Task Force Meeting

of

NEW JERSEY BIOTECHNOLOGY TASK FORCE

"The Task Force will hear testimony
from members of the academic community,
and from members of the biotechnology industry"

LOCATION: Commercialization Center for Innovative Technologies (CCIT)
North Brunswick, New Jersey

DATE: January 25-26, 2018
10:00 a.m.

MEMBERS OF TASK FORCE PRESENT:

Debbie Hart, Chair
Assemblyman Andrew Zwicker, Vice Chair
Senator Linda R. Greenstein
Assemblyman Gary S. Schaer
Assemblyman Christopher P. DePhillips
Timothy J. Lizura
Daniel J. O'Connor, Esq.

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DEBBIE HART (Chair): Good morning, everyone, and welcome to this meeting of the Bio Tech Task Force.

We're really thrilled to have you here.

I'm Debbie Hart, the President and CEO of BioNJ. And I have, really, the delightful job of chairing the Task Force; and I have my Co-Chair here, Assemblyman Andrew Zwicker. And we appreciate your time, Assemblyman, and we're hoping for great things from you-- (laughter)

ASSEMBLYMAN ANDREW ZWICKER (Vice Chair): No pressure. (laughter)

MS. HART: --and from the Task Force. What we've seen so far -- based on that I think we're in pretty good shape.

This is really important for the life sciences industry in New Jersey. And if I may, just a moment of history in task forces -- a history of task forces in biotechnology.

So back in 1995, we were fortunate that the Legislature and then-Governor Whitman signed legislation that established the High Technology and Biotechnology legislation that was to bring industry into New Jersey. And then, as a result, there was a specific Task Force set up around biotechnology. And the result of that was some amazing legislation, including the now-legendary NOL program, that I'm sure some of the companies that we'll hear from tomorrow will have taken advantage of. Dan O'Connor -- now with OncoSec, previously Advaxis -- has taken advantage of.

DANIEL J. O'CONNOR: I plan to take advantage of it again, actually. (laughter)

MS. HART: Oh, good; okay. Good, good.

And that legislation, back then, really put New Jersey on the map across the country. It really let the other states that were soon to be bio tech hubs -- it sort of put them on notice that New Jersey was serious about biotechnology and supporting it in very significant ways.

And so, you know, time has passed and we've had tremendous opportunities, and we've capitalized on many of them through the things like the NOL program and other really supportive measures that the State has introduced and supported.

And at the same time, we know that there's lots of opportunity; this industry is still growing and there's plenty of opportunity to bring more companies here to New Jersey. And so we want to make sure that we are capitalizing on that, and that's why we're here today, really. You know, we have tremendous partners in the State of New Jersey -- specifically, the New Jersey Economic Development Authority -- over so many years. We were just talking this morning that this complex -- this building is now 15 years old, and that their support goes well beyond that, and we cannot thank you enough.

And also to OLS, who has been our partner on this meeting; and particularly today -- thank you (indicates) for your support.

And so then, ultimately, thank you to the academic institutions that are here today to tell your story, to help us and help our Legislature figure out how they can really support the industry and help it grow from here.

So without further ado, we will get into the testimony.

I do just want to make a couple of housekeeping remarks.

So we are expecting-- So this is being taped, as you can clearly tell, right? It is a public meeting. We are expecting that media may join us at some point in the day; and then we will politely enforce the 10-minute rule. So your testimony -- we're looking to hear 10 minutes, and then we will allow 5 minutes for Q and A. And Maureen Hassett, our friend from EDA, will help us enforce that.

MS. HASSETT (NJEDA Staff): Two-minute warning (holds up sign). (laughter) So eight minutes in, you'll see this. (indicates)

MS. HART: So watch for that, okay?

ASSEMBLYMAN ZWICKER: Just one other housekeeping rule for the Office of Legislative Services.

If you would identify-- The first time you speak, just identify who you are and your institution. That way, when the record is put down, it will be clear who is speaking each time. You only have to do that the first time you speak.

MS. HART: Thank you; thank you, Assemblyman.

And then if we could just-- If the members of the Task Force -- maybe we can go around and just say hello, and then we'll -- the group will know to whom they are speaking.

So Tim, you want to be first?

TIMOTHY J. LIZURA: Sure.

Welcome; good morning.

My name is Tim Lizura; I'm the President and Chief Operating Officer of the New Jersey EDA, with the privilege to both lead an organization that's dedicated to economic development and technology of economic development; as well as your host for today in this great facility

that Debbie mentioned. In fact, I do think the entire concept of the Tech Park was born out of that same Task Force so many years ago,

So I am glad to be a partner with the biotech community and part of this Task Force.

MS. HART: Assemblyman Zwicker, did you want to say something? (laughter)

ASSEMBLYMAN ZWICKER: I just want to welcome Assemblyman Schaer--

MS. HART: Assemblyman Schaer is here.

ASSEMBLYMAN ZWICKER: I just wanted to say I am very much looking forward to everything this Task Force is doing.

Thank you to Debbie Hart for her leadership here; it's my pleasure to help and assist in any way I can.

And just to -- as we know, there's remarkable opportunity in 2018 between what's happening in Trenton, what's happening in the university system, what's happening in the for-profit, the nonprofit, the private sector, etc. You know, this is a remarkable time; and to have this Task Force happening now I think is just ideal.

I will give one plug as well. In the General Assembly, we have created a brand-new Committee called *Science, Innovation, and Technology*, of which I am the Chair. And we will be following up in -- both with a report and lots of things around innovation. Our first meeting will be February 1; but we'll be looking carefully at what is the role of the State and how we can best enable what everyone around this table has been working on for so long.

So I am very much looking forward to all of this.

MS. HART: Yes, we are very excited about that. A little serendipity for this Committee too.

ASSEMBLYMAN ZWICKER: We did it just for this Committee. (laughter)

MS. HART: Thank you for that; yes.

Assemblyman Schaer has joined us.

Did you want to say hello?

ASSEMBLYMAN GARY S. SCHAER: It is a pleasure to join with everyone here today, echoing my colleague and friend, Assemblyman Zwicker's comments.

Certainly, what we are looking to do, to the extent possible, is translating all of these wonderful good thoughts into practical realities for the State.

We know we have a great partner in the Executive Branch; I'd like to think the same in the Legislative. Obviously, so much of what we do is directed by available resources. But also I think a prioritization, necessarily -- that all of you sitting around this table today, and so many of your colleagues who couldn't be with us, are vital to the future of this state. And we need to ensure that there's primacy towards the things that we're doing here for the future of the State.

Thank you.

MS. HART: Thank you, Assemblyman. I look forward to working with you in this project.

ASSEMBLYMAN SCHAER: It is my great pleasure.

MS. HART: Thank you.

Anyone else from the Task Force, or representing, want to--

Oh, Dan; yes, please.

Dan.

MR. O'CONNOR: Oh, sure; thanks.

It's great to be here, and I am looking forward to the work of the group.

I'm a 20-year biotech veteran. I started a CRO -- or helped start a CRO, known as PharmaNet, a long time ago. It's been inVentiv Health and a couple of other iterations. I was a Senior Vice President and General Counsel of ImClone Systems -- which I'm sure a lot of folks know -- in Branchburg. I helped build, recently, a biotech company that started here; and I took it from 2 cents to a lot more than 2 cents over several years, which was terrific for our shareholders. And I recently took on a project that was started in San Diego, and now I am relocating, in part, to New Jersey. So interestingly, the technology from this company -- which is a cancer immunotherapy company -- came out of another company that started in California and migrated to Pennsylvania. It's now a $500 million market-cap company. So same roots in California, but migrating it, hopefully, to New Jersey.

And part of the reason why Debbie mentioned at the outset -- our program is unparalleled in any state in the United States. So it's a real attractive incentive for small companies that don't have revenue to come in and use the tax program, to really augment their financial picture so they can do clinical research to get products to patients and their doctors.

So thank you; I'm really glad to be here.

MS. HART: Thank you, Dan.

MR. O'CONNOR: You bet.

MS. HART: So I think now we'll move into our testimony.

First, we're going to hear from Anne-Marie Maman; and Anne-Marie is with Princeton University -- the Executive Director of Princeton University's Princeton Entrepreneurship Council.

Thank you, Anne-Marie.

A N N E - M A R I E M A M A N: And I'm speaking both my section and Dean's section. He was to follow me, so those are consolidated into one.

MS. HART: Okay.

MS. MAMAN: So thank you for inviting me to speak to the New Jersey Biotechnology Task Force today.

As you said, I am Anne-Marie Maman; I'm the Executive Director of the Princeton Entrepreneurship Council, which is the advisory and coordination body on entrepreneurship programs at Princeton University. We work with many different groups around campus, and my remarks represent the collaborative input of my colleagues from the Office of Corporate Engagement, the Office of Technology Licensing, the Office of Public Affairs, the Keller Center, and others.

Last year, the University released a strategic framework that prioritizes, among other things, new and improved research facilities, and space to accommodate academic partnerships with the corporate, government, and nonprofit sectors in an expanded innovation ecosystem. Among the objectives of this plan, as Princeton President Chris Eisgruber describes it, is "to improve Princeton's connection to the innovation ecosystem."

So I'm pleased to have this opportunity to share with you what Princeton is doing.

President Eisgruber stated, in his 2017 State of the University address, that "Technological change has increased the importance of the surrounding innovation ecosystem in achieving Princeton's teaching and research mission. Our faculty increasingly find that connections to that ecosystem enhance their ability to produce interesting research about fundamental questions, and students and faculty alike seek connections to that ecosystem to leverage the impact of their learning.

"Princeton must develop its campus and its programs in ways that cultivate and expand both the surrounding ecosystem and our connections to it."

Now, to provide some context. With approximately 800 tenure-track faculty members, 5,500 undergraduate students, and about 3,000 graduate students, Princeton University is a fraction of the size of Rutgers and many of our other outstanding research university counterparts in the country. And we have no med school, we have no law school, and no business school. But we do have internationally renowned academic departments engaging in both foundational and translational research. Perhaps most important to understand about Princeton is its unofficial motto, "In the nation's service and the service to humanity." It is through this lens that decisions and plans are made at Princeton. In other words, Princeton is committed to life sciences entrepreneurship, to industry engagement, and to technology licensing. Princeton is committed to connecting with the innovation ecosystem in New Jersey because these

connections advance the University's mission by bringing knowledge and discovery to bear on social and economic problems.

As perhaps we all know already, 2017 was a breakout year of life sciences and healthcare investments. PitchBook's fourth quarter 2017 review reported that $17.9 billion was invested in life science companies last year, an increase of 48 percent over 2016 numbers, and an increase of 21 percent over the previous record set in 2015.

But the report also pointed out some important trends which should be noted. As they say, "Technology is driving the future." This is shown in the notable increase of technology in the life sciences sector. So while there were some very large healthcare deals in 2017, there was also an increase in generalist investors making smaller investments in life sciences companies that have strong data science components.

Princeton has real strength in hard sciences: chemistry, biology, chemical engineering, and material sciences. And we also have great strength in data science and computer science. Our group focusing on Computational Biology -- which includes bioinformatics, functional genomics, and immune system modeling -- is just one example of how Princeton University and the State of New Jersey is poised to take an active role in this trend toward integrating computational work into life sciences innovation.

In 2016, Princeton began to translate its commitment to fostering entrepreneurship into strategic additions to the staff. The Princeton Entrepreneurship Council was officially formed at that time, and I was brought into the University two years ago. I have a staff of five people committed to engaging and supporting entrepreneurship and

innovation on and off campus. Our two main areas of focus are to engage the alumni community around entrepreneurship and innovation; and to engage with others, on campus and in New Jersey, to build the local ecosystem.

Some of our alumni engagement programming includes a small seed fund, which invests in alumni who are less than five years from graduation. In three years, $1.75 million has been invested in 25 companies. However, of those 25 companies, only one is currently based in New Jersey. Most of our companies are based in New York City or in Silicon Valley, which are more interesting places for millennials.

Another program we run are VC Roadshows, where we competitively select a small number of alumni and faculty start-ups and then we take them on a curated visit to top venture capital firms. Our first VC Roadshow was in Silicon Valley, and resulted in money being invested. Our next VC Roadshow will be in New York City.

And most relevant to this discussion, I am closely involved in the creation of the newly opened Princeton Innovation Center Biolabs. Princeton Innovation Center Biolabs is a 31,000 square foot wetlab/drylab incubator, located three miles from our main campus, on the Forrestal Campus. One thing that I think is important about the new Center is that it welcomes founders who have relationships with the university, and also founders who do not have relationships with the University. We have recognized that we cannot create a vibrant entrepreneurial ecosystem for our faculty and graduate students without the involvement of others in the ecosystem.

We have contracted with BioLabs, a professional lab management group based in Cambridge, Massachusetts, to run this facility. In evaluating partner organizations to manage this site, one of the things we looked at was the impact of their facilities. I'd like to share some of the impact numbers from the 2016 annual report from their flagship LabCentral facility, which opened a little more than three years ago in Kendall Square.

They have 25 resident companies, and 24 companies have graduated from their incubator. These 49 companies have raised a total of $1.1 billion in funding; 717 jobs have been created by LabCentral companies since it opened; 73 percent of the resident companies were founded or cofounded by immigrants; 93 percent of the graduating companies have stayed within four miles of LabCentral.

And of course, perhaps the most important part, they have been developing lifesaving medicines and creating breakthroughs in medical science.

Another thing that is relevant to this discussion is that LabCentral was founded with a $5 million initial investment from the Commonwealth of Massachusetts in 2013. Massachusetts invested an additional $5 million for their expansion. So, a relatively small investment by Massachusetts into an incubator focused on leading-edge technologies and teams, and then the creation of strong support programming for those teams, has had an outsized impact on the creation of life science innovation in the Boston area. We hope and expect that Princeton's investment will have a similar impact, and we encourage the State to consider making moderate investments in incubators and accelerators in New Jersey, and in

organizations that work to coordinate efforts among the many incubators in the state.

And also, while Princeton has made an investment in the local ecosystem, we encourage the State to, at the very least, maintain the incentive programs that are administered by the EDA to help support these small companies. This includes programs such as the Angel Investor Tax Credit, the Founders and Funders program, the NOL program, and the Edison Innovation Fund.

At the same time as Princeton was creating the Princeton Entrepreneurship Council, it also made another critical addition to the staff in the Office of Technology Licensing. Princeton made a strategic decision to create a new role focused on spinouts, and hired a New Ventures Associate. My colleague, Tony Williams, works directly with faculty and graduate students interested in starting companies. Along with his colleagues in OTL, Tony worked to launch 10 companies based on University intellectual property this past year. This is considerably more than Princeton has spun out in past years.

The technologies being spun out from Princeton are of an excellent quality; but generally, academic spinouts are very early stage, and Princeton is no exception. Academic startups are often in the *valley of death* funding stage that many venture funds won't touch. Princeton's Office of Tech Licensing has had to work with faculty inventors to find other ways to get the University spinouts through that Valley. They have cultivated relationships with some of the few genuinely patient capital investors; or they have found that the faculty member, or a co-founder, has had their

own capital connections, or they joined accelerators -- which typically means that that startup has left New Jersey.

We think that there are two specific ways that the State can help to support academic spin-outs. The creation of a seed fund, which invests in technologies in the valley of death, could be one way that the State could support promising technologies being spun out of New Jersey's academic centers. This would bridge the gap to more traditional venture funding for these startups.

And another way the State can support academic spin-outs is to help us to attract experienced business entrepreneurs who can mentor or partner with our scientific entrepreneurs. Our strong scientific founders, coupled with strong business founders, create teams which are appealing to investors, and are poised for successful implementation.

Princeton University, as does the State of New Jersey, faces challenges in creating a welcoming environment for entrepreneurs. We could benefit from an approach that integrates business incentives with infrastructure investment in transportation and other resources to make New Jersey an economically feasible and attractive option. Today's millennials are seeking vibrant communities in which to live and work, ones that are affordable and accessible by public transportation.

Turning now to the topic of Princeton's collaborations with industry. Earlier in my testimony, I mentioned Princeton's unofficial motto. This motto defines and bounds our efforts to engage with industry on research as well. As a recent Princeton Provost expressed it, "Research is one of the ways that Princeton works to fulfill its informal motto: *In the nation's service and the service of humanity.* We celebrate the benefit to

humanity that starts with the creation of knowledge, and continues with the transfer of that knowledge into lifesaving and life-improving technologies. We at Princeton, with the help of the business and technology-transfer communities, have a tremendous opportunity to make a profound and lasting beneficial impact on the world."

At Princeton, collaborations help transform theories and research that begin in classrooms and laboratories into real-world projects that can make a difference to society. As President Eisgruber has said, "By talking to industry scientists, our faculty learns about the kinds of questions that matter in the world."

At Princeton, the Office of Corporate Engagement and Foundation Relations is located within the Office of the Dean for Research. Corporate Engagement offers a front door to businesses, helping them to identify and build mutually beneficial research collaborations with all aspects of the University community. Princeton places importance on fostering strong, long-term relationships with companies that are not only financial, but are also centered around a collective effort.

Over the past few years, Corporate Engagement has undergone a similar evolution to the Entrepreneurship Council and the Office of Tech Licensing. Under director Coleen Burrus, who joined Princeton in 2015, the Office has ramped up its efforts to engage with New Jersey industry and organizations. Among the areas in which Corporate Engagement is focusing its efforts is Life Sciences. For example, the University has increased its participation and leadership in such organizations as BioNJ, the HealthCare Institute of New Jersey, the New Jersey Tech Council, Choose New Jersey, and the Research and Development Council of New Jersey. Princeton now

has a Corporate Engagement Officer, Dean Edelman, whose full-time focus is building relationships with companies in the life sciences ecosystem.

In addition, Princeton's Dean for Research encourages faculty collaborations with industry through The Innovation Fund for Industrial Collaborations, a competitive grant program that provides University funding for projects that have industry support.

We also note that, over the past year, the Legislature and the Governor made significant strides to support, encourage, and incentivize academic-industry collaborations. These included the creation of a Commission on Higher Education and Business Partnerships, to which President Eisgruber and several other college presidents and industry representatives were appointed.

State efforts also include an expansion in the Grow NJ tax credit program to include companies that partner with research universities and locate within three miles of that institution. This geographic consideration will help us to build strong local ecosystems around strong academic communities.

And the Legislature and Governor also teamed up to provide new fellowship opportunities for Ph.D. students and post-doc researchers working in information technology. The program provides for at least 20 fellowships, of two- to three-year duration, in New Jersey companies with projects that are technology and research based. It also includes set-asides for small companies. While this program does not focus on biotechnology, it does provide an opportunity for biotechnology companies to participate, and it may provide a good model for similar programs focused on other industries.

Undoubtedly, as a result of many factors, Princeton is seeing an increase in the desire of life science companies to engage with the University and its faculty. Princeton has relationships with long-time New Jersey companies, such as Merck, Bristol-Myers Squibb, Janssen, and Celgene; and also with companies that have recently moved facilities to the state, including Daiichi Sankyo, Mallinckrodt, and Evotec.

Princeton's collaboration with Merck is a good example of the long-term, multipoint engagement that the University believes best supports its education and research mission, and the interests of its corporate collaborators. The Merck Center for Catalysis opened in 2006 with initial funding from the company; and in 2017, they announced additional funding for the Center. The Center for Catalysis is a state-of-the-art facility at Princeton featuring a robotic system that allows for rapid set-up, monitoring, and characterization of thousands of reactions. In addition, Merck also supports faculty research in chemistry and in molecular biology. And the company engages with graduate students, post-docs, and the broader University community through participation in programs such as our annual Celebrate Princeton Invention event, and in the Molecular Biology *Lunch & Learns*, designed to help grad students understand career options in industry.

Merck's engagement highlights another benefit of academic-industry collaborations relevant to life sciences companies, and that is the issue of feeding the talent pipeline. Academic-industry collaborations provide a way for graduate students to learn about industry careers, and for companies to become familiar with our grad students. And we are seeing more graduate students who are interested in pursuing careers in industry

and in spin-outs. Policymakers may want to give thought to ways that encourage grad students to work with the local biotech industry, and to stay in New Jersey during the next phase of their careers.

The last topic I would like to highlight today is collaboration among New Jersey's higher education academic institutions. Princeton views its collaboration with the state's other higher eds as an important part of its efforts to connect with and strengthen the New Jersey innovation ecosystem. There are two projects in particular we would like to draw your attention to because of their relevance to life sciences companies.

The first is the New Jersey Research Asset Database, a project being developed under the auspices of the New Jersey Secretary of Higher Education and the EDA, along with the participation of many of the state's innovation organizations. Princeton has taken a leadership role in facilitating the state's adoption and implementation of this new tool, and is one of five institutions participating in the pilot program. The NJRAD will be a publicly available and searchable database that will allow researchers and industry to more easily determine the research interests of faculty at New Jersey's participating institutions. This improved transparency will make potential academic and industry collaborations easier to identify and to form. State funding of this project is vital.

The second example of higher ed collaboration is lower tech. This past October, Princeton hosted a Biomedical Data Science Day. The event brought together academic researchers from Princeton and Rutgers with industry peers from top pharma and biotech companies. The goal of the day was to share information on the latest advances in biomedical data science and to initiate a discussion -- led that day by Bob Hugin, Executive

Chairman of Celgene -- about the potential of forming a community to advance our region's strength in genomics, machine learning, Artificial Intelligence, and computational biology.

The event was very well received. Noting how his own collaboration with a Princeton researcher had come about by chance, one Rutgers researcher remarked, "It shouldn't be serendipity and luck that brings academics together. We need to create models and structures and systems and individuals" that bring together researchers and companies with similar scientific interests. There is now interest in pursuing this initiative in a larger conversation with other academic institutions, including NJIT, and similar future events are being discussed.

These are some of the many initiatives at Princeton that are happening at this potentially transformative moment. We look forward to continuing to work with our peer institutions, ecosystem advocates -- like BioNJ -- and interested parties from our State's government to foster entrepreneurship and mutually beneficial engagements that both advance Princeton's mission of research and teaching, while also potentially leading to collaborations that foster life science breakthroughs which improve and save lives.

MS. HART: Thank you, Anne-Marie. Very well done.

MS. MAMAN: Thank you.

MS. HART: Thank you, and congratulations on that day. I happened to be there, and it was just -- it was really fabulous. We need more of that in New Jersey.

Congratulations on the incubator.

MS. MAMAN: Thank you.

MS. HART: I do have-- I'll kick off the questioning, if I may.

And I should mention -- I should have mentioned previously-- So we gave Anne-Marie 20 minutes, because we had two different speakers who were slated from Princeton, and they consolidated into one.

So what has been the interest -- initial interest in the incubator--

MS. MAMAN: So--

MS. HART: --and-- I'm sorry, because it's sort of a two-part; and then I'll be quiet and listen to you.

What do you see as the challenges to replicating the kinds of success that Cambridge has had?

MS. MAMAN: Okay; so the first part, the interest -- that one is an easier one to answer. (laughter)

In the interest -- we have not yet had a media event, so we haven't officially had any information being published about it. That will be on Monday; our first one.

We were having, during construction, about two or three interviews a week -- people coming through to check it out, to see how it was, to see if it would be a good fit for them. In the last week or so, we've been having two or three potential tenants a day. These are people who are small companies and large companies; not all of these companies are appropriate for this site. These are companies that want to move from New York, and from Philadelphia, and from California, and from international -- from overseas. So some of those referrals have come from BioNJ, some from Choose New Jersey, some from our own faculty. We obviously have several faculty members who have come out to look. We have received

three applications so far -- I believe that's right -- and we are expecting the first tenant to move in soon. I don't know exactly what that date is, but the interest is robust.

MS. HART: Terrific; good.

MS. MAMAN: With regard to what can be done to replicate the Cambridge environment -- I think one of the big issues is seed funding, especially in life sciences. There is no true seed funding in the state, at this time, that is available to anybody. There is one seed funder that's available to a few select institutions; Princeton is one of them. But it should be -- the seed funding to get through that valley -- to be able to show milestones that have been hit, to be able to attract true venture money that a life sciences company needs -- is sorely lacking.

In technology, you can do it more easily on a smaller budget. Perhaps now with technology and life sciences blending, we'll see some of that starting to happen with a little bit smaller funds. But real biotechnology can't happen without the backing of some seed funding.

MS. HART: Okay; thank you.

And also, if anyone has testimony, we would love to have a copy of it if you wouldn't mind leaving it with us, please.

So the other members of the Task Force--

Please.

ASSEMBLYMAN ZWICKER: Do you happen to know, off the top of your head, if MassVentures does seed funding under their umbrella? I don't know if you know the answer to that.

MS. MAMAN: I don't know that answer.

ASSEMBLYMAN ZWICKER: Okay.

MS. MAMAN: I can find out; I don't know.

ASSEMBLYMAN ZWICKER: And then the other question I have is -- you know, and others may know, that as Princeton has started to build out into this space more and more, there was a lawsuit that has caused a problem, for Princeton in particular, but for New Jersey in general. I think the question is one of-- I mean, I know there was a settlement, but what can -- what do you think should happen so that universities, broadly defined, are able to collaborate with the private sector without concern over their nonprofit status?

MS. MAMAN: Yes; thank you for that question.

That lawsuit has had a large impact on the University, especially in the innovation and entrepreneurship sphere. It is something that I think about every day and am faced with every day, only because it likely will come back to us. It was settled, but it has not gone away fully.

It would be nice if the State could put forward some legislation that would eliminate the possibility of it coming back to take away our nonprofit status. And probably more than that, somebody else at the University would be better to answer that.

ASSEMBLYMAN ZWICKER: Great.

This is not particular to Princeton; this is--

MS. MAMAN: All universities.

ASSEMBLYMAN ZWICKER: --true across the state.

MS. MAMAN: Yes; and had we lost our nonprofit status, a lot of universities in New Jersey and around the country would have been upset.

MR. LIZURA: Anne Marie, I'm interested-- Two questions: The 12 companies who participated in the alumni program, are they considered -- do you consider them *spin-outs*, or is that really a different class of--

MS. MAMAN: So that was a mix. The 12 companies that-- So are you talking about the VC Roadshow? Which--

MR. LIZURA: You had -- I think you had testified that you had -- one of 12 companies remained in New Jersey at the alumni program.

MS. MAMAN: Yes; I'm sorry.

So that's one of 25--

MR. LIZURA: Oh, 25.

MS. MAMAN: --and those are young alumni; so, five years or less.

MR. LIZURA: Right.

MS. MAMAN: Those are not spin-outs, in that the University does not own that intellectual property. Students at Princeton own their own intellectual property. There was one of those companies that had a faculty involved, so the Office of Tech Licensing was involved in that. But these are mostly young students, just graduated, to alumni status spin-outs. So it's not really a *spin-out*; it's a *start-up* company.

MR. LIZURA: Okay. And the investments that you make in those companies are from the Foundation?

MS. MAMAN: No. That is from some general-- Some very generous alumni gave us some funds specifically for that. So we manage that out of a separate pot of money that we hold as an investment mechanism; so it is a safe note that we offer. So it's a simple agreement for

future equity, and it's up to $100,000 matching; it has to be matched by nonfamilial funds. So it cannot be that, "My grandmother has invested in me because she thinks I'm great," and we will give you money. It has to be a real investor.

MR. LIZURA: Some other due diligence has to be done by an outside party.

MS. MAMAN: Exactly.

MR. LIZURA: Thank you.

MR. O'CONNOR: Anne-Marie, Dan O'Connor.

First, a tremendous presentation.

MS. MAMAN: Thank you.

MR. O'CONNOR: Thank you so much for that; I really appreciated it.

You know, in terms of all the elements that Princeton offers and has to support biotech and entrepreneurism in the state, how can we help get that more broadly communicated? Or do you feel like the message gets out broadly so that -- not just the New Jersey community knows about it, but the Massachusetts, the San Diego -- all of the little pockets around the United States where innovation is occurring knows what Princeton has to offer? That's part one.

Part two is, how can we help you? You know, what are the things that you would look to us-- Beyond some of the things you identified in, but maybe just centered around industry -- how could industry actually help support what you're doing and what your goals are?

MS. MAMAN: So the answer to the first question is, it is not well known. It's a relatively new effort. I've been onboard for two years;

our programming is just starting to take off. Many of the people who are focused -- fulltime focused on this effort are relatively new, like me; not everyone, but most of them -- many of them. We are reaching out to let alumni know, around the country and the world, which we believe will also seep down into industry and other parts of other sectors around the country.

We are also starting -- as we start to show some results, we'll become more -- we'll have more things to talk about and more things to show. So help doing that -- we're all for collaborating and pushing each other's words out. We do that on campus; we do that with our academic collaborators as well.

Industry collaboration and, certainly, through the corporate engagement group, research on campus and getting faculty and graduate students to understand that academia is not the only opportunity for them; but that there are excellent opportunities also in business, and start-ups, and businesses.

What specifically we could ask industry to do is to basically come and talk to us and figure out how we can work with you in a way that meets your needs and could meet our needs.

MR. O'CONNOR: It's great; thanks.

And then, in terms of the opportunity for the University itself -- is, I guess-- It sounds like a big part of it is getting students the opportunity to work in labs or get exposure to commercial entities or companies that are looking to become commercial. Is that, kind of, the attractiveness to the University?

MS. MAMAN: The attractiveness of entrepreneurship?

MR. O'CONNOR: Yes; so what is-- In terms of these programs, what do you -- what does the University like about it, vis-à-vis the University and its students?

MS. MAMAN: So I think that faculty members have been making a strong statement to the Presidents and the University that they are no longer just -- some of them -- are no longer just academics; that they also have aspirations to spin that technology off-campus. And Princeton was losing some potential, very high-quality faculty members to other areas that had more integrated ecosystems. That's also the situation with some grad students and with some undergraduate students. We'll see undergraduate students coming in saying, "I've started two companies already--" You know, this is a high school kid -- "I've started two companies already; I'm looking at Princeton, MIT, and Stanford. Tell me why Princeton's entrepreneurial ecosystem is best for me."

MR. O'CONNOR: Great; thank you.

Thanks; thanks so much. I appreciate it.

MS. HART: I think we're--

MS. HASSETT: Yes; next up. (laughter)

MS. HART: Okay, thank you so much, Anne-Marie. We appreciate it.

So next we're going to hear from Vince Smeraglia, the Executive Director of the Office of Research Commercialization at Rutgers, The State University of New Jersey.

Vince, you're on.

V I N C E N T A. S M E R A G L I A, Esq.: Like Princeton, we're actually going to combine forces here; and we'll have our Rutgers testimony presented by our Vice President of Innovation, Dr. David Kimball.

MS. HART: Thank you.

S. D A V I D K I M B A L L, Ph.D.: Thank you.

MR. SMERAGLIA: I think we get extra time. (laughter)

DR. KIMBALL: I will appreciate the extra time, but I don't know that I will use it all.

Chairwoman Hart, Assemblyman Zwicker, and members of the Task Force, thank you for inviting me to speak to the NJ Biotechnology Task Force.

I would like to start by explaining my background and my qualifications to provide testimony in this forum.

My name is David Kimball, and I am Vice President of Innovation and Research Commercialization at Rutgers University. In that capacity, I am responsible for shepherding faculty inventions from their inception through patenting, marketing, licensing and, as appropriate, assisting in the creation of new spin-out companies based on these technologies.

In addition to standard tech transfer activities, we have created, under my direction, two new capabilities at the University which directly impact our ability to advance biomedical discoveries towards commercialization. First, we've established a unique biomedical research core, *Rutgers Translational Sciences* -- and Vince Smeraglia is the Executive Director of that group -- comprised of seasoned research staff who were previously employed in the pharmaceutical and biotechnology industries in

New Jersey. These professional staff assist faculty in generating translational data -- medicinal chemistry, molecular imaging, research pathology, histopathology, and screening -- to dramatically increase the competitiveness of grant applications and faculty's ability to generate robust intellectual property. In addition, the RTS group serves as an interface between the University and the private sector, and has provided experimental data for biopharma companies in the region, thereby supporting the biotechnology ecosystem.

Second, we have established a new fund with the specific objective of building value from Rutgers intellectual property and moving technologies towards commercialization. I will speak more about this in a moment.

My experience in biomedical research reaches back to my Ph.D. degree in chemical biology and synthetic organic chemistry. In 1982, I moved to New Jersey to work at the Squibb Institute for Medical Research, which was rapidly expanding following their commercialization of the first rationally designed drug, *Captopril.* I spent 19 years at BMS, leading research groups for 15 years. In the summer of 2001, I left Bristol-Myers Squibb with an opportunity to build small molecule drug discovery at Lexicon Pharmaceutical, a Texas-based biotech which located its small molecule chemistry specifically in Princeton, New Jersey, because of the talent pool that was available.

Over the next six years I built a chemistry team of 75 exceptional scientists including medicinal, analytical, process, and computational chemistry; attracting the Ph.D. and post-docs from Stanford, Caltech, Princeton, and Columbia. As Lexicon then transitioned into a

company focused on clinical trials, I moved to Pharmacopeia, in Cranbury, New Jersey, where I was the Senior VP of Nonclinical Research. In that role I gained further direct experience and insight into drug development and manufacturing.

In 2008, research at Pharmacopeia was discontinued, and the company was later sold to Ligand Pharmaceuticals. At this juncture, I was unable to identify an attractive position in biomedicine in the State of New Jersey, and was recruited to Hydra Biosciences in Cambridge, Massachusetts, as Chief Scientific Officer.

The long commute to Cambridge gave me a great deal of time to reflect on the value of a robust biotechnology ecosystem. (laughter) The energy in Cambridge reminded me of central New Jersey in the 1980s and 1990s, when my career was younger and big pharma was then at its peak.

Unlike many of my New Jersey drug discovery colleagues, I would not move to Massachusetts. As soon as I identified a suitable opportunity at Rutgers to build biomedical research, I returned home.

And finally, I am a co-founder of Z53 Therapeutics, a biotech based on discoveries made at the Rutgers Cancer Institute of New Jersey. In short, I have both the direct experience and the motivation to provide testimony on our biotechnology ecosystem in New Jersey.

So let's start with the data.

The recent data in the BioNJ white paper of January 4 -- Table 1 is taken from page 3, and I will provide this-- This is going to be provided to the Committee, but I'm sure Debbie knows it well. (laughter)

It shows the rankings of New Jersey relative to other states with biotech hubs, comparing a number of parameters that affect the region's

attractiveness for biotech. What is striking is the similarity between New Jersey and the states that are our most immediate competitors: Massachusetts, California, and New York. The quality and quantity of talent, infrastructure, overall business environment, industry environment, and cost of doing business are broadly similar. Furthermore, New Jersey is as attractive as Massachusetts in Pre-K to 12 education; and as California in the value of incentives offered to business. So we cannot attribute our challenges in growing a vibrant biotech industry to taxes or the local business environment.

New Jersey does clearly lag in the amount of NIH funding; number 23 versus numbers 1, 2, and 3 for California, Massachusetts, and New York, respectively.

And while New Jersey ranks No. 23 also in universities -- number of universities -- versus No. 1, 11, and 2 for California, Massachusetts, and New York -- the location of our Garden State, sandwiched between the significant biomedical research centers of New York City and Philadelphia, should be looked upon as an opportunity. Indeed, in the past biotechnology companies spawned at Columbia and Mount Sinai led to New Jersey-based companies -- Pharmacopeia and Amicus, respectively.

So the challenge: My thesis is that the decline of the New pharmaceutical industry, and the anemic growth of our biotechnology, relative to Massachusetts and California, can be attributed, in part, to two things that are under our control, and are not derivative of the evolution of pharma and biotech as a business: number one, lack of strategic focus, and number 2, a resulting dearth of financial support for the nascent

biotechnologies to seed the New Jersey biotech industry. This is clearly illustrated in Figure 1 (indicates), which shows that all of our peers have state and Federal programs to support gap funding; New Jersey alone is amongst the seven states without gap funding from either source, either Federal or State sources.

The seed funding of early biotech innovations is the foundation upon which the industry grows. Given compelling biotechnologies, biotech start-ups can be formed; given compelling biotech companies, venture capital and deals will flow in; given capital and research muscle, the Genzymes, Biogens, and Genentechs of the 21st century will evolve here.

Figure 2 (indicates) captures a *valley of death* that is the first hurdle for nascent biotechnologies. Most often, these start as discoveries in the medical school or biology departments of faculty principal investigators, *PIs*, who may or may not have contemplated developing a product and commercializing their discovery. In order to approach this issue, the PI needs to generate sufficient funding to obtain *proof of concept*. While this gap is common to all technologies, it is especially acute in biotech, where the requisite studies can be costly and are generally not covered by available Federal, State, or foundation-granting mechanisms. Critical proof of concept studies at this stage could include, as exampled, the synthesis of probe molecules to elucidate a biological pathway; the conception and reduction to practice of a small molecule or antibody that can be awarded a composition-of-matter patent; exploratory toxicology and pathology studies to de-risk the project; imaging, screening, metabolism and pharmacokinetics; and screening for off-target activities.

The prototype: Successfully obtaining these data can be sufficient to generate further funding in the form of NIH and SBIR grants, and angel or seed investing. Rutgers' strategy to address this need has been the recent creation of the *TechAdvance* fund. This fund is specifically designed to bridge the gap between early discoveries and data, or intellectual property that can lead towards commercialization. Applicants to the TechAdvance fund are required to have filed a Notice of Invention with the Tech Transfer office; and to have done market research with companies that are potentially interested in licensing, developing, or otherwise supporting the technology.

Critically, the decision whether to fund the application is driven by reviews from three independent industry experts. These grants provide faculty with up to $100,000, dependent upon achieving defined and measurable milestones. Applicants may apply for a second tranche of $100,000 if the defined objectives are being met and additional funds will drive increased value. This process maximizes the integrity and objectivity of decision-making.

The fund was initiated, with a pilot study, in the beginning of 2017, and opened to all faculty in June 2017. To date, over $900,000 has been awarded to research projects. One of the technologies supported by TechAdvance has already been licensed to a new local start-up company. Unfortunately, it was not a biotech, but it is still a successful license. (laughter)

MS. HART: Congratulations. (laughter)

DR. KIMBALL: So, the proposal: As instrumental as it has been in catalyzing research aimed at commercialization, it is critical to note

that the research TechAdvance fund, by itself, is not sufficient to accelerate all of the inventions at the University, not to mention the statewide need. In order to effectively trigger the birth of new biotechnologies in New Jersey, we see three specific requirements.

One, the State of New Jersey needs to create a seed funding mechanism that is similar in function, if not in form, to the TechAdvance fund. To strategically catalyze the nascent biotechnologies across the state would require an allocation of $10 million per year.

Two, this funding mechanism must be run and evaluated independently of New Jersey's major academic research institutions, and must serve scientists and entrepreneurs across the state. In order to effectively administer such a proposed gap fund, the Commission on Science and Technology should be re-formed. Additional supportive activities of the Commission would be the post-doctoral support for new spin-outs, and bridge funding of SBIR grants that are in between Phase 1 and Phase 2, as is provided by the historical Commission that existed in the past.

And number three, these actions should generate a flow of biotechnology opportunities across the State of New Jersey that could attract funding, start-up formation, and licensing from larger biotech and pharma. New Jersey has several pockets of talent distributed across the state, most obviously along the Route 1 corridor from Newark, to New Brunswick, to Princeton, to Camden. Each of these loci is surrounded by a distinct ecosystem with unique opportunities for biotechnology.

It is critical for us to recognize that our strength does not lie in a single locus, such as in Cambridge, Massachusetts; but that we must meet

the challenge of creating a plan to build our biotechnology capabilities in a more distributed manner. Otherwise, our centers of excellence will end up fighting a sum-zero game for limited resources and not compete effectively with our aspirational peers.

Thank you.

MS. HART: Thank you; thank you, David.

MR. SMERAGLIA: I'll just add a few words.

Two major points I want to make. One is, I advocate to the Task Force the continuous support of the staff and the building of infrastructure that we're in now. The CCIT incubator has been an incredible resource to Rutgers start-up companies. In fact, two or three that I know of -- biotechs that started at CCIT -- have now received their *Series A* funding and are now going into clinic with therapeutic medicines that will help patients. If it wasn't for the CCIT providing a bit of a subsidy to those early-stage companies, those therapies would not be going forward to help patients.

The second thing I want to do is, we can also -- we need the seed fund that Dr. Kimball requested. We also need to do nonmonetary things to help the ecosystem. Tonight, Rutgers is hosting a biotech spin-off company forum for biotech companies that come out of the University. And we have colleagues from TCIT helping us, and folks from around the state are going to come. We have about a hundred guests who are going to come to the Rutgers Visitors Center to hear about our start-ups.

So we continue to build an ecosystem through financial seed funding, but also nonmonetary means.

MS. HART: Thank you; thank you.

Questions from my colleagues on the Task Force?

ASSEMBLYMAN ZWICKER: I would say a *comment* more than a question.

The Science and Technology Commission, of course, never really went away; it just got de-funded, right? And there's draft legislation to start to put money back into it and bring it back. I think it-- From everything I hear, it's pretty clear that the State needs to have a hub; and the Commission is the-- Since it previously existed, it would be the easiest way to create that hub instead of bringing something back.

My question is -- so you proposed $10 million a year, independent. And as Assemblyman Schaer pointed out in his opening remarks, on one hand we are a cash-strapped State -- right? -- with enormous, enormous problems. He is one of the leading experts on that, in his work.

Should it be independent? I'm actually talking about in terms of the zero-sum game. Should we be looking to match? You know, how do we leverage, in your opinion, limited dollars; understanding well that the great -- in my opinion, at least, the greatest return on investment that the State could make would be in the innovation ecosystem because of its job creation capabilities. Could you comment on that?

DR. KIMBALL: Sure.

Yes, the $10 million is not a firm number; that's--

ASSEMBLYMAN ZWICKER: Twenty million? (laughter)

DR. KIMBALL: Well, certainly.

ASSEMBLYMAN ZWICKER: Should I be writing the checks?

MS. HART: Sold.

ASSEMBLYMAN ZWICKER: I'm not a good negotiator. (laughter)

DR. KIMBALL: I guess not.

No, I'm a firm believer in the matching mechanism; I've seen it work in the university setting very well. You can find money; if you put up $50,000, somehow the other $50,000 could appear. And I think that -- and I'm not really speaking--

ASSEMBLYMAN SCHAER: We should do that with the budget. (laughter)

DR. KIMBALL: Well, there are many sources; in fact, the TechAdvance fund -- what we're trying to do is get matching from-- For example, the New Jersey Health Foundation has put up $100,000, which needs to be matched. So these are mechanisms that do work; they have the potential to lower the burden on the State budget, in particular.

But my point about being independent is that it shouldn't be driven by one university; or it can't be parochial. And New Jersey sometimes gets parochial because we have all these little centers. So we need to have this distributed across the state. Wherever the talent is, wherever the best start-up ideas are, or the need is greatest, we should go there. That's really the point I would like to make.

ASSEMBLYMAN ZWICKER: Yes, true; it makes sense.

MS. HART: Assemblyman Schaer.

ASSEMBLYMAN SCHAER: Rutgers is obviously the largest player in the field. To what extent does Rutgers have formalized agreements with other universities, as well as medical centers, etc., in terms of developing synergies? In conversations I've had with presidents at a

number of universities, there's been some reticence on their part, in terms of the extent of that cooperation.

DR. KIMBALL: On Rutgers' part--

ASSEMBLYMAN SCHAER: Yes. (laughter)

DR. KIMBALL: -- or just in general?

Oh, okay. (laughter)

Well, I can't speak too much about the history-- I mean, the history, of course, before the merger was going to be different because it was the University of Medicine and Dentistry of New Jersey and Rutgers separately, and they both had very separate and distinct histories.

We have -- at that merger, that's the point at which I became involved with this process. And my boss is Chris Malloy, who ran the merger from the Rutgers' side. He's from industry as well. Bob Barchi, the President, has a lot of experience in the outside world. And the mantra is, *we're open for business;* and coming from a non-academic background -- since my post-doc -- this is something that we really are trying to put into effect to make the University run more like a business and get things done.

Now, typically -- and I think Vince can speak to this, because he has a long history at the University with this kind of tech transfer -- but typically, these agreements rise out of a single technology, or a portfolio of technologies, that you're licensing and collaborating across universities. And so they emerge as single, inter-institutional agreements. So we did not have, let's say, a large inter-institutional agreement with Princeton yet; but we are working with Princeton -- the Cancer Institute of New Jersey is working with Princeton to share resources and cooperate. And Princeton is

a member of the Cancer Institute of New Jersey. So our objective and our direction is to move and broaden those relationships.

But maybe you ought to speak to--

MR. SMERAGLIA: Yes, one thing I will add, to push back a little bit on that notion, is just in the last year we have gotten together with NJIT, Stevens, and Princeton to form something called the *New Jersey Academic Drug Discovery Consortium,* where we're sharing drug discovery resources. We're going to be applying for major Federal grant applications together and partnering with companies. We just put on a conference at the Institute for Life Sciences (*sic*) in Union County, where we brought together universities from around New Jersey to advance drug discovery.

So as Dr. Kimball said, a lot of this was spurred on by the merger of the University of Medicine and Rutgers. But we do have a handful of agreements directly with Princeton University, but more broadly with the leading universities in New Jersey that do drug discovery through this academic drug discovery consortium.

MS. MAMAN: I'd like to add one thing to that -- is the collaboration between Rutgers and Princeton around neuroscience.

DR. KIMBALL: Yes.

MS. MAMAN: So the Rutgers-Princeton Center for Computational Cognitive Neuro-Psychiatry -- I believe that's what it's called -- which is relatively new-- From our side we have very strong foundational research; from your side, you have very strong applied research and you have clinical setting. So from the two universities together, it seems like a very nice pipeline, from the very bottom all the way through to

the clinic. We talk about that a lot inside, and I'm sure you guys do as well on your side.

MR. LIZURA: Similar to the Assemblyman's historical references, I haven't been around for a while. I recall various conversations and want to just get your sense on something that, if it was true or if it continues to be true, at Rutgers.

There were some of your predecessors, in your offices, who used to compare and contrast the underlying authorization for Rutgers to spin out companies using technology at Rutgers; and a compare and contrast between what Rutgers has -- the legislatively authorized or enabled, statutorily, authorization to-- Compare that to what Stanford does, for instance. And I've probably now expanded my -- extended my reach of what that was; I knew that it was a difficulty. And does that still exist, and are there legislative changes to the underlying documents that would be able to facilitate additional tech transfers?

DR. KIMBALL: So I'll make a quick comment, and let Vince speak to-- He may know more about the technicalities of that.

We don't actually spin out the companies directly; we assist the faculty in spinning them out. So, for example, the company that I'm the co-founder of -- that's on me and my partner at the Cancer Institute to start up, but we're getting assistance -- guidance from the University.

MR. LIZURA: Right; I understand that. But that academic -- that staff person, if they were in Stanford, would have a different relationship than if they were at Rutgers. So I guess that was the thing.

MR. SMERAGLIA: Well, I can speak from one vantage point.

At Stanford, which is a private university, they're not particularly governed by the rules -- the conflict of interest rules of the state of California; whereas Rutgers, because we're the State public university, we're following our own guidelines as well as the State guidelines on conflict of interest and how much time a scientific founder can spend at the company, versus with the University. We could try to get a little more creative on that to provide flexibility to scientific founders who have to put a lot of energy to starting a company.

There are fewer restrictions on Rutgers than some other state universities in other states. So I wouldn't say we're in the worst shape, but there are some changes that we could make, in terms of that.

MS. HART: I would suggest that perhaps that's a topic that this Task Force should look at. Are there opportunities--

MR. LIZURA: You have legislators in the room who you could tell what changes would be helpful.

MR. SMERAGLIA: Okay; we could suggest those.

DR. KIMBALL: Yes.

MS. HART: That would be great.

D O N A L D H. S E B A S T I A N, Ph.D.: I'll tack on-- We have -- in NJIT's enabling legislation, it's explicit -- the freedom, if you will, to form for-profit entities that commercialize university intellectual property. So I've never seen legal restrictions as a barrier to doing that. There are practical restrictions, as you cited, that you're hiring your faculty to do their job; there's only so much time. And then if they're not buying their time, (indiscernible) from a regular grant, then you have this conflict of time, interest -- or conflict of interest in time management to be concerned with.

Really, though, the question is a pipeline one. How often is a faculty member actually the one who's in a position to be building a company and commercializing the research? I think that if you look at other states, what you really see, very often, is it's the graduate students who got the fundamental training in the laboratories who understand what the basic research was; and then decide to make a business out of what they learned, as opposed to go-- In the past, you would go work in a big pharma lab; now they see that there are greater opportunities to start their own businesses.

MS. HART: And I'd like to just do a time check.

How are we, Maureen?

MR. ROSE (Task Force Aide): We just wrapped up when we came out--

MS. HART: We just wrapped up; okay, perfect timing.

Congratulations to Rutgers and, you know, your creativity. The fund is very exciting. So we look forward to seeing more from you all.

Thank you.

And so next, actually, so that some-- Actually, I guess we're going to segue to-- We're going to go south; we're going to go to Rowan. And we have Tony Lowman, who is the Dean of the College of Engineering, here to talk to us.

Thank you, Tony.

A N T H O N Y M. L O W M A N, Ph.D.: So thank you.

I'm going to, actually-- Because of the loss of a voice from an illness, I'm going to turn it over to our Vice President for Research; and then we'll kind of tag-team this presentation.

MS. HART: Terrific; thank you.

S H R E E K A N T H M A N D A Y A M, Ph.D.: Thank you, Debbie.

Good morning. I'm Shreek Mandayam; I'm the Vice President for Research at Rowan University, and the Executive Director of the South Jersey Tech Park.

It's a pleasure to be here to talk to the Task Force.

So Rowan, as you know, is New Jersey's newest public research university, with both M.D.- and D.O.-granting schools. The majority of the leadership -- I'd say, all of the leadership in the institution has been hired in the last five years, and the majority of the faculty have been hired in the last five years in the university. So we have gone ahead and targeted a new breed of faculty, so to speak, that are innovative and entrepreneurial, to come work at Rowan.

So while we may not have the legacy of other research institutions in the state and in the region, because we are new we have been able to build up programs and create programs that break down barriers to innovation. And the best example I can give is the operation that I run in Research and the Tech Park.

So we have one unit that manages and supports the academic side of the house with faculty, and proposal development, and sponsored programs to business development, which is Rowan Innovation and Tech Commercialization; to real estate, which is the South Jersey Tech Park. So it really is a one-stop shop for proposals and knowledge to be created; to be commercialized and translated to locate in a particular space. So definitely that's where we think we have done something new, because we didn't have

these legacy units that we had to merge, or anything like that. So we created it this way,

So in our Technology Park we have programs that offer consultative advice to new companies -- of course, patents and commercialization; the financial side -- how to manage your payroll, for instance. So that's help we give to new companies -- the legal side, the marketing side. Of course, lab and office space. Most importantly, the workforce, with interns and employees that the companies can hire. And we have workshops and seminars where we bring in other units to advise companies to be successful; and networking opportunities so that they can have business connections.

So how are we able to fund companies to do this? Well, I will echo what my previous speakers have talked about: the valley of death, and the fact that there is no funding in New Jersey for, really, early-stage companies. So what we have that has funded the early-stage companies in the Tech Park is the New Jersey Health Foundation. So they give little bits of money for very early-stage companies.

Rowan University itself has used its foundation and created Rowan Venture Fund (*sic*), and that is for companies beyond the early stage. I would say they are not full venture capital ready, but just beyond the early stage. Since we are in the Philadelphia metropolitan area, we have been participating in the *QED* program that the University City Science Center runs. So that has funded some companies in the Tech Park.

So as a result of all of this, you know--

MR. LIZURA: What is a QED? What does QED stand for?

DR. MANDAYAM: QED, I do not think has an expansion.

DR. SEBASTIAN: It's Latin, *it is demonstrated.*

DR. MANDAYAM: But I don't think it is *quod erat demonstrandum.*

DR. SEBASTIAN: It's a Philadelphia incubator, basically. University City's--

DR. MANDAYAM: I think it's-- It's a program that the Science Center runs for early-stage companies; and so we were charter members. Rutgers is part of the Science Center too, so they have gotten plenty of QED funding. And we are new at this; so again, we have gotten-- They give about $100,000.

So just to give you some numbers. The New Jersey Health Foundation gives you about $25,000 to $35,000; the QED Program gives you $100,000 max; and our Rowan Innovation Venture Fund gives you about $250,000 max. So in tranches, I mean; you can get a multiple of those.

So as a result of this, in the last five years, we have 17 small businesses and large businesses in the Tech Park, everything from a spin-out from a faculty member, to Inspira Health Systems' Innovation Center that they placed in the Tech Center.

And so, really, the Garden State creates its own incentives, that we hope will never expire -- are a wonderful thing for us to recruit companies. What we have done with Rutgers and BioNJ in creating this clinical trials master agreement -- that has been a wonderful thing for us so that we can work with pharmaceutical companies and get them to do clinical trials here.

So before I talk about what the State can do, I'd like to turn it over to Dean Tony Lowman to talk about the business spin-outs that have occurred just within his college.

DR. LOWMAN: Sure; so I'll do the best I can to speak to our college.

So in the scheme of things we're talking about -- particularly with our other institutions in the state -- we're relatively a baby. The College of Engineering at Rowan is just now 20 years old; for the first 17 years of its existence, it focused exclusively on undergraduate education, per of the mission of Henry Rowan. With the Higher Ed Restructuring Act and the new research mission of Rowan, we also changed our mission in the College of Engineering. We've only had a Ph.D. program in Engineering for four years now; we just had our first doctoral defense that we're very proud about. We'll have our first doctoral defense in the next month, in Biomedical Engineering, which is also a brand-new program at the college. So the trajectory in education and research is on the upward direction.

So as a college that's trying to reinvent itself and also focus on entrepreneurship, spin-outs, commercializing technology, we've done a number of things including integration of our curriculum with industry needs. And so we focus very heavily on working hand-in-hand with industry in educating our students. This leads to a number of programs annually where we have industry working in our labs, side-by-side, with students as part of the curriculum. And the biomedical engineering, while just about to graduate its first class, has been very, very active in linking practicing clinicians at our medical schools, in industry in the region to develop solutions to biomedical problems.

The Rowan Innovation Fund has been a tremendous help towards this program. In the last year, we had four biomedical engineering start-up companies, out of our new program, launch businesses into our Tech Park. And I should tell you that's notable because we only have five total faculty in the program. That means that just about everybody we've hired in the last five years -- including the Dean of the College and the Chair of the program -- has launched ventures in our Tech Park.

We emphasize entrepreneurship in our curriculum. We are one of the newest members of the current Engineering Entrepreneurship Network in the United States. It's a network of 30 like-minded engineering programs that have a goal of, within 20 years, creating educational programs where the word *engineering* and *entrepreneurship* are interchangeable. So we have created programs in our educational tracks -- that every engineering student will be touched, at various stages of their curriculum, with the entrepreneurship mindset. So we are very, very excited about that.

I want to give one example to one of the questions about collaborations with our institution and industry that, while not in the biotechnology space, I think is very, very relevant and is the model of how we do business.

We established an educational program with Lockheed Martin -- that many in this room may have heard about -- that after four years of work has now developed a pipeline where students have two full years' experience working with Lockheed Martin during their curriculum. And it has led to a program that, of the last two years, 20 students annually have been hired directly out of Rowan to the Moorestown facility at Lockheed. Now, put that in perspective: Two years ago, that was 10 percent of our

graduating class; this year, it's a little lower percentage because our numbers have grown. But we intend to take that model and work with industry in the region and continue to grow, certainly in the biomedical space.

The last point I'll have, before I turn it over to my colleague here, is one of the key areas that we need to address -- and I've heard it mentioned by our colleagues from other institutions -- is the need for gap funding. So while some of our biomedical faculty have certainly benefited from the New Jersey Health Foundation funding, it's a relatively small seed amount of funding. While some of our faculty have benefited from the Rowan Innovation Fund, it's a more mature fund; it requires a more mature company. So it's not really that gap program that many of our researchers, entrepreneurs need, students -- would be available.

And probably the unfortunate thing that I've seen too many times over the last two years is small businesses with ties -- strong ties to South Jersey leaving our region and moving across the river to Philadelphia, because the programs available over there are much more attractive than we can offer them here.

DR. MANDAYAM: So the critical thing in the Lockheed program, which Tony talked about, is the University allowed Lockheed employees to come teach classes at Rowan. So we-- The most sacred thing faculty have is control of their curriculum; and that is one we persuaded our faculty to give up. And we said, "You know, you know best what you need in your future employees. So why don't you come here and teach it to our students?" And so that was the model of success that we have started replicating with other institutions. So that is why Inspira is here, and that is exactly what we want to do. "We will let you come in and teach to train

your future workforce." Because the most valuable thing companies want from the universities is the workforce -- much more than the talent, and anything else that we could -- and the land, and anything else we could think about, is -- and that's what we are marketing.

So just to turn it around -- what can the State do? And I won't mention again what others have said. Yes, of course, money for accelerators, money to cover the valley of death. But here's something critical the State can do, and this is what we have noticed in our start-up companies in the Tech Park. The greatest need beyond money is professional advice. And this is professional services advice on taxes, on accounting, on financial, on marketing. And so what we have tried to do is get-- And they don't have much money to get this. So what we have tried to do is get local companies and give pro bono services to them. If they become successful, then hopefully they will be able to use the services of this company when they become -- when they can make payroll.

It would be wonderful if the State could provide a tax incentive or something to -- when you provide a pro bono service to a company in a technology park that's not able to make money. So that's one thing the State could do that may not be as expensive as creating these other programs. But that would be very helpful to these start-up companies.

DR. KIMBALL: Could I just throw in -- to add on to that.

Our TechAdvance fund, for example, is a prototype. The experts that we bring in from industry -- we're curating them. They're becoming a bullpen of experts who will, hopefully, turn into entrepreneurs-in-residence, and the kind of expertise you need.

But you have to be -- above all, you have to be very strategic. You can't expect it to happen in a year. But we've gotten very favorable responses from -- a lot of interest in the technologies as they've developed. So that's a great suggestion.

DR. MANDAYAM: Thank you very much.

DR. LOWMAN: Thank you.

MS. HART: Thank you; and congratulations on that tremendous growth over the last 20 years, and even more recently. That is very significant.

So thank you.

So you mentioned that you'd like to replicate the Lockheed program. And so we know that -- we all know, right? -- New Jersey's geography is such that most of the largest companies or companies that might be able to partner with you in that way are, sort of, in the more northern part of the state. What are the types of companies that you might target in the South Jersey geography?

DR. MANDAYAM: Sure; we are targeting the healthcare companies, really, so that the next thing that is going to replicate the Lockheed model is Inspira Health System. The hospital is moving right across from our South Jersey Tech Park campus. So they have established their innovation center not on their campus, but away from their campus because they want to be in a different environment, and they want to work with the faculty and students at Rowan University. So we are going to create a similar program with them.

There's another similar program to Lockheed that the Computer Science Department is actually doing in New York City, with

another company called *Perka*. And so New York, still, is some distance away; but they come in once a week and teach our students in the Computer Science Department.

So I really think we should consider ourselves in the northeast; South Jersey is not that far away, and companies -- these programs, people come once or twice a week. So I know that many people haven't been south of Exit 9, but come on down South. (laughter)

MS. HART: Well, well-stated.

And, you know, I-- Red flag: You know, whenever we hear that companies are going to Philadelphia, that's obviously a concern. Thinking in terms of this Task Force and our work -- how can we, sort of, prevent that?

I'd like to hear from my colleagues on the Task Force.

Any questions?

ASSEMBLYMAN SCHAER: Something brief; as someone who grew up at Exit 4, by the way (laughter)--

DR. MANDAYAM: Good; we love you.

ASSEMBLYMAN SCHAER: --how does one foster that greater communication, that greater growth, that greater share of the resources between Rowan and our other universities? One understands the National Geographic attraction to Philly, and Philly has some exceptional institutions; there's no question. But how does one make sure that Rowan, effectively, does not become an outlier -- which, to some extent, I would argue, that it is right now. And you have some brilliant leadership, from the President on down. But how does one facilitate that?

DR. MANDAYAM: So we are already facilitating that.

Don Sebastian, of NJIT, is on the Board of the South Jersey Technology Park. So we are part of NJII, is how we look at it; and he has--

DR. SEBASTIAN: And Ken Blank is on the Board of NJII.

DR. MANDAYAM: Exactly. And so he-- And so there's a lot of business collaboration that is happening between our institutions. As I said, we worked with Rutgers very closely in developing the clinical trials master agreement under the auspices of BioNJ. And Chris Malloy and I have a wonderful relationship, and we participate on projects together.

So I think once Rowan -- once the Legislature classified us as a research university, I think we have -- and then with the new leadership -- we have been aggressive in seeking our partnerships, with Rutgers and NJIT particularly. All three of us serve on the Governor's Innovation Task Force. So I think we are doing more than we did in the past. But I agree; we have to do more. But the partners have been good to us.

DR. LOWMAN: And if I can give some examples. In other areas -- other technology areas there have been some wonderful synergies developed across the engineering schools; certainly in the area of transportation, is a prime example. That's probably-- On our campus, transportation research is probably the largest research program on campus. It's doing more annual research this year than Rowan, as a University, was doing in 2012; that's how rapidly it's grown.

Rutgers is one of the nationally recognized leaders in transportation research. NJIT has outstanding programs in transportation research, and we have complementary expertise. Just last fall, the three universities put in on a Federal Department of Transportation UTC

proposal. And that took some doing because of old history between the schools -- the unknown entity of Rowan. But we've done that.

Unmanned systems -- well, that was not an ideal program that was brought to us as-- New Jersey wasn't put in a good place with other partners; but certainly the Universities rallied together, I think, to put together a pretty good solution to a very challenging problem. And now we're developing our own programs to make New Jersey a leader.

So I think if the same groups are brought together in this space, I think we could do the same thing.

ASSEMBLYMAN ZWICKER: Could you-- You mentioned companies that you were losing to Philadelphia -- or to Pennsylvania; I'm not sure. Can you be more specific and explain what was the key driving factor, or what were the most significant factors for companies you were losing?

DR. MANDAYAM: Keystone State.

DR. LOWMAN: Blunt -- the blunt answer is money.

DR. MANDAYAM: Money.

ASSEMBLYMAN ZWICKER: Blunt and honest.

DR. LOWMAN: The blunt answer is money.

ASSEMBLYMAN ZWICKER: Money? Okay.

DR. LOWMAN: We have a company that we cultivated, a small biotech start-up; a surgical device company. They had some loose ties to Rowan, so they qualified for the Rowan Innovation Fund. They received funding from our own Innovation Fund; they used one of our engineering educational programs. We still have a great partnership with the company

from hiring our students and our students working; but after their funding, and they needed bigger funding, there simply was nothing available.

ASSEMBLYMAN ZWICKER: Did they get private or state funding from Pennsylvania?

DR. LOWMAN: I think -- Ben Franklin; quasi-state funding, so--

ASSEMBLYMAN ZWICKER: Yes; it's Tech Partners, yes.

DR. LOWMAN: Right; so it is state. So essentially, quasi-state funding.

MR. LIZURA: And does *funding* mean grants or mean *investments* in some kind of -- across the academic board?

DR. MANDAYAM: Investments, really.

MR. LIZURA: We keep using *funding*; sometimes that's different.

DR. LOWMAN: It's more investment.

DR. MANDAYAM: Investment.

DR. LOWMAN: Investment. As somebody-- I spent the first 15 years of my academic career in Philadelphia. I had a start-up in Philadelphia 15 years ago when start-ups weren't -- it wasn't cool to be a start-up -- right? -- as an academic. And the opportunities there, quite honestly, were better than what we have as a State, I think.

DR. MANDAYAM: But we have lost multiple companies in the Tech Park to Philadelphia. You know, there's Social Reach, one of these companies that pops up the annoying ads on Facebook whenever you-- So that company was at the Tech Park and moved out to Philadelphia. Again, they got investment from there.

Right now, there's a company that is in the unmanned -- UAV space that is being recruited heavily by Philly and by New York. And this person doesn't want to move out of Jersey; he wants to stay here. And he is finding it difficult to get investments. So it's really money.

ASSEMBLYMAN ZWICKER: Can I ask a follow-up question to the group as a whole, starting with you.

Does it make sense, in New Jersey, to replicate what Ben Franklin Tech Partners has? Let's take the money piece; I mean, do we have that here, should we have that here?

DR. MANDAYAM: Yes.

MS. MAMAN: I'm a recipient on two of my start-ups, prior to Princeton, both their smaller funds, as well as in their larger funds program. They mandate that you be located in Pennsylvania; and if you're invested in through the southeastern Pennsylvania one, the Philadelphia area -- it has to be in that region. So they have several throughout the state. That seed funding program is, in my opinion, why Philadelphia has come back with start-ups, and why it has become a millennial hub again, and why it is where things happen. Certainly, along with their academic centers, but seed funding.

DR. MANDAYAM: And the Science Center.

MS. MAMAN: And the Science Center, which is largely seeded by companies that have Ben Franklin funds.

MR. SMERAGLIA: And this QED fund that's at the Science Center -- that, in my mind, you're trying to distinguish between *grants* and *investments.* It's both, because that $100,000 gets the technology off the ground and makes more attractive the notion of a venture capitalist coming

with money. With that $100,000, there is no venture capital after that. So that seed money is, maybe, called a *grant*; but it's really an investment by the City of Philadelphia and the state of Pennsylvania.

MS. MAMAN: But the QED program also comes with coaching that is all about--

DR. MANDAYAM: Yes; the most valuable thing of the QED program is that, more than the money.

MR. MAMAN: Right; so money does not always equal money.

MS. HART: But you can get the QED funding and be in and stay in New Jersey; is that correct?

All: Yes.

DR. KIMBALL: Yes, we have multiple--

DR. MANDAYAM: You can, you can.

MS. HART: But it's that next stage where they're likely to move to Philadelphia.

DR. MANDAYAM: Yes.

DR. SEBASTIAN: I think it's their expectation that the graduates will actually populate there.

But you're right; it's a little like *Shark Tank* in the sense that the investment is small compared to the investment of time and expertise of the sharks, in terms of the potential and growth of a company. They're making an investment; but what it really is -- because it is highly competitive to get into QED -- is the business coaching that they give you, then, to take your idea forward. That adds much more value, probably, in the end than the dollars that they're putting in.

ASSEMBLYMAN ZWICKER: That was very explicit. I think it's not in this report, but in the McKinsey report, about coaching as something that would be of critical importance to New Jersey, with our 500-plus municipalities, and county governments, and State government, and everything else.

MS. HART: How we doing on time?

MR. ROSE: We're just about wrapped up.

MS. HART: Okay; thank you, thank you.

Okay, great; terrific.

Thank you so much; yes, Tony and Shree. Well done.

So next we're going to hear from Don Sebastian, from NJIT; President and CEO of NJIT's Innovation Institute, doing some of the important collaboration that we've been talking about all morning.

DR. SEBASTIAN: Thank you.

If you don't mind, I have some visuals; that's sort of my modality here.

And given a narrow slot of time to tell a very big story, I had to make some very hard decisions about what I would and would not talk about. And I am dual-hatted; I'm a Senior VP at the University, and ran the research program for about 15 years before we created NJII. But I decided that if I were to talk about all the great things we're doing as a polytechnic institute, you've already heard them, right? It's exactly the same sort of things. It gets a little *me too-ish.* We're a little bit smaller in scale than some, and little bit larger than others. We do about $140 million a year in research; that makes us, what, maybe six times smaller. I'm not sure where Rutgers has gotten now, after the merger; you're

probably somewhere north of $750 million. I know Princeton is bigger than us, but we're fifth in the country amongst polytechs.

But I would argue that that's just not good enough. In fact, if we put all the pieces together of all the things we're doing -- if we're trying to talk about growing a robust sector of this economy, we need a whole lot more. And university activities, by themselves, don't scale. So I'm being a little slavish; you asked me to address some questions, and so I'll use your format as a way of kind of making the point I'm trying to make -- that we need to do things that universities typically don't do.

And so when we talk about NJII, we're really talking about creating a mechanism not just for NJIT, but we designed it explicitly so that all the universities in the state, public and private, might find a vehicle to do the work that connects them to the needs of industry, because that's our mission, right? It's not our mission to drive philanthropy back to the university to do what we want to do that may be relevant, or hopefully will be relevant; it's really to take on the problems of industry, and particularly, industry clusters.

And this one is one of our five anchor clusters, biopharmaceuticals production; and health care is another. So in a sense, we have the mid-tech embedded in there.

So a little bit of history -- NJIT began small business incubation in the late 1980s. It adopted economic development as a mission element back then, long before most universities would even acknowledge that that was an important contribution.

And I remember -- I came to NJIT in the mid-1990s; Saul Fenster was the President who had this, and he told (indiscernible), "It's

not important that NJIT does everything, but it is important that NJIT make sure that everything gets done."

And so it was in that spirit he created an incubator -- not to drag university IP out into the marketplace, although it was open to that -- but to allow for *spin-ins*. I'm not even sure that it was a concept back then. Be a place where companies could come -- small companies could come and access the resources of the University -- advanced equipment, student workers, faculty expertise -- and have a place to grow. And so, over the time, we've grown to be not just the oldest -- that's just a survivor's game -- but the largest technology business incubator in the state; 90 companies in residence; a measured economic impact of $145 million a year; and on, and on. We hire 300 students; it has created 800 new jobs in the workforce; attracted close to $100 million, now, I think, in private investment for those companies.

But even that is not enough. Because we found that when you spread your resources across all possible technology areas, there's not enough to have a critical mass to be of value to a particular industry or industry sector.

You're beginning to see the emergence of these so-called *business accelerators* -- some of which are captive, like *JLABS* -- to try to at least aggregate companies in a common framework that becomes, then, a captive shopping ground. And I think we're finding that big companies-- As much as they are looking to collaborate with small companies as the replacement for corporate R&D as a source of innovation, no one company can sustain even that model.

So what we're trying to do is put together a model at NJII that leverages our focus on sectors; leverages physical assets -- demonstration centers. We'll talk about some of the physical facilities we're putting together that go beyond what a university can do as a breeding ground that attracts companies in those sectors.

That becomes an easy shopping mall, if you will -- for example, companies in the life sciences to connect to emerging companies in the life sciences and take them through structured problem-solving exercises. We call it *innovations of services* -- I don't have time to describe the whole thing -- but there really is much more than incubation, which was place-based, which was, "Here are subsidized facilities." Now it's more and more about sexy co-working spaces that kind of look like Starbucks, but also have some office accoutrements. Or accelerator programs that come largely out of the investment community; boot camp for a company -- 8 to 12 weeks of intensive training, then push you out and hope, in 5 years, you're going to get a 5- or 10-fold increase on your investment.

This is about creating a continuum of services that begin on both ends. Innovation from the small company, as well as problems from the big; and put them all together and take them, progressively, from ideation, through execution, and demonstration in a physical facility, and then translation out into the workplace and the commercial workplace.

Some of the things that we are doing -- two in particular that are germane to this industry sector -- is the creation of pilot-scale production centers. Recognizing that, for the bio community, what you can do in a lab is not going to be the same way that you're going to do it on a commercial basis. And so if we can allow you to move up into

demonstrating your capability in that world, work with you to do that process development, we've not only lowered the risk to an investor to know that what happens in the lab can happen in production scale, but we've made it of much more value and of interest, then, to companies. And so we get an opportunity now to underwrite the expense of running such a facility -- and that's part of the comment here; it is a very expensive sport -- by not only from the investors; but from the companies that gain access to that.

We are launching a Cell and Gene Therapy Development Manufacturing Center in the former Hoffmann La-Roche site in Nutley, in a building where Hackensack and Seton Hall Medical School will be doing advanced cancer research. We start training for cell gene classroom training in about a week. And cell and gene therapy manufacturing -- they're going to be in the business, and they're going to be opening a Summit facility in December. This will become, then, a hands-on component as soon as we get this thing rolled out.

The other major announcement that we made earlier in the fall is a partnership with Rutgers for a Continuous Pharmaceutical Manufacturing Center. We have a $10 million appropriation queued up in the FDA budget for Fiscal Year 2018. If Congress ever decides to stop doing continuing resolutions and pass the budget, we'll be able to pull that money through. Both of these activities are the outcome of a big Federal proposal that we put together last year -- not just with Rutgers; they were certainly a strong partner, because we're basing it on a decade-long collaboration that was at the NSF Engineering Research Center -- Rowan was part of it, Princeton was part of it, Stevens was part of it, and about a

dozen other universities in the country. We were told we actually had the best technical proposal; but Vice President Biden had his finger a little bit on the decision process and it went to Delaware.

But we also learned -- and this is an important lesson, because it's not just sour grapes -- they had an overwhelming cash match from participating states. Between Massachusetts, Delaware, Maryland, and North Carolina -- they had more state pledges guaranteed for the five year program than the Federal money going in. We had a sort of vague promise of first-year funding that was partly in-kind, partly cash from the State of New Jersey; and that was it.

And so when they were making their decision based on the sustainability of the program, in the long-term ours, I think, was much better. We had industry participation and real contract work going through that Center. The Delaware program is academic research programs hoping to be viable. But in the end we lost, frankly, because we couldn't put the money on the table.

So are there gaps and challenges? Well, I think you've heard this is very-- Incubation is a very expensive sport. When we started in the 1980s, and we put up the two buildings that we currently occupy with some bond-supported and State-supported funds, we were getting -- we had kind of half of market rate for space. Now it costs more than we can get in market rate rents just to keep the lights on and the heat on, even without people staffing it.

So at one point we had State Commission of Science and Technology funding to all the incubators in the state. That money doesn't exist anymore. There's nothing that has to come out of the University's

back pocket, which is part of why we have to look at models that have an opportunity to generate more revenue than rent; and part of why that innovation and service then becomes a model -- not just what we can do at the University, but the core suite of services becomes a moveable feast that we could do throughout the state, wherever it makes sense to cluster based on the competency that's there in the university sector and the industry's desire to aggregate around that location.

Property tax; we pay commercial property-- We pay it, on the R&R incubators; we pay the city property tax as if it were a commercial enterprise. That's $500,000; it was, at one point, $750,000 a year in expense. Now, the University doesn't want to be a bad resident of Newark and deny them the tax revenues they need. But clearly that becomes a crippling thing to apply when something-- Which, although there are commercial companies in there, there's no profit being generated in start-ups, and we're not making a profit out of it.

And a barrier is that, for the most part, university commercialization offices are simply not self-sustaining. There's not enough revenue flow from the licensing of academic research to sustain the kind of effort that you really need to have to cover 19-- We have 19 Ph.D. programs. Rutgers-- The good news is, you guys at least had a big-- You have 14 or 15 people who could work industry sectors; most of the others are dealing in single-digit numbers. And yet, it's almost happenstance as to where the most valuable property will come from. So there's an opportunity then to begin to aggregate our capabilities so there's some critical mass here in approaching market sectors with portfolios, as opposed

to something which then becomes university-driven; and university-specific becomes State-driven and market-oriented.

Are there challenges or current collaborations? I sort of alluded to some of them, right? So NJII was designed to be a collaboration machine. One of our mottos is *Collaborate to Compete,* and we preach that to industry -- that we're trying to bring together industry sectors to define large-scale problems that go beyond their individual corporate capabilities to solve, and to pull together their funds and government funds in order to compete. But we also have to eat -- take our own medicine here; and so finding ways in which we can begin to build bridges between what have often been warring factions where, you know, the basic university model is still single investigator, peer-reviewed, grant-driven research. And so you're a warrior against your colleagues in the same discipline at other schools going for limited resources. We need to be able to find ways to engage in large-scale programs and team science. And this is the thing which then creates an opportunity now to use the drivers that come from the problems of industry, to define problems that are too big for any one person to own anyway. And now that starts to build bridges in which we can collaborate. And the Rutgers Continuous Manufacturing Center is a beautiful example of where we see that growing.

What has it done for the University? It's linked us to corporate partners, partnerships that we didn't even have before. I could go through the whole laundry list, but we'll use Celgene as an example -- as a major sponsor of the cell and gene therapy, with Novartis lining up behind that; and Kite, as part of Gilead, coming onboard. So these capabilities, that no one else in the country, frankly, has, become an easy conversation opener.

And our motto -- I'm going to take one up on Princeton, because I'll give it to you in Latin. *Quid tibi faciam* -- write that one down -- *how may I help you (sic)*? That attitude -- which is not driven as a philanthropic model of "how can you help me," but "how can we, together, understand your problems and come up with a solution," -- has opened up doors that would have been closed to the University in the past.

And that creates, then, wonderful opportunities for our faculty and students. We were already employing 300 students a year in the incubator companies. Now our programs are generating internship and employment opportunities. My Healthcare Division, that does, maybe, $30 million a year in activity, has about 20 kids who -- they've taken them through an internship program and now have stuck as employees of the organization.

And, of course, it gives faculty, then, an exposure to real-world problems that can then inspire the research they propose for Federal awards. It's not quite on this topic, but just yesterday I saw an announcement of a faculty member in Physics who got an NIH award to use a LIDAR technology for identifying mosquito larva. Now, why is that important? Our UAV program, for the last year, has been working with Warren County to look for remedies for Zika virus identification. And while we could spot bogs and potential places for mosquito larvae breeding, we weren't able to know for sure what was there unless someone went and tested. Now the UAV can actually determine whether or not there are larvae there and, with a paint gun, actually deliver a ball of insecticide to stop the problem.

So this is just an example of where a little real world thing now has turned into major NIH funding for a young faculty member, which can really launch a career.

So your last question was, what can the State do, obviously? Well, you know, as I've said incubation, in the broadest sense of the term, is an expensive sport; and not a for-profit. The for-profit incubators are accelerators; they are short-term, highly competitive to get in, and great expectation for short-term returns to the investors. That's very different than anchoring in the State economy and creating a flow. Somebody has to help us with the sort of the basic facilities and programmatic support. I don't mean *us*, NJIT; I mean the State, and coordinate these things.

You've heard it over and over: Everybody has their own little thing, and most of them are driven by the host institution trying its best to do the right thing. But if we can begin to coordinate assets that are available and programs, and really think clustering and sub clustering -- right? The life sciences are broad enough that we could have a solid dose manufacturing cluster, and a biologics cluster, and a cell and gene cluster, and on, and on, and on. So where does it make sense to begin to aggregate these things so that we build on the value of proximity -- of companies being close together, working together, and being accessible to the large ones that ultimately take them to market?

The State -- many states have SBIR and grant matches. The Commission of Science and Technology used to do that. That's a good example of *validating* -- when somebody else has already said it's good and valuable work, and providing dollars to do that.

And I think there has to be a way to deal with this issue of tax revenue to municipalities that they're expecting -- whether it's hospital systems or incubators -- in which they don't lose what they need to keep the lights on, and the roads paved, and plowed, and so on. And yet, the host nonprofit institution doesn't have to try to, then, cover that as if it's making a profit within its facility.

So those are a couple of things; and I would be pleased to take your questions.

I think we just squeaked into our 10-minute window there.

MS. HASSETT: It was 15; I gave you an extra 5, Don. (laughter)

DR. SEBASTIAN: Oh, thank you very much. (laughter) So, I mean -- that's the trouble, I talk too much.

MS. HART: Thank you, Don; thank you.

And I'm on the NJII Board, so I have gotten to see, firsthand, the really amazing things that have happened there in a really short time. So congratulations.

And so-- They're telling me to move closer to the microphone; sorry.

And so, you know, a thought -- so ensuring, statewide, a coordination of program and assets. I wonder, you know-- I'm not aware that we have a catalogue of what all the assets are. Could that be an opportunity for the Task Force or the State to, first of all, catalogue; and then figure out how to coordinate? I wonder if--

DR. SEBASTIAN: So you guys are funding, at least, the database approach to that as a starting point, right, which is for the

universities to contribute in faculty expertise and physical assets. I think it's an opportunity to build on and expand that to talk about programs and programmatic services, so that if there's an incubator -- not *if;* there is an incubator operation in the Rowan Tech Park, and if it needs some expertise, it doesn't have to sit across the street at Rowan, "Well, where do I go?" Well, maybe we can begin to collaborate; and I'm talking about this innovation as a service model.

As I said, this is something we can deploy. We're going to be starting things -- not just in Newark; the UAV center is a good example. The location of the biopharma projects -- one will probably be down here in New Brunswick, the other in Nutley. But it's also something open to others. If someone wants to do a fintech in Jersey City or in Hoboken -- whoever that might be -- there's a portfolio of services that we could deploy, and not -- and provide much more value than to the place-based and rent-based opportunities.

MR. LIZURA: So, two things: We're happy to take that up as a request for the Committee to put together, and lean on our friends and colleagues to help us with that.

I think, Don, you're exactly right on the notion of replicating and best practices. Because we just spout a couple of hours this week, I guess it was -- it might have been yesterday or the day before -- where we sat with SOM, the School of Medicine Hackensack, that is taking the best learnings from Lenzie and his team here, and trying to import them to the School of Medicine's incubator that they're planning at Roche site.

So, I mean, that's great to sit there; but maybe there's a playbook that you can use that you don't necessarily have to spend a couple

of hours -- three hours -- and you can actually hand it over and, "Here's the manual," in some fashion. So maybe there is some learning -- a better way to categorize that learning as well.

MR. SMERAGLIA: Just to add on to that -- the new Celgene incubator that opened up a few days ago got their learnings from Lenzie and the CCIT as well. We spent a lot of time with John Anthes at Celgene, talking to him about best practices; and they've incorporated that into their program as well.

MR. LIZURA: That's true.

MS. HART: Thank you.

Questions from--

ASSEMBLYMAN ZWICKER: I have one question.

Sort of burrowing through the weeds on something you said, for a moment.

So we talked last year when you were negotiating with the Administration about the matching grants.

DR. SEBASTIAN: Yes.

ASSEMBLYMAN ZWICKER: And you implied -- but this is my question for you -- that if the Science and Technology Commission had been funded and up and running, there would have been a mechanism for this?

DR. SEBASTIAN: No--

ASSEMBLYMAN ZWICKER: And my question is really -- you were in active negotiation, right? But it was a one-off sort of thing.

DR. SEBASTIAN: Right.

ASSEMBLYMAN ZWICKER: What would it take so that the next time there's a large, multi-million dollar grant, there's at least a mechanism to evaluate whether or not the State should provide matching funds?

DR. SEBASTIAN: Good; so it's a two-part dance, right?

So absolutely, I think we all agree that the Commission of Science and Technology is an important vehicle. And particularly, go back to its formation in the Kean Administration and the original objective of the Advance Technology Centers, which was to do kind of what we're talking about here -- right? -- to be university-hosted, but not university-driven, and to be industry-facing. It's important to get something like that that's a voice -- an enduring voice in State government.

And so yet, then comes the money question, right? So then you would have a State entity that has life beyond the duration of a grant program, and an authority to judge and then grant funds that put some validity behind it.

Massachusetts has something like that; and they pledged their component for that grant. But under the constraint, that had to be spent in Massachusetts. And I think North Carolina -- same thing; and I imagine all the (indiscernible). But when you put them all together, you had -- what was it, like, $15 million to $20 million a year in Federal funding, and there was like $50 million a year in State funding coming in as a match. When they're trying to brag about their ability to leverage Federal funds, that was just overwhelming. We had $4 million.

ASSEMBLYMAN ZWICKER: Right; okay.

MS. HART: Okay; thank you.

Anything else from the Task Force? (no response)

Okay, great.

Thank you, Don; we appreciate it.

And next, we are going to hear from Dr. Kenny Wong, Program Director of the Department of Chemistry and Chemical Biology at Stevens Institute of Technology.

Welcome.

K E N N Y K I N - C H U N G W O N G, Ph.D.: Well, thank you.

My name is Kenny Wong, and I am actually relatively new at Stevens Institute of Technology. But I spent 23 years at Merck & Company in the R&D organization.

And I have a lot of experience in taking a novel idea, developing it for concept, and then, of course, commercializing products for Merck.

So I am excited to, and thank you for-- The Task Force has given me, and Stevens Institute of Technology, an opportunity to offer our view on how to build a first-rate innovation economy in the State of New Jersey.

Innovation and entrepreneurship are intrinsic to Stevens' educational and research mission. Stevens is a private, nonprofit, science and technology-focused educational institution with a rich history of educational excellence and research innovation. We aspire to ensure that every student coming out of Stevens has the mindset and skill set to be innovators and entrepreneurs when they enter the workforce; and sometimes, even before they graduate.

Stevens Institute of Technology was founded in 1870 by America's First Family of Inventors, the Stevens family. This was a family

of innovators who patented steam ferries, as well as the modern form of railroad track, among other inventions.

We are located in Hoboken; Stevens is home to 6,600 undergraduate and graduate students who collaborate with approximately 300 faculty members in an interdisciplinary, student-centric, entrepreneurial environment. Within the University's three schools and one college, Stevens offers a range of academic and research programming including business, computer science, engineering, the arts, and other fields, which actively advance the frontiers of knowledge while leveraging technology to confront our most pressing global challenges.

Stevens Institute of Technology is home to three national research centers of excellence, as well as interdisciplinary research programs in fields such as artificial intelligence and cybersecurity, data science and information systems, complex systems and networks, financial systems and technologies, biomedical engineering, healthcare and life sciences, as well as resilience and sustainability. Innovation and entrepreneurship are intrinsic to Stevens' educational and research mission.

Since 2011, *U.S. News & World Report* rankings of higher education institutions have recognized Stevens as one of the nation's top universities, including a recent ranking of No. 69 in the category of *Best National Universities,* as well as being named one of the Top 25 *Most Innovative Schools* in the nation for 2018. Stevens Institute of Technology was recently cited by Forbes Magazine as "one of the most desirable STEM colleges in the nation."

As the fourth-largest employer in the City of Hoboken, Stevens generates $269 million in economic output to the State of New Jersey.

In order to initiate discussion of the Task Force's first question regarding programs offered by Stevens to create spin-offs, I am proud to tell you about the work of the Stevens Office of Innovation and Entrepreneurship -- *OIE* for short -- which coordinates, facilitates, and manages the University's entrepreneurial and technology commercialization programs and activities. OIE is a one-stop shop for faculty, researchers, undergraduate and graduate students, and also alumni looking to start a company or in need of assistance in identifying market opportunities.

The Office assists with business strategies, tailoring, and field-testing solutions, sourcing marketing teams and capital, and bringing real-world corporate and entrepreneurial experiences back into the undergraduate and graduate curriculum. OIE hosts and supports regional, national, and international events which promote entrepreneurial activities, including the New Jersey Tech Meetup, the Propelify Innovation Festival, as well as the periodic meetings of the International Council for Small Business.

The Stevens Office of Innovation and Entrepreneurship also manages the day-to-day operations of the Stevens Venture Center, an incubation program dedicated to the development of student and faculty start-up companies. SVC is an innovative entrepreneurship ecosystem designed to connect Stevens entrepreneurs with an infrastructure, resources, and funding assistance, with the objective of building an ecosystem of entrepreneurship on our campus, leading to sustainable and successful commercial entities based on Stevens-derived technologies.

SVC's mission has two goals: educating our students in modern entrepreneurial thinking, and providing the opportunity for students and

faculty to explore the commercialization of their ideas. We encourage ingenuity in research and promote initiatives for change in education, infrastructure, and administration.

With regard to the gaps or challenges that could be addressed by the State of New Jersey that would further empower Stevens to create more spin-offs, the State should re-establish, in some form, the efforts of the former New Jersey Commission on Science and Technology. Between 1985 and 2010, the Commission on Science and Technology generated innovation and economic growth, which is well documented in the State. During this period, grant funding was awarded to vibrant scientists and engineers, in partnership with colleges and universities in the State, to carry out cutting-edge research or launch new businesses.

The work of the Commission on Science and Technology advanced life-changing technologies and spurred new knowledge, innovation, and creativity in such fields such as biomedical engineering, renewable energy, and telecommunications.

In its final year of operation, the Commission on Science and Technology awarded 30 grants to technology business incubators and early-stage technology companies, which leveraged $3.5 million in private and Federal funds from Commission grants of $2.5 million. These grant awards accounted for the creation or retention of over 2,000 high-paying science and technology jobs in the state. Projects funded in 2009 alone supported innovation in the fields of dental bone grafts, cardiac monitoring, drug discovery and delivery, as well as precision timing synchronization.

Unfortunately, due to budget restrictions, the New Jersey Commission on Science and Technology was defunded with the passage of the Fiscal Year 2010 State budget.

The State would also benefit from providing annual funding in the form of two-year investigator-initiated research grants, to academia or industry, to generate discoveries and intellectual property that will seed the formation of new and/or strengthen the portfolio of existing companies in our state. At the same time, New Jersey would benefit from advancing the establishment of innovation centers of excellence in academia -- that will catalyze academic and industrial research within the State of New Jersey -- by providing expertise, personnel, and technical infrastructure that can be leveraged by academic researchers and small companies. This will help the latter to develop their technologies and services in a cost-effective manner without having to make a large investment in infrastructure.

The two-year investigator-initiated grants would support new STEM ideas toward proof of concepts that will generate IP and technologies for seeding new start-ups. Creating new start-ups will enable the State of New Jersey to capture graduates from universities within the state through employment opportunities, and counteract the brain drain effect as big companies reorganize toward building R&D organizations in areas such as Boston and San Francisco.

The establishment of new innovative centers of excellence, that academic institutions and industry can access to catalyze their research and serve as a scientific hub to foster collaborations, will have the potential to go beyond state boundaries and impact research in neighboring states, such as the growing biotech ecosystem in New York City. Some examples

include new technology platforms in the area of genetics, computational biology, and bio-printing -- just to name a few -- that will enable academic and small industrial labs of all sizes in the state to accelerate their R&D enterprises toward commercializing innovative science.

Many of the concepts addressed are embodied in the legislation currently pending before the Legislature, A-1930 -- sponsored by Assemblyman Mukherji, Assemblywoman Chaparro, Assemblyman Chiaravalloti, Assemblywoman Huttle, and Assemblyman Gary Schaer -- which would establish the Edison Innovation Science and Technology Fund in EDA. If enacted, this legislation would provide funding for individual investigator-initiated grants for proof of concepts -- that I mentioned -- and that will lead to innovative discoveries.

This program would also provide funding for academic collaborative groups, engaged with an industrial partner, that will enable their research toward commercialization. This legislation would spur collaboration between academia and industry, while also seeding a new momentum in rebuilding a first-rate innovation economy in the State of Jersey.

Stevens supports the BioNJ recommendation for increased funding for incubators in New Jersey. BioNJ's recent report, *The New Jersey Biopharma Industry: A Prescription for Growth,* reported that California more than doubled the number of biopharma incubators in the state. As referenced in the report, "Nine hundred and ninety-six biopharma companies were founded in California between 2011 and 2015; and another 296 were founded in 2016."

Incubators are proven economic development tools, designed to accelerate growth and success of entrepreneurial companies. New Jersey would benefit from increased funding as we seek to flourish in the innovation economy.

Stevens has had great success in collaborative efforts with industry in the state. As an example, Stevens is home to the Center for Healthcare Innovation, *CHI* for short -- led by Professor Peter Tolias -- which works to advance medical technology and improve healthcare delivery through education, research, and partnerships which connect the fields of biology, engineering, and computer science. CHI also works to strengthen the healthcare workforce by identifying skill gaps and adapting or creating curricula designed to address these gaps.

Within the Center for Healthcare Innovation, Stevens has developed the Biotechnology and Drug Discovery Laboratory, which is a research and training facility established, in part, from a generous donation of equipment and supplies from Roche and Merck; and also with support from the New Jersey Department of Labor. The laboratory's mission is to facilitate partnerships by Stevens faculty and students with external academic and industry collaborators who require the expertise of the laboratory to advance their research.

The Biotechnology and Drug Discovery Laboratory is operated by 11 scientists -- all formerly employed at Roche, Merck, and Novartis -- with extensive experience in biotechnology and drug discovery, five of which have over 150 years of combined R&D experience in pharmaceutical and biotechnology corporate laboratories.

Since its inception, the Biotechnology and Drug Discovery has established numerous collaborations across New Jersey which have proven to be beneficial in the biotechnology and pharmaceutical sectors. Examples include moving our discoveries into the clinic setting through a long-standing translational research partnership with Hackensack University Medical Center, New Jersey's top rated and largest hospital; and a new educational partnership with the new Seton Hall-Hackensack Meridian School of Medicine. Further, contractual relationship with Cepter Biopartners, a New Jersey contract research organization, provides us with drug discovery and development projects from biotechnology and pharmaceutical companies.

Our students have benefited from the professional experience through these industry collaborations on campus; in addition, internal projects, initiated from the Stevens faculty, have yielded new drug patent applications and the emergence of one spin-off company.

With regards to the Task Force's final question, we strongly support the establishment of the Edison Innovation Science and Technology Fund, which was previously noted as the ideal program to strengthen industry-university research collaborations, while also creating the increased potential for attracting Federal funding and private investment.

Thank you for the opportunity to speak to you today. I welcome any questions that I could answer.

Thank you.

MS. HART: Thank you, Dr. Wong; thank you.

Questions from the Task Force? (no response)

So can you speak to-- You know, we've heard a lot about the opportunities for collaboration across -- among the university academic centers. Can you elaborate on what Stevens might be doing there, and how we might help facilitate that through the Task Force?

DR. WONG: Yes. From a biotech side, we are very nascent in that. And since I came from Merck, it's through, really-- I'm trying to catalyze, based on my network, in terms of a lot of Merck -- ex-Merck employees who have actually gone out to start biotech companies.

So one of the ideas is to invite them to Stevens and tell them about our programs, in terms of-- Really, it's about training students, right? That's our mission -- training entrepreneurs, training innovators. And have a conversation with our students and what it's like in a biotech company; and these are start-ups. And my aspiration is that these students will get inspired by these innovators and then want to set up companies. And then hopefully, through maybe internships, through mentorships, and just building trust and dialogue on finding common ground in the science -- building trust so that when our students actually go out, they can actually get jobs in these biotech companies. So that's one thing -- is just starting the dialogue.

The second thing is these investigator-initiated two-year grants that might serve -- that if there's an idea from a faculty, and there might be an entrepreneur out there who is interested in collaboration, that $100,000 grant will actually get the experiment going to proof of concept. I think $100,000 for one year, renewable for another year, to actually get to proof of concept -- that would be one thing that would actually help spur those activities to proof of concept.

I think the most important thing is the proof of concept. That is a major milestone in any setting -- in industry, in academics. You get the proof of concept, and everybody is excited. And now you bring in the business people and say, "How can we scale this up to actually make a product?"

And I like the idea of mentorship, because you need the business ideas -- people who are experienced in scaling the proof of concept to a commercialized product. And we try to do that in a small way at Stevens, because we have a good business school. We've built in the entrepreneurship thinking. But I think New Jersey can actually help us a lot with that because there are a lot of smart people out there in business to actually grow to the commercialization.

Sorry; that was a long-winded answer.

MS. HART: No, no, no; not at all.

So, lots of opportunity for collaboration, it sounds like. And hopefully, you're connecting with your colleagues in academia--

DR. WONG: Absolutely; yes.

MS. HART: --to do some of that as well.

Terrific; okay.

Any other questions for Dr. Wong?

Yes, please, Assemblyman Schaer.

ASSEMBLYMAN SCHAER: I'm not going to phrase this very well, so you'll excuse me--

DR. WONG: That's okay.

ASSEMBLYMAN SCHAER: --in advance.

I've always been told that -- I've oft-times been told, more appropriately -- unlike New Jersey, which has any number of amazing and wonderful institutions located throughout the state, one of our disadvantages is that we don't have a core geographic area where entrepreneurs, exploring any number of different fields, would be physically located in the same geography and have the ability to interact with each other on any number of ideas.

Tremendous initiatives are going on throughout the state. But when we speak about Massachusetts, we don't speak about *Massachusetts;* in fact, we speak about the Boston area. When we speak about California, we don't really speak about *California*; we speak about Silicon Valley. There are other examples as well.

Is this a realistic concern; and if it is, how do we bridge that concern?

DR. WONG: Yes, it is actually a concern.

I think there's this concept that by proximity great ideas and innovation can happen. And I think Boston is an experiment that seems to be successful; and San Francisco. So I think that geography is definitely something that we need to think about; creating hubs--

ASSEMBLYMAN SCHAER: So forgive me for interrupting.

DR. WONG: Sure, go ahead.

ASSEMBLYMAN SCHAER: So how do we confront -- how do we meaningfully deal with the issue of the wonderful things that are going on over at Stevens in Hoboken, versus the tremendous initiatives going on in New Brunswick, Gloucester County? I mean--

DR. WONG: Yes, and--

ASSEMBLYMAN SCHAER: The list includes everyone at this table--

DR. WONG: Yes, yes--

ASSEMBLYMAN SCHAER: --and many, many others as well.

DR. WONG: Yes, short of doing the impossible of shrinking the state (laughter), it's actually the hubs. I think the hubs are actually very important because the state is large, as you mentioned, and there's a huge amount of intellect that's out there. So the hubs serve as the incubator, and then we might -- and again, this is just my opinion -- you may need multiple incubators that need to be tightly aligned, to actually capture all of the intellect and the entrepreneurs that are in the state.

ASSEMBLYMAN SCHAER: So would it be within the purview of this body to effectively make those very difficult choices, and to say that we're going to have a hub here (indicates), and a hub here (indicates), and a hub here (indicates)? And we'll have 3 hubs, or 12 hubs, or 6 hubs, or 1; but to begin concentrating our resources, meaningfully, for the benefit of the state's future -- not wanting in any shape or form to denigrate the tremendous initiatives that have taken us so far. But all of us, I think, are a bit frustrated that we're not further along in this process. And we should be, given the intellectual resources that we have in this great state.

DR. WONG: Yes, that-- Maybe somebody could jump--

Yes.

MS. MAMAN: Yes, I'd like to talk a little bit about Boston.

ASSEMBLYMAN SCHAER: I don't know if that was the *verboten* subject to raise, by the way. (laughter)

MS. HART: It's an important one.

ASSEMBLYMAN SCHAER: That's what happens when you're a novice amongst so many professionals.

MS. HART: It comes up all the time.

MS. MAMAN: I'd like to talk a little bit about your point about Boston.

Boston is a very large location; so there's Boston, there's Cambridge, there's Waltham; there's 98, there's 95, there's 295.

MS. HART: And 128; Route 120--

MS. MAMAN: And 128 and 295. So all of those are considered *Boston* when we talk about them.

But getting from one place to another, even if it's from Boston proper to Cambridge, can be -- if you're taking the subway, the *T*, it can be 45 minutes. Here, in New Jersey, our transportation system doesn't allow for that -- to take the subway or the train, as easily; or the bus. But if we're driving from Rutgers to Princeton, for example, it's a half-hour on not-rush hour time. It's a little bit longer during rush hour.

So is that different from the Boston area? I could argue that it's not really. It's the presentation of not having one name -- that it is, we do not call it-- They call it *Boston*, but they don't mean all of Boston; they mean all of those pieces put together. So perhaps it's more of the presentation of a location than the actual physical location itself.

MS. HART: I would suggest--

DR. KIMBALL: Could I speak to that for--

MS. HART: Excuse me for just one second. I want to make, sort of, an ancillary point, and then I want to hear from you gentlemen.

I would suggest that, you know, it's a constant theme that we talk about. It's not only what we have here, but it's how we talk about it. And if we're not doing the marketing -- the talking about it in the correct ways, such as the positioning that you're talking about here -- then we are -- we're never going to take care of this problem. So I would suggest that, to the extent that we can, through your work in the Legislature, to address that in some way. I think it's really important.

And so, folks on this specific topic?

DR. SEBASTIAN: So I might have been too abstract when I was addressing that issue. It's not a *verboten* topic; and I will agree with you (indicates), but also agree with you (indicates).

If you take New Jersey and then stick in on top of what really is Silicon Valley, they are about the same size; and the same for the Research Triangle. So it certainly is possible to still talk about all of New Jersey with a focus; but I also agree it's fundamental to think about clustering assets, but not about picking only one winner. It's not that Newark wins, and everybody loses; or Camden wins, and everybody loses. In the 1880s, we started a dozen major industries, right? We are rich enough in talent and capabilities to have multiple locations. But what I would argue against is continuing what -- sort of what we have all been doing, which is a general purpose incubator in every location, right? Because that's what a university will do, because it has to cover all of its own bases, right, so it has to be open to every possible technology. But then you can't cluster assets that are important; expensive physical assets. You know, if you're an app program, you don't need any assets; but if you have a biotech start-up, if you're going to do a production of a classic pharmaceutical, if you do

anything -- you start to get into the need for very specialized, expensive equipment that's beyond the bounds of start-ups to afford.

You're doing it here; you're providing that capacity here, which is why this is such a wonderful success.

So being able to replicate that model in which there are, yes, pre-determined places where certain technologies will be fostered and grown; and it is driven by the industry need, not by a host institution's priorities; but having more than one theme for New Jersey, I think, is the recipe that we should be pursuing.

C O R N E L I A H U E L L S T R U N K: Yes, if I could just add to that. .

I'm Cornelia Huellstrunk; I'm with Princeton University. I'm the Executive Director of the Keller Center, which focuses primarily on the teaching, and learning, and research around entrepreneurship. So we're very student-centered, but also have programs for faculty.

So I want to address the question -- the *verboten* question here as well, because I think it's an excellent one.

At Princeton we think a lot about creating entrepreneurship the Princeton way. And I would encourage the State to also create entrepreneurship the New Jersey way. So I don't believe that necessarily replicating what is happening in Silicon Valley or in Cambridge is the only way to do this. What if instead of thinking about putting tons of resources behind certain clusters, what about creating frameworks and resources to enhance creative collisions? So whether that means doing the mapping -- I think you talked about sort of mapping everything that's happening in New Jersey in an effective way. Putting much more awareness around that;

creating easy pathways for people to get together frequently, rather than putting all the resources behind certain infrastructural choices.

So I'm just putting it as another possibility. I don't think we need to replicate.

ASSEMBLYMAN SCHAER: I think that we've heard from virtually all of our speakers.

With your permission -- we've heard from virtually every one of our speakers in terms of the need for additional funding from the State -- whether it be $10 million a year, or $20 a million a year, or whatever. And we all know that those numbers are going to be difficult to achieve.

We also know that we have the great, interested Trenton -- for lack of another term -- in terms of proceeding with this putting New Jersey in better stead.

I think, necessarily, if we're going to, in one sense, endorse as a group -- support in the strongest terms possible, the $20 million a year for incubators, or whatever it is that we're speaking about; that conversely we be prepared to make some recommendations in terms of what is different, right? Members of the Budget Committee have the questionable pleasure of hearing from people all the time about requests for more money. What distinguishes one request from another, oft times, is a totally different approach; a recognition that what we've been doing up until now has not brought us where we need to be; and despite the difficulties and the political sensitivities, we need to, nonetheless, proceed in a different sort of direction.

I would suggest, respectfully, that this is one of those areas that we need to put on the table amongst ourselves for frank conversation, so

that when we try to propose and -- forgive the term -- *sell* the idea of funding in one area or another, that we show that the idea is different. It's not just funding, but it's, in fact and effectively, that new approach that we're speaking of.

DR. KIMBALL: Just-- I wanted to comment a little bit on the *verboten* question which, in fact, is -- I tried to -- I was alluding to it, but that really is one of the key things that we just have to confront and face it.

And while I agree substantially with everyone here, Cambridge is different, and we're not going to recreate Cambridge anywhere in New Jersey unless we invest $100 million in Newark, or New Brunswick or some such.

But we do have the talent, and we have the ability to try to keep things in New Jersey. Just on the example of the Ben Franklin fund: Perversely, there's a great incentive-- If you tell me that I can have money but I have to stay in New Jersey, the fact that we don't have a lot of other options for getting capital will keep me in New Jersey. I think that that's a great tool with a lot of leverage, just due to the history and the fact that currently we don't have 20 or 30 venture funds fighting with each other to put money into the state.

So that's just-- One very simple thing I was just thinking of, listening to this. It is critical to try to bring together the ecosystem; and it's not trivial, because we are spread out. One thing that the State could do that would cost very, very little is to think about Bio. Bio is the key meeting for the biotechnology group, the industry, as a whole. And Choose New Jersey has a done a lot; and Debbie has done an awful lot with BioNJ and is a huge supporter of it. If the State, for example, would match --

either take care of it, or match 50-50 with every institution, that one person go to Bio to represent their university -- instead of having us struggle to get together $5,000 and send one person -- we might be able to have a real representation and a real influx of ideas amongst all of us at that organization -- at that meeting, every year.

MS. HART: Thank you, David.

MR. SMERAGLIA: I just want to follow up a little bit on your question.

The key is that there's not a desire for just generic funding to universities. It's a very specific type of funding, called *seed funding,* which we tell you, based on the success of California and Massachusetts, will lead to leveraged follow-on funding. If that funding happens in a very specific way, a very seed way, it will lead to venture investment. Venture capitalists in New York, and in California, and in Boston will start funding New Jersey-based biotech companies if we can prove principle and do some of the other things that we talked about. So it's not generic funding; it's very precise, specific biotech seed funding which will bring more dollars to New Jersey.

We'll also be much more competitive with NIH grants and NSF grants -- other types of Federal dollars. So that has helped California and Boston lead the way with Federal dollars.

ASSEMBLYMAN ZWICKER: Could I-- If I may, Assemblyman, pose his question in a slightly different way.

His experience, when it comes to the budget, is vast. And it was the, sort of, the *why*. I mean, obviously, I'm a strong advocate for $20 million for seed funding, or $5 million for Edison, or whatever it might be. But the question is, let's assume we have $20 million to spend. Should we

spend it on one of those, or should we expand pre-K in the State of New Jersey? And you can make arguments on both. But in the tight budgetary ecosystem that we're in, I strongly agree that we must have a, "Why are we different, why is this a return on investment?" You know, obviously it's not an either/or that we're trying to be in; but these are the questions that the State has to look at.

The new Governor has laid out a very ambitious set of priorities. And it's clear that we don't have-- And one of them is innovation; strong. Where that money will come from is a matter of debate. And so I think as a body, it behooves us to make sure that we understand that; and how we message that is going to be critical.

S T E V E N L E S I A K: It's jobs.

DR. SEBASTIAN: So something to think about as a model.

ASSEMBLYMAN ZWICKER: No, I know it's jobs, but--

MR. LESIAK: No, no; I mean it's jobs for your children. It's jobs for the college graduates and the folks who are--

I'm sorry; for the record, my name is Steven Lesiak. I'm Vice President -- VP of Finance and Operations at the Institute for Life Science Entrepreneurship.

I was just sitting in for Keith Bostian, and then wanted to attend.

But it just struck me, when you mentioned that, that I think about the -- that the investment is going to be-- My concern is that it may be viewed, as well, just for pharma, and pharma might have a negative view, and-- We're supposed to be honest, right?

But it's not about that; it's about the scientists who are graduating; it's the 22- and 23-year-old students who have spent six, eight years getting their master's degrees and their Ph.D.s, and are passionate about the work they want to do. Now they need a place to go, and so that's where the money is going to go to. And starting those companies, and then, again, yes, attracting all the (indiscernible) follow investment.

Anyway, just--

DR. SEBASTIAN: So Andrew, in Germany there's an entity called the *Fraunhofer Institutes.* It's now about a $2.5 billion enterprise. It started after World War II to assist industry sectors to rebuild and regrow the economy.

I think there are 80 institutes; they are all special purpose. They are hosted by universities, but it's run by Fraunhofer LLC -- it's GmbH. The point is, is that the mechanism they use for funding these things is a federal share-- It used to be a third federal dollars, a third industry sector memberships and contracts, and a third whatever they could do on their own as entrepreneurs and grantsmanship, and so on. Usually also competing for then-German, and later EU.

My point is that the federal share became proportionate to the success of the industry sector that those companies served. So there's a philosphy there that says, "I'm taking tax revenue from an industry sector, and I'm reinvesting it into a shared resource to help you grow." I'll make it a polar opposite from saying, "We'll take the tax revenue from our big corporations and we'll use it to take care of general infrastructure, general--" And it's not that those are bad things; but there is no wire line between the source of revenue and a benefit to the person who's producing that revenue

stream. It's not all or nothing; it's not like they don't pave roads and have education in Germany. But I'm suggesting there might be a model here by which you look at-- Take from the rich, so to speak-- You know, Robin Hood, right? But you're also reinvesting in things that ensures that--

ASSEMBLYMAN SCHAER: As Democrats, we can't relate to that. (laughter)

ASSEMBLYMAN ZWICKER: We were also talking about leveraging dollars, right?

DR. SEBASTIAN: Yes.

ASSEMBLYMAN ZWICKER: So in my example of pre-K--

DR. SEBASTIAN: It doesn't create new money until it's successful; but at least it creates a relationship to those who are paying it, to know that they're getting back something. And the point was, if you don't get a benefit, then the baseline funding for those operations decreases and some disappear because they didn't answer the mail.

ASSEMBLYMAN ZWICKER: Then it's also going to go towards, per my example, pre-K education. There is no other place, besides the State. You know, and there's a model that we're talking about which is the public dollars, the private dollars, etc., -- right? -- and as you said, with a line connecting them.

DR. SEBASTIAN: Yes.

MS. HART: Any other questions or comments? (no response)

Okay; I'd like to thank everyone for coming, especially those who came and testified. We very much appreciate it.

And so, where do we go from here?

Yes; I'm sorry. Closer to the mike. (laughter)

Where do we go -- or speak up -- where do we go from here?

So tomorrow we will hear from industry; the same format, same timeframe, etc. Anyone is welcome to attend and hear what industry has to say.

Then we will also be accepting additional written testimony through the end of February. You can submit that to the Committee, through the Economic Development Authority.

And then we will see -- take a look at from whence we've come, and where we might go, and we'll be developing a written report. There may be some other steps that we figure out we want to take between now and then, or here and there. But we'll continue the conversation.

I hope that today has helped to build relationships and maybe make some new introductions; and you know, we're all in this together. You know, the New Jersey economy needs a boost, and I certainly believe, obviously, that biotechnology can be a major factor.

I'd like to thank our Legislators who are sitting with us on this Committee; we very much appreciate your time. We know you could've been at least in Trenton or, probably, 25 other places today, so we very much appreciate that, and we'll look forward to seeing many of you tomorrow.

Did I miss anything, Mr. Lizura?

MR. LIZURA: No, I think our-- Again, our friends at OLS who did all the yeoman's work on the microphones and the recording. That's terrific; thank you.

MS. HASSETT: And if I could acknowledge Jim Hooker, who is representing Senator Greenstein as Chief of Staff.

Thanks, Jim, for joining us.

J A M E S H O O K E R: Senator Greenstein is very much interested, but there are two Committees that she's on, including one she is chairing this morning. So she sent me along, late notice. That's why I was sort of--

ASSEMBLYMAN ZWICKER: There's nothing going on in Environment today, right? (laughter)

MS. HART: I do believe the Senator will be with us tomorrow.

MR. HOOKER: She expects to attend tomorrow, yes.

MS. HART: Great; okay.

MR. HOOKER: And this was a great meeting, so I'll be able to deliver a lot of good information to her.

MS. HART: Thank you, Jim, for coming in.

We have a representative from Assemblyman McPhillips' (*sic*) office.

B R I T T A N Y W H E E L E R: (off mike) DePhillips; yes.

He couldn't attend today; it was short notice. But he will be here with everybody tomorrow.

MS. HART: Great; thank you, everyone.

Safe home; we'll see you again, hopefully, tomorrow.

(FIRST-DAY MEETING CONCLUDED)

DEBBIE HART (Chair): Good morning, everyone.

Thank you so much for being here. We're so excited to have you here with us.

So I'm Debbie Hart; I'm the President and CEO of BioNJ, a job that I love. And this is equally fun, I think, chairing this Task Force.

We have some really talented people who are on this side of the table (indicates); and some equally talented people on that side (indicates). We can't wait to hear from you.

And so, just if I may, just a moment on behalf of my Co-Chair -- Vice Chair, but Co-Chair, right?

ASSEMBLYMAN ANDREW ZWICKER (Vice Chair): Vice. (laughter)

MS. HART: Actually, you should be leading this thing -- Assemblyman Andrew Zwicker, who is a scientist, so he really gets it. And he's really passionate about the work that we're doing. We can't thank you enough for your time and your leadership.

ASSEMBLYMAN ZWICKER: Thank you.

MS. HART: Assemblyman Zwicker was just named as the Chairman of a brand-new Committee in the Assembly on science and innovation; and so we're excited that we have someone like the Assemblyman who is leading that charge.

ASSEMBLYMAN ZWICKER: Thank you.

MS. HART: I know he has some terrific ideas. I know it seems as if there is a lot of energy and interest in the new Administration for this type of topic, so that the timeliness -- it just could not be better.

We are -- our host today is the New Jersey Economic Development Authority, and Tim Lizura is the Economic Development Authority's representative to the Board. They, again, are our hosts, and also the managers of this whole process. So thank you, Tim.

In a moment I'm going to ask each of the Task Force members to say a few words. I would just like to tee this up with a couple of comments, if I may.

So this Task Force was actually established through legislation that BioNJ strongly advocated for. And it was fortunate that we had open ears in Trenton for it. It was established in 2016, and we're just really beginning our work now once the final appointments were made.

We're very excited because, you know, this kind of an effort has a tremendous history. So back in 1995, there was a Biotechnology Task Force formed, through the Legislature and signed by Governor Whitman, that was a bicameral, bipartisan effort, just as this is. And some really tremendous things came out of it, including the NOL program -- which some of the companies on the other side of the table have taken advantage of -- and other things as well. So we're equally excited that this could be a similar type of effort with similar success.

You may have seen our BioNJ -- we released a White Paper recently; I'd be happy to share a copy. I have a few here; I can send you one in the follow-up. But we released a White Paper, just on January 4, that outlined the challenges and the opportunities. And we are hopeful that this Task Force-- And it's really just serendipitous that it's come together at the right time, along with the Science Committee in the Assembly, and

we're hopeful that we can build on some of the opportunities that we believe exist.

The industry is still growing, and New Jersey very frequently gets -- we get our shot at new companies coming here. We think there are lots of opportunities being left on the table. There's a lot of opportunity for more company creation; we had a tremendous meeting yesterday with the academic institutions -- a lot of tremendous dialogue and interchange. And again, we think we saw opportunity on that front; we think great things will come of it.

The end result will be, after today, in a couple more weeks-- We'll accept additional written testimony until the end of the month. And then, what we're listening for -- the legislators in the room are listening for is, where can they make a difference, what can they take back to Trenton; and perhaps write legislation, perhaps encourage another entity within government to do something that's supportive.

So again, we're very excited.

A couple of housekeeping items, if I may, and then I'm going to ask my colleagues to please say a few words.

So we are sticking to the 10 minutes. You will see that we will very gently nudge you with the 10-minute sign. (laughter)

This is being recorded; they're not microphones, they're just for-- Well, they are; but for recording, not for projection. We ask you to please speak clearly and loudly into them.

This will be -- this is public testimony. There may be media in the room at some point. We are not sure exactly; there's a definite possibility, so I encourage you to keep that in mind.

And I think that's it, in terms of housekeeping and the remarks I wanted to make.

Assemblyman Zwicker, would you please say a few words?

ASSEMBLYMAN ZWICKER: Sure.

Well, thank you, everybody, for being here today.

I am just starting my second term in the Legislature. And as Debbie mentioned, this new Science, Innovation, and Technology Committee is something that I think is coming together at the right time.

But I just want to acknowledge the tremendous leadership that BioNJ and Debbie Hart have done for a long period of time. And to get to this point has taken -- and she knows better than anyone -- many, many years of hard work.

And 2018 is, I think, a year of tremendous opportunity in New Jersey for growing out the innovation economy. Yesterday we heard from universities across the state; everything from STEM education, to challenges when it comes to taking an idea and providing seed funding to a brand-new company, to angel investment, to VC -- venture capital -- on out.

And so to hear from you today about the industry side of it, and all of your different places, I think is critically important.

And then it's up to us in the Legislature to be innovative in what we do. And it doesn't mean that there's a legislative answer to everything that we do. We want to make sure that we are working properly and hand-in-hand with the private sector, the educational institutions, the nonprofits, so that we can really see that New Jersey is competing with New York, Massachusetts, California, etc.

So thank you for coming today; and we have a lot of work to do.

Thanks.

MS. HART: Okay; thank you.

Assemblyman Schaer.

ASSEMBLYMAN GARY S. SCHAER: It is a great pleasure to be with all of you today.

You will forgive me; I just mentioned to someone -- I'm not a scientist. I can barely spell words that are frequent in your vocabulary. (laughter) But I do have an appreciation for all that you do and, most importantly, its potential impact upon New Jersey economically.

I was privileged to write the legislation which established this Committee. And I remember approaching the Speaker, at the time, and said, "You have to draft Zwicker onto this Committee. He's the only one in the whole Legislature who is legitimate to be here." (laughter)

ASSEMBLYMAN ZWICKER: I'm a plasma physicist; I'm not a life science expert. (laughter)

ASSEMBLYMAN SCHAER: So I think the challenge that we will have, from the Legislative point of view -- whether it be from the General Assembly or from the Senate -- will be to translate all of these good ideas into practical reality, hopefully without having the politics enter too much into the fray; although that would be a bit naïve to suggest that politics doesn't make some play.

So the issue, of course, is how do we combine both the political along with the policy; with an emphasis, as much as possible, on the policy

so that we can effectuate positive, real change from an economic point of view.

There's no question that all of you here, your colleagues, your colleagues in other areas -- in education, in the private sector, and the public sector, at healthcare institutions -- are critical to where New Jersey goes. And I think that we are very fortunate to have a new Governor who recognizes that; who, in fact, campaigned on that to a large extent.

So it's very exciting to be here. If I look to you, at a moment or two, like I don't understand what you're saying, you'll forgive me; I probably don't understand what you're saying. But hopefully, I'll understand enough, in my own small way, to make some small and helpful differences.

MS. HART: Thank you, Assemblyman.

And to my Senator, Senator Greenstein.

SENATOR LINDA R. GREENSTEIN: Hi.

I'm Linda Greenstein. I've been in the Legislature for 18 years; the first 10 in the Assembly, the last 8 in the Senate. And I do think that, as Andrew said, a lot of things are coming together right now.

In all my years in the Legislature I don't remember as much of an emphasis on science, on hearing from businesses as to what their needs are, and the very practical approach of trying to see what needs to be done. So I'm very grateful for your being here today; and also to Debbie and BioNJ, for the great work that they do; and all the other folks on the Task Force.

Right now, in addition to this caucus -- or *group*, I should say -- we also have something called the Manufacturing Caucus, chaired by Bob

Gordon. And what we're doing there is, we're looking -- we've heard from many manufacturers about their needs. We're going to be, I think, floating a bond to get much more vocational educational in the state for the middle-level jobs. So it's great that we're looking at all the different levels and all the different needs and, most importantly, listening to people who are out in the field. I think that really makes a difference, and it's something we haven't always been doing.

And I look forward, also, to Andrew's Committee. We don't have an exact replica of that in the Senate, but maybe we will eventually. We'll just have to find another Andrew clone in there (laughter) to run that Committee.

ASSEMBLYMAN ZWICKER: That's their job (indicates). (laughter)

SENATOR GREENSTEIN: That's right, that's right.

But anyway, thank you all for coming. I look forward to hearing from you.

MS. HART: Thank you, Senator.

Assemblyman DePhillips.

ASSEMBLYMAN CHRISTOPHER P. DePHILLIPS: Good morning, everybody.

I'm Assemblyman Chris DePhillips from District 40. Unlike the Senator, I've been a member of the Legislature for two-and-a-half weeks. (laughter) So it's nice to meet you.

SENATOR GREENSTEIN: Nice to meet you.

ASSEMBLYMAN DePHILLIPS: I am a member of the Science, Innovation, and Technology Committee; so I look forward to

working with Assemblyman Zwicker on that. We've already spoken about our goals there.

I'm an attorney by trade; I've been an attorney for the last 26 years. I work in the life sciences industry; I work for a life sciences consulting firm in Morristown, where I'm General Counsel and I also have a business role there. So I'm very interested in hearing from your testimony today.

I'm very interested in solutions to incentivize the pharma industry, the biotech industry, the medical device industry, and the hospital and healthcare industry as well.

I look forward to your testimony; I look forward to working with all of you.

And thank you for being here today.

MS. HART: Thank you.

And Tim.

TIMOTHY J. LIZURA: Thank you, and good morning, Debbie and Assemblymen; and thank you for your leadership on the Task Force.

And to our elected friends -- thank you for your participation.

I am Tim Lizura, President and Chief Operating Officer of the New Jersey Economic Development Authority.

We at the EDA have been involved in technology-led economic development for the better part of two decades. This facility, this complex that we're hosting in -- this facility today -- is a direct outgrowth of that effort. We have, as Debbie said, run the NOL program and the R&D Angel Tax Credit program, as well as made a suite of investments in venture funds

that make investments into technology and life sciences' companies. We are thrilled, though, that there are new opportunities and new ideas that can come out of this facility, or this conversation, and we look forward to engaging in those conversations.

Just to take a quick moment -- starting with some of our EDA colleagues in the room -- Maureen Hassett, who oversees both our technology and real estate groups; and there is quite an interplay between those two operations, as you can tell by this kind of facility.

We have Kathleen Coviello, who is our thought leader and practice group leader for our Technology and Life Science Investments and programs. She's been with us for a decade or more now, I would think; we stole her from Silicon Valley Bank, and we've been thankful every day since.

Lenzie Harcum runs this facility; and we were able to steal him the EDC in New York. He has done a tremendous job in providing value to the tenants in this facility.

We have our Governance and Communication team -- which is staff to this Committee -- who will be doing all the writing when the writing is due. So we're excited to have Erin Gold and the whole team here -- Pat and Rachel -- who will be doing the work.

So thank you for your participation. We look forward to being helpful.

One other housekeeping thing that Debbie missed: If you have written testimony, please turn it in to our friends at OLS, who were good enough to put the microphones up; but copies of your testimony are even better.

MS. HASSETT (NJEDA Staff): And if I may make one more introduction, because it comes from an initiative that the Legislature supported several years ago.

Eli Khazzam is the EDA's Program Manager, who is working with the Office of Higher Education to create what we hope to be best in class -- a database that will link all of our assets in STEM, including our research universities here in New Jersey -- the five universities that we heard from yesterday. They are on the ground; they are working hard to get this database up and running with an internationally recognized team called *Elsevier*, one of the biggest scientific publication databases in the world. So in the next couple of months, we hope to launch that database with Eli's help. Secretary Hendricks has been very terrific in supporting that.

And as we build that out, over time, we're starting in the academic realm; but really, it's industry that we need to tie into that database in order for people to understand the collaboration that can exist with the great research that's happening here in New Jersey.

So, thank you.

MS. HART: Thank you; thank you, Maureen.

And I would be remiss if I didn't introduce my colleague, Beki Perkins, our Vice President of Government Affairs, who really has made a lot of this happen, along with the EDA.

So, thank you, Beki.

So now we want to hear from you.

So, right now, I'm going to invite Nick Crider, the Co-Founder and Chief Operating Officer of Visikol, to please address the group.

Thank you.

N I C K C R I D E R: Thanks, Debbie.

Yes; so as Debbie said, I'm Nick Crider. I'm a Co-Founder and Chief Operating Officer of Visikol.

A little brief history about the company. I'm really excited that I am invited to speak here. And I'm really excited as well that I've gotten the opportunity to go first, because everybody has to start somewhere.

And we started here in New Jersey, and I'm thrilled that we had that opportunity. Me and my co-founders, who both went to Rutgers -- I, unfortunately, didn't; I'm actually from Chicago, but we'll pretend like I didn't say that -- my co-founder invented the core technology for our company during his grad studies at Rutgers. And then we formed a small company, just together, and then worked with the Office of Technology Transfer at Rutgers to license the patent that Tom developed, and formed that into what is Visikol today.

We have four employees; we're hiring our fifth. We're located just down the hall, here in CCIT. And I think that's really what I'm here to talk about today, and just comment that without the resources that CCIT, and especially Rutgers, have shared with us, we wouldn't have been able to start. I think one of the most powerful things that New Jersey does is this incubator space. I mean, our business first started in a garage, like all good start-ups. We made the first batch of our chemical in my co-founder Tom's garage, and from there we sold it on the Internet. But as we knew, we needed lab space; and it's incredibly expensive to go and rent an entire lab if you just need a bench. And so that's where facilities like CCIT, and the resources that the State can offer, really come into play for us.

And so I think that that's really just the strongest -- really what helped us get started and where the State can really address that challenge.

I want to speak about-- I know your neighbors in the north; they e-mail me quite frequently and say, "Hey, we have these incubators; we have all this space. We even have money to give you guys." And I think that for companies on the starting end of the spectrum, it's those types of incentives that really help folks get started. Because it's that $25,000, $50,000 -- enough to get an IP attorney to really pull something together that allows folks to take an idea and turn it into a company. Because as much as the attention goes to my esteemed colleagues on the panel here, like I said at the beginning of my testimony, everybody has to start somewhere. And I am thrilled that I could share a little bit about where we got started, and how the State of New Jersey was really instrumental in that.

So thank you for the opportunity to testify.

SENATOR GREENSTEIN: I just have a quick question.

It's probably ignorant; but you know, that's how you learn, right?

Now, what is your product? What do you-- That's the first question. (laughter)

MR. CRIDER: Oh, yeah.

SENATOR GREENSTEIN: What is it used for?

MR. CRIDER: Yes; so essentially, we have a chemical that turns tissue transparent. So it's like a liquid X-ray. You can take any kind of excised tissue; you put it in our chemical and it becomes optically transparent. And then you can image it directly in 3D.

And so before, the way that that was done was through *slicing*. So you take a bunch of thin slices, and you take a bunch of those images, and then reassemble them in a computer. And so now you can just do that imaging directly, and so you get a whole bunch of speed in addition -- you know, essentially, more data than--

SENATOR GREENSTEIN: The reason I asked -- and it's interesting to know what each of your products or ideas are -- were there those in the industry already who could have helped you financially, in terms of these things? Whatever; let's just say -- I'll make this up -- is it used for visual kinds of things, or--

MR. CRIDER: Yes, it's used in research.

SENATOR GREENSTEIN: Research.

MR. CRIDER: Like cancer research or drug development screening.

SENATOR GREENSTEIN: So the companies, or the places that would benefit from that product -- could they have been involved in the funding, or do they get involved in the funding?

MR. CRIDER: You know, I don't really-- Not directly, right? So there's -- we had a lot of good, sort of, cheerleading support from folks who said, "Yes, I'm a customer; I would use that. But here's the type of data that I need to see before I can make the purchasing decision." And so that's really where we needed that lab space -- to go from just the chemical in the garage and say, "Hey, you can buy this," to then put the data together that shows that, "Hey, here's the product and here's how it can benefit your business, and this is why it's useful to incorporate into a scientific or drug discovery."

SENATOR GREENSTEIN: So you need the money so early because it's before those companies would commit.

MR. CRIDER: Exactly.

SENATOR GREENSTEIN: Okay; thank you.

MS. HART: Any other questions from the panel?

ASSEMBLYMAN ZWICKER: Was it Massachusetts that recruited you, or New York? (laughter)

MR. CRIDER: No; New York, yes.

ASSEMBLYMAN ZWICKER: New York.

MR. CRIDER: So they--

ASSEMBLYMAN ZWICKER: What was the offer?

MR. CRIDER: It was $100,000 convertible note, and six months free rent in the accelerator.

ASSEMBLYMAN ZWICKER: The one on Roosevelt Island?

MR. CRIDER: In Rochester.

ASSEMBLYMAN ZWICKER: Rochester; huh.

Okay; thanks.

MS. HART: And why didn't you go? We're thrilled you didn't; but why didn't you go? (laughter)

MR. CRIDER: Essentially, we just actually, a couple of weeks ago, closed a round with a local New Jersey investor; so we really didn't need the money. (laughter)

MS. HART: And actually, to your point -- you didn't need the money now, but it does take, I know, 10 to 15 years and $2.6 billion, I believe, to bring a drug to market. So those needs will go on for a very long time. And actually, as we move through the panel, we'll be hearing from

folks who are a little further along and have been able to ride those waves, some of which were really rough.

But I think you wanted to say something.

MR. LIZURA: So yesterday we heard quite a bit about the *valley of death.* And it seems like you've at least made your way across some portion of the valley.

MR. CRIDER: Working on it. (laughter)

MR. LIZURA: So what I'd like to hear is how did you get from funding -- from garage to incubator, right? And incubator is a form of subsidy, right? -- because it allows you to take whatever money you have and use it differently.

MR. CRIDER: Right.

MR. LIZURA: But it means you still needed to get some other money. So what kind of capital did you raise from garage to "congratulations on your first closing"?

MR. CRIDER: Yes, thank you.

So yes, a brief history about that.

So yes, when we had-- Initially, it was just a few thousand dollars between myself and the co-founders that allowed us to get the license from Rutgers and start up the business. And then, at that point, we knew that we needed investment. And we were able to get investment from a local New Jersey group; actually, the New Jersey Health Foundation, a venture capital group. And so that was really instrumental, too, in that they had a special relationship with Rutgers, and sort of knew that -- and were willing to invest and work with the Technology Transfer folks as well. So that was a really instrumental relationship in getting us started. And that's

what allowed us to bridge the gap, essentially, between the garage and where we're at today.

MR. LIZURA: And you had to pay Rutgers for the IP?

MR. CRIDER: Yes, we did; a small initial license fee. And then, of course, we had to repay them for the legal costs in pursuing the patent.

ASSEMBLYMAN ZWICKER: That's pretty common; yes.

MR. LIZURA: Yes?

ASSEMBLYMAN ZWICKER: Yes; Princeton has something similar to that; yes.

MR. LIZURA: Do they take an equity position in the company, or a royalty stream, post--

MR. CRIDER: Yes, yes. So there's-- Yes, there are those options as well.

ASSEMBLYMAN ZWICKER: Princeton does not.

MR. LIZURA: Does not?

ASSEMBLYMAN ZWICKER: Does not; no. No equity. But you do pay back, if you can, the costs -- the original costs.

ASSEMBLYMAN DePHILLIPS: Chair?

MS. HART: Sure; please, Assemblyman.

ASSEMBLYMAN DePHILLIPS: So as I mentioned, I'm an attorney; and I tend to look at these issues from the legal side.

And you mentioned patent issues, and licensing issues, intellectual properties issues. I'm just interested -- did you have any challenges, as you were starting up and getting going, with either any State laws or Federal laws that we should know about?

MR. CRIDER: You know, not specifically that I can imagine. I think that the most challenging aspect was just the negotiation with Rutgers; being, sort of, fairly naïve, you know, at negotiating with Rutgers, and having that-- And that's where the New Jersey Health Foundation was really -- came in instrumental, because they had some relationship in dealing with those folks and were able to help us, sort of, shape up the -- essentially, turn the license into something that was what we had initially negotiated -- into an investable company that folks could do in the future.

But as far as specific laws that came into play, I can't comment on anything like that.

ASSEMBLYMAN DePHILLIPS: Okay.

MS. HART: So I wonder, have you-- One of the things that we're advocating for at BioNJ -- and I hope it will make its way to the report that goes to the Science Committee and others -- you know, we would love to see the Angel Investor Tax Credit go from 10 percent to 25 percent. Have you, by chance -- and I would ask everyone else to please address this, if they can -- have you taken advantage of that program at all? If so, good -- thumbs up, down? Would you like to see it be 25 percent? Please say yes. (laughter)

MR. CRIDER: Absolutely.

So yes, our first investment was through the New Jersey Health Foundation; they are actually a nonprofit. But our second investment -- which we just closed a few weeks ago -- was from two angel investors. And so the Angel Tax Credit was definitely helpful in sealing that deal to them. And yes, I definitely think -- I would love to see it higher. I think that it

would benefit a lot of companies like mine at being able to raise that sort of start-up capital that you need.

Y U S H E N G X I O N G, Ph.D.: I'd like to comment too.

That's really important. In our company, we were funded by a private investor, and an angel investor, and our own money too. We made our installment schedule -- two installments; and once we were made aware of the angel tax credits, we made additional investment -- a third installment, and essentially put back the Angel Investor Credit, and into a third investment. And that's very important; I would really appreciate it if you could make it higher. (laughter)

MS. HART: Thank you.

MR. LIZURA: Debbie, is it Bio's position -- the increase from 10 percent to 25 percent, does it still go all to the investor, or does any portion of that -- does the company directly benefit from, or you don't have a position on where the -- if there's a split?

MS. HART: We have not taken a position on that; but I'd love to hear from the folks at the table if that would be a plus or a minus at some point.

Any other questions for Nick? (no response)

All right; Nick, thank you so much, and good luck to you. You're on a very exciting trajectory, it sounds like.

And actually speaking of *trajectories*-- So our next speaker, actually -- their company, you'll hear, has come right from here to a really tremendous trajectory; a few years longer at this than you, Nick.

So next we're going to hear from, actually, a BioNJ Board member -- in the interest of full disclosure -- and thanks. We're going to

hear from Brad Campbell, who is the President and COO of Amicus Therapeutics.

Thanks, Brad.

B R A D L E Y L. C A M P B E L L: Thank you, Debbie.

Thanks to the EDA, to the Task Force here. We think this is a great example of bipartisan, public-private initiatives to focus on making our biotech industry great. And it's something I think we're all focused on, in addition to our missions as representatives of our companies here.

So let me also apologize; unfortunately, I have a previous commitment that will take me away from this panel soon after my Q & A. So to my fellow speakers and to the panel, I do apologize for leaving early.

Let me give you a little bit of background on Amicus and share our story about New Jersey; and share with you, I think, two very important strategic initiatives that we are facing that I would like to raise to the panel's attention; and also provide some recommendations on how we think about continuing, again, to make this ecosystem in New Jersey great.

So at Amicus, our dual mission is clear. We seek to deliver the highest quality, innovative new medicines for patients living with rare and metabolic diseases; and thereby maximizing value for our shareholders. We are a public company.

Today there are more than 300 patients globally who take an Amicus medicine. And at the JPMorgan conference -- which, you may know, is the largest industry healthcare conference of the year; it happened two weeks ago, in San Francisco -- we announced our vision that, by 2023, we hope that 5,000 patients living with rare diseases will benefit from an Amicus medicine. That may not sound so large in the context of Big

Pharma, but I can tell you, in our space, that's a significant contribution to treating patients who are living with these challenging diseases. It would put us in a space where we could generate $1 billion of global revenue, and in the company of great institutions and organizations like BioMarin and Vertex. So that's our vision.

Our strategy is to create, manufacture, test, and deliver great medicines for orphan diseases. We've invested in core technologies, which are the bases of our approved medicine for Fabry disease, as well as our product pipeline. We seek to advance and expand this pipeline with potential first-in-class, investment-class medicines. And our biologics capabilities, as well as our global commercial infrastructure, will now allow us to deliver those medicines to patients today, as well as provide a platform for future opportunities.

We are in a period of significant growth as we look to build a global, beating-rare-disease biotechnology company.

Some additional metrics: From the corporate side, we're a public company, as I mentioned. We're listed on NASDAQ exchange; we're over $2.5 billion in market cap today. We have 400 global fulltime employees, 280 of which are located in our headquarters here in Cranbury, New Jersey. We're expected to grow to almost 600 employees by year end.

We generated $36 million in revenue in 2017 from our precision medicine, *Galafold*, for Fabry disease.

And to your question earlier, Senator, Fabry disease is a lysosomal storage disorder, which leads to kidney failure, heart failure, and stroke. Our medicine is actually a small molecule pill that, instead of taking enzyme replacement therapy -- which is an infused biologic -- patients can

now simply take a pill. It is approved in Europe and many other jurisdictions outside of the United States; and we're actually on file now with the FDA as of December. So we're making progress there.

We have $359 million in cash on our balance sheet, which should fund our operations to the second half of 2019.

As I mentioned, we have a global footprint. We have employees or consultants in 27 countries around the world; offices in 8 countries outside of the United States. And we have a robust pipeline, importantly including a biologic in development for Pompe disease, which demonstrated very exciting data last year in patients with Pompe disease. And we're currently manufacturing, with our partner, WuXi Biologics -- you might have seen an article this morning, or yesterday afternoon, in the *Wall Street Journal* talking about our CEO and our decision to locate a biologics manufacturing plant here in the United States. I'll talk more about that in a few minutes. But that's a very important part of our strategy in our company, going forward.

As Debbie mentioned, we have a very rich history in New Jersey. We're actually graduates of the CCIT, thanks to funding from the EDA. We were located here as our original headquarters; we licensed technology out of Mount Sinai School of Medicine in New York; and in 2005, we moved to our current location in an office park in Cranbury, New Jersey.

We've been an active participant and contributor in a number of the initiatives, the programming, the leadership, and organizations like BioNJ, like HINJ; as well as certainly benefitting from the broader biotech and biopharma community here in our great state.

And while over 90 percent of our funding has come from private investors, as well as public investors and our strategic partners, we certainly did benefit from the NOL program here in the state, as well as a number of workforce training programs that we've taken advantage of over the years.

And I think, thanks in part to the ecosystem here, but also the hard work and persistence of our employees who are so dedicated to our mission, we're now one of the top pure play biotechnology companies here in New Jersey.

And as I alluded to, we do have some really important strategic initiatives that we're faced with today; two that I'll talk about here are very germane to the conversation and to this group, I think.

So first is, we're growing very rapidly; and we have now run out of space at our current Cranbury facility. I think we have 10 seats left throughout the building, which is not enough to accommodate the growth we have this year, and certainly not our aspirations for the years going forward. We are projecting to need a new facility that will require over 200,000 square feet of office space to accommodate our growth in this area for many years to come, upwards of 500 to 1,000 employees over the years.

And second, with the advance in our Pompe program -- again, this gets back to the article today that John was quoted in, our CEO -- we have now decided to invest in our own state-of-the-art biotechnology manufacturing facility. It will be estimated to be a $150 million to $200 million facility, which can support 200 highly skilled biomanufacturing employees in a 200,000- to 300,000-square-foot facility, and eventually we hope could expand to co-locate with an R&D hub.

So as we continue our diligence on both of these strategic initiatives, I would call your attention to the resource that Debbie mentioned -- that I think BioNJ had a great part in putting together -- which is the New Jersey Biopharma Industry report, *A Prescription for Growth*. I would encourage you all, if you haven't read it, to read it carefully.

We've also looked very closely at the McKinsey Report that came out last year -- I know the Governor and his team have used this as a resource as well -- which is *Reseeding Our State's Economic Growth: A Vision for New Jersey.* I think there are a lot of very important opportunities, and it highlights such great work that New Jersey has done over the years to support this community; but also, unfortunately, some challenges.

I'm highlighting a few here that are important for us.

The first, from the positive standpoint, as I'm sure you know, biotech, here in New Jersey, is 3.7 percent of our GDP, versus the average in the United States of 1.9 percent. I think that's a great standard.

We have created 350,000 direct, indirect, or induced jobs through this industry, which is something to be proud of.

Our cost of lab space here in New Jersey is less than $20 a square foot; versus San Francisco, which is at $50, and Boston which is at $70. I came from Genzyme up in Boston, many years ago. There were 2,300 patents filed in the New Jersey/New York cluster, and 25,000 publications. And I think, most importantly, a statistic we hope to join soon -- a third of drugs approved by the FDA, from 2015 to 2017, came out of companies headquartered here in New Jersey. That, I think, is the most

important statistic on this list, and something we all should be proud of or aspire to.

From a challenges perspective, I think there are some statistics and trends here that are truly threatening our sector and our position as the preeminent state for biotech and biopharma.

If you look at the information in the report here, we're 23rd -- we're the 23rd state in the country for the number of universities for health care and biotech; we're 23rd in NIH funding; 46th in our regulatory environment. We're 41st in the country for cost of living, and I think increasingly, and particularly with the Federal tax laws that I think will disproportionately impact states like ours, that is something we have to focus on. From a cost-of-business perspective, labor and utilities are reported to be 40th in the country; property costs are 44th. And I think, really, all of this has led to a negative impact on our industry and on trends in our industry. If you look at employment growth, we've shrunk 2.2 percent from 2006 to 2016; and again, we would contrast that with states that we compete with, like California and Massachusetts, that have grown by 2 percent over that time period.

Specifically, which is germane to us, from 2005 to 2015, biomanufacturing employment has shrunk 3.6 percent; and again, that's during a period in which our rival states have grown, including Massachusetts, California, and North Carolina.

So what does that mean for us, and what does that mean for our conversation today?

As it relates to our global headquarters, our home is here in New Jersey, our history is here in New Jersey. We would like nothing

better than to stay here in New Jersey. But I can tell you, some of those factors are forcing us to consider neighboring states where we have to choose a location that is not just sustainable for us as a company and our duty to our shareholders, but is sustainable for our families in the long term. That's number one.

Number two: From a manufacturing standpoint, I think for some of the reasons that I've outlined, it's even more imperative that we do our diligence and look at our other states in the country. Again, to ensure it's not just the incentives, but it's that we need to have a biotech and biomanufacturing ecosystem that we can partner with that creates a sustainable and strong environment; not just for Amicus, but for growing, and attracting, and retaining the workforce that we'll need to populate that manufacturing facility.

I will note -- and I think Debbie alluded to it, and many of you have as well -- I think now is such a great time in our state. The Governor has already, I think, identified a number of these issues as important to him. We've talked about it; that's why we're here today, I think. And the Governor has also already reached out to us to initiate a dialogue on how we can work together to address these strategic initiatives, so I think this is exactly the right time to have this conversation. And again, it's not just about Amicus; but it's about us as a community, and us as a state, and our future together.

So I'll close with just a few proposals.

The first is to this Committee; which is, I would look to BioNJ's recommendations on some solutions for how to address some of these critical issues on attracting and retaining biopharma companies, as well as

the workforce that serves at those companies. Begin to address the business environment and the quality of life issues.

We can promote investment in the life sciences innovation, from the earliest companies through the later-stage companies that exist here.

We can make New Jersey the world leader in education and training for biopharma.

And we can increase the state's biotechnology brand; we can bolster our story, and we can tell it far and wide.

The second thing that I would recommend to the Committee, to the State, to the city and local governments, is that we need to continue this bipartisan effort to work with companies like ours. Not just to make sure that we keep these great companies in New Jersey -- imagine what would have happened had Celgene left for Massachusetts or California early in its days, and what it has contributed to our economy -- but we also have to attract more like it; we have to keep companies like Nick's here in the great State of New Jersey.

And I think we also have to make sure we're keeping the great people who work at those companies here in New Jersey as well.

So we look forward to working with the Task Force here, with BioNJ, with the other institutions here in New Jersey; to work with the Governor and his team on finding ways to continue, again, to make our industry great and our state great.

So that concludes my prepared remarks; and I thank you again for your time, and your efforts, and I would open it up to questions.

MS. HART: Terrific; thank you so much, Brad. And congratulations on all those amazing things happening there.

MR. CAMPBELL: Thank you.

SENATOR GREENSTEIN: First of all, I want to say that you should stay in the 14th District, where you are right now. (laughter) And I'm always -- I've met Mr. Crowley a number of times, and I'm so impressed with what he's done to build this company. And I realize he had the strong personal motivation, but still it's amazing--

MR. CAMPBELL: Thank you.

SENATOR GREENSTEIN: --what's been done. And I'm always impressed when I meet the employees.

MR. CAMPBELL: We're lucky to have him.

SENATOR GREENSTEIN: Yes. You mentioned that our state is 46th in the regulatory environment. That is the kind of the thing that we might be able to effect legislatively. As Andrew said earlier, we can't do everything legislatively, but that's something.

Can you talk a little bit about some places where you've hit brick walls on the regulatory environment?

MR. CAMPBELL: So we're in an office park, which is, you know, owned by a large landlord. And so a lot of our dealings are through the landlord, which has nothing to do with the State and local government. I will share an anecdote that I shared earlier this morning, which is when we -- and it's just a microcosm of the kinds of things that I think we can address and we should address -- when we first moved from a small building within that space to a new headquarters, we actually wanted to put three flags up in our parking lot. We wanted to put a flag for New Jersey, a flag

for the United States, and a flag for Amicus. And it took us more than six months to get the permits to put those flags up, which is-- Again, it's a small thing; it doesn't, you know-- But that's a microcosm of what we're talking about.

When we're thinking about either our new headquarters or, certainly, the manufacturing facility where we may need to break new ground, the permitting, the workforce requirements -- the kinds of things that, unfortunately, by virtue of the system that we have here in New Jersey, can take longer than it needs to take-- Versus when we have conversations -- and we are having these conversations with other states, where there's a roadmap, that is instantaneous, that you can follow that helps you just get through the kinds of things that, frankly, are bureaucratic. They're important -- licensures, the processes, etc. -- but do nothing for creating jobs or moving forward with the investment that we need to make.

SENATOR GREENSTEIN: Is this-- I'm a little -- I'm not sure about this -- does the EDA help people get through this and help them with a roadmap?

MR. LIZURA: We have colleagues in our Business Action Center, that's in the Department of State, who will run interference with permitting agencies to ensure timely responses; and most often, an efficient communication, which is really what's needed, right? So it's not -- you can't always get the "yes," but you can get to a--

SENATOR GREENSTEIN: An answer.

MR. LIZURA: --as Brad mentioned, an answer; yes, an answer. Which is, you know, as important as sometimes getting to "yes." So there are -- that is in their body of work.

SENATOR GREENSTEIN: Well, that seems like something we should do even better. If you're taking six months to be able to put up an outside flag, that's insane.

MR. LIZURA: Well, home rule, though, is always a challenge for our State colleagues.

SENATOR GREENSTEIN: It is.

MR. CAMPBELL: Yes.

MS. HART: Please; Assemblyman.

ASSEMBLYMAN DePHILLIPS: So thank you very much for your testimony.

I know John's story personally. John and I went to high school together, as well as college. He's two years younger than I am, so I'm the older guy.

MR. CAMPBELL: Wiser, I'm sure. (laughter)

ASSEMBLYMAN DePHILLIPS: So I know what he's done and the great things he's done to build his company, and it's amazing; it's an amazing story.

My question today goes to -- how does a company like yours decide which rare diseases to focus on and which ones not to focus on? Obviously, it comes down to funding, etc.; but, you know, rare diseases are killing people in our state every day.

MR. CAMPBELL: Yes.

ASSEMBLYMAN DePHILLIPS: And those are not the stories we read about, we know about. In my own family, yesterday one of my children's childhood friends, an 18-year-old boy, died of a very rare and aggressive cancer. This was a track star--

MR. CAMPBELL: That's tragic.

ASSEMBLYMAN DePHILLIPS: --a lacrosse star, a soccer star, who just, back in June, was on the ballfield leading his life. And eight months later, he died yesterday. And he was a strong athlete who just could not combat what he was facing, and he tried mightily.

So how, in our state and in the industries that are dedicated to eradicating rare diseases -- how do you decide which ones to focus on and which ones that will be put on the shelf?

MR. CAMPBELL: Now, that's a great question.

First of all, I'm sorry for your friend, and for your loss. It's -- I think all of us are touched in some way by rare diseases or diseases broadly. And again, I think the fact that New Jersey is doing so much to contribute to new drugs, I think, is something really we should be all proud of.

From Amicus' perspective, I would answer that a couple of ways. You start with the technology; there was a founder -- it was Fabry disease, which is what we focused on. That's our first product, our lead product. And then John joined the company shortly thereafter, and had a vision that it shouldn't just be Fabry; it could be more than that. And that took us to Pompe which, of course, was near and dear to him -- and many of the rest of us had worked on Pompe disease in the past -- but also a concept that we could have a specialty within that family of diseases.

Over time, I think we've had the good fortune -- and I think this gets to a trend that's here, and ties back to the academic testimony yesterday -- which is, in early days, there's not a lot of choice, right? So getting that $50,000 grant from whomever to cross the chasm, to be able to locate here and have a lab to do more things -- I don't think you have a lot of choice. As you go, and as we've been able to be successful with our lead program -- but also attract capital and convince people that we had an ability to do this in a way that made sense for patients and for our shareholders -- we've been able to build a set of expertise, and that allows us to have a lane through which we can look. So I think what we've said is, "Look, we are going to look down the lane of rare--" and now we've said "--metabolic diseases," which is a space that we know. But we're going to be agnostic to technology. We've been able to attract the capital that allows us to go from small molecule, which is the first product, to biotechnology, which is Pompe; and now we're looking at gene therapy/cell therapy, etc.

And I think, really, that choice is something that is -- has to be earned, and that's the way we've approached it. I'm sure there are other ways as well. But I think that's an important thing to be thinking of -- is that part of the capital allows you to get to a place where you could do more and choose more.

ASSEMBLYMAN DePHILLIPS: I appreciate it.

Well, maybe some of the subsequent speakers can address -- just for example, since it's on my mind -- just cancer therapies and how to deal with rare cancers that are still taking the lives of even young people.

MR. CAMPBELL: Yes.

ASSEMBLYMAN DePHILLIPS: And that -- I understand what the focus of your company has been; and in no way, shape, or form am I being critical of what you focus on in your business. But certainly broadly -- and this is sort of a public policy issue -- is how to do we get our arms around rare diseases in the state and in the cancer realm, where a lot of people in our state -- a lot of business people and a lot of families -- think we've beaten cancer, and we just haven't. And I told -- you told your personal story from yesterday. But, you know, I applaud Amicus and the things that it is doing. We need to encourage more companies like Amicus to thrive in this state, and I'm sure Assemblyman Zwicker and I will be addressing some of those issues on our Science Committee, moving forward.

So thank you.

MR. CAMPBELL: Thank you; I look forward to it.

MS. HART: Okay; thank you.

Did you have a question?

ASSEMBLYMAN SCHAER: Yes, please.

A few questions.

MR. CAMPBELL: Please.

ASSEMBLYMAN SCHAER: Why are you in Cranbury? Why did you choose, affirmatively, Cranbury?

MR. CAMPBELL: At the time it was a -- the next most-affordable alternative from the space here. We grew out of our lab space here. It was a unique building that had labs; and, in fact, it was Perdue Pharmaceuticals, at the time, that had been going through their own challenges, and afforded us a chance to take over part of their building. So really, it was opportunistic.

ASSEMBLYMAN SCHAER: Yesterday, during conversations we had with various of your colleagues, it became clear to me -- correctly or not -- that successful models that we might replicate here in New Jersey currently exist in California and Massachusetts. But it's not California, it's the Silicon Valley; and it's not Massachusetts, it's Cambridge-Boston -- defined areas where people -- working in, I believe the term is *ecosystem*--

MR. CAMPBELL: Sure.

ASSEMBLYMAN SCHAER: --can interact with each other and benefit from each other through conversations, through relationships, etc.

How important, or is it important, that we identify a defined geographic area within the state, rather than -- I don't want to say the efforts are disparate or uncoordinated; but certainly, at a great distance, we have some tremendous efforts going on at Rowan in South Jersey; some tremendous efforts going on in Newark, and throughout the state. How important, or is it important, that there be a defined space; a creation, if you will, of this ecosystem?

MR. CAMPBELL: I think that's a very insightful comment and question. So it's something at BioNJ we focus on quite a bit, and have had various efforts to try, from a private perspective, to address.

If you were to walk up and sit down in a coffee shop in Cambridge, in Kendall Square, or in Silicon Valley, or in San Francisco, and I'm sure there are -- in RTP, I think you would have a great opportunity to meet with colleagues, with academia, with investors, with public companies. And I do think that there is something to be said for that virtuous ecosystem and environment. I think New Jersey -- we're disadvantaged by not having, I think, the same kind of hub for those kinds of interactions.

So my personal opinion -- and again, something that I think we've focused on at BioNJ -- is that, yes, if there is a way to create a physical space, but then also the network around that space, that could be very meaningful. Because I can't think of, today -- I'm sure there are some -- but I can't think of, today, the same comparable of a -- both ecosystem and physical location in New Jersey that would be the same as Cambridge, for example.

ASSEMBLYMAN SCHAER: So where on this list, Brad, would that element go -- the list of things working on our behalf, as well as those things working against us? Where would this rate?

MR. CAMPBELL: You know, I think it's -- I think it's emblematic of a higher issue, which is the broader ecosystem. I think by having-- You know, perhaps it's a virtuous cycle there. I think that Big Pharma, to me -- which is not meant to be a disparaging or any negative comment -- to me, has a hub here in New Jersey. Biotech--

ASSEMBLYMAN SCHAER: That hub -- has that hub -- forgive me for interrupting you -- rapidly become more administrative?

MR. CAMPBELL: Could be, yes.

ASSEMBLYMAN SCHAER: Versus R&D?

MR. CAMPBELL: Yes.

ASSEMBLYMAN SCHAER: You've seen an exodus of R&D into Silicon Valley, into Massachusetts, into other areas. The response of Big Pharma is that we still have the jobs in New Jersey but, you'll forgive me--

MR. CAMPBELL: It's not the same kind.

ASSEMBLYMAN SCHAER: It is not the same kind.

MR. CAMPBELL: Yes.

D A N I E L J. L O U G H L I N: Yes, the jobs-- Excuse me; I'm Dan Loughlin. I'm in the real estate business, and I represent the Big Pharma companies and emerging companies; and I have done deals at Cambridge, I've done deals in Seattle, I've done deals in La Jolla.

There's a cloister there where there's academic, there's health care, there are young people, and there's research, all together. I think New Jersey has this opportunity; I think in New Brunswick -- a little self-serving, because I happen to work with Chris Paladino; we're marketing The Hub project in New Brunswick.

But I also think Hoboken and Jersey City also afford us the opportunity to really attract millennials and create this sort of cluster and this collaborative environment, as does Newark. I'm not sure what Rowan's doing, but I'm sure there's something similar to that there.

So there is-- I think New Jersey has been more of a suburban-based environment, and we're handling a lot of these-- You know, we handled the Roche Nutley campus; we handled Sanofi's campus in Bridgewater; we sold Merck Summit to-- So, you know, we are redeploying a lot of these old Big Pharma campuses; and actually they're being reutilized by up-and-coming and innovative companies that are sort of mid-cap or emerging.

MS. HART: Thank you, Dan.

And so, in the interest of time, I do need to move this.

But I thank you so much.

MR. CAMPBELL: Of course.

MS. HART: Godspeed in your great work, and I look forward to maybe one, if not two, ribbon-cuttings; that would be wonderful. (laughter)

But thank you for sharing your story; it's a really important one.

SENATOR GREENSTEIN: Deb, could I just ask a very quick question.

The group *Einstein's Alley* -- it seems like the goal is to try to do what you're saying -- bring all this together. I don't know how much funding they have; I think that could be a problem. But has, in your experience, that been helpful at all in trying to accomplish some of these things?

MS. HART: So Einstein's Alley has been around for a while, and I love-- You know, they put up their signage, they have built a reputation. Unfortunately, it's never been able to get quite the traction that we would all love to see.

SENATOR GREENSTEIN: I don't think they--

MS. HART: Because we were talking yesterday that, you know, when you talk about San Diego and Boston-- I mean, Boston is huge, right? San Diego in some cases, you know-- New Jersey's the same size as some of these ecosystems that we're talking about, but they're branded differently, so it just rings differently.

And so I'm not quite sure what the answer is, frankly; but yes, so Einstein's Alley has never been able to--

SENATOR GREENSTEIN: Just another possible resource--

MS. HART: --quite get what they needed, and perhaps resources is part of it.

So thank you again, Brad--

MR. CAMPBELL: Thank you.

SENATOR GREENSTEIN: Thank you.

MS. HART: Thank you to our panel; we appreciate it, yes.

MR. CAMPBELL: Excellent. And unfortunately, I do have to leave, and I apologize to my fellow speakers.

But thank you again; we really appreciate it.

MS. HART: Thank you.

MR. LIZURA: Thanks, Brad.

MS. HART: And next we will hear from yet another BioNJ Board member with another very interesting story, another angle in terms of how he has grown and why he's here in New Jersey. So we can't wait to hear that.

Dr. Marco Taglietti, who is an M.D. doctor; and President and CEO of SCYNEXIS.

M A R C O T A G L I E T T I, M.D.: SCYNEXIS (indicating pronunciation).

MS. HART: SCYNEXIS (indicating pronunciation).

DR. TAGLIETTI: So I am Marco Taglietti, CEO and President of SCYNEXIS.

Let me say it is really an honor to be here.

And I think this Task Force really is a great opportunity to talk with people with very different experiences; companies, I think, all sharing the same commitment to New Jersey, but very different sizes.

I think our company -- and I will talk in a moment about our company -- is really between Visikol, probably, and Amicus; hoping to be, one day, like Amicus.

Our company, SCYNEXIS, is a publicly traded company; we are listed on NASDAQ. The company is focused on the development of new anti-infective products; I am an infectious disease specialist by training. And we are developing -- going back, actually, to Assemblyman DePhillips -- connection to cancer -- our company is developing the new antifungal for severe hospital-based fungal infections, which are very high mortality-type of infections. Actually, one of the most common reasons for a failure of a bone marrow transplant, for example -- a failure of a bone marrow transplant frequently means death -- is actually fungal infections. And of course we are bringing, actually, a new class. And there have been no new antifungals in the last 20 years; no new classes of antifungals in the last 20 years. So we think we have a very innovative product.

Just, very briefly, about the company. The company was created in 1999, in North Carolina, at the Research Triangle Park. And we stayed there for many years, growing, developing new anti-infectives. And then, in 2015, I decided it was time for the company to move to the next level, to try find a new house where we could continue to expand.

And so we made the decision to move to New Jersey. And of course, there were many other places competing, you know; Boston -- we were just talking about Boston; Cambridge, of course; San Francisco; San Diego. And with the weather these days, maybe that would have been a good place for us to go. (laughter)

But we went for New Jersey; and let me say why, what are some of the challenges, and maybe give you some food for thought about our experience.

First of all, we decided on New Jersey because there is a great pool of talent. And this is a very diversified pool that covers, really, the full life cycle of a product -- not only early development, discovery times; but also later on -- commercialization, and so on, and so on. It covers, really, what we call the *full ecosystem.* A very diversified workforce, so we felt the talent was here in (indiscernible).

A good mix of organization; because you have the Big Pharma, but you also have some biotechs; and that, again, is what creates this environment, this ecosystem.

Certainly the strategic location. I truly believe that New Jersey is blessed by the fact that you have a great infrastructure. You know, three airports allow me to -- it's easy to fly everywhere, nonstop, basically -- being between Boston, Washington, Philadelphia. I think it's a great place with proximity to Wall Street. That, of course -- that's also very important for us.

Let me just-- One little aspect that we were discussing before -- what's the problem? The problem, I think, that everyone was mentioning-- What New Jersey is missing is a clear identity. You think *Massachusetts*; but really, you think *Boston-Cambridge.* We were talking -- Kendall Square. You think Silicon Valley, you think La Jolla. New Jersey is very fragmented; it is very dispersed. I have been one of the strongest advocates of saying we should find a place where we can bring together academia, and-- But that is a bigger topic.

But that is really what is missing here. This is something that makes it a little difficult to bring someone from outside of the state, you know, to come here to appreciate, actually, what New Jersey can offer.

Also, the State incentives. And actually, let me talk about that for a moment, because maybe this can give you some food for thought about some of the challenges.

Our company is a --- it is still a small company; we have about a $50 million cap. Our burn rate is about $25 million, $30 million a year; so we have a pretty high burn rate. So we need to bring, of course, continuously, cash; and some from our investors.

And one of the reasons we came here -- certainly not the biggest, but certainly an important reason -- were State incentives. Interestingly, for many aspects, we could have been eligible for that; we weren't able to take advantage of it. And the reason was because there is a clear requirement, which is either having a long-term lease or owning the place where you are. I understand the logic of this; which is, you want to make sure that before you give incentives to a company, they have a long-term commitment to New Jersey. So I understand the logic.

However, at the same time, the companies that may need the most of these types of incentives -- like our company, being in a transition moment -- it's a company that naturally has a problem making a 10-year lease commitment. And by the way, we did a 3-year lease commitment that made us not eligible for these types of incentives.

We are now, actually, closing a lease for, actually, a 10-year commitment so we would be able to grow. The company now has about 25

employees; and we expect, probably, to double our size in the next three years; so bringing, again, a high level of high tech jobs.

But that would be something, maybe, for the Legislature to think -- if there is some way -- maybe it is in the details -- some way to change it. The ideas that I had -- it could be, for example, the possibility of making someone ineligible; but freeze, basically, the State incentive, being there saying, "Hey they are there. On the day you commit you are ready, really, for a long-term commitment, hey, we will unfreeze the money." That is, for example, something that I was just wondering. That could happen to many companies when they are in this delicate stage.

Second, certainly, infrastructure -- the point they just made -- trying to-- How can we create an identity for New Jersey? An identity, I think, cannot be a State identity; it must be a hub; call it, you know, like -- City Combali (phonetic spelling) is a nice name, of course. Find some way to identify a hub where you can build the academia. And by the way, we use a lot of the academia at Rutgers. We have a strong collaboration with Rutgers in developing our drives, and so on. But the-- Newark, you know -- you pick Newark, and New Brunswick, Princeton. In some way, I would say it doesn't matter where; just pick a place and help that place become that hub.

And finally, let me make my little -- what I think about the diversity of a workforce. A company that decided to come to New Jersey -- we were not born in New Jersey; we *decided* -- being someone, personally, who decided to make this country my home country. And so not just because I wasn't born, by chance, here; no, I decided to come here. I hope that New Jersey will continue to be open, and will not join the madness that

we have seen, recently, down in Washington, with a negative attitude against immigration. That is amazing. I thank God for my workforce; our people are coming from outside of the U.S. and are really here by choice, helping to make our country always the best. And I call it *our* country because, let me say, in the time I've been here, I've become a New Jersey boy. (laughter)

ASSEMBLYMAN ZWICKER: What exit? (laughter)

DR. TAGLIETTI: I'm still working on the accent -- still working on the accent. (laughter)

MS. HART: You just don't sound like one, right?

DR. TAGLIETTI: What?

MS. HART: You just don't sound like one yet.

DR. TAGLIETTI: A little-- But over time.

Thank you.

Any questions?

MS. HART: All right; thank you, Marco.

Thank you.

ASSEMBLYMAN ZWICKER: Chair, I have a question.

MS. HART: Yes.

ASSEMBLYMAN ZWICKER: I'll preface it with-- Last night I was at Liberty Science Center; and they have a very ambitious plan to develop 14 acres in Liberty Science Park as something they're calling *SciTech Scity,* which would be a school, incubators -- sort of this cluster we're talking about. It's in the early stages, but it's certainly an interesting idea. And also, the largest planetarium in the western hemisphere, which I highly recommend we all go to. (laughter)

I want to go back to what Brad was talking about, what you were talking about; and I pose a question to everybody, which is -- you know, we hear workforce, location, regulatory issues, access to capital, incentives -- sort of the broad themes. And in the BioNJ report-- So Brad mentioned we are 46th in regulatory environment out of 50 states, and that's not a place that we want to be; that part is clear. But the question I have is, so California is 48th and Massachusetts is 39th, right? So since that's what we normally talk about -- California and Massachusetts-- New York is in here too; New York is doing better, I think; New York is 27th, right? But it's our competing states -- and North Carolina is actually doing very well in regulatory issues. You have -- when you have to make a decision about where -- as you outgrow a space -- where you want to be, it's based upon lots of different factors. And so I'd like to ask you, you know, how -- and this is something that I think the Assemblyman was asking as well -- how do you rank these; what goes into that? Because you want access to the people who can get the job done; location. But it's expensive and the regulations are often burdensome because of home rule and other reasons. What's the calculus for you?

DR. TAGLIETTI: That is interesting. What we did when deciding where to move -- because, of course, this decision involved my Board and we had to present good rationale for it -- it was really to make a matrix; we listed all the facts, the talent pool.

ASSEMBLYMAN ZWICKER: Yes.

DR. TAGLIETTI: Interestingly, I would say regulatory was felt to be an important one to make things easier. It was not really what was driving it; what was driving it was, I think, again, the strategic aspects; the

strategical vision I think for us has been an important one. But again, proximity to Wall Street; proximity to what university where we were doing work, like Rutgers; the proximity of many other companies; reasonable price. I mean, Cambridge and Boston have become--

ASSEMBLYMAN ZWICKER: Very expensive.

DR. TAGLIETTI: --very expensive.

To be honest, New York was also a place we looked into -- again, cost was another one; so a variety of factors. I think a main incentive -- either State incentive or indirect incentive, like a lower cost of renting space, certainly played a role. But also the understanding that we were able to find -- we were confident that we could find the talent that we needed for a company that-- We were in Phase II, the beginning of Phase III. So we needed also, at a certain point, to have commercial support. And so these have been clear.

The thing that was rated very low was, again, these aspects of being not clear what New Jersey is.

ASSEMBLYMAN ZWICKER: Yes.

K. S T E P H E N S U H, Ph.D.: I just-- My name is Stephen Suh from Hackensack Medical Center.

I just want to add some comments to your question, and your comments.

Regulatory-wise and environmental-wise, we are ranking 46th; and you just mentioned Boston and California -- they're not doing so well either. Well, you know, you never expected, 10 years ago, that China would start to become world ranking No. 2; 20 years ago, we would

probably never thought about it. You never expected South Korea -- war-stricken Korea, a war-stricken country -- to come in 10th place.

You know -- and we're doing great; the State of New Jersey is doing great. But we must not stay in this environment. We have to improve, and we must enhance our environment, as the others mentioned, because others could catch up. North Carolina -- they're doing well; you would have never known, 10 years later they are starting to do really well.

So it is prudent and important that we keep up the environment and make a nice hub; and bring up the environment to a stature where you would thrive far and beyond.

MR. LIZURA: Marco, did you take advantage of the NOL or the R&D tax credit programs?

DR. TAGLIETTI: That was what we tried to apply for, but there were some limitations to it.

MR. LIZURA: Okay, so that is the program you're speaking of?

DR. TAGLIETTI: Yes.

MR. LIZURA: The five-year commitment, maybe?

DR. TAGLIETTI: Yes; we needed to have at least a five-year commitment in terms of lease.

MR. LIZURA: Right.

DR. TAGLIETTI: In fact, in just a few months, we will change locations--

MR. LIZURA: And then you will qualify for that?

DR. TAGLIETTI: We're based in Jersey City, and we plan to apply; because we expect, actually, to see if we can grow in the next 12 to 18 months.

MS. HART: And how far back can they look back for their NOLs? From the date they got here?

MR. LIZURA: I think NOLs and R&D tax credits stay on the balance sheet, so long as you don't use them. So there's no-- On those two programs, there's no real loss. They accrue, unfortunately, (laughter) until you have revenue and profits to offset. But so long as you're accruing losses and R&D tax credits, they stay on your books and you can sell them *en masse* in that program.

MS. HART: Any other questions for Marco?

ASSEMBLYMAN DePHILLIPS: One quick question.

You focused on location, and marquee location, and how and why that is so important. So I'm trying to understand your perspective on it because, in our state, we have hubs all over the state. We have a pharma hub in Bergen County, you know; where I work in Morristown is considered a hub; Princeton is obviously a hub. Everything between Morristown and Princeton is a hub; in the Senator's District, Amicus, in the central part of the state. So it's diffused; it's disseminated all over the state. So is that a bad thing?

DR. TAGLIETTI: Yes. (laughter) It's a simple "yes." It's-- No, it's good that we have it; you know, Assemblyman Zwicker was just mentioning about this new Center. We have, clearly, an effort; but it's very -- I would say more than disseminated; I would say *fragmented*. (laughter)

And this is what is missing; this is what we were talking about -- this new place, 14 acres -- and my question is, RTP -- how many acres is RTP, you know?

ASSEMBLYMAN DePHILLIPS: It's gigantic.

DR. SUH: Thousands.

DR. TAGLIETTI: Thousands; that's my point.

In other words, there is some power in the proximity -- in having *closeness* more than *fragmentation*. Don't take my words that I'm saying I don't like it; actually, that's one of the reasons why it was that we moved to New Jersey. But it's one of the weaknesses.

I always say New Jersey has all the ingredients to be the most successful state; at this point, I am very impressed. And it's just that sometimes you need to take these ingredients (indiscernible) very well, you know, and to make them into a good sauce. (laughter)

MS. HART: Thank you.

And one of the things we did talk about yesterday was cataloguing anything that is in New Jersey. And I think that's something that we will be taking on.

I think we have one more minute.

Assemblyman, yes; please.

ASSEMBLYMAN SCHAER: Is there currently a framework whereby all the people involved come together and sit down and talk to each other; including the healthcare institutions, including beginning organizations -- the whole gambit.

DR. TAGLIETTI: Well, actually, I think so. Maybe we can all say-- That is also fragmented. I think BioNJ -- I'm a member; I'm on the

Board -- BioNJ is a way to bring these people together; HINJ is another one -- certainly, also very active. Other associations; of course, the universities -- (indiscernible), Princeton, Robert Wood Johnson, and, you know, Rutgers.

And again, it's still a little bit fragmented It's one of the, maybe -- one of the things I think, unfortunately, plays a little bit in New Jersey; New Jersey, you may know, has a little bit of a reputation that politics gets in the way sometimes.

ASSEMBLYMAN DePHILLIPS: Well, all the legislators on the panel are going to fight for where the hubs should be--

MS. HART: Right. (laughter)

ASSEMBLYMAN DePHILLIPS: --where the central hub should be.

DR. TAGLIETTI: Yes, okay.

SENATOR GREENSTEIN: We're a home rule state, so everybody wants their little piece of the--

DR. TAGLIETTI: Yes, and that is a--

ASSEMBLYMAN SCHAER: The challenge is-- The challenge -- and my two colleagues are, of course, with tongue in cheek -- the challenge, of course, is to rise above that--

DR. TAGLIETTI: Yes.

ASSEMBLYMAN SCHAER: --to figure out how we effectuate necessary change. Which means that if the proposition -- or one of the propositions is to identify a defined geographic area, that we all understand that, at some time down the road, each one of our legislative districts will be the ultimate beneficiary, right?

DR. TAGLIETTI: Yes.

ASSEMBLYMAN SCHAER: But obviously there does require that step.

My question had really been, is there any formal process bringing together healthcare institutions, bringing together BioNJ, bringing together HINJ? Each one of those organizations -- the Hospital Association -- they have a focus, desirably so; parochial, necessarily so. But is there any formalized structure -- whether imposed by the State or imposed to the point possible -- where everyone sits down and where the work of your company, sir, and yours, and Hackensack, all have the ability to make use -- to develop those synergies which, in fact, is what we're talking about doing here, right?

MS. HART: Unfortunately, Assemblyman, the answer is "no." But I think that, you know, there's a germ -- more than a germ of an idea that perhaps we should have a liaison.

MR. LIZURA: Yes,

DR. TAGLIETTI: And I hope, really, the question actually triggering the interest of having a formalized process -- all this comes to fruition. Because this can be only a global effort, in a sense, as you mentioned. It cannot be just industry, it cannot be just universities; it cannot be just the State. Everything needs to come together -- real estate -- the interest of everyone needs to come together.

So I hope your question is actually opening--

MS. HART: Well, then, I would suggest that that make its way to the -- it will, because it's on the record now, but maybe a little more firmly stated -- that at least, as a starting point, that we create a summit

where we do bring all those parties together; we have that conversation; we do work collegially and cooperatively to try and move this forward.

So thank you, Assemblyman.

ASSEMBLYMAN SCHAER: And maybe we say to ourselves -- whether it be State-initiated or not -- that a *summit* -- and that's a great word -- that there be, every six months, a summit so that we ensure that this is not a best efforts one-shot; that it effectively takes us nowhere after that shot's been taken. But we establish a continuing -- a role model whereby everyone will effectively speak with each other, to everyone's hoped-for benefit -- to everyone's hoped-for benefit.

DR. TAGLIETTI: And let me say, I think the challenge is really that it cannot be a one-shot. This is an effort that must be, really, long-term planning, or-- I think we should talk about the kids.

ASSEMBLYMAN SCHAER: It needs to be as--

DR. TAGLIETTI: You know, 10, 20 years--

ASSEMBLYMAN SCHAER: It needs to be as inclusive as possible. Some of the initiatives that we've seen, Doctor, in terms of Hackensack Meridian--

DR. SUH: Like Pecora--

ASSEMBLYMAN SCHAER: --I mean, have been extraordinary, right? Heavily involved still others, in terms of what you're doing with Seton Hall, etc.

MR. LIZURA: The Council of Councils.

MS. HART: Well, thank you; thank you.

DR. TAGLIETTI: Thank you.

Thank you, Marco; we appreciate your time. All the best to you, as you go forward.

And Dan-- So we're going to hear from Dan. We heard a little bit from Dan; but you know, you have an interesting perspective, because it comes from all different places and conversations.

So Dan is the International Director, Broker Lead, for JLL in New Jersey.

So thanks, Dan.

MR. LOUGHLIN: Thanks, Debbie.

And I also co-chair our life science practice group. JLL is a global company; we're a Fortune 500 company; we're a real estate services company. I happen to co-chair a life sciences practice group and am very active in this community in New Jersey.

You know, my experiences -- three, four, five years ago, there was a Big Pharma consolidation in New Jersey. Merck, Roche, Sanofi, Bristol-Myers Squibb -- all gave me these big campuses to redeploy. And I'm honored and privileged to say that we've been very successful in doing that. Hackensack Meridian is up at the Roche campus; Nestlé, Amneal, Ashland, and a host of other companies have all redeployed and repositioned themselves in the Sanofi campus at Bridgewater. We're actively marketing the Bristol-Myers Squibb site in Hopewell, where we have a biologics manufacturing facility that I'll make sure Rob knows about. (laughter)

So I have a unique perspective, as I represent life sciences companies in their real estate matters, whether they're acquiring facilities-- I've done deals, as I said -- Boston-Cambridge; Seattle; La Jolla, California;

all over -- Bethesda. And I'm proud of New Jersey, and I think New Jersey has a lot going for it. It's not just about cost. You know, all these companies aren't moving up to Cambridge to save money; they're actually spending twice as much as it would cost to do business in New Jersey. It's all about talent and it's all about collaboration.

And I think Marco made a good point about -- we need sort of a center focus in New Jersey -- of a location, and a brand, and an identity. The problem is, we're a very suburban-oriented market, such as La Jolla is a very suburban-oriented market. So, you know, it's not -- just being in a center urban market isn't the key to success, but New Jersey has the ability, I think, to do both. I think New Brunswick -- as I mentioned before, there's a big project there that needs to come out of the ground that has all the attributes of health care, academic, county seat. There's a lot going on there, and there's mass transit. So this whole dynamic of people moving to the urban centers isn't just life science; it also impacts all the offices.

So it's really a talent attraction, millennial attraction; and mass transit and urban centers are really where that labor force is focused on. So I think we need to address that; and I think we need to try to develop some life science opportunities in Jersey City, Newark, Hoboken, and New Brunswick to meet that millennial demand.

I'll tell you what I've seen in the market, because I have an interesting perspective of what the demand drivers are. People like New Jersey because of our labor, and I think we need to do a better job of advertising or promoting our labor. JLL puts together a life science cluster report where we look at global markets; New Jersey has, sort of, fallen a couple notches. And the criteria there is science and technology-educated

employees; National Institute of Health investment; venture capital investment. So, you know, Boston-Cambridge, Seattle, San Francisco, even New York is starting to move up the rankings of that. So New York is becoming more of a competitor of us, and they are investing big into their economic development programs to try to attract those same kinds of companies.

What we've been successful at, as I mentioned before -- redeploying and reutilizing some of these older pharma campuses or vacated pharma campuses. Where emerging companies or mid-cap companies don't have those types of capital opportunities, they're leveraging what's left behind by these Big Pharma companies.

I think we've done a great job on the incubator. Tim and I have worked together for 25 years. We actually did the first deal together here, on this site, with Merial; I don't know how long ago that was, but it was a while ago.

MR. LIZURA: A site, by the way, which was a J&J site, which was abandoned.

MR. LOUGHLIN: Correct.

MR. LIZURA: So it may be one of the first repositioned white elephants in New Jersey.

MR. LOUGHLIN: Yes; very true.

I think the other thing New Jersey is recognized for is its commercialization. I think -- when people think of *commercialization*, I think New Jersey probably ranks number one.

What are the challenges? I mentioned this urban-centered, mass transit-oriented solution. We don't really have that. When you think

about where life science companies are located, they're not in urban centers, and they need to be, or they should be; and they will be, because that's where everybody else is migrating to, to attract talent.

I'd like to see our higher education and our universities more engaged in our community. Between Rutgers and Princeton, I know they both have different incubator programs, as well as NJEDA; but I'd like to see them more active in that effort.

The other thing that I think is difficult, as Marco mentioned -- when you come out of this incubator stage, and you go to, kind of, an innovation stage, the next step is tough for them because they have to sign a 10-year lease, or they have to make big capital commitments to facilities -- and there's a gap between the incubator and the Big Pharma -- or lease facilities that are available to them. So there's a little bit of gap in that innovation space.

So anyway, I'm honored to be here; thank you. I have an interesting perspective, and I see where people are moving and why they're moving. And I think New Jersey still has the reputation, and we have the facilities, and we have the market to compete.

MS. HART: Thank you, Dan.

ASSEMBLYMAN SCHAER: Quick question; and you'll forgive me if it sounds a bit off-the-wall.

There was a drive to the suburban areas years ago; people left the cities and migrated out to bucolic suburbs. That trend has now reversed itself; everybody wants to move into a city, right?

JLL is obviously foremost in the world, in terms of what it is you all do. Do you see that trend continuing for the next 25, 30, 40 years? Do you have any prognostication that would indicate that?

MR. LOUGHLIN: Yes, we actually see, because of the demographics -- every time I meet a millennial I say, "I have lots of kids," because somebody needs to buy my house in the suburbs at some point.

So what you see is, you know, young adults and professionals who are living in the City, and Hoboken, and Jersey City -- once they have children, it's very difficult to raise a family in that kind of -- and very expensive. And that's where we do see -- when this younger generation starts to have a family, we'll see some migration back to the suburbs.

ASSEMBLYMAN SCHAER: So--

MR. LOUGHLIN: But for the near-term, it's all urban-centric.

ASSEMBLYMAN SCHAER: So should, in the planning -- that hopefully will be as a result of this Committee -- should we actively be considering that as well, in terms of-- If the folks are to define a location -- however small or grand it might be -- should that be one of the considerations we have as well; that room for--

MR. LOUGHLIN: What you see happening now -- even at the Sanofi campus, right? -- so what they're doing there is they're developing kind of an urban setting, yet in a suburban marketplace. So if you look at all the major developments that are going on in the suburbs, they're trying to create--

ASSEMBLYMAN SCHAER: Would Bell Labs fit into that?

MR. LOUGHLIN: What's that?

ASSEMBLYMAN SCHAER: Would the Bell Labs--

MR. LOUGHLIN: Sure; Bell Works is another great example of that, you know, where they're adding hotels, and restaurants, and amenities that look like you're in an urban setting, but you're actually in a suburb.

ASSEMBLYMAN SCHAER: Thank you.

MR. CRIDER: So I just wanted to add in, because you started talking about millennials (laughter), and I might be the only one in the room here.

And like, you're right; talk to people. I don't know; people I talk to, my age, not, really do people want to stay in New Jersey. That's not really something that says, "Oh yes, I really see my future here in New Jersey." Everyone says, "Oh, yes, California," when they're like-- You know, and there's a lot of things that-- It just seems to be the trend. And I think that whether it's even moving into New York City, and how unaffordable that is, people are still willing to do that because of the amenities that it has.

So, yes, 30, 40 years -- I wouldn't be investing in suburban real estate; that's just my opinion.

MS. HART: Ouch. (laughter)

Other questions for Dan?

MR. LIZURA: Dan, if you were advising Amicus -- other than Hopewell -- walk us through the process that would get New Jersey on their list and -- I say *Amicus;* a company like Amicus, of course, right? -- and get New Jersey a successful win in that conversation. And how would you advise them if they're-- And let's say, for the moment, they're only East Coast-centric; that they're not looking nationally.

MR. LOUGHLIN: Right.

You know, a lot of it has to do with their current employee base. So it's easy to say, "We're going to look at North Carolina, we're going to look at Lehigh Valley, we're going to look at upstate New York." But I don't know how many employees he says they currently have; but I think he said it was 350, that's going to grow 600. You know, their company is built around that employee base, and they've grown with that employee base. It's hard to just move all those people. One thing about -- we've learned about people, companies moving out of New Jersey -- their employees don't normally go with them. New Jersey has deep roots, and I think a lot of it is based on families. But they will look in North Carolina; they will look in South Carolina; they will look all over, because they need to for incentives. But I think the other challenge we're having in New Jersey for a requirement like that, which is more than industrial-looking buildings, is that our industrial market is one of the strongest markets in the country right now. And most of it is around e-commerce and e-retailing. So that's why you see all these warehouses, and supply chain, and logistics facilities being built; and a lot of that land that's suitable for a manufacturing and biopharma production facility is getting very expensive and it's getting developed as warehouse space.

ASSEMBLYMAN SCHAER: Which is not to our advantage.

MR. LOUGHLIN: You know--

ASSEMBLYMAN SCHAER: It is what it is, but it's not part of--

MR. LOUGHLIN: It is what it is; but if you compared it to the number of employees working in a warehouse building, versus a pharmaceutical manufacturing, it's dramatically less favorable for us.

MS. HART: And also the types of jobs are different.

ASSEMBLYMAN SCHAER: And the incomes that go along with it.

MR. LOUGHLIN: And the type of jobs, and the salaries, and-- Yes.

ASSEMBLYMAN SCHAER: Right.

MS. HART: Right, right.

And you know, one of the challenges with a company -- the Amicus situation -- is that while, absolutely, for their headquarters, that would really be difficult; but they clearly have to look at all the options. But for a brand-new start-up manufacturing facility, they can go anywhere.

MR. LOUGHLIN: Sure.

MS. HART: The world is their oyster. So we need to be well-prepared for that.

ASSEMBLYMAN SCHAER: Would one way to-- If I may?

Would one way be, to proceed with our conversations, to include commitment to a building such as this, where companies, in their embryonic stage, could be facilitated? Or should we be looking at more established areas and more established companies like Amicus, or even go up the scale?

MR. LOUGHLIN: I'm not sure I follow your question.

MS. HART: Well, if I may--

MR. LOUGHLIN: Please.

MS. HART: So the way I'm interpreting your question is, you know, focus on incubators, or focus on turning over that (indiscernible)--

MR. LOUGHLIN: Oh, I see -- focus on more mid-cap companies--

MS. HART: Yes.

ASSEMBLYMAN SCHAER: Or is it necessary to focus effectively on both, in terms of that evolutionary--

MR. LOUGHLIN: Yes, I think you need to do both.

DR. TAGLIETTI: And if I can put my hat (indiscernible) in the industry -- I truly believe that we start (indiscernible) and all companies-- (Indiscernible) the one, but it's like the children; it's like, you know, you start and then you let them go. I think starting, really, pushing for early companies -- we come here, we see the benefit, and then we stay here. I think it's an important one. It may be actually easier than trying to convince a $2.5 billion company like Amicus -- let's say an Amicus based somewhere else -- to come here and uproot, you know, employees and so on.

So I'm really thinking-- Plus it creates this innovation, these dynamics (indiscernible) the millennials -- it's attracting the millennials.

MS. HART: Yes.

DR. TAGLIETTI: That should be one of the objectives.

MR. LIZURA: So, on that note, with companies that begin here and have the propensity to stay here -- Kathleen, do you know, off the top of your head, how many companies which started here and graduated continue to stay in New Jersey?

MS. COVIELLO (NJEDA Staff): (off mike) It's the majority.

MR. LIZURA: The majority; so--

MS. COVIELLO: Yes; absolutely, the majority.

ASSEMBLYMAN SCHAER: And it's because -- or one of the reasons might be because the employees have effectively established roots in their communities?

MS. COVIELLO: Yes. And what we've even heard from the companies that are here is that they want to stay very close to here once they're here. And so the EDA, on this campus now, is building out, kind of next generation space. And we heard that; that 3,000 to 10,000-square-feet of space is very difficult for these companies. We have three, currently, on this campus, but we're opening a co-location space similar to this. And to the same theory, this is kind of K-12; we've nurtured you, and that's going to be college. We're going to give you a little bit of help; you're not to see us as much.

And then we have companies, like Merial, on this campus. So I think that's the concept in a lot of these repurposed suburban locations -- is to have some living, some amenities; but support companies through each stage so that we can have availability to support companies throughout their life cycle.

MS. HASSETT: With flexibility on the lease terms. So in this new space that we've just built out, we're not asking for 10-year commitments to the space.

MS. HART: Right; yes.

MS. HASSETT: We're -- three years, minimum.

MS. HART: Yes; a year here; three years in the next level space.

MS. HASSETT: Right.

MR. CRIDER: I just, sort of, want to chime in again, and sort of double down or maybe clarify a little bit of what I said earlier.

I think that, you know, there are a lot of great resources in New Jersey; but the problem is, when we talk about in comparison to California or Massachusetts -- it's, you know, a problem of *sexiness*. It's not really-- There are a lot of great particular incentives; the workforce is really great. You see companies, when they start in New Jersey they end up staying in New Jersey for these reasons. But New Jersey just doesn't capture a lot of the mind share of folks because it's not sexy, like, you know-- And I think that that's the issue from a millennial attractiveness standpoint. From the recruiting standpoint, it's tough to get people to come to a state that doesn't have this sexy aspect to it. And so whether that's a big, fancy, shiny facility at the Science Center, or something like that; it's when we think New Jersey, we think that refinery by Newark, because a lot of people fly from California, land at Newark, go into the City. "Hey, New Jersey's a big refinery." It's like, "Well, no--" Hey, I once thought that, because I moved here from Chicago, you know what I mean? And you learn, after living in New Jersey, it's great; and you really get integrated into the community, and I can see myself staying here. But moving here -- I was not like, "Hey, great, I'm moving to New Jersey!" I'm like, "Oh, I'm moving to New Jersey." (laughter)

And so I think that that's the issue; it's *sexiness.*

ASSEMBLYMAN SCHAER: But as things grow, I mean, New Jersey City is beginning to dispel that, right? It is becoming -- what do they call it, the *Sixth Borough*?"

MR. LOUGHLIN: Yes.

ASSEMBLYMAN SCHAER: So what you're pointing out is something we're all critically aware of, and it is a tremendous challenge. And I think what we're trying to do, as a Committee, is to put all those challenges there and see best how we can, from a holistic point of view, begin to address them so that we can begin, with millennials, to change that scenario.

MS. HART: Thank you.

And we do need to move on.

I just want to make a point -- we did talk about it yesterday -- it's not only what we have, but it's how we talk about it. So marketing, branding clearly have a place; so Nick, thank you for that impassioned plea for better marketing and branding.

So thank you.

So we are going to move now; I think we're going to hear from Dr. Stephen Suh, Director of the Genomics and Biomarkers Program at Hackensack Meridian Health. It's amazing what's going on at Hackensack; I can't wait to hear your presentation.

So thank you, Steve.

DR. SUH: Thank you, Debbie.

Thank you for inviting me.

(refers to Power Point presentation)

I'm going to kind of, sort of, put you to the front, and cover a little bit of fundamentals before we get to the incubator, the accelerator, the economy of biotech, moving forward.

The goal, of course -- we're here to boost the biotechnology sector of New Jersey. How? From the hospital and healthcare perspective, I believe that providing excellent patient samples and data is really, really crucial for biotech and pharma to move forward.

How do we do that? We need to really enhance the current structure of *biobank.* And this might be a word that you might not have heard of; but biobank is a facility where it stores the patient -- the clinical data and the patient sample. Why do we need a good patient sample and a good biobank? Because the pharma, the biotech -- when they move forward, they need to identify targets and use those targets to develop drugs. And if you have really junk samples and really poor data, it is very difficult to come up with innovative drug discoveries.

Setting up infrastructure to access non-PHI patients -- PHI means *patient health information.* So you could strip off the names, the birthdays, and the so on and so forth. There are 18 different PHIs. But once you strip that, that portion of the clinical data should be available and that data should be associated with the patient sample. And we should be able to distribute those patient samples -- really high-quality, procured, good patient samples with associated data -- to the pharma and the biotech, especially the ones that spring up from the incubator space.

And we need to -- we mentioned again and again about the environment. We need to really bring doctors, researchers, and scientists together. We need to do something about setting up this infrastructure, because, as some mentioned, it's sort of fragmented; there's no environment that brings everybody together.

Why do we need this? Because the future demands personalized and precision medicine. I know a lot of us are working on precision medicine, and we have this buzzword that's going around that talks about *personalized medicine.* You can't do any of this -- what the future demands -- without this. So this is kind of a fundamental side; that's why when the Task Force was here, I decided to inform you about the importance of biobank infrastructure and the collaborative space.

So how do we know that this is all needed? Because I'm about to show you the national data; and all the Congress data shows that this is where we're going -- personalized and precision medicine.

I'm just going to briefly introduce you to how much money is going in -- about $2 billion in about 10 years -- money going in for drug discovery. A good batch of that discovery phase is actually -- 70 percent, before you move into clinical trial, is spent here in the laboratory, in the pharma, in the biotech. And a good portion of that -- 40 percent, right off the bat -- is in the very beginning phase -- the $2 billion. And you need very, very good patient data -- well, very fine and validated, and high-quality patient samples; the biobank -- a really good biobank.

Why is it important? Because also, it takes about 10 years on average to make the drug, costing $2 billion; and about 60 percent of the time is actually spent on the bench in the laboratory. And 20 percent of the time is, right off the bat, upfront. That's why it's very important that we need to do that. But it's all not well done in the United States. I actually presented this type of talk at NIH about 10 years ago at the national level; NIH got a little better. If you take -- build a really good structure in New Jersey, we could really take off. It's like a rocket booster.

Normally, we have a medical center, and clinical samples pass down. And we use those clinical samples for a whole bunch of different *omics,* we call them -- discovery efforts. And then we identify a molecular target, which turns into a drug. Now, if there were a junk sample here, and this had been passed down, you're just going to get junk data; no doubt about it. When I was at NCI for 10 years, the only thing that money could not buy -- and we had a lot of money during the Clinton Administration time -- we could not purchase a good patient sample and patient data. That's why I ended up coming to the hospital and doing my research; extremely important.

So why is it so hard to do this? It's because there are so many components in the hospital involving patient samples procurement, okay? I'm not going to go through all this; I'm just going to tell you -- it needs a lot of coordination and, therefore, it needs a lot of support from State government and from the institution.

And with all the patient data and the research, this all has to come together as a circle. The basic science, the clinical studies, the diagnostics and drugs, the clinical, and so on and do forth. I mean, this all has to come together to move forward; and without this coming together, it's so difficult to come up with innovative and constructive technology, in terms of the health care side.

I'm not going to go through all this. We are an established hospital in upper Bergen County, New Jersey. We are now part of the Hackensack Meridian; now, as of January 1, we now have merged with JFK Health. Just for Hackensack Medical Center we have this type of setting with a lot of doctors and a lot of beds. Just for the Cancer Center alone, we

rank 5th in the U.S. for patient visit volume alone, top 10 drug buyer, and so on.

What I want to mention here is that out of 45,000 surgical procedures, just in my hospital alone, half of them are cancer. And we procure much, much less than 1 percent -- all of these precious patient samples just end up in the trash. This is something that the policymakers really have to critically think about, because the biggest asset where we can procure and pass on to our researchers in pharma and biotech -- is that they all end in the trash. This is something that policymakers really have to think about; at the Federal level they are trying, but I think it's easier at the State level.

So why is this all important? Because the Federal data shows where we're going. This is Congress Budget Office data from -- all the way -- you can't see it but-- The economy is moving-- (off mike) I think I'm just going to stay over here (moves from podium).

The effects of the fiscal policy of the Congress Budget Office long-term budget scenario, on real GNP per person -- you can see signs, from 2009 and onward, it's going to basically remain flat line. We are always in a deficit. We had a surplus in the Clinton Administration time, you know; this is when we sequenced human genome. Science requires money; this is when we sequenced human genome and our life expectancy increased 15 years. The Congress Budget Office always thinks that we are going to have a better Treasury rate, but it's always falling. I think we're now at about 2 or 3 percent. Therefore, at the Federal level, but also at the State level, we need to think about where the economy is going, because, at

the end, we need to come up with a very innovative method to discover drugs.

The U.S. must reduce and eliminate debt progressively. This is the Federal debt held by the public, under Congress Budget Office's data; this is at 2007 (indicates). The Congress Budget Office -- they do this all day long, all year long. They always meet and try to figure this out. You know, at the Federal level, it's just going to go down, and the personal debt level goes up.

So it's a real problem at the national budget, on the health care side. We spend about 25 percent of the budget; therefore, there's a lot of money there; therefore, we need to move further ahead and come up with some innovative ideas, I think biobanking and the collaborative structure side is really important.

We are on overdrive. We are supposed to fit for $2 trillion; but we are, right now, spending about $3 trillion. So we need to come up with a better method. The U.S. doing here (indicates); they are spending a lot more money, compared to other industrialized nations. It's kind of abnormal how we spend our research money. This is a healthcare model (indicates) that is unsustainable because our household incomes are gradually increasing, but our insurance costs are catching up with household income. And it is supposed to be there (indicates) in 2025, and that is just not sustainable.

I won't go further; our money is drying up, both Federal government data and private data show that. Therefore, we have to think carefully. We have to come up with a model, with some collaborative efforts with biotechnology -- doctors and researchers -- to reduce to costs at

the end. This is the expenditure model (indicates); but with inflation adjusted, you know it's going down. The Government is not going to spend money. I don't think New Jersey state is planning to spend more money.

Two-thirds of the hospitals on the East Coast -- I think we're here (indicates); we are perfectly situated to really boost up our technology. I want you to understand that greater than 85 percent of patient visits in the United States are happening not at the Harvard University academic-oriented hospital, but at a community hospital, like Hackensack -- greater than 85 percent of patient visits. You need to work more with the community hospitals.

A lot of our costs are preventable, so that's where the direction is going. The future direction is, from the hospital perspective-- We need to set up a statewide infrastructural biobank; we need to be able to access data; we need to be able to distribute the data and the resources -- high-quality patient samples and data that biotechnologists can use.

Environment -- productive collaboration -- we just keep talking about the hub, collaboration. We need to bring all these together.

And education -- we talked about a workforce, but we need to have some sort of on-demand courses that can supply students to match what the biotechnology sector needs, not just a B.A. or B.S. degree.

And some grants, of course. Grants are needed, and money is needed, for science to move forward.

So that's how I am going to wrap up and my recommendations.

Thank you.

MS. HART: Thank you, Steve. That was very compelling.

I guess my overarching question would be, how do we bring that to a State level, and how do we make it actionable by this Committee to make recommendations to the Legislature -- and what are the recommendations?

DR. SUH: We need to-- From my perspective, we need to come up with some policymaking, some guidelines from the State level so that all hospitals can come together and contribute to the biobank. And the biobank should be set up so that we don't just simply throw away all these valuable samples -- to end up in the trash, basically. We need to procure them, and we should be able to redistribute them to the biotechnology sectors and pharma. Because that's just-- You know, NCI-- NIH actually purchases biobank samples; $3,000 for each sample. That's how valuable they are; $3,000 per sample, with clinical data associated with them.

MR. LIZURA: Is there a personal health issue? I mean, do people have to consent to provide their samples to the biobank?

DR. SUH: That's right. We consent patients; and only patients who have consented to donate their sample -- it comes to the biobank.

MR. LIZURA: So what is the -- what's the gating issue between getting people to consent? Is there--

DR. SUH: I think it's the participation rate from the doctors, because they are all busy; and nurses are too busy--

MR. LIZURA: So not everybody's asking? Nobody asks--

DR. SUH: Yes, it is very difficult to break the consultation time and ask them, "Would you like to donate," and patient education -- the public-wide education.

MR. LIZURA: "What does that mean? What does it mean?" right. "What does that mean when I do that?"

And is there a business around biobanks? Once you have that sample or those materials, would the *bank,* if you will, make money by providing these samples back to the companies -- to the (indiscernible)?

DR. SUH: Well, there are commercial biobanks in the United States; but most of the biobanks are not for-profit.

MR. LIZURA: Is Coriell like a -- is Coriell similar to this?

DR. SUH: Coriell is a commercial biobank.

MR. LIZURA: It's a commercial biobank.

ASSEMBLYMAN SCHAER: In Camden?

MR. LIZURA: It is; it is today?

ASSEMBLYMAN SCHAER: No, no. I'm saying Coriell in Camden.

MS. HART: In Camden; yes.

MR. LIZURA: Oh, Coriell in Camden; I'm sorry, Assemblyman.

ASSEMBLYMAN SCHAER: May I ask a question that is going to appear unrelated, but has always been troublesome to me?

At this point, 50 percent of all of our med students who graduate med school leave the state because of a lack of -- or what we've been told is a lack of fellowships and advanced degrees available in the state. Would you agree to that statement?

DR. SUH: I cannot completely answer your question, because I lack that portion of knowledge. Why do 50 percent of the medical graduates leave the state? I have five medical students who go through

rotation through my lab. They cannot land their residency at a hospital; the hospital does not have residencies available. And they wait; they apply; wait for matching the next year. They do not match; they try once more, and if they do not match, they leave.

So, you know, that's-- I can't speak on behalf of how to fix that--

ASSEMBLYMAN SCHAER: But you would identify that as a problem.

DR. SUH: I'm sure that is one of the problems; I don't know if that covers the whole problem -- but not enough residencies.

SENATOR GREENSTEIN: I wanted to ask -- a couple of slides ago, you said something about the U.S. -- I think it was the U.S., or maybe the New Jersey healthcare system--

DR. SUH: U.S. health care.

SENATOR GREENSTEIN: --being *abnormal;* you used the term *abnormal.* Can you explain that a bit?

DR. SUH: Yes. I could just go back and explain what -- so that you understand the concept.

So the U.S. health system is abnormal because the U.S. is spending a lot of money. You can see (indicates) that the healthcare spending per percent of GDP. This is U.S. (indicates); these are all the other industrialized nations. This is how much we spend (indicates), and this is only 2012 data. We are up here (indicates).

This is the spending, U.S. projected versus the other industrialized nations. This is 2020 -- we expect to spend this much (indicates). By 2014 -- because I made this slide in 2014 for another talk --

there was already a $1.5 trillion per year gap between industrialized nations average, versus U.S. Right now, it's like more than, maybe, $3 trillion difference. That's how much money that we spend in the U.S. You know, the number two ranking economic power in the world, China, is only $2 trillion -- their annual budget. We're spending a lot more than what China spends per year on--

SENATOR GREENSTEIN: That's because we're set up the way we are, as opposed to the other nations, giving healthcare as an entitlement?

DR. SUH: That's part of it, right.

SENATOR GREENSTEIN: In your opinion -- just a little bit of a tangent -- but do think the other nations are not giving the level of care that we're giving--

DR. SUH: Well, that's this data, right here (indicates)

SENATOR GREENSTEIN: --or do you think we're wasting money?

This is the gold standard (indicates): the how long they live -- lifespan -- versus how much they spend. The U.S. is over here (indicates). Japan, Korea, other western industrialized nations -- they are all in this cluster. We live a lot less, and this is the gold standard for how good your health care is. This is how long we live here (indicates), and this is how much we spend. It's very abnormal.

SENATOR GREENSTEIN: Do doctors make a lot more money here than they do in other countries, for example?

DR. SUH: That's true.

SENATOR GREENSTEIN: They do. And hospitals and other facilities are a lot more expensive, probably.

DR. SUH: That's true.

SENATOR GREENSTEIN: That's where it goes, I guess. (laughter)

DR. SUH: But we could do better if we come up with a better infrastructure.

ASSEMBLYMAN SCHAER: But it's a national problem; not something that's--

DR. SUH: I don't think New Jersey's that very much different than that data.

ASSEMBLYMAN SCHAER: No, no; I would assume that New Jersey would be the same. In fact, I'd argue it's probably higher. But the question is, what within the purview of this Committee we can do, it would seem to me that would be a national problem unless there's some New Jersey-specific compounding--

DR. SUH: I think it's the infrastructure issue; we mentioned it here. If we come up with a better idea, innovative, constructive idea to make a better environment, better policymaking, less regulation, for specific research, that would bring us a lot of revenue -- whatever it is. You know, that's the core of this problem; I think we could solve this problem if you set up a really nice infrastructure. Bringing all the pharma to New Jersey -- you set up a biobank with the patient data, good quality samples, you're ready to distribute to all the pharma. I'm pretty sure everybody will come to this state, because they always lack patient samples to do research.

MR. LIZURA: On the biobank -- is it an information dissemination gating issue, or is it actual, physical samples -- meaning that Maureen, and her team, and Eli are doing this great database for existing, ongoing research that's at the universities; if what was available in today's banks was digitized, is that -- does that make the pipe bigger, or do you just need to put more supply in the bank?

DR. SUH: Actually, maybe one-quarter of what you just said, and three-quarters of -- we need more supplies. There is simply not enough data. Pharmas pay for their samples; that's okay. None of the researchers in academia or government -- they cannot get the samples because they don't pay for it. And the lack of samples, lack of data; therefore it holds -- the lag -- it suppresses the progress dramatically.

MS. HART: So may I suggest that maybe that's a whole category that could be really delved into more deeply at some point; maybe even at the Science Committee. Because it certainly sounds like there's grounds for -- there's fodder there that could--

DR. SUH: Yes. If you have a State-supported biobank system that brings all the hospitals together -- a hundred hospitals in the State of New Jersey -- and you're willing to spread and distribute those samples with patient data to pharma and biotech, everybody would be here.

MS. HART: Okay, great. Thank you.

ASSEMBLYMAN SCHAER: One additional question, if you don't mind?

There has been, in the past few years, a growing consolidation within hospital systems -- Hackensack Meridian is a perfect example -- to

the point where we're experiencing, perhaps, six to seven major chains within the state. That obviously makes things better for us?

DR. SUH: You are asking a very difficult question for me to really answer. That's--

ASSEMBLYMAN SCHAER: You'll forgive me; they pay me to ask the questions. (laughter)

DR. SUH: Is it better for the State of New Jersey?

ASSEMBLYMAN SCHAER: In terms of effectuating the -- our goals within this Committee, right? We can't change that consolidation, whether that consolidation is good or bad. But what we can do, hopefully is make use of it in terms of expansion, right?

DR. SUH: That's correct. So as hospitals expand, rather the large healthcare network versus the independent, I think just getting bigger the better. I don't know; it's a difficult question to answer. But I think -- is it easier to make a structure? Yes, because now it's bigger. If you implement the changes and set up the infrastructure, we can change faster because we're a bigger network, compared to the independent hospitals.

MS. HART: Okay; thank you, thank you so much, Stephen.

Good luck with all the cool things going on at Hackensack. We appreciate your time.

And our final speaker -- and then we'll just spend a few minutes talking about next steps -- Dr. Xiong, CEO of Quixgen.

DR. XIONG: Yes.

MS. HART: Did I say that okay?

DR. XIONG: That's correct.

DR. SUH: I'll just shut this down (referring to PowerPoint)

MS. HART: Thank you.

DR. XIONG: So I'm thrilled to have the opportunity; to speak on this panel. And I agree with most of our colleagues in their big picture assessment of the New Jersey state, in terms of the biopharma environment. And I'd like to just focus on a narrow, small one because our company just started, just one year ago. And we are aspiring to be one of those early graduates from CCIT.

So we started the company-- Me and my partner worked at a large pharma for many years. And at the end of 2016, we came out and we started our own company doing drug discovery. So we looked at places -- at several places in New Jersey, and looked at one place in Pennsylvania. And we were really happy that we made a decision to come to CCIT here.

The one primary reason was the environment; the environment of an ecosystem that's very convenient for innovative, small companies. We cannot do everything in our small company, so we basically contract out many of our activities. And many of those activities we actually contract out just locally, near us. One of our chemical synthesis companies that we work with is down the road on Route 1. So I have a daily interaction with them -- a phone call, or visit them, and they may-- We designed the compound they made for us.

Another company that does the bioanalytical work that our samples are from -- animal samples of our cell samples -- we send it right away without delivery services. We just drive it to there -- down Route 1 again. They gave us data and a lot of the troubleshooting -- there's nothing routine there -- a lot of the troubleshooting that we work with. So again--

Another great facility is the Rutgers University Animal Facility that they use to support their faculty for their research, but they are open to us through the coordination by CCIT. We work with them; we have set up a very, very convenient collaboration. So they provided an animal for us, and we -- animal husbandry, everything. And we go there and use the animal any time we want to; we collect sample, come back to our lab to do processing, and then send it to the analytical our little company. So the whole process of turning around data is a lot faster -- faster than when I was in Big Pharma. A lot of the problems can be solved immediately if you have some idea you want to test -- like, say you drive to Rutgers to do the study.

So all these are the result of a great infrastructure that was left in New Jersey, likely due to the presence of large pharma -- before the whole ecosystem; so all these are all related. So if you look at -- the previous panel mentioned about the employee base, the workforce that they have. And I would add to that, there are a lot of small companies that provide service to the innovative companies, and that's also an important part of this system.

Another thing is about the policy-wise -- the Angel Investor Credit. And that was very instrumental in that we were able to -- we calculated that, so we knew we could put it back -- all those credits -- right away, to the company.

One thing I would suggest to that -- another program like the loss cumulation that can convert it into tax credit. The definition of those -- the qualification criteria is more written in the language for a company that has a real product. You need a revenue stream, etc. For a drug discovery company, there won't be any product until FDA approval -- many years down the road. So for many years there won't be any tangible

revenue because everything is a loss. So I would recommend that you revisit the language for that legislation to see if the -- not the service company, they do have a fitness model; but the innovative drug discovery company -- that somehow they could also benefit from this program.

One more thing that I would propose that this Committee take back and see -- it's a small suggestion. One of the big things I felt different, leaving a big pharmaceutical company and coming to start on your own, is the access to literature; the information--

SENATOR GREENSTEIN: Access to what?

DR. XIONG: The literature -- the scientific publications. It's very expensive for a small company to subscribe to Elsevier, which was just mentioned -- the big publishers. It's a big deal for a company that tries to discover a new drug -- you need to stay in the forefront of the scientific development. So I would suggest that New Jersey, BioNJ, or through one form or another, have a syndicate group subscription -- either in conjunction with a university or some sort -- to allow us a cheaper access to the literature, journals, and perhaps even drug discovery business type of a data bank that we could access.

So I would say this is probably what you can do, also, that will benefit many of the small start-up companies.

MS. HART: And actually, to your point -- a few years ago, there was something offered through the Legislature, through the State Library, that bought a subscription; and companies had access to it. And that went away, I think at the same time that the Commission of Science and Technology. But perhaps that's clearly something that we could work

into the report, and maybe it's something that is a low price point and we could -- the Legislature could recreate.

SENATOR GREENSTEIN: Well, I think it's a great idea to do group buying for these very small companies and innovative companies, when you can. Maybe there are ways of setting up a kind of cooperative to make it easier. It's silly to reinvent the wheel -- everybody buying literature.

MS. HART: We do have that through BioNJ. We do have, actually-- There's something -- I don't want to do a commercial for BioNJ, but we do have something to subscribe to *Nature*. But this was a resource that was State offered, again, a few years back. And it was free access, actually. So BioNJ -- you used to still have to pay, but you got a reduced rate.

MS. HASSETT: Debbie, if I may -- that is the intent of the New Jersey Research Asset Database. It will have a public portal; and right now, the legislative appropriation of $1.5 million is essentially for the creation of the database; and 5,000 subscriptions that we are working with the five research universities on apportioning. So as we build out that database, beginning with the academic research and then building into the industry assets in terms of incubators, equipment -- whatever it may be -- that will be a bit a challenge. The support--

SENATOR GREENSTEIN: But that doesn't exist now; you're just working on it.

MS. HASSETT: We're right in the midst of it; yes.

So by year end, you know, our hope is that the academic research will be linked with a public portal; and the economic development

assets and the industry assets will grow, over time. And the challenge will be just for the annual subscriptions to keep that up.

MS. HART: Will that go, Maureen, beyond just New Jersey -- published papers, research, etc.? I mean, will they have access, or is there a way to get access to the whole world of data, and papers, publications, etc.?

MS. HASSETT: Right; yes. I'll ask the expert, Eli Khazzam--

MS. HART: Well, there you go.

MS. HASSETT: --who is the Program Manager.

MR. KHAZZAM (EDA Staff): (off mike) Yes, Debbie, I believe there will be-- The entire Scopus, for example, archive will be accessible for everybody everywhere. I am not clear on if you are not a member of Scopus, for example, and you are trying to follow through with what the database will give you -- you know, a complete listing of that person, that individual, and all his or her publications -- I am not clear, if you ae not a member of Scopus, if you will be able to get past the paywall into that.

MS. HASSETT: Right; okay.

MR. LIZURA: Well, maybe we can ask Deb to do some research.

MS. HART: Well, that will be-- Yes.

ASSEMBLYMAN SCHAER: I think that would be very common sense to do.

MS. HART: Okay.

ASSEMBLYMAN SCHAER: Because obviously we don't want to have an artificial barrier or some companies establishing--

MS. HART: Questions for Dr. Xiong?

MR. LIZURA: Just one question.

So you still work at Merck?

DR. XIONG: No.

MR. LIZURA: Oh, did you say-- What did--

DR. XIONG: We left Merck; yes, we left Merck.

MR. LIZURA: You *used* to work at Merck.

DR. XIONG: Right.

MR. LIZURA: Is there an impediment to capitalizing on more of the talent that is at Big Pharma to spin out their own companies? So historically, I think, one of the big differentiations -- and I'll propose this; you can say if it's true or not -- historically, people would leave Merck in New Jersey -- because we were blessed with the entire pharmaceutical community -- and they would go to Pfizer, or they would to Bristol-Myers Squibb. In California, where there was this entrepreneurial community, they would leave -- what's the big one out there? Eli?

MS. HART: Well, I mean--

MR. LIZURA: The big pharmaceutical company?

DR. XIONG: Genentech?

MR. LIZURA: Genentech. And they would go create their company. They wouldn't go to -- from an industrial company to industrial company, if you will; or institutional company to institutional company. They would-- So what could New Jersey do to better foster that kind of spin out of intellectual talent to company generation?

DR. XIONG: Like the Legislature-- Like the Angel Investor Credit; I wasn't aware of that. And increase that will clearly facilitate the people who are leaving the Big Pharma to start on their own.

MR. LIZURA: Okay.

DR. XIONG: Another thing is that things are changing now, so when you leave Merck, you are not going to Pfizer; not anymore. They are -- they realize that -- that the opportunities are outside the Big Pharma. And in fact I've got my previous friends contacting me, "How is the CCIT?" They are interested in the CCIT.

So these are old-time; but the new trend is actually for them to actually to strike out. I'm just one of them; I've seen quite a few of my friends go out on their own. Although some are going to small -- there are many going to Boston to work for a small biotech.

MS. HART: So is there anything we can do here in New Jersey to encourage them to do that here? And then, you know, we phrase it another way: So in California, you have a layoff, and you get business plans; in New Jersey, you have a layoff, you get résumés (laughter). And we do believe that it stems from -- you know, a long-time career in Big Pharma, you didn't have to worry about it. But, please, I'm glad to hear the trend is changing -- how do we keep them here?

DR. XIONG: It's very -- it's hard for me to say exactly. I know what I was thinking. I had had enough of the big company's bureaucracy; I will say it out loud. I think a small company definitely has the advantage of turning things much faster.

The one thing -- the major issue was the making available angel investor or the funding.

MS. HART: Excuse me; you know what? Do you mind moving your microphone a little closer to you? I think -- it looks like we're having some trouble getting you; no problem.

DR. XIONG: Right.

MS. HART: Even closer, if you wouldn't mind.

DR. XIONG: Yes.

MS. HART: Thank you; thank you.

DR. XIONG: One of the major concerns that when I left the company was she access to capital; yes.

For -- not a lot -- for many of the people who had an experience in the Big Pharma, this is the thing that they are not familiar with -- they don't know how to access it. As I was learning still; I'm still learning. So if you made that available, instead of like CV/résumé signing (*sic*) to other people, if you come to -- instead of a job fair, rather a VC Fair to educate the scientists where to access capital that will help them to start.

DR. SUH: Again, I would like to reiterate bringing doctors and end-user to some BioNJ-promoted or hosted conference or something, as the Senator mentioned, and create that infrastructure environment so that there is input from the end-user point of view. You know, don't make some device for 10 years, thinking that it's the best of the world. You bring it to the hospital -- and we reject it in 5 seconds. We don't need that. You know, you obviously do not understand what the reimbursement (*sic*) is willing to pay for it, and you make that device but nobody is going to pay for that.

So I think that's one of the key points: capital. But you also need all that input. So creating that special environment will out-compete any state, I think, if you could create that environment to keep them here, educate them here, and make the product together with doctors and the end-users.

MS. HART: Please, yes.

ASSEMBLYMAN DePHILLIPS: In addition to incentivizing people like you to stay here -- it's great when you decide to stay here, but is there also something we at the State level can be doing to expedite commercialization? Because, I mean, Debbie mentioned at the beginning of the program -- it still takes, what, 10 to 15 years to bring drugs to market. I mean, billions of dollars of investment, and it's an incredibly slow and laborious process. And maybe you too, Doctor, can comment on this.

Is there something we can do at the State level in New Jersey to expedite this; or is this just a global issue, it's a Federal issue, and beyond our control in the state?

DR. XIONG: In the early stages, yes you can do -- providing a good infrastructure to speed up the pre-clinical stage. Once it's in the clinical stages, it's a Federal issue. The FDA dictates all the processes.

ASSEMBLYMAN DePHILLIPS: Okay, so in the pre-clinical stage, what can New Jersey do?

DR. XIONG: In the pre-clinical stage-- For us, our experience was a lot of small companies provide the services; that's a great plus to us. And other than that is access to the capital; and also we do have a very good employee base here. You don't have a problem finding qualified people to work with you.

ASSEMBLYMAN DePHILLIPS: Any comment?

DR. SUH: I think the hundred hospitals in the State of New Jersey -- the doctors should know what pre-clinical studies are coming on board. That would really enhance the process. If you're in the pre-clinical stage and you're using an animal modeled to do the drug testing, I think doctors should know, way before, that actually the study's done so that we

know that there is something coming up, so that we could open up a Phase 0, Phase I; being ready for that pre-clinical stage study to be finished. And if the data is good, that they could come right onto Phase 0 or Phase I, so that kind of streamlines the process. That would enhance--

ASSEMBLYMAN DePHILLIPS: I have a follow-up to that.

So it sort of gets back to a question I had when you were speaking. Where should the research and innovation be taking place on that issue? Should that be at the university setting, should that in the hospital setting, should that be in the pharma companies themselves, in a lab? Where?

DR. SUH: In the era of the Fourth Industrial Revolution-- You know, the First Industrial Revolution, out of England, until the Second Industrial Revolution, lasted 120 years. Second to Third Industrial Revolution lasted 80 years. Third to now -- which is the Fourth Industrial Revolution, started about 5 years ago -- it lasted 50 years. The Fifth Industrial Revolution will come, I think, in about 20 years. It's moving so fast; if we don't prepare ourselves and get it set up, it will be overwhelming.

Therefore, I think it should (*sic*) be partitioned. It should be government, it should be industry, it should be academia. We should create an environment where we should always be boiling something together and cooking something together. It should not be separate anymore. We should approach a brand-new setting that's highly innovative, highly communicative, and there has to be some pot in which we can cook something together.

ASSEMBLYMAN DePHILLIPS: Marco wanted to make sauce before; so we're in good shape. (laughter)

MR. LIZURA: It's lunchtime. (laughter)

SENATOR GREENSTEIN: How is the communication now; how do doctors find out when clinical studies are done, how is that communicated now?

DR. SUH: Maybe with a conference and you find out something was done, and--

SENATOR GREENSTEIN: But you may not know--

DR. SUH: Which we may not know. And we find it when all the studies are done, and they spend one year writing a manuscript; it's finally published, maybe a year-and-a-half later. So, you know, that's the gap.

And whoever catches up to that gap and shortens it becomes the winner. And the more you set up the better environment, the faster we can streamline it.

SENATOR GREENSTEIN: It's a little dicey that you find out -- I mean, you might or you might not.

DR. SUH: You might not. You find out from your colleagues,

MS. HART: Maybe there are--

Please.

ASSEMBLYMAN DePHILLIPS: Yes, just a follow-up.

So being a resident of Bergen County, we're blessed to have Hackensack Medical Center; I'm sure the Assemblyman would agree. And it's also the place where all four of my children were born. So I have very good feelings about the University Medical Center and everything that's done there, in terms of research and investment.

My question is, how many people are -- how many people like you exist at Hackensack who are advancing these ideas about innovation and research and then collaborating with biotech? I mean, I love what you're saying, but how extensive is that effort?

DR. SUH: I think Dr. Pecora, who is the top of the line -- the leader -- who is pushing this forward, with Bob Garrett's leadership at Hackensack Meridian -- they are trying, but we're still lacking infrastructure. You know, you could try from up here (indicates), but you literally have to do something to bring us together. And there's nothing to bring us together at the moment.

Doctors are meeting separately; researchers, and basic scientists, and whatever -- academia -- they are meeting separately; I'm sure the policymakers meet separately. We never come together -- and, maybe, Task Force, maybe through BioNJ -- maybe you should set up a two-night, three-day conference where we come and we just cook together. (laughter)

DR. TAGLIETTI: I think, actually, you asked a very good question -- which is, how many of these doctors are in a hospital setting. And it's interesting to see that that can be a cultural aspect.

One of my children is in Boston; actually, he lives in Cambridge. And it seems there is something in the water or in the air there -- he finished college, and the first thing he did was go to France and (indiscernible). And he failed, by the way; but that's okay. (laughter) But the point -- he tried. And he is now thinking about the second one.

And I think you're on to something, thinking, how can we create a culture where more doctors, when they are in the hospital -- of course, they think about treating patients, but (indiscernible) think about,

"How can I change the treating of patients?" And maybe -- which I don't know how many either in Hackensack or a Robert Wood Johnson with this attitude. I'm just wondering--

ASSEMBLYMAN DePHILLIPS: Well, maybe Debbie can give us advice on that; I mean, in terms of collaborating with the Medical Society and the Hospital Association in the state, with BioNJ. Maybe that's underway; I don't know, I'm brand-new.

MS. HART: It's not, but certainly I wrote it down as an opportunity.

ASSEMBLYMAN DePHILLIPS: Yes, absolutely.

DR. TAGLIETTI: I think it's a good question.

DR. SUH: There is no state that brings all this together yet, as far as I know. If the State of New Jersey becomes the first one to bring all this together, and sets up such a unique constructive, innovative infrastructure, I'm absolutely sure that we'll be, really, putting a rocket on our wings.

MS. HART: The other thing that I'd like to just get on the record -- and we are at the end -- I think we're going to give the Assemblyman the last word; I think he had his hand up. But one of the things I would like to see happen -- and we did a white paper on it about a year or so ago -- we need more clinical trials in New Jersey. So what can we do to affect that? And we had some recommendations in our white paper as well.

So Assemblyman, did you want to make another comment?

ASSEMBLYMAN DePHILLIPS: No, I'm fine.

MS. HART: Okay; anyone else who would like the last word? (no response)

Okay; okay; okay.

I cannot thank you enough for being here.

SENATOR GREENSTEIN: Thank you.

MS. HART: The level of engagement is extraordinary.

Thank you to our Task Force. Clearly, I think we have our work cut out for us, but I think we're up to the task.

The next steps will be -- we will be discussing-- Clearly, we have six hours of testimony that will be whittled down into a paper with some recommendations. We will be continuing the conversation; as I mentioned, we're taking additional written testimony through the end of February. We're expecting to issue a report the end of March, somewhere thereabouts.

And then one of the other things that we had talked about yesterday -- that didn't come up quite so much today, but a little -- is, you know, what are other ecosystems doing and how have they gotten to where they've gotten. And we had discussed the possibility of maybe hearing from one or more of them. So I promise you that we will continue that conversation.

And so I encourage you to continue to be engaged with us, with each other. Thank you for your tremendous ideas, and all your time, and your passion around this.

Thank you; and safe home, everyone, And I hope to see you at our annual meeting next Thursday. (laughter)

Thank you.

(SECOND-DAY MEETING CONCLUDED)