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FUELING LOCAL ECONOMIES: RESEARCH, INNOVATION, AND JOBS

HEARING

BEFORE THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

JUNE 29, 2010

Printed for the use of the Joint Economic Committee

U.S. GOVERNMENT PRINTING OFFICE

57–986 WASHINGTON : 2010

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

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FUELING LOCAL ECONOMIES: RESEARCH, INNOVATION, AND JOBS

TUESDAY, JUNE 29, 2010

CONGRESS OF THE UNITED STATES,
JOINT ECONOMIC COMMITTEE,
Washington, DC.

The committee met, pursuant to call, at 10:01 a.m. in Room 106 of the Dirksen Senate Office Building, The Honorable Carolyn B. Maloney (Chair) presiding.

Representatives present: Maloney, Hinchey, Cummings, Snyder, Brady, and Burgess.

Senators present: Klobuchar.

Staff present: Andrea Camp, Gail Cohen, Colleen Healy, Jessica Knowles, Ted Boll, and Robert O'Quinn.

OPENING STATEMENT OF THE HONORABLE CAROLYN B. MALONEY, CHAIR, A U.S. REPRESENTATIVE FROM NEW YORK

Chair Maloney. The meeting is called to order. I understand Mr. Brady is on his way, but I have also been told that we must break at 10:30 for votes, so I think it is important that we start on time and move forward with this important hearing. I welcome all of our panelists today and thank you so much for coming.

I just have to note that I spent the last week in this room on the Financial Regulatory Reform Bill, so I hope there will be more agreement today in moving forward than we had in the debates last week in this same room.

I am very pleased to hold today's hearing on the role that innovation has on fueling employment and growth in local communities. This Congress is continuing an innovation agenda in order to rekindle growth and prosperity in the United States.

One important part of this agenda is the reauthorization of the America COMPETES Act, which passed in the House of Representatives on May 28th. This legislation will help fund universities and ensure U.S. competitiveness in the global economy.

Recently the JEC issued a report on the importance of federally funded basic research. The report shows that basic research—research which contributes to our fundamental stock of knowledge—is an important component of research and development and can have a large impact on productivity.

The private sector under-invests in basic research because the returns from these investments are often smaller than the returns to the economy as a whole. Yet this basic research is critical to the private sector. Investment in basic research is a mechanism for spurring precisely the innovation that business leaders, academics,

and policy makers have identified as critical for our nation's economic growth.

The Federal Government funds almost 60 percent of basic research in the United States. The innovations that have improved the country's productivity and quality of life flow directly from these investments. The technology improvements created from basic research have played an important role in enhancing the productivity of businesses and workers, and have spurred new job-creating industries such as the biotechnology sector.

Basic research occurs at universities across the United States. This partnership between the Federal Government and universities helps to form an entrepreneurial ecosystem that benefits the local economy by creating jobs and spurring economic growth.

The Science Coalition recently released a report that shows the tremendous return on the Federal investment in university-based basic research. Their report is a dramatic demonstration of the economic impact that these research universities have on the local community and it highlights a key fact: companies that grow out of university research often locate very near those universities. These universities are often the biggest employers in the community and serve as business incubators that drive new companies.

Equally important, universities and their communities foster creativity, talent, and ideas, which lead to the next generation of businesses and innovations that will drive the new economy.

I am pleased that this partnership between universities and businesses is represented by two New York witnesses, Dr. Stanley and Mr. Shulman, who can illustrate how these synergies are working across New York State.

As our economy starts its recovery from the tremendous blow of the "Great Recession," it is important to remember the role that entrepreneurs and innovation have in spurring growth.

I am very sorry that Dr. Litan is ill and is unable to deliver his oral testimony today. I was especially eager to continue our conversation on strategies to promote the next generation of innovation in the United States.

As some of my colleagues may recall, when Dr. Litan testified before us last December on financial regulatory reform, he also mentioned that a job creator's visa should be considered by Congress as a way of creating jobs without any additional cost to the Federal Government.

A few months later, Senators Kerry and Lugar created legislation that addressed this issue: The Start-Up Visa Act of 2010. Inspired by Dr. Litan's testimony, I recently introduced the Kerry-Lugar bill into the House of Representatives. I am happy, however, that Dr. Litan's co-author, Mr. Stangler, is here in his stead.

I am eager to discuss with our panel additional ways that Congress can make sure that we regain the innovative and dynamic economy that we once had.

I welcome each of you, and I look very much forward to your testimony and a conversation on ways to create more jobs and innovation in our great country.

I now yield to Mr. Brady.

[The prepared statement of Representative Maloney appears in the Submissions for the Record on page 32.]

OPENING STATEMENT OF THE HONORABLE KEVIN BRADY, A U.S. REPRESENTATIVE FROM TEXAS

Representative Brady. Thank you, Madam Chairman. I am pleased to join in welcoming the witnesses before the Committee this morning.

Since its founding, the Republican Party has been committed to supporting higher education and scientific research. Back in May of 1862, President Abraham Lincoln signed legislation creating the Department of Agriculture to conduct ag research and disseminate its findings to farmers.

On July of the same year, President Lincoln signed the Morrill Land-Grant College Act. Sponsored by U.S. Representative Justin Morrill, this Act endowed public colleges in each state with the proceeds of all federal land sales. These land-grant colleges grew into great state universities that have educated millions of Americans and conducted a majority of our basic scientific research over the decades.

In July of 1958, President Dwight Eisenhower signed the National Aeronautics and Space Act, creating NASA. In his 1970 State of the Union Address, President Richard Nixon committed this country to a "war against cancer" to find treatments and cures for this dreaded disease. And Federal funding for the National Institutes of Health grew by 181 percent from 1996 to 2007 under Republican Congresses.

By definition, basic scientific research doesn't have an expected immediate commercial application. However, the "Sparking Economic Growth" report from the Science Coalition provides empirical support that Federal funding of basic scientific research generates real economic benefits.

Basic scientific research leads to new discoveries and technological breakthroughs. Entrepreneurs can commercialize these discoveries and breakthroughs by establishing new companies, creating new products and services, and employing thousands of workers in highly skilled, well-paying jobs. This scientific and technological entrepreneurship keeps American firms at the cutting edge of the global economy. And in turn, these new companies and their workers pay millions of dollars in Federal income and payroll taxes.

Supporting basic scientific research is an appropriate role for the Federal Government. Unlike so much of Federal spending that proponents mislabel as an investment, supporting basic scientific research is a real investment that produces substantial returns for American taxpayers over time.

In this context, I am troubled by President Obama's short-sighted decision to cancel the Constellation Program designed to develop new launch vehicles and spacecraft capable of reaching the Moon and Mars.

Human space exploration drives technology that makes the United States more economically competitive. Life science research with astronauts has spurred breakthroughs in the detection and prevention of cancer, heart disease, and osteoporosis. De-funding the Constellation Program will harm the U.S. economy.

I am also troubled that this Congress has allowed the research and development tax credit to expire. Congress enacted the R&D

tax credit in 1981. Seeing the benefits of our tax credit, other countries have mimicked us by enacting more generous R&D tax credits. By 2004, the U.S. had fallen to 17th place in R&D tax benefits among our major member competitive countries.

The U.S. competes with other developed countries for R&D spending by multinational companies. Corporate R&D creates some of the highest-skilled, best-paid jobs. We want corporations to conduct their R&D in the United States to strengthen the long-term competitiveness of our economy. We should be enhancing the R&D tax credit and making it permanent. This Congressional inaction is incomprehensible.

Turning to today's testimony, Dr. Litan cited a number of bureaucratic difficulties that inhibit the commercialization of discoveries and technological breakthroughs from basic scientific research at universities.

First, he described a major weakness of the peer review system; that is, some established academics abuse peer review to squash the research that is contrary to their own views or that is viewed as outside of the box.

The most recent example of peer review abuse is the scandal at East Anglia University when some climatologists tried to suppress research that contradicted their notion of man-made global warming. I am interested in Dr. Litan's views, or Mr. Stangler's views, on how to prevent peer review from becoming a closed "old boys' club" that suppresses innovative thinking.

Second, he raised the issue of the centralization of licensing at universities. No single university bureaucracy is likely to have all the necessary knowledge to commercialize the varied discoveries and technological breakthroughs that may occur at a major research university. I am interested in suggestions of the panel today for introducing competition into the licensing process to speed commercialization.

Third, I am also interested in the ideas of prizes to incentivize the development of innovative ways of commercializing university research.

I look forward to hearing today's testimony. I am very pleased that Chairwoman Maloney called this hearing on a very interesting topic, and I yield back.

[The prepared statement of Representative Brady appears in the Submissions for the Record on page 32.]

Chair Maloney. Thank you very much.

Now, Mr. Snyder is recognized.

[No response.]

Chair Maloney. Mr. Cummings.

OPENING STATEMENT OF THE HONORABLE ELIJAH E. CUMMINGS, A U.S. REPRESENTATIVE FROM MARYLAND

Representative Cummings. Thank you very much, Madam Chairwoman, and I appreciate your calling this hearing, especially in light of the fact that we will receive statistics regarding the employment situation for the month of June this Friday.

According to an update provided by the Bureau of Economic Analysis last week, the Gross Domestic Product increased at an an-

nual rate of 2.7 percent in the first quarter of 2010 from the fourth quarter of 2009.

While this is a much needed improvement to the overall stability of the United States' economy, it does not necessarily translate directed into job creation, which is desired by our constituents and needed for a full economic recovery.

For the month of May the employment situation improved by adding over 430,000 jobs, edging down the unemployment rate to 9.7 percent. We are on a path to recovery, and others would say that it is not moving at the rate that we want it to because a large percentage of those jobs were in the public sector.

The Democratic-led Congress and President Obama have created—or saved nearly some 3.5 million jobs through the stimulus legislation. To build upon this success, the House on June 16th passed two vital pieces of legislation to create hundreds of thousands of jobs on Main Street by expanding lending to small businesses and offering tax incentives to help small businesses grow, hire, and fuel our economy.

H.R. 5297, the Small Business Jobs and Credit Act, and H.R. 5486, the Small Business Jobs Tax Relief Act, will provide nearly $300 billion in loans to small businesses, and $2 billion for innovative state lending programs supporting small businesses.

Additionally, the HIRE Act, signed in March, is creating some 300,000 jobs by rebuilding America's infrastructure and giving tax credits to businesses that create jobs, and closing loopholes that allow corporations and the wealthy to hide income offshore.

However, we must continue to look for new and creative ways to employ and train the 15 million unemployed people, and to prepare for the millions who are expected to enter the workforce over the next five years.

Therefore, the hearing we are having today about the positive impact of federally funded research through university grants on communities and the potential for economic growth is very timely.

I have the honor and privilege to represent Baltimore City, which has many wonderful universities dealing with research. We have the very prestigious Johns Hopkins University smack dab in the middle of my District, and the University of Maryland Professional Schools also located in the middle of my District.

Johns Hopkins, a preeminent institution that often leads the Nation in the total amount of support dollars received by the Federal Government. In fact, nearly 85 percent of the research funding received by Johns Hopkins is support by Federal research dollars. This translates directly to the creation and maintenance of 5,700 full-time jobs at Hopkins.

I might note that 20 years ago our number one employer was Bethlehem Steel in my District, and today it is Johns Hopkins.

Additionally, scientists and physicians at Hopkins have competed for and so far won nearly $200 million in research funds from the stimulus bill already. This money will be spent over several years, but has already brought Baltimore 151 solid, well-paying new Johns Hopkins staff jobs for research technicians, biostatisticians, research nurses, programmers, and others.

Other educational institutions in my Congressional District are making great strides as well. Coppin State University just received

a million dollars from the Department of Commerce to establish a computer center that will provide access to broadband services and offer numerous training and educational courses and online resources. The Center will offer a total of 15 training and educational courses on a regular basis which will provide a wide variety of opportunities for the entire family in computer and broadband instruction, job training and creation, health information, and education, and education more generally.

Together, the new infrastructure and instructional resources offered by the Center will not only stimulate greater and more efficient use of broadband services, but will also create and save approximately 5,500 jobs, provide a better-educated workforce, improve schools, and help people be more globally competitive businesses and schools and greater financial stability.

Federal programs have also provided nearly 100 jobs at Morgan State University and have sustained 22 jobs in Baltimore City.

And so, Madam Chair, I look forward to hearing from our panel and I thank you for calling this hearing. And with that, I yield back.

[The prepared statement of Representative Cummings appears in the Submissions for the Record on page 33.]

Chair Maloney. Thank you so much. Dr. Burgess.

OPENING STATEMENT OF THE HONORABLE MICHAEL C. BURGESS, M.D., A U.S. REPRESENTATIVE FROM TEXAS

Representative Burgess. Thank you, Madam Chairwoman.

This is an important hearing that we're having today. It is likely to highlight some of the differences that exist on both sides of the dais, and perhaps even some of the differences that exist within our own sides: The proper role of government funding in scientific research.

The issue has never been more timely. The Majority, the Democrats, are allowing a number of critical research and development tax credits to expire by refusing to compromise on other tax issues, the tax extender bill that should otherwise be enjoying bipartisan support. But the Majority's refusal to acknowledge the economic constraints in which we find ourselves as a Nation and pay for the spending that is in that legislation.

Now for a long time, certainly I felt that the proper role of government in funding research and development and a host of issues for medical research, to energy policy, is when the government removes impediments towards advances in science and technology. And sometimes that means providing some measure of tax relief.

The government funding that inherently comes with strings attached really wasn't needed in the field of cellphones. The private market drove those innovations, and today we have smaller, sleeker cellphones being released every month. I shudder to think what would have happened had the government been in charge of that. Those big, boxy, clunky things we had back in the '80s might still be the state of the art.

Now all the work done at the National Institute of Health that has been done on genetics and personalized medicine, with the mapping of the human genome, is the real promise for medicine in the future. Government funding was the first step. But now it cer-

tainly is the private sector that is moving faster and faster than the government. It is clear that at least in the issue of genomic medicine government funding was necessary to get the ball rolling, and will be necessary in its initial development phase.

Few in the private sector had the stomach to venture into the previously uncharted territory of genomics, and the government initiated the research. But it will no doubt lead to the private sector in spurring the private sector to actually develop and deliver on that promise.

I was not a Member of Congress during the 1990s. I was just a regular guy. But the Congress of the late 1990s, under the leadership of Speaker Gingrich, when the Senate failed to pass a balanced budget amendment by one vote, they decided to get to work and play like there was a balanced budget amendment and worked toward a balanced budget in the House of Representatives.

But at the same time, they assigned priorities. We know the history shows they were successful in achieving that balanced budget, but they did assign priorities. Because in those same years that they achieved a balanced budget in two years when they thought it would be seven, and the Administration said it would be ten, they assigned priorities. They doubled spending at the National Institute of Health.

So it is possible to control Federal spending and fund those areas that are a priority for our future, to make those investments that are a priority for our future.

The other instance that I would reference would be the development of what's called "hydraulic fracturing" in the tight-shale, alternative shale formations. It's certainly been an economic blessing in my part of the world in a shale formation known as the Barnett Shale. It protected our area from the Recession for a full year. The country entered into a Recession in December of 2007, but it was really December of 2008 before we really felt that in Fort Worth, Texas, and that's because of the energy activity that was going on because of a Federal research and development grant from 15 years prior that allowed the development of that as an energy resource.

And now it has changed the equation and changed the discussion about energy production in this country, because so many of these formations exist around—within our Continental United States.

To be sure, we have to be careful about the environmental impacts, as we now benefit from the economic impacts, and that is an issue that will continue to require work, and will continue to require some Federal involvement. But the Federal Government planted the seed with research and development 15 years ago, and the private sector took off and developed the resource.

So Federal funding can be an important part of finding a solution to a number of the world's problems, but too often we put such a reliance on government spending, and then we kind of forget that the private sector really can do a better job at some of these issues than the Federal Government. And we end up picking winners and losers.

I would just reference what's going on now in the field of electronic medical records—probably not part of this discussion because it was in the stimulus bill—but almost everyone carries a Smartphone nowadays. The Smartphone is the platform. Why don't

we allow the applications to be built for medical purposes around the platform that already exists? Instead, we have the National Coordinator for Health Information Technology, or the Office of the National Coordinator, developing this extraordinarily complex set of rules regarding meaningful users, and meaningful use, and we may find that we end up with less use than we would have gotten had we simply developed the platform and then gotten out of the way.

But anyway, I look forward to hearing our witnesses today, and I will yield back the balance of my time.

[The prepared statement of Representative Burgess appears in the Submissions for the Record on page 35.]

Chair Maloney. I thank my colleagues for their testimony and for being here today. And before I introduce today's panel, I would like to acknowledge and thank Senator Gillibrand from New York for her Summit on Innovation with the presidents of universities in New York State. Out of this research came many good ideas that were part of the formation of making this hearing happen today. So I wanted to acknowledge her contribution.

I would also like to welcome our first panelist, Mr. Dane Stangler. Mr. Stangler has graciously agreed to testify in place of Dr. Robert Litan, who has submitted written testimony but was unable to be here today due to illness.

Mr. Stangler is a Research Manager at the Kauffman Foundation. In that capacity, he provides research and writing on a wide variety of subjects, including entrepreneurship and urban economics. He also initiated and manages the Kauffman Foundation Research Series on Firm Formation and Economic Growth, and contributes to the Blog: Growthology. So we'll all have to check out that blog.

And now I'd like to introduce Dr. Samuel L. Stanley, Jr. Dr. Stanley is the president of Stony Brook University. Stony Brook University is known for its prestigious research and integration of research with undergraduate education. He is a university president, as well as a preeminent scholar on infectious diseases.

And finally I would like to welcome Mr. Zachary Shulman. Mr. Shulman is a managing partner at Cayuga Venture Fund, a venture capital fund located in Ithaca, New York. Mr. Shulman also teaches courses on venture capital and law for high-growth businesses at Cornell University.

Thank you very much, and we'll begin with Mr. Shulman. You are recognized for five minutes. Please give your testimony and put the rest into the record so that we will have time for questions. Thank you for being here.

STATEMENT OF MR. ZACHARY J. SHULMAN, SENIOR LECTURER OF ENTREPRENEURSHIP, THE JOHNSON SCHOOL, CORNELL UNIVERSITY; MANAGING PARTNER, CAYUGA VENTURE FUND, ITHACA, NY

Mr. Shulman. Thank you very much.

Good morning and thank you for inviting me to testify before your Committee. My name is Zachary Shulman. I am a Professor at the Johnson School at Cornell University. The Johnson School

is Cornell's Business School. I am also a Managing Partner at the Ithaca-based venture capital firm called Cayuga Venture Fund.

As you may know, Cornell ranked number one in New York State and number 15 overall in U.S. research spending in 2008. I would expect similar results for 2009. Fortunately, the spillover effect on employment and company growth in the Ithaca region is real and measurable.

I can speak from experience as my Venture Fund invests significantly in companies commercializing Cornell-developed technologies. In my view, the partnership between government-sourced research dollars, Cornell University, and my venture fund is a model that should be replicated in smaller cities throughout the U.S. that have a strong research university.

The partnership, as I will explain, leads directly to real products in consumers' hands, job creation and retention, and direct economic growth in terms of revenue base—I'm sorry, revenue generation, payroll, and tax base. Let me give you some numbers to consider.

My current venture fund has invested in 11 companies; 7 of the 11 are commercializing technologies developed at Cornell. Additionally, 2 out of the remaining 4 have significant grant collaborations with Cornell. Thus, 9 out of the 11 companies have a real Cornell connection. These 9 companies currently employ over 450 people, and that number is growing. The payroll for these companies is in the tens of millions.

Likewise, in 2009 these companies generated revenues of over $95 million. And, importantly, these companies have garnered over $300 million in total investment from VCs like my own fund.

We are a small fund in a small community, so you can do some quick extrapolation to measure the potential impact for other regions.

Startup companies mean more jobs, more payroll, more revenue, more tax base, and more dollars invested. Smaller communities feel a relative impact of such drivers of economic growth to a greater degree.

So the key question that I have can be framed this way: How is Cornell involved besides just being a research engine?

Critically, Cornell supports the entrepreneurial community by being a significant direct investor in my venture fund. This is the true essence of the partnership. Cornell is partnered with the government in terms of the receipt of research dollars. Cornell is partnered with faculty in terms of the creation of intellectual property. Cornell supports the tech transfer function related to that intellectual property. And then, given its desire to see that research commercialized, engages in post-research activities that foster company creation and sustain growth.

On the company-creation side, Cornell tech transfer works with entrepreneurs, including some faculty members, to vet technologies, look into commercial viability and market needs, and then licenses technologies to startup companies. Without the tech transfer function, the innovation culture would stagnate completely.

On the sustained growth side, there's no mystery that startups always need more capital to start and grow. Some are funded by SBIR/STTR grants. That's productive but not nearly enough.

Without committed seed stage investors, both venture capital firms and angel investors, startups would in most cases die. Cornell has taken the critical step of investing via its endowment in our venture fund. This allows us to attract additional investors into our fund—for example, Cornell alums who care about startup creation, and who also care that Cornell is committed to startup growth—and, importantly as the numbers show, allows us to attract additional investment dollars into our companies.

Simply stated, without Cornell's investment in our fund, our model would be severely hampered and likely unsustainable.

In summary, entrepreneurial communities built around strong research universities have an advantage if those universities actually embrace the value that startup companies bring to the given locale.

In my view, the Federal Government should put into place directives for universities that receive Federal research dollars to invest in company formation. For example, a small portion of research dollars could be set aside for such investing activity. It does not take a large number of make a huge impact. Cornell has invested approximately $12 million in my current fund, and that has been leveraged into over $300 million of investment.

I have made some other suggestions in my written statement, and I will yield back to the Chair. Thank you.

[The prepared statement of Zachary Shulman appears in the Submissions for the Record on page 35.]

Chair Maloney. Thank you very much. Dr. Stanley, you are recognized for five minutes.

STATEMENT OF DR. SAMUEL L. STANLEY, JR., M.D., PRESIDENT, STONY BROOK UNIVERSITY, STONY BROOK, NY

Dr. Stanley. So, Chairwoman Maloney, Members of the Committee, thank you so much for the opportunity to testify before you today on this critically important subject.

The Chair mentioned in her initial remarks this report "Sparking Economic Growth" that comes from the Science Coalition, and again I would like to call the Committee's attention to this. It has some very impressive facts. It looks at the origin of a number of companies and finds that many of them had their origin in research sponsored at universities by the Federal Government, including companies like Google, Genentech, and others. And I think these provide a great opportunity and a great example of how much this kind of support has meant.

Those companies employ more than 100,000 employees, and have annual sales in excess of $100 million. So as Dr. Burgess was talking about, we can really identify the kind of benefit that has come from this kind of investment.

Stony Brook is a major leader in this area, and I think we—I hope—epitomize some of the things that Bayh-Dole means and how successful the implementation of that Act has been. Stony Brook is the leading technology transfer campus across the State University of New York system.

We are responsible for over 90 percent of the transfers and licensing revenues that came across that entire system during the last decade. This achievement consistently puts the State Univer-

sity of New York system, as well as Stony Brook alone, among the top 25 tech transfer campuses in the Nation, according to the reports of the Association of University Technology Managers, or AUTM.

Chair Maloney. Dr. Stanley, could you move the microphone a little closer?

Dr. Stanley. A little closer? Sure.

Our campus also consistently leads or ranks high in all of the other metrics of tech transfer performance: Invention disclosures, patent applications, issued patents, and executive licenses.

Our technology transfer program is selective: Approximately 60 percent of patent applications turn into issued patents, and we have been able to collect over $10 million in royalties annually that we plough black into research on our campus.

Whereas some universities focus on exclusive licenses, especially in biomedicine, we focus on ensuring that our technology gets out into the marketplace for societal benefit. In fact, one of our research patents has been licensed to almost 120 different industrial users.

The most successful of these licensed technologies formed the basis for ReoPro, which received FDA approval in 1994 and is still recommended for the 250,000 cardiac angioplasties performed annually in the United States.

Other drugs developed with Stony Brook include Periostat, the first systemic treatment for periodontal disease; Oracea, the only oral therapy available for rosacea; and Xiaflex, our newest drug, which is the first approved non-surgical treatment for Dupuytrens contractures. These drugs are the first four to receive approval from a SUNY campus.

As a New Yorker, I regret to say that the companies that manufacture these drugs are actually located in Pennsylvania, not New York, but as an American I am very proud to say that they have remained within the U.S.

Together, through our efforts, our company has led—our university, rather, has led to companies that have created more than 17,000 jobs, and created companies that have obtained more than $600 million in financing and increased corporate revenues.

So recognizing that my time is short, I want to refer you to my written testimony for details of some of the programs that have made a difference and helped Stony Brook succeed in this area.

I have to note that New York State Government has been very important, and an important proponent of this kind of industry academic partnership. And their investment has made a significant difference in this area.

I want to point out five lessons that Stony Brook has learned, in my closing statement.

The first is: There is no magic bullet, but there are best practices. Stony Brook and the Long Island region have benefitted from programs like the University of California-San Diego-UC Connect, and the efforts of the APLU's Commission on Innovation, Competitiveness and Economic Prosperity to spread best practices throughout the higher education community. And we applaud some of the Federal efforts in this area, including the "Innovation Ecosystem" component in the National Science Foundation Partnership.

In a speech—one thing that I think is very important to emphasize is that it's not just about technology licensing when you think about what universities can do. There was a famous speech that occurred from the Dean of Engineering at Stanford where he looked at what the major contributions were for Stanford to the region around in Silicon Valley.

He found that 15 percent of the revenues in Silicon Valley resulted from technologies licensed directly from Stanford, but 40 percent of the revenues were earned by companies that were started or populated by Stanford faculty or students but weren't directly related to university intellectual property. So universities are magnets for talent, and we make a difference, and don't just think of us in terms of licensing.

The second is just that point. It's about talent. Universities manage to attract talent. They manage to bring them to a region. They make a tremendous difference in regional economies, and investment really makes a difference in that area.

The third thing is about partnerships. One of the things we are working very hard to do is continue to find ways to partner in our region, to promote the kind of regional economic development. We partner with Brookhaven National Laboratory. So we develop private as well as Federal Government partnership for State institutions. We think this is vitally important.

And finally, two more points, basic research is critical. Innovation comes from discovery and invention. And as Vannevar Bush foresaw, the Federal investment in basic research makes the innovation frontier endless. Because basic research is inquiry-driven not objective-driven, we cannot tell in advance what the results will be. But 60 years of Federal investment has proven its value from the MRI, to LASERs, to the Internet; this is the inexhaustible fountain of youth for innovation, and we need to build it. This is one of the reasons I think that the COMPETES Act is so important for NSF, and I really encourage its reauthorization.

And finally, last but not least, Bayh-Dole Works. I think we are an example of it. It's been called by some the most important bill ever passed by Congress. And it continues to help our Nation maintain its lead in bringing innovation to people.

Thank you.

[The prepared statement of Dr. Samuel L. Stanley, Jr., M.D. appears in the Submissions for the Record on page 38.]

Chair Maloney. Thank you very much.

Mr. Stangler.

STATEMENT OF MR. DANE STANGLER, RESEARCH MANAGER, EWING MARION KAUFFMAN FOUNDATION, KANSAS CITY, MO

Mr. Stangler. Well thank you, Chair Maloney, and Members of the Committee.

Obviously I am not Bob Litan, so I apologize for any disappointment on that front. But I have the privilege of delivering his testimony today, so I will only briefly make some remarks based on the written testimony.

First, at the national level economic research has established beyond doubt that innovation is the most important driver of eco-

nomic growth. And in turn, Federal R&D support is crucial for innovation.

Moreover, innovation drives jobs. Since many of our most important innovations through history were brought to market by entrepreneurs. Since 1980, in fact new firms have accounted for nearly all net job creation in the American economy.

Second, at the local and regional level Federal R&D monies have important positive spillovers beyond the traditional multiplier impact of any government spending. Federal dollars help local communities by supporting the work of star scientists, those unique individuals who are not only great teachers and researchers but also successful entrepreneurs who launch new companies.

Companies launched re aided by star scientists, whose research typically is federally funded, grow faster and survive at much greater rates than other new firms. Firms founded by star scientists also help local entrepreneurial ecosystems of other scientists and skilled workers and professionals of the kind we see in many communities in the United States, not just Silicon Valley and Route 128.

Third, you have asked whether we can get more bang for our Federal research bucks in terms of new products and services brought to the market more quickly. The answer is: Yes. But only if we recognize and fix some limitations of our current innovation ecosystem.

For one thing, Federal research monies are not allocated as efficiently as they could be because the peer review process unintentionally has biases against younger, more innovative researchers and also because funding agencies, quite frankly, like to please Congress and distribute at least some funds for political rather than scientific reasons.

The age bias might be fixed by requiring research funding agencies to have younger scientist set-asides, or by putting younger scientists on peer review panels.

Fixing the political bias is more difficult. A halt to all research funding earmarks would be a good start. In addition, some sunlight might help. Research funding agencies might be required to report on new firms and their growth that Federal research money has stimulated by State and Congressional Districts.

Our universities and Federal labs also could do an even better job of commercializing their inventions. This is not to denigrate the huge progress toward commercialization that has been made since the Bayh-Dole Act was passed in 1980. But one unintentional consequence of Bayh-Dole is that universities have concentrated their licensing activities in single offices known as "Technology Licensing" or "Transfer Offices," TLOs or TTOs.

On each campus these have legal monopolies. Faculty members have little choice except to go through their campus TLO if they want to commercialize their technologies. We believe this slows commercialization. Nowhere else in our economy do we sanction such artificial monopolies or bottlenecks.

Ideally, therefore, universities and Federal labs would permit faculty and Federal innovators to choose their licensing agent. The government could push this along without having to touch Bayh-Dole itself, by requiring research applicants to demonstrate com-

mercialization effectiveness, and having an open licensing policy would be presumptive evidence that this is the case.

Government also should encourage universities, on their own or working together, to harness the wisdom of serial entrepreneurs to help screen ideas and mentor innovators who need and want help.

The Federal Government should also consider awarding prizes to universities that have the best short- and long-run records of spinning out new firms and growing them.

Finally, innovation policy cannot be discussed fully without recognizing the unusually strong contributions of skilled immigrants who account for roughly one-quarter of all high-tech startups in the United States, as well as a similar fraction of patents.

These percentages clearly are far greater than the share of immigrants in the U.S. population. These data are screaming out to us. If we want more innovation and more job creation, we need more highly skilled immigrants to come and stay here. Many are already studying at our universities and benefitting from Federal research money, so why not staple green cards to diplomas earned by foreign students at our universities? If that's too politically difficult, then at least why not adopt the Kerry-Lugar proposal that would give start-up visas to immigrants with $250,000 of outside financing?

Even better, why not improve upon the Kerry-Lugar bill and tie entrepreneurs or job creators' visas to jobs created here without any investment threshold?

I would be happy to expand on these ideas and to answer any questions. Thank you.

[The prepared statement of Robert E. Litan appears in the Submissions for the Record on page 48.]

Chair Maloney. I want to thank all the panelists. You've given us a great deal to think about. We have been called to a 15-minute vote, which is followed by a 5-minute vote. I am told that Senator Casey is on his way, but we need to adjourn so that we may go and vote and we will be back as quickly as possible. I hope Senator Casey will be here shortly so he can begin participating and learning from your new ideas.

We are now in recess. Thank you.

[Brief recess.]

Chair Maloney. The meeting is called to order, and the Chair recognizes herself for five minutes.

First of all I want to thank you for your testimony, and I would like to cite a recent New York Times article that talked about the "valley of death." The "valley of death," as they described it, is the difference between having a good idea and getting the funding to turn that idea into the reality of jobs and a company.

Some universities seem to be very, very successful in getting the funding for their research, such as MIT, to cite one, and of course Stony Brook and others. I would like to ask the panelists, what can be done to identify the university-generated innovations that deserve to be funded? And how can we facilitate getting the funding to get these ideas into the reality of companies, innovations, and jobs?

And I recognize anyone who would like to comment on it. Mr. Shulman? Dr. Stanley? Mr. Stangler?

Dr. Stanley. I would be happy to start. It's a great question, and I think one that we think a lot about in the academic community and throughout the universities.

I think there's a couple of things that we're trying to do. One is, there are programs—and I think the SBIR and STTR program is a great example of a program that is designed essentially to help with that valley of death, providing very early-stage support for faculty and their ideas before they potentially have great appeal to industry or academic sponsors.

The second I think is something that Mr. Shulman talked about, the possibility of creating our own kind of mini-funds which we have done at Stony Brook and we did at Washington University in St. Louis when I was there before. We created funds that were designed to help our faculty.

They are actually in part administered by our technology licensing offices. But they were funds designed to help our faculty get over that gap. Again, do proof-of-principle experiments, for example, that would allow them to show that an invention potentially could have appeal for market.

So I think those are the kinds of things we can do both externally in terms of the SBIR/STTR program, and internally in terms of universities taking some responsibility for helping their faculty in those ways.

Chair Maloney. Any other comments?

Mr. Shulman. Yes. I'll add to that. So the valley of death really in my view is not the initial SBIR/STTR monies, because the first couple hundred thousand dollars actually is not that hard to come by. It's once you get to that phase and you have something that might be worth commercializing. It's how do you get to the next phase of funding, which typically are angel investors.

So it's the next $500,000 to $1 million that's actually really, really tough. And that is the true valley of death. So you're beyond the research. You have a product that might be commercializable, and you're waiting. You go to a bunch of venture capitalists like myself and we all say: Oh, no, you're too early. You know, you don't have a market yet. Or you haven't introduced anything quite yet. So you're still a little too risky for us.

And that's actually what my thought in my oral testimony provided, was if the school, the university actually had funds set aside to invest after the company has got its first grants, and when it's on its way to becoming a real commercial entity, that would be the perfect solution, in my view.

And I mean Cornell is kind of lucky in that they have us there serving that purpose, but most schools don't have a local venture fund that's tied to the school.

I just read an article yesterday that NYU is starting a venture fund—I'm not sure if you guys saw that or not. So NYU is starting a venture fund, and it's actually being funded by donations.

So all the returns from that venture activity will go back to the fund, back to the school essentially, to keep investing. So it's really that extra, you know, first million dollars of investment that's so hard to come by.

Chair Maloney. Should the Federal Government tie its research dollars to a proven record of being able to commercialize or turn

it into a job or a company? Should we target that? Or require a track record? Is there any way we could incentivize it in a way that might spur more turning the idea into a reality? Should we do that? What's your response? Mr. Stangler?

Mr. Stangler. Yes. I think there are opportunities for conditions to be attached to Federal research dollars. Obviously one danger you run is you don't want to pick winners in advance and prospectively subsidize companies that will fail or lose jobs. But I think there are ways to do it to sort of push, or nudge universities and centers within universities to pull the technology out.

Some of the ideas we support—and this goes to your prior question, too, on the valley of death, proof-of-concept centers, which I believe was the focus of that article you mentioned, and have had some success in sort of overcoming that.

You know, it's possible the Federal dollars could be used to scale those across the country. We might also want to think about some sort of commercialization education that could be tied with Federal research dollars to sort of—for those who want it—to sort of help teach the basic skills and pull those technologies out.

So, yes, I do believe there are opportunities for that.

Chair Maloney. Any other comments? Is there any game-changer, any new policy we haven't put in place that could help make this happen?

Dr. Stanley. Well I don't have that answer immediately, unfortunately, but I would just add that I think it's reasonable to have some metrics in place to ask. But they really have to be I think based on a relatively long time frame. Because as you know, there is a long time between the time one of these basic discoveries hits and the time that a product develops. And of course not every basic discovery, every discovery coming out of an academic institution, will lead to a product.

So while I'm not opposed to the concept of metrics, I would be careful about how I set this up. And I would be careful about the time frame we're looking at in terms of how we evaluate. Because I think it could be very counterproductive to set up a system where, as my colleague talked about, we're too focused on short-range gain and less focused on the long-term benefits that happen.

The work that led to the MRI, magnetic resonance imaging, and many of the people in this room may have had one, came out of some basic chemistry research at Stony Brook. It led to a Nobel Prize for the person who did the work at Stony Brook, but it was very basic research. And decades passed before that transferred into the technology we now know as the MRI.

We would have to have seen a situation where, because we were looking too short-term, we missed this kind of opportunity.

Chair Maloney. My time has expired. Mr. Hinchey is recognized for five minutes.

Representative Hinchey. Thank you very much, Madam Chair.

Let me apologize, first of all, for not being here for the opening of these remarks. We have sort of a tenuous schedule here today, and I really wanted to be here to listen to what you were talking about.

The situation that we're dealing with here, the general economic circumstances of this country, are deeply critical. We are seeing some interesting aspects in a lot of other countries, particularly over in Europe, and the way in which they are operating.

The major tendency appears over there to be increasing taxes and reducing spending, which strikes me as just the opposite things they ought to be doing. We have a great need in this country for internal investment. We have not had an awful lot of internal investment here in this country in decades, and there are a lot of things that really need to be done.

In addition to things like investments in transportation and things like that, which is very necessary, the focus of attention that you are putting on is intellectual investment. This is something that is critically important to the future of this country and the future of this planet.

One of the major aspects of that of course is energy. We see a lot of interesting issues with regard to the growing shortage of the kind of energy that we need—oil, and gas, and things of that nature.

One of the things that strikes me as being very important, and one of the issues that frankly we've been concentrating on, is alternative energy: The need to be able to develop energy outside of the fossil fuels.

So I wonder if you might be interested in and willing to talk a little bit about the need for solar energy? I know that Cornell University is engaged in research for solar energy. I have the privilege of working directly with them. We have set up a not-for-profit corporation called "The Solar Energy Consortium," and we have been generating jobs as a result of that.

Energy investment is something that really needs to be done on a big scale. So I wonder if you might be interested in talking a little bit about that, what we should be doing with regard to the development of alternative energy in this country, and then spreading that development globally?

We know that Germany is doing certain things. We know that China is doing certain things. Both of those countries more than we are doing. We have a responsibility for leadership, and we have a responsibility for the internal needs of this country.

So I wonder if you would be willing to talk a little bit about that, gentlemen?

Mr. Shulman. Sure. Well, I was going to—first I want to thank you, Mr. Hinchey, Congressman Hinchey, for your help with Primet, which is a battery company which does relate to solar energy, that stores energy, and great things will certainly happen there. I was speaking with the CEO last night, and he wanted me to send his regards.

Representative Hinchey. Thank you.

Mr. Shulman. I think that for a venture capitalist, solar energy—any type of alternative energy is a really, really hot topic. We make lots of investments in that space continually, and we will always want to do so.

And at the risk of sounding like a broken record, I think I will just say it again: If 1 percent of research dollars, let's say a university receives $500 million from different sources of Federal research

monies, if 1 percent, say $5 million of that was actually earmarked and mandated by the Federal Government to be invested into startups, it would really make a big difference.

And that investment could be either directly by the university, which I don't think would be that efficient, or it could simply be by the university investing in a venture fund as an example, or other investment vehicle that invested in those startups.

What that would do then—you could even in your market, if you wanted to, you could say, listen, it's going to be invested in companies that are about alternative energy, if you really wanted to get specific. And those investment vehicles could then invest in those types of companies.

I think that the conflicts are completely manageable. In one of my colleagues' comments, there's some risk about, you know, what technologies get the money. Okay? And the tech transfer office, should they make the decision? I think that's a little bit risky in terms of conflicts. There are ways to handle the conflicts.

Dr. Stanley. So I think a little different perspective. I think in some sense I agree with what you said. I think maybe this is our next Space opportunity in terms of trying to commit to what is an extraordinary problem, not just for the United States but for the world, and how do we harness the same kind of tremendous partnership between government, between private industry that we saw essentially in how we got to the Moon.

And I think in some sense, based on our position in the world today, it is absolutely imperative that we take a leadership role in this area. So I think there are many ways to do it. But I think some of the efforts that Congress has done already in conjunction with the Administration, in terms of increasing funding to the Department of Energy, to the National Laboratories that already have a very strong infrastructure in this area, to encourage as we're trying to do here partnerships between industry and academia that are going to lead to the cutting-edge research we need. But it does require investment. There's no argument about that.

But we need to think. And I think having some type of national strategy—and I think that is coming from Secretary Chu and others, but helps guide where are the areas where we want to focus I think is critically important. But I agree with you completely that this is a critical issue, and I think the research universities are absolutely critical to helping move it forward, and are interested in doing our part to help. But I think it has to be a partnership, as I said, with National Laboratories, and with other components of the infrastructure that we have in place already.

Chair Maloney. The gentleman's time has expired. The Chair recognizes herself for five minutes.

Mr. Stangler, last year, in December actually, when Dr. Litan testified before this Committee, he talked about a job creator's visa that would be a no-cost way of creating new jobs and growing our economy.

Please expand on his idea and any other ways we could reform our immigration laws to help generate entrepreneurs and growth in jobs in our country. Any member of the panel, starting with you, Mr. Stangler.

Mr. Stangler. Yes. Thank you. Great question.

The Job Creator's Visa, or the Entrepreneur's Visa, is something that we have promoted. We're not the only ones promoting it. There are lots of people—venture capitalists, notably, are promoting the idea.

As you mentioned, Senator Kerry and Senator Lugar have introduced the Start-Up Visa bill. It's a great first step. As I noted in my remarks, and as you'll read in the written testimony, it is only a first step.

It might be more important to bring in immigrants who can create jobs with a lower investment threshold than is currently proposed at a quarter of a million dollars. There are a lot of immigrants who come to this country who do not meet that threshold, and they are going to make jobs by creating new companies.

The research is absolutely clear on this. Immigrants contribute hugely to job creation in this country. These are immigrants who make jobs. They don't take American jobs. They make jobs for Americans. And many of them are studying at our universities. And the one option to get them to stay, instead of sort of sending them home after they study here, after they conduct research here, is to staple a green card to their diploma.

Many of them will start companies. Many of those who leave will start companies, but if they leave they're going to start companies somewhere else. So we fully support this idea of encouraging them to start up here.

This is a critically important source of job creation and innovation to the future of the economy, particularly now.

Chair Maloney. Any other comments? Dr. Stanley?

Dr. Stanley. Thank you. I agree with everything that was said. I think one of the key things that has helped the U.S. lead in innovation has been our ability to import talent. Essentially we have been able to pull the best and the brightest from countries outside of the United States.

That is threatened. And it is threatened of course by immigration policy, and it is also threatened by the fact that these countries are now developing better universities. They are going to have more attraction essentially for the people at home.

So I think the notion of really revising our policies so that we really do encourage the outstanding students who come from China, India, South America, to stay in our universities, makes tremendous sense. They will be innovators in the future, and I think we want to make them U.S. citizens.

Chair Maloney. Mr. Shulman.

Mr. Shulman. Yes. Let me add a slightly different angle. So the EB–5 Program, which I'm not very familiar with, but just a little bit, allows for investors who invest in companies, I think it's a half a million dollars, if that investment stays invested for a certain period of time, which I believe is 5 years, they can then be on their way to getting a green card visa.

The strange thing about the program is that it doesn't work for start-up companies. These investments have to be made in companies that are actually larger, and that can actually keep the money for five years. Lots of venture-backed companies want their companies sold quickly.

So what I would advocate and ask you to consider would be a tacking program, where if an outside investor makes an investment in a company, and the company is then sold and the person gets their money back, that they could then roll it into another company, okay, to get their 5 years of credit, as opposed to having to start again from time zero.

Likewise, that investment has to be tied to job creation, which I think it should be. And again, a little bit self-serving here, but if that investor could invest in a venture fund, okay, as opposed to a company directly, right? I mean the venture funds are creating tons of jobs. And their money, I can almost guarantee, will be tied up for five years in a venture fund because their return portfolios are much longer than that, typically.

So there are very, very I think accessible ways that wouldn't cost the government any money at all where we could actually stimulate additional investment dollars here. Thanks.

Chair Maloney. Thank you. Senator Klobuchar, thank you for joining us, and you're recognized for five minutes.

Senator Klobuchar. Thank you very much. I was just up at the Supreme Court hearing, but I needed a little break so I thought I'd come down here.

I head up a Subcommittee of Commerce on Innovation, and have become completely devoted to this idea as a way to get out of this economic slump, including export promotion. I always think about those Beijing Olympics with the opening ceremonies with the 2,000 drummers, and I remember watching with my family thinking we're in trouble. Those drum beats are only getting louder and louder, and I'm convinced the way that we need to achieve in our economy is by promoting innovation.

I come from a State that has always believed in science. We brought the world everything from the pacemaker to the Post-It Note. We are now 7th in the country for Fortune 500 companies, even though we're 21st in population. Medtronics started in a garage. The 3M started as a sand paper company in Two Harbors, Minnesota. And so I'm very concerned about the lack of a competitiveness agenda in our country.

Senator Warner and I and others have been working on this in the Commerce Committee. So I see this as one what should be the uniting causes for our country right now. So I think we need a competitiveness agenda, an innovation agenda.

We have done this in the past when we had other problems. I think there are regulatory obstacles—everything from the 510(k) process for medical devices on down. We need to look at these things in a way that is sensible, education issues, science and engineering, and then also immigration policy, which I know you have just talked about. I would add to education issues also that the H–1B visa issue needs to be changed.

And then finally of course a government policy with R&D tax credits, which we're trying to get done right now in this Extender bill, as well as other small business policy that I know that you have already discussed.

So I think I would like to start with regulatory obstacles. Not talking specifically about the FDA, but what you see as something that could guide us. And, if you see that as an issue for investment.

I know in the medical devices we have seen a one-third reduction in venture capital because of some decisions that have been made recently. And just where are you in terms of seeing that as something that we should look at? That is supposed to be Cass Sunstein, who I believe in. I think we need to look at that as a piece of this as well.

Mr. Shulman.

Mr. Shulman. Well in short terms, anything you can do to quicken the 510(k) process and the full FDA review process would be incredibly appreciated.

There are many, many small companies and they are asked repeatedly by investors when they'll bring products to market, because we care about that, and the answer is often tied to, well, time one starts after regulatory approval. And gauging when that will be is often difficult.

So, you know, for a full-blown process, and I'm sure that Dr. Stanley can talk about this further because of all the stuff at Stony Brook. I mean, it's a long, drawn-out process.

Senator Klobuchar. Right. And what's happening now on the 89th day, somebody at the FDA is coming in and asking for more studies. And there have just been a lot of disruptions. People don't understand this, but China is requiring country-of-origin approvals, starting to do that. So what's happening is that a lot of the countries are just moving over their innovation to Europe because there they have a process that is fair and safe, but works quicker.

So we are encountering a major problem right now. I don't know if you want to add anything, Dr. Stanley?

Dr. Stanley. Just very briefly. I think that unfortunately research universities, particularly those with medical schools, are probably among the most regulated industries I think in the world. So I think anything that can be done to take a hard look at what do we want to accomplish, what are our regulations designed to accomplish, and how can we streamline them so we still provide the protections that are necessary and yet really free up our scientists and physician scientists to do the kinds of research they need to do. I think that would be welcome, and I think that is what you are driving at, Senator.

Senator Klobuchar. Um-hmm.

Dr. Stanley. And I think groups like the AAU and the AAMC I think would be more than willing to work with you in trying to get these things done.

Senator Klobuchar. On Sunday, there was a piece on a broad array in The New York Times that focused on the efforts of universities, including MIT, to help professors take their inventions to the private sector.

The concept is to take new discoveries from universities and turn them into start-ups that create jobs. One professor of mechanical engineering from MIT, who has already sold one start-up and is busy on another, put the need for more efforts to help professors commercialize their research this way:

The public is paying for all these wonderful innovations that are just sitting in the drawer because there's no way for them to make the leap to the commercial world.

My last question: How do we change that? And how do we make the private sector best positioned to develop products based on the work being done in our great universities?

Mr. Stangler.

Mr. Stangler. Yes. Thank you. That was a great article on the MIT professors, the proof-of-concept centers. One of the things I might call your attention to is, in North Carolina the universities there have pioneered the Carolina Express License Agreement, which is to deliberately smooth the process, lower the barriers for faculty and researchers at the universities to take their innovations from the university and turn them into companies.

Rather than going through an individualized process for everyone, they are now standardizing the process for professors, this License Agreement, to get things out the door faster.

I think that might be something that would be worth taking a look at to see if somehow the Federal Government could sort of encourage that in other states.

Senator Klobuchar. Thank you very much.

Chair Maloney. Mr. Shulman, you had a comment?

Mr. Shulman. Yes, let me go back to the question for a bit. So the Deshpande Center at MIT, that's actually funded by MIT, and alums from MIT. And it's an incredible Center. So if the Federal Government wanted to increase its activity with tech parks, I kind of consider the Deshpande Center to be in essence a tech park. It's one huge building with lots of companies inside.

If they could work with the universities directly to actually foster the creation of additional technology parks—and notice I'm not using the word "research," I'm actually using the word technology because I'm talking about companies as opposed to R&D—so you would know better than I the ways the Federal Government could do that. But there could be incredible innovation and then commercialization if the Federal Government encouraged universities through incentives to actually create additional technology parks.

Senator Klobuchar. Um-hmm.

Chair Maloney. Thank you very much.

Mr. Shulman, you mentioned using tax credits for investments in start-ups based on university research. Would this give an advantage to university-based research over private-sector development of technologies that would also be competing for these funds?

And are there other targeted approaches that we could use to incentivize the creation of start-ups that does not choose between private-sector technology or university-based technology?

Mr. Shulman. Yes. Exactly. So I would actually encourage—and the way we do it in New York State, we have QETC credits, Qualified Emerging Technology Company credits. And it's literally a direct tax credit for investing in start-ups.

There are certain parameters put around the size of the start-up, which is fine because the thresholds are quite liberal. So to address your question, there is no need in my view to actually limit a Federal tax credit to university-generated technology companies. If you wanted to take a baby step, that would be the first baby step.

What I would rather see would be a tax credit, the same way we do it in New York State, where it is simply a tax credit for investments made into technology companies. And again to bring it back

to the venture fund world, our venture fund gets a tax credit for making an investment in a New York State technology company, and those tax credits are then passed directly through to our investors—because we're a pass-through entity, a VC fund is a pass-through tax entity.

Our investors care about those tax credits. I mean they really care. So it clearly, in my view, fosters and encourages investment, which is exactly what we want. So, sure, a tax credit costs the government some dollars, but I think the benefits far outweigh the costs.

Chair Maloney. Any other comments on this issue? Mr. Stangler?

Mr. Stangler. Yes. I second Mr. Shulman's remarks, and I would also say, on MIT and the Deshpande Center, there's been some great work on just how important MIT is not only to the Massachusetts economy but also to the national economy. And the reason that places like MIT and Silicon Valley are such hotbeds of innovation is they rely on networks, social networks. And those are sort of squishy, you know, they can't totally be codified and they can't just sort of be created. But those are the bedrock of those clusters of innovation.

And those networks rely on openness and sharing of ideas. It doesn't mean you're always going to get a home run or a hit, but if we found a way to sort of push or encourage more of that sharing of innovations in universities, the focus of this hearing, and types of innovation exchanges, we can sort of foster those networks in additional places, that might be another thing you could do that wouldn't cost additional money.

Chair Maloney. Well thank you.

Mr. Hinchey.

Representative Hinchey. I just want to focus a little bit more on the kind of operations that colleges are doing and the practical outcome of that, and how it might be more effective.

In particular with regard to the situation that we're doing at Cornell University, the City of Ithaca and the general area there, currently, Tioga County has the lowest unemployment rate of any place in New York, and one of the lowest unemployment rates any place in the country.

One of the reasons for this notably low rate is the ability of the research and development there to spread out into activities that are productive and income-generating. New jobs are being created. New companies are being set up.

That is something that really has to be encouraged and accelerated as much as possible. We have been able to do that, particularly with regards to Primet, and Applied Materials; which has generated into a small battery operation, which is something that is moving forward very effectively. The ability for this little battery to absorb huge amounts of energy from the Sun and then be able to generate that energy over periods of time is impressive. This battery could be very positive in the context of the energy circumstances that we're dealing with and also in the context of the economy.

So one of the issues that we are dealing with here now is internal opposition within this Congress, and to some extent outside of

it, to try to prevent spending in a variety of ways. There is an awful lot of money that is being wasted. We see some of the recent stories about the situation in Afghanistan and elsewhere, how billions of dollars are being transferred to places like that, and away from this country, not having any effect on the economy here but having positive effects for at least minor people in the context of economies in that particular situation.

I think we need much more internal investments intellectually, and then much more security to ensure that the intellectual investments are then spread out into more opening operations.

So I'm wondering if you might be willing to talk a little bit about that, and to make some suggestions about the kinds of things that we should be doing.

Dr. Stanley. I'm happy to start. I think you have really pointed to I think what is a critical issue for us at this point in time. That is, that this is absolutely the wrong time to de-invest essentially in the institutions that I think have helped lead us over the past 60 years.

And again I will point to this incredible partnership that has occurred between the research universities and the Federal Government. That has really driven a tremendous amount of the innovation.

The discovery of the Tablet Computer, as this iPad I have today, a lot of the components of that were done at the University of Illinois, work 40 years ago—30 years ago. So this kind of work I think is really leading to innovation, and we should not be de-investing.

And I think the remarkable things about the research universities is they do lead to regional growth, as you talked about. They become anchors, essentially, for regional growth. So you point to Cornell in Upstate New York. You point to Stony Brook around Long Island. Obviously Silicon Valley with Stanford and Berkeley. University of Minnesota. These become the anchors, essentially, for the regional growth.

So I think that it is the wrong time to de-invest. We have to be careful about how we invest, and I think programs again—and I hate to harp on the same thing every time, but I do believe that an investment in basic research tends to pay long-term dividends. And I would not pull away from that.

It does not mean that we do not need to consider applied things. It does not mean we should not be tackling big problems as we have talked about before in terms of energy, health devices, and so on. It does not mean that. But it also means we should not pull away from basic research. So I do share your desire and goal that this is the right time to further invest.

Representative Hinchey. Mr. Shulman.

Mr. Shulman. Do I get in trouble for saying the same thing three times? [Laughter.]

So I think that—maybe for the fourth time—that the Federal Government should force universities to spend a very small portion of the research that they receive on investment in companies. Call it one percent. Call it half a percent. It probably will not be more than one percent. But force them to spend the dollars that they receive, that small percentage, directly into companies. And Dr. Stanley will probably punch me, so I'll stay away, but I think that that

money, that one percent that I am talking about, cannot be subject to university overhead because it will take half of it away.

When a grant comes into the school, half of it goes, or more than half, probably, at least at Cornell it is close to half, goes not to the actual R&D lab, it goes to overhead to the university. Well maybe there is a way to say to the university, that one percent that you are going to make investments with, it is not subject to overhead.

So again in the case of a school that does $500 million of R&D that is federally funded, $5 million, which is not a large amount but it can make an incredible difference because it can be leveraged many times over, can be invested.

Dr. Stanley. Can I make a quick response to that?

Chair Maloney. Yes.

Dr. Stanley. Just very quickly, I think that there is a challenge, I think, in this proposal. I think that that is, this seems to be one area where market is really very important. And I think to mandate for all universities across the country that they have to set aside this kind of fund would probably, to me, not push what you want to push forward.

It is very interesting that Cornell has done this on their own. It is very interesting that this kind of opportunity exists all the time in Silicon Valley. And on Long Island, we are setting up our own angel network, and we are working with private investors and the university to try and set up our own network.

My own bias is, this is something I would rather see market driven rather than directly instructed to universities. And we can disagree on that, but this is——

Mr. Shulman. This actually makes a lot of sense. And again, this is going to sound very self-serving, but I am only down here once so I guess I will just do it, the way to make it market driven is to force the investment into a venture fund. Then it's completely market driven.

There's no one at the school that would be making the investment decision. It would be a set of investment professionals deciding what to invest in. Okay? And if they don't invest in the regional companies, that's not the end of the world. So if the school happens to be based in, I don't know where, I'm not going to say any particular state at the risk of offending anybody, but there are some states that don't do as much R&D as others, but there are certainly schools in all states that receive R&D funds. If the VC firm wants to invest somewhere else, that's actually okay. It's still going to be creating jobs through those investments, so that could be a good market check.

Chair Maloney. Thank you very much. Senator Klobuchar.

Senator Klobuchar. Thank you. I have listened to this debate here and am thinking what examples do both have from other countries? What has worked?

Because as we know, there has been a recent study out showing that we are starting to fall behind with innovation. The American people think we are falling behind. They're right.

What are the other countries doing? I am not talking about here top-down with China, but what are some of these other countries doing that are allowing them to beat us out?

Dr. Stanley. So I think I will point to a couple of things. So one is, I still think that some of what they are doing, Senator, is imitating us. So one of the things they have done, actually, and Japan is an example, I think Sweden may have followed suit but I am not positive, is to actually adopt things like Bayh-Dole, to actually realize that this kind, again, of government-university partnership which encourages universities and their inventors to actually get technology out works, and I think they are actually trying to emulate that.

The second thing, again, and I am going to be guilty of beating the same drum probably again, is investment. I think in many cases they are making investments essentially in this kind of infrastructure. And they are saying that in order to compete with the U.S., we need to put money essentially into talent. And I think that is the big thing.

So if you look at what Singapore, what other countries are doing, they are going after U.S. talent. They are going after international talent. And that is the coin of realm in terms of innovation. And I think we——

Senator Klobuchar. And that leads you to the immigration changes. How about education? My daughter was in the Arlington high school science fair recently in 9th grade. Her experiment was comparing the bacteria in unwashed lettuce and washed lettuce, which she concluded, looking at the judges and saying: I have one piece of advice for you. Wash your lettuce.

Dr. Stanley [continuing]. Excellent.

Senator Klobuchar. So let's just say she didn't win a ribbon, but I was able to watch these kids. I was just in awe of them. It was very exciting. Hundreds of kids. I don't remember this from my high school. Public high school here in Arlington. You know, walking across with their ribbons. And how do you take that excitement and then move it up a notch so they are going into science and engineering, going into that in college.

I know we have STEM, and I know we are doing—but we still are not keeping up with some of these other countries.

Dr. Stanley. It is a tremendous challenge, and I think two things.

One is, I do think COMPETES and STEM are very important components to helping us in that. So I wouldn't look away from that at all. But it does start I think in K–12. I think it is a pipeline issue. It is something at Stony Brook that we are very concerned about.

We have traditional strengths in science, engineering, and math, and the quality of students coming to us, unfortunately, from K–12 many times are not able essentially to perform.

So I think it does get back to that. I think it gets back to emphasizing as a society that we value teachers of science and mathematics, that we value engineering and these disciplines, that they are something that is actually important to us as a society, they mean something.

I think it is almost a cultural issue. But I think it is also about coming up and learning and looking at best practices in other countries, as you have implied. How are they doing better in science education than us?

I think some of it is cultural, I really do. I think some of it is mom and dad at home saying that you have to perform in math. Math is critical, and there's no if, ands, or buts. I think that's part of it.

Senator Klobuchar. That's what we heard at an Innovation Forum. I did an Innovation Forum at IBM in Rochester, Minnesota, and it was surprising the number of sort of small business owners that were very focused on the cultural issues at home. They're watching TV. I mean, they were obsessed with that in terms of trying to push the kids into a direction and making that much more acceptable than other activities.

Dr. Stanley. I agree. But it's not just that. And I think that's very important, but again I think one of the reasons those countries are going after our university system is that they recognize that it's not just enough to get those STEM things, but to get the kind of creativity and innovation you need all of the components I think with universities.

I think that one of the reasons we are so successful is that we actually blend social sciences, and humanities. This gives people a perspective, helps them understand as they're discovering things as well. So I think it is a mix of those things.

Senator Klobuchar. What about this idea—and then I will end with this question, for all of you coming back, which we have done in other decades, to coming up with a competitiveness innovation agenda for our country?

Understanding that there are certain regional clusters, that there are certain areas of development that we want to foster and focus on, and that this would help us get to the issues you are talking about, but as well as some of these regulatory issues we identified—immigration—and really pushing this as a national agenda. As we look at this incredibly difficult competitive environment globally, that we should be doing what Tom Friedman, who is a Minnesota native, has said, "Nation building in our own Nation."

Answer? We're looking at some kind of an actual competitiveness innovation agenda to guide decisions in Congress so we're not hurting innovation, and that we are promoting things that help the industries that are growing leaps and bounds and are trying to export, as opposed to just spreading our money out across the board with any industry that we want to save?

Dr. Stanley. So I wish I could encapsulate an answer to that, but I will simply say I think we do have some examples where it is working. We have talked today about MIT. We have talked today about Silicon Valley. I think there are best practices we can look at.

And then I think to bring the people, as you are doing right now, and ask what are the barriers again that are keeping us from reaching full potential? This kind of hearing I think is very valuable to identify those things. But I think looking at those cases for best practices I think is a good start for us.

But I do believe, as I talked about before, that it also makes sense to me to set some major targets in terms of what are the things that the U.S. wants to lead on going forward in the future?

I would say: Renewable energy to me is an example of that.

And then: What's our national agenda to push that forward?

And that involves DOE, as I've talked about before. That involves National Science Foundation. But some type of cohesiveness there could be very helpful. Again—and I will shoot myself if I don't say this—but again, emphasizing basic research is a critical component to moving that forward.

Chair Maloney. Thank you.

I would now like to invite the panelists to talk about efficient leveraging of Federal research funds. Specifically, some of you believe that the universities' technology licensing offices may not have the expertise or resources to facilitate commercial development of inventions. And while there are some economies of scale to lead to commercialization in the university, there may be inefficiencies created at the same time.

Can each of you comment on this challenge, on your perspective and your ideas to better leverage Federal research funds? Starting with Mr. Stangler.

Mr. Stangler. Thank you. One of the primary intents behind the Bayh-Dole Act of 1980 was to lower the transaction costs to moving innovations out of universities, whether into existing companies or new companies. It was to sort of build this platform upon which researchers could work on a standard platform.

Over the years, perhaps predictably and quite understandably, bottlenecks have developed in that process. No institution is perfect, and our innovation ecosystem changes from year to year. We have to make policy changes to keep up with that.

My colleagues, Lesa Mitchell and Bob Litan, have proposed that to carry forward the intent of Bayh-Dole, to keep moving those intentions forward of lowering transactions costs, that we open up the market of technology transfer and allow professors—not force them; they can do what they want—but allow them to go outside their own university to license their technology, rather than making them stay within their universities.

It is completely optional, but you would see a new market develop. This is sort of the point of Bayh-Dole. If the point is to move more innovations out of universities, this is sort of the next step in that process of what we want to do.

Chair Maloney. Dr. Stanley.

Dr. Stanley. So let me preface my comments by saying that I think much of the work that the Kauffman Foundation has been doing, particularly at universities to promote entrepreneurship, I think is right on target and I think is very positive.

I disagree very strongly with this recommendation, however, about the concept of free-agent faculty. I think there are three problems I have.

The first is, I do not think there is any demonstrable evidence that technology licensing offices are failing in their mission. I do not see that. And I think you will see in supplemental materials that you may have that that really I do not think has been proven to anybody's satisfaction that that is the case.

So we have great examples. The office at Stanford, I spend a lot of time speaking with the people who ran Stanford. When I was Vice Chancellor for Research at Washington University, I was responsible for a tech transfer office.

I went to Stanford. I met with Kathy Koo who ran it. What are you doing? And I found out that they were doing the same things that we were doing, the same things we are doing. It really was not very different. And they are widely acknowledged, including by the Kauffman Foundation, of being among the best.

So I do not think the problem is with our technology licensing offices. I think we could work to try and improve them. There always can be room for improvement. I do not think that is a fundamental problem. I think there are other components of the pathway that are more flawed.

But the second thing is, we had this kind of system really before Bayh-Dole where faculty were more free agents. And I can tell you, everybody tells me, and I wasn't doing this kind of work then, that it was pretty disastrous. So what you ended up doing was, you ended up paying lawyers to mitigate disputes between faculty who felt they had co-invented things, between faculty and companies who didn't have any expertise in this area but ended up trying to make deals with a company in negotiating their own things, and ended up discovering that in fact all of their research in perpetuity was now owned by a company and not by them anymore.

So I think the notion of having free agents in this makes no sense. Less than one percent of faculty have extensive experience in this area. So to think that they are going to license and go out and shop around in an educated manner I think does not make sense.

Having a local tech transfer office at the university that knows them, that serves them, and importantly knows the region as well I think is incredibly important. We have heard before that economic development tends to be regional in nature, and I think to take this out and try and shop it widespread makes no sense.

I think it would lead to more litigation. I think it would lead to less efficiency, and I am very much opposed to this concept.

Chair Maloney. Mr. Shulman.

Mr. Shulman. Yes. I would tend to side with Dr. Stanley on this. The university owns the intellectual property, the same way that IBM owns the intellectual property of its employees.

You know, if a faculty member invents something, the university owns it. I don't think that Mr. Stangler is arguing against that, right?

So then the question becomes how does that technology actually get out into the field? And if the faculty member thinks he can do it better than the tech transfer office, that actually might be the case in certain circumstances. The person might have a connection with a company that might actually want the technology.

I mean, at Cornell I think it has actually happened a couple of times, and it still goes through the tech transfer office. So we can leave that argument aside, because it's been talked about enough.

What I think would be interesting would be if there is a way for again for the Federal Government to incentivize universities to actually start companies. So it's interesting. Again what Dr. Stanley said is right. The Stanford policy for IP transfer and conflicts looks a lot like Cornell's—maybe the other way around, Cornell's looks a lot like Stanford's. But Stanford is simply better at it.

And there is a reason, which we can't avoid. Stanford is located in a beautiful spot with lots of people. And Cornell is located in a beautiful spot with no people, and with no highway, and with no high-speed rail, and with a little tiny airport. So there are some definite geographic/demographic constraints that limit the ability of a university to start companies, or to help transfer the technology out to startups.

But that is not to say that it can't be helped. So if for example the Federal Government gave an extra boost, whatever form it came in, an extra research dollar to reward actual startup creation—and I really do mean startup creation again as opposed to licensing to big companies, because startups create more jobs—that would be interesting.

We have a group of entrepreneurial faculty at Cornell. And let me tell you, it is a very different feeling at Cornell than it is at Stanford. I mean, at Stanford a faculty member is rewarded for starting a company. I mean, in their tenure process it is looked on favorably, I think. At Cornell, that is not the case yet. A faculty member who wants to start a company, if they are not already tenured, it is risky. And that is a problem. I don't think it should be, but it is.

So again, if the government gave incentives to the university to actually start companies, it might change the way the universities think about their faculty members getting involved with those companies.

Chair Maloney. Thank you very much. Our time in this room was limited to 12 o'clock, and we have passed that time. So I want to thank all our panelists.

Today's hearing was focused on the role of basic research in fueling employment and growth in local communities. Over half of basic research is funded by the Federal Government. This partnership between the Federal Government and universities helps form an entrepreneurial ecosystem that benefits local economies.

At our last hearing in December on innovation, some of the ideas of the panelists were turned into legislation, specifically the Jobs Creation Visa, and I believe that some of the ideas you have presented today will be further examined before Congress in the form of legislation.

I want to thank you for your work, for your time, and for your testimony today. This meeting is adjourned. Thank you.

[Whereupon, at 12:10 p.m., Tuesday, June 29, 2010, the hearing was adjourned.]

SUBMISSIONS FOR THE RECORD

PREPARED STATEMENT OF CAROLYN MALONEY, CHAIR, JOINT ECONOMIC COMMITTEE

I am pleased to hold today's hearing on the role that innovation has on fueling employment and growth in local communities. This Congress is continuing an Innovation Agenda in order to rekindle growth and prosperity in the U.S.

One important part of this agenda is the reauthorization of the America COMPETES Act, which passed the House just one month ago, on May 28th. This legislation will help fund investments aimed at ensuring U.S. competitiveness in the global economy.

Recently, the JEC issued a report on the importance of federally funded basic research. The report shows that basic research—research which contributes to our fundamental stock of knowledge—is an important component of R&D, and can have a large impact on productivity.

The private sector underinvests in basic research because the returns from these investments are often smaller than the returns to the economy as a whole. Yet this basic research is critical to the private sector. Investment in basic research is a mechanism for spurring precisely the innovation that business leaders, academics, and policy makers have identified as critical for our nation's economic growth.

The federal government funds almost 60 percent of basic research in the United States.

The innovations that have improved the country's productivity and quality of life flow directly from these investments. The technology improvements created from basic research have played a singular role in enhancing the productivity of businesses and workers, and has spurred new job-creating industries, such as the biotechnology sector. Most basic research occurs at universities across the U.S. This partnership between the federal government and universities helps to form an entrepreneurial ecosystem that benefits the local economy by creating jobs and spurring economic growth.

The Science Coalition recently released a report that shows the tremendous return on the federal investment in university-based basic research. Their report is a dramatic demonstration of the economic impact that these research universities have on the local community and highlights a key fact: companies that grow out of university research often locate very close to that university. These universities are often the biggest employers in the community and serve as business incubators that drive new companies.

And equally important, university communities foster creativity, talent and ideas which lead to the next generation of businesses and innovations that will drive the new economy.

I am pleased that this partnership between universities and businesses is represented by two New York witnesses, Dr. Stanley and Mr. Shulman, who can demonstrate how these synergies are working across New York. As our economy starts its recovery from the tremendous blow of the "Great Recession," it is important to remember the role that entrepreneurs and innovation has in spurring growth.

I am sorry that Dr. Litan is ill and thus unable to deliver his oral testimony. I was especially eager to continue our conversation on strategies to promote the next generation of innovation in the U.S. As some of my colleagues may recall, when Dr. Litan testified before us last December on financial regulatory reform, he also mentioned that a job creators' visa should be considered by Congress as a way of creating jobs without any additional costs to the federal government.

A few months later, Senators Kerry and Lugar crafted legislation that addressed this issue—the Start Up Visa Act of 2010. Inspired by Dr. Litan's testimony, I recently introduced the Kerry-Lugar bill into the House. I am happy, however, that Dr. Litan's co-author, Mr. Stangler, is here in his stead.

I am eager to discuss with our panel additional ways that Congress can make sure that we regain the innovative and dynamic economy that we once had.

I welcome each of you this morning and look forward to your testimony.

PREPARED STATEMENT OF REPRESENTATIVE KEVIN BRADY

I am pleased to join in welcoming the witnesses before the Committee this morning.

Since its founding, the Republican Party has been committed to support higher education and scientific research. On May 15, 1862, President Abraham Lincoln signed legislation creating the Department of Agriculture to conduct agricultural research and disseminate its findings to farmers. On July 2, 1862, President Lincoln signed the *Morrill Land-Grant College Act*. Sponsored by U.S. Representative Justin Morrill, this act endowed public colleges in each state with the proceeds of federal land sales. These land-grant colleges grew into great state universities that have

educated millions of Americans and conducted a majority of our basic scientific research over the decades.

On July 28, 1958, President Dwight Eisenhower singed the *National Aeronautics and Space Act*, creating NASA. In his 1970 *State of the Union Address*, President Richard Nixon committed this country to a "war against cancer" to find treatments and cures for this dread disease. And federal funding for the National Institutes of Health grew by 181 percent from fiscal years 1996 to 2007 under Republican Congresses.

By definition, basic scientific research does not have an expected commercial application. However, the *Sparking Economic Growth* report from the Science Coalition provides empirical support that federal funding of basic scientific research generates real economic benefits.

Basic scientific research leads to new discoveries and technological breakthroughs. Entrepreneurs can commercialize these discoveries and breakthroughs by establishing new companies, creating new products and services, and employing thousands of workers in highly skilled, well-paying jobs. This scientific and technological entrepreneurship keeps American firms at the "cutting edge" of the global economy. In turn, these new companies and their workers pay millions of dollars in federal income and payroll taxes.

Supporting basic scientific research is an appropriate role for the federal government. Unlike so much of federal spending that proponents mislabel as an "investment," supporting basic scientific research is a real investment that produces substantial returns for American taxpayers over time.

In this context, I am troubled by President Obama's short-sighted decision to cancel the Constellation Program designed to develop new launch vehicles and spacecraft capable of reaching the moon and Mars. Human space exploration drives technology that makes the United States more economically competitive. Life science research with astronauts has spurred breakthroughs in the detection and prevention of cancer, heart disease, and osteoporosis. Defunding the Constellation Program will harm the U.S. economy.

I am also troubled that this Congress has allowed the research and development tax credit to expire. Congress enacted the R&D tax credit in 1981. Seeing the benefits of our R&D tax credit, other countries have mimicked us by enacting more generous R&D tax credits. By 2004, the U.S. had fallen to 17th place in R&D tax benefits among OECD member-countries. The United States competes with other developed countries for R&D spending by multinationals. Corporate R&D creates some of the highest-skilled, best-paid jobs. We want corporations to conduct their R&D in the United States to strengthen the long-term competitiveness of the U.S. economy. We should be enhancing the R&D tax credit and making it permanent. This congressional inaction is incomprehensible.

Turning to today's testimony, Dr. Litan, you cite a number of bureaucratic difficulties that inhibit the commercialization of discoveries and technological breakthroughs from basic scientific research at universities. First, you describe a major weakness of the peer review system; that is, some established academics abuse peer review to squash the research that is contrary to their own views or that is viewed as "outside of the box." The most recent example of peer review abuse is the scandal at East Anglia University when some climatologists tried to suppress research that contradicted their notions of man-made global warming. I am interested in your views on how to prevent peer review from becoming a closed "old boys' club" that suppresses innovative thinking.

Second, you raise the issue of the centralization of licensing at universities. No single university bureaucracy is likely to have all of the necessary knowledge to commercialize the varied discoveries and technological breakthroughs that may occur at a major research university. I am interested in your suggestions for introducing competition into the licensing process to speed commercialization.

Third, I am also interested in your idea of prizes to incentivize the development of innovative ways of commercializing university research.

I look forward to hearing today's testimony.

PREPARED STATEMENT OF REPRESENTATIVE ELIJAH E. CUMMINGS

Thank you, Madam Chair.

I appreciate your calling this hearing, especially in light of the fact that we will receive the statistics regarding the employment situation for the month of June on Friday.

According to an update provided by the Bureau of Economic Analysis last week, the gross domestic product—the output of goods and services produced by labor and

property located in the United States—increased at an annual rate of 2.7 percent in the first quarter of 2010, from the fourth quarter of 2009.

While this is a much needed improvement to the overall stability of the U.S. economy—it does not necessarily translate directly into job creation, which is desired by our constituents and needed for a full economic recovery.

For the month of May, the employment situation improved by adding over 430 thousand jobs—edging down the unemployment rate to 9.7 percent (from 9.9 percent).

We are on the path to recovery!

The Democratic-led Congress and President Obama have created or saved nearly 3.5 million jobs through the stimulus legislation.

To build upon this success, the House on June 16th passed two vital pieces of legislation to create hundreds of thousands of jobs on Main Street by expanding lending to small businesses and offering tax incentives to help small businesses grow, hire and fuel our economy.

H.R. 5297, the Small Business Jobs and Credit Act and H.R. 5486, the Small Business Jobs Tax Relief Act will provide nearly $300 billion in loans to small businesses and $2 billion for innovative state lending programs supporting small business.

Additionally, the HIRE Act (PL 111–147) signed in March is creating 300,000 jobs by rebuilding American infrastructure, giving tax credits to businesses that create jobs, and closing tax loopholes that allow corporations and the wealthy to hide income offshore.

However, we must continue to look for new and creative ways to employ and train 15 million unemployed people and to prepare for the millions who are expected to enter the workforce over the next five years.

Therefore, the hearing we are having today about the positive impact of federally funded research through university grants on communities and the potential for economic growth is very timely.

* * *

I have the honor and privilege to represent Baltimore, Maryland—home to many universities and research institutions—the most prestigious being Johns Hopkins University, a preeminent institution that often leads the nation in the total amount of support dollars received by the federal government.

In fact, nearly **85 percent** of the research funding received by Johns Hopkins is supported by federal research dollars—this translates directly to the creation and maintenance of 5,700 hundred full-time jobs at Hopkins.

Additionally, scientists and physicians at Hopkins have competed for and, so far, won nearly $200 million in research grants funded by the stimulus bill.

This money will be spent over several years but has already brought Baltimore 151 solid, well-paying new Johns Hopkins staff jobs for research technicians, biostatisticians, research nurses, programmers and others.

Other educational institutions in my Congressional District are making great strides as well. Coppin State University just received $1 million from the Department of Commerce to establish a computer center that will provide access to broadband services and offer numerous training/educational courses and on-line resources.

The center will offer a total of 15 training and educational courses on a regular basis, which will provide a wide variety of opportunities for the entire family in computer and broadband instruction, job training and creation, health information and education, and education more generally.

Together, the new infrastructure and instructional resources offered by the center will not only stimulate greater and more efficient use of broadband services, but also create, save or improve 5,500 jobs, provide a better educated work force, improved schools, healthier people, more globally competitive businesses and schools, and greater financial stability.

Federal programs have also provided nearly 100 jobs at Morgan State University, and have sustained 22 jobs in Baltimore City.

These figures do not even take into consideration the number of employees of local companies who benefit from local purchases of goods and services needed to support the research work.

But just as important to creating jobs, these dollars are also creating a better future and leading to innovation.

* * *

The economic downturn has been traumatic to the millions who have been unemployed for an extended period of time—needing to be re-trained because they have lost jobs that are never returning to the United States.

However, one of the few good things that can come from this hardship is that this nation will have the opportunity to re-establish itself as a leader in developing new technologies that translate into "real world" applications and create long-term employment.

Madam Chair, I look forward to hearing from our witnesses on how university research can assist in job creation, and to a productive discussion that helps us find the road back to another prolific decade of economic growth.

With that, I yield back.

PREPARED STATEMENT OF REPRESENTATIVE MICHAEL C. BURGESS, M.D.

Thank you, Madame Chairwoman.

I look forward to this hearing today because I think it will highlight some fundamental differences that Members of this Congress have concerning the proper role of government in funding scientific research. Indeed, the issue has never been timelier, as Democrats are allowing a number of critical R&D tax credits to expire by refusing to compromise on a tax extenders bill that should otherwise be enjoying bipartisan support, but for the Majority's refusal to acknowledge the economic constraints we find ourselves in as a nation and pay for the spending in the legislation.

I have long believed that the proper role of government in funding research and development on a host of issues from medical research to energy policy is when government removes the impediments toward advances in science and technology—including burdensome taxes. Government funding that inherently comes with strings attached wasn't needed in the field of cell phones—the private market drove innovations that, today, result in a newer, faster, smaller, sleeker cell phone being released every month. Moreover, even with all the work the NIH has done on genetics and personalized medicine the mapping of the human genome, government funding was the first step, but it was the private sector that far surpassed the government in the end. However, it is clear that, at least in this last instance, government funding was necessary to get the ball rolling and will continue to be necessary in this initial development phase. While few in the private sector had the stomach to venture into previously unchartered territory of genomics the government-initiated research will no doubt lead to the private sector actually developing the promise.

Let me be clear, federal funding of research can be an important part of finding a solution to any number of the world's problems. But too often, people place such a reliance on direct government spending that they lose the forest through the trees. What we should be focused on is, when we as the federal government do decide that direct spending is proper, what is the best way to ensure that taxpayers' dollars are being utilized to their maximum advantage. Political decisions on where funding should go have no place in scientific research. How do you best create a system of funding that allows the best ideas to reach the top and allow for less-than-ideal ventures to be left behind? I look forward to a frank discussion with our witnesses today.

With that, I yield back.

PREPARED STATEMENT OF ZACHARY J. SHULMAN, SENIOR LECTURER OF ENTREPRENEURSHIP, THE JOHNSON SCHOOL, CORNELL UNIVERSITY; MANAGING PARTNER, CAYUGA VENTURE FUND

Good morning Chairwoman Maloney, members of the Committee. Thank you for inviting me to testify before the Joint Economic Committee today. My name is Zachary Shulman. I am a professor at The Johnson School at Cornell University where I teach courses on entrepreneurship and run a program called Entrepreneurship@Johnson. I also am a managing partner at Cayuga Venture Fund, an Ithaca-based venture capital firm.

I believe the partnership between government-sponsored research dollars, Cornell University, and Cayuga Venture Fund is a model that can be replicated in smaller cities throughout the United States that have a strong research university. This kind of partnership leads directly to new consumer products and services, job creation and retention in the community, and direct economic growth in terms of revenue generation and expansion of the tax base.

Cornell University is a major research university located in a small town. It ranked first in New York State and fifteenth in the U.S. in research spending in 2008 with a level of approximately $688 million. I expect comparable rankings in 2009, as the University's research expenditures fell only slightly to $687.4 million. The spillover effect on employment and company growth in the Ithaca region as a result of such spending is real and measurable. The Bureau of Labor Statistics re-

ports that Tompkins County has the lowest rate of unemployment in New York State, 5.2 percent in May 2010, compared with a state rate of just over 8 percent.

Cayuga Venture Fund is a small fund in a small community. Since 1995, we have been working to create and establish a thriving community of leading edge, high tech start-up companies in Ithaca and upstate New York by providing the necessary capital and other resources they need to grow and prosper. We have a history of opportunistic investing across a wide variety of industry sectors. Many of our companies have a strong Cornell University technology connection.

To date, Cayuga Venture Fund III (our current fund) has invested in 11 companies, seven of which are commercializing technologies developed at Cornell. Additionally, two of the remaining four have significant grant supported collaborations with Cornell. These nine companies currently employ more than 450 people and that number is growing. Together, their payrolls are in the tens of millions of dollars. Likewise, in 2009 these nine companies generated revenues of approximately $95 million. They have attracted more than $300 million in total investment dollars from CVF and our investment partners.

Startup companies mean more jobs, more payroll, more revenue, a higher tax base, and more dollars invested. As the unemployment figures for Tompkins County suggest, smaller communities feel the relative impact of such drivers of economic growth to a great degree.

Cornell is more than just a government-funded research engine, but is a full partner in the economic growth and development of Ithaca, Tompkins County, and New York State. You are probably most familiar with the way that Cornell partners with the government to attract research dollars from federal and state agencies. The University also partners with faculty as they create new intellectual property by providing lab space, library resources, and support services. Once promising IP has been developed, Cornell's partnership extends to post-research activities—technology transfer and commercialization—that foster *company creation* and *sustained growth*.

On the *company creation* side, the Cornell Center for Technology Enterprise & Commercialization (CCTEC) manages the technology transfer process for the main campus in Ithaca, the Weill Cornell Medical College campus in Manhattan, and the New York State Agricultural Experiment Station in Geneva. CCTEC connects Cornell technology to industry and business development efforts by working with entrepreneurs (including some faculty members) to vet technologies, research commercial viability and market need, and license technologies to startup companies. Without the technology transfer function, much university research would never leave the laboratory and the innovation culture would stagnate completely.

On the *sustained growth* side, startup companies need capital to get off the ground. Some are funded at inception by the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs and related grants. Those programs are helpful, but only up to a point. Without committed seed stage investors such as venture capital firms and angel investors, most technology-based startups would die. Cornell has taken the critical step of investing some of its endowment funds in CVF. This allows us to attract additional investors into our fund—for example, Cornell alumni who care about startup investing and care that their alma mater is committed to startup growth—and, more importantly, allows us to attract additional direct investors into our companies. Simply stated, without Cornell's investment in our fund, our model would be severely hampered and likely unsustainable.

In summary, entrepreneurial communities built around strong research universities have an advantage *only* if the university embraces the value that startup companies bring to their community. In my view, the federal government could foster the sort of partnership that has flourished at Cornell by directing universities that receive federal research dollars to invest in company formation. For example, if a tiny portion of research dollars were set aside for such investing activity, it could be leveraged to have a huge impact. Cornell has invested approximately $18 million of its own resources in CVF ($12 million in our current fund), which we in turn have leveraged into over $300 million of investment. Finally, let me suggest several ways that the federal government could help foster the commercialization of university-developed technologies:

1. As stated above, the government could mandate that a university recipient of research dollars apply a small percentage of these funds to actual company investment. In other words, if the research yields a technology or process worthy of commercialization, a small portion of research dollars would be invested in the company (in exchange for equity) and spent on building prototypes and doing market assessments.

2. The government could offer direct tax credits for investments made in companies commercializing university-developed technologies. This would attract investment at the critical start-up phase when it's needed the most. The credits could be limited to investments into pre-revenue companies.

3. The government could actively support regional research and commercialization business parks associated with research universities, mainly in the form of tax relief. I believe that the Senate is already having discussions on this topic.

It has been a pleasure to testify before your Committee. Thank you. I would be pleased to answer any questions you may have.

JOINT ECONOMIC COMMITTEE Written Testimony

Tuesday, June 29, 2010

Samuel L. Stanley Jr., M.D.
President, Stony Brook University

Chairwoman Maloney, Vice-Chairman Schumer, members of the Committee, thank you for the opportunity to testify before your Committee on this critically important subject. Before turning to Stony Brook's experience, I would like to bring to the Committee's attention a recent report by The Science Coalition, a national organization of which Stony Brook is a member. The report, "Sparking Economic Growth," (http://www.sciencecoalition.org/successstories/) provides examples from communities across the country of exactly what the Committee is examining today – how federal investment in basic research leads to innovation and job creation – by tracing the origins of 100 companies, including global industry leaders like Google, Genentech, and Cisco Systems as well as up-and-comers and start-ups across a spectrum of industries, back to breakthrough research conducted at a university and sponsored by a federal agency. Collectively, these 100 companies employ well over 100,000 people and have annual revenues approaching $100 billion.

Background. Stony Brook is located 60 miles east of New York City on more than1,000 acres on the north shore of Long Island. Our university has been elected to the Association of American Universities (AAU), and the London Times Higher Education–QS World University Rankings placed Stony Brook University among the top 200 universities in the world. Stony Brook's main campus includes academic units in the canonical arts and sciences, engineering, marine and atmospheric sciences, business, and the health sciences, including medicine and dental medicine, a teaching hospital, Stony Brook University Medical Center, and the Long Island State Veterans Home. Our resources include:

- An exceptionally talented faculty with core strengths in the academic disciplines most relevant to the growth sectors of the global economy, including biomedicine and the life sciences, engineering, the physical sciences and computer science;

- A half-billion-dollar infrastructure of exceptional and diverse laboratories and specialized facilities;
- Annual research expenditures of $175 million, and;
- Our longstanding partnership with Brookhaven National Laboratory, which we co-manage for the U.S. Department of Energy with Battelle Memorial Institute.

Our Long Island home, where we are the only major research university, has a population greater than 19 states; Stony Brook is its largest single-site employer, with an aggregate economic impact of more than $4.6 billion annually. (http://www.stonybrook.edu/sb/impact)

Record of Success. Stony Brook illustrates how the goals and intentions of the Bayh-Dole Act of 1980 should be implemented and carried out. It is the leading technology transfers campus in the SUNY system, responsible for an average of over 90% of the licensing revenues across the entire system during the last decade. This achievement consistently places both SUNY and our campus alone among the top 25 tech transfer campuses in the nation, according to the reports of the Association of University Technology Managers. Our campus also consistently leads or ranks high in all of the other metrics of tech transfer performance: invention disclosures, patent applications, issued patents, and executed licenses. Our technology transfer program is selective: approximately 60% of patent applications turn into issued patents, and we have been able to collect over $10 million in royalties annually that we plough back into research on campus. Whereas some universities focus on exclusive licenses, especially in biomedicine, we focus on ensuring that our technology gets out into the marketplace for societal benefit. In fact, one of our research patents has been licensed to almost 120 different industrial users.

The most successful of these licensed technologies formed the basis for *ReoPro,* which received FDA approval in 1994 and is still recommended for the 250,000 cardiac angioplasties performed annually in the U.S. Other drugs developed with Stony Brook include *Periostat*, the first systemic treatment for periodontal disease, which afflicts 25% of American adults, *Oracea*, the only oral therapy for rosacea, and *Xiaflex*, the first FDA-approved non-surgical treatment for Dupuytrens contracture. These drugs are the first

four to receive FDA approval from any SUNY campus. As a New Yorker, I regret to report to the Chair and Vice-chair that the manufacturers of these drugs – Centocor Ortho Biotech, CollaGenex Pharmaceuticals (now Galderma, which manufactures both Periostat and Oracea), and Auxilium Pharmaceuticals and their jobs are located in Pennsylvania. As a citizen concerned about our economic future, I am delighted that these products are being made in the U.S.

On the base of its talent pool – which includes its knowledgeable professional staff – its physical infrastructure as a research institution, and committed high-level leadership, Stony Brook has developed an array of economic development programs which, while not making us all things to all people, enable us to partner with businesses of any size at any stage of development, "from cradle to Fortune 500." Recent cumulative data demonstrate that, through these programs, our university has helped to create or retain more than 17,000 jobs and assisted many hundreds of companies to obtain more than $600 million in financing and increased corporate revenues.

Secrets of Stony Brook's Success. Recognizing that time is short, I would like to refer you to my written testimony for a detailed summary of these programs, and to use the remainder of the time allotted to point to lessons Stony Brook has learned about the critical linkage between federally funded academic research and the growth of our regional economy. I must note, however, that New York State government was an early proponent of university-industry collaboration as a key to economic growth. State-funded programs, although generally modest in their investment of tax dollars, continue to provide considered and essential support for our efforts.

New York State Centers for Advanced Technology (CATs)

This program supports fifteen Centers for Advanced Technology that are mandated to encourage, facilitate and support university-industry collaborative research and technology transfer of commercial relevant technologies in industry sectors selected for their established base, research strength and future promise for the state's economy. These include biotechnology, information technology, energy systems, and electronics.

Stony Brook is the only campus in the state with two CATs, one in Medical Biotechnology and the other in Sensor Systems. At less than $2M per year for both, the CATs are precluded by this limited funding from fulfilling the founding vision of statewide impact in their industry sectors, but they have nonetheless achieved 50 times that amount in corporate revenue impacts for their dozens of industry partners.

Strategic Partnership for Industrial Resurgence (SPIR) Program

Fifteen years ago, Stony Brook led SUNY's engineering colleges in creating SPIR, which mobilizes their thousands of degreed professional engineers to provide advanced technology assistance on a fast turnaround basis to companies around the state. At Stony Brook alone, more than 400 New York companies have been assisted through 2,269 projects, creating or retaining a projected total of 11,808 jobs and helping the companies win more than $100 million in external funding. Among the several program's roles, it serves as a de facto outsourced R&D division for small companies with limited margins, enabling them to perform new product development while preserving resources to ramp up manufacturing when the product is ready for market. The program has been able to serve about 20% of Long Island's manufacturing and technology companies – a total that does not include the region's large information technology and software sector – at its present level of state funding. The companies that have benefited are very satisfied with the results, but the population served should be doubled or tripled to have a lasting effect on the regional economy.

U.S. Small Business Administration Small Business Development Centers

In New York, the SBA's Small Business Development Centers are based primarily on SUNY campuses. Stony Brook has an SBDC, which provides confidential counseling at no cost on all aspects of small business start-up and management. Our SBDC has reported more than $250 million in financing obtained for its clients. The on-campus presence of the SBDC and the recruitment of business advisers with deep experience in technology-based businesses provide a valued resource for Stony Brook 's new business incubation programs. Both the SBDC and the Long Island High Technology Incubator are collaborating to help new energy businesses start up and grow through awards they

have received from the New York State Energy Research and Development Authority.

Incubation

Incubation space and program support for start-up companies are provided in the 67,000 s.f. Long Island High Technology Incubator, our region's first, and the Stony Brook Incubator at Calverton. Just out the back door of Brookhaven Lab, it will grow to 24,000 s.f. upon completion of the planned Consumer Food Science Center, which has been developed in collaboration with participants from the East End of Long Island, the largest agricultural producer in the state. In addition, the R&D facilities in the university's Research and Development Park provide modest space for start-up companies associated with our research programs. Stony Brook's incubators have "graduated" more than 40 companies in the last fifteen years, which earned more than $100 million in corporate revenues last year, providing jobs for hundreds of Long Islanders. Most of these companies are research-based start-ups – about half based on Stony Brook technologies or know-how – for which the SBDC is an essential business guidance resource. Some of these incubator tenants are among the recipients of the more than $16 million in SBIR and STTR awards that the SPIR program has helped its partner companies obtain. The SBIR/STTR program provides support that is available from no other source to fund proof of concept, prototype development and technology commercialization, primarily by start-ups and small companies. A number of internal and independent studies have shown that 50% of SBIR projects reach the marketplace, an extraordinary success rate for early stage technologies. We very much hope the program can be reauthorized before the end of this Congress.

New York State Centers of Excellence

Stony Brook is home to the New York State Center of Excellence in Wireless and Information Technology (CEWIT) and the Advanced Energy Research and Technology Center (AEC). CEWIT and the AEC respectively serve the industry sector most responsible for the productivity improvements in the U.S. economy over the last two decades and the sector whose modernization is critical to our continuing economic competitiveness and security as well as the health of our environment. Their missions are

to focus formidable research and development strengths, from the university and through the academic, research and industry partnerships they create, on these growth engines of our global economic future. CEWIT, occupying the first building in Stony Brook's 245-acre R&D Park, has completed more than 300 projects with partner companies since the inception of the program, obtained more than $100 million in joint funding, and assisted companies in creating more than 600 jobs.

Showing that technology development follows its own pathways, CEWIT has responded to the rapid increase in demand from colleagues in the hospital and biomedical departments by adding a program in medical technologies to its multidisciplinary R&D divisions. CEWIT is also partnering with the AEC –whose building, funded by a State Senate allocation, will be completed at the end of the summer, the first Platinum LEED research facility in New York State – to develop a globally significant R&D focus in Smart Grid, the greatest technology revolution in the energy sector in more than a century. The AEC will be the home of the New York State Smart Grid Consortium, an unprecedented alliance of energy providers, regulators, state agencies, industry, and research institutions to keep New York at the forefront of this extraordinary emerging opportunity. These two facilities are engaged in cutting edge research and development in two of the hottest industry sectors in the global economy, with the goal of keeping our region, our state and our nation a world economic leader. The third building in the Park, for biomedical R&D, is already being planned, and we are already thinking about a fourth building that will provide a variety of accommodations for commercial and not-for-profit research partners.

Performance metrics. Individually, and collectively through the AAU, AUTM, APLU, and other organizations and institutions, the higher education community is currently seeking to define appropriate metrics for the impact of our economic development efforts. Our colleagues in the public and private agencies tasked with economic development as a mission, and supportive of our efforts in this regard, measure our success by the creation and growth of jobs and of new and established business enterprises. We are persuaded of the simplicity and objectivity of these metrics, but feel

that longer timescales are needed to demonstrate sustainable success. Silicon Valley, Research Triangle and Route 128 are the product of decades of commitment by private leaders and elected officials; we look to the recent initiatives of Michael Porter and the Council on Competitiveness, Battelle's State Science and Technology Institute, the Milken Institute, the Brookings Institution, and the very recent program announcements by DOE and NIH/NSF to help us define the ingredients and trajectory of effective regional industry cluster development.

These comments focus on Stony Brook and the Long Island community. But before closing, I want to recall the Science Coalition report (available from The Science Coalition (www.sciencecoalition.org/successstories/) referenced at the beginning and in particular two points that are particularly relevant to our discussion of economic ripple effects.

1) Companies spun out of research universities tend to perform better than typical startups, having better success rates and becoming public companies at a greater rate than the average for new businesses. There are a variety of reasons for this success including the unique ecosystem and mission of a research university and the emphasis we place on helping would-be entrepreneurs move their breakthroughs to innovations.

2) The companies universities help to create often locate close by, creating local jobs, attracting other research-intensive businesses and stimulating growth of supporting industries. Good jobs beget other good jobs. Of the 100 companies highlighted in the report 84 located in the same state as their affiliated university, and most often, within very close proximity to the university.

Lessons Learned

1) **There is no magic bullet, but progress is possible on multiple fronts.** We applaud our university colleagues for learning from the experience of MIT, Stanford and the universities of the North Carolina Research Triangle and seeking to reproduce their vibrant, self-sustaining economic centers through

programs like UCSD's UC Connect and the efforts of APLU's Commission on Innovation, Competitiveness and Economic Prosperity to spread best practices throughout the higher education community. We applaud the federal government's first ventures into regional innovation cluster development in the EDA's partnership with NIH and NSF to initiate the i6 Challenge, and the proposed addition of "Innovation Ecosystem" component in the NSF Partnerships for Innovation program – as we applaud New York's support of technology-based economic development over more than two decades. However, we need to get beyond the notion that the primary contribution of research universities is the commercialization of our own technologies. It is a critical contribution, but it represents a minor fraction of the impact we can have. Example: In a speech to the Materials Research Society more than a decade ago, the then-Dean of Engineering at Stanford examined the major contributors to the total corporate revenues of Silicon Valley companies the previous year. He found that ~15% of revenues resulted from technologies licensed from Stanford, and ~40% of revenues were earned by companies that were started or populated by Stanford faculty or students. We should not to ignore the 40% while we are addressing the 15%.

2) **It's about talent**. Universities are great attractors and retainers of talent. Some of the talent is academically-oriented and some isn't. Universities need to overcome their natural inclinations and nurture both the students we educate and the entrepreneurs in our midst. Stony Brook has a student business competition, which a winner of the MIT $100K helped us create. (Our prize fund is up to $75,000 this year. We're gaining on them.) Not a business plan competition: we are interested in helping our student talent start growth businesses, not write plans. Six of our nine winners thus far are still in business. One just received a $2.4 million venture capital investment; another has doubled its staff and is growing so steadily from revenues, after winning an SBIR Phase 1, that it is no longer looking for outside investment.

3) **It's about economic regions and partnerships**. I think we've all learned from the profound and perceptive work that has been done on industrial competitiveness that strong national economies are based on strong economic regions. Stony Brook's existing programs do an excellent job, within their resource constraints, to help new companies start up and existing companies – an economic resource that economic policy-makers may under-appreciate – grow and create more jobs, but we need to do much more. We are engaged in a comprehensive strategic planning exercise at Stony Brook and one of our goals for our economic development programs is to develop a continuous real-time collaborative process to support commercializable innovation wherever it may appear in our region – our faculty, other institutions' researchers, our industry partners. This will strengthen our already deep relationship with Brookhaven National Laboratory – which has committed its historic strengths in energy science and technology to the Advanced Energy Center – and which has just hired its first-ever commercialization director. Our strong collaborations with public sector economic development agencies will be complemented by new connections with regional leadership organizations. We have been instrumental in the creation and ongoing management of our region's first angel investor network, which has already funded two IT start-ups, one based on a novel Web technology for natural language information gathering that emerged from our Computer Science Department. It will be a critical resource for the commercialization of our region's new technologies.

4) **Basic research funding is critical.** Innovation comes from discovery and invention and, as Vannevar Bush foresaw, the federal investment in basic research makes the innovation frontier endless. Precisely because basic research is inquiry-driven, not objectives-driven, we can't tell in advance what the results will be. But sixty years of federal investment has proven its value, from lasers to the MRI to the Internet. It is the inexhaustible fountain of youth that will keep our economy ever green.

Bayh-Dole Works. It has been called the most important bill ever passed by Congress, and it continues to help our nation maintain its lead in bringing innovation to the people.

Thank you.

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Prepared Testimony of Robert E. Litan[1]
Before the U.S. Congress Joint Economic Committee Hearing

Fueling Local Economies: Research, Innovation and Jobs

Thank you for asking me to discuss with you today the ways in which federally funded innovation benefits national and local economies and ways in which federal research dollars can be better leveraged to generate even greater economic and social benefits.

Your attention to these topics could not be better timed. The U.S. economy is struggling to recover from one of the deepest downturns since the Depression, even with the extraordinary fiscal and monetary stimulus measures of the last two years.

Economic research has established two keys to sustained growth over the long run. First, continued innovation will play a central role in the future, as it has in the past, in driving long-run growth and thus continued improvement in living standards. Second, as I will discuss shortly in more detail, entrepreneurs are critical to disseminating innovations into the marketplace and throughout society.

Furthermore, Kauffman Foundation-supported research has established that *new* firms—those no more than five years old—over the past three decades have been responsible for virtually all of the net new jobs created in our economy.[2] If the economy is all about "jobs, jobs, jobs" then we must rely on a new generation of entrepreneurs to commercialize the innovations of the future and in the process bring back the roughly 8 million jobs that have been lost in this recession.

I want to address, therefore, today four topics that should be of interest to this Committee:

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[1] Delivered by Kauffman Foundation researcher Dane Stangler on behalf of Robert Litan, vice president for Research and Policy at the Kauffman Foundation and Senior Fellow, Economic Studies, The Brookings Institution, and Research Manager.

[2] See John Haltiwanger, Ron Jarmin, and Javier Miranda, "Jobs Created from Business Startups in the United States," Kauffman Foundation, January 2009, available at www.kauffman.org; and Dane Stangler and Robert E. Litan, "Where Will The Jobs Come From?" Kauffman, Foundation, November 2009, available at www.kauffman.org.

(1) the importance of federally funded research in spawning innovation, both for the national economy and local economies;

(2) the limitations in the current university/lab eco-system that slow the commercialization of innovations spawned by federal funding;

(3) measures that would overcome these limitations; and

(4) how the reform of immigration policies could significantly raise the rate at which new "scale" businesses, often commercializing innovations, form and grow.

I want to emphasize that none of the reforms I advance under topics (3) and (4) today would require any more than a de minimis amount of additional federal spending, a feature that should be of special interest to the Congress and the American people given the importance of reducing federal deficits over the longer run.

The Importance of Federally Funded Research

In 2009, the various federal agencies spent $147 billion on research and development. Roughly 60 percent of this amount, or about $90 billion, was channeled through U.S. universities.[3]

U.S.-funded research benefits not only Americans but ultimately citizens throughout the world when it leads to new knowledge and innovation—new products, services and methods of production. Innovations cannot generate these benefits, however, unless they are disseminated. Universities are central to this process through their teaching of students and publications of their faculty in academic publications and increasingly via the Internet.

Increasingly, universities and our federal labs also disseminate innovation through their commercialization activities—specifically the licensing of discoveries by faculty members

[3] National Science Foundation, *Science and Engineering Indicators 2010*, Chapter 4.

to companies they form or to existing firms. Some contest whether commercialization should be a university function at all, however, arguing that universities exist to further the creation of new *basic* knowledge and that it is not their role or that of their faculty to engage in commercialization. Based on this view, some worry that commercial activities divert faculty from more fundamental research and their instructional activities. Moreover, it is sometimes claimed that commercialization can distort the values and culture of the university, its faculty and its leaders.

These worries are misplaced. Universities may be Ivory Towers but they are not monasteries. New knowledge for its sake cannot benefit human beings unless it also is applied to real-world problems and challenges. When this is done, the results must be disseminated throughout society. In market economies, dissemination is often best accomplished when innovations are commercialized, for it is the infusion of human and financial capital that enables innovations to "scale." To take the academic inventors out of this process can significantly reduce the likelihood that discoveries in the lab will be turned quickly to constructive uses by the larger society which exists outside university walls.

Moreover, the notion that there is some bright line between "basic" and "applied" research also is misplaced. It is impossible *ex ante* to predict which research activities, supposedly basic design, will turn out to have commercial potential. Indeed, this fact highlights another key point: invention (the discovery of a new idea or technology) is not the same as *innovation* (which is the *application of the invention* to addressing a real-world problem or need). Generally speaking, universities and federal labs are much better at invention than innovation, with the exception of the rare "inventor/innovators" able both to discover something new and then find ways to introduce it into the marketplace as a true innovation.

In fact, America's academic inventor/innovators have made great contributions to our society and economy, with the aid of federal funding and because the Bayh-Dole Act of 1980 facilitated commercialization by clarifying that universities have rights to the intellectual property developed with federal funds. As evidence, consider the list of the 50 most important innovations and discoveries funded by the National Science Foundation in its first 50 years, according to the NSF itself in 2000. Although this *Nifty*

Fifty list includes some huge basic advances—such as the discovery that the universe is expanding at an accelerating rate—most items on the list are innovations that have been commercialized, or that have become platforms for many commercial products and services and are widely in use: barcodes, CAD/CAM software, data compression technology used in compact discs, and perhaps most significant of all, the Internet (which the NSF funded along with DARPA, a defense research agency).[4] Not all of the *Nifty Fifty* innovations are high-tech, however, but their importance is indisputable. These include yellow barrels used on the sides of highways to slow down out-of-control vehicles before they hit barriers and walls, and the American Sign Language Dictionary, which has changed the lives of the deaf.

Another, more recent accounting of the importance of university-generated innovations is reflected in an analysis of the top 100 "most technologically significant new products" listed each year in *R&D* magazine. Fred Block and Matthew Keller report that universities and federal laboratories have become much more important sources of the top 100 innovations over the last 35 years.[5] In 1975, for example, they note that private firms accounted for over 70 percent of the R&D 100, while the academic institution share was just 15 percent. By 2006, just three decades later, these two shares were reversed: academia contributed over 70 percent of the top 100 innovations, while private firms accounted for about 25 percent. Bayh-Dole almost certainly helped contribute to this turnaround, but so has the huge growth of federal funding for research over the six decades after World War II.

University-generated innovations, if anything, should be even more important to the U.S. economy and society in the years ahead. As Jonathan Cole states in his impressive history of universities in the United States, "*In the future, virtually every new industry will depend on research conducted at America's universities* (emphasis added)."[6] Federal research monies will continue to be heavily involved in bringing this better future about.

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[4] National Science Foundation, 2000. *Nifty Fifty*, available at www.nsf.gov/od/lpa/nsf50/nsffoutreach/htm/home.htm.

[5] Fred Block and Matthew Keller, 2008, "Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006." (Washington, D.C.: The Information Technology and Innovation Foundation).

[6] Jonathan Cole, 2009. *The Great American University: Its Rise to Preeminence, Its Indispensable National Role, Why It Must Be Protected* (New York: Public Affairs).

Federal funding of university research is not only important at the national level, but also has significant local or regional benefits or spillovers. One of the important channels through which this occurs is the commercialization activities of so-called "star scientists," those uniquely gifted individuals who are terrific teachers, researchers and entrepreneurs.

In a series of papers, Lynne Zucker and Michael Darby, both professors at UCLA, have investigated the economic effects of star scientists.[7] They find that businesses with higher star scientist involvement go public faster and with higher overall valuations than firms with little or no contact with star scientists. In a survey of pharmaceutical businesses, for example, firms working with star scientists survived at a rate of 80 percent over 9 years, while firms without such star support survived at a rate of only 17.4 percent over the same period.[8] Further, in many high-tech industries, from biotechnology to semiconductors, support of star scientists has been associated with the creation of firms that are leaders of an industry both in terms of increased employment and innovation. For example, biotechnology firms that are highly involved with star scientists employ on average nine times as many people as those without any star involvement (80 employees compared to 734 per firm). Star scientists, when serving as the primary resource fueling a startup or when employed by existing firms, drastically improve the chances that a given venture will survive and grow, leading to more jobs and higher output.

Beyond the impact of star scientists on specific firms are many regional benefits. The mere existence of star scientists in a given region tends to increase the number of technologically related startups in the area. In part, this positive impact flows from scientists working directly with businesses. In addition, the "star power" these scientists bring to their ventures encourages the development of an ecosystem—other scientists and professionals, as well as skilled workers—around the firms they help create. This ecosystem makes it easier for other entrepreneurs with their own ideas to launch new ventures, creating a virtuous circle of development. It is in this way that regions can

[7] These articles are summarized in Zucker, Lynne and Michael Darby. 2009. "Star Scientists, Innovation and Regional and National Immigration," in David Audretsch, Robert Litan and Robert Strom, eds. *Entrepreneurship and Openness: Theory and Evidence* (Northampton: Edward Elgar), pp. 181-211.

develop into hubs of new technology, ventures and ideas. Examples include: Silicon Valley with Stanford and Berkeley, Austin (University of Texas), Boulder (University of Colorado), San Diego (UC San Diego), Raleigh-Durham-Chapel Hill (Duke, North Carolina, North Carolina State), and Seattle (where the local university, Washington, has been important, but not the critical ingredient to that area's entrepreneurial success).

I want to stress that national or even local policy (with the possible exception of Research Triangle Park in North Carolina) did not intend to create any of these high-tech hubs or clusters, but that each emerged as the by-product of entrepreneurial success that was fueled by federal research money or contrasts. In other words, federal research funds may increase the chance of launching a new cluster in a given area, but money alone does assure success. Somewhere along the way there must be some entrepreneurial sparks.

A key challenge for the nation at this critical time is for policymaking more generally (beyond federal support of university research) to help encourage many such entrepreneurial sparks. The health and future growth of our economy depends on this.

Translating Research Into Commercially Useful Innovation: We Need To Do Better

Yet as important as federal research support is for innovation, it is not the only ingredient. America's "innovation machine" is actually a complicated mechanism or engine that has many parts: universities, federal labs, entrepreneurs, financiers and even lawyers (to ensure that inventors secure appropriate intellectual property rights in their inventions). Before we pour even more fuel—that is, federal money—into this innovation machine, it is important to make sure that it is firing on all cylinders. Otherwise, the machine is likely to fall victim to diminishing returns, with less and less innovation coming out of the process.

There are several reasons why our current innovation system is not performing as well it could and should. That's the bad news. The good news is that these problems can be fixed.

Issues Related to the Allocation of Federal Research Monies

First, there are problems with the way federal R&D money is distributed to researchers.[9] One well known by-product of the peer review system for awarding research monies is that it too easily tends toward "clubiness," which in turn imparts a bias against out-of-the-box thinking and research. Competing scientists have incentives to scratch each other's backs to ensure that each receives grants. In addition, peer reviewers who are at the top of their fields can have an inclination to avoid challenges to the scientific orthodoxies to which they themselves may have contributed. These features of the current peer review system—however well-intentioned and sensible it may appear on the surface—have the effect of awarding federal monies to older researchers who are less likely than younger scholars to explore ideas which could upend the old order and usher in real breakthroughs.

This age bias in peer review awards has been recognized as a problem by some foundations. The Gates Foundation, for example, has launched a special initiative, *Grand Challenges in Global Health*, that is aimed specifically at funding untested ideas with high innovative potential. The Foundation wants to avoid the standard peer review process by reaching out to any researchers, regardless of age, who might have breakthrough ideas to fight global diseases.[10]

The federal government should follow suit in some form. Perhaps some fraction of federal research dollars should be set aside for younger scientists. Or there may be ways of fixing the current peer review system, such as putting younger scholars on the review panels. I don't know which remedy or mix of remedies is ideal, but this issue is important, can be rectified and should be further explored.

Another problem with the current federal research spending effort is that it has some of the characteristics of defense spending—by which I mean that research dollars must be spread around to as many Congressional districts as possible to assure some degree of political "equity" in the awards. For example, by my count, NIH has grants in 429 Congressional districts. While there are many highly qualified health researchers in

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[9] For a general discussion of the problems in the ways federal research monies are handed out, see a recent essay by my colleague and Kauffman President, Carl Schramm, "Made in America", in *The National Interest On-Line*, April 20, 2010.

[10] The President of the Gates Foundation's Global Health Program, Dr. Tadataka Yamada has written that "[p]eer review can kill truly novel ideas because they are, by definition, peerless." See Tadakata Yamada, "In Search of New Ideas for Global Health," *New England Journal of Medicine*, 2008, 358:13, pp. 1324-25.

America, they are unevenly distributed; the best institutions tend to have the most, it's a fact of life. When research money is allocated by federal research agencies as much to help sustain political support in Congress as it is to secure the best research outcomes, then the system is generating less innovation than it could be.

This problem is not easily solved. It is understandable why elected officials want the most research money—or any federal money—for their districts or states. One obvious solution is for Congress to avoid earmarking research funds for particular projects or regions. Another approach may be to require the research funding agencies to measure and report on the successful outcomes (new firms started and their revenue and employment growth, and patents filed for or received) per dollar of research money handed out by state or even Congressional district. Sunlight has a way of at least partially restraining the natural impulse to distribute funds for political reasons.

Issues Relating to the Commercialization of Federally Funded Research

Not only are the flaws in the way federal research money is handed out, but perhaps even more important, the system for commercializing the innovations that are generated by the research is not operating at peak performance. Here, I specifically am referring to the process in America's universities, and I believe in our federal labs, for licensing the intellectual property (IP) rights in innovations financed by federal research funding.

Thirty years ago, in passing the Bayh-Dole Act, Congress recognized the importance of commercializing the results of federally funded research by authorizing universities to hold and license IP in innovations spawned by this funding. This Act was an important development and no doubt has helped contribute to an increase in the share of major breakthroughs that are accounted for by academic researchers.

One of the unintended consequences of the Act, however, is that universities responded by centralizing all of their licensing and commercialization activities in single offices—now known as technology licensing offices (TLOs) or technology transfer offices (TTOs). There were good reasons for this, among them: to realize economies of scale in licensing, to assure that faculty members reported their discoveries to the universities so that universities could thus accurately keep tabs on royalties they were owed under

faculty employment agreements, to coordinate patenting decisions when multiple faculty and students were involved, to coordinate licensing arrangements when faculty from other universities were co-inventors, and presumably out of a belief that TLOs would accumulate more knowledge about the most advantageous licensing opportunities than individual faculty members.

But centralization has had a price. It has given the TLO on each campus what amounts to monopoly control over the licensing activities of all university faculty innovators. As my Kauffman colleague Lesa Mitchell and I have recently argued,[11] this subjects faculty inventors to a bureaucracy that may not always have the expertise or resources to quickly and most efficiently commercialize their discoveries. If universities applied the same model to faculty research, it would mean that all faculty members would be required, by contract, to first obtain the approval of a central "publications office" that would coordinate the submission of articles to journals and books to publishers. It almost goes without saying that faculty would not stand for such an approach to their publications, nor would universities voluntarily adopt it for fear of frustrating the dissemination of research results to the academic community and the wider public. Yet when it comes to commercial activity, universities have taken a very different approach, one which I believe generates less innovation and more slowly than would be the case than if we allowed *the market* rather than bureaucracies to make the key licensing or commercialization decisions.

By market decision-making I mean allowing university faculty members, as well as employees of federal labs, to have decision-making authority over the licensing of their discoveries, while leaving undisturbed their employment contracts that split royalties or other income with their university employers (or the federal government, in the case of federal labs). In essence, faculty or lab innovators should be able to use the licensing agents of their choosing, include their own university's (or their agencies') TLO, TLOs at other universities (or agencies) that have expertise in the particular subject matter of the innovator's discovery and that realize the entrepreneurial potential of competing for this business, or agents not affiliated with universities.

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[11] Robert E. Litan and Lesa Mitchell, "A Faster Path from Lab to Market," *Harvard Business Review*, January, 2010, pp. 52-53.

Ideally, universities would realize the advantages of a free market in technology licensing on their own. Such a market would provide much stronger incentives for faculty to commercialize their discoveries more quickly, eliminating the potentially long waits at the TLO to get recognition. This would generate benefits for society, for faculty innovators and the universities who will share in their success. Choice in licensing would also encourage specialization and thus economies of scale among licensing agents, whether or not they are affiliated with universities. Some universities might even decide to drop their TLOs, merge or pool them with other research institutions, or significantly reduce their staffs as a result and thereby save money and generate better returns. Or universities could decide to keep their TLOs to compete with other licensing agents and/or transform them into technology consulting offices that would give advice to faculty about the commercialization and licensing process.

The federal government can and should facilitate a market in technology licensing—that is, help push universities along to do what is in the broader public interest. Individual funding agencies could require grantee organizations to provide evidence of their commercialization capabilities as a condition to obtaining research grants. Providing licensing freedom to faculty innovators would be one presumptive way to satisfy this requirement. Agencies overseeing the various federal labs—the Department of Energy in particular—also could require the labs to grant licensing freedom to their employee innovators. It is possible that these policy changes could be effected through regulations issued by the Department of Commerce, which has authority for implementing Bayh-Dole.

There is one significant point I want to underscore: *there is no need to change the Bayh-Dole Act itself or any other statute to implement these reforms.* Of course, Congress could move these reforms along—either in authorizing legislation or appropriations bills—by requiring agencies to adopt measures to encourage licensing reform.
I realize that there are objections to creating or encouraging a freer market in technology licensing, but I believe these can be readily addressed, and I would be happy to discuss them in detail if the Committee wishes. But at a broad level, I believe the critics can be best answered by asking a question of them: why only in the particular case of technology licensing, but not in the publication of research, should faculty members not be able to choose the best method for advancing their innovation—especially when the

exercise of choice does not disturb in any way the university's royalty or gain-sharing arrangement in the faculty member's contract? To be more precise, on what grounds can monopoly in this narrow sphere of activity be justified, when the presumption in virtually every other sphere of economic activity favors competition? At the very least, opponents to free agency would seem to have the burden of proof in carrying the day on each of these questions.

My colleague Lesa Mitchell, vice president for Advancing Innovation at Kauffman, has identified several other ways that federal agencies can speed up the commercialization process in recent Congressional testimony.[12] Here I will single out one of her ideas for special emphasis.

Whether or not Congress encourages universities and federal labs to grant their innovators greater licensing freedom (and whether or not these institutions adopt this reform on their own), the federal government should encourage and ideally help fund commercialization education of innovators at universities and federal labs. While many university star scientists have extensive entrepreneurial and/or licensing experience, others (especially first-timers) do not. This is one of the main justifications for having a centralized TLO.

But if entrepreneurial education and coaching is what is needed, it is not clear that TLOs are in the best position to provide these services. Rather, creative ways should be developed to bring in panels of outside, serial entrepreneurs to help university (and federal lab) innovators develop the commercial potential of their innovations and to help them navigate their way through decisions whether to license the IP rights to existing firms or to start new firms. In particular, if the latter decision is made, faculty/lab innovators could profit from expert guidance about how to build and grow their companies, how to seek outside capital, how to build a management team, and so on. There are excellent examples of this kind of activity going on at certain universities already.

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[12] Testimony of Lesa Mitchell before the House Committee on Science and Technology, Subcommittee on Research and Science Education, June 10, 2010, available at www.kauffman.org.

Federal agencies responsible for the research grants could add some modest additional funds for such training and mentoring, provided the university/lab sponsor has developed an appropriate plan for doing this. In addition, universities may want to band together to support a team of serial entrepreneurs who could help do this for faculty innovators at all participating institutions. The federal labs could do the same. There is no clear single right answer here, but some more creative thinking and multiple experiments would be helpful.

A third idea for accelerating commercialization at universities and/or federal labs I credit to another Kauffman colleague, Harold Bradley, who is chief investment officer at the Foundation. This idea would adopt an innovation by the "X Prize Foundation" and create several federal prizes for universities demonstrating great success in commercialization. "Success" could be defined by an index composed of measures representing the number of new firms launched, and the revenues realized and jobs created from these enterprises. In particular, one could envision a $1 million prize to the university demonstrating the greatest success each year, and perhaps a larger prize (say $5 million) for the best success measured over a five-year period. What is equally important is that the prize *not* be contingent on the traditional measures of TLO performance, notably patents generated and licensing income earned. The prize instead should reward what is most important for society and jobs—namely new firms created and measures of *their* incremental performance.

There is an extensive economics literature on the powerfully strong incentive effects created by prizes. The quest for the money and the fame stimulate far more activity than the amount of the prize itself. Also in creating such prizes, the federal government would indirectly encourage the other two commercialization reforms suggested here—more licensing freedom for and entrepreneurial education of innovators.

Boosting Formation and Growth of New Scale Firms

Not only are new firms generally important to the vitality of the economy and job growth, but new firms that "scale"—those that grow in revenues and jobs—are especially important. My Kauffman colleague Dane Stangler has documented from Census Department jobs data that the top 1 percent of all companies generate 40 percent of new

jobs, and that the vast majority of these firms are no more than five years old. Furthermore, although the most rapidly growing young firms (those between ages three and five years) represent less than 1 percent of all companies in the economy, these few firms account for 10 percent of new jobs created each year.[13]

New firms, and the entrepreneurs who found them, also are vital parts of the innovation eco-system. Precisely because they are not tied to existing businesses, products, and services, new firms are responsible for a disproportionate share of the "radical" or "breakthrough" innovations that really drive growth. Think of the automobile, the airplane, the computer revolutions, among other innovations—all were brought to the market by entrepreneurs, not by established firms.

The reforms for improving commercialization of academic innovations represent one set of ways for stimulating the growth of new scale firms. Another set of policies—those that affect how many skilled immigrants we let into this country—also would contribute significantly toward this objective.

It has been widely noted that for some time that a majority of the graduate students in science-related fields have been foreign students.[14] Some have been alarmed by this fact, arguing that it reflects either or both the lack of interest or excellence in science and math among native-born Americans.

Whether or not these factors are true, we should do much more to harness for the benefit of the U.S. economy and society, more broadly the creativity and entrepreneurial inclinations of foreign students who study here, many of whom work with faculty members receiving federal research grants. Vivek Wadhwa of Duke University and Anna Lee Saxenian of the University of California at Berkeley, among others, have documented that immigrants account for a disproportionate share of startups of successful high-tech companies, new enterprises generally, and patents. These

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[13] Dane Stangler, "High-Growth Firms and the Future of the American Economy," Kauffman Foundation, March 10, 2010 at www.kauffman.org.

[14] According to the National Science Foundation, "[f]oreign students received nearly 60 percent of all engineering doctorates awarded in the U.S. and over 50 percent of all doctorates in engineering, mathematics, computer sciences, physics, and economics." National Science Foundation, 2008, *Science and Engineering Indicators 2008* (based on data from 2005).

immigrants bring both skills (often acquired at U.S. universities) and entrepreneurial drive to their efforts.

If we want more such companies—and clearly we do because they create jobs and wealth for other Americans—then some relatively straightforward changes in our immigration policies are in order.

The most ambitious reform that is attracting growing interest in the private sector and in Congress would be simply to staple green cards to all U.S. university diplomas handed out to foreign students. There are variations of this idea. Green cards could be attached to any kind of diploma in any subject, to undergraduate and/or graduate degrees, or to degrees in certain fields (science, technology, engineering and math, or STEM) which are likely to generate many, if not most, of the next big innovations.

If any version of the green card is viewed to be too politically risky, there is an obvious fallback that should not be, and that is to create a new "startup visa." Senators Kerry and Lugar have proposed such a plan that would grant a temporary visa to entrepreneurs who receive at least $250,000 in outside financing and hire at least one non-family member, and then a green card once their enterprises employ at least five non-family members or earn at least $1 million in revenue. This is a good first step and certainly far better than the current EB-5 visa which is available only for up to 10,000 individuals who bring at least $1 million into the country and invest it in companies here (the threshold is $500,000 if the investment is in an economically distressed area). Even then, the EB-5 is only temporary, since it is valid for just two years.

But an even better entrepreneurs' visa, in my view, would be based solely on jobs created here and not have any investment requirement, which many immigrants may not be able to meet. After all, what could be more important, especially in the current economic environment, than to encourage the formation of firms that actually hire Americans? Immigrants who thus establish enterprises here should receive an immediate temporary visa, and then a time-limited visa, perhaps for five years, once they hire at least one non-family member. As in Kerry-Lugar, the visa should convert to a green card once the immigrant-entrepreneur hires some larger number of family-members (say five or 10).

There is an ample supply of immigrants who might qualify for a lengthened startup visa: the 1 million skilled foreign workers who are here now on temporary H1-B visas who otherwise must go home after six years, as well as the roughly 60,000 foreign students who each year earn a degree at an American university. These are far larger numbers than the relatively few individuals who could qualify for entry under the Kerry-Lugar proposal.

If, conservatively, roughly one in 10 of the H1-B's and foreign students launch a U.S. business—about the share of self-employed in this country among all workers—and each hire an employee, a true "job creators" visa could generate at least 100,000 new jobs. The number could be higher given immigrants' propensity to launch jobs at a greater rate than native-born Americans.

Moreover, since immigrants educated here or who already have skills from abroad are highly educated, the new businesses they launch are likely to be more technology-intensive than the typical business. This outcome is consistent with the need to accelerate the development and commercialization of innovation in this country.

Immigration reform for highly skilled workers, especially those with an entrepreneurial bent, is long overdue. We are competing in a global marketplace for ideas and talent. Other countries—notably Australia and Canada—have more liberal immigration policies for skilled individuals than we do. While the world benefits when these individuals start or work for new business anywhere, they are likely to do best for us and for the world if we can give them to chance to launch their businesses here in the United States, since we still have the world's best entrepreneurial infrastructure. If we want to keep it that way, we need to be far more open to the world's best minds and talents than we are now.

Conclusion

In sum, continued federal support for research in academia and the federal labs is important for innovation, and has important economic benefits for the national economy and local economies. But at the same time, we will not maximize the benefits of this

spending for society unless we do all we can to maximize the incentives for commercializing the innovations that this spending generates.

Our current innovation eco-system has clear limitations. These can and should be addressed as part of any national "innovation agenda." I have outlined some ideas here for doing so.

At the same time, our immigration laws should be changed to let in and keep precisely those skilled individuals who have a demonstrated record for turning new ideas into new companies, jobs and wealth for Americans.

Good economic outcomes make for good politics, especially when the measures available for achieving these outcomes cost little or no additional federal money.

Thank you for giving me the opportunity to appear before you today. I look forward to answering any questions.

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