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The House Committee on Science, Space, & Technology
U.S. House of Representatives
2321 Rayburn House Office Building
Washington, D.C. 20515

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RE: SST Committee Seeking Input on Future Stimulus Package

Alternative proteins — including plant-based meats, cultivated meat,¹ mycoprotein and other foods made from fungi, and food produced through fermentation — are approaching a technological tipping point. It is realistic to expect that they could serve as the foundation of the U.S. food system in the near future if there is adequate research and development. In a 2017 report on future products of biotechnology, the National Academies of Sciences, Engineering, and Medicine named alternative proteins as an area with high growth potential.² If successfully implemented, a food system based on alternative proteins has the potential to grow the U.S. economy, sustainably feed 9.7 billion people globally by 2050, and address global public health issues such as antibiotic resistance and zoonotic threats.

The Covid-19 pandemic and resulting economic crisis have created volatility and disruption at a critical time for these nascent food production systems. This disruption threatens to eviscerate the tremendous advances in research and industry development that have been made in recent years and, consequently, significantly delay their public benefits. The Committee can play a pivotal role in ameliorating these harms and creating a resilient, sustainable food supply for the future by dedicating \$100 million in stimulus funds to research and workforce training to support these sectors.

¹ Sometimes called cell-based meat, cultured meat, or clean meat, cultivated meat is produced by starting with the basic building block of all life: the cell. Beginning with a small sample of animal cells, cells are grown into meat, poultry, and fish. A tank called a cultivator facilitates the same biological process that happens inside an animal by providing warmth and the basic elements needed to build muscle: water, proteins, carbohydrates, fats, vitamins, and minerals. The result is meat, identical to conventional meat at the cellular level. It looks, tastes, and cooks the same.

² Nat'l Acads. of Scis., Eng'g, & Med., *Preparing for Future Products of Biotechnology*, 52-53 (2017), <https://bit.ly/2MG2Jes>.

I. The Covid-19 Crisis Has Had a Significant Adverse Impact on Alternative Protein R&D.

While plant-based meats and some foods made from mycoprotein (for example, Quorn) are currently sold in the United States, the vast majority of these foods are not yet commercialized. Approximately one dozen U.S. startups are currently working to develop cultivated meats and seafood, several more startups are working on developing meat and other foods from plant proteins, mycoprotein, and other fungi, and a number of others are developing ingredients such as milk and egg proteins through fermentation facilitated by fast-growing, highly efficient microorganisms. These new production methods allow companies to produce innovative foods demanded by consumers more quickly, efficiently, and sustainably than traditional agricultural processes, yielding substantial economic, public health, and environmental benefits.³

These companies face significant research challenges. As we explained to the Office of Science and Technology Policy in comments last year, significant research is needed to ensure that the United States retains its lead in this sector.⁴ Other countries are actively supporting the development of their alternative protein industries. For example, the European Union announced in July 2019 that it is directing approximately \$15.5 million for plant protein research (including research into mycoproteins, which are fungi).⁵ The Netherlands spent \$2.3 million on cultivated meat research from 2005 to 2009 and is currently spending \$6.6 million on a five-year research project to improve plant-based meat manufacturing technology.⁶ Some countries in Asia have taken an even bolder approach, with China and Singapore investing \$300 million and \$144 million, respectively, into a variety of next-generation technologies intended to bolster their bioeconomies, including cellular agriculture.⁷ Canada, Germany, India, Israel, and Japan are making similar investments.

³ Liz Specht, *Meat by the Molecule: Making meat with plants and cells*, *The Biochemist* (Aug. 2018), <https://bit.ly/34wq6BC>.

⁴ The Good Food Institute, *Comment in Response to Request for Information on the Bioeconomy* (Oct. 22, 2019), <https://bit.ly/3b8Recg>.

⁵ \$5 million (€4.5 million) for a large-scale biorefinery project to produce mycoprotein and \$10.5 million (€9.6 million) for the Smart Protein project, primarily funded by the European Union to develop protein-rich foods from plants and fungi. Katie Askew, *Affordable and scalable: 3F Bio's 'first-of-its-kind' mycoprotein biorefinery*, *FoodNavigator-USA* (July 23, 2019), <https://bit.ly/2V1ZpBI>; Mary Allen, *This \$10.5 Million Initiative is Dedicated to Developing Alternative Proteins*, *The Good Food Institute* (Oct. 3, 2019), <https://bit.ly/34wuCA5>.

⁶ Elie Dolgin, *Sizzling interest in lab-grown meat belies lack of basic research*, *Nature* (2019), <https://go.nature.com/2K3mmhs>.

⁷ Chase Purdy, *Israel found an unlikely buyer for its lab-grown meat: China*, *Quartz* (Sept. 13, 2017), <https://bit.ly/2V4rOqR>; Yoolim Lee & Joyce Koh, *Singapore Backs Lab-Grown Meat, Robots in \$535 Million Push*, *Bloomberg* (Mar. 27, 2019), <https://bloom.bg/2XAHJ1F>.

Research

Covid-19 has dealt a devastating blow to American research in this sector. Due to the need for social distancing, startups and producers in this space are facing restricted access to laboratories needed to bring their products to market or improve and refine foods that are already being sold. In-house research activities are likely to be reduced to the bare minimum level required for maintenance, resulting in increased overall project costs as companies see reduced productivity and return from their fixed costs, such as employee salaries, facilities, and other overhead. This situation is only compounded by the fact that many startups face uncertainty about what R&D activities are currently permitted by the Food and Drug Administration in the wake of Covid-19.

Additionally, shortages of necessary research equipment, including flasks, pipettes, chemicals, gloves, and sterilization equipment, have forced project timelines to be pushed back several months until such unknown time when orders will be able to be fulfilled. The situation is particularly dire for companies that lack the capital to weather this research freeze and are faced with the prospect of having to sell the equipment they have on-hand to raise funds necessary to maintain their existence. At universities, in-progress alternative protein research projects have halted or slowed down due to campus closings and scientists not being allowed in labs, delaying scientific progress that would otherwise be expected to serve as bedrock, foundational knowledge on which this emerging sector would build.

Investment

Covid-19 and its myriad impacts are likely to have a chilling effect on venture capital and growth investment in alternative proteins. As a young and fast-growing industry, alternative protein is in a critical period where access to early-stage and growth capital is extremely important, yet access for startups raising money and meeting with investors has been seriously harmed. Because this industry is pioneering the use of new food technologies, new crops and ingredients, and new production methods, research and development investment is mission-critical. This particularly affects companies that, prior to the pandemic, were in preparation to launch new funding rounds. Furthermore, early-stage startups that do not yet have products on the market may not be able to avail themselves of the stimulus funds currently available where eligibility to receive such funds is based on revenue.

Nearly 150 plant-based food companies in the United States are contributing to industry growth and technological innovation. In 2019, these companies raised funds at all stages, from angel investments to (historic) initial public offerings.⁸ Last year, early-stage funds, including

⁸ Mike Murphy, *Beyond Meat soars 163% in biggest-popping U.S. IPO since 2000*, MarketWatch (May 5, 2019), <https://on.mktw.net/2yOBxbZ>.

accelerators and seed rounds, amounted to over \$83 million in capital for up-and-coming startups. The most active investor types in this space are venture capital and angel investors.⁹

Since 2016, cultivated protein startups have been established in at least 19 countries across five continents, but over one-third of these companies are based domestically, making the United States a strong leader in a promising new food-tech industry that could transform global protein supply chains. After significant post-seed venture capital fundraising rounds and product proofs-of-concept, many cultivated meat companies are now at the stage of needing capital to build out pilot-scale facilities, ensure regulatory compliance, and prepare their commercialization strategies.

With the appropriate support, the alternative protein industry promises enormous potential for new products, as well as new ingredients and manufacturing processes, that will further drive technological innovation, economic growth, and job creation.

Market Activity

Problems caused by Covid-19 also plague more developed companies with products on the market, which may not be able to take advantage of existing stimulus funds at the same level as other, more established food companies if they are particularly invested in R&D with an eye to future products and sales — true of the most innovation-forward players in the industry.

Several companies that sell their products in restaurants and supermarkets, moreover, have lost sales and closed facilities and seen disruptions in their supply chains.¹⁰

- **Impact on Sales:** From interviews with plant-based food companies and market data, it is clear that foodservice sales have been disproportionately hit as consumers shift their purchasing from restaurants to grocery stores and retail. We believe that this effect is widespread in the industry and may disproportionately affect young companies and those with innovative products — both categories to which the majority of plant-based meat companies belong — because food service has lower barriers to entry and is the ideal platform for more experimental products, as diners may be more adventurous than home cooks. Since foodservice operators and restaurant chains are facing vast decreases in sales and retailers are struggling to keep up with demand for their existing product inventories, most sales and new business development is frozen, creating additional hurdles for startups and small businesses.

⁹ Based on GFI custom PitchBook analysis of plant-based food companies (including fungi) based or selling in the United States. Last updated February 11, 2020.

¹⁰ These impacts have been identified based on information compiled by The Good Food Institute from public and non-public sources in the early stages of the current crisis. These representations reflect our current understanding of present and potential future conditions facing the industry that are subject to change and substantial uncertainty.

- **Impact on Operations:** Some plant-based food companies have closed production facilities to mitigate potential risks from Covid-19. While other kinds of food processing companies are facing similar disruptions,¹¹ closures of this kind can have a greater impact on companies that are new or experiencing rapid growth, as the plant-based food sector is,¹² because they are not operating with the same reserves or redundancies as incumbent companies.
- **Impact on Supply Chains:** Many alternative protein companies rely on ingredients that are relatively scarce in the global supply chain and may face challenges sourcing these key inputs in adequate quantities and dealing with wildly volatile price fluctuations. Under these conditions, established incumbents gain a disproportionate advantage over industry newcomers, and strokes of bad luck can be more crippling, regardless of the soundness of a company's product or business plan.

II. The Committee Should Fund Research to Mitigate the Impacts of the Covid-19 Crisis on the Advancement of Alternative Proteins.

In order for the United States to fully recover from this crisis and become the global leader of the alternative protein sector, we must make a concerted effort to fund the science and technology that will enable this new sector to flourish. Therefore, we respectfully recommend that the United States make investments to lead the world in building a robust bioeconomy that will be more resilient to future crises. Specifically, we request that the Committee:

- Fund the National Science Foundation to establish interdisciplinary research centers to serve as physical knowledge hubs for conducting pre-competitive research, training new researchers, demonstrating pilot-scale facilities, and nucleating additional collaborations among academic and industry partners (for example, to develop specific technical solutions beyond the pre-competitive space);
- Authorize funding for the Office of Science and Technology Policy to work with the Office of Management and Budget to identify new and existing research funds across multiple agencies that could be directed to grow this sector of the bioeconomy (considering, among others, the Departments of Agriculture, Defense, and Energy, as well as the National Science Foundation, the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the National Institutes of Health, and the National Institute of Standards and Technology), and direct the offices to work together;

¹¹ Miriam Jordan & Caitlin Dickerson, *Poultry Worker's Death Highlights Spread of Coronavirus in Meat Plants*, New York Times (Apr. 10, 2020), <https://nyti.ms/2V6vmJ7>.

¹² The Good Food Institute, *Plant-based Market Research Overview* (2020), <https://www.gfi.org/marketresearch>.

- Establish an interagency initiative among these agencies, similar to the National Nanotechnology Initiative, to identify and perform the research and development that will remove the technological barriers currently facing the alternative protein sector of the bioeconomy and ensure interagency coordination in such research efforts to improve efficiency, minimize duplication of effort, and grow workforce talent;
- As part of Manufacturing USA’s network, establish advanced manufacturing institutes dedicated to performing research on plant-based, cultivated, and fermented protein technologies, lowering barriers to commercialization, and creating a skilled domestic workforce capable of supporting the industry as it grows, while leveraging existing resources from industry, universities, and government agencies; and
- Encourage and support STEM students working on alternative proteins and related fields through work-study and internship programs, jointly funded innovation competitions, career fairs and discussion panels at research centers, and shared intellectual property programs to ensure that the future workforce required by the alternative proteins industry is adequately trained.

These efforts will improve the economic health of this sector and create jobs in the areas likely to be most severely affected by the pandemic. Without a concerted effort, the food industry players who are most likely to emerge from the current crisis in a position to continue feeding Americans will be older, more established companies and legacy brands. By funding research to ensure progress on alternative proteins, the Committee can ensure that the food industry is able to continue to innovate, resulting in more choices for consumers in the marketplace.

III. Alternative Protein R&D Will Help Boost the Economy and Create a Resilient Food System.

Research into alternative proteins would benefit the bioeconomy at large and allow us to diversify the food supply so that it is resilient to crises like the one we face now, extreme weather, the emergence of crop diseases and pests, and changing consumer demand.

Return on Investment

Former Secretary of Agriculture Tom Vilsack has recognized the economic benefit of investing in public research: “Studies have shown that every dollar invested in agricultural research creates \$20 in economic activity.”¹³ Very few government or private programs have a return on investment of 20x.

¹³ U.S. Dept. of Agric., Press Release, *USDA Secretary Announces Creation of Foundation for Food and Agricultural Research* (July 23, 2014), <https://bit.ly/2V4s8G5>.

Research into alternative proteins in particular will help the many companies that have recently launched into this sector and will help to create many more, adding to the many highly skilled jobs this sector already creates. Publicly funded research will employ researchers and provide workforce training essential for the bioeconomy, and will employ even more researchers at the companies that use and build on the publicly funded science, making Secretary Vilsack's prediction a reality. Furthermore, product formulation and manufacturing require engineers (bioengineers, chemical engineers, mechanical engineers, and tissue engineers), biologists (cell biologists, molecular biologists, and plant biologists), food scientists, nutritionists, and biochemists (specializing in protein chemistry). These jobs are required for the initial research as well as for the industries that will develop around the publicly funded work.

The research we are proposing will also benefit farmers because plant-based and cultivated meat production methods process otherwise inexpensive feedstocks such as legumes, grains, sugars, and amino acids into meat, which will create opportunities for farmers to grow crops for a higher-value market. For example, instead of selling crops for animal feed at commodity prices, farmers have the option of selling inputs for plant-based products at greater profit.

Finally, as alternative proteins become established, a diversity of products will be developed to match local preferences from available ingredients. Given the right incentives, local facilities similar to other sectors, such as craft beer breweries, will become more viable for the production of alternative protein-based foods.

Additional manufacturing plants will be required for the production of the tools and equipment involved throughout the alternative protein supply chain. With many such food and manufacturing facilities operating in close proximity to both their crop inputs and their end consumers, costs can be decreased while simultaneously creating sustainable jobs and economic growth in rural, agricultural communities.

These local facilities would also increase the capacity of the alternative proteins industry to adapt to changing agricultural inputs and consumer preferences.

Food Security

Demand for meat is expected to increase by more than 50 percent by 2050 relative to 2012. However, our current meat production system is vulnerable. In addition to the enormous impacts a viral pandemic can have on public health and consumer demand, a single disease outbreak — like African swine fever or the avian flu — can result in massive damages to the food supply, where millions of animals need to be culled.

In part due to the demand of conventional animal agriculture for inexpensive feed crops to give to livestock, four crops dominate U.S. agriculture: corn, soybeans, wheat, and cotton. This extreme uniformity creates fragility in the food supply, as a single adverse event threatens widespread effects. Because plant-based and cultivated meat can be made from a wide variety of different, high-value crops, a shift to these methods of protein production will allow the country to diversify the crops it grows, making us more resilient to extreme weather, crop diseases, and pests. Yellow peas, for example, which are currently used in plant-based meat production, are more resilient than corn, soybeans, and wheat, because they “require less water [and] are drought tolerant.”¹⁴ Regardless of the benefits of any particular crop, having a greater variety of plants grown in American fields will provide an insurance policy against circumstances that would devastate just one.

A new alternative protein infrastructure could also lend itself to smaller, more widely distributed facilities and supply networks. Such a system would safeguard American jobs in both farming and food technology and keep money flowing through local economies. A distributed system would create an overlapping network of food protein production to protect against supply chain issues such as drought or batch loss. By diversifying inputs, the system would become more resilient in the face of unpredictable agricultural conditions. These changes would result in greater food security for Americans.

Additionally, the inputs for plant-based and cultivated meat can generally be stored until needed, allowing production of these foods to rise if conventional meat production plummets. And of course, plant-based meat is completely insusceptible to zoonotic disease because it is free of animals, and cultivated meat will be grown in a closed system where any contamination can easily be contained, adding security to the supply chain.

Production Efficiency

Alternative protein production methods are efficient in a number of different ways that would help protect the domestic food supply from disruptive volatility. For example, plant-based and cultivated meat inputs and production platforms are flexible enough to be used to produce different kinds of meat, which allows them to adapt more quickly to changing consumer preferences. The same peas used in plant-based burgers, for example, could be used in plant-based chicken or pork. Similarly, all the food that is produced is in exactly the cuts that consumers demand.¹⁵ If the market of the future pays more for chicken breast than chicken feet (as it does now), cultivated meat producers will grow only chicken breasts.

¹⁴ Larissa Zimberoff, *The Rise of the Pea: How an Unassuming Legume Emerged as a Frontrunner in the Race to Replace Meat and Dairy*, TIME (Aug. 15, 2019), <https://bit.ly/2Xw08wB>.

¹⁵ Liz Specht, *Alt-Meat Trounces Animal Meat's Massive Inefficiencies*, Wired (Aug. 19, 2019), <https://bit.ly/3abxLGU>.

Ancillary Benefits

In addition to these important benefits, research might yield unexpected results that have little value for an individual company but tremendous value for another area of science or industry. The scale and price points needed for cultivated meat, for example, are driving innovation in growth factor production. Growth factors are components of cell culture media that are used in the biomedical industry as well. Developing cheaper methods to produce growth factors for cultivated meat could also lead to price reductions and efficiency gains in the production of important growth factors and other cell media components for biomedical labs and companies.

IV. Conclusion

We appreciate the opportunity to share these comments with the Committee. We are grateful for your efforts to help the United States weather this crisis while advancing sound science. Please let us know if we can be of assistance in any way.

Sincerely,



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