Testimony of Tara O'Toole, MD, MPH
Executive Vice President, In-Q-Tel

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Hearing on Biothreats

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Good afternoon, Chairman Ernst, Ranking Member Peters, and distinguished members of the Subcommittee. Thank you for the opportunity to appear before you today to discuss how the Department of Defense can help counter the potential biological threats facing Americans.

I have worked as a practicing physician, but much of my career has been spent in academia and government. I was a program manager at the Congressional Office of Technology Assessment, served as Assistant Secretary of Energy, and founded and led the Johns Hopkins and University of Pittsburgh biodefense centers from 1999-2009. I served five years as Under Secretary of Homeland Security for Science and Technology, where I oversaw the National Biodefense Analysis and Countermeasures Center and supported the creation of a new National Bio and Agro-Defense Facility. In 2014, I became executive vice president and senior fellow at In-Q-Tel (IQT), a non-profit investor for nine United States national security agencies, accelerating and shaping commercial startup technologies to advance the national interest.

I appreciate the opportunity to come before you today and commend the Subcommittee for addressing this vital and neglected aspect of national security. I would like to emphasize four points.

First, rapid advances in the life sciences, biotechnology, and artificial intelligence, plus what we know about our adversaries' programs, require a fundamental shift in United States biodefense strategy. New and evolving technologies have enabled a more dangerous and dynamic biothreat landscape than is contemplated in current biodefense policy and programs.

The past decades of biological science have brought us an array of powerful technologies such as DNA sequencing, gene editing, and synthetic biology. These and other advances have caused a revolution in our understanding of, and ability to alter, living organisms. We have learned that biology is essentially programmable: life runs on code. The knowledge and technologies needed to read, write, and edit this code are improving exponentially – faster than Moore's Law. In other words, the code of life, which consists of four different base pairs instead of ones and zeros, is being digitized, and this information is being stored in huge genomic data banks.

These capabilities have and will continue to generate great benefits across a range of industries, such as new approaches to cancer treatment, and extremely efficient ways to

produce complex chemicals and new materials. But these capabilities can also be exploited for evil purposes.

All powerful technologies can be dual-use, and this is particularly true of modern biotechnologies. The same methods that enable the repair of genes which cause disease, allow us to genetically engineer bacteria to produce insulin, or alter a virus to create a vaccine, can be employed to create pathogens not seen in nature. Such pathogens, which could affect humans, animals, or plants, could be constructed to be particularly virulent, evade conventional diagnostic tests, or to resist available drugs and vaccines.

As bioengineering methods advance, and especially as artificial intelligence methods are applied to DNA sequencing, synthesis, and editing, the deliberate creation of new pathogens will be within reach of many more actors. In addition, because techniques such as genomics and gene engineering are so useful in so many industries, and will be so central to the blossoming bioeconomy, more and more people around the world will have access to these technologies and know how to use them.

The United States had a powerful, secret offensive biological weapons program during the Cold War, which lasted until 1969. Most people today, even in the military, do not understand how effective and advanced these programs were. The bioweapons we built then were intended to be strategic weapons, like nuclear weapons. The country tested these bioweapons in all conditions short of actual conflict and demonstrated them to have the large area coverage and lethality of nuclear weapons. And this was accomplished using 1960s technologies.

Given the unavoidable expansion of these dual-use biotechnologies; the absence of any enforceable national treaties controlling bioweapons production and use; and the rise of competitive peer state adversaries; the United States must urgently consider how it will defend itself against what could be an existential threat to civilian populations, our agricultural assets, and warfighters.

In addition to these man-made biological threats, we live in an age of epidemics. Naturally-occurring outbreaks of infectious disease have increased in frequency and impact over the past two decades. They are the consequence of modern trade and travel patterns, human intrusion into once remote ecosystems, and global urbanization with its attendant problems of poverty and poor sanitation. As has been seen with human outbreaks of SARS, MERS, Ebola, and Zika, and the ongoing epidemic of African Swine Fever in Asia which has resulted in the deaths of over 300 million pigs, these outbreaks impose tragic costs in terms of death, suffering, economic losses, and social upheaval.

Second, the United States should aggressively develop and apply new and emerging technologies to create new capabilities needed for a robust biodefense against natural and man-made biothreats. Such a strategy would have the additional benefit of strengthening United States competitiveness in the global economy.

The 2018 National Biodefense Strategy (NBS), many years in the making, is a detailed and coherent declaration of the broad capabilities needed to prevent, detect, contain, and recover from naturally-occurring epidemic disease. The NBS does not, however, recognize the urgency or potential challenges of protecting the nation from deliberate and covert bioweapons attacks, which could be far more devastating than even the most serious natural outbreak. The NBS also lacks a mechanism for continuous monitoring of the capabilities inherent in rapidly evolving biotechnologies. Nor does the document assign priorities, confer authorities commensurate with stated responsibilities, or provide new resources. Critically, in my view, it lacks a viable, appropriately ambitious, strategic plan for biodefense technology development.

The biothreats posed by new biotechnologies, the potential for large-scale outbreaks in this age of epidemics, the rise of powerful nation state adversaries, and the feasibility of non-state actors wielding bioweapons, requires that the United States immediately commit to significant investments in developing and deploying the technologies needed for biodefense.

To start, the national security community needs to develop a more realistic understanding of biothreats and their underlying dynamics. This will require competence in genomics, proteomics, computer science, and artificial intelligence – skills in short supply across the government. Also needed is a much more ambitious, strategic approach to the technologies needed for biodefense – that is, for detecting, managing, and quenching epidemics, including epidemics caused by pathogens not previously seen in nature, and possibly designed by humans.

Relying on traditional, slow, and costly methods of drug and vaccine development and hoping that what we need will be available in expensive (and inevitably inadequate) stockpiles of medical countermeasures will not suffice. What is needed is a national commitment to the develop technologies that, for example, would enable rapid design and manufacture of medical countermeasures (diagnostic tests, vaccines, and therapeutics) at scales and in timeframes that could impact management of a large, lethal, and fast-moving epidemic. Also needed – and in use commercially today– are technologies that provide situational awareness during outbreaks. This requires the collection, wrangling, and analysis of essential data needed to make informed decisions about epidemic management. Such technologies, if deployed, should provide a defense against both engineered bioweapons and newly emergent natural diseases.

Third, Department of Defense (DoD) leadership is critical to United States biodefense, but talent and resources are currently quite limited.

DoD has historically played a critical role in response to disease outbreaks overseas. The key diagnostic test, vaccine, and therapy that were deployed to contain the 2014 West African outbreak of Ebola virus would not have been available but for DoD investments in R&D. DoD's long experience with technological development could make significant contributions to protecting warfighters and civilians against natural and man-made biothreats. The Department

is not, at present, optimally organized nor stocked with the sufficient trained staff to execute this mission.

For several years, DoD's Defense Advanced Resarch Projects Agency (DARPA) has executed important projects in biotechnology, including in projects designed to better understand biothreats, and has recently expanded its Biological Technologies Office (BTO) staff and budget. The quality of DARPA's work is excellent, and their staff is highly expert. But BTO is less than 50 people. The Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) also has a number of excellent people working on important aspects of biotechnology, focused on providing warfighters protection from CBRN threats. But JPEO-CBRND's mission and budget could benefit from being considered a higher priority within DoD.

The Committee might consider a review of current DoD biodefense programs with the aims of increasing coordination, encouraging risk-taking, and placing an emphasis on capabilities for rapid medical countermeasure development, while providing sufficient resources to allow DOD officials to make meaningful contributions. Contract and budget mechanisms to effectively partner with innovative small companies, which populate most of the biotech landscape, will be essential, as will programs to recruit and retain talented scientists and engineers.

Fourth, China has urgent and compelling reasons to aggressively pursue advancements in biomedicine and biotechnology. But China's geopolitical strategy to dominate the bioeconomy – and indeed to "own the biorevolution" – represents as great a threat to United States national security as their bid to assert dominance in artificial intelligence, quantum computing, and space.

China is planning, organizing, and financing efforts to become the world leader in biotechnology. The Chinese government rightly seeks ways to feed billions in the face of a changing climate, to bring medicines to a population with the world's highest cancer incidence and 100 million diabetics, and to help its aging population stay healthy. Many nations share these goals, and we should find ways to cooperate to advance biology's humanitarian contributions.

Yet it is also true that China sees biology as a route to expand its global power. China is using all the means available to an authoritarian state to reach its 5-year R&D plan to make the biotechnology sector 5% of its GDP by 2020. China is investing heavily in research, building new facilities, recruiting talent from abroad, reforming its regulations for drug approvals, establishing financial rules that favor Chinese companies, and linking its giant internet firms like Tencent and Alibaba to biotech development. Having watched the UK lead the industrial revolution and the United States lead the information revolution, China aims to capture the revolution in biotechnology.

The United States should not cede this ground. The United States and its international partners must plan, organize, and invest to advance key aspects of biotechnology and then harness the vitality of our entrepreneurs to turn discovery into product. The first step is a national

biotechnology strategy, one that can incorporate the vital contributions of the biodefense strategy but also transcend it, recognizing that biology will reshape world leadership as much as our quality of life on this planet.

Conclusion

The challenge of preparing for bioattacks and epidemics, natural or engineered, is integrally linked to broader imperative of maintaining America's leadership in biotechnology. Within the national security community there has been much focus on artificial intelligence, which clearly has enormous implications for our economy and our defense establishment, and already shapes our shopping habits, provides big data analyses, and operates robots. Biology will prove equally transformative – Americans just do not see it yet. This is a problem because biotechnology is both a humanitarian and geopolitical necessity.

Biotechnology will dramatically and literally reshape our lives and our world. It will also become a significant source of national power – economic, and in all likelihood military – as it creates entirely new possibilities, materials, and products. The question is whether our government can best position the United States to capitalize on this promise.

Thank you.