Written Testimony of

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"Challenges and Opportunities to Investigating the Origins of Pandemics and Other Biological Events"

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Chairman Griffith, Ranking Member Castor, Members of the Subcommittee, thank you for inviting me to meet with you today to discuss this important topic. I am Michael Imperiale, and in addition to my position at the University of Michigan, I am the Editor-in-Chief of *mSphere*; a member of both the American Society for Microbiology and the American Society for Virology; and a Fellow of the American Academy of Microbiology and of the American Association for the Advancement of Science. I would like to focus my remarks on the importance of maintaining a strong life sciences research program for being able to deal with pandemics in the future.

I have been studying viruses for more than forty years, and for almost two decades I have been involved in science policy efforts relating to biosecurity and biosafety, in Washington, DC and internationally. My thoughts and opinions are therefore informed by my scientific expertise, countless hours of discussion with scientists and policy experts within and outside of the U.S. government, and what I feel are my obligations as a scientist to the public.

The life science research enterprise in the United States is second to none, providing understanding of and cures for diseases including infectious diseases, supporting more than half a million jobs in all 50 states and the District of Columbia, and contributing in many other ways to our economy. The bioeconomy is growing at a fast pace. Much of this success can be traced back to recommendations put forth in the report published in 1945 entitled “Science The Endless Frontier,” which was written by Vannevar Bush, the Director of the Office of Scientific Research and Development at that time – he was the first presidential science advisor, during World War II. Bush’s key recommendation was that the federal government invest in scientific research at universities. He recognized that this could lead to an amplification of the return on the investment because not only would cutting edge research get done, but students and other trainees would be involved, and they would go on to become the next generations of scientists. He has been proven correct time and again.

The results of this strategy are perhaps no better illustrated than by our response to the COVID-19 pandemic. In the spring of 2020, hundreds of virology laboratories, as well as laboratories in allied fields, pivoted their efforts to tackle this disease. Working from the extremely strong foundation laid by decades-long investments in basic research, largely by the US government, we made tremendous progress in a short period of time. Much of this groundwork came from studies of other viruses such as SARS and MERS coronaviruses, which are just as virulent but fortunately did not cause pandemics because of effective public health measures. If you had asked me during that spring how long it would take to develop and test a vaccine, I would have said at least a couple of years. Yet, we were putting shots in arms before the end of the year.

This is a remarkable accomplishment that would not have been possible without longstanding U.S. leadership in science and innovative public-private partnerships. Monoclonal antibody and drug therapies soon followed. The hard work and creativity of thousands of scientists, in the U.S. and around the world, must be acknowledged for allowing us to be emerging from the pandemic as quickly as we are. The loss of life and effects on the economy could have been much worse. For example, it has been estimated that the vaccines alone saved 20 million lives in their first year.

However, recognition of these substantial accomplishments of the scientific community, along with ongoing efforts to improve the ability of this community to respond even more effectively to future public health emergencies, appears to be taking a back seat to concerns about the possibility that another pandemic may arise due to inadvertent release of a dangerous pathogen from a laboratory that is working to protect us from these threats. Some even contend that scientists are not thinking about the potential risks. This rhetoric has been amplified on social and traditional media platforms. Even reasoned debate has been drowned out by uninformed discourse. I know of colleagues studying these viruses who have received threats to their lives. I can only imagine the second thoughts they may be having about continuing their important work, and if they were to step away it would be a great loss to society and our economy, leaving us less well-prepared for future threats.

This characterization of the scientific community is wrong. Scientists have always paid close attention to biosafety and biosecurity: in the early days of recombinant DNA research, it was concerned scientists who assembled a group of scientific and non-scientific experts to debate the benefits and risks of this new technology. This led to the development of the NIH Guidelines for Research Involving Recombinant DNA Molecules, which to this day are followed in order to minimize the risks of this type of research. I would argue that no group of scientists pays more attention to biosafety than those of us who study infectious agents, because we know the harm they can cause to ourselves in the laboratories and to our communities if such agents were accidentally released from our laboratories. Working together with biosafety professionals at our institutions, we have the appropriate equipment and procedures in place to perform the work safely. I would note to the subcommittee that despite all the precautions we take in our laboratories, there is a tremendous opportunity for improvement in this area with increased research and investment in applied biosafety. I thank Congress for passing key provisions from the bipartisan PREVENT Pandemics Act last year, which will help facilitate some necessary improvements related to biosecurity and public health preparedness, including work to bolster biosafety research. We in the U.S. should take a leadership role among our international partners and collaborators to help them continue to improve the safety and security of their facilities as well.

The related concern regarding potential risks of working with pathogens surrounds the concept of gain of function experiments. Unfortunately, this term is widely misunderstood. “Gain of function” covers a very broad area of experimentation in which, as the term states, an organism or cell or infectious agent is given or acquires a new property. In the vast majority of cases, these properties are innocuous or, indeed, beneficial. For example, engineering bacteria to synthesize insulin has greatly facilitated its production and its use in millions of patients. Adenovirus, a common respiratory virus, has been engineered to produce the SARS-CoV-2 Spike protein for use as a COVID-19 vaccine. Nature itself carries out this type of experiment all the time: antibiotic resistance is a gain of function. The question is whether a laboratory gain of function experiment might result in a pathogen that has the potential to cause severe harm or even a pandemic if it were to get out of the laboratory, either accidentally or through an act of malfeasance. Clearly such research projects need careful consideration before being started and as they are being conducted. These experiments should only be performed when they are addressing a significant biomedical question of pressing concern, other approaches are not available or are scientifically suboptimal, and the work can be performed safely.

To conclude, I would like to return to where I began. The U.S. life science research enterprise has been so successful over the years because of the generous investments you and your predecessors have made, providing financial resources and creating a welcoming and supportive environment that has allowed the best scientists from our nation and around the world to contribute to the betterment of humankind. This has enabled us to lead the world in science and innovation, and in the field of microbiology, we have saved countless lives through the development of diagnostics, vaccines, and therapeutics to target infectious disease threats. Regardless of the origin of the next pandemic, we need to invest in a strong public health infrastructure that will allow for surveillance for the next threat and a robust response when that threat arises. The scientific community understands the responsibility it has to the public, who both fund our laboratories and are the recipients of the benefits of the research we perform. Not surprisingly, however, other countries have recognized our strategy and have been emulating it, such that now their research programs are thriving. The U.S. is not always the automatic first choice of location for scientists to perform their research, and for American students to train to be the next generation of innovators. As we look to ensure that the U.S. maintains its prominence, performing this life saving research with appropriate safety and security parameters in place, we must be careful to not throw sand in the gears that may slow down our progress, dissuade U.S. scientists from conducting the research, and discourage young people in our country as well as international talent from wanting to be part of our amazing system. In this way, we can be better prepared the next time an infectious agent jumps from nature into the human population. Our national and economic security depend on our continued leadership in life sciences research.