASSEMBLYMAN AZZOLINA: Any questions?

ASSEMBLYMAN HENDRICKSON: Just to explore a little bit -- you're saying a strong leader and perhaps we should kind of have a third in it. Your feeling is that a strong leader could not be brought down through a chain through Cook College, from Rutgers, through Cook, to what we're talking about? Not necessarily set up that third tier?

DR. SHATKIN: I think it's possible to do that. But I think it would be advantageous in terms of visibility and developing independent programs -- in terms of gaining visibility at the national-international level, in terms of attracting new grant support from the Federal agencies, to have a person with independent visibility. Someone who could come in and interact very effectively with the existing structure, but still be strikingly and demonstratively visible as an entity -- part of the overall, but not necessarily down through the ranks as you imply.

ASSEMBLYMAN HENDRICKSON: You're just saying there should be a little more flexibility perhaps.

DR. SHATKIN: Yes. I think one should be very flexible. I think the important thing -- the key as I said before -- is to get the right person. And if we don't do that then I think--

ASSEMBLYMAN HENDRICKSON: I think we'd all agree with that.

DR. SHATKIN: Yes, I think if we don't do that then it's just going to be another--

ASSEMBLYMAN HENDRICKSON: (inaudible)

ASSEMBLYMAN AZZOLINA: Okay, any other questions? All right, thank you very much Doctor.

DR. SHATKIN: Thank you.

ASSEMBLYMAN AZZOLINA: Dr. Harold Hafs, Vice President of the Animal Science Research, Merck Sharp & Dohme.

D R. H A R O L D H A F S: Mr. Chairman, members of the Committee, thank you for this opportunity to address you this morning. Until five years ago, I was on the faculty for the previous 22 years at Michigan State University in the College of Agriculture. The last six of those years as the Chairperson of one of the departments in that college. And so I feel quite at home in visiting about the kinds of issues that you're grappling with on your Committee today.

Five years ago, I assumed my present post as Vice President in charge of Animal Science Research and Development at Merck Sharp & Dohme Research Laboratories. Our headquarters are in Rahway, New Jersey. My job is to be responsible for the discovery and development and registration of new drugs for animals world-wide, and including in the United States of course. My organization -- comprising something over three hundred people, based principally in Rahway here in New Jersey -- is part of Merck Sharp & Dohme's Research Laboratories. This is a freestanding division of Merck & Co., Inc.. The other divisions are more well-known to most people -- those are the commercial divisions. The commercial division for which we develop products is called MSD AGVET. We develop both plant health and animal health products, principally animal health products. Our company is one of the largest human pharmaceutical companies world-wide, and so are we one of the largest animal health companies world-wide.

It's timely that I would appear before you today because I have just completed an assignment on a national research council -- National Academy of Sciences Committee -- on creating a strategy for biotechnology and agriculture. And in that capacity we were assigned the job of reviewing centers -- such as being proposed now for Cook College -- nationally and internationally, and then recommending to Congress and to the United State Department of Agriculture a national strategy for the future, so far as integration of biotechnology into agriculture is concerned.

If I may, please, I'd like to enthusiastically endorse the proposal for a Center of Biomolecular Biology Institute in Cook College. In my opinion this is a farsighted plan. It is, in one fell swoop, capable of catapulting Cook College and Rutgers University of New Jersey into a position of leadership. And yet it is realistic-- In terms of the resources which are requested are capable, in my opinion, of getting the job done. I'd like to make just three points, Mr. Chairman.

The first is I think it's absolutely critical, essential, that -- as the proposal currently outlines -- that this new center be integrated completely within Cook College. The center's staff should have access to the existing resources of Cook College. The center's staff should have teaching capability to the extent that they wish to. They may be able to guide students. They'll be able to test their practical applicational ideas through current Agricultural Experiment Station and Cooperative Extension Service faculty members. And of course they'll be guided by the land-grant philosophy and the mission orientation of Cook College. Conversely, the current staff of Rutgers University in general, and especially Cook College, would have access to the new resources, including the new people in this center. Students and faculty alike would be exposed to these new resources and the result would be

an amplification -- a manyfold application -- of the output of this center; by comparison with the situation if it were a freestanding institute distantly located from Cook College, or distantly administered from Cook College. So I'm enthusiastically in support of the proposal that the center be fully integrated with the current resources at Cook College.

The second point that I'd like to make is that New Jersey is ideally suited to the kind of proposal which is put forward here, for a couple of reasons: In the first place, as you know there is a concentration already of high tech businesses in this general location, such as our own company. To name a few others there is Cyanamid, Roche, and FMC, and in addition to my own, that's four. The largest agri-business, high technology companies in the world are located within just a few miles from Rutgers University. I think New Jersey is more suited for this kind of a proposal than any of the so-called "farm belt states." For the reason I just mentioned, and also the reason that I expect that the products coming out of this new high tech research, this new biotechnology, will be consumer oriented products. And New Jersey of course had ready access to many large markets, the largest markets in the world; particularly in the northeastern United States, but also in Europe.

The third point that I'd like to make with you is one that was alluded to also a little earlier this morning, industry absolutely depends upon government support, especially in two ways: training of new people, and basic research. Now let me speak to the first point. I had occasion just about ten days ago in the course of my regular business to summarize for my bosses the people that I had hired in my job in the last two and a half years -- there were a total of 59 new people that I hired -- and to summarize for them the kinds of people that were hired. The largest single category by far was biotechnology and molecular biology. And also I should point

out -- as was alluded to by one of the earlier speakers -- we've had to go overseas until now for many of these people. You'll recall I mentioned earlier this -- in my testimony before you -- that I think a major feature will be the exposure of Cook College students and others at Rutgers University to the new resources in this Biotechnology center. Training I think will be an essential and very important output from this new center, although the principal assignment of course will be research.

The second thing that I mention that an industry like Merck requires from government -- either Federal or State, someplace or another -- is basic research inputs. Industry is notoriously myopic. History teaches us that industry will not invest in long-range research, or invest very little in long-range research. By partnership arrangement it's been a very successful sort of thing which has evolved here in the United States. Let me give you just two examples, one which I hope you'll know about because it happened quite close to here. The successors to it were alluded to in the Waksman Institute in the discovery of streptomycin. Not long before that penicillin was discovered in England, and was a very important discovery during World War II, but it remained a medical curiosity, very important. Medical curiosity, until my predecessors at Merck discovered how to produce it in large quantities. They developed a means of producing it in sufficient quantities so it made a difference to people, so it could be widely available towards the end of World War II. An enormously important partnership between federally sponsored research -- governmentally sponsored research, and private industry.

And another example, until about ten years ago, Marek's disease was a dreadful disease that limited the poultry industry-- It would be impossible for Perdue to do the sort of things that you know that he does now with his chickens because

of Marek's disease. Well, federally sponsored research isolated the virus that caused Marek's disease -- the first time anybody had done anything like this, with any kind of virus, human medicine or animal medicine. But they lacked the technology to convert that virus into a vaccine. My predecessors at Merck were able to do that in cooperation with a governmentally sponsored scientist. They converted this virus into a vaccine, which now controls world-wide Marek's disease. To point out to you-- When I was boy growing up, chicken meat was about as expensive as beef. I don't have to tell you what it is now. I think that's a very important contribution to be able to control diseases like this. At a company like ours we think that human nutrition is the first prerequisite for human health. It doesn't do much good to vaccinate people if they're starving to death. We don't starve to death in this country. We have other kinds of nutritional problems.

ASSEMBLYMAN AZZOLINA: We have too damn much food.

(laughter)

DR. HAFS: Many of these other nutritional problems are also attackable by biotechnology. So in summary, I think the proposal which is before us is farsighted and well planned. It can quickly -- and by quickly I'm thinking in terms of five to ten years sort of time frame -- contribute meaningfully to agribusiness in New Jersey of an entirely different kind, that we don't know about until now. But mind you, this is not a pipe dream way off in the distant future. Biotechnology is here today. We know that these things are doable.

And finally, companies such as Merck I think will gravitate in large numbers to support this Institute the way that it's proposed -- the way the structure is proposed -- because it will foster inter-disciplinary and collaborative arrangements between companies like Merck and the proposed new

institute. In overview, I'm an enthusiastic supporter of the proposal. Thank you.

ASSEMBLYMAN AZZOLINA: Thank you very much. Any other questions? (no response) Thank you very much, Doctor. Let's see, we have Dr. Nancy Fogg-Johnson. Did I pronounce it right? (affirmative response) Vice President of Food Science Technology, Campbell Institute for Research and Technology, Campbell Soup Company. I've got to get to know you. I'm in the supermarket business. I sell a lot of your soup. (laughter)

D R. N A N C Y E. F O G G - J O H N S O N: I'm very pleased to hear that.

ASSEMBLYMAN AZZOLINA: A lot of it.

DR. FOGG-JOHNSON: I do not have formally prepared comments, Mr. Chairman. I have a few informal comments.

ASSEMBLYMAN AZZOLINA: Whatever you want to say.

DR. FOGG-JOHNSON: I'm pleased to be here this morning to tell you Campbell Soup's interest in this proposed institute. You've heard earlier about specific commercial applications of biotechnology that are here today, and in existing food products being sold by Heinz and Perdue. As an agriculturally based company, Campbell Soup obviously shares that type of interest. And as a New Jersey based company, we have a very proprietary interest in what goes on at Rutgers and the State University.

We perceive biotechnology and its products as a massive force that will change the way we do business, and the way we do our research within the corporation. My title doesn't necessarily indicate what I do, but my responsibility within Campbell's is for the basic research program for the corporation. We have in that program a major biotechnology component.

ASSEMBLYMAN AZZOLINA: Are you a scientist also?

DR. FOGG-JOHNSON: Yes I am. The shame of it for us is that -- as a New Jersey based corporation right now -- is that for our biotechnology interests we focus primarily outside the State of New Jersey, as well as internationally. And we see no reason why this type of institute could not be developed successfully within the State of New Jersey; and benefit the existing corporations, and also result in some major economic and scientific growth within the State.

Mr. Collins, you asked earlier, "Why New Jersey?" And I'd give you an answer from a slightly different perspective. It's an investment in the State. Biotechnology is happening everywhere, and there is no reason why New Jersey should not, and could not, support an institute of this nature. It's really a business investment, because by developing the scientific and technical expertise within this institute and within the State, you will attract scientists, and you will attract a lot of grant money that now flows outside of the State for this type of research program to go on.

Historically, the agriculturally based research on which Campbell's and other food companies have relied, has been based on breeding, and then growth, and demonstration of plant growth in the field. That's necessarily a very slow process. You've heard of a few potential applications of biotechnology this morning, and I'd like to give you examples of a few others -- And I'm sure being in the grocery business you can appreciate this, Mr. Azzolina.

We have heard, and we have seen evidence that it's going to be possible to control the ripening process of fruits and vegetables. With that in mind, and ripening -- if you will -- on demand, we also perceive that it's going to be possible to control other consumer important and economically important aspects of fruits and vegetables, such as flavor, texture, shape, color. It's not difficult to see the economic implications of these types of achievements.

We at Campbell's have a very strong sense that if we're not in the race, we're certainly sitting at the starting line with the engines running, and it's just a matter of picking the right direction. And I would encourage you on the Committee to develop that type of sense of urgency, because biotechnology is happening today. It's happening in other states. It's happening in other countries. We see that the people who develop the momentum, through successful research programs and successful applications, really attract and are able to mount major research programs. They attract the human resources, as well as the financial resources.

In short, Campbell's wholeheartedly supports the development of this type of institute, and we would look forward to working closely with the people at Rutgers to help define the appropriate research programs. I would recommend that you move aggressively in the staffing area, and the funding area; focusing on quality of staff, and quantity of funding, because it's not possible to achieve a major movement forward in this type of program without the human resources and the financial resources. It cannot be done on a shoestring. And on the theory that pure academic research is one part -- only one part, but a very necessary part of success -- I would encourage a very strong interaction with industry in order to identify the long-range research areas that would be of practical economic interest to industries located within the State of New Jersey as well as outside the State of New Jersey. I think in so doing -- in focusing part of the research program of the institute in that way -- then we will assure ourselves of success; and have something that's a viable and enviable type of program.

And I thank you for the opportunity to comment. If you have any questions--

ASSEMBLYMAN AZZOLINA: Thank you Doctor. Any questions?

ASSEMBLYMAN COLLINS: Yes, I have a question or two.

DR. FOGG-JOHNSON: Yes.

ASSEMBLYMAN COLLINS: You make--

ASSEMBLYMAN AZZOLINA: Jack here is a-- He's not a professor, but he's at one of the colleges down there. What is it?

ASSEMBLYMAN COLLINS: One of them. It's not important, is it? (laughter)

ASSEMBLYMAN AZZOLINA: Down around your area, anyway.

ASSEMBLYMAN COLLINS: A question. You mentioned the potential to ripen on demand, and so on--

DR. FOGG-JOHNSON: Yes.

ASSEMBLYMAN COLLINS: Carrying this out, would this bring us the possibility of having Jersey tomatoes throughout the year?

DR. FOGG-JOHNSON: It's feasible. It's not out of the realm of reality.

ASSEMBLYMAN AZZOLINA: How can you have it through the year?

ASSEMBLYMAN COLLINS: Well, if they can ripen on demand, I mean--

DR. FOGG-JOHNSON: We either ripen on demand or we ripen on the schedule. And if not throughout the year then certainly we can expand the availability of vine ripened, freshly ripened tomatoes.

ASSEMBLYMAN AZZOLINA: You mean you pick them and ripen them later?

DR. FOGG-JOHNSON: I'm not sure what the mechanism would be. Whether it would be controlled on the vine-- In theory it could be, but I suspect it would be controlled in the warehouse.

ASSEMBLYMAN COLLINS: And the second question, may not be in your realm but-- Again with tomatoes, Campbell has in the southern part of the State, moved out of the tomato

industry, or moved out of the tomato business, and moved to other states. Would anything in the future scientifically be able to bring that business back to the southern part of the State -- any biomolecular development or anything like that? I don't know if either of us know the full details of why the industry left.

DR. FOGG-JOHNSON: Well I was just going to ask you that. I've been with Campbell's about nine months now, and I'm not familiar with their history of why they left the southern New Jersey area.

ASSEMBLYMAN COLLINS: Well, it was a cost factor as much as anything else.

ASSEMBLYMAN AZZOLINA: I knew he was going to ask you that.

DR. FOGG-JOHNSON: That's all right. I would think that if there are technological developments that we're able to apply that make it economical for us to come back to the State, then obviously we would; because we have a major manufacturing facility right there in Camden.

ASSEMBLYMAN AZZOLINA: You're not going to close that up, are you?

DR. FOGG-JOHNSON: Of course not. Don't put that in the record. Don't start any rumors. (laughter)

ASSEMBLYMAN COLLINS: One of the losses that we had in losing the tomato industry, is just what you mentioned, in Campbell's. I grew up in Gloucester City which is en route to Camden. And I can still remember -- there's no judicial or police officers here -- when the truck would stop at the red light, we would sneak out and steal the tomatoes as they were going to Camden. And that's a whole--

ASSEMBLYMAN AZZOLINA: Well, no wonder they left. (laughter)

ASSEMBLYMAN COLLINS: --that's a whole growth procedure that's gone from the youth.

ASSEMBLYMAN AZZOLINA: That's on the record, remember. That's stealing tomatoes.

DR. FOGG-JOHNSON: I think you're past the statute of limitations. I think you're safe. (laughter)

ASSEMBLYMAN COLLINS: Yes, that is true, fortunately. Thank you, Doctor.

DR. FOGG-JOHNSON: Thank you.

ASSEMBLYMAN AZZOLINA: Okay, any other questions? (negative response) Okay, thank you very much.

DR. FOGG-JOHNSON: Thank you.

ASSEMBLYMAN AZZOLINA: Need any good advice about New Jersey? He's from down your way. (laughter)

ASSEMBLYMAN COLLINS: Yes.

DR. FOGG-JOHNSON: All right fine, I'll keep that in mind. Thank you.

ASSEMBLYMAN AZZOLINA: Dr. David Simcox, Director of Biological Evaluation Department, FMC.

D R. D A V I D S I M C O X: Mr. Chairman.

ASSEMBLYMAN AZZOLINA: Hi.

DR. SIMCOX: How are you?

ASSEMBLYMAN AZZOLINA: Good thanks. What's FMC again?

DR. SIMCOX: It used to be, Food Machinery Corporation. We just go by FMC now.

ASSEMBLYMAN AZZOLINA: What do you do now?

DR. SIMCOX: Food machinery, some chemicals too.

ASSEMBLYMAN AZZOLINA: Oh, still the same.

DR. SIMCOX: It's just easier that way. It's a little difficult to start out being myopic-- Well, I've got a few prepared comments that I'd like to run through.

ASSEMBLYMAN AZZOLINA: Talk into the mike too so that she can record it. You're being recorded for posterity.

DR. SIMCOX: All right, for future reference.

My job is the Director of the Biological Evaluation and Research group at FMC, and this is within the agrichemical

group of the company. And I thought it would be useful to lay out a framework from which we operate, our size relative to the industry, what our competition is, and what we think the benefits of having an institute, such as the proposed one at Rutgers, would behoove us being located in the Princeton area, and conducting research in biotechnology and molecular biology.

First of all, FMC is a diversified multi-national, and we have sales of over three billion dollars, and approximately 10 or 15% of that is in the agrichemical sector. That rates us in the second tier companies, 10 to 15th in the world in that regard. There's a great deal of competition in our world from West Germany -- as cited before -- Japan, in the biotechnology sector. Many companies have identified as Dr. Fulkerson had, the rapid growth and explosion of this technology where one can make advances both, that were unlimited before, and now in realistic time frames. We recognize this. I joined in FMC in 1982, and started the biotechnology research program with the corporation, the first of its kind.

We had prior to that time, not had biological research in the State. We had a Chemical Research Center located in Princeton on Route 1, which houses a traditional seven or eight hundred employees at that location. And we've been there for 30 years. We, in bringing our biological group to the Princeton area, recognized the need to have access to scientists in agriculture, in order that we could provide some interaction -- as I'll describe in a minute -- with these. I believe over the last four years, we have utilized the scientists at Rutgers in a number of ways: as consultants, we've used center scientists to advance courses at the University. We supported a plant science seminar series, and we have also been having discussions about bringing in-house a course on bio-chemistry for our local employees.

In summary, with regard to FMC, we feel that the institute will advance our ability to take advantage of biotechnology and molecular biology research, in the long-term areas where, let's say, we're medium-term focused. It takes us about seven to eight years to bring a product to market, and it costs us about \$30 million on average to do that.

The institute's stated mission is consistent with what we feel are our research goals. Let me run through a laundry list of these, and if you have questions about them I'll be glad to answer. Primarily it's the local access that is important to us. Access to research programs that overlap our interests. And in reading the proposal and talking to people at Rutgers, the number of the areas that are cited in the plant sciences directly relate to our research and long-term needs. We see benefit from it.

We cannot afford to develop this technology in-house. Roughly \$100 million to \$200 million are spent in the United States just by companies in our business in the area of biotechnology, and this is probably a 5X or a 10X growth of the last four or five years. We can't afford to spend at that level. Traditionally we spend on outside programs in this area from one to five million, depending on the number of programs and how large and how quickly we want to get there and determine the answers.

The primary interest is: 1) to keep in touch with technology, 2) is to study the feasibility of an approach. If it makes sense, if it works out then we can bring it in-house and help to apply it. That's where our interest lies in research programs. Also it aids us in recruiting trained scientists. Having local access allows us to have firsthand knowledge, the ability to know them beforehand, bring them in, and the prospects of long-term employment are increased.

We also see advantages in advanced training of our scientists and technicians in the area of molecular biology techniques, and biotechnology. It's highly specialized and requires equipment and training, that we might not be able to provide in-house, that we can through the University. It provides the availability of consultants that can deal with our scientists frequently, and fairly inexpensively as compared to travel across the United States, and we look at this. We also see that access to seminars that are put on by the institute would provide us with information from world renown scientists that would be brought into the area. We see this as a major benefit.

We have reviewed numerous proposals such as this, for corporate involvement in (inaudible) in other states. And we have decided not to invest in those. The things we looked for are: How were these programs relevant to what we're doing internally in our long-term strategy? How do we (inaudible) with what they would like to work on. Two, how would we be able to utilize and assimilate this technology and apply it? What's the mechanism involved in order to do so? And we recognize the importance of scientific exchange and collaboration as the key ingredient in success. I think that local access gives us a greater chance of being successful.

In general we support funding on the outside, in universities, on a selective basis. We have research contracts in place that utilize existing expertise. We don't have to develop it internally. We can go to somebody that knows how to do it, can do the feasibility studies, and hopefully we can apply the technology that pays off. We also would be interested in funding postdoctoral associates -- someone does a research project at the institute that is in line with our interests, that has the techniques or the instrumentation that we would not want to purchase internally. And finally, as referred to previously, the industrial liaison program which is

called the Cooperative Research Program-- We would certainly review and consider membership in that program. We feel this might be one of the ways of gaining access and becoming more familiar with the scientists at the University.

I did mention that the programs that were identified as proposed by the institute in the area of plant sciences, are in concord with the areas that we believe investment research should be conducted in the plant science area. And we wholeheartedly support that.

A question was raised about where this facility should be located. In my tenure in directing research, we think that a key to success is having a multi-disciplinary effort, that combines both the basic research and the applied science. The applied science in this case is agriculture: animal and crop agriculture. The basic science is biotechnology and molecular biology. It's very important that whatever the Committee decides (inaudible) that can ensure that there is an integration of the basic science and the applied science. To ensure: 1) That technology can be promptly applied, and 2) There's a great deal of information that comes from the applied science -- say, "There are the new problems. This is new information. And unless you have an integrated team, you don't have current problems for the biotechnology, and the basic researchers to study."

Dr. Fulkerson mentioned a number of biomolecular institutes comparable to what's being proposed here. With regard to business activity around the -- probably the most notable is the one at the Research Triangle. We note that in our business that a number of companies have either -- in the agri-chem industry -- have either increased their investment, or started new research facilities in the Research Triangle area. BASF is an example that is moving their facilities

there. Formerly, these were located in New Jersey. We see a great deal of new biotechnology, small start companies, being developed in the Research Triangle area. It's a hotbed of crop biotechnology right now.

So New Jersey has an existing high tech nucleus in which to build from. By establishing the institute, it will secure a long-term position for the State in this technology sector. It will encourage continued investment by companies such as FMC in this area. And finally, it will spawn a generation of smaller, agricultural, entrepreneurial, biotechnology companies in this area of the State. And we wholeheartedly support the establishment of the institute.

That's my prepared comments.

ASSEMBLYMAN AZZOLINA: Thank you very much. We have about nine-- Do you have some questions? I'm sorry.

ASSEMBLYMAN HENDRICKSON: Just one question. If I understood you right, we had recommendation perhaps that to get qualified people we would probably need a third tier flexibility there. If I understood you right, you're saying perhaps it would be better to be integrated so that there's a complete flow of knowledge moving from the industry through.

DR. SIMCOX: I believe so. That's my recommendation.

ASSEMBLYMAN AZZOLINA: Thank you very much.

DR. SIMCOX: Thank you for your time.

ASSEMBLYMAN AZZOLINA: We have nine more witnesses, so I suggest that we break for about a half hour or so for lunch. I've got to eat anyway. I'm on insulin, so I've got to eat. So, we'll break and get up here as soon as possible. Half hour, 35 minutes, whatever it takes, okay? Thanks a lot.

**RECESS**

(AFTER RECESS)

ASSEMBLYMAN AZZOLINA: May I have order please? We're going to get going. It says here, Mr. Sam Garrison-- I'm sorry. It says Secretary of Agriculture. (laughter) Yes sir.

A S S T. S E C R E T A R Y S A M U E L G A R R I S O N: Thank you, Mr. Chairman. Chairman Azzolina and members of the Economic Development and Agriculture Committee, I am Sam Garrison, Assistant Secretary of the State Department of Agriculture, and I'm here representing the Secretary of Agriculture, Arthur Brown. Due to a commitment with the Governor today, the Secretary was unable to attend, but personally asked me to convey his personal regrets, and also express his personal greetings to all of you, for particularly considering this important subjects, the establishment of an institute for Biomolecular Research in Agricultural and Environmental Sciences at Cook College, Rutgers University. And again I'd just like to reiterate that had he not this prior commitment, he would have been here today to personally express his support for this project, the institute at Cook College.

During the past legislative session, the State Board of Agriculture closely monitored the progress of an Assembly bill whose purpose was to establish such an institute. The State Board supported the legislation, with the provision that the center be established at Rutgers, Cook College. Although that bill is now law, we are still awaiting the final determination of the need for the institute, and the selection of its location, by the Commission on Science and Technology.

The need for research into basic molecular and cellular biology is essential for the long-term survival of New Jersey's agricultural industry. During the past forty years, tremendous production gains have been made through the use of innovations -- research innovations -- such as: animal

artificial insemination for better genetic selection, the development of hybrid seeds for better crop yields, and better control of plant and animal diseases and pests. These advances have led to an unexcelled quality and quantity of food available to this State and country. Furthermore, much of this technology has also been exported to previously underdeveloped countries. For example, India once dependent on grain imports, is now a grain exporter.

However, some people would argue that these advances have led to surplus commodities and reduced profitability. These critics are reluctant to endorse new technology for fear that innovations in production will make the farm economy worse. While an understandable concern, the long-term results of stifling research progress could be the loss of our State and nation's number one industry, agriculture. The research possibilities are enormous and could range from the management of toxic wastes to finding industrial uses for surplus agricultural commodities such as corn and soybeans.

Agriculture in the 1990s and beyond must adapt to survive. Already in New Jersey, a dramatic change has occurred. Farms are more intensely managed with a significant increase in high value crops, such as fresh fruits, vegetables, and nursery stock. The Agricultural Experiment Station at Rutgers, Cook College, has played a key, major role in assisting the farmers during these periods of transition. It is for this reason that the State Board of Agriculture believes that the institute for Biomolecular Research in Agriculture and Environmental Sciences, should be located at Rutgers, Cook College. The land-grant mandate of developing and applying basic research has long been a role of the Agricultural Experiment Station. The new institute would expand that function to include both basic and applied research. It goes without saying that the budget for the institute should be funded separately and not be at the expense of the current

programs at Cook. The establishment of a Biomolecular institute in New Jersey offers great possibilities for agriculture and the environment.

In conclusion, I appreciate the opportunity to have provided the position of the State Board of Agriculture, and to indicate our support for the proposed institute. And also, I'll be glad to answer any questions you have, or relay any comments that you may have to Secretary Brown and the State Board of Agriculture. Thank you, Mr. Chairman.

ASSEMBLYMAN AZZOLINA: Do you have any questions? (negative response) Thank you. You must have been that good. Okay. Peter Furey, New Jersey Farm Bureau?

P E T E R F U R E Y: Thank you, Mr. Chairman. My comments will be very brief, but I did want to make an appearance today to let you know that the farmers of this State are at work studying the ramifications of biomolecular research and what it means to them in the future. We have a committee just established to analyze this Vision 21 plan. We consider this proposal something in addition to that document as having possible ramifications for us in the future.

I think it goes without saying that research is absolutely essential to support current farming operations in the State. It's always been that way; always will be. Perhaps in the future with some of these other countries getting more active in expanding their production, competition is even going to be more fierce. So the comments made this morning about the need to stay competitive, and the need to do that for this purpose, we think are right on target. Technological advances in the past have served farmers well, so we are very open to the possibilities of what this is. I don't think, to be honest, that the farmers are extremely conversant with what all this means. They're so busy trying to make a living now, that this is a little bit fuzzy to them. But more and more, there is a lot more attention being paid.

We have basically two concerns. One Mr. Garrison just mentioned -- that the current essential applied research that is being done now, not be sacrificed to pursue this type of program, which could be years before it comes on-line. In other words, we don't want to see the research which is vital to the current survival, be sacrificed or take a step back, with obvious consequences in the present. That's one concern.

The other concern is, as we and you consider the investment of public funds for this purpose, that you keep in mind the economic structure of the family farm. We don't want all the results of this research to end up in the hands of only these large macro producers, and not be applicable. I was over in Holland last year, and we were watching some of the way they applied gene splicing. And those operations were many hundreds of thousands of dollars of investment, greenhouses and so forth. They get a lot of government help over there. And in the horticultural crops, this is reality. As was mentioned this morning in livestock, horticulture is probably in the vanguard as far as having applications right now. So we urge that you keep the farmland preservation and the policy of the State -- to support and encourage farmers -- in mind as you make some of these investments.

One last comment is-- Reference was made to the new leadership at Cook College. This was a very big issue for us two years ago, as was the whole relationship between Rutgers and Cook College. To a large extent that has settled down under the leadership of the Dean, and we are in a close position of communicating our concerns to him. So you should be advised that Cook College, as it invites this new institute, is in very capable hands. I appreciate this chance to testify.

ASSEMBLYMAN AZZOLINA: Thank you.

ASSEMBLYMAN HENDRICKSON: I have just one question. Pete, are you saying to us that farmers feel that there's been more progress made on the horticultural side, rather than on the ag side?

MR. FUREY: No, I'm not necessarily saying that's the farmers' opinion. It's my observation. But I have heard some growers, especially the nursery growers in New Jersey-- The greenhouse and the wholesale nursery propagation industry is coming on like gangbusters. Those are the people making money, and they have the funds to invest to get into some of this application, from the basic research into commercial production. So it's really happening. The front line is in the horticultural crops.

ASSEMBLYMAN AZZOLINA: Yes Jack, when we took the agricultural tour this year--

ASSEMBLYMAN HENDRICKSON: We saw it.

ASSEMBLYMAN AZZOLINA: --we saw it, and it's really booming.

ASSEMBLYMAN HENDRICKSON: No question.

ASSEMBLYMAN AZZOLINA: In fact, compared to Europe in flowers, plants, the whole horticultural-- They're way ahead of us in the use of-- It's just in its infancy here in the states now. Oh it's a big field coming on.

MR. FUREY: If this is going to be part of the future, New Jersey should be right up front. And we're going to be a commentator as events progress.

ASSEMBLYMAN AZZOLINA: Okay, I'd like to call Mr. Charles Lain, President Board of Managers, New Jersey Agricultural Experiment Station. Why is it called, "The Experiment Station"?

C H A R L E S L A I N: The Experiment Station is a-- They are the ones that-- Here, I'm a farmer myself. I'm Chairman of the Board of Managers, but the Experiment Station I think has been set up primarily from-- The Federal government puts up a third of the funds, the State and the local area, and they dispense the information from research done by the Research Station to the counties.

ASSEMBLYMAN AZZOLINA: I see. So you're hooked into the Experimental Station though, aren't you?

MR. LAIN: No. I'm strictly President of the Board of Managers, and we are--

ASSEMBLYMAN AZZOLINA: So, the New Jersey Agricultural Experimental Station is Rutgers, isn't it?

MR. LAIN Well it should be Cook College, Board of Managers, is my official title. I'm Chairman and I represent agriculture from Sussex County. And there are actually 21 of us on the Board of Managers, and we are the--

ASSEMBLYMAN AZZOLINA: But you're the President of the Board of Managers?

MR. LAIN: Yes sir.

ASSEMBLYMAN AZZOLINA: Just so I get this straight.

MR. LAIN: And we are actually the sounding board from the county production of agriculture to Cook College, and to the Research Station. We let them know what some of our concerns are, some of our problems. In fact this year one thing we've done, we've actually bought in agri-business. We have four members from agri-business, including an environmental group, to get their views concerning Cook College and work being done at Cook.

My background-- Mr. Chairman, first I'd like to thank you for inviting me here to appear before the Committee. I happen to be a sod farmer. I heard you mention here, horticulture. Actually here we are the bright spot in the industry in the State. To give you an idea how these changes come about, I started in the sod business 22 years ago. The sod industry back then was probably a million dollar business in sales. Today it's in excess of \$30 million in sales. This is primarily adapting to the needs of the State.

As someone pointed out on the Committee earlier, there was the concern, "Gee, are we going to overproduce more?" I personally think -- and here the Board of Managers are very

much in support of biotechnology for the simple reason, it's going to put us in the 21st century and keep New Jersey on top of what's happening here in agriculture. And I really think if we don't get on board and get behind this, and especially at Cook where the agricultural research is being done now-- It's a matter of economics. I personally think here everything you do on a state level is economics; and my business, it's economics. I look at it this way. We have an Agricultural Experiment Station that's doing research. Through the extension agents, they ferret this information back to the county, back to the farmers, production agriculture, and to the taxpayers of this State. And this, rather than duplicating efforts, bring it all in one area, and here tie these two areas together -- these two research groups, and here utilize your dollars better.

My industry, as I said, has grown by leaps and bounds. We here in Cook-- I happen to have started 22 years ago. Twenty two years ago it used to take me 24 months to grow a good commercial harvestable sod. We used to have to worry about the root system holding the plants together. Today I can grow that same crop in one year's time, and that's thanks to the research done by Dr. Reed Funk and others at Rutgers. And I will say this, they have made Cook College and Rutgers number one in the field of turf research in the world -- not just strictly in the U.S. but in the world. They are continuing developing, and of course the ultimate-- This is the same reason I say we can't stop. I was born and raised on a dairy farm. My brother today produces actually twice as much milk, in half the herd, with half the acreage. Well, this acreage has gone into such new industries as the sod industry, and into the nursery industry, and thank God for the research done at Cook. They are actually -- and the Research Station -- they are developing your small crops.

Peter mentioned earlier -- from the Farm Bureau -- the fact of the concern of the small farmer being deleted or possibly being pushed out. I maintain with the research being done at Cook College and the Research Station, this is bringing about the small farm. You have a lot of small fruit farmers, small vegetable farmers. This is what they're doing. They're producing the specialized vegetables and specialized fruit, that the other states are not doing. We aren't pouring money into soy beans and corn research. We'll let Kansas and Nebraska and others do that. And the same with dairy. Dairy has come down in the State. We're doing less on your big animals and more on agriculture that pertains to the needs of New Jersey.

Also there was reference earlier to Vision 21. This is Cook College's plan to fit the needs of production agriculture, fit their research to fit the needs of future agriculture in the State. And I'm convinced here that-- I hope you all get copies. I think the Dean can give you copies of the Vision 21, because it really does outline some of the progressive vision being done at Cook, and some of the progressive work done.

I think the future of Cook as a leader in agriculture, not only in this nation, but in the world, and also the future of agriculture in this State, depends on a biotechnology center being developed at Cook College -- Cook/Douglass Campus. I firmly believe this is imperative. I speak for production agriculture on this. I'd like to answer any questions, if there are any.

ASSEMBLYMAN AZZOLINA: Okay, thank you very much.

ASSEMBLYMAN HENDRICKSON: Just a comment. That Experimental Station on peaches out there on 539, has done very well. We were there when the Dean opened it. And I think it's done a fantastic job.

MR. LAIN: I think this is fitting here the needs of agriculture in the State, and I think serve--

ASSEMBLYMAN HENDRICKSON: That's one of them.

MR. LAIN: Yes. Thank you.

ASSEMBLYMAN AZZOLINA: Stephen Kleinschuster, are you ready yet? Dean and Executive Director, Cook College, Rutgers State University.

D R. S T E P H E N J. K L E I N S C H U S T E R: Thank you, Mr. Chairman, for your very kind invitation to be here with you today, and to provide some testimony to this Committee. I've received some letters, some of which are addressed to you, and some of which are addressed to me, relative to input to this Committee. I would like to read them to enter them into the record. In the interest of time, I'll skip the titles.

"Dear Mr. Azzolina: I regret that I am unable to testify before your Committee on October 15 due to a prior commitment. I am therefore, submitting written testimony because I feel it is so important to express my feelings on the need for a strong agricultural biotechnology research effort in New Jersey and have it be a part of Cook College and the New Jersey Agricultural Experiment Station.

"American Cyanamid Company is one of many important international companies with its agricultural research development headquarters in New Jersey. My company is committed to the continued discovery and development of innovative new products for global agriculture, as well as in the medical field and, as such, has invested significantly in biotechnology research at both its Medical Research Division headquarters in New York, and its Agricultural Research Division in Princeton New Jersey, where approximately 20% of our annual research budget is dedicated to molecular biology.

"Many new products for the future will depend heavily on the tools and techniques of molecular biology. Such products as the bovine and porcine somatotropins, new animal

vaccines for economically important diseases such as poultry coccidiosis, growth hormone-releasing factors, and new crop plants with resistance to disease, pests and broad spectrum herbicides are all in our pipe lines and will be on the market in the near future.

"The molecular biology for these products is being done by agricultural research and development organizations both in private industry and in our universities, especially at land-grant institutions of the United States. It is unfortunate that the land-grant system in New Jersey has not kept pace with some other states and it is time to increase the efforts in New Jersey for agricultural biomolecular research.

"I believe that I speak for the agricultural industry when I say that we are in favor of a strong biomedical research base in our State. We feel just as strongly that it is important to have a solid agricultural biotechnology research effort in our universities.

"In order to be effectively integrated into the agricultural research, teaching and extension activities in the State of New Jersey, as well as throughout the nation, the Agricultural Molecular Biology Institute must: 1) Be located on the Campus of Cook College; 2) Serve as an essentially new research arm of the NJAES; and 3) Have an outstanding Director of world renown who reports directly to the Dean of Cook College, and the Executive Director of the NJAES.

"Once again, I apologize for not having been able to testify, but I hope that my written comments are helpful to you. I would be interested in any comments you have or in providing any additional help or support to you and your Committee. Very truly yours, James V. Gramlich, Vice President for Research, Agricultural Research Division, American Cyanamid Company."

"Dear Assemblyman Azzolina: Thank you for your invitation to provide testimony concerning the Institute for

Molecular Biology in Agriculture and Environment proposed by Rutgers University. Unfortunately, due to prior commitments, I cannot be with you today, but I do wish to offer a short summary and evaluation of the proposal.

"The document in general is most impressive, and certainly complements the general biotechnological effort of the University. In particular, I was delighted to notice detailed attention paid to the integration of basic and applied sciences proposed for the institute. It is of utmost importance for the success of any institute doing agricultural research that these associations, both physically and programatically are as complete as possible.

"The administrative structure reported in the proposal is also appropriate for the institute. As you know, the institute is proposed as a research arm of the Agricultural Experiment Station with appropriate administrative relationship. These arrangements provide integration with the other investigators of the Station and University, and perhaps more importantly, provides access to the agricultural activities, interactions, and initiatives at the national level.

"I hope these brief comments will be helpful to you in your deliberations. Sincerely, Charles Browning, Dean and Director, Oklahoma State University, Chairman National Association of State Universities Land-Grant Colleges, Division of Agriculture, Committee on Biotechnology."

And the third letter is from DNA Plant Technology Corporation, in Cinnaminson, New Jersey. "Dear Dr. Kleinschuster: I am sorry that I will be unable to attend the public hearing on Tuesday, October 14, 1986, as requested in the September 30 letter from Joseph Azzolina.

"I have had an opportunity to discuss the Institute for Biomolecular Research in the Agricultural and Environmental Sciences with you and Dr. Roger Wyse. In addition, I had an opportunity to read the proposal for the institute as well as

the Vision 21 document. As we discussed, I am extremely excited about this proposal and offer our support in any way possible.

"The program outlined in the proposal represents an extremely timely and viable activity. Rutgers and the State of New Jersey are to be congratulated on the planning and consideration of the program. During the past 5 - 10 years we have seen the discovery of numerous technologies that will have significant impact on agricultural production in the 1990s and beyond. These biotechnologies will be commercialized during the next several years and will alter several aspects of American agriculture. New techniques of molecular biology are being developed that will permit us to identify specific genes for traits controlling such consumer attributes as flavor, color, and texture. Thus for the first time there is an opportunity to use these new techniques to modify crop plants.

"It is imperative that these molecular biology programs be tightly coupled to agricultural programs to permit realization of the benefits of this new technology. All plants' cells that are transformed will need to be field tested and selected for superior agronomic performance before they can lead to new products. The successful integration of molecular biology and traditional agricultural programs is absolutely necessary to insure that the new techniques are most rapidly applied to crop improvement. Any effort to insure this integration of molecular biology with the traditional agricultural programs at Cook College and the NJAES should be applauded.

"We at DNA Plant Technology Corporation are excited to see that the State of New Jersey and the Rutgers University are planning to initiate a program that will ensure the integration of molecular biology and agriculture. As a business that is focused on agricultural biotechnology, it is very important to see that the University is responding to a need for the

training of students in these new areas. With the astonishing growth of agricultural biotechnology, the need exists to create a professional curriculum for Rutgers' graduates. If agricultural biotechnology is going to have a profound impact on agricultural production in the 1990s and beyond, it is very important that future graduates of Cook College understand this technology. Moreover, as a corporation we are extremely excited about the potential this new institute offers for additional interaction with our corporation.

"Finally, this institute will be important in determining the future of New Jersey agriculture. New Jersey, the Garden State, had moved more and more to production of high value specialized crops, such as cranberries. Cook College/NJAES has been extremely important in supporting these crops. Development, integration, and application of new molecular techniques will be essential to secure New Jersey's economic position in our existing crops and for new crops in the future.

"We at DNAP wish you well with the plans for the institute. Best regards. Sincerely, David A. Evans, Vice President." So, I would offer, Mr. Chairman, these letters as part of the record.

I also have a short statement that I would like to offer. I also recognize that we have had much support during today's hearings and certainly there would little new that I could offer to the very fine things that have been said today. But nevertheless I will briefly go through my statement.

Advancements in cellular and molecular biology have created new and powerful techniques for understanding and manipulating living systems which expand biological horizons to proportions limited only by imagination. Presently, the biomedical sciences enjoy the most advanced state of these technologies. The development and transfer of the new technology in the agricultural and environmental sectors have

not kept pace with the biomedical sector. Historically, agriculture has relied more heavily on slower, yet time-tested and successful methods to address problems in production, breeding, and management. These conventional techniques must be enhanced by developing and utilizing advanced technologies and by their transfer to the renewable resource sector of our society.

It is the purpose of the document before you to propose the establishment of an institute for Biomolecular Research in the Agricultural and Environmental Sciences as a new research institute within the New Jersey Agricultural Experiment Station, which will engage in research activities in these advanced technologies.

The purpose of the institute is two-fold: First, the institute will focus and greatly strengthen the University's basic research and advanced training at the molecular level in the agricultural and environmental sciences, opening the way to international distinction in these upcoming fields. Second, the institute will provide a vehicle for speeding the transfer of new discoveries to product development and service in the field, both of which are needed to sustain and enhance New Jersey's second largest industry, agriculture.

Benefits of the Institute: The institute should provide the framework for the mutual benefit of the University, pharmaceutical, agrichemical, agricultural, and environmental industries. First to industry: The strongest support for the Cooperative Research Program will be found among locally based corporations which can benefit from the proximity to the proposed institute. Several corporations have already expressed interest in biotechnology initiatives on the campus and frequently participate in scholarship activities. The relative newness and small size of their own biotechnology programs renders them more open to external opportunities for such information. Strengthening the University's research

capabilities will simultaneously aid the formation and success of the smaller firms in biotechnology. The role of the institute and Cook College departments is to develop new knowledge to the point where industry can develop products in a one to three year time frame.

**Benefits to Rutgers University:** Rutgers University assumes primary responsibility in the State to encourage creative research and to train highly specialized people; therefore, it must respond to the opening of this broad new research area. Through the institute, its faculty and facilities will rapidly confer international prominence on the University in this area of research, and will also serve as the vehicle by which the advances in understanding biological mechanisms at the cellular level will be systematically integrated into the many departments of Cook and the Station as well as other units of Rutgers.

In addition, by creating the institute, the University will complement the similar initiative already approved by the State for the creation of the Center for Advanced Biotechnology in Medicine. Collectively, the University is presented with a timely opportunity to make a massive impact in this area.

**Benefits to the State:** In the 1984 public referendum, New Jersey voters established the Jobs, Science, and Technology Bond Issue. Clearly the people of New Jersey support the State's planned investment in higher education and promotion of biotechnology for the purpose of creating industrial vitality and jobs. Research in the agricultural and environmental sciences of the type described in the proposal before you, has a central and paramount place in the fulfillment of the goals approved in that bond referendum.

Agricultural research is estimated to represent \$34 of value added, for each dollar the State invests. The food processing industry, with its \$8.0 billion annual contribution to the State's economy, is New Jersey's second largest

industry. Production agriculture -- also profiting greatly from the activities of the institute -- alone is about a \$3 billion enterprise.

Organization of the institute: The institute will be established as a new, separately budgeted research unit of the New Jersey Agricultural Experiment Station -- NJAES. By virtue of State and Federal legislation as well as an overwhelming demand of logic, this 125 year old research organ of the State -- legally mandated and responsible for the agricultural and environmental research undertaken at the land-grant university -- can best serve the interests of the proposed institute. Available to the benefit of the institute will be the vast infrastructure of the Station, including large tracts of research land, millions of dollars worth of research equipment and, perhaps most importantly, 350 scientists with a holistic appreciation for the totality of the problems they are solving. Additionally as you know, in the New Jersey Agricultural Experiment Station a mechanism already exists for extending the institute's work to New Jersey's varied and vital agricultural and environmental industries via our Cooperative Extension Service. The institute would provide an additional collaborative connection by establishing a Cooperative Research Program with the State's abundant agrichemical, food, and pharmaceutical industries.

A leading scientist will be recruited as institute Director and as Associate Director of the NJAES. The Director will be appointed by the University President and will report to the Executive Director of the NJAES. A residentially appointed Scientific Advisory Board of distinguished scientific leaders drawn from the academic and industrial organizations, will oversee the activities of the institute; reporting to the Executive Director of the Station, to the President of the University, and the New Jersey Commission on Science and Technology.

I'll skip a bit and get over to page five -- in the interest of time -- over to the location of the institute. The Institute of Biomolecular Research in the Agricultural and Environmental Sciences will be located on the Cook/Douglass Campus of Rutgers University. The specific site on the campus will be in close proximity to those Cook departments with which the institute will interact most intimately.

A site on the Cook/Douglass Campus is the most logical choice. Agricultural and Station scientists are concerned not only with exceptional basic science, but perhaps more important, must have a deep appreciation and working knowledge of all facets of the biological questions they are asking. This is accomplished by deliberately and purposely dovetailing the skills and expertise of the molecular biologist with those of the traditional plant/animal breeders and scientists. Without exception, the traditional or clinical skills are indispensable in exploiting the discoveries of the molecular biologist, and the molecular biologist is equally indispensable in providing to the traditionalist, exploitable tools and techniques. This interdependence with all of our scientists aligned as closely as possible, programatically and physically, will assure the success of the institute.

Relative to the testimony you have heard today, Mr. Chairman, I'm sure you will agree that the unique opportunity and benefits emerging from the implementation of our proposal are exceptionally substantial. The impact of this initiative will certainly drive Rutgers University and the Station into international eminence and will provide assured return to the State, to the same historic degree agricultural research has always provided society: an increased quality of life, and \$34 returned for each dollar invested. Thank you, Mr. Chairman.

ASSEMBLYMAN AZZOLINA: Thank you. Let me ask you a question. I gather that having the institute at Cook College, Cook Campus, is very important to the agriculture of this

State. Suppose the institute is not there, and it is somewhere else. Do you see a devastating effect on the agriculture industry in the State.

DR. KLEINSCHUSTER: I don't see how one could have an agricultural research program in a complementary organ, with the basic and applied areas coming together to provide a synergy to address the research and problems of New Jersey agriculture. As I tried to indicate in the testimony, the closer one can integrate -- both physically and programatically -- together these programs, the more assured success is. And certainly with the mandate and the 125-year-old history of the Station doing this sort of thing best, I in all logic can't see it placed anywhere else.

ASSEMBLYMAN AZZOLINA: Well, do you feel it's an integral part of the future of Cook College to be in there?

DR. KLEINSCHUSTER: Oh yes.

ASSEMBLYMAN AZZOLINA: Do you think it's not important whether it's there or not?

DR. KLEINSCHUSTER: No, I think it's absolutely important, as part of our educational efforts, our scholarly efforts, our research efforts, the direction which the Station must go. Even speaking from a selfish standpoint, it's of absolute importance for these various reasons that I spoke of.

ASSEMBLYMAN AZZOLINA: What would happen if the Commission decided to put it somewhere else? How would it affect--

DR. KLEINSCHUSTER: Then I suppose-- How would it affect the College?

ASSEMBLYMAN AZZOLINA: Would it be detrimental to the College?

DR. KLEINSCHUSTER: Oh absolutely. Absolutely it would. There just no doubt of that, in my mind, and in the mind of the many testifiers you've heard today.

ASSEMBLYMAN AZZOLINA: Jack?

ASSEMBLYMAN COLLINS: Dean, if I may. Would it be detrimental to the College? I mean, how could it be detrimental to the College if there's nothing there? It's not like something is going to be taken away. This is going to be created.

DR. KLEINSCHUSTER: It would remove the initiative that is absolutely necessary to bring the Station up to national excellence. In that sense it would damage the Station and the College.

ASSEMBLYMAN COLLINS: Even though it might be somewhere else at Rutgers?

DR. KLEINSCHUSTER: Absolutely, absolutely. It's for that very reason that the Medical School Biotech Center isn't over on the ag campus.

ASSEMBLYMAN AZZOLINA: Yes, what would happen if that were so, on the ag campus? That's a good point. It just wouldn't be compatible I guess.

DR. KLEINSCHUSTER: I don't know if I want to bite that, Mr. Chairman. (laughter)

ASSEMBLYMAN AZZOLINA: All right, in other words, let's say the Biomolecular Institute would be more compatible at the Cook Campus and the Experimental Station, than it would somewhere else.

DR. KLEINSCHUSTER: Mr. Chairman, that's our business. That's what we've been doing for 125 years.

ASSEMBLYMAN AZZOLINA: God, you don't look that old. (laughter)

DR. KLEINSCHUSTER: Our legislative mandate is to do that sort of research.

ASSEMBLYMAN AZZOLINA: Okay.

ASSEMBLYMAN HENDRICKSON: Mr. Chairman, one thing. I would be interested in the grant money coming from the land-grant money. I should think if it was a scattergun approach -- more than one campus -- it would be more difficult

for Cook or the biochem lab to secure the kind of funding they probably need, rather than one college going to the bunker.

DR. KLEINSCHUSTER: No, not in that regard. As a research arm of the Station, the Station has the prerogative to go within the State wherever it wants to find the sort of--

ASSEMBLYMAN HENDRICKSON: I'm talking about the Federal monies.

DR. KLEINSCHUSTER: The Federal monies I can also dispense as I see fit.

ASSEMBLYMAN HENDRICKSON: Okay.

ASSEMBLYMAN COLLINS: Dean, I notice in the document that you read from, and gave to us, it says, "It is the purpose of the document before you to propose the establishment of an Institute of Biomolecular Research in the Agricultural and Environmental Sciences." Now, I looked at this, and part of it is taken from this. Now, is this your document that Rutgers has put together?

DR. KLEINSCHUSTER: Yes.

ASSEMBLYMAN COLLINS: Okay. Has this document been given to the Commission on Science and Technology?

DR. KLEINSCHUSTER: It has been mailed to the Governor's Commission on Science and Technology with appropriate cover letters, both from Dr. Pond, and he included in his letter a memorandum that I sent to him suggesting enhancement of the peer review panel by additional members. As Dr. Pond indicated--

ASSEMBLYMAN COLLINS: But they already have this as they are reviewing, first the need for this -- and of course as Mr. Cohen said this morning, it definitely would be at Rutgers if we have one. So they do have this to help them with their decision?

DR. KLEINSCHUSTER: Yes.

ASSEMBLYMAN COLLINS: Okay.

ASSEMBLYMAN AZZOLINA: Well, there's still a

decision-- I gather from Mr. Cohen, they haven't decided if we're going to have this yet.

DR. KLEINSCHUSTER: I can't speak for Mr. Cohen.

ASSEMBLYMAN AZZOLINA: Well, that's what he said, I think. Am I right?

ASSEMBLYMAN HENDRICKSON: That's right.

ASSEMBLYMAN AZZOLINA: And this would have to come from future bond monies, not present bond monies. Is that what your understanding has been right along?

DR. KLEINSCHUSTER: I think so, yes.

ASSEMBLYMAN AZZOLINA: How do we know we can get another bond through? Who knows?

DR. KLEINSCHUSTER: I don't know.

MR. WILLIAMS: Is this the original proposal, or is this a revision since the one before?

DR. KLEINSCHUSTER: Well, I wasn't here when the original proposal went to the Commission. That's my original -- or the University's original proposal.

ASSEMBLYMAN AZZOLINA: This is your University's. Now there's an update beyond this?

DR. KLEINSCHUSTER: Not that I'm aware of.

ASSEMBLYMAN AZZOLINA: Well what was the other report they're waiting for? This morning he kept saying--

ASSEMBLYMAN HENDRICKSON: Oh that's coming out of their Commission.

ASSEMBLYMAN AZZOLINA: No, there's an additional report out of Rutgers I thought.

DR. KLEINSCHUSTER: Not that I'm aware of.

ASSEMBLYMAN AZZOLINA: That's what I-- What was the-- Yes go ahead, come on up. (refers to member of audience) Just acknowledge your name so we have it for the record.

J O S E P H M O N T E M A R A N O: Joe Montemarano of the Commission. It's my understanding that we are waiting for an additional revision to this proposal as per a letter to Al Pond--

ASSEMBLYMAN AZZOLINA: That's what I gathered this morning. Yes? This document here? (responding to inaudible comment from audience)

UNIDENTIFIED MEMBER OF AUDIENCE: That document. I have asked them to be alerted to the possibility that as a result of a recent consultation where we had the leading figures-- We may want to change some parts of it. I believe I'm within one telephone call of being able to say that the University will not propose any changes to that document at this time.

ASSEMBLYMAN AZZOLINA: Okay. That's why it was brought up this morning. Thank you. Any other questions at this point? (no response)

DR. KLEINSCHUSTER: Thank you, Mr. Chairman.

ASSEMBLYMAN AZZOLINA: Thank you very much, Dean. We appreciate it. Dr. Harry Janes, Professor of Rutgers University. I guess it's the State University not Rutgers University. What's the right word, would somebody tell me? (inaudible response from audience) Why can't we just say Rutgers University? It sounds so much easier. (laughter) Okay.

D. R. H A R R Y W. J A N E S: Mr. Chairman, and members of the Committee, it's been my pleasure to be invited to speak to you this afternoon. I've been involved for the past few years in the planning for the development of the Institute for Biomolecular Research in Agricultural and Environmental Sciences. I am currently a faculty member in the Department of Horticulture and Forestry at the Cook College campus of Rutgers. My research during the past eight years has been directed towards advancing the New Jersey greenhouse vegetable production industry. In an effort--

ASSEMBLYMAN AZZOLINA: The vegetable end?

DR. JANES: The vegetable end. --towards advancing the production of fresh produce during the colder times of the year. I am also involved in an international effort to increase production per unit area, through a basic understanding of plant environmental interactions; using that information to modify current cultural practices to further increase production and grow a profit.

As a result of my research efforts, I have had the pleasure of interacting both with the grower -- that is the individual or family operating greenhouses in the State -- as well as individuals within some of our industries, related to and dealing directly with our production agriculture.

ASSEMBLYMAN AZZOLINA: When you say greenhouses -- I hate to interrupt -- you're talking again vegetables, right?

DR. JANES: I'm talking about the production of something like tomatoes, during the wintertime.

ASSEMBLYMAN AZZOLINA: Yes, because greenhouses over the years has been--

DR. JANES: Usually people think about greenhouses with flowers or bedding plants--

ASSEMBLYMAN AZZOLINA: I know. That's what I wanted to clear up. Fine. Okay.

DR. JANES: Okay, but it is tomatoes. Actually we're looking to provide a good product that you can sell in your supermarket in November and December and January.

ASSEMBLYMAN AZZOLINA: I wish we could have them year-round.

DR. JANES: So we don't have to bring it in from Mexico or California.

ASSEMBLYMAN AZZOLINA: We've got lousy tomatoes right now.

DR. JANES: That's right. That's why we're doing it.

Okay, I have been fortunate enough to have companies such as Monsanto, Public Service Electric & Gas, and DNA Plant Technologies, support my program with about \$1 million in research grants. I have also aided the development of two start-up companies, Bio Organics, and Agro Dynamics, through cooperative research projects. Although I do not classify myself as molecular biologist -- that is, those are the people who are most associated with the current meaning of the term biotechnology. However, I like to think of biotechnology more in the terms defined by the Office of Technology Assessment, where they state that biotechnology is the use of living organisms or their components in industrial processes. In that sense, I think all of us at the New Jersey Agricultural Experiment Station are involved in biotechnology.

Because of my background and involvement with industries, I will briefly comment on the interaction of the institute, and potentially its involvement with New Jersey industrial companies, as I see it.

ASSEMBLYMAN AZZOLINA: Could you clarify something, because I'm getting mixed up here? A lot of talk today has been about biotechnology. We're talking about biomolecular research. Does it mean the same thing, or is it a little different?

DR. JANES: I think the connotation of the term is molecular research today.

ASSEMBLYMAN AZZOLINA: Today?

DR. JANES: I think so.

ASSEMBLYMAN AZZOLINA: So when you talk of biotechnology, we're talking about biomolecular technology.

DR. JANES: Yes. I think that's how the term is generally being used.

ASSEMBLYMAN AZZOLINA: As long as we know it means the same thing. It's not two different things.

DR. JANES: I think sometimes we refer to the institute as a Biotech Institute.

ASSEMBLYMAN AZZOLINA: Yes, right.

DR. JANES: And again the Biomolecular Research Institute.

ASSEMBLYMAN AZZOLINA: That's a tough word to pronounce, tongue twister. (laughter)

DR. JANES: There's no doubt in my mind that there is a tremendous benefit to New Jersey industries for having a strong research university only a few miles from their base of operations. Observing research and interaction with the scientists conducting that research, is much easier than if the project were in Minnesota or Iowa, or California for instance. Also the strong research programs at the University are recruiting tools for industry, in relocating scientists to the State, and potentially expanding operations.

I would like to quote a spokesman for Ciba-Geigy on the reasons for building a biotechnology research institute in the state of North Carolina. "This facility will serve as the headquarters for the company's ag research division," the spokesman said. "North Carolina is known for its excellent universities and research facilities. Those factors, plus the state's interest in biotechnology, and the presence of other high technology firms, were very important factors in our decision."

This was a statement that was made about three or four years ago. I believe that today the same thing can be said for New Jersey, with regard to the State's recently demonstrated interest in biotechnology, and the increasing numbers of high technology firms in the State. But we still need to further strengthen our agricultural research commitment. And I believe that the plan we have put forward will do just that; by allowing us to construct the modern facilities, and hire the support personnel necessary to attract the best scientists to

concentrate on and develop more intensively molecular biology related to agriculture.

The New Jersey Agricultural Experiment Station and Rutgers University, are world renowned and respected agricultural research and educational units, of which I am proud to be a part. We, however, realize that new technologies are developing, that must be exploited for the benefit of all of New Jersey's agricultural industries. I often work with the growers. I see and hear, either directly or through the extension agent, of new businesses which are starting, and at times of others failing, of successful practices, and of non-productive varieties. In this way, even though my research at times is situated in the laboratory or controlled environmental growth room, I can subtly direct and alter my research direction as a result of this communications process. And if I am successful, I can get my research findings scrutinized in the real world.

This scenario is an example of what the Agricultural Experiment Station is and does. While we are concerned about the needs of the larger ag-chem firms -- and I as a faculty member appreciate the interaction with industrial scientists and the support these industries can provide in my efforts to reach my research goals -- we must still look to see how this institute can benefit the farmer of New Jersey. People speak of herbicide resistance and nitrogen fixation as processes that can be manipulated by these new biotechnological techniques. Surely the New Jersey farmer will benefit from any successes in these areas. But I feel the greatest benefits will come because of the communication networks already established within the Experiment Station. The fact that I am better able to serve New Jersey agriculture because of it, is undeniable.

I feel that biomolecular research at the Experiment Station and Rutgers University is necessary, and will complement the traditional disciplines of agronomy,

horticulture, and plant and animal breeding, as well as the more basic areas of physiology and biochemistry which are already important parts of our agricultural research effort. We need to vigorously and aggressively expand on efforts to include molecular biology in genetics more intensively than we have been able to do so far. Within the research community of the New Jersey Agricultural Experiment Station, with information flowing from the grower to the extension service, to the applied researcher, to the physiologist, biochemist, and biomolecular biologist and back again, we can envision an institute that will add to our knowledge of the genetic mechanisms of control of growth and development -- an institute that will serve as a focal point for existing industries, and attracting new; and an institute that will be attentive to the problems of the guy trying to grow a product at a profit.

We must realize today the tremendous potential we are ascribing to this biotechnology for agriculture. However, we must look at it with both caution and optimism. Caution not to expect too much too soon, and optimism that much can be accomplished even in the short-term -- especially if we do not look at it alone, but as a part of a larger research effort to benefit agriculture, which is already in place at the New Jersey Agricultural Experiment Station and Rutgers University.

Apart from the grower and the large agricultural, chemical, and pharmaceutical companies, I believe the presence of an Institute for Biomolecular Research in the Agricultural and Environmental Sciences will benefit the student through courses, seminars, and symposia. Not only will we attract industry to New Jersey for the information they can receive, but also through the skilled manpower that will develop. We will be better able to prepare our students for careers in industry through the institute's interaction with industry. And this can also be better accomplished in the existing milieu of the Experiment Station where we can train our students to

understand and use the techniques of biotechnology within the framework of our applied disciplines. A scientist so trained will be better able to develop a research program that will be responsive to the short-term needs of industry.

In conclusion, I believe the institute will benefit industry in New Jersey, lead to the creation of new jobs, and aid in the training of new scientists. However, the establishment of the institute and the funds needed to put up a structure, are only the start. The integration through the institute of the State, the University, and private industry, all working together for the benefit of New Jersey agriculture and related industries, continually asking the right questions, using state-of-the-art equipment and techniques, will require tireless dedication to the pursuit of ever changing goals. I thank you for this opportunity to express my views, and wholeheartedly support the Institute for Biomolecular Research in the Agricultural Environmental Sciences. Thank you.

ASSEMBLYMAN AZZOLINA: Thank you very much. Any questions? (no response) Thank you very much.

Is Dr. Colin Scanes, Chairman, Animal Sciences Department, Rutgers - the State University? You're young looking for a professor, or a doctor. (laughter)

D R. C O L I N G. S C A N E S: I don't feel that young today. Thank you, Mr. Chairman. It's a great pleasure to be invited to this august group to talk about the institute for--

ASSEMBLYMAN AZZOLINA: You must be from England, huh?

DR. SCANES: Originally from England. Before starting, just to introduce myself, I've been at Rutgers now eight years. I've been a professor and Chairman of the Department of Animal Sciences now for five years. I have developed a research program in the control of growth in metabolism of farm animals, and have successfully competed at the national and international level for grant support. I'd like to talk today about the animal side of the proposed

Institute for Biomolecular Research for Agriculture and the Environment.

I'm going to consider that as far as I can see there are four great advantages for the institute. I'm taking it as a given that it should be at Cook College. I think it's with the emphasis that obviously it has got to interact with the existing scientists in the area. It's got to be able to interact with the scientists throughout Rutgers University. And finally, in terms of location, I think it's obvious that it's got to be an arm of the Experiment Station.

Turning to why we should have it. I think there are four groups of people who are going to be affected by it. I'm going to start with a group that haven't been mentioned, and that's the consumer. In terms of agricultural products, we are really supplying in this country high quality food to individuals. I'm going to give an example of two areas, one for the future and one from the past, of what people have done in the animal industry. One is in terms of poultry. Going back over the last forty years, going back to the late 1940s, the price for poultry meat in this country is the same now -- cents per pound -- as it was forty years ago. Now, there's not many items that you can find at exactly the same price. Our consumption has risen between ten and twentyfold in terms of poultry meat. Why are we eating more poultry? Basically because it's cheaper. Secondly because it's better for us. There's less fat in it. So that's an example of where research in agriculture was very successful.

Where do we bring in research? We bring in research-- The genetics of the chicken have changed. The chicken now is different from what it was forty years ago. The nutrition is different. The housing is different. The disease control is different. So we've got an example from the past of a great shift.

I'd like to mention some work that's been going on, which is related, but not my direct area; and that is in terms of the pork industry, where people have been using a genetically engineered material to affect the growth rate of pigs. Now, not only have they stimulated the growth rate, they've also increased the efficiency of production, so it's cheaper for the farmer to produce the pigs. And for the consumer there's less fat on the pork. By and large, people like thin meat these days for obvious health reasons. So we've got a consumer reason.

I'd like to talk secondly about the farmer. In terms of the animal industry, I think the animal industry in this State is still fairly successful. We have a substantial dairy industry in the State. We have a poultry industry, and we still have some swine industry. We also have a very extensive horse industry. I'm not going to bring that in in terms of agriculture, in terms of the biotechnology institute, but I think it's something we should bear in mind.

Potentially, the most important thing that this Biotechnology institute which we are discussing could provide, is disease control methods. That's something which could be peculiar to New Jersey. For instance, in terms of poultry we've seen avian influenza, otherwise known as fowl plague, decimate the poultry industry of Pennsylvania, with an outbreak also in New Jersey. Hence, disease control is important. This could be very much a localized situation, where a disease could have a very dramatic effect on one particular locality. In terms of the future, effects on growth, carcass composition of animals is something which we are going to see.

The third area, which I think we've seen today: We've seen representatives from Merck, FMC, American Cyanamid, Hoffman-La Roche. This is very much the animal health plant agricultural chemical capital of the United States. It's important that we provide the infrastructure behind this.

Finally, in terms of advantages of the institute, is the area of academic excellence. Basically a state provides an infrastructure -- state, country, whatever -- provides an infrastructure. And one of the things that it can do is provide an area where you have academic excellence. I would say that at this stage, it is important, it's compelling, that an institute be erected on the Cook/Douglass campus as soon as possible. I think speed is important.

I think a question that Assemblyman Collins brought up was, "Would it be detrimental if the institute was not built?" And I think firmly the answer is, it would be detrimental if it was not built, because if you stay exactly where you are, you fall behind. Other states, other countries, are making great investments in this area. We have at this stage only begun to do that. I think it's important that we give due consideration to it. I humbly request your support for the endeavor, in terms of the speedy erection of the Institute for Biomolecular Research for Agriculture and the Environment. I'd be delighted to take any questions.

ASSEMBLYMAN AZZOLINA: Your statement was very good. Very right to the point.

DR. SCANES: Thank you.

ASSEMBLYMAN AZZOLINA: Yes?

ASSEMBLYMAN COLLINS: I have a questions. Dr. Scanes, I don't know, I'm just trying to go back if it was Dr. Fulkerson or Mr. Cohen this morning. You mentioned the pork industry, and they mentioned -- one of the two -- was talking about boar taint.

DR. SCANES: I'm aware of-- It was Mr. Cohen. And boar taint is a compound which does give a very adverse smell to the male pig, uncastrated male pig meat.

ASSEMBLYMAN COLLINS: All right. He had mentioned that there was some work in this area. Is any of that going on that you're familiar with, and when are we going to get the smell of the boar taint out of the nice big pork chops--

ASSEMBLYMAN AZZOLINA: All the pigs are down your way anyway. (laughter)

DR. SCANES: It's an area that I know less than I should about. I would say that simply put, the method of castration has been very successful. If you have a castrated boar, you do not get the boar taint odor. There are breeding techniques to reduce it. That may well be also a factor of speeding, getting the pig coming to market. If it's younger the chances of boar taint will be considerably lower.

ASSEMBLYMAN COLLINS: Well, as I was explaining to Assemblyman Hudak at lunch, I have a few hogs, and just took a boar to market. I would be able to make a lot more money if we get rid of that.

DR. SCANES: I would appreciate that situation.

ASSEMBLYMAN COLLINS: He even said he would buy one from me, and I-- (inaudible amidst laughter)

ASSEMBLYMAN HUDAK: I never said that. I'd buy a pork chop from you.

ASSEMBLYMAN AZZOLINA: How many do you have?

ASSEMBLYMAN COLLINS: Well, I've had as many as forty right now. But they're all going to market. The market is good right now in pigs, right?

DR. SCANES: Indeed.

ASSEMBLYMAN COLLINS: The best ever.

ASSEMBLYMAN AZZOLINA: Well, thank you very much.

DR. SCANES: You're welcome.

ASSEMBLYMAN AZZOLINA: Dr. Barbara Zilinskas, Associate Professor, Rutgers - the State University.

D R. B A R B A R A Z I L I N S K A S: Thank you very much for the opportunity to speak with you.

ASSEMBLYMAN AZZOLINA: Sorry that you had to wait so long.

DR. ZILINSKAS: I must apologize in advance that some of my comments will be redundant.

ASSEMBLYMAN AZZOLINA: Don't worry about it.

DR. ZILINSKAS: You can't help but be redundant when you have a whole cast of people before you.

ASSEMBLYMAN AZZOLINA: That's okay.

DR. ZILINSKAS: So, I thank you also for your patience.

ASSEMBLYMAN AZZOLINA: What is your background there at Rutgers?

DR. ZILINSKAS: I am a faculty member at Rutgers, at Cook College, in the Department of Chemistry and Microbiology. My research program deals primarily in the area of photosynthesis, the process on which all living organisms depend. And I have taken a multifaceted approach to studying this process, which draws from the disciplines of physics, and chemistry and also biology. Most recently, realizing the power of recombinant DNA technology, as well as the seemingly intractable nature of some important unsolved problems in photosynthesis, I took a sabbatical leave at Harvard University a couple of years back, to familiarize myself with the recombinant DNA methods. I now very heavily utilize these in my laboratory. And I'm totally convinced, and this is why I feel so strongly about this proposal. I'm totally convinced that an integrated approach to agricultural problems provides the greatest opportunity for progress in agriculture.

Several of my colleagues at Cook, have taken a similar approach, in that they've returned from sabbatical. One is a cytogeneticist, trained as a cytogeneticist. The other is a microbiologist. A third is a protein biochemist. They went on sabbatical to learn some of these techniques as well, and in returning they are now prepared to address some important agricultural problems with their dual expertise in recombinant DNA methods, as well as some other areas of biology. Some of the questions that these people are addressing: One is interested in how, by non conventional genetic methods, to produce superior varieties of strawberry, blueberry, and

cranberry. Another is interested in how we can get tomatoes during nine months of the year, that don't taste like cardboard. And a third is interested in how to obtain valuable chemical feedstocks from cellulosic waste. In addition, we are fortunate to have recruited at Cook College in the last couple of years, some very excellent scientists; several of them that are working in areas of molecular biology.

Although now there is a presence -- a decided presence -- in the area of molecular biology at Cook College -- both through retooling of faculty that have been there for awhile as well as recruiting new faculty -- this exciting new area of molecular biology can be greatly enhanced by the establishment of this proposed institute. This institute would provide both faculty and facilities necessary to do high power molecular biology research. In exchange, Cook College has the strength of the basic sciences, particularly in areas of plant and animal physiology and also in biochemistry; as well as in the more traditional aspects of agriculture, namely weed science, plant pathology, plant breeding. Our current faculty working in these more traditional disciplines of biology, could recognize what are the important agricultural problems. And the molecular biologist would in turn, isolate the genes needed to be manipulated and work on these to be able to transfer them into crop species. In short, the interaction between existing NJAES and University faculty who have expertise in the basic sciences, as well as traditional agricultural disciplines, and the institute's molecular geneticists will be mutually advantageous to both sets of faculty; and will provide a perfect setting for the establishment of a world class center for research directed towards crop improvement.

There are many examples -- you've heard of several today -- that are now being realized, the potential of non conventional genetic manipulation for agricultural and environmental improvement. Right here in New Jersey, I don't

think we've heard some of the people speak today from industries that have had recent success in using these non conventional genetic means. DNA Plant Technology has produced a tomato with increased solids, which is very important for food processing industry. They did this completely from biotechnological means. American Cyanamid has just developed a line of corn which is resistant to a very powerful and supposedly safe herbicide that they've recently designed. And in collaboration with a biotechnology company based in Minnesota, they have been able -- and I think this is one of the first examples of this -- to be able to get a maize, or corn line regenerated into a whole plant. There are many other examples under way which you've heard of. For example, trying to engineer plants resistant to disease, resistant to insects, tolerant of environmental stresses, etc.

I'd also like to mention two examples of faculty at my college, who have recently contributed to the success stories in agricultural biotechnology. One is Dr. John Chin, a member of the Plant Pathology Department, who has developed monoclonal antibodies as a diagnostic means to detect disease in citrus fruits long before damage can ensue. And Dr. Douglas Everleigh, a member of my department in Biochemistry and Microbiology, has engineered *ecolai*, a simple bacterium, to be an effective degrader of cellulosic waste. There are many other examples, but I don't have time to go into them.

In summary I'd simply like to say that the establishment of this Institute in Biomolecular Research in the Agricultural and Environmental Sciences, will provide a long overdue and very necessary resource for the State and its emerging biotechnology industry. Thank you, and if you have any questions, I'll be glad to answer them.

ASSEMBLYMAN AZZOLINA: Very good. Any questions? (no response) All right, thank you very much.

Dr. Roger Wyse, Associate Director, New Jersey Agricultural Experiment Station.

UNIDENTIFIED MEMBER OF AUDIENCE: Mr. Chairman, Dr. Wyse couldn't be here.

ASSEMBLYMAN AZZOLINA: Oh okay. Scratch him. Okay, we have Dr. Bob Tucker, Director, Office of Science and Research, Department of Environmental Protection.

D R. R O B E R T T U C K E R: Thank you very much. I appreciate the opportunity to be here. I don't have a prepared statement--

ASSEMBLYMAN AZZOLINA: Say whatever you want.

DR. TUCKER: --but I'd like to tell you that we're very strongly in favor of this institute. We see it as having tremendous advantages, some of the things that were just outlined here already today. If we can come up with plants that are disease resistant, insect resistant, we'll need to use less broad spectrum pesticides. From an environmental point of view that has tremendous advantages.

There is talk of using biomolecular techniques to engineer organisms that can degrade wastes. This would be a tremendous advantage in New Jersey. Perhaps not just in industrial areas. These organisms could perhaps be available for groundwater cleanup or landfill cleanup -- that kind of thing. We're presently looking at the possibility of monoclonal antibodies as a detection mechanism for some particular organic materials. And so, there are techniques generated by these methods that would be of tremendous advantage in the State, and have tremendous advantage for the environment.

I think in the past there have been some questions about the technology itself. I think the techniques, the questions, have been explored to a great extent with the National Institute of Health, within EPA; and that the guidelines that researchers presently work under do reassure that we don't run into safety problems. And I'd just like to say that I think early on, we'd certainly be glad to work with

people in the institute to review those procedures, and make sure that the regulatory aspects are taken care of early on.

And the second recommendation was that I think it would also be advisable to have a pro-active campaign to get the public knowledgeable about the techniques, so that any fears that they may have from past information or misinformation about these techniques should be allayed. And that actually a pro-active campaign, and perhaps involving consumers and members of the public, to get that information out would be helpful. Thank you.

ASSEMBLYMAN AZZOLINA: Any questions? Thank you very much. Is there anybody else in the audience who would like to speak? (no response) If not, I'd like to thank everyone for coming. This concludes the hearing. Thank you very much.

(HEARING CONCLUDED)

**APPENDIX**



# Testimony of Dr. Stephen J. Kleinschuster

## I. INTRODUCTION

Advances in cellular and molecular biology have created powerful new techniques for understanding and manipulating living systems which expand biological horizons to proportions limited only by imagination. Presently, the biomedical sciences enjoy the most advanced state of these technologies. The development and transfer of the new technology in the agricultural and environmental sciences have not kept pace with the biomedical sector. Historically, agriculture has relied more heavily on slower, yet time-tested and successful, methods to address problems in production, breeding and management. These conventional techniques must be enhanced by developing and utilizing advanced technologies and by their transfer to the renewable resource sector of our society.

It is the purpose of the document before you to propose the establishment of an Institute of Biomolecular Research in the Agricultural and Environmental Sciences (IBRAES) as a new research institute within the New Jersey Agricultural Experiment Station (NJAES) which will engage in research activities in these advanced technologies.

## II. MISSION OF THE INSTITUTE

The purpose of this Institute is two-fold: first, the Institute will focus and greatly strengthen the University's basic research and advanced training at the molecular level in the agricultural and environmental sciences, opening the way to international distinction in these upcoming fields; second, the Institute will provide a vehicle for speeding the transfer of new discoveries to product development and service in the field, both of which are needed to sustain and enhance New Jersey's second largest industry, Agriculture.

Oct. 13, 1986

### III. BENEFITS OF THE INSTITUTE

The Institute should provide the framework for the mutual benefit of the University, pharmaceutical, agrichemical, agricultural and environmental industries.

#### A. To Industry

The strongest support for the Cooperative Research Program will be found among locally based corporations which can benefit from the proximity to the proposed Institute. Several corporations have already expressed interest in biotechnology initiatives on the campus and frequently participate in scholarly activities. The relative newness and small size of their own biotechnology programs renders them more open to external opportunities for such information. Strengthening the University's research capabilities will simultaneously aid the formation and success of the smaller firms in biotechnology. The role of the Institute and Cook College departments is to develop new knowledge to the point where industry can develop products in a 1-3 year time frame.

#### B. To Rutgers University

Rutgers University assumes primary responsibility in the State to encourage creative research and to train highly specialized people; therefore, it must respond to the opening of this broad new research area.

Through the Institute, its faculty and facilities will rapidly confer inter-national prominence on the University in this area of research, and will also serve as the vehicle by which the advances in understanding biological mechanisms at the molecular level will be systematically integrated into the many departments at Cook/NJAES and at other units of Rutgers.

In addition, by creating the Institute, the University will complement the similar initiative already approved by the State for the creation of

the Center for Advanced Biotechnology and Medicine. Collectively, the University is presented with a timely opportunity to make a massive impact in this area.

#### C. To the State

In the 1984 public referendum, New Jersey voters endorsed the Jobs, Science and Technology Bond Issue. Clearly, the people of New Jersey support the State's planned investment in higher education and promotion of biotechnology for the purpose of creating industrial vitality and jobs. Research in the agricultural and environmental sciences of the type described in this proposal has a central and paramount place in the fulfillment of the goals approved in that bond referendum.

Agricultural research is estimated to represent 34 dollars of value-added for each dollar the State invests. The food processing industry, with its 8.0 billion dollars annual contribution to the State's economy, is New Jersey's second largest industry. Production agriculture, also profiting greatly from the activities of the Institute, alone is about a 3.0 billion dollar enterprise.

#### IV. ORGANIZATION OF THE INSTITUTE

The Institute will be established as a new, separately budgeted research unit of the New Jersey Agricultural Experiment Station (NJAES).

By virtue of state and federal legislation as well as an overwhelming demand of logic, this 125 year old research organ of the State, legally mandated and responsible for the agricultural and environmental research undertaken at the land-grant university can best serve the interests of the proposed institute. Available to the benefit of the Institute will be the vast infrastructure of the station including large tracts of research land, millions of dollars worth of research equipment and, perhaps most

importantly, 350 scientists with a holistic appreciation for the totality of the problems they are solving. Additionally as you know, in the New Jersey Agricultural Experiment Station (NJAES), a mechanism already exists for extending the Institute's work to New Jersey's varied and vital agricultural and environmental industries via our Cooperative Extension Service. The Institute would provide an additional collaborative connection by establishing a Cooperative Research Program with the State's abundant agrichemical, food and pharmaceutical industries.

A leading scientist will be recruited as Institute Director and as Associate Director of the NJAES. The Director will be appointed by the University President and will report to the Executive Director of the NJAES. A Presidentially appointed Scientific Advisory Board of distinguished scientific leaders drawn from academic and industrial organizations will oversee the activities of the Institute, reporting to the Executive Director NJAES, to the President of the University, and to the New Jersey Commission on Science and Technology.

The annual state budget for the Institute will be provided through the New Jersey Department of Commerce and Economic Development. The Director will prepare annual budget requests and budget reports that will be reviewed by the Scientific Advisory Board, and the Executive Director of NJAES before being approved by the President and Board of Governors of the University, and submitted to the Commission on Science and Technology in the Department of Commerce and Economic Development. A copy of the proposed budget is included in the complete Institute proposal.

Two Associate Directors of the Institute are contemplated, one for the research program of the Institute and one for the educational and Industry-Related programs. This will allow time for the Director to pursue an

active research program.

The Associate Director for Research will be responsible to and will aid the Director in the design, implementation and maintenance of a research program that is world-renowned and relevant to the needs of agriculture and the environment.

The Associate Director for Educational and Industry-Related Programs will be responsible to the Director for administration of an educational and industry-related program. The Program will be planned and operated with the advice of an Industrial Advisory Board, consisting of representatives of the corporations which contribute by annual membership fees to the support of the Cooperative Research Program. Faculty participation in the program will not be restricted to members of the Institute, but will be open to all individuals in Cook/NJAES, elsewhere in Rutgers and in other academic institutions.

#### V. LOCATION OF THE INSTITUTE

The Institute of Biomolecular Research in the Agricultural and Environmental Sciences will be located on the Cook/Douglass Campus of Rutgers University. The specific site on the Cook/Douglass Campus will be in close proximity to those Cook departments with which the Institute will interact most intimately.

A site on the Cook/Douglass Campus is the most logical choice. Agricultural and station scientists are concerned not only with exceptional basic science, but perhaps more importantly, must have a deep appreciation and working knowledge of all facets of the biological questions they are asking. This is accomplished by deliberately and purposely dovetailing the skills and expertise of the molecular biologist with those of the traditional plant/animal breeders and scientists. Without exception, the

traditional (clinical) skills are indispensable in exploiting the discoveries of the molecular biologist and the molecular biologist is equally indispensable in providing to the traditionalist exploitable tools and techniques. This interdependence with all of our scientists aligned as closely as possible, programatically and physically, will assure the successes of the Institute.

Relative to the testimony you have heard today, Mr. Chairman, I'm sure you will agree that the unique opportunity and benefits emerging from the implementation of our proposal are exceptionally substantial. The impact of this initiative will most certainly drive Rutgers University and the NJAES into international eminence and will provide assured return to the State to the same historic degree Agricultural research has always provided society, an increased quality of life, and 34 dollars returned for each dollar invested. Thank you for your kind attention.

