



T H E
GOOD FOOD
I N S T I T U T E

1380 MONROE ST. NW #229
WASHINGTON, DC 20010

September 20, 2017

To Whom It May Concern:

Thank you for the opportunity to respond to the USDA-NIFA-AFRI-006351 AFRI Foundational Program RFA.

We applaud AFRI's focus on "addressing enhancement of sustainability of agricultural systems," and on the desire to support foundational research directed at answering one of the most critical questions we face today:

How can we feed the world's growing population with safe and healthy foods produced through systems that do not negatively impact climate, biodiversity, and scarce natural resources?

In the study, "[Shifting Diets for a Sustainable Food Future](#)," the World Resources Institute estimates we will need 70% more food to meet global demand in 2050, compared to 2006. It is unlikely that improvements in agricultural productivity alone will be able to close this gap, given yields would have to increase 33% faster than they did during the Green Revolution. The authors suggest that closing this 70% food gap will require both productivity increases and dietary shifts away from consumption of animal-based proteins, due to the fact that the production of animal-based foods involves more resources and environmental stress than the production of plant-based foods.

Nevertheless, decades of work by scientists, public health authorities, environmentalists, and others to convince people to consume more plants and less meat have not put a dent in meat consumption. Despite rising awareness of the global impacts of our dietary choices, consumers continue to base their purchasing decisions primarily on price, taste, and convenience. Quite simply, reducing meat consumption is difficult or impossible for most people due to a lack of appetizing and affordable products that could serve as alternatives to conventional meat products. The challenge, then, is to innovate and bring to market diverse non-animal protein alternatives that are as delicious, price-competitive, and convenient as their animal-based counterparts. Doing so would make the healthy and sustainable choice the default choice.

Thus, we recommend that AFRI consider language in future RFAs to explicitly encourage research proposals focused on the development of sustainable, high-quality, protein-rich, center-of-the-plate foods. Specifically, the areas of plant-based meat and [clean meat](#) (i.e., meat produced from animal cells grown in culture) represent two complementary approaches to addressing the global food crisis. Despite the potential promise of these food products and production methods for reducing the food gap we face, little to no public funding in the U.S. is currently supporting research in these areas. AFRI is well-positioned to bring these needed research areas to the forefront, given that they fit within the scope of AFRI's already established priority areas. Below we highlight two priority areas and provide examples of research questions that fit within these priority areas to illustrate the scope of research needed for advancing the fields of plant-based and clean meat, and how AFRI could incorporate these research topics into future RFAs. We provide examples only and not an exhaustive list, as one could envision

Creating a healthy, humane, and sustainable food supply

many valuable research ideas related to plant-based meat and clean meat that would fit within the scope of the food safety, nutrition, and health priority area.

Plant Health and Production and Plant Products Priority Area

As stated in the FY17 AFRI Foundational Program RFA, “Plant production, protection, and the development of new plant products are critical to the sustainability and competitiveness of U.S. agriculture, and the growth of our nation’s economy... [B]y increasing knowledge of plant systems and the various factors that affect productivity, we can help U.S. producers and consumers face critical challenges in areas such as food security, stewardship of natural resources, [and] climate variability...” Research aimed at investigating plant protein sources and creating appetizing and affordable plant-based meat products from these protein sources is directly in line with the stated mission of this priority area.

Despite the market presence of plant-based foods, large areas of unfilled knowledge gaps exist in the field of plant-based food research. For example, the Pacific Northwest U.S. grows several varieties of pulses (dry beans, dry peas, lentils, etc.). The enormous genetic diversity of pulses represents an almost entirely untapped source of protein for novel plant-based meat products. In general, pulses require fewer inputs (due to their ability to fix atmospheric nitrogen through a symbiotic relationship with the microbes growing on their roots) and have higher protein content than other common food crops such as corn and wheat, thus conferring both environmental and nutritional benefits. Even with these benefits of diverse plant protein sources like pulses, a significant majority of plant-based meat products rely on soy or wheat protein as their primary ingredient. Research is needed to functionally characterize the proteins in pulses and other crops, and high-throughput targeted breeding programs are needed to increase yield and robustness and to select for strains with ideal protein compositions for downstream processing into consumer products such as plant-based meat. Processing methods for these protein sources also need to be refined to optimize their functional parameters for incorporation into products with desired taste, texture, and food science characteristics (gelation, foaming, emulsion, etc.), as well as advantageous interactions with other ingredients in cooking and baking. Research is needed to assist with determining what plants will make the best plant-based foods, in terms of cost, environmental impact, and consumer acceptance.

Agriculture Systems and Technology Priority Area

The mission of this priority area, as stated in the FY17 RFA, includes developing “the next generation of engineered systems, products, processes, and technologies... blend[ing] biological, physical, and social sciences, thus leading to sustainable, competitive, and innovative solutions for United States and global agriculture and food systems... The broad list of topics encompassed by this area includes, but is not limited to, new uses and products from traditional and nontraditional crops, animals, byproducts, and natural resources...” Clean meat production, which is heavily dependent on both biological sciences and engineering, is an interdisciplinary and innovative solution to producing traditional animal meat with non-traditional technologies that results in a more sustainable method of production.

In March 2017, the National Academy of Sciences, Engineering, and Medicine released a report, “[Preparing for Future Products of Biotechnology](#).” The report, which was researched and written by more than a dozen top scientists and peer reviewed by an additional 17, focused on identifying the products that are likely to be produced by biotechnology in the next 10 years. In the report, clean meat is flagged as an area of high growth potential.

For clean meat to achieve this high growth potential, public and private funders must invest in the essential research and development needed to accelerate the commercialization of clean meat. Research projects supporting this endeavor include, but are not limited to:

- Engineering growth factors for higher stability and potency, reducing their requirements in cell culture media and thus drastically reducing cell culture costs for food and agricultural applications;
- Developing stable cell lines for agriculturally relevant species capable of differentiating into all meat-relevant cell types (muscle, fat, connective tissue, etc.);
- Developing contained production platforms for clean meat including fully automated bioreactors, integrated cell culture media monitoring and recycling systems, and cell harvesting protocols; and
- Performing detailed life cycle assessments and economic feasibility studies on scaled-up clean meat production to better understand the impacts, both positive and negative, of this production method and identify target areas for increased efficiency and reduced cost.

If successfully implemented on a global scale, a food system with a much greater reliance on plant-based and clean meat has the potential to sustainably feed 9.7 billion people by 2050, mitigate climate change and other pressing environmental problems, reduce animal suffering, and decrease global public health issues such as antibiotic resistance, zoonotic threats, and diet-related chronic disease. We can identify no better way to invest public research funds, and we look forward to seeing how AFRI-funded research can lead the world in revolutionizing our global food and agricultural systems through support of plant-based and clean meat research and development.

We are happy to answer any additional questions you have regarding these topics and are available to discuss this proposal in more detail. Thank you in advance for your consideration, and for your commitment to supporting the creation of a healthy and sustainable food supply.

Sincerely,



Erin Rees Clayton, Ph.D., M.P.H.
Scientific Foundations Liaison
The Good Food Institute
ErinC@gfi.org