

# THE INNOVATION PIPELINE: FROM UNIVERSITIES TO SMALL BUSINESSES

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## HEARING BEFORE THE SUBCOMMITTEE ON INNOVATION AND WORKFORCE DEVELOPMENT OF THE COMMITTEE ON SMALL BUSINESS UNITED STATES HOUSE OF REPRESENTATIVES ONE HUNDRED SIXTEENTH CONGRESS SECOND SESSION

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# THE INNOVATION PIPELINE: FROM UNIVERSITIES TO SMALL BUSINESSES

TUESDAY, FEBRUARY 11, 2020

HOUSE OF REPRESENTATIVES,  
COMMITTEE ON SMALL BUSINESS,  
SUBCOMMITTEE ON INNOVATION AND WORKFORCE  
DEVELOPMENT,  
*Washington, DC.*

The Subcommittee met, pursuant to call, at 10:03 a.m., in Room 2360, Rayburn House Office Building, Hon. Jason Crow [chairman of the Subcommittee] presiding.

Present: Representatives Crow, Finkenauer, Kim, Davids, Houlahan, Balderson, Chabot, Hern, Burchett, and Joyce.

Chairman CROW. Good morning. The Committee will come to order.

We want to thank everyone for joining us this morning, and especially to the witnesses here today. For those of you who have not testified before a Committee, the way that these Subcommittees usually work is members sometimes have overlapping Subcommittees and obligations, so people will come and go throughout the Committee and ask questions during the time that we have allotted today.

So that that, I wanted to make an opening statement before I turn it over to Mr. Balderson, the Ranking Member.

This past year, this Subcommittee has seen a lot of inspiring examples of the value of innovation and entrepreneurship. For decades, the U.S. has led the world as the best place to innovate and start a small business. A large driver behind this innovation, however, is our commitment to publicly funding research and development in health care, science, and technology. And as a result of that, hundreds of patents are developed on our Nation's college campuses every year. Products like lifesaving drugs, groundbreaking medical devices and advances in agriculture are the result of collaboration among faculty, students and the business community.

These innovations, made possible in some part by public investment, are needed now more than ever as technology rapidly changes every sector of our economy. However, as more states cut funding for research-based universities, the Federal Government's role in supporting innovation is more important than ever.

For an economy as large and diverse as ours, the only way for sustained economic growth is through innovation that results in new solutions or improvements in products or services. The U.S. Government made Federal R&D funding a priority starting in

World War II, and those investments have paid off. Federal funding is responsible now for approximately 30 percent of all new U.S. patents every year.

The story is different now and the U.S. is one of the only OECD countries that has decreased public investment in R&D over the past 25 years. I believe we should be working together to support increased investment in research and development, particularly at our colleges and universities where our next generation of innovators are being developed.

But research and development funding is only one part of the equation. Bringing an idea from a university lab to consumers is no easy process as we have heard from a lot of businesses and innovators over the past year. There are numerous steps involved, from developing a business plan to doing market research to licensing the technology and securing venture capital funding. Fortunately, universities and organizations are working all around the country to make this process easier. By providing space in incubators and accelerators, universities can cultivate emerging technologies and leverage their vast networks for fundraising and mentorship.

The knowledge available to entrepreneurs in these environments can help them through the so-called “valley of death,” another thing that we have heard a lot about from entrepreneurs directly. And that is where the technology is not yet perfected, and investors are hesitant, and many startups fail to get off the ground and get through the “valley of death.”

In my district, the Fitzsimmons Innovation Community, in partnership with CU Anschutz, the Children’s Hospital of Colorado and UC Health is providing vital support for bioscience research, innovation, and commercialization. Another example of the success of the intersection of small business and Federal R&D are the SBIR and STTR programs, which work to commercialize cutting-edge technology. Over the last 3 decades the SBIR program has boasted significant return on investment and has generated billions in tax revenue.

A priority for me as the Chair of this Subcommittee is to identify how policymakers can help rebuild and develop the Main Streets of our country. Whether it is a tech startup in Kansas, a medical device company in Colorado, a pharmaceutical research firm in Philadelphia, or any small business in any city or town across the country, we know these public-private partnerships accelerate innovation, provide jobs, and support our communities.

So, I hope that today’s discussion will shed light on the many benefits of the innovation pipeline taking place at our Nation’s universities. And I look forward to working with my colleagues in Congress so more small businesses can bring their ideas to market.

So now I would like to yield to our Ranking Member, Mr. Balderson, for his opening statement.

Mr. BALDERSON. Thank you, Chairman Crow. Thank you, witnesses, for being here today.

Studies show that when universities and firms both have close personal and geographical links, these connections help produce greater innovation outcomes. Ohio colleges and universities spent nearly \$2.4 billion in fiscal year 2018 on research and development

activities, landing the 12th District on the R&D state ranking. Ohio State University, which has campuses in my district, led the state with \$875 million in R&D expenditures and is ranked 25th of American research universities.

So how can close ties between universities and local firms help business innovation? Just last week I participated in a hearing about the SBIR/STTR programs held by the Research and Technology Subcommittee of the Space, Science, and Technology Committee. I asked the panel about the biggest burdens faced by small businesses in the R&D space and learned that they need help in two major ways—risk assessment of their technologies and general startup resources for business planning and management.

This is where the ties between universities and local firms come in. Institutions that take advantage of both personal and geographical links between R&D and entrepreneurship are able to effectively transform potential into product and scientists into businessmen, or women.

A recently published book, *Jumpstarting America*, illustrates how two MIT professors developed an index system of metro statistical areas or MSAs—very challenging words to put all together there—to rank each one's potential to becoming the Nation's next great tech hub. MSAs were ranked by workforce size, four education measures, and three lifestyle measures. The education measures qualify workforce and production elements required to support research and development systems. I am proud to say that six Ohio cities made the list, including Columbus in my district, which was ranked number 4 out of 102 metropolitan areas. Columbus and its surrounding communities offer a great quality of life and have unlimited potential for high-tech industries thanks to our local colleges and universities.

*Jumpstarting America* and similar economic development studies are limited in scope for various reasons to urban areas. But, what about our rural areas? Surely, there are great innovations coming from the heartland universities.

Last month, the Subcommittee discussed ag tech entrepreneurship as a catalyst for rural revitalization efforts. Our witness for the hearing, Dr. Douglas Jackson-Smith represented Ohio State University's Innovation for Food and Agricultural Transformation, a project that embodies many of the themes we will be discussing today. At this hearing, we will examine the local impact of universities as centers of innovation. While some excel at technology transfer and commercialization, others act as a keystone of entrepreneurial ecosystems.

I appreciate the witnesses' work in this space and look forward to hearing your success stories.

I yield back, Mr. Chairman.

Chairman CROW. Thank you, Mr. Balderson. The gentleman yields back.

And if Committee members have an opening statement, I would just ask that they be submitted for the record.

I want to take just take a few minutes to explain the timing rules for those of you who have not testified before. Each witness gets 5 minutes to testify at the beginning, and then member get 5 minutes for questioning. There is a lighting system to assist you

right in front of you. So, the green light comes on when you begin. The yellow light will come on when you have 1 minute. And then the red light comes on when your time is completed. And we do ask that you try to stick with those timing limits so that the members can get questions in and we can move the questions around between the witnesses as well.

So, I would now like to begin by introducing our first witness, Dr. John Younger. Dr. Younger is the vice president of Science and Technology at the University City Science Center. With extensive clinical research and extramural experience, Dr. Younger is working on the Science Center's Commercialization Startup Investment and Business Acceleration Program. Dr. Younger also founded Akadeum—did I get that right, Dr. Younger? Close enough. Akadeum Life Sciences, a venture-backed life science company out of his lab at the University of Michigan and serves on the National Advisory Council of the National Institute of General Medical Sciences. Welcome, Dr. Younger.

Our second witness is Dr. Sheila Martin. Dr. Martin is vice president for Economic Development and Community Engagement at the Association of Public and Land-grant Universities. Dr. Martin leads and engages with senior university leaders and stakeholders on talent and workforce development, innovation and entrepreneurship, and social, cultural, and community engagement. She also directs APLU's Commission on Economic and Community Engagement. Dr. Martin earned a B.A. from Southern Illinois University, an M.A. from the Patterson School of Diplomacy and International Commerce at the University of Kentucky, and a Ph.D. from Iowa State University. Welcome, Dr. Martin.

Our third witness today is Dr. Ethan Mann. Dr. Mann is a vice president of Sharklet Technologies, an innovative surface technology company based in Aurora, Colorado. Dr. Mann has led many of Sharklet's translational scientific studies aimed at demonstrating the use of microtextures for biological control. Dr. Mann holds a Bachelor of Science from Chadron State College, and a Ph.D. from the University of Nebraska. He trained as a post-doctoral fellow in infectious disease at The Ohio State University, which I am sure Congressman Balderson is happy to hear. Do not let it go to your head, Troy. Dr. Mann currently serves on NIH review panels to evaluate small business innovation research grants which support commercialization of innovative technologies. Thank you, Dr. Mann, for being here today.

I would like to now yield to our Ranking Member, Mr. Balderson, to introduce our final witness.

Mr. BALDERSON. And just so you know, my deputy chief of staff is a graduate of Miami.

I am turning the reins over. I did not see him come in yet, so I am turning it over to the Ranking Member Chabot for the introduction.

Mr. CHABOT. Thank you. Just trying to be part of the woodwork over here, Mr. Chairman.

I want to thank the Chairman and Ranking Member, Mr. Balderson, for allowing me to introduce our fourth and final witness here today, Dr. Gregory P. Crawford, the 22nd president of Miami University, one of the great universities in Ohio. And I



would note that our staff director, Mr. Kevin Fitzpatrick, is a graduate of Miami; as is my son, Randy; as is my younger brother, Dave. And so, a great university. Excuse me.

Aside from being an Ohio native, Dr. Crawford is uniquely suited to present on today's topic. He has bachelor's degrees in mathematics and physics, a master's degree in physics, and a doctorate in chemical physics from Kent State University. His work includes more than 400 research and education publications, review articles and book chapters. Dr. Crawford has an extensive track record of guiding research to commercialization. He has participated in spin-off and startup companies and is credited with 21 U.S. patents and patent applications. Before coming to Miami, he launched research commercialization initiatives at Brown University and at Notre Dame. He is currently a member of the board of directors at Cintrifuse, the incubator and accelerator dedicated to creating a stronger technology presence in the Greater Cincinnati area. Dr. Crawford's administration emphasizes diversity, inclusion, and interdisciplinary collaboration across all of Miami's campuses and colleges.

We thank you for joining us today as we do all the witnesses on this distinguished panel. I want to thank you for your dedication to Miami University and the Greater Cincinnati area and the state. Thank you very much, Doctor.

Chairman CROW. Thank you. The gentleman yields back.

And the members, we got through our introductions which whenever folks from academia come is really the most challenging part for us. There are a lot of acronyms here. So, thank you for bearing with us.

So, let's start with Dr. Younger. You are recognized for 5 minutes, Doctor.

**STATEMENTS OF DR. JOHN YOUNGER, VICE PRESIDENT OF SCIENCE AND TECHNOLOGY, UNIVERSITY CITY SCIENCE CENTER; DR. SHEILA MARTIN, VICE PRESIDENT OF ECONOMIC DEVELOPMENT AND COMMUNITY ENGAGEMENT, ASSOCIATION OF PUBLIC AND LAND-GRANT UNIVERSITIES; DR. ETHAN MANN, VICE PRESIDENT OF MARKETING AND BUSINESS DEVELOPMENT, SHARKLET TECHNOLOGIES, INC.; DR. GREGORY P. CRAWFORD, PRESIDENT, MIAMI UNIVERSITY**

#### **STATEMENT OF DR. JOHN YOUNGER**

Mr. YOUNGER. Great, thank you.

Chairman Crow, Ranking Member Balderson, and members of the Subcommittee, thank you for the opportunity to testify today. It is an honor to join my distinguished colleagues on today's panel, and I will suppress my Wolverine access for the rest of the morning.

Before a great idea becomes a business, or creates a sustained new job, or generates a dollar of export, it must spend time in what you have called the "valley of death." The term applies to a period of commercial development in which really critical questions have to be answered—does anyone actually need the idea that is being

put forward? If so, how many people actually want it? What are they willing to pay?

If you have an adverse answer to any of these questions, a really great idea can be shown the door very quickly. In most instances, that is the appropriate outcome. A lot of ideas turn out to be much better on paper than they are in practice.

The concept of the “valley of death” applies to any new undertaking but it is really acutely relevant to startups, in which there is no predefined market and there is no proven business model to draw from. Startups often die on the vine. Nobody buys, the intellectual property is not defensible, a capable founding team cannot be recruited. That is common and a key tenet of startup thinking is that poor ideas should be identified as such as quickly as possible and abandoned as quickly and efficiently as possible. That saves investment and it saves time for the entrepreneurs that are working on that ideas to move on to more promising ideas.

I began my career as a physician scientist and pursued that path for 20 years. However, for the last 6 years of my career, I have spent a really great time working in the “valley of death,” first as an entrepreneur of a Michigan-based biotech startup, and most recently as part of a team that is doing everything possible to make the journey of that valley as quick, if not painless, as we can for new ideas and new companies.

I now work at the University City Science Center of the Nation’s oldest and largest urban research park, founded in 1963 and based in Philadelphia. As the Science Center’s vice president for Science and Technology, I lead all of our efforts to help universities and startups move their technologies beyond the valley, including a program that provides grants to research universities to better prepare their most promising technologies for entry into the world, a portfolio of some of the most effective business incubators on the East Coast, and an early stage investment fund that provides critical early capital to biotech and healthcare IT startups in their most vulnerable formative days.

Our Nation’s economy faces persistent and intensifying challenges. Innovation is the key to addressing many of those concerns, but how best to support innovation is an especially tough nut to crack. There is no question that research funding is essential to creating ideas and universities that may become great new companies.

However, I am here today to draw your attention to what must happen after those ideas come out of universities as they mature through formation, commercialization, job creation, and economic impact.

In 2010, Steve Blank, a seminal thought leader in entrepreneurial theory, defined a start-up as an organization formed to search for a repeatable and scalable business model. Having launched my own startup, I whole-heartedly endorse that idea. Startups are not small versions of established businesses. They are harsh, marketplace experiments seeking to determine if a business idea has legs or not. These experiments are risky. They are often heart-breaking. They are typically expensive, and in most instances, end up with a decision to call it quits. But they are an unavoidable and unblinking prerequisite for commercial success.

The nature of startups suggests that the predominant models of Federal support are not really well-suited for these endeavors.

The measured pace of grant submission, review, and award operate at a speed that does not match the tempo of intense innovation. A startup applying for an SBIR or STTR award typically will not see that money for over a year after application. In that time, many companies will fold or pivot so strongly away from the original plan that even when the SBIR arrives, the idea is no longer in alignment with the grant was meant to pay for.

Much like the patent process, the SBIR/STTR mechanism is a funding approach that favors teams that have the luxury of being able to take things slowly. In my opinion, taking things slowly is not part of an effective formula for a national innovation strategy.

Startups do not necessarily need a lot of money; they need money right away. It is not practical for the government to implement a mechanism to quickly release small amounts of cash. Fifty thousand, \$100,000 dollars can be transformative. In my experience, the best approach instead is to provide funding to reliable and proven incubator and accelerator programs and organizations, such as the Science Center, which has helped over 400 companies launch. These enterprises have boots-on-the-ground familiarity with the core ingredients that companies will need. Who are the talent? Who are the local advisors? What is the behavior of local investors? These startups require these ideas to move forward, and the companies we help launch grow benefit from our decades of experience in this space.

My sense is that the best practical means of facilitating and monetizing the innovation that turns academic research into business development is to specifically support the growth of private sector organizations that can make rapid, unbiased determinations of which early-stage ideas have sufficient commercial promise to attract investment. This is a role we currently play for BARDA using our multistate tech transfer network to identify biotechnology ideas that may be of interest to Health and Human Services.

I am going to—wait, am I past time? All right. I am going to give up my negative time and say the rest of my remarks are in written comments. Thanks.

Chairman CROW. All right. Thanks, Dr. Younger.

Dr. Martin, you are recognized for 5 minutes.

#### **STATEMENT OF DR. SHEILA MARTIN**

Ms. MARTIN. Thank you, Chairman Crow, Ranking Member Balderson, and members of the Committee. I am grateful to be here to testify today. It happens to be National Inventors'

Day. So Happy National Inventors' Day to all of you.

The subject of today's hearing is important to public research universities who work with small businesses to improve their success in three important ways:

The first one is talent. The most important form of technology transfer happens when businesses hire our graduates. When our students participate in federal research grants, they benefit by learning about scientific discovery, participating in cutting-edge research, and working in teams. And they bring that knowledge to the companies that hire them.

The second way that public research universities work with small businesses is through innovation, the discovery that generates new products, greater productivity, and entirely new industries, while solving important social problems.

Third, universities are important to improving the quality of life in their local communities. They generate prosperous economies, offer cultural activities, enrich civic life, and partner with local organizations to address important community issues. And thriving regions are a magnet for the talent that small businesses need to innovate and flourish.

In thinking about the innovation pipeline, we really have to take the long view. We cannot always predict what area of basic research will lead to an invention that transforms our economy, cures a widespread disease, or allows us to lead more fulfilling lives.

Because the benefits of basic research are so diffuse and long term, few private sector companies will fund it. And therefore, it makes economic sense that basic research is funded by Federal agencies. So, maintaining or increasing that Federal basic research funding is essential to ensuring that the font of scientific knowledge that feeds the innovation pipeline continues to flow.

University researchers are anxious to see their discoveries put into practice by businesses. And they often launch their own businesses. But before those ideas reach the market, someone has to invest in the engineering, design, and market research that is necessary for commercial success.

That is why programs like SBIR and STTR are so important. They provide funding to help companies work through some of the more difficult technical risks, evaluate the market potential, and take ideas to the point where the private sector is willing to invest.

Public and land-grant universities are important sources of both ideas and talent to companies who benefit from SBIRs and STTRs. Empirical studies of these programs demonstrate that SBIR projects that have a connection to a university are more likely to be successful commercially.

And while there are many examples of companies that have successfully used an SBIR grant to commercialize a university technology, I will highlight just two here and there are many more provided in my testimony.

The first I will talk about is Solid Power. It is a Louisville, Colorado company that spun out of the University of Colorado at Boulder and is developing solid state battery technology for the electric vehicle market. Its SBIR awards have led to successful funding by strategic investors. And so, these Federal investments have not only helped us make progress in clean mobility technology but also have spurred success for this small company.

The second is Core Quantum Technologies, a Columbus, Ohio firm that developed a method for speeding diagnoses and identification of cancer treatment options. The company's founder is Professor Jessica Winter from The Ohio State University's College of Engineering. She benefitted from Ohio State's NSF-funded Advance Program which develops the entrepreneurial capacity of women faculty. It helped her start her company, win the SBIR grant, and connect to additional investors. And that project also illustrates the importance of programs that diversify STEM fields

and provide resources for women, minority, and student entrepreneurs so that they, too, can be successful with SBIR and with their companies.

Because as great as they are, SBIR and STTR are not enough. Funding for basic research and complimentary programs, like NIH Reach, NSF I-Corps, EDA's Regional Innovation Strategies, and NIST's MEP partnership are also important for successful small businesses.

APLU and its member universities are grateful for the Committee's support for these programs. To see for yourself how our universities are supporting the universities' small business innovation pipeline, I invite all of you to meet inventors at the Innovation and Entrepreneurship Showcase, sponsored jointly by APLU and the Association of American

Universities, on April 28 at 5 PM here in the Rayburn Cafeteria. I look forward to seeing you there.

Chairman CROW. Thank you, Dr. Martin.

Dr. Mann, you are recognized for 5 minutes.

#### **STATEMENT OF DR. ETHAN MANN**

Mr. MANN. Thank you for inviting me. It is truly an honor to be here.

I want to talk a little bit about Sharklet Technologies, which has been a recipient of several SBIR awards over the years. Sharklet is a startup company based in Aurora, Colorado, developing novel surface textures applied to consumer and medical products to prevent the spread of germs that cause infections. The novel paradigm-shifting concept was the brainchild of Dr. Anthony Brennan, a professor of Engineering at the University of Florida in Gainesville. Dr. Brennan noticed that tiny surface structures impact biological response of cells, like bacteria. He noticed also that sharks are not susceptible to fouling like whales, manatees, and sea turtles. When he studied shark skin, he noticed that that specific texture is responsible for preventing fouling, and when reproduced on plastic surfaces, it is able to prevent the accumulation of bacteria.

Sharklet has been developing numerous applications for this technology now based in Colorado ever since Dr. Brennan's original discovery.

Developing novel innovations for market readiness requires significant investment regardless of the sector involved. Science Direct reports that medical device development requires about 7 years to go from concept to commercialization, and costs more than \$31 million. Biomedical technologies require substantial safety and efficacy testing, usually to the molecular level, to satisfy regulatory approvals. Other advanced industry fields are similar due to the intricacies of the technology. Manufacturing and development steps are completed with the utmost scrutiny to ensure consistency and safety of the products used by customers.

Innovations with high likelihood of success are those that have been de-risked to the point where certainty of value surpasses the risk of failure for these new ventures. More quickly, driving technologies to this value inflection step should be the step of technology transfer offices around the country. Activity of these offices

is critically important to ensure taxpayers are allowed to benefit from the technologies they have had a part in funding.

Offices of technology licensing should be appropriately resourced to support the quantities of emerging innovations that are in our amazing universities.

Resources may need to be expanded to track with the fast pace of science occurring in these academic research centers. Perhaps one of the best examples to support de-risking innovations is the SBIR and STTR grant programs which serve to fund proof of concept and early R&D activities for these innovations. Small businesses taking advantage of these mechanisms are at a distinct advantage. They have improved their technology and added value without selling equity which dilutes investors.

Delivering technologies to the marketplace provides a value beyond the obvious use of the technology. Supporting small businesses and innovation fuels entire community growth. For example, the life science industry in Colorado in my home state has been invaluable for the state's economy. The life sciences industry provides more than 30,000 high-paying jobs with an average annual salary of more than \$89,000. Moreover, these direct jobs lead to estimated indirect jobs of about 92,700.

I sit on the board of directors for the Colorado Bioscience Association, CBSA. CBSA is a state organization that creates co-opportunity for the Colorado life sciences community. CBSA champions a collaborative life sciences ecosystem and advocates for a supportive business climate.

Workforce collaboration is key to the growth and maturation of any industry. CBSA and the life science industry together work to cultivate a strong life sciences talent pipeline in Colorado with several different workforce development and skilled training programs including various interactive educational experiences, mentoring, internships, and workforce skill building.

And Colorado life sciences companies see the value of engaging not only in K-12 but in higher education. In fact, Sharklet Technologies, for example, engaged with CSU, Colorado State University, biomedical engineering students each of the last 4 years to complete a senior design project as part of their senior-level course work. These projects included core components to the Sharklet product development activities.

Support from the Committee on Small Businesses and the Subcommittee on Innovation and Workforce Development is critical to reduce barriers and ease the ability to bring technologies to life.

Chairman CROW. Thank you, Dr. Mann. I just love that Colorado is leading the way on shark-based technologies.

Dr. Crawford, you are recognized for 5 minutes.

#### **STATEMENT OF DR. GREGORY P. CRAWFORD**

Mr. CRAWFORD. Good morning, Chairman Crow, Ranking Member Balderson, and Committee members. I truly appreciate the opportunity to testify in front of the Committee today.

Today, I wish to answer how universities and small town American and rural America can create a vibrant economy based on innovation, creativity, and entrepreneurship.

I wish to make three points today.

First, pulling in innovation that you do not necessarily have to grow it at home, but you can pull it into your institution.

Second, educating innovators for innovation. How technology acceleration and the global world today requires a new set of skills for our students.

And three, keeping innovators and innovation at home. How do we attract talented graduates to stay in small town America and work at small companies to create vibrant communities?

Number one. Pulling innovation into our ecosystem. Oftentimes, universities use a push strategy. They invent, they patent, and they try to push it out through a startup company and/or license it to a big co. We also do that, but we have also started a new kind of process and we call it the pull strategy. And pull strategy means that we go to our partners and we pull in patents into our ecosystem and then develop them with our students, faculty, and staff.

And so, two examples there: We work with Wright-Patterson Air Force Base in Dayton, Ohio, and they have over 1,000 patents for defense-oriented applications, and we have access to that portfolio to try to find commercial applications for their use.

And second, we work with companies. And so, there may be an idle technology that may just be too small for a company developer, not on their critical path but then they decide to push it our way. We will pull it into our ecosystem and develop it, which is great for a small, entrepreneurial company. Entrepreneurship is about shots on goal and pulling these patents into our ecosystem is a way in which we can accomplish that.

And three, in the great state of Ohio—got to put a plug in there—but working with Lieutenant Governor Husted and also all the Ohio public universities, we just created an IP promise in Ohio which is a really simple way for companies and universities to work together with a very simple agreement and a very simple technology transfer contract.

Second, educating innovators for innovation. Jobs today are not blue collar or white collar, but they are new collar jobs. Industry 4.0 and artificial intelligence is driving change all across our industries from biomedicine to advanced manufacturing the materials to climate and the environment. And how do we train students in this new area? Well, one is to train them in humanics or humanics, however you want to call it. And it is the convergence of learning a little bit of science and technology, the quantitative aspects, statistics and mathematics, but also the humanities. And pulling those all together makes somebody actually very robot-proof. I always get asked, how do you make sure your students are robot-proof in this new world? And I say, the best way to do that is to be good at being human first.

And second of all, we want to educate in entrepreneurship. We want students to deal with ambiguity. We want students to fail and to use that steppingstone to pivot to something successful. And we do that through many different avenues with business plan competitions and a top entrepreneurship institute in the country. But more importantly, we also put students and they spend a semester in Silicon Valley where they work at the most innovative companies in the world and also take courses out there. And we

also have a specific internship program for students to work at small startup companies, not just the big cos.

And third, experiential learning. We just started something I am very excited about. It is called the Work Plus program. But we place students in our local companies, and they work 24 hours a week. They get a salary. Then, that company actually pays off their tuition. It is a debt-free education. And one example is Thyssenkrupp Bilstein, company in our area which makes shock absorbers, and our students are working in their industry 4.0 robotics laboratory.

And third, keeping innovators at home. Small and rural towns need talent to live, work, play, and enjoy, to build these powerful small towns in America. People and ideas are the key to these thriving small towns.

A couple of things that we are doing as we looked at the Department of Ag's report by Wojan, and to attract that talent to small towns, innovation and creativity was important so the arts was just equally as important as the technology side. So, with Oxford, Ohio, we work together, and we have a space that we use jointly where we have creatives come in. It is called our Center for the Arts. And the second floor and third floors have spaces for photographers, architects, artists, musicians, and sculptures, and these sole proprietors actually add to our local economy.

And the next phase of that is taking a second building on that same block and moving towards putting our technologists and innovators in there so that we truly combine an innovation block in small town Oxford, Ohio, which pulls together both the creatives and the technologists in one space and one place.

And I am so happy to have joining with me today our assistant city manager, Jessica Greene.

That concludes my comments.

Chairman CROW. Thank you, Dr. Crawford. As a wayward liberal arts major, I share your passion for the humanities, so.

I am going to begin by recognizing myself for 5 minutes. And I appreciate the opening statements from all of you.

Let me begin by a comment that Dr. Younger, you had made about the difference between accelerators and incubators and just direct SBIR/STTR funding and some of the kind of vetting role that some of those kinds of intermediary organizations might play. And I would like to hear from all four of you.

Is it your view that more of the funding and more of the support should go to kind of some of these intermediate incubators and accelerators on the ground as opposed to kind of direct funding directly to companies and that would be more helpful for folks? Or is there kind of a middle ground here?

Let's start with Dr. Younger.

Mr. YOUNGER. It is a great question. So, the question at hand is how do you make that money as rapidly deployable and as accountable as possible; right? You want the money to succeed. And for better or for worse, startups are local endeavors. You can attempt to be global, but your advisors are likely local. Your first investors are probably going to want to visit you on a frequent basis. They are not going to be a world away. And so being able to put resources right at the spot where the company is starting, I think



is really key because everything is going to happen locally, at least in the first 6 months to a year. The role that we play is that we have the ability of knowing pretty much all the facts on the ground. Who is active? Who is doing what? Who do these people need to connect with? And that is something that the study sections for SBIRs/STTRs just do not have at their fingertips. And their ability to evaluate the novelty of the technology is unquestioned, but their ability to sort of very effectively and wisely put the money to play quickly is limited. And that is just the nature of the beast. So, I think that there is actually a role for using incubators, not as an alternate sort of recipient of the money but as the decider for how that money is going to get deployed most effectively. And that is the way that I would frame it.

Ms. MARTIN. I think the important thing to remember in this is that each of these places needs to build a complete innovation and entrepreneurship ecosystem. And we all have a different role to play in that. And each of those pieces needs to be strong. And so, I think the answer to that question probably varies depending on where you are and where that ecosystem is strong and where it might have some weak points. Certainly, capital is a challenge for many different companies and many different stages of the development of those companies. So, you know, it is important to remember that we do need to continue to fund basic research to make sure we have the basis for those discoveries. Capital and mentorship and, you know, the incubators and accelerators are all very important, but I think the answer really depends on where you are and where the strengths and pain points are.

Mr. MANN. I think the incubators around the country really serve as the support structure for a lot of the ecosystems that these small companies exist in. I know in Colorado there is a number of incubator-type facilities. Sharklet has been located in the Fitzsimmons Innovation Campus for a period of time now and really have developed strong relationships with mentors on an unofficial basis, but also with the staff at the incubator facility. So, I think there is a case to be made for sharing funding with the incubator facilities to be able to leverage some of those assets that are kind of company agnostic and be able to kind of rapidly deploy those systems. But I agree in some cases the companies themselves have made the case for what they are doing and could quickly utilize those funds as well. So, I would agree that at times the answer is kind of both, but there are circumstances where those can be identified.

Mr. CRAWFORD. Thank you. I agree with those statements that we should put dollars into the incubators and accelerators and greenhouses and so forth. I just do believe in that principle of subsidiarity, getting the resources down on the ground where those folks can make those decisions that know that area the best. But more importantly, I think when you put dollars there, really look for that co-investment. And if those dollars are highly leveraged with angel investors, venture capitalists, and other city and state constituencies and so forth so you get the most bang for your buck so to speak.

Chairman CROW. Thank you.

I am going to end my time here and then I will recognize the filling in Ranking Member, Mr. Hern, for 5 minutes.

Mr. HERN. I would like to thank the Chairman. I would like to thank the witnesses for being here today.

As an engineer and a small business owner, former small business owner for 35 years, I certainly understand the value of our research universities we have around the country and how valuable they are to small business.

With the localities across the United States constantly evolving their policies to create environments that are conducive to small business growth, research universities help to serve as a significant resource for small businesses looking to capitalize on technological and entrepreneurial knowledge. This is why I am glad to have such great research universities, not only in our district but in our state, University of Tulsa, Oklahoma State University, and University of Oklahoma. These universities are assets to Oklahomans, and I believe it is our job in this Committee to help universities like these to continue to have these types of relationships with small local business owners.

As a part of this, I think it is necessary for members of this Committee to try to work, and we do this a lot, work in a very bipartisan way to reduce the onerous regulatory burdens which have been placed on these institutions. This is something that I would like to spend the remaining amount of my time to ask each of you to elaborate, what are the most significant regulatory and administrative requirements of federally-funded research programs, and what do you think—let's talk about that. So, if we could just go through, and maybe think in your mind about what some of those solutions might be as we go through.

Dr. Crawford, we will start with you and come this way.

Mr. CRAWFORD. What I wanted to mention about that is one of the areas, you know, I have also started a couple of companies based on my inventions, and so I saw it from the side of being a professor and trying to struggle to get the intellectual property out of the university. And then as a leadership role, actually trying to make it a little bit more conducive to great cooperation.

One of the areas that you see with small businesses and companies and so forth is just the complexity of the contracts and so forth that have to kind of take place to get that relationship developed. And I am going to kind of embellish a little bit here but there will be a stack of papers that you put down on the company and here at the university and they are like, this is the contract.

Well, what we did in Ohio is we wanted to kind of crunch that sort of piece down into something that was reasonable, a page or two, so that we could create these kinds of agreements. And so, when there was an interest and an idea coming out of a university, a research project, that we could move on it much quicker. We were not negotiating over something that may or may not happen in the future, but we actually agreed to moving it forward today and then coming back to the table when that was successful. And so I think from that perspective of always having sort of something simple and that is easy to understand and moving forward that you can actually pull together the company and the university and get

things off the ground much quicker than I think we ever could in the past.

Mr. HERN. Thank you.

Dr. Mann?

Mr. MANN. Yeah. I think your point is well brought. I think that certainly as a small company is starting off and licensing and technology or developing and technology, they have to think not only in that short window but they have to think, you know, 10 years down the road when they are trying to exit to a strategic or disclose things publicly. So, all of the agreements have to accommodate that.

I would take, maybe as an example, something like the Bayh-Dole Act has provisions in it that are extremely ambiguous that are challenging for even legal counsel with a small business to be able to understand some of the restrictions associated with how the use of Federal funding and productization occurs. And so just simple ambiguity can lead to stacks of legal agreements where you have to be able to decide around how you are going to handle ambiguity.

So, from a simplistic sense, perhaps even looking at the current regulations and providing more detail for what is trying to be accomplished could be dramatically impactful for small businesses.

Mr. HERN. Thank you.

Dr. Martin?

Ms. MARTIN. Thank you, Congressman Hern.

I would just say that developing patents is very expensive, and it is really important that our institutions be able to defend those patents in court. And so, I will follow up with you in writing on other aspects of the regulatory system that our institutions might need some relief with. But I would just like to mention that it is very important that companies be able to defend their patents in court because not only is it expensive, but getting a patent also makes it much more likely that that company will be successful in getting venture capital.

Mr. HERN. Thank you.

Dr. Younger, I am sorry, but I have got to close out here. But I just want to take your thoughts, and I know you have got great thoughts there, and encapsulate those in this Committee as we go forward and looking at how we continue to do what I like to say is, you know, when I ran for this office, was to get government out of the way so we can help entrepreneurs create jobs and put Americans to work. I have said that statement so many times and this is a classic example of people who are right in the fray, especially when you have been on both sides of this you know exactly what to do. And so I have also been one to claim that a lot of people talk about a lot of things in Congress they know nothing about, so it is always refreshing to come to this Committee because we always have great witnesses that are either nonpartisan or bipartisan in what they are trying to get accomplished. So, thank you so much for being here.

And Mr. Chairman, I yield back.

Chairman CROW. Thank you, Mr. Hern. Appreciate your comments and questions.

So now the gentleman from New Jersey, Mr. Kim, who is also the Chairman of the Subcommittee on Economic Growth, Tax, and Capital access is recognized for 5 minutes.

Mr. KIM. Thank you, Chairman. I am really glad we have an opportunity to talk about this issue. I represent a district in South Jersey and the Shore, Burlington County, Ocean County, about 120,000 small businesses in that area. And I am trying to think about not just where my district is tomorrow or next year but what do we think our district is going to look like 20, 30 years from now when my kids are adults, and what is it going to look like at that point? So, I am trying to piece this together. We have some great assets. We have a joint military base on the district, a lot of innovation happening there and other things. But we do not necessarily have sort of a top research university. And I guess some of my thinking is, you know, Dr. Younger, you are right across the bridge from us, so you are maybe familiar with our area. I guess what I am trying to get a sense of is I have a deep respect for the work that your organization does, the partnerships that your organizations have with the universities. What about places that are more suburban and rural? I think Dr. Crawford, you kind of got to some of this. But I am trying to think about this. Is that model Dr. Younger of what your organization is doing, how can that be replicated, or should it be replicated in places that might not have a top research-type university? Are there examples of how this partnership has happened with community colleges or other types of examples? I would just love to get your thoughts on that.

Mr. YOUNGER. That is a great question.

So, for the record, the Science Center now has relationships with four out of five research institutions in New Jersey, and we love working with them. There is quite a spectrum of talent there. So, I think that some of these issues come down to sort of population density. How many people are around to come up with new ideas? How many people are there to work in new companies? How many people around that potentially serve in the capacity of angel investors?

But I think that in the end I do not believe that a research university is absolutely a requirement for making something remarkable happen. And I think the Miami example is just right. I grew up in a little town in Missouri. Things can be innovative in lots of different places. I think what you need is you need local champions. So, you need folks who are really going to stand up and try to make something happen. You need imaginative capital that can come in from potentially a farther distance than you would otherwise expect that can make the trip and come in and try to support things. And you need founders who can have a pretty broad sense of sort of what region are they in. Right? So, am I in Cape May or am I on the East Coast; right? And that is a mindset that really matters, that makes a difference. But I do not really think that there is any reason to believe that—institution is required for something remarkable to happen. I think things can happen in lots of different capacities if you have the right resources.

Mr. KIM. Well, I certainly hope so. And our district, certainly a lot of innovation going on there but I think, you know, some of the points you mentioned about the local champions, the founders, a lot

of it also comes down to just, you know, the sheer infrastructure, ensuring that we have the broadband infrastructure and the other types of just sheer capacity components.

Dr. Crawford, I would not mind getting some of your further thoughts on this type of approach.

Mr. CRAWFORD. That is actually a great question, and I grew up on the track of, you know, Ph.D. programs, post-docs, inventing things, patents and spinning things out of the university. But as I have been in this career now for over 25 years in academics and seeing what is happening today, you know, it is quite interesting because it is not necessarily the sole property of graduate students, faculty, and post-docs anymore. But we are seeing undergraduates come in because they can do an app. They can do coding. They can do all kinds of great things. And I think if you put more emphasis on looking at some of that talent, they are younger in their career, of course, but they can just do some spectacular things. It may not be a farmer or the billion-dollar molecule, but it can be some great, neat things going on.

And we are doing it in Ohio to building up a network of universities and putting their entrepreneurship centers together. We are on our path for doing that. And I do think that one of the things that we should all be thinking of, too, is just going down in that pipeline of the training of undergraduates, also going into the high schools, because some may not go to college and some may become plumbers or electricians or what have it, but the entrepreneurial skillset is going to be very important to them. So, trying to figure out ways which you can train high school students and making sure your local community colleges and local undergraduate institutions can also play a role in this very vibrant and accelerating economy.

Mr. KIM. I think that is right. I mean, look, we pride ourselves in New Jersey for having top public schools, K-12, and having developed that kind of workforce, but we also see such an exodus of that young talent going to other places. And I think for me, I am really trying to get to this understanding that, you know, innovation is what you do, not where you do it. And how do we then try to have that sense of spreading that out and not just further, you know, siloing our society in terms of where innovation and that type of technology can be done. So, I appreciate your thoughts.

Chairman, I yield back.

Chairman CROW. The gentleman yields back.

I now recognize the gentleman from Pennsylvania, Dr. Joyce, for 5 minutes.

Mr. JOYCE. Thank you, Mr. Chairman.

What a great presentation you have brought to the table today.

Dr. Younger, I, too, come from a medical background, and having trained at Temple University School of Medicine, my wife at Drexel University School of Medicine. And I find it really fascinating that you are here today with a background in emergency medicine and talking from the city with an incredible history in medicine. And bringing that forward into these discussions. You and I recognize that Pennsylvania has more medical schools than any state in the union. And with the addition of another medical school in 2022 at Duquesne in Pittsburgh, that will even be further expanded.

Would you please comment on the importance of you setting up a program in West Philadelphia, really in the hub of medical science in the northeast?

Mr. YOUNGER. Sure. So, Philadelphia is remarkable. Pennsylvania is remarkable. I just got back from Pittsburgh. It is a remarkable commonwealth.

I think that we are trying to do some heavy lifting; right? We are trying to do some difficult things. There is amazing technology. There are diseases that will be gone in my career that are going to come out of West Philadelphia. There is no question about that. Treatments are going to be just remarkable.

We are trying to find out how do we take this idea forward? There is a traditional model. The Science Center is trying to innovate at the same time that we are trying to support people. We are in some ways a startup like a lot of our startups are in trying to figure out what is the best path to try to make some of these things happen? I spend a lot of my day in that regard.

I think if there was one thing I could do to the physicians in Pennsylvania, the physicians, the academic scientists everywhere, is I would look for a way to lower the boundary by which someone can do what I did, which is to do the math and say I am going to be okay leaving the university to go try to launch an idea. The math is very much against that move; right? Having a tenured position. Having a clinical practice. There is hardly any reason to go innovate because you are pretty well taken care of. And I think that if there is one thing this Subcommittee can do is to look at existing policies and regulations and say how can we make it so that that balance is a little bit more in favor of people taking a shot as opposed to staying in their sort of usual position. And I think I have some great ideas I can follow up on that but I think that one of the things that we are trying to do is there is a lot of talent sitting in universities that is most comfortable there but that might be most impactful outside. And I would love to think about ways in which simple things could be implemented to allow people to take a shot coming out of university to try to make a remarkable thing happen.

Mr. JOYCE. Do you think your background, the presence of a strong science base allows for innovation in a different line than we might traditionally see in engineering or in math?

Mr. YOUNGER. Perhaps. I guess the proof of the pudding is in the eating. We will see. I think I have a fairly broad technical background and so I think I try to put my skills to use wherever I can. But I think clearly just physicians, just engineers, just physicists, that is not enough. I think the crossover is where amazing things happen, and it requires people to be relatively flexible in how they define their backgrounds.

Mr. JOYCE. What can we see in students in training these days? What can we expect? How can we raise that bar so that the students that you work with, the innovators that we will see tomorrow, how can they be better prepared?

Mr. YOUNGER. So I think two things. One was alluded to here before which is just embracing ambiguity; right? Being able to work in very uncertain circumstances is a great skill. Frankly, just personally I will say that numeracy matters, and we train a lot of

folks in a lot of skills but just being able to quantitatively think about problems I think is something that always needs sort of re-emphasis. But I think those two points would be the ones that I would say deserve a lot of respect.

Mr. JOYCE. Thank you.

I yield the rest of my time.

Chairman CROW. Thank you. The gentleman yields back.

I will now recognize the gentlelady from Pennsylvania, who is no stranger to entrepreneurship and starting and growing businesses, is now recognized for 5 minutes.

Ms. HOULAHAN. Thank you. And I am really appreciative, Dr. Joyce, of your conversation as well. Philly is where it is definitely happening. And I am from just outside of Philadelphia as well and I am going to carry on with your line of questioning as well as with Mr. Kim's line of questioning because I have been struck by in the couple years that I have been running for Congress and now the one that I have been here how many people I meet who say, oh, yeah, I am from Philadelphia, or yeah, I am from Pittsburgh, but yet they are not there anymore. And I really want to figure out not just for my community, for Philadelphia, for Pennsylvania, and for Pittsburgh, why that is happening but also for places all over our country where people are going to places like the Silicon Valley or like Boston with the talent that they have learned and gained from places like Pittsburgh and places like Philadelphia because there is definitely a brain drain going on and I am trying to figure out as an entrepreneur who came to Philly and stayed in Philly, you know, how do we make that happen more?

And so, I would like to dig in a little bit more on what Dr. Joyce was asking, which is how do you incentivize people to take their shot?

I was very, very fortunate because I had a ROTC scholarship and then I had a research assistantship first at Stanford and then at MIT. I ended up coming out with no debt from both of those experiences, and that allowed me to take chances and allowed me to take a shot at being entrepreneurial. And I just wonder if you could dig a little bit deeper, first Dr. Younger and then anybody else who would like to answer, what can we do to provide more incentive for people to not be scared?

Mr. YOUNGER. So I think it is mostly leading by example; right? I think that it is a process that takes time. You need to have some local success. There need to be some high visibility successes. And I think that you need to have the ability of folks who understand that going into an early stage company is a career path that actually counts.

I am a very big proponent of having greater influence of business, but frankly, small business in really sort of core university processes, like when a training grant is under evaluation at the NIH, should there be folks who represent more of an industrial perspective looking at the science and the training programs? So, if we are going to be training people to go into biotechnology companies or go into engineering technology companies, should there be company representation in evaluating what those training programs look like? I think it is a great question, and if you make small changes to the curriculum, then these decisions to go into

early stage companies become much more reflexive. It just seems like a natural thing to do because your training curriculum has focused on this idea of how to innovate and how to move quickly into a new idea.

So, I think that there are processes that go all the way back to make students more comfortable in making a decision to do something fairly risky right out of the gate. So, I think that is certainly part of it. But then once they are out, how do you prevent local brain drain? That is outside of my wheelhouse. I will not make much of a shot at that except to say I think examples count; right? And once you can stand up someone, you know, if you can sit down and have coffee with someone who has pulled it off, then it looks like something that can exist and then you can move on.

Ms. HOULAHAN. So I say this a lot as a woman and as a STEM professional, you cannot be what you cannot see. If nobody is there that you can see, and you cannot look at success then it makes it pretty easy for you to go somewhere else.

And I am interested in also Dr. Crawford, you know, what role do universities play in trying to create those centers of gravity and trying to capture people's minds and attention so that they stay?

Mr. CRAWFORD. That is a great question. I know our graduates, they are pretty enthusiastic, and they want to go to the right and left coast, or they want to go to Austin, Texas, or Chicago, Illinois. And we obviously would love to keep them in Oxford. And I do think that the report that I mentioned in the beginning by Wojan about bringing the creativity, creatives together along with the technologists can actually build more of a vibrant community around small towns rural America where you can actually keep and attract that talent to kind of stay locally.

I do think also following up on the other remarks, it is important, I think, for us to see that you can be an entrepreneur early on in people's thinking. I think in some cases, by the time you go through graduate school—undergraduate, grad school, you may go to medical school or whatever—you are already thinking about how to pay off your debt and how to do all these different things. And you have a car and a house and so forth but that seed early on in the education is great. And I think there is no better experience than an entrepreneurial experience as an undergraduate where you get in there and you can fail a bunch of times and nothing matters and you have all the support of professors around you. And so, I think the more that we can offer those experiences it will get that mindset going so that when they do graduate, they will think about something on more of a startup rather than the status quo.

Ms. HOULAHAN. Yeah. And I only have 7 seconds. I just want to emphasize the importance of it is easy to create opportunities to dream, but if you do not provide places and pathways for the people to do that and also the freedom to be able to dream where you are not burdened by so much debt that you cannot make good choices, we need to work on that, and I would look forward to working with our Small Business Committee on those particular issues as well.

I yield back.

Chairman CROW. Thank you. The gentlelady yields back.



And now I recognize the gentleman from Tennessee, whose own experience starting and running businesses adds a lot to the depth of this Subcommittee as well. Mr. Burchett, you are recognized for 5 minutes.

Mr. BURCHETT. Thank you, Mr. Chairman. I think my business knowledge is sort of like my stock knowledge. If you see me invest in something, do not or short it and then you will come out on top.

I want to thank you all so much. And Mr. Ranking Member, who really is not the Ranking Member but is sitting in the chair, thank you for your hard work.

And this is the part where I praise the Chairman for our bipartisan work on our two bills, but I will just sort of leave that up to the historians to figure out what those two bills are because their names are very long. But I do appreciate you, brother. We work very close on them and dealing with technology.

I have questions for the panel. I will just kind of throw it out there. And I appreciate academia. My parents were lifelong educators. Have a degree in education, and so I appreciate all the research and things that you all have been a part of.

What are the biggest barriers to technology transfer from Federally funded laboratories and universities to the private sector?

This is totally off the record, so just go ahead and speak your mind.

Ms. MARTIN. Thank you, Congressman.

I would say that first of all, developing intellectual property is very expensive. And many of our universities are under resourced in their technology transfer offices. Of all of the ideas that are disclosed to universities every year, only a small fraction of them are developed because this process is so expensive. So that is one barrier.

The second, of course, is the capital that is not always available in order to develop those technologies into commercializable ideas. And certainly, programs like SBIR and STTR are important for that early stage funding when the private sector is not yet willing to invest because it is too risky. But there is also capital that is needed before a small business is formed and so it is not yet eligible for SBIR. So what they call phase zero programs, like the NIH Reach program are also important because it helps the faculty develop the technology a little bit more to the point where they are able to form a small business and apply for an SBIR and STTR program.

So, as I mentioned earlier, these complementary programs to SBIR and STTR are also important, as well as continuing to fund our basic research.

Mr. MANN. Yeah, I think to that I would just add, you know, as someone who has dealt with license agreements that were put together 10 years ago and probably had 10 or 12 amendments, maybe more than one a year, and looked at licensing additional technologies, I think one of the components that you deal with in a technology transfer or licensing office is that those offices are not aligned with the same levels of success as what the small businesses, meaning that those offices are essentially protecting a political capital by making sure that they do not miss an opportunity on some unicorn; right? So, nobody wants the Gatorade story. So

then when you go through a licensing conversation with somebody, it is very challenging to be able to get broad terms that are going to be supportive of raising capital and developing a technology, and not necessarily knowing where you are going to end up but that you are going to end up somewhere valuable.

And so, I think that maybe merging what a technology transfer office's interest is would be critical. And perhaps part of the way to do that is their resources are so restrictive that they only get to pick a few winners a year. So, they do not want to miss, so they have got to pick what is going to be the Gatorade. What do I not want to miss, is what is going to be some billion-dollar unicorn? Because if it comes out that we passed on some unicorn, you know, then we are in real trouble.

Mr. YOUNGER. Yeah, I would just add, I cannot say that better. I think the reason why university is pursuing intellectual property is different than the way a small business pursues intellectual property. The small business is having that intellectual property pulled by market forces. The university is pushing that intellectual property to protect sort of academic assets. Both of them are legitimate behaviors but they are just very different. And so that is why I think you see an accumulation of IP in universities where you would never see that kind of accumulation of unused IP inside of a business.

Mr. BURCHETT. All right. My wife is very supportive of me and my crazy inventions. She always says, baby, I am sure somebody laughed at the pool noodle. You know, if you have got a pool, you have got a pool noodle. And they cost like 6 bucks, and I am sure they were probably just some insulation on a pipe somewhere and somebody took one home, some plumber and their kid was swimming around in a pool somewhere. So, there you go.

What is the best way to measure the economic impact of university R&D? Is there a way to do it? I get aggravated sometimes, and I am running out of time and I have got a great story, but I will tell it later. You can read it in my book. But go ahead one of you all quickly.

Chairman CROW. Yeah, I will extend. I will extend for a few minutes so you can answer the question.

Mr. BURCHETT. Thank you, Mr. Chairman. I appreciate your effort at bipartisanship.

Should I tell my story now or should they read it in my book?

Chairman CROW. I am not going to extend it for the story, but I will extend it for the answers.

Mr. BURCHETT. Okay. All right. Well played, Mr. Chairman. Well played. And I appreciate the cameraman occasionally taking the camera of me because my nose was really itching back there and I could not scratch it because, you know. Go ahead.

Ms. MARTIN. Well, that is a tough act to follow.

I would just say that the long-term impact of university R&D is a very difficult thing to measure. In fact, I was asked once if I would do that for my dissertation and I said I will move on to the next subject now, please.

You need to look at long-term growth of industries. There are entire industries that have grown from university R&D. The most recent winner of the Nobel Prize in Chemistry developed the lithium

ion battery that we are all carrying around in our pocket. And you do not always know where that impact will be. And so, it is a very difficult nut to crack. We try to do it; the Association of University Technology Managers has some measures that we can track that are useful metrics. But you have to look at the whole equation and how universities and the companies that they spin off affects their communities in the long run.

Mr. BURCHETT. Thank you, Mr. Chairman.

Chairman CROW. Thank you. The gentleman's time has expired.

So, I am going to thank all the witnesses for coming in and taking time away from your busy schedules to share all your experience and your knowledge with us. I think this is one of the most bipartisan Committees in Congress as a matter of fact. We pride ourselves on that because these are not political issues; these are issues that I think we can do a lot of great work on and we have been. And I think we also pride ourselves on this Committee that we have passed over 30 bills I think in the past year unanimously out of the Small Business Committee. So, we have some great ideas that we continue to hear in hearings like this that we will follow up and take some action on. And to the extent that you have additional information to supplement your testimony, we would love to receive that through the staff so that we can have discussions about what we can do to kind of fulfill our dual purpose. As Mr. Hern mentioned, I think we all share this view that we have a dual purpose here. One is to kind of reduce barriers and kind of get red tape and bureaucracy out of the way of innovation when it is necessary when we can do that. And as a matter of fact, the broader Committee merged two programs in the Federal Government last year to make it easier for veterans to certify their own small businesses and reduce some barriers and red tape. And I think that is a great example of us working together to make things easier for folks.

But the secondary purpose is really finding ways to promote and boost up and where government can get involved in a positive way through very directed funding to accelerate and to help businesses through the "valley of death" or other difficult areas where the market does not necessarily work perfectly but where there might be tremendous innovations that can benefit all of us as a society. And if we can shepherd those through very targeted investments, we want to find ways to do that.

So, we appreciate you all sharing your time and experiences with all of us.

And I would ask unanimous consent that members have 5 legislative days to submit statements and supporting materials for the record.

Without objection, that is so ordered.

And if there is no further business to come before the Committee, we are adjourned.

[Whereupon, at 11:13 a.m., the subcommittee was adjourned.]

**A P P E N D I X**



**Dr. John Younger, MD**

**Vice President, Science & Technology**

**University City Science Center**

**Before the**

**Subcommittee on Innovation and Workforce Development of the**

**Committee on Small Business of the**

**United States House of Representatives**

Chairman Crow, Ranking Member Balderson, and members of the Subcommittee, thank you for the opportunity to testify today. It is an honor to join my distinguished colleagues on today's panel.

Before a great idea becomes a business, or creates a sustained new job, or generates an export, it must spend time in the Valley of Death. The term applies to a period of commercial development of an idea when fundamental questions must be answered: does anyone actually need what the idea is offering? How many of those people are there? What are they willing to pay? Is the product safe? Can enough of the product or service be produced to sustain an enterprise? What's the competition doing? An adverse answer to any of these questions can be the death knell of a great idea. In most

instances, that's the appropriate outcome; a lot of ideas turn out to be not as good in practice as they are on paper.

The concept of the Valley of Death applies to any new undertaking but is acutely relevant to start-ups – undertakings in which there is no predefined market and no proven business model. Start-ups entering the Valley can die on the vine – nobody buys, the intellectual property is not defensible, a capable founding team can't be recruited. This is normal, and a key tenet of start-up thinking is that invalid ideas should be identified and abandoned as quickly and efficiently as possible. This saves investment and, importantly, frees up entrepreneurs to move on to more promising ideas.

It's not all gloom. Some start-ups exiting the Valley can do so spectacularly. In 2020, a start-up is delivering engineered genes to children with previously untreatable diseases; another is delivering supplies to the international space station; another may have allowed you and your staff to learn about my background on-line before I was invited to testify today.

I began my career as a physician scientist, and pursued this path for 20 years. However, for the last six years of my career I have spent my days in the Valley of Death, first as an entrepreneur of a Michigan-based biotech start-up, and most recently as part of a team devoted to doing everything possible to make the journey quick, if not painless, for new ideas and new companies.

I now work at the University City Science Center, the nation's oldest and largest urban research park, founded in 1963. We are a privately-held nonprofit corporation with 31 nonprofit shareholders, including leading universities and research institutes throughout Pennsylvania, New Jersey, and Delaware. As the Science Center's Vice President for Science and Technology, I lead our efforts to help universities and start-ups move their technologies beyond the Valley of Death, including a program that provides grants to research universities to better prepare their most promising technology for entry into the world – a proof-of-concept program we call QED – as well

as a portfolio of some of the most effective business incubators on the East Coast, and an early stage investment fund that provides critical early capital to biotech and healthcare IT start-ups in their most vulnerable formative days.

Our nation's economy faces many persistent and intensifying challenges, including public health disparities and defending ourselves against many types of threats, such as biological- and cyber-attack. Innovation is the key to addressing many of these concerns, but how best to support innovation is an especially tough nut to crack. There's no question that research funding is essential to creating a healthy stream of ideas from within universities that may find success in the marketplace. Nevertheless, it should be no surprise to this Subcommittee that in real dollars the United States significantly lags countries like China, which has dedicated hundreds of billions of dollars to fund the research and development of new technologies. Funding of leading-edge academic research is an important consideration in securing and strengthening our country's innovation and entrepreneurial pipeline. However, I am here today to draw your attention to what must happen *after* ideas take their first steps out of universities and other research institutions, as they mature through company formation, commercialization, job creation, and economic impact.

In 2010, Steve Blank, a seminal thought leader in entrepreneurial theory, defined a start-up as '*an organization formed to search for a repeatable and scalable business model*.' Having launched my own start up, I whole-heartedly endorse this definition. Start-ups are not small versions of established businesses. They are harsh, marketplace experiments seeking to determine if a business idea has legs. These experiments are risky, often expensive, and in most instances end in a decision to call it quits. But they are an unavoidable, unblinking prerequisite for commercial success.

The nature of start-ups suggests that the predominant models of federal support are not well-suited for these endeavors. As a member of the National Advisory Council for General Medical Sciences at

the NIH, I appreciate the spirit of discovery behind most NIH and NSF grants to research universities. These funds emphasize novelty over practicality by intention and thus are a poor fit for the work underway within a start-up. Other small business grants are typically not intended for the type of highly speculative work being done within start-ups either.

The measured pace of grant submission, review, and award operate at a time scale that does not match the brisk tempo of intense innovation. A start-up applying for an SBIR or STTR award typically doesn't receive that money for a year or more. In that time, many companies fold or pivot so strongly away from their original plan that even when the SBIR arrives, it no longer aligns with the company's new direction. Much like the patent process, the SBIR/STTR mechanism is a funding approach that favors teams with the luxury of being able to take things slowly. And taking things slowly is not, in my estimation, part of an effective formula for our national innovation strategy.

Start-ups don't necessarily need a lot of money to get underway. Rather, they need more modest capitalization and they need it right away. These companies raise money in incremental steps, with each new infusion of cash specifically used to achieve a developmental step that will justify the next infusion of cash. Companies' earliest funding allows them to gather the evidence needed to entice their first private investors or, in some cases, to quickly decide an idea is untenable and to walk away.

It's not practical for the government to implement mechanisms to quickly release awards on the order of \$50,000 - \$100,000 dollars. In my experience, the best approach instead is to provide funding to reliable and proven incubator and accelerator programs and organizations, such as the Science Center, which has helped over 400 companies launch. These enterprises have boots-on-the-ground familiarity with the core ingredients – talent, track record, the availability of local business advisors, and preferences of active early investors – that start-ups require to move forward. The

companies we help launch and grow benefit from our decades of experience and international network.

My sense is that the best practical means of facilitating and monetizing the innovation that turns academic research into business development is to specifically support the growth of private sector organizations that can make rapid, clear-eyed, unbiased determinations of which early-stage ideas have sufficient commercial promise to attract investment from federally-backed seed funds – perhaps matched by private capital. This is a role we currently play for the Biomedical Advanced Research and Development Authority (BARDA), as an accelerator operated under their Division of Research, Innovation, and Ventures (DRIVE). We use our multistate tech transfer network to identify biodefense technologies that may be of interest to BARDA.

Federal policies have only started to acknowledge the value of innovation intermediaries like the Science Center. Due to the leadership of this Subcommittee and its members, along with their Senate counterparts, the Fiscal Year 2019 national defense bill included language to strengthen the SBIR/STTR programs by allowing researchers, if they choose, to use a greater portion of the award for commercialization services, including through partnerships with innovation intermediaries like the Science Center. We are grateful for legislation led by two members of this Subcommittee, Representatives Balderson and Houlihan, that would clarify that each individual recipient of SBIR/STTR funding can (and should) decide how best to use the funding to help bring their products to market, including by partnering with local and regional innovation intermediaries.

This work is laudatory and sorely needed, but I encourage the Subcommittee to look beyond the SBIR/STTR mechanism for the reasons I outlined above and consider novel mechanisms by which research parks and other intermediaries can be directly supported to fully realize the nation's potential to transition academic ingenuity into early stage start-ups. As your Subcommittee considers



federal programs, we encourage you to allow organizations like ours – so called innovation intermediaries – in addition to universities, to be lead applicants to all innovation-focused federal funding opportunities across all government agencies and departments.

In addition, we support continued investment in the Small Business Administration's Regional Innovation Clusters program, the Economic Development Administration's Regional Innovation Strategies competition and similar efforts that encourage innovation and entrepreneurship in all geographic areas and economic sectors.

In order for our nation to be able to compete in this global economy, the federal government must have a renewed focus on innovation and entrepreneurship, and a clear-eyed understanding of, and approach to, the particular needs of start-ups traversing and moving beyond the Valley of Death.

Thank you for the opportunity to testify today, and I look forward to your questions.



*Written Testimony of  
Sheila A. Martin, PhD*

*Vice President, Economic Development and Community Engagement  
Association of Public and Land-grant Universities  
House Committee on Small Business  
Subcommittee on Innovation and Workforce Development  
Hearing on  
"The Innovation Pipeline: from Universities to Small Businesses"  
February 11, 2020*

#### **Introduction**

Chairman Crow, Ranking Member Balderson, and members of the subcommittee, good morning and thank you for the opportunity to testify. It is an honor to be with you today—on National Inventors' Day—to discuss the University-Small Business Innovation Pipeline.

My name is Sheila Martin and I am the Vice President for Economic Development and Community Engagement at the Association of Public and Land-grant Universities (APLU). APLU is a research, policy, and advocacy organization dedicated to strengthening and advancing the work of public universities in the U.S., Canada, and Mexico. The association's membership consists of 242 public research universities, land-grant institutions, state university systems, and affiliated organizations.

APLU's mission is to expand access and improve student success to deliver the innovative workforce of tomorrow; advance and promote public impact research and discovery to improve society, foster economic growth, address global challenges; and build healthy, prosperous, equitable, and vibrant communities locally and globally.

The subject of today's hearing is important to public and land-grant universities. Public universities work with small businesses to improve their success and competitiveness in three ways:

- **Talent:** Probably the most important source of technology transfer occurs when companies hire our graduates. When our students participate in federally funded research, they benefit in many ways: they learn about scientific discovery, they participate in cutting-edge research, and they learn how to work in teams. They carry that knowledge and experience to the companies that employ them. They often participate in internships and capstone classes that provide direct experience within companies, including small companies, and these efforts provide businesses the opportunity to solve problems with pioneering techniques that our students are learning from their faculty.
- **Innovation:** The second way universities work with small businesses is through research and discovery that brings new products, greater productivity, and entirely new industries to our

economies, while solving important societal problems. This kind of public impact research isn't just about science and technology. Innovation happens not just in scientific discovery, but also in new business models, new marketing models, and new methods for product delivery. Small businesses of all kinds benefit from these discoveries and their application.

- **Place:** Universities are also important to improving the quality of life in their local communities. They generate more prosperous economies, offer a rich cultural life, enrich civic life of their communities, and partner with their local governments and other organizations to address important community problems like transportation, housing, and public health. Thriving regions are a magnet for the talent that small businesses need to innovate and flourish.

#### **University Innovation: The Long View**

We used to think of universities as primarily conducting basic research – uncovering the mysteries of nature that applied researchers build on to generate new products, processes, and businesses. With vital support from federal agencies, it is certainly true that universities conduct a great deal of this basic research and discovery.

Importantly, basic research often leads to unexpected but significant public impact. We don't always know where areas of basic research will lead. For example, consider the two American winners of the 2019 Nobel prize for Chemistry, Stanley Wittingham, of Binghamton University, SUNY and John Goodenough from the University of Texas at Austin. Their basic research into the properties of superconducting materials and magnets led eventually to the development of lithium-ion batteries—an invention that each of us is carrying in our pocket—because it powers our phones and our laptops, fuels electric vehicles, and enables the small business community to easily use the internet to expand their businesses.

The National Science Foundation funded the research that led to the development of these batteries over a span of 30 years.<sup>1</sup> The agency did not know their funding would revolutionize power electronics, but that is the nature of scientific discovery. It is not always possible to predict what kinds of basic research will yield innovations that have economic value; furthermore, that value often comes years, or even decades, after the research investment has begun.

Because the benefits of basic research are so diffuse and long-term, few private sector companies are willing to fund it on their own. Yet without it we would not have the scientific basis for today's economy. Therefore, it makes economic sense that basic research is funded by federal agencies such as the NSF, NIH, NASA, DOD, DOE, and the USDA. Maintaining or increasing the funding to these agencies is essential to ensuring that the font of scientific knowledge that feeds the innovation pipeline to small businesses continues to flow.

Once the value of that research has become more apparent, the private sector leverages federal investment in basic research and invests its own funds to further develop it into innovative new products and industries. Universities collaborate with the private sector to make that happen.

#### **Universities Innovations Drive Small Company Success**

University researchers are anxious to see their discoveries put into practice. They are passionate about public impact research and have turned that passion into launching their own businesses or working

<sup>1</sup> <https://www.nobelprize.org/prizes/chemistry/2019/press-release/>

with existing businesses to further develop and implement those technologies. According to the Association of University Technology Managers, (AUTM), from 1995 to 2018, entrepreneurs have used university research to launch 14,021 companies.<sup>2</sup> Before good ideas reach the market, though, someone must invest in the additional research, design and process engineering, as well as marketing and business models that turn them into a new product, a new process, a new business, or an entirely new industry.

At this stage, there is still a great deal of risk involved in that process—risk the private sector is often loath to shoulder without incentives, despite the potential for economic returns and positive public impacts. That is why programs like the Small Businesses Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs are so important. They provide funding to help companies work through some of the more difficult technical risks, evaluate the market potential, and take ideas to the point where the private sector is ready to invest.

Public and land-grant universities are important sources of both ideas and talent for the companies that benefit from SBIRs and STTRs. A survey by the National Research Council found over half of respondents reported some university involvement in SBIR projects. Of those companies, more than 80 percent reported that at least one founder was previously an academic.<sup>3</sup> Furthermore, studies show direct, systematic evidence that a university connection to an SBIR project, as either the source of the technology or involvement of a university researcher in the company, increases the probability that the SBIR grant will lead to a successful commercialized technology.<sup>4</sup>

There are many challenges to getting great ideas from the laboratory into the marketplace. AUTM estimates that over 380,000 innovations were disclosed to research institutions in the past 25 years. Many of these innovations will never become companies or products. And many companies that are launched don't survive for very long. Of the 14,021 companies formed from university innovations from 1995 to 2018, only 6,518 are still operational.<sup>5</sup> The costs of patenting and perfecting a technology for the market, the technical challenges at early development stages, the lack of early stage capital, and the shortage of market and business expertise among scientists all stand in the way of a successful product and business. But with the help of public research funding and programs like the SBIR and the STTR, universities and their partners are tackling these challenges.

While there are countless examples of companies that have received SBIR funding based on university technologies, I will highlight a few here.

#### ***Powering A Clean Energy Future***

Innovative technologies based on university research are helping to move our economy toward cleaner, more sustainable energy sources. Solid Power is a great example. Solid Power is a Louisville, Colorado company that spun out of the College of Engineering and Applied Sciences at the University of Colorado at Boulder. It is developing solid state battery technology for the electric vehicle market. Solid state

<sup>2</sup> <https://autm.net/surveys-and-tools/tech-transfer-infographic>

<sup>3</sup> National Research Council 2008. An Assessment of the SBIR Program. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11989>.

<sup>4</sup> Link, A. N., & Ruhm, C. J. (2009). Bringing science to market: Commercializing from NIH SBIR awards. *Economics of Innovation and New Technology*, 18(4), 381–402. <https://doi.org/10.1080/10438590802208166>

<sup>5</sup> Association of University Technology Managers. <https://autm.net/surveys-and-tools/tech-transfer-infographic>

batteries are safer than standard liquid electrolyte designs, and they provide approximately double the run time—a significant factor in the demand for electric vehicles. Solid Power received Phase I and II SBIR awards from NSF, DOD, DOE, and NASA. They are now backed by strategic investors including Hyundai, BMW, and Samsung. Federal investment has laid the groundwork for societal impact and private sector competitiveness.

Xpeed Turbine Technology (XTT) of Piscataway, NJ was launched with technology developed at Rutgers University by co-founders Arturo Villegas and Javier Diez. XTT's mission is to improve the efficiency of wind turbines. They have developed a deflector that can be deployed on existing wind turbines to make them up to 4 percent more efficient for a small investment with a one-and-a-half to three-year return on investment. XTT received a \$150,000 Phase I SBIR from NSF in 2016 and a Phase II \$750,000 Phase II grant in 2017 to further develop this technology, which will help our wind energy industry become more economically sustainable.

#### ***Melding Engineering and Life Sciences to Address Health Care Needs***

Biomedical technologies are improving the quality of life for many who face physical challenges. Point Designs is addressing the needs of partial hand amputees, including many veterans. The Lafayette, Colorado company spun off from the Biomechatronics Development Lab at the University of Colorado. The lab is led by Professor Richard Weir, who still serves on the company's board of advisors. Dr. Weir has received many research grants from the NIH and the VA for development of prosthetics. He has also worked side-by-side with the founder of the company, Levin Sliker. The idea for their flagship product, the Point Digit, came from repeated requests from industry clinicians for a durable ratcheting full-finger prosthesis. After two years of development, many iterations, and feedback from prosthetists and end users, they launched the Point Digit in early 2017. Their two SBIR awards, a Phase I award and Phase II fast track award, have both resulted in commercial products that are now being used to improve quality of life for amputees.

Actuated Medical, Inc., located in central Pennsylvania, was incorporated by two graduates of Penn State University with a vision to improve patient outcomes and reduce healthcare costs by integrating electronically controlled motion into medical devices. The SBIR program provided the early-stage capital needed to bring their medical devices to patients. Their first product, the TubeClear system, was funded with a National Science Foundation SBIR. It clears clogged feeding tubes while the tube remains in the patient and works at bedside. The National Institutes of Health (NIH/NICHHD) SBIR funded a pediatric model that is in clinical testing at the Children's Hospital of Philadelphia. TubeClear is a faster, more effective method that works on more types of tubes and types of clogs than current practice. With repeat sales in several large US hospitals, the TubeClear system is enabling patients to receive medication, nutrition, and hydration therapies optimally and on schedule. Without the SBIR program, the TubeClear system would not be available to help these critically ill patients. Actuated Medical has since received private investment and developed strategic partnerships to help fund their growth. Actuated Medical has generated 22 issued U.S. patents and over 40 pending U.S. and international patent applications. Additional devices are working their way through development and regulatory approvals to revolutionize areas like neural implant treatments and pain management.

In 2017, Kansas State University graduate Austin Pfannenstiel founded Precision Microwave, a start-up company in Manhattan, Kansas. Precision Microwave is developing and commercializing new microwave ablation (MWA) technology spun out of the Kansas State's Biomedical Computing and Devices Lab. MWA procedures offer cost-effective, minimally invasive treatment options for localized tumors and other diseases. These treatments are especially important to the large population of cancer patients who are poor candidates for surgery or other physically demanding therapies. Yet currently available MWA systems may damage critical healthy tissues or result in disease recurrence if not placed precisely. Precision Microwave received an NSF STTR Phase I grant to pursue technical R&D of a directional microwave ablation (MWA) applicator. If successful, the resulting proposed technology will facilitate both procedural and technical simplification of MWA treatments, saving time and critical resources in hospitals, and ultimately improving quality of, and access to, cancer treatment for a broad range of patients.

#### ***Entrepreneurship that Serves National Security***

The SBIR program also plays an important role in national security. The program helps meet the procurement needs of the Department of Defense by encouraging companies to develop technologies they view as essential to keeping the nation safe. Technology from public universities has been instrumental in meeting these needs. For example, ARCS Aviation of Cookeville, Tennessee develops eLearning modules that employ virtual-reality and augmented-reality for aviators. This cutting-edge technology allows them to build interactive courses where students can do such things as a tip-to-tail walkthrough of an aircraft without ever leaving the classroom. Not only does this give students more hands-on learning time, it allows for simulations to run with complete safety. With help from the University of Tennessee's Procurement Technical Assistance Center and its Center for Industrial Services ARCS Technology secured an SBIR grant from the Air Force—expanding the technology the Air Force employs to train pilots, flight dispatchers, and maintenance, and safety workers.

In 2011, a Kansas State University nuclear and mechanical engineering research associate began a Manhattan-based start-up company, Radiation Detection Technologies, to commercialize innovative, compact, and lightweight radiation detection/monitoring sensors for the defense, homeland security, and health physics sectors where reduced power consumption and compact packages are critical to mission success. RDT addresses a gap in the radiation detection industry that is particularly noticeable because of the lack of a transition of many novel technologies reported in academic literature to the commercial sector. RDT is focused on commercializing technologies such as those developed in two Kansas State University laboratories: The Semiconductor Materials and Radiological Technologies (SMART) and Laboratory and the Electronics Design Laboratory (EDL). Through a series of SBIR grants the company, in partnership with these labs, has successfully transitioned university-grown technologies to its industry partners to deliver innovative, low-power, and compact sensors to the Department of Energy, the Department of Defense, and private industry partners.

#### ***Meeting the Challenge of Early Stage Risk***

While the SBIR program has been very helpful in getting great ideas to market, there are other innovative ideas that never make it to that stage. Even before they form a company—and therefore become eligible for SBIR—researchers need help understanding the potential for commercial applications of their discoveries.

The National Institutes of Health is working with universities to test new approaches to early-stage risk with its Research Evaluation and Commercialization Hub (REACH) program. REACH funds what are called

Phase 0 projects that focus on the evaluation of discoveries for their commercial potential and, once identified, advances them to the point where the scientists can launch a company, making them eligible for SBIR. The University of Colorado Anschutz Medical Campus is using its REACH award to support translational research projects and their product development efforts.

Colorado REACH is leveraging another important program that offers public university researchers the entrepreneurship skills they need to be successful. Programs such as NSF's I-Corps complement SBIR, STTR, and REACH. I-Corps provides real-world, hands-on, immersive learning about what it takes to successfully transfer knowledge into products and processes that benefit society and reduce the time to translate a promising idea from the laboratory to the marketplace.

AEIOU Scientific of Athens, Ohio provides an example of this successful combination of SBIR and I-Corps launch methodology. AEIOU is a startup company based on a technology for measuring bone strength developed at Ohio University. Three Ohio University researchers joined forces to develop a technology that accurately estimates bone strength—a radical improvement over current diagnostic technologies. After seed funding from Ohio University, they participated in I-Corps@Ohio, a state-sponsored program modeled after NSF's I-Corps. This technology will enable researchers to better understand osteoporosis and other bone diseases and has the potential to help doctors more accurately identify patients at risk of bone fracture. The company is a client of Ohio University's innovation Center incubator, allowing it to manufacture the technology and grow its businesses in southeast Ohio.

#### **Diversifying the Talent Pipeline: Supporting Female, Minority, and Student Entrepreneurs**

Public universities are working tirelessly to improve the success of female, minority, and student entrepreneurs in the SBIR program. One example is the ADVANCE program at The Ohio State University. The mission of Ohio State ADVANCE is to impact the recruitment, retention, and advancement of women faculty in the STEM disciplines (Science, Technology, Engineering, Mathematics and Medicine), with a focus on building research leaders. REACH for Commercialization is a signature program of the ADVANCE grant; it develops the entrepreneurial capacity of women faculty. With funding from the National Science Foundation, ADVANCE fosters institutional change through support, increased representation, and advancement of women faculty in academic STEM careers.

The Ohio State University has successfully nurtured women to start companies that have been successful with SBIR and beyond. One example is Core Quantum Technologies. The company's founder and Chief Scientific Officer is Professor Jessica Winter from Ohio State's College of Engineering. The technology uses quantum dots, which can fluoresce in multiple colors, to allow laboratories to check for multiple cancer biomarkers at the same time, speeding diagnosis and identification of cancer treatment options. The company's COO, Kristie Melnik, is a graduate of The Ohio State University—another beneficiary of Ohio State's commitment to diversity in STEM fields.

The talent pipeline of entrepreneurs is further enriched by programs that nurture student entrepreneurship. Public universities not only offer formal degree programs in entrepreneurship, but also informal clubs, pitch competitions, and supportive environments like Ohio University's Center for Entrepreneurship and Iowa State University's Student Innovation Center. Universities also partner with organizations like the Lemelson Foundation, which funds Invent Oregon, to mentor students and provide them the resources they need to take their inventions from ideas to working prototypes. From there, they can start working with the services we've already mentioned to get assistance launching a

company. Precision Microwave, mentioned earlier, is a great example: the founder benefited from winning Kansas State's Launch a Business Competition.

#### **Strengthening American Manufacturing**

American universities have an important role to play in the development of new technologies that are transforming American manufacturing. University research, often in partnership with industry, advances technology in digitization, the use of smart sensors, robotics, simulation technologies, advanced materials, nanomanufacturing, and additive manufacturing techniques.

Federal support for programs such as the Hollings Manufacturing Extension Partnership and the Manufacturing USA programs complement SBIR in providing support to small and medium-sized manufacturing businesses that work with public universities to develop and utilize these important Industry 4.0 technologies.

For example, Xact Metal is a client of the Innovation Park at Penn State University and the Pennsylvania MEP and is a member of America Makes. Xact Metal's Chief Technical Officer, Matt Woods, laid the foundation for Xact Metal when he recognized the need for additive manufacturing to offer higher performance in a sustainable way. He developed the technology at Penn State's Center for Innovative Materials Processing Through Direct Digital Deposition (CIMP-3D), a leading additive manufacturing research facility. Xact Metal is taking the essential specifications for metal powder-bed fusion and combining them with breakthrough technology to establish a new level of price and performance for additive manufacturing. This allows lower-capital firms to enjoy the benefits of the next generation of innovative manufacturing solutions powered by metal 3D printing. Although they have not received SBIR funding, this company benefits from the suite of state and federal investments that are supporting innovation in manufacturing.

#### **Support for Small Business is a Team Sport**

Obviously, successful small businesses—even those in technology intensive industries—need more than technology to be successful. They also need insightful marketing and business strategy advice, assistance with financing, identification of customers, help with training, and eventually, partnerships that will help them manufacture their product and deliver it to customers. This is where other programs, such as the Small Business Development Centers, the Procurement Technical Assistance Centers, and the Hollings Manufacturing Extension Partnership (MEP) complement SBIR and STTR to support small businesses. Public and land-grant universities are very good at leveraging multiple resources to provide these businesses the support they need to achieve sustainability so they can have a greater public and economic impact.

The support that Iowa State has provided Gross-Wen Technologies provides a case study. The company is based on a technology developed at Iowa State University by the company's founders, Dr. Martin Gross and Dr. Zhiyou Wen. This technology removes nutrients and pollutants from wastewater using algae while creating a valuable product that can be turned into fertilizer and a supplement for livestock feed.

After Gross and Wen first formed their company, they met with the Small Business Development Center at Iowa State University to develop its early strategy. The company later joined the cohort of the Iowa State University Startup Factory, which helped the company refine its business model. In that same year, they received a Phase I SBIR award, which enabled the company to demonstrate the feasibility of its technology for producing a slow release algae-based fertilizer. This success led to a Phase II award the



following year to scale production, and another award to use the technology for development of a supplement to livestock feed.

In 2018, Gross-Wen secured its first customer—the city of Slater, Iowa. Applying the company's technology saved the city over \$1,000,000 compared to the cost of constructing a conventional wastewater treatment system that would otherwise have been required to meet wastewater discharge quality standards. In the meantime, Iowa State's Center for Industrial Research and Service, Iowa's MEP affiliate, helped the company connect to manufacturers also in need of lower cost wastewater treatment options.

Other important resources at Iowa State were also involved in this company's success. Iowa State's Ivy College of Business set up student groups to assist the company with market discovery, which gives those students valuable experience while providing essential information to the company. The Pappajohn Center for Entrepreneurship provided one of the founders a scholarship that supported his research while in graduate school.

Not only did this company save a small town a great deal of money and bring the world a new, lower-cost wastewater treatment technology that also generates a beneficial byproduct, it also has created several jobs in the small town of Slater.

While Gross-Wen illustrates the importance of leveraging multiple programs across a university, it is also sometimes important to identify resources from multiple universities to support a startup. This was the case with APDM Wearable Technologies, a small company in Portland, Oregon born of technology developed in part at Portland State University. APDM is tackling the problem of balance and fall risk for people with Parkinson's disease and other sources of movement disorders. Founded in 2007 by Portland State University Professor of Electrical and Computer Engineering, James McNames and his associates, Mateo Aboy, and Andrew Greenberg, APDM has received SBIR and STTR awards from HHS, NIH, and DOD. The company develops technologies for monitoring human movement with wearable sensors and for storing the resulting data for analysis. This supports researchers who are conducting clinical studies testing approaches to addressing these problems. APDM's success has required collaboration among experts in embedded systems, signal processing, physical therapy, and web-based data management, and has collaborated with scientists, faculty, and clinicians at Oregon Health & Science University, Portland State University, and Oregon Institute of Technology.

#### **Cultivating Place: Building Stronger Innovation Regions**

Research and innovative technologies are obviously not all that is required to assist small businesses in overcoming the challenges of getting new ideas into the market where they can have the greatest impact. They also need capital, legal expertise, mentorship, and a policy and innovation environment that is generally supportive of entrepreneurs and attracts the required talent.

Public and land-grant universities collaborate with industry, state and local government, and economic development organizations to build that supportive ecosystem. A notable example is the creation of TechAccel, a private capital development company headquartered in Overland Park, Kansas and launched by Kansas State University's Institute for Commercialization in 2014. Addressing the shortage of venture capital that plagues many smaller metropolitan areas, TechAccel brings private capital to invest in, acquire, and advance early-stage discoveries and technologies in plant and animal agriculture,

animal health and nutrition, and related areas including food safety and quality and crop processing. TechAccel works with partners to de-risk new technologies. Supporting emerging companies in the animal and animal health sector takes on a new approach through the company's unique "Equity+" investments of capital and talent.

Complementary programs, like the Economic Development Administration's Regional Innovation Strategies program, help bring additional assets into efforts to support the innovation ecosystem. For example, AgLaunch is a nonprofit partnership launched to support the agtech industry in Tennessee. Its EDA i6 Challenge grant is creating AgLaunch i6, a farm-centric commercial validation program for agricultural-technology startups. The initiative will focus on creating a platform to commercialize technologies in agriculture and facilitate farmers' transitions into next-generation agricultural opportunities, stimulate job creation in at-risk rural and urban communities, and create a more profitable system to support AgTech investors and startups. The partnership includes a number of higher education, state government, private sector, and nonprofit partners.

Partnerships between universities, government, and the private sector can also be effective at improving the livability of a community, attracting and keeping the talent that is essential to fueling the innovation economy. The SBIR program contributes here, too, because it helps fund startups in smart cities technologies that improve community livability.

A 2018 SBIR award from the Department of Transportation to Knowledge Based Systems Inc, a small research and development company in College Station, Texas, created a unique research partnership with Texas A&M's Transportation Institute to create a public mobile application for citizens to report sidewalk and pedestrian mobility issues. Working with regional metropolitan planning organizations, pedestrian advocates, and municipal leaders, the grant enabled the creation of this new tool that is being deployed in various areas around the state. In the future, this could provide tools to decision makers in metropolitan areas, such as Fort Worth, TX, where sidewalks are an element of the Active Transportation Plan, and the tool will help identify improvements that will facilitate active transportation.

**Conclusion: Universities Strengthen the Innovation Pipeline, But More Can be Done.**

I'll conclude by stating what might seem obvious from the examples I've shared: public and land-grant universities strengthen the innovation pipeline from universities to small businesses by nurturing the talent that small businesses need; by generating the basic science and applied innovation that companies are built upon and that make them productive and competitive; and by contributing to the broader entrepreneurship and innovation ecosystem and the quality of life in their communities. This combination of talent, innovation, and place is what propels our regional economies and their small businesses forward. Creating and supporting small businesses that take innovative ideas into the marketplace is a part of our mission because it ensures that our research truly has public impact.

Still, there are many challenges to getting great ideas to the market where they can have the greatest impact. APLU and its member universities are grateful for the support of the committee for the important funding programs that fill and advance the innovation pipeline from universities to small businesses. We look forward to working with you to test and scale successful approaches to breaking down the remaining barriers.

To see for yourself how our universities are supporting this pipeline, I invite all of you to the Innovation and Entrepreneurship Showcase, sponsored jointly by APLU and the Association of American Universities, to meet some of the inventors and entrepreneurs that leverage federal research funding to create companies that sell products and processes that have important public impacts. This year, the event takes place on April 28 at 5 PM in here in the Rayburn Building, in the Cafeteria. I look forward to seeing you there.

Ethan Mann, PhD, MBA  
 02-11-2020  
 Sharklet Technologies, Inc.

"The Importance of the Innovation Pipeline for Small Businesses and Workforce Development"

Thank you for inviting me to be here, it is truly an honor.

I am Ethan Mann, VP of Business Development and Marketing at Sharklet Technologies, Inc. in Aurora, CO, just outside of Denver. Sharklet Technologies, Inc. is a start-up company developing a novel surface texture applied to consumer products and medical devices to prevent the spread of germs that cause infections. The novel paradigm-shifting concept was the brainchild of Dr. Anthony Brennan, a Professor of Engineering at the University of Florida, in Gainesville, FL. Dr. Brennan noticed that tiny surface textures impact the biological response of cells, like bacteria. He also noticed that sharks are not susceptible to fouling like whales, manatees, and sea turtles. When he studied shark skin, he noticed that it has a specific texture and when that texture is reproduced on plastic surfaces, it is able to prevent the accumulation of bacteria that contributes to common medical device infections. Sharklet has been developing applications for this technology in Colorado ever since Dr. Brennan's discovery.

Stories like these are inspiring as we learn more about the world around us and how research and innovation can have a lasting impact on patient lives. In fact, the United States has built the world's leading innovation factories in its academic institutions and small businesses. The UN's Global Innovation Index ranks Northern America as the top region for innovation economy. This has developed for many reasons, the most important of which is the active support for innovation. To get beyond the initial concept stage, technologies require the expertise and execution from small businesses. I've seen the development of many technologies beginning once the innovation leaves the academic research centers in one form or another.

When a small business leader takes over, the commercialization process begins in earnest for truly impactful technologies. Innovations are exposed to market forces that serve to sculpt productization. For example, manufacturing capability or scalability, regulatory strategy, and customer discovery all have massive impacts on how a technology is delivered to the public. Technologies with the best likelihood of navigating early commercialization evaluation are those that also have exclusivity protections, usually in the form of patent protection. Other competitive barriers can be developed, but intellectual property protections are the most important to securing a developing technology's value. Founders and investors tasked with delivering an innovation to the marketplace rely on market exclusivity provided by these competitive barriers to deliver an attractive return on the investment risks taken.

Developing novel innovations for market readiness requires significant investment regardless of the sector involved. ScienceDirect reports that medical device development requires about 7 years to go from concept to commercialization and cost more than \$31 million. Biomedical technologies require substantial safety and efficacy testing, usually to the molecular level, to satisfy regulatory approvals. Other advanced industry fields are similar due to the intricacies of the technologies. Manufacturing and development steps are all completed with the utmost scrutiny to ensure consistency and safety of the product used by consumers.

Given these circumstances around the risk, labor, and time it takes to launch a novel technology, what current and future support structures are the most critical to ensure successful commercialization and why are they important?

Innovations with a high likelihood of success are those that have been de-risked to the point where certainty of value surpasses the risk of failure for new ventures. More quickly driving technologies to this value inflection step should be the task of technology transfer offices around the country. Activity of these offices is critically important to ensure taxpayers are allowed to benefit from the technologies they have had a part in funding. Offices of technology licensing should be appropriately resourced to support the quantities of emerging innovations.

Resources may need to be expanded to track the fast pace of science occurring within academic research programs. Perhaps one of the best examples of support to de-risk innovations is the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grant programs which serve to fund proof of concept and early R&D activities for new innovations. Small businesses taking advantage of these mechanisms are at a distinct advantage. They have improved their technology and added value without selling equity which dilutes investors.

Small business on the front lines of R&D need additional resources to maximize commercialization of technologies. Technologies are rarely finished with innovation once they've left the academic lab. The SBIR and STTR programs do not allow funding to be used for critical business activities protecting long-term value, like intellectual property (IP) protection or regulatory strategy. Both of these functions are critical for the commercialization process. New or revised programs providing small businesses with funding mechanisms allowing for IP filings or regulatory work could improve commercialization of important technologies thereby dramatically changing the public's access to the latest technologies and cures.

Finally, delivering novel technologies to the marketplace provides a value well beyond the obvious use of the technology. Supporting small businesses and innovation fuels entire community growth. For example, the life sciences industry in Colorado, my home state, has been valuable for the state's economy. The life sciences industry provides more than 30,000 high-paying jobs with an average annual salary of \$89,000. Moreover, these direct jobs lead to an estimated 92,700 indirect jobs. I sit on the board of directors for the Colorado Bioscience Association, CBSA. CBSA is a state organization that creates co-opportunity for the Colorado life sciences community. CBSA champions a collaborative life sciences ecosystem and advocates for a supportive business climate.

Workforce collaboration is key to the growth and maturation of any industry. CBSA and the life science industry together work to cultivate a strong life sciences talent pipeline in Colorado with several different workforce development and training programs including various interactive educational experiences, mentoring, internships, workforce skill building, and leadership development.

And Colorado life sciences companies see the value of engaging not only in K-12 but higher education. In fact, Sharklet Technologies, for example, engaged CSU biomedical engineering students each of the last four years to complete a senior design project as part of their senior-level course work. These projects included core components of Sharklet product development activities.

As industry and the business community continue to collaborate and work together to support life sciences and these important innovations the industry will continue to grow and thrive while seeing more innovations coming out of our great state and the entire country. With this work, ultimately, innovations will improve lives. We will also see continued job creation which provide high-paying, globally engaging and rewarding opportunities, and students young and old are provided relevant experiences while discerning opportunities of interest. Support from the Committee on Small Business and the Subcommittee on Innovation and Workforce Development is critical to reduce barriers and ease the ability to bring technologies to life.



## The Innovation Pipeline: From Universities to Small Businesses – A Rural Perspective

February 11, 2020

### **Good Morning.**

Chairman Crow, Ranking Member Balderson, Committee Members, I appreciate the opportunity to testify before the Committee today.

### **Background.**

My name is Greg Crawford. I am the president of Miami University in Oxford, Ohio. I have been passionate about entrepreneurship and education for my entire career. I began my professional career at Xerox Palo Alto Research Center, I have served as the Dean of Engineering at Brown University and the Vice President and Associate Provost for the University of Notre Dame. I am a practicing entrepreneur, having started two biomedical companies, been a part of a spin out company, created the Program in Innovation Management and Entrepreneurship (PRIME) at Brown, the Engineering, Science, and Technology Entrepreneurship Excellence Program (ESTEEM) at Notre Dame, and led Notre Dame's California initiative in Silicon Valley. At Miami, our focus is not only on graduating great students who find great jobs but also on graduating great entrepreneurs who create tens, hundreds, or thousands of great jobs.

### **Small Town/Business Ecosystem.**

Today, I am going to describe Miami University's vision for an innovation pipeline for moving students and graduates from the university to small businesses. I am going to speak to the importance of creating and developing talent and retaining some of that talent in small-town and rural America so that those places fully participate in the economic revival underway in our urban core.

As a public university, we believe our service to the state and nation starts at home. Oxford is recognized as one of the greatest college towns in America, but like many rural communities across America, it is facing huge challenges from dislocations in the global economy. Fifteen years after Thomas Friedman famously declared "the world is flat," the effect of that shift is crushing many of our once thriving and idyllic rural communities. Building an innovation pipeline that moves talented students and graduates from university to small businesses in rural communities is a primary focus for Miami University and our rural community.

In Oxford, Ohio, we seek to create a vibrant, innovative, and forward-looking organization, comprising constituents from Miami University, the City of Oxford, and local small businesses. All working collaboratively to advance ideas, inventions and innovations with real economic value to the market place. I will share with you how we intend to accomplish this in an iconic small town with resources and assets similar to rural communities across the country. This strategy, built in collaboration with the City of Oxford and our rural stakeholders, will restore economic viability to our community and serve as a model for small towns across rural America. This work is in progress – and it is making progress.

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**“Pulling” Innovation into the Ecosystem.**

**The Pull Strategy:** While most universities concentrate on pushing out the intellectual property (IP) they discover, Miami has added an approach that pulls in IP from outside partners. We take idle IP from companies and national labs and develop it further right in Oxford, Ohio, with the intention of applying it for commercial and social benefit. For example, patents developed at Wright-Patterson Air Force Base were shared with us to see whether we could discover uses for dormant or small-scale ideas.

**More “Shots on Goal” & More Ideas:** Our “pull strategy” provides our students with great practical experience in examining idle IP for ideas, strategies, development and promotion into new technology, products, services, or for the creation of new ventures. It also provides our students the opportunity to learn the art of de-risking an idea. The more students and faculty involved with the pull strategy the greater the number of idle IPs we can examine and the more ideas we can take through the de-risking process.

**Ohio’s IP Promise:** Complementing our pull strategy, the State of Ohio has developed a statewide IP “push strategy” called the Ohio IP Promise. All Ohio public universities have united in the Ohio IP Promise. The IP Promise establishes a uniform set of guiding principles so researchers know exactly how they can take charge of their work and make it available to the public and so the public knows exactly how they can access university intellectual property. Now, even small companies in rural towns can have access to powerful university ideas.

**Educating Innovators for Innovation.**

Whether physically located in a rural community or an urban core, universities are crucial in creating the talent that will flow through the innovation pipeline. At Miami University, we develop talent by, among other things, providing our students:

- **Humanics** – offering in-demand programs in the areas of healthcare and health sciences, engineering, automation and robotics, and data and analytics that address the human factor while tackling societal challenges. All of which move us toward providing our students with quantitative acumen, humanities acumen, and scientific acumen. Overall, we strive to instill an entrepreneurial mindset in our students, i.e. “Robot-proof” them for the 4.0 Emerging Industrial Revolution.
- **Open-Ended Experiences** – opportunities to experience the messy, complex, sometimes risky, tension-filled aspect of the compromise-driven world of real business and value creation through project work, internships, and employment.
- **Working hand in hand with small businesses and industry**, Miami University educates workforce-ready graduates. We complement our students’ humanics and open-ended experiences with intense career advising. Advising is offered early, often, and at a high level for every Miami student.

**Humanics:** College graduates must be able to address today’s problems as well as tomorrow’s unidentified challenges. They must be educated in quantitative acumen – data, humanities acumen – the human aspect, and scientific acumen – technology. At its core, to be “Robot-proof” means to understand that simply because data and technology can do something, one should appreciate the value of questioning whether that thing should be done.

**Dealing with Ambiguity & Learning to Fail Successfully:** Developing talent with an entrepreneurial mindset is where Miami excels. Our motto is learn by doing, grow through experience, and improve with practice.

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Just last year, more than 4,000 students from across every major took an entrepreneurship class – creativity at work and how to create value. We have programs around the country and internationally where our students learn through practicing entrepreneurship – Silicon Valley is one example where our students intern with some of the world's most innovative companies. Additional internship opportunities are available through our entrepreneurship intern program where we place students in startups during the summer.

Working Hand in Hand with Small Businesses and Industry: Through our Work+ Program, students can receive a debt-free education. Students in the program work 24 hours a week at a company – for example, thyssenkrupp Bilstein's Industry 4.0 – and get a paycheck while the company pays their tuition.

All of these experiential engagement opportunities make Miami graduates ready to create value, start companies, participate in new-collar jobs, not just blue-collar or white-collar jobs. Miami has had great success in moving students and alumni through the innovation pipeline from the university setting to small businesses and beyond:

- Some, 1,500 Miami alumni on the social network LinkedIn currently self-identify their jobs as a founder or co-founder;
- More than \$2B in venture funding has been raised by Miami-affiliated high-growth companies since 2011; and
- 94 Miami-affiliated high-growth companies have exited through acquisition since 2011.

Unfortunately, these graduates often head to the east and west coasts, to the most innovative places in the world – Silicon Valley, Austin, Chicago, Cincinnati, and Route 128 in Boston.

#### **Keeping Innovators & Innovation Home in Rural Communities.**

Imagine the impact on small town America if some college graduates trained in technology, innovation, and entrepreneurship, set up shop in rural American towns like Oxford, Ohio. Innovation has brought our urban cores roaring back, including in Ohio cities like Cincinnati, Columbus, and Cleveland, but we need to bring rural communities into the prosperity.

There is a need to recruit and retain talent in rural America. With technology and AI hitting all sectors of industry across the country, the United States needs to find a way to keep some of our most innovative thinkers in rural America. That's our mission in Oxford. Our rural community wants to figure out how to keep some of Miami University's brilliant minds in Oxford, and Butler County, Ohio. We need them owning homes, building small businesses, engaging civically, and contributing economically to our community.

Agriculture Department Report Cites Creatives Necessary for Rural Innovation: A Department of Agriculture Economic Research Service study by Tim Wojan revealed that creativity and innovation are key to how rural America innovates. "Ultimately, Wojan and [his] colleagues' analysis find a strong statistical association between the arts, innovation, and economic dynamism in rural areas," reports Richard Florida in "The Rise of the Rural Creativity Class" (2018).<sup>1</sup> "And this leads them to conclude that the arts are a direct force in rural innovation, not just an indirect factor that helps to attract and retain talent for all

<sup>1</sup> [https://getpocket.com/explore/item/the-rise-of-the-rural-creativity-class?utm\\_source=pocket-newtab](https://getpocket.com/explore/item/the-rise-of-the-rural-creativity-class?utm_source=pocket-newtab)



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industries." Wojan's studies demonstrate the possibilities in general, and our community would like to demonstrate the possibilities in particular.

Our aim is to establish a hub of creativity and innovation, imagination and design, art and science. We are developing a city block in Oxford that unites creativity with technology. We believe the unity and collaboration of a full range of human endeavor, including technology, arts, commerce, entrepreneurship, and environmental stewardship will empower renewal and prosperity for our community and beyond.

Oxford Advances Creatives First: A key component of Wojan's studies is the presence of a strong arts community. Our city has a wonderful arts community and a vibrant Arts Center. Our first phase is the identification and exploration of the creatives – artistic entrepreneurs and sole proprietors in architecture, music, painting, photography, sculpting, and dance that occupy the Arts Center – as well as the arts infrastructure provided gratis by Miami University (the Arts Center and the natural park area located directly behind the Arts Center).

Next Phase – Technology, Entrepreneurship, Creative, Hub: Our next phase will focus on the development of the technical portion of the project, the recruitment of individuals and companies and the rehabilitation of a structure for infrastructure purposes. We believe that we can be successful in recruiting tech-minded individuals by leveraging the big ideas that come out of the university and focusing on recruiting companies who want proximity to our top-tier talent as well as startups. We have identified space in a vacant 400,000 square foot Miami University-owned building, located directly across the street from the Arts Center. This former food preparation facility, with multiple floors of wide-open space, is ideal for incubator-type activity and for forming an innovation hub where scientists, engineers, and entrepreneurs can collaborate in coworking spaces, sharing ideas and creativity, ingenuity and design, and so much more.

Phase three will consist of the full integration of the creatives and the tech portion. Together the Arts Center, the natural park area, the anticipated innovation and entrepreneurship building, and the Oxford Municipal Building (housing the city's administration and economic development offices), located across the street from the Arts Center, will comprise the Technology, Entrepreneurship, Creativity, Hub Corridor (the TECH Corridor).

The TECH Corridor would be one of the first of its kind established in an Ohio – and American – rural community to foster such collaborations and converge expertise across disciplines. The TECH Corridor proposed here is novel in several ways:

- It is situated in a rural community facing the struggles with the new world order;
- It is in close proximity with an institution of higher education;
- It consists of an entire block of infrastructure where technology and the arts co-exist and thrive together;
- It contains a broader vision and engagement strategy than one sees at most incubator sites; and
- It has a park amenity where creatives and investors can find refreshing green space for reflection, contemplation, and discovery. Research shows that such green space elevates creativity and cognitive processes.<sup>2</sup>

<sup>2</sup> <https://bjm.bmj.com/content/49/4/272?sid=56h97a4c-0e75-46d0-a6ba-41c7f41a089c>;

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We can capitalize on our existing Miami University investment in the Oxford Community Art Center, and utilize their creativity constituents to work side-by-side with scientists, engineers, business professors, and entrepreneurs on this rare block with a park and new amphitheater and the Oxford Municipal Building across the street. We are ready to leverage this promising convergence of circumstances and infrastructure for the good of our University, our community, our state, and our nation.

#### **Current & Future Strategies.**

One big necessity in rural communities is to stay connected with other cities, the urban core within the region, and the world.

*Stay Connected to Cities:* In today's world, rural communities need the urban core and the urban core needs rural communities. At Miami University, we are active in the Greater Cincinnati region's economic development efforts as a member of the Regional Economic Development Initiative (REDI Cincinnati). I serve on the board of Cintrifuse, an incubator and accelerator dedicated to creating a stronger technology presence in the Greater Cincinnati region. Our students regularly participate in the #StartupCincy entrepreneurial ecosystem interning at Cintrifuse, early stage investors CincyTech and Queen City Angels, a variety of accelerators, and tech companies such as the Brandery, 84.51, Frameri, and Roadtrippers, to name a few.

*Stay Connected to the World:* Oxford has a sister city in Differdange, Luxembourg, and Miami has a learning center there. Once a steel country, Luxembourg is now the heart of Europe for finance and creativity. While Differdange once had large blast furnaces, it now supports business incubators.<sup>3</sup> There are lessons to be learned from how Differdange and Luxembourg reinvented themselves.

*Stay Connected to Each Other.* Small towns and universities located in them are inseparable. Each entity must collaborate and connect with the other. The success of one hinges on the success of the other. If you represent rural communities without a university, please adopt us – Miami University and Oxford, Ohio, are open for business! Jessica Greene, the Assistant City Manager for Oxford, is here with me today and we would love to talk with you after the hearing.

#### **Grateful & Thank You!**

Thank you for your time today. I am honored to present to the House Subcommittee on Innovation and Workforce Development. I am the son of parents who lived the American Dream. Neither went to college – I am first-generation. My Dad is a veteran & retired air traffic controller who worked for the federal government for 36.5 years. My mother worked in retail. Their dream was simple – for their children to go to college – they made it possible.

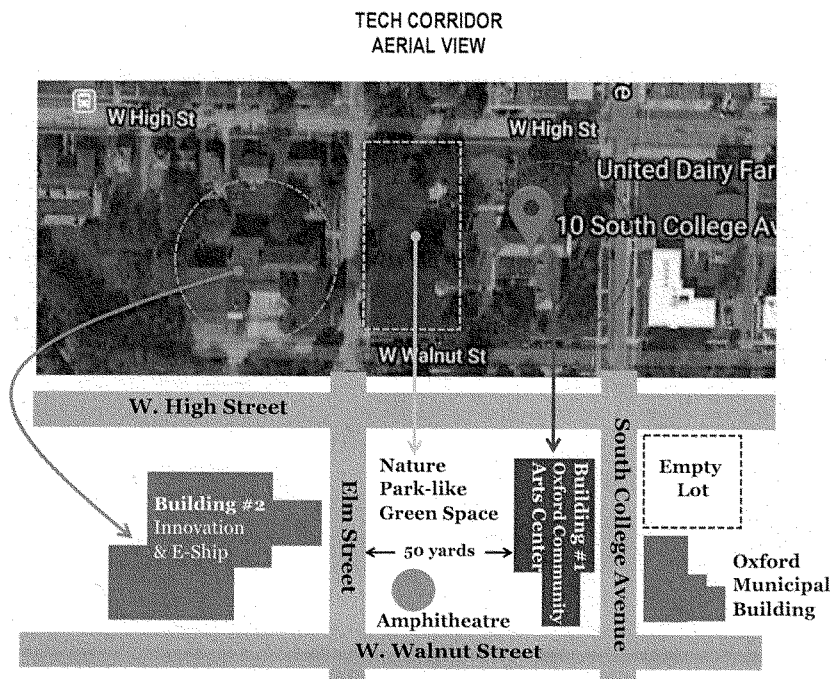
I feel fortunate everyday as a university president to extend their dream to tens of thousands of others in our state and nation, educating them to be great honorable citizens, leaders, innovators, entrepreneurs, and creators. When we bring together good people and good ideas, we will elevate the quality of life for

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<sup>3</sup><https://blog.pwc.lu/luxembourg-become-hottest-startup-scene/>

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everyone in our nation, in the small towns and countryside as well as the big cities. We can and will be great everywhere when we work together as one.





February 27, 2020

The Honorable Jason Crow  
Chairman  
House Committee on Small Business  
Subcommittee on Innovation  
and Workforce Development  
Washington, DC 20515

RE: Answers to questions raised at the hearing on February 11

Dear Chairman Crow:

It was an honor to testify at the subcommittee's hearing "The Innovation Pipeline: from Universities to Small Businesses" on February 11. During the hearing, there were several questions raised by members that I either did not have the opportunity to answer (because we ran out of time) or that I was unable to answer with the information I had at that time. This letter provides an addendum to my testimony for the purpose of answering these questions.

1. Congressman Hern asked about the most significant regulatory burdens facing universities with respect to innovation and what can be done to reduce them.

We appreciate the question because researchers on APLU member campuses spend more and more time engaged in administrative activity as part of their federally-funded research, draining resources that could otherwise be devoted to scientific research and innovation that can lead to commercialization through small businesses. We have called for clear, consistent, streamlined, and coordinated regulations across the different research agencies to help decrease these burdens.

We recently laid out a set of suggestions in a letter to Chloe Kontos, Executive Director of the National Science and Technology Council Joint Committee on the Research Environment in the White House Office of Science and Technology Policy. The recommendations are based in part on reports from the Government Accountability Office and the National Academies of Science,

Engineering, and Medicine.<sup>12</sup> That letter is dated January 27, 2020<sup>3</sup> and has many recommendations, but I will point to a few here that are especially relevant to programs that are the purview of the committee. The recommendations include the following:

- Facilitate cooperation among federal agencies to create a single financial conflicts of interest policy to be used by all agencies that include standardized definitions, disclosure forms, and monetary thresholds;
  - Continue to harmonize federal agency forms, systems, and frequency for collecting grant application and management information such as project budgets and biographical information;
  - Limit proposal requirements to the information needed for peer evaluation of the merit of the proposal. Supplementary information—such as IRB approval, conflict of interest disclosures, and fully detailed budgets—should be provided “just in time,” after the research proposal is deemed likely to be funded.
  - Ensure that subrecipient monitoring requirements are limited and appropriate for preserving accountability but not overly burdensome or duplicative of other reporting.
  - Stand up the Research Policy Board called for in the 21<sup>st</sup> Century Cures Act.<sup>4</sup> As called for in statute, this board, with members from both government and the public nonprofit research community, could assist longer term in examining and coordinating policies and reducing regulatory burdens.
2. Congressman Kim asked about how to spark innovation in rural places and those without major research universities.

We encourage members of Congress to become familiar with the Cooperative Extension programs run by the land-grant institutions in their communities. Cooperative Extension has a presence in nearly every county in the United States and runs a variety of programs that contribute to more innovative economies in rural communities. For example, the Community and Economic Development Initiative of Kentucky (CEDKIK) at the University of Kentucky and the Purdue Center for Regional Development (PCRD) are working in partnership with the U.S. Department of Agriculture (USDA) and the extension programs in North Dakota, Ohio, and Wisconsin to provide technical assistance to rural communities with 50,000 or fewer people who want to build their communities through entrepreneurship, innovation, and workforce development. This is just one example of the

<sup>1</sup> “Optimizing the Nations Investment in Academic Research, A New Regulatory Framework for the 21st Century,” (2016) <https://www.nap.edu/catalog/21824/optimizing-the-nations-investment-in-academic-research-a-newregulatory>.

<sup>2</sup> “Federal Research Grants: Opportunities Remain for Agencies to Streamline Administrative Requirements,” (2016) <http://www.gao.gov/assets/680/677949.pdf>

<sup>3</sup> <https://www.aplu.org/members/councils/governmental-affairs/CGA-library/ostp-research-environment-rfi-comment-letter/file>

<sup>4</sup> <https://www.congress.gov/114/plaws/publ255/PLAW-114publ255.pdf>

many programs that Cooperative Extension maintains to assist small business innovation in rural communities. Continuing to support Cooperative Extension efforts through USDA is important to maintaining these programs.

Entrepreneurship training and services are provided by many public universities serving rural areas—not just the land-grant universities. TechGrowth Ohio, which is led and managed by Ohio University's Voinovich School of Leadership and Public Affairs, was Founded in 2007 by Ohio University and the Ohio Third Frontier program. TechGROWTH provides intensive professional services and seed-stage investment capital to technology companies and entrepreneurs in southeast Ohio. It has assisted more than 2,236 entrepreneurs and has invested more than \$7 million in 15 startup companies and provided 90 companies nearly \$5 million in GROWTH funding awards. These services and investments have helped companies in southeast Ohio generate more than \$591 million in additional economic activity, including co-investments, loans, grants, increased sales, and new jobs. Every \$1 of state money invested generates almost \$25 in economic activity. Tech Growth Ohio has just been awarded another \$5 million by the state in a competitive funding process for venture development services. The grant will be matched by Ohio University and private organizations, allowing TechGROWTH to continue and expand services through 2022.

3. Congressman Burchett asked about the best way to measure long-term economic impact of universities.

The positive impact of public universities extends well beyond the confines of their campuses. Indeed, it is a core part of public universities' mission to serve their communities and there is scarcely a corner of society that doesn't benefit from their work. Measuring the full long-term economic impact of universities on their regions, states, and the nation is quite challenging. The benefits to both individuals and society of spreading knowledge, enriching culture, broadening perspectives, which are core components of the mission of higher education, are beyond calculation.

Yet the positive impact of college graduates on the economy is clear. Of course, graduates benefit themselves from lower unemployment, higher wages, and increased job security. But graduates also contribute immensely to all of society expanding economies, boosting the productivity of other workers, and fueling innovation.

Exhaustive research from University of Maine Professor Philip Trostel quantifies this impact to society across several measures.<sup>5</sup> Bachelor's degree recipients receive significantly less government benefits compared with individuals whose highest degree is a high school diploma. This includes services such as Medicaid, housing assistance, nutrition assistance, and

unemployment benefits, among other benefits. Across an individual's lifetime, government expenditures are \$82,000 lower for college graduates than for those with high school degrees

Because of their higher earnings and corresponding tax brackets, college graduates contribute more in taxes as well. All told, they contribute over \$510,000 in taxes during their lifetime—\$273,000 more than a high school graduate. Taxpayers see a big payoff for their investment in public higher education.

Most universities produce economic impact statements and can usually include:

- university purchased goods and services;
- spending by faculty, staff, students, visitors;
- capital spending;
- research spending;
- patent applications, and licenses; and
- value of volunteer work by students and faculty.

Universities will typically then use an input-output model or standard multipliers to calculate direct, indirect, and induced effects, and then usually calculate the total impact on economic output, jobs, and tax collections.

This methodology, however, only tells part of the story because universities affect so many other aspects of the economy that are difficult to quantify. These aspects include:

- talent retention and the development and growth of industries;<sup>6</sup>
- development and competitiveness of industry clusters;<sup>7</sup>
- the performance of local firms;<sup>8</sup> and
- the growth of new companies through the type of entrepreneurship that we have discussed during this hearing.<sup>9</sup>

Thank you again for the opportunity to testify; I am happy to answer any additional questions.

<sup>6</sup> See. Felsenstein, D. (1996). The university in the metropolitan area: Impacts and public policy implications. *Urban Studies*, 33, 1565-1580; and Blackwell, M., Cobb, S., & Weinberg, D. (2002). The economic impact of educational institutions: Issues and methodology. *Economic Development Quarterly*, 16, 88-95.

<sup>7</sup> Paytas, J., Gradeck, R., & Andrews, L. (2004). *Universities and the development of industry clusters* (Prepared for the Economic Development Administration, U.S. Department of Commerce, Washington, DC). Pittsburgh, PA: Carnegie Mellon University, Center for Economic Development.

<sup>8</sup> Belderbos, R. Carree, M. Lokshin, B..(2004). Cooperative R&D and Firm Performance. *Research Policy* 33(10): 1477-1492.

<sup>9</sup> 5. Chrisman, J., Hunes, T. and Fraser, S. 1995. Faculty Entrepreneurship and Economic Development: The Case of the University of Calgary. *Journal of Business Venturing* 10(4), 267-281.

Sincerely,

A handwritten signature in dark ink, appearing to read "Sheila A. Martin", with a stylized flourish at the end.

**Sheila A. Martin**  
Vice President for Economic Development and Community Engagement





February 27, 2020

Attn: Members of the Subcommittee on Innovation and Workforce Development of the House  
Committee on Small Business

Engine is a non-profit technology policy, research, and advocacy organization that bridges the gap between policymakers and startups. Engine works with government and a community of thousands of high-technology, growth-oriented startups across the nation to support the development of technology entrepreneurship. To that end, Engine welcomes the opportunity to provide comments for the record on the innovation pipeline and access to funding for small businesses and startups.

As a great deal of research and innovation pours out of our nation's universities, it is important to consider which funding streams are available to transition university-generated research and development projects into economically viable small businesses and startups. The subcommittee correctly states that "bringing an idea developed in a university lab to consumers is often a lengthy process," and many of the funding streams available to small businesses and startups reflect this challenge.<sup>1</sup> As startups and small businesses represent large drivers of U.S. economic and job growth, federal support for research and development is important to the continued growth of American innovation. The subcommittee discusses funding provided by incubators and accelerators, which are often found on or near university campuses. Support for incubators and accelerators in some instances provides better support than some federal grant programs for new startups, due to their ability to meet a startup's immediate and short-term needs, while still enabling university-generated innovation to commercially expand. Federal grant programs like the Small Business Innovation Research program (SBIR) and the Small Business Technology Transfer program (STTR) represent unique opportunities for certain

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<sup>1</sup> See hearing memo, available at: [https://smallbusiness.house.gov/uploadedfiles/02-11-20\\_hearing\\_memo.pdf](https://smallbusiness.house.gov/uploadedfiles/02-11-20_hearing_memo.pdf)

startups and small businesses to engage in federally funded research and development with eventual commercialization.

At Engine, we publish weekly startup profiles to highlight ecosystem leaders and developments across the country. Through this work, we have been able to examine the benefits of the SBIR and STTR programs firsthand. In Tucson, Arizona, startup SGNT uses radio frequency identification (RFID) to create seals for products like medicine bottles so that products can be authenticated as having not been tampered with.<sup>2</sup> While SGNT has taken advantage of state-level angel investing programs, they were also the recipient of an SBIR grant from the National Science Foundation in 2018 for \$225,000. SGNT's founder refers to this grant as an "inflection point" for the company. According to founder and CEO Emil Tremblay, "when you can say that the NSF agrees that what you're working on is important, that opens a whole world of possibilities and gets investors more interested. This is an incredibly important program, and I wholeheartedly endorse it. Frankly, I don't think we could have gotten here without the NSF."<sup>3</sup>

Another startup organization Engine featured, StartupSac—a Sacramento-based nonprofit "focused on informing, educating, empowering, and connecting founders and innovators"—also stresses the importance of the SBIR and STTR programs to certain startups.<sup>4</sup> As StartupSac's founder indicates, the Sacramento area has a lot of regional talent in biotech and life sciences.<sup>5</sup> Because of this, grant programs like the SBIR and STTR programs have "helped to fund many ideas that take longer to incubate/launch (deep tech) than less complex products/solutions."<sup>6</sup> This message, however, does indicate that grants like those provided by the SBIR and STTR programs, may not address the immediate needs of all nascent startups.

While the hearing focused largely on the federal funding of academic R&D, witness Dr. John Younger highlighted that this type of funding often does not address the immediate needs of many startups.<sup>7</sup> Though many startups benefit from grant programs and venture capital funds, the majority of America's startups are launched with personal or family savings and loans, while

<sup>2</sup> Engine, #StartupsEverywhere, available at: <https://www.engine.is/news/startupseverywhere-tucson-ariz>

<sup>3</sup> Id.

<sup>4</sup> Engine, #StartupsEverywhere, available at: <https://www.engine.is/news/startupseverywhere-sacramento-california>

<sup>5</sup> Id.

<sup>6</sup> Id.

<sup>7</sup> See testimony of Dr. John Younger, available at: [https://smallbusiness.house.gov/uploadedfiles/02-11-20\\_dr\\_younger\\_testimony.pdf](https://smallbusiness.house.gov/uploadedfiles/02-11-20_dr_younger_testimony.pdf)

other funding streams like venture capital are only awarded to roughly two percent of startups.<sup>8</sup> Reliance on personal loans requires a great deal of risk for the founder, and many minority and underserved communities may have difficulty accessing financing for their startup or small business, thereby boxing them out of the ability to compete.<sup>9</sup> Startup and small business loans are also difficult for many to acquire.<sup>10</sup> While some founders may seek out small business bank loans, reductions in community banks and lending make this avenue more challenging, as many larger banks may look to provide funds only to more established businesses and avoid the inherent risk associated with launching a startup.<sup>11</sup> Bank requirements surrounding profit or established longevity similarly block startups from being able to access small business loans.<sup>12</sup> To that end, policymakers should examine all avenues in considering ways to drive needed capital to underserved entrepreneurs.

Though federal grant programs are not typically amongst the most common sources of funding startups seek out, programs like the SBIR and STTR grant funds do provide a unique opportunity for American startups to pursue often risky research and development efforts in conjunction with the federal government where traditional streams—like bank loans—might be hesitant to provide funds. But, as Dr. Younger noted in his testimony, applying for grant funds is a lengthy and time consuming process that may not be suited to the startup lifecycle, where companies often need a smaller amount of capital quickly.<sup>13</sup> As previously noted, the average startup launches with less than \$80,000, often with a founder who is not yet taking a salary and a small or nonexistent staff.<sup>14</sup> Launching a startup is risky—and with a small staff, most startups often have trouble committing resources toward obtaining federally funded grants that may not be immediately available. Moreover, there is the need to add to the stream of funding to pick up

<sup>8</sup> Engine, Primer: Access to Capital (Jan. 31, 2019), available at: <https://www.engine.is/news/primer/accesstocapital>

<sup>9</sup> Mels de Zeeuw, Mind the Gap: Minority-Owned Small Business' Financing Experiences in 2018, available at: <https://www.federalreserve.gov/publications/2019-november-consumer-community-context.htm>

<sup>10</sup> Id.

<sup>11</sup> Ben Luthi, How to Fund Startup Business Loans (Aug. 27, 2019), available at: <https://loans.usnews.com/how-to-find-startup-business-loan> and Matt D'Angelo, When Community Banks Die: How Small Businesses are Affected (Oct. 28, 2018), available at: <https://www.businessnewsdaily.com/11101-death-of-community-banking-small-business.html>

<sup>12</sup> Ben Luthi, How to Fund Startup Business Loans (Aug. 27, 2019), available at: <https://loans.usnews.com/how-to-find-startup-business-loan>

<sup>13</sup> See testimony of Dr. John Younger, available at: [https://smallbusiness.house.gov/uploadedfiles/02-11-20\\_dr\\_younger\\_testimony.pdf](https://smallbusiness.house.gov/uploadedfiles/02-11-20_dr_younger_testimony.pdf)

<sup>14</sup> Engine, Primer: Access to Capital (Jan. 31, 2019), available at: <https://www.engine.is/news/primer/accesstocapital>

where the grants left off. An alternative, as Dr. Younger pointed out, is to better enable government funding for incubators, accelerators, and innovation intermediaries who have more familiarity with the startup ecosystem in their communities and the individual needs of the companies they serve.<sup>15</sup>

In addition to supporting R&D at the university level and through the support of incubators and accelerators, Engine encourages the subcommittee to consider other barriers to capital access so that the federal government can help address the needs of a wider variety of startups in the nation, like ways to improve lending in underserved communities. Though perhaps outside the scope of this hearing, lawmakers should reexamine recent developments like Regulation Crowdfunding, which allows startups to raise capital from small retail investors on the internet. While on its face, Reg CF appears to be a step forward, the SEC caps the amount a startup can crowdfund to \$1.07 million. This arbitrary limit often serves to prevent startups from even pursuing crowdfunding, because doing so is costly in and of itself.<sup>16</sup> Policymakers should also continue to examine expanding the definition of “accredited investor,” so that more people with adequate startup knowledge can invest in startups and expand the pool of capital available to startups.<sup>17</sup>

Engine appreciates the opportunity to provide comments for the record on the innovation pipeline and capital access for startups and is happy to be a resource for the subcommittee on the issue. We look forward to further engaging with the subcommittee on issues affecting startups in the future.

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<sup>15</sup> See testimony of Dr. John Younger, available at: [https://smallbusiness.house.gov/uploadedfiles/02-11-20\\_dr\\_younger\\_testimony.pdf](https://smallbusiness.house.gov/uploadedfiles/02-11-20_dr_younger_testimony.pdf)

<sup>16</sup> Engine, Primer: Access to Capital (Jan. 31, 2019), available at: <https://www.engine.is/news/primer/accesstocapital>

<sup>17</sup> Id.

ABBY FINKENAUER  
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**Congress of the United States**  
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Washington, DC 20515-1501

HOUSE COMMITTEE ON  
TRANSPORTATION  
AND INFRASTRUCTURE

SMALL BUSINESS COMMITTEE  
CHAIRWOMAN, SUBCOMMITTEE ON RURAL  
DEVELOPMENT, AGRICULTURE, TRADE AND  
ENTREPRENEURSHIP

February 27, 2020

The Honorable Jason Crow  
Chairman  
Subcommittee on Innovation and  
Workforce Development  
House Committee on Small Business  
U.S. House of Representatives  
2361 Rayburn H.O.B.  
Washington, D.C. 20515

The Honorable Troy Balderson  
Ranking Member  
Subcommittee on Innovation and  
Workforce Development  
House Committee on Small Business  
U.S. House of Representatives  
2069 Rayburn H.O.B.  
Washington, D.C. 20515

Dear Chairman Crow and Ranking Member Balderson:

On February 11, I attended the hearing in the House Small Business Subcommittee on Innovation and Workforce Development on the crucial role of universities in local and regional economic development. Small businesses drive prosperity in northeast Iowa and supporting small business innovation and growth is one of my top priorities as a Member of Congress. This includes supporting educational institutions that not only develop our next generation workforce, but also offer support services to small businesses and produce research and development that small businesses can translate into new products and services.

The University of Northern Iowa (UNI) is the perfect example of how the work of research institutions can translate into small business growth. In 1985, UNI started Business & Community Services (BCS) to help small businesses across Iowa in everything from business counseling to facilitating the transfer of technological innovation into products and services. Since then, UNI BCS has helped small businesses in all of Iowa's 99 counties.

Specifically, UNI BCS has supported small business growth by offering incubator and small business support services. UNI's incubator graduates have created more than 1,000 jobs over the past several years with companies such as Virtual Paint, Far Reach Technologies, and Red Lab Technologies. In the past year alone, the total economic impact from startup and spin-off companies is estimated to be at \$67 million.

In addition, UNI BCS research and development and technological innovations have been used by small businesses to create new products and services. For example, UNI is integral to helping its students navigate the intricacies of filing patent applications for their intellectual property and inventions, as well as assessing the feasibility of bringing their inventions to the market. In Fiscal Year 2019, UNI was successful in filing and receiving 2 patents and securing two licensing agreements for UNI student inventions.

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**Congress of the United States**  
**House of Representatives**  
Washington, DC 20515-1501

HOUSE COMMITTEE ON  
TRANSPORTATION  
AND INFRASTRUCTURE

SMALL BUSINESS COMMITTEE  
CHAIRWOMAN, SUBCOMMITTEE ON RURAL  
DEVELOPMENT, AGRICULTURE, TRADE AND  
ENTREPRENEURSHIP

Close collaboration between small businesses and their neighboring research universities helps local and regional economies grow and thrive. The innovation emerging from UNI is invaluable to the future of my district. With strong federal support for universities like UNI, our research institutions will not only continue to prepare students for the jobs of the future, but also create university-small business collaboration that will strengthen our local and regional economies.

Sincerely,



Abby Finkenauer  
Member of Congress



February 11, 2020

Chairwoman Ms. Nydia M. Velazquez  
Committee on Small Business  
2361 Rayburn House Office Building  
Washington D.C. 20515

Ranking Member Steve Chabot  
Committee on Small Business 2361 Rayburn House Office Building  
Washington D.C. 20515

Chairman of the Innovation and Workforce Subcommittee Jason Crow  
Committee on Small Business  
2361 Rayburn House Office Building  
Washington D.C. 20515

Dear Chairwoman Ms. Nydia M. Velazquez, Ranking Member Steve Chabot, and  
Chairman of the Innovation and Workforce Subcommittee Jason Crow:

We are writing in regards to the hearing on February 11, 2020 entitled "The Innovation Pipeline: From Universities to Small Businesses".

Chairman of the Innovation and Workforce Subcommittee and members of Congress heard from witnesses on the value of Universities and Small Businesses that have the capabilities to build strong economies locally and regionally and how they can act as a conduit for innovation and workforce development. The testimony discussed numerous issues that impact the university-small business innovation pipeline, including the following:

- 1) the determination of how funding gets deployed for incubators and start-ups;
- 2) regulatory relief for research programs;

<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

<sup>3</sup>HBCUs make america strong: the positive economic impact of HBCUs Retrieved <https://uncl.org/programs/hbcu-impact>



- 3) small business complexities with the understanding of contracts for small business;
- 4) the aversion of venture capitalist to supporting early-stage start-ups;
- 5) lack of mentorships and training to prepare students to be innovators;
- 6) how to incentivize students to be more innovative and entrepreneurial;
- 7) the practical effect and differences between technology developed from university owned IP and technologies developed from small businesses;
- 8) cuts to research funds for national laboratories and universities; and,
- 9) the lengthy process of moving an idea developed in a university lab to the marketplace.

According to Michael Borras, traditional venture capitalists have grown more averse to supporting early-stage start-ups.<sup>1</sup> As a result, innovative small businesses are finding it more difficult to raise the capital they need to bring promising new technologies to market. In this credit-scarce environment, he noted, small companies are finding it difficult to survive the so-called Valley of Death, the 5 to 12 years it typically takes to turn an invention in the laboratory into a commercial product.<sup>1</sup>

These issues have a negative impact on innovations that can increase job and economic growth across the country. To help solve these issues, the Federal Government can provide funding to assist universities and small businesses in building a more robust innovation pipeline. This may be achieved by creating tech-transfer offices, start-up assistance, small business accelerators, and incubators in communities where economically disadvantaged and untapped talent can take full advantage and become thriving small business innovators. Federal funding has traditionally played an important and supportive role in the development of major research universities. The Federal Government should commit funding for new growth industries/communities that require new ways to initiate and accelerate the commercialization of new technologies. Hence, part of the solution to creating jobs and economic growth as well as new growth industries is creating

<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

<sup>3</sup>HBCUs make america strong: the positive economic impact of HBCUs Retrieved <https://uncl.org/programs/hbeu-impact>





more robust innovation pipelines in economically disadvantaged communities (universities, small businesses, urban and rural areas).

Furthermore, issues with training the next generation of Americans for highly skilled STEM professions and to become innovators can be traced to the lack of education, access, and resources that focus on intellectual property and small business ownership in K-12 curriculums. Through various surveys, STEM and other professionals have revealed to The Commercializer®, LLC's IP Task Force, that their knowledge of intellectual property (IP) and the value it provides to their small business did not begin until they completed higher education (college and graduate school) and/or began working with a company that required them to assign the rights over to their IP. Educating the nation's next generation of innovators at an earlier age will help drive innovation and economic growth. Thus, developing models that demonstrate innovation and the value of intellectual property within K-12 curriculums will properly prepare the next generation and incentivize them to become innovators and more entrepreneurial earlier in their careers.

A new study from Harvard Business School and NYU, "The Bright Side of Patents," spotlights the value that patents bring to startup businesses. Among its key findings:

- o A first patent issued raises employment growth an average of 36% over 5 years.
- o A first patent issued grows sales an average of 51%.
- o A first patent grant increases the probability of securing VC funding by 53%.

The value in patenting and commercialization comes from innovation and entrepreneurship, which in-turn promotes economic growth. Funding research is not the only component required for a strong innovative and entrepreneurship ecosystem. A robust innovation pipeline also requires educating the innovators in order to develop the skills to become successful small business owners who can properly exploit and leverage their intellectual property, whereby they can actually benefit from it. This ultimately, will increase the intersection of universities, innovation, and small business development. Educating and providing access to the resources for innovation and entrepreneurship to aspiring innovators is critical to creating a robust innovation pipeline.

<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

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According to AUTM President-elect Ashley Stevens, AUTM data revealed dramatic increases over the past two decades in the number of university inventions, licensing revenue, and expenditures on full-time technology-transfer specialists and patent applications. The number of start-ups launched by AUTM members also has climbed steadily, from 200 in 1994 to nearly 600 in 2008.<sup>1</sup>

These results have not taken into account a greater increase in university inventions and small businesses from economically disadvantaged and untapped talent, especially Minority Serving Institutions/Historically Black College Universities (MSIs/HBCUs). As stated from Dr. Sheila Martin's testimony, there needs to be a more concerted approach for diversity in tech-transfer and commercialization. The Commercializer®, LLC's IP Task Force supports more education and access at tech-transfer offices to propel commercialization for more innovators in growth areas from economically disadvantaged groups. Although there have been benefits from federal funding to support collaborative research between universities and small businesses to build an innovation pipeline, our nation needs to create a more robust innovation pipeline by committing funds for tech-transfer offices at MSIs/HBCUs and encourage students to become small business innovators. More programs like Ohio State's Advance program mentioned by Dr. Sheila Martin's testimony and more centers such as Jackson State University's Center for Innovation and Entrepreneurship that works directly with the Small Business Development Center in Jackson to drive the university and community small business pipeline, are essential to the economy in urban and rural communities. According to Dr. Almesha Campbell, Jackson State University's Director of Technology Transfer, Commercialization and Research Communications:

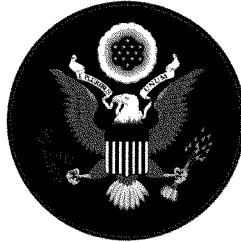
*"While we are forging ahead in creating an innovation and entrepreneurial pipeline for our students and faculty, much of these efforts come without any sustainable support or funding. However, we understand the importance of creating an environment that supports innovation and entrepreneurship, which is why we extend our reach to the K-12 system and the community. These efforts are driven by the Tech Transfer Office, which is at the frontline of all of the innovation at Jackson State University."*

MSIs/HBCUs can strengthen our nation by creating a dual pipeline of STEM professionals and Small Business Innovators in their state and local economies. MSIs/HBCUs produce 27 percent

<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

<sup>3</sup>HBCUs make america strong: the positive economic impact of HBCUs Retrieved <https://uncf.org/programs/hbcu-impact>



of African-American students with bachelor's degrees in STEM fields. Studies show MSIs/HBCUs produce a majority of the nation's degree holders in STEM with eight schools among the top 20 institutions awarding bachelor's degrees to black graduates from 2008 to 2012.<sup>2</sup> In total, the nation's HBCUs generate \$14.8 billion in economic impact annually; that's equivalent to a ranking in the top 200 on the *Fortune* 500 list of America's largest corporations. HBCUs contribute nearly \$15 billion to the U.S. economy, according to a new report by The United Negro College Fund (UNCF).<sup>3</sup> The study was prepared by the University of Georgia's Selig Center for Economic Growth. Nationally, MSIs/HBCUs are educating and preparing students for "an information-age workforce," said Michael L. Lomax, president and CEO of the UNCF, in a prepared statement.<sup>3</sup> Locally, they're a powerful economic engine that generates jobs, income and spending in the cities where they are located. The top eight institutions where African American Ph.D.s in science and engineering earned their bachelor's degrees from 2002 to 2011 were all HBCUs, according to the National Science Foundation.<sup>3</sup> MSIs/HBCUs hold a unique advantage in the nation's efforts to bolster the participation in STEM academic and workforce communities and might play an especially critical role in commercialization and small business innovation. MSIs/HBCUs are creating world changing innovations, such as food scientist developing processes for allergen free peanuts that revitalizes urban areas and strengthens the innovation pipeline locally, regionally, and worldwide. With the use of Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) programs, MSIs/HBCUs and small business innovators are collaborating with each other to develop new technology through research developed by universities or by federal laboratories that drives growth and change.

Hence, the relationship between universities in urban areas, universities in rural areas, MSIs/HBCUs, and small businesses can revitalize urban and rural areas by increasing the number of small business innovators through commercialization of their technologies; thereby, creating a robust innovation pipeline for our nation, resulting in greater economic growth. The benefits of a robust innovation pipeline in urban and rural communities, MSIs/HBCUs, and small businesses can create corporate alliances, new venture practices and programs, seed fund programs, and virtual and on-site incubators. For example, MSIs/HBCUs such as Jackson State University's technology transfer office is viewing commercialization to not only bring new technology to market as a revenue generation for the institution but also as a platform for

<sup>1</sup>Clustering for 21st Century Prosperity:Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

<sup>3</sup>HBCUs make america strong: the positive economic impact of HBCUs Retrieved <https://uncf.org/programs/hbcu-impact>



participation in innovation, economic development, and advancing regional prosperity. Small Business Innovators in new growth industries from areas with economically disadvantaged groups can develop commercially viable technologies in partnership with other public institutions and private companies, to provide innovative solutions for those regions.

The United States has led the world in innovation, in large part because of our commitment to funding research and development at our nation's universities. Now Congress can look to the relationship between universities in urban areas, universities in rural areas, MSIs/HBCUs, and small businesses to continue to build an innovative economy, which looks to institutions, entrepreneurs, and technological change to advance growth, tapping into different cultures to develop our nation's top solutions. A continuity of policy and allocated funding efforts for commercialization of technology at MSIs/HBCUs will support innovation capabilities and national competitiveness.

As stated by Secretary Locke, job growth is what matters most to Americans and the best way to create jobs, Mr. Locke said, is to create new businesses. That means there is an *"urgent need to move great ideas more quickly from university labs into the marketplace."* *Developing more regional innovation zones, "where entrepreneurs, scientists, product developers, and venture capitalists are clustered together and can work together,"* can accomplish that. Mr. Locke said regional innovation clusters, therefore, should be a key part of the nation's long-term strategy for growth. *"It is to lay a new foundation for sustainable long-term economic growth,"* he said.<sup>1</sup>

Increasing public private partnerships to accelerate innovation, provide jobs, and develop communities with the potential legislative proposal EEAPCS ACT gives Universities and Small Businesses an opportunity to be a conduit for economic growth through intellectual property and technology transfer. A robust innovation pipeline for university-small business must begin with more education, access, and capital for the ownership of intellectual property in order to build stronger innovation regions, especially in areas where economically disadvantaged groups are over-represented.

The Commercializer®, LLC would like to thank the Chairman of the Innovation and Workforce Subcommittee and members of Congress for shedding light on the benefits of the innovation pipeline taking place at universities and the way Congress can improve workforce development

<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

<sup>2</sup>TakePart (2016, October) These Schools Are Turning Black Geeks into Black Grads Retrieved from <http://www.takepart.com/article/2016/10/11/colleges-turning-black-nerds-into-black-grads/>

<sup>3</sup>HBCUs make america strong: the positive economic impact of HBCUs Retrieved <https://uncl.org/programs/hbcu-impact>



with more small businesses that bring world changing innovations to the marketplace. The Commercializer®, LLC's IP Task Force looks forward to working with Congress on ways to improve the University-Small Business innovation pipeline for economically disadvantaged groups that have the potential to create world changing technologies that drive innovation in their communities and globally.

Sincerely,

Janeya Griffin

CEO, The Commercializer®, LLC

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<sup>1</sup>Clustering for 21st Century Prosperity: Summary of a Symposium (October 2012).

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