Testimony of Jason Kelly
Co-Founder and CEO of Ginkgo Bioworks, Inc.

Before the

Subcommittee on Oceans, Science, Fisheries and Weather
United States Senate Committee on Commerce, Science, and Transportation
"Securing U.S. Leadership in the Bioeconomy" Hearing
March 3, 2020

Chairman Gardner, Ranking Member Baldwin, members of the Subcommittee, thank you so much for this great honor to come and speak to you today about this exciting moment in the trajectory of synthetic biology technology and the growing bioeconomy.

My name is Jason Kelly and I am the Co-Founder and CEO of Ginkgo Bioworks, a Boston-based cell programming company with over 300 employees that is currently valued at over $4 billion. Ginkgo operates in the emerging field of synthetic biology. In synthetic biology, we program cells like you program computers. We can do this because cells run on digital code in the form of DNA. DNA is made up of As, Ts, Cs, and Gs – not 0s and 1s, but you can read the DNA code with DNA sequencing and write the code with DNA printing. Ginkgo is the largest user of DNA printing in the world which we use to program cell "apps" for customers ranging from Bayer/Monsanto in agriculture to Roche in pharmaceuticals. Importantly, Ginkgo and other companies are seeing exponential improvements in this technology. For example, the cost to read and write DNA has been improving faster than Moore's Law. Moore's Law is the rate at which microprocessors in computers (built by companies like Intel) improve and a metric of one of the fastest improving technologies in the world.

Synthetic Biology will enable companies to program cells across all economic sectors. The cellular applications ("cell apps") of synthetic biology offer limitless opportunities for biological manufacturing and innovation, and are making tangible differences in our daily lives, whether through protecting our environment, improving our health, or advancing our security.

One of my favorite examples of an application in this space is a partnership Ginkgo has with Bayer Crop Science, the world's largest agricultural biotechnology company, to innovate on fertilizer production. Currently, farmers must apply large amounts of synthetic fertilizer to grow cereal crops such as wheat, corn, and rice. These fertilizers are energy-intensive to produce, and cause runoff into water supplies, generating local environmental problems. Ginkgo and Bayer created a joint venture called Joyn Bio to engineer microbes that will live on the roots of these crops and provide them with nitrogen without the need for synthetic fertilizers, with enormous potential for economic and environmental benefit. This is just one of countless examples of how synthetic biology can make our world more sustainable, safe, and productive.

In the biomedical space, we have a partnership with Synlogic, a therapeutic company that is engineering probiotic bacteria to treat patients with metabolic disorders, such as maple syrup urine disease. Synlogic equips these microbes with genes to fill in the metabolic step missing in these patients, so that they can break down the metabolite that is building up and causing the

patients' symptoms. We apply our platform to accelerate the development of these living medicines.

Ginkgo also recognizes the threats and opportunities synthetic biology poses to U.S. national security. To that end, Ginkgo participates in several DARPA and IARPA programs to help advance tool development to mitigate risks and defend against malicious acts. As part of the DARPA Synergistic Design and Discovery, or SD2, program, Ginkgo is helping to generate better models to predict the effects of genetic engineering. Within IARPA's Finding Engineering-Linked Indicators, or FELIX, program, Ginkgo is developing algorithms to determine whether DNA sequences have been engineered. Finally, as part of IARPA's Functional Genomic and Computational Assessments of Threats, or Fun GCAT, program, Ginkgo is helping to develop screening mechanisms to more rapidly identify threatening DNA sequences.

The cross-cutting and transformative nature of these applications, along with the exponential improvements in the underlying technologies to read and write DNA, have motivated significant investment into this field by private industry and foreign governments alike. More than $12 billion of venture capital funding has been invested in synthetic biology companies in the last ten years, most of which are U.S. based. Simultaneously, allies such as the U.K. and Germany have developed detailed bioeconomy strategies and near-peer competitors like China have made huge investments in synthetic biology development. The next decade will define which countries get to lead the bioeconomy, and much like in the automobile, airline, or semiconductor industries, the winning countries will be those that capitalize on first mover advantage and economies of scale.

Private sector funding, which is often targeted at specific companies or projects, is not enough for the U.S. to capitalize on these advantages. It is essential that the federal government makes robust investments in the research and development programs that underpin advancement in synthetic biology. This field was born out of public grants from agencies including the National Science Foundation (NSF), Department of Energy (DOE), Department of Defense (DoD), and National Institutes of Health (NIH). As an early beneficiary of many of these programs, Ginkgo can attest to the enabling power they can provide. Thanks to this early investment, American companies like Ginkgo currently lead in this space. However, to ensure America remains the global leader in synthetic biology, the U.S. government must strategically reinvest in its bioeconomy. The U.S. has done this before with nuclear technology, semiconductors, space technology, the ARPANET, and the Human Genome Project. Synthetic biology will be as or more important to the strategic interests of the country than these previous technologies.

We are pleased to see recognition of the importance of this critical need in this hearing and in bipartisan initiatives such as the Industries of the Future Act of 2020 introduced to the full committee this January and the Engineering Biology Research and Development Act of 2019 that passed out of the House this past November. We look forward to partnering with you and your colleagues to ensure this type of innovation-focused legislation advances and federal agencies have the resources and policies they need to keep America at the forefront of this emerging field.

Thank you for your time and for your continued leadership on these important issues. I look forward to your questions.