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Before the

U.S.-China Economic and Security Review Commission
Hearing on "An Assessment of the CCP's Economic Ambitions, Plans and Metrics of Success"
Panel IV: Policies and Planning for Emerging Industries: New Mobility, Cloud Computing, and Synthetic Biology
April 15, 2021

Vice Chairman Cleveland, Commissioner Wessel, members of the commission, thank you for inviting me to speak here today on the strategic importance of synthetic biology to the economy and to international competition.

I am the Co-Founder and CEO of Ginkgo Bioworks, a Boston-based cell programming company with over 500 employees that is currently valued at over $4 billion. Ginkgo was founded in 2008, when three of my PhD classmates, one professor, and I left MIT with the mission of making biology easier to engineer. We have dedicated our professional lives and nearly $1B of private capital investment towards building the infrastructure, automation, software, and knowledge that today allows us to program cells like we program computers. Our products and customers span the entire economy, from microbial fertilizers with Bayer Crop Science to new antibiotics with Roche to sustainable materials with Genomatica. We believe that there are endless possibilities for biotechnologies to positively impact all aspects of the economy. Now is the time for sustained investment and strong leadership to ensure the growth of a robust and inclusive bioeconomy that benefits the public interest.

COVID has exemplified the importance of investment in the bioeconomy. At the beginning of the pandemic, Ginkgo donated $25M worth of access to our platform to partners working to make vaccines, therapeutics, and diagnostics. Our two biggest initiatives were around nucleic acid vaccine manufacturing, where we partnered with Moderna and others to optimize the production of key raw materials, and testing. We pivoted much of our platform capacity to the development of low cost, highly-scalable COVID-19 testing which we implemented in classrooms across the country to help enable K-12 schools from rural Massachusetts to Baltimore to Milwaukee reopen and stay open.

All of Ginkgo's COVID-19 responses are unprecedented in our company's history. Nonetheless, we have been able to contribute to ending this pandemic precisely because the powerful synthetic biology platform we have created was designed to support *all* bioeconomy applications, in the same way that a cell phone or desktop computer can run any app. Unlike so many of our national resources constructed to respond to a single type of threat, our platform can be applied to a wide array of challenges we may face—in traditional "biology" or "medical" applications, and beyond.

Your questions about the role of synthetic biology in the global economy get at the heart of what I consider to be a critical issue for the United States. Whoever leads the bioeconomy will

not only have a huge advantage in making their supply chains robust and sustainable, but also will lead the world in pandemic prevention and response infrastructure.

Q1: Role of synthetic biology in China's future growth
China has recognized the transformative potential of synthetic biology, and is strategically investing in basic research, key technologies, and workforce development. In 2020, China spent twice as much as the US did on synthetic biology R&D.[1][2] Earlier this year, the Chinese State Development and Investment Corp (SDIC) made a huge investment in the private company BGI, formerly Beijing Genomics Institute, the most significant competitor to U.S.DNA sequencing companies.[3] Finally, for the last several years China has dedicated significant resources towards attracting foreign scientists to set up their laboratories in China, including through the Thousand Talents Plan.[4]

Q2: CCP's access to and collection of data around the globe
Genetic sequencing is a foundational technology of synthetic biology. Access to both human and non-human genetic data has large ethical and economic implications. The CCP and BGI have increased China's access to this information through the donation of equipment as a kind of extension of diplomacy.[5]

Q3: The significance of the CCP's efforts to collect non-human genetic data in the wake of COVID-19
Non-human genetic data is the raw material of the bioeconomy. DNA sequences from plants, animals, fungi, and bacteria are incredibly valuable for cell programming because they contain instructions on how to make an unimaginable number of molecules and structures. Biotech companies have been commercializing products based off of these wildtype sequences for decades, and we will see the number of these products grow exponentially as sequencing costs continue to fall and our DNA programming capabilities become more advanced.

Given the incredible value of DNA sequences, a multilateral system for equitable accessing and benefiting from these sequences is essential, rather than systems that enable individual countries to control and limit access to large resources. The US excels at developing open technical ecosystems that become international standards such as many of the technologies enabling personal computers, the internet, and mobile phones. We should take the lead in developing similar international standards for hosting and sharing non-human DNA sequences.

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[1] https://www.cnbc.com/2021/03/01/chinas-spending-on-rd-hits-a-record-378-billion.html

[2] https://fas.org/sgp/crs/misc/R46341.pdf

[3] https://www.reuters.com/article/us-china-genomics-state/chinese-state-fund-invests-in-gene-firm-bgi-idUSKBN2AM0AT

[4] https://www.npr.org/sections/health-shots/2018/11/27/669645323/china-expands-research-funding-luring-u-s-scientists-and-students

[5] https://www.reuters.com/article/us-health-coronavirus-bgi-specialreport/special-report-covid-opens-new-doors-for-chinas-gene-giant-idUSKCN2511CE

Q4: The state's approach in directing this sector, and the implications for U.S. businesses and workers

U.S. businesses will be at a significant disadvantage if our government does not prioritize synthetic biology as thoroughly as China has. If we do not increase our R&D efforts, the timeline from idea to commercialization will continue to be too long and cause many businesses to fail despite having amazing potential. If we do not better support companies supplying core technologies, like DNA synthesis, it will be challenging for these businesses to remain in the U.S. Finally, if we do not make a concerted effort to increase the number of people trained in this field and compelled to remain in the country after their training, our industry will be limited by the size of our workforce.

Q5: The Commission is mandated to make policy recommendations to Congress based on its hearings and other research. What are your recommendations for Congressional action related to the topic of your testimony?

The U.S. has been put at a disadvantage by not prioritizing synthetic biology sufficiently in recent decades. If we hope to remain competitive in this space, our government needs to massively increase investment in R&D and support for workforce development initiatives, so that our commercial pipelines can be accelerated and more individuals from more backgrounds can support our growing industry. Critically, the federal government should also prioritize biologically-derived solutions for procurement whenever they are available to expand the market of our products. Most importantly, someone in our federal government needs to be responsible for the development of a national biotechnology strategy, similar to our efforts in cyber. Accountability and dedicated resources are required to address the issues I laid out here and to begin to properly accelerate U.S. capabilities.

When it comes to exponentially improving technologies like synthetic biology, even small lags in investment will cause huge differences in where you end up in a few years. Now is the time to secure our position as the leader of this transformative field.

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