Testimony from Neil D. Kane, President, Illinois Partners Executive Services, to the
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Program to Leverage Research Investments"
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I'd like to thank Chairman Brooks, Ranking Member Lipinski and the other members of the Committee for the privilege and honor to speak to you today. I represent on today's panel the perspective of an Innovation Corps Mentor. Last fall our team, now known as GlucoSentient, Inc., was part of the first cohort of the Innovation Corps program.

You can think of me as the proverbial serial entrepreneur. With a degree in mechanical engineering and an MBA, I spent the first part of my career in large companies like IBM and Microsoft in a variety of engineering and customer facing roles. About 12 years ago I saw an opportunity to apply my technical and business experience to help researchers, typically from universities and federal laboratories, commercialize the fruits of their work. My involvement is sometimes as a consultant or advisor, and on more than a few occasions I have been the CEO of a startup company formed to commercialize this work. My focus tends to be on innovations derived from the engineering sciences with an emphasis on advanced materials and nanotechnology. On this journey I was the Entrepreneur-in-Residence at the Research Park at the University of Illinois at Urbana-Champaign, and earlier I was co-Executive Director of the Illinois Technology Enterprise Center at Argonne National Laboratory. Through these efforts I was involved in the launching of innovative companies such as SolarBridge Technologies, a maker of micro-inverters for photovoltaic systems; Semprius, a leading flexible electronics company; and Advanced Diamond Technologies, a pioneer in the synthesis of diamond from natural gas. Together these companies have raised over $110 million. Currently I am involved in a number of projects, all based on university research, and I hope they become as successful as these companies.

The core technology underlying Advanced Diamond Technologies (ADT) is a process, very much like processes used to make semiconductors, which converts natural gas (the stuff that heats your home) into diamond. Applications of our synthetic diamond thin films range from reducing friction on wear parts in rotating equipment like pumps to electrodes for the treatment of water in cooling towers with myriad electronic applications along the way. I co-founded ADT with two scientists from Argonne in 2003. Today we have products generating revenue in multiple markets and are exporting our technology around the world from our factory in Romeoville, IL, near Chicago. Along the way we have been recognized many times for our innovations including being named as a Technology Pioneer by the World Economic Forum. I was the CEO of ADT from its founding in 2003 until 2011. I learned firsthand that the road from the laboratory to the marketplace is a long one, especially for complex technologies, and particularly for those that are derived from academic research.

At ADT we owe a debt of gratitude to NSF. It is doubtful that we would have made it were it not for the SBIR program. As Tom Peterson noted in a session a few weeks ago at Northwestern University, NSF can't take *all* the credit for their grantees' success, but they unquestionably deserve *some* of it. All of the products that ADT is selling commercially today at one time were the subjects of NSF SBIRs. We also owe a big thanks to Congressman Lipinski who has been a constant supporter of ours even before we landed in his district as a result of redistricting after the 2010 census.

Last summer Professor Yi Lu from the University of Illinois at Urbana-Champaign had just published a paper on a new innovation which was generating unsolicited inquiries from around the world. He figured out a way, using DNA technology, to repurpose a personal glucose meter (the kind used by diabetics to measure blood sugar) into a platform for dozens of diagnostic tests that could be administered as simply as a patient today measures their blood sugar levels. Imagine a library of test "strips" that could be used at home to measure infectious diseases like HIV or hepatitis, diseases like tuberculosis, poisons like lead or mercury, recreational drugs, environmental hazards or cancer all with a simple, inexpensive device and a test strip that costs a few dollars—similar to the way home pregnancy tests work. Now that glucose meters are becoming wirelessly enabled and are available as smartphone attachments, the possibilities are even more expansive. It is a transformative technology.

I had known Prof. Lu for many years due to time I spent in Champaign as the Entrepreneur-in-Residence at the Research Park. Last summer we had lunch and he made me aware of the just announced Innovation Corps program and asked if I would be the mentor for his team. He had already identified one of his students, Tian Lan, as the entrepreneurial lead. We applied and got accepted into the first class of I-Corps which was taught by Steve Blank and his team at Stanford University. Our focus was to assess the commercial potential of Dr. Lu's new DNA-sensing technology based on the personal glucose meter. We had a working hypothesis about the best market to go into. It turns out our hypothesis was wrong.

The goal of the I-Corps program is not to make entrepreneurs out of professors. Rather it is to teach the Customer Development methodology (developed by Steve Blank) and Business Model Generation technique so that professors and other academics develop an awareness and appreciation for what elements need to be present in an innovation for it to have a chance to succeed in the marketplace. In my experience it is more often poor market fit, rather than poor technology, which causes startups to fail. People who have not experienced what it takes to commercialize a new technology always underestimate the time and effort required. Here is a quote from my 2010 testimony on the subject of technology transfer:

> I've learned over the past ten years that *the real challenge is not transferring the technology out of the laboratory—it's transferring the technology into the marketplace*. If we do everything right except get products to market, we've accomplished nothing. A professor friend of mine [who had started a company] said, "When the technology leaves the lab, it's 5% done."

A professor's reputation is tied up in the quality of their research. As an entrepreneur, I see things through a different lens. In my world view, technologies have limited value unless they are applied. And for jobs to be created and the tax base to go up, somebody, *eventually*, needs to make a profit. In the 12 years I have been working with university professors, their work almost always takes the form of a "technology in search of a solution". Often times the work coming out of academia is scientifically interesting but completely unproven for commercial purposes. I learned firsthand that the I-Corps demonstrably improves a startup's chances for success by helping to remove market risk and business model risk—two areas where scientists typically don't have much experience.

As a thought experiment, consider two potential outcomes of the I-Corps program:

1) A professor attends the program and determines that his/her idea has no commercial merit and does not pursue a startup.

2) A professor attends the program and receives customer feedback that is highly encouraging.

The first outcome is good because they will avoid spending fruitless years or wasted money in pursuit of a goal that isn't going to be fulfilled. It's far better for all concerned that they spend their time on something else. The second outcome may catalyze the momentum for forming a startup company, and now the company is getting started based on good information with the wind at their backs. In both cases the NSF has trained a professor to think differently in the future about how to structure his/her research programs. While the I-Corps program in no way guarantees the success of a startup, it diminishes the risk and increases the likelihood of success. Even without a startup, the I-Corps experience moves the needle in getting researchers to think about the commercial significance of their research programs which is a beneficial effect for all concerned.

If a new technology is developed in academia, and it is clear how it should be applied (such as a cure for cancer), then I-Corps is not needed. When it is obvious that "If I build it, they will come," the I-Corps program has little value. Rather the purpose of I-Corps is to diminish or mitigate what are known as market risk and business model risk. In other words, it answers the question "If I build it, *will* they come?" NSF's other traditional programs address what is known as invention risk which answers the question, "*Can* I build it?"

I-Corps is a teaching program with a considerable amount of skills transfer that, over time, will increase the effectiveness of research programs across the country when measured on a new dimension, commercial impact. We learned in I-Corps to "get out of the building" because only in the marketplace can we find the answers we are seeking. We would never find them in our conference room. As a business professional I have been trained in customer interview techniques, but the technical team members needed to be pushed outside of their comfort zones to learn not only how to do this, but to acknowledge its value despite its simplicity. In the case of our entrepreneurial lead for whom English is not his native language, I think he found making cold calls on prospective customers particularly stress inducing.

Entrepreneurship is the link between scientific innovation and economic development. Instead of discouraging I-Corps, Congress should encourage it. It's a low cost program, and although the benefits won't be calculated for several years, it adds fuel to NSF's research mission. I-Corps will pay a handsome return for taxpayers through job creation and wealth building not to mention enhancing the global competitiveness of the United States.

Initially, a lot of the feedback we got from talking to market participants about our DNA technology by "getting out of the building" was inconclusive. We heard many opinions and received many responses but nothing was converging. Then we spoke to a major pharmaceutical company who saw how our technology could be applied in a way that added a lot of value to their operations. With that insight we pivoted away from our original hypothesis and focused on a new set of customers for a different application. Only then did we decide to start a company. What we learned in I-Corps was how to assess the market need and fit for our innovations.

As an aside, we are nearing agreement on a test plan with that pharmaceutical company, and we've identified another pharmaceutical company with the same need who appears even more motivated to work with us. Our future is not guaranteed, that is for sure. But had we not gone through I-Corps, we'd be wasting our time right now trying to raise money. Instead we are spending our time, albeit with

limited resources, on technical risk reduction and the development of a prototype so that when we do begin raising money, our company will be an excellent candidate for financing.

As helpful as I-Corps is, the job is only half done. I think there's another piece that's missing. Now that NSF has helped to motivate professors to start companies based on their research, I don't necessarily think it's a good idea to try to have them manage those businesses. This is not a new insight for me, and I wrote about this obstacle in 2004. Career scientists are challenged by some of the decisions that business people make which are based on incomplete and often ambiguous information, with very uncertain outcomes. I recall an academic co-founder once exclaiming that he wished there was an equation he could plug into that would give him the right answer. So there's a cultural issue as well about what it means to be the founder of a business which the I-Corps program didn't really delve into.

One way to help cross this cultural divide would be for the I-Corps program to add a module that removes some of the mystery and provides more transparency about what the startup process looks like. We went to our class at Stanford hoping to get some of that from the instructors but they deftly dodged the issue. I share this with you not being sure whether its NSF's problem to fix, but rather I'm identifying it as an impediment to the commercialization of NSF-funded research, an objective we all share.

As I noted in my testimony to this panel in 2010, another impediment to starting companies based on university technology is that the professors have no benchmark for what a "normal" deal should look like. The researchers have no calibration about what they can expect in terms of equity and compensation for participating in the formation of a startup company. When they solicit opinions from their peers, they get wildly divergent viewpoints which accentuates their anxiety. The fear among the researchers that they're not getting treated fairly has, perhaps surprisingly, been one of the biggest barriers in getting companies started. War stories are abundant, and anyone who has done this at least once has at least one story to tell. I-Corps could play a valuable role in helping to educate professors on what it means to be a founder of, but not the manager of, a company. I've seen this issue repeatedly slow down the momentum of many promising startups.

I was personally motivated to go through the I-Corps program so I could take Steve's [Blank] class. As a mentor, entrepreneur and consultant, I benefited enormously from the curriculum. Most significantly, I am working on another technology at another university that did not go through I-Corps, but I have brought the teachings of the curriculum to that project. So I have become a disciple of the methodology and there's a lot of leverage now that I've been trained in it. This "teach the teacher" outcome is a nice dividend to the investment that NSF made in the program. And I've passed the torch to several MBA students, one of whom has his own startup, through that mentoring project.

I think my academic partners got a deep appreciation for the necessity of having market feedback. And I know that my professor colleague, who is used to cramming the night before an exam and still doing well, has an appreciation for the time and commitment needed to do this right. There are no short cuts, it is not easy, and intellect does not guarantee success. This is a huge reset for people who have spent their careers excelling at academic pursuits. My teammates acknowledged what they gained from the program by offering insights such as:

> *Get out of the building and find out who the customers are and what they need before product development begins.*

Start with the customer and adapt the technology to the customer need.

Most of the time, things are not obvious. It takes a long time to find the appropriate market.

Fail fast and learn from the failures. It's a trial and error process too.

We have formed a company called GlucoSentient, Inc. to bring our innovation to market. I became the founding CEO and our entrepreneurial lead from I-Corps is the founding CTO. In his case he is an early career scientist who, we can see by the day, is growing professionally through this odyssey of being part of a startup. Since the I-Corps program ended, the students in Champaign, IL who are on our team received a $10,000 business plan prize, we were accepted into the I-Start Program which provides subsidized legal and accounting services and, most importantly, we got a Phase I SBIR from NSF. The SBIR money is critical to our advancement since our technology was not ready for venture investment a few months ago. The SBIR money gives us the critical funding needed to translate the technology from the university setting to the commercial world.

Entrepreneurship training is vital in today's economy. When I was an undergraduate engineering student there was no entrepreneurship curriculum and the basic courses of marketing and finance that were taught at the university level were in the business school, so far across the campus from the engineering quad that we couldn't have taken courses there even if we wanted to. Now it's cool for engineers, scientists and programmers to be entrepreneurs and learn business skills. What the recent change in our economy has taught us is that even if you are a STEM student, unless you become a career researcher or academic, you need business skills to succeed professionally. The I-Corps program helps prepare a new generation of researchers for the realities of today's economy regardless of whether they become entrepreneurs. The professors who go through the program develop a deeper appreciation for the relevance of their research which improves their effectiveness. And NSF is investing in a network of mentors who, over time, can help to materially move the needle in improving the global competitiveness of the commercial entities that become the stewards of NSF-funded research.