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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.