AMERICAN SOCIETY FOR MICROBIOLOGY

July 31, 2020

Mr. Stephen Censky
Deputy Secretary
United States Department of Agriculture
1400 Jefferson Dr. SW
Washington, DC 20250
Re: Docket Number USDA-2020-0003

Dear Deputy Secretary Censky:

On behalf of the American Society for Microbiology (ASM), thank you for the opportunity to comment on the Agriculture Innovation Agenda. As one of the oldest and largest life science societies with more than 30,000 members in the United States and around the globe, our mission is to promote and advance the microbial sciences. ASM appreciates the U.S. Department of Agriculture's (USDA) commitment to environmentally sound and economically viable agricultural practices, and we support the goal of increasing U.S. agricultural production by 40 percent while cutting the environmental footprint of U.S. agriculture in half by 2050. In order to achieve this goal, USDA will need to invest in research and innovation and sustain those investments.

Microbiomes are communities of microorganisms, or microbes — bacteria, archaea, viruses, fungi, prions, protozoa and algae — that live on, in, and around people, plants, animals, soil, oceans, and atmospheres. Some of the most important developments in modern medicine have resulted from harnessing the power of microbes, including a vaccine against smallpox and the discovery of penicillin. While applications of microbiome research in human health have seen rapid expansion, microbes also play key roles in animal and plant health and the stability of ecosystems. As noted in the National Academies report *Science Breakthroughs to Advance Food and Agricultural Research by 2030,*[1] further understanding of animal, soil, and plant microbiomes will provide opportunities to improve crop production, transform feed efficiency, and increase resilience to stress and disease.

Plant, animal, soil, and water microbiomes play an integral role in a healthy and economic supply of food, fiber and a well-functioning agroecosystem. However, more support is needed for research and on plant, soil, and animal microbiomes. ASM encourages the USDA, through the Agriculture Innovation Agenda, to establish initiatives to increase the understanding of the animal, soil, and plant microbiomes and their broader applications across the food system. We also strongly encourage continued coordination of microbiome research across federal agencies.

Applying Microbiome Science to Plant Health and Nutrition

The *Breakthroughs* report noted that identifying and harnessing the soil microbiome's capability to produce nutrients, increase nutrient bioavailability, and improve plant resilience to environmental stress and disease will lead to more productive and sustainable crop production systems.[2] Microbes can promote plant growth, and plant roots recruit a myriad of microbes to help enhance tolerance to environmental stresses and activate defenses against pathogens. Microbiologists have been studying how to harness the

[1] National Academies of Sciences, Engineering, and Medicine. 2018. Science Breakthroughs to Advance Food and Agricultural Research by 2030. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/25059.
[2] Ibid, p. 7.

ability of these microbes to increase sustainable crop production and to develop dynamic crops that can turn certain functions on or off only when needed. Moreover, plant microbiome studies have broad relevance, including for sustainable crop production, environmental health, human health, and climate change mitigation.

The plant-soil-microbe interaction in the rhizosphere provides vast opportunities for enhance crop health**.** Development of a new generation of soil microbes is needed with improved water and nutrient management and disease resistance through enhancement of existing soil microbes and genetically-enhanced microbiomes. USDA has a unique opportunity to accelerate discoveries that will lead to new products by forming partnerships with burgeoning start-up companies in this area. Research is needed in the beneficial interactions that occur between aboveground plant parts and microbes that enhance disease resistance.

Applying Microbiome Science to Animal Health and Nutrition

The microbiome of animals is just beginning to be explored. As with humans, microbiome science has implications for nutrition and feeding as well as disease susceptibility. Understanding the interaction of gut bacteria with beneficial microbes has potential to both fight disease and to cut antibiotic use, as in humans. As our knowledge of animal microbiomes evolves, nutrient formulations could be combined with more information about the microbiome and its interactions with nutrients.

In addition, as noted in the *Breakthroughs* report, the possibility of diagnosing a wide array of diseases while standing beside the animal could remove many time-consuming steps to diagnosis, allowing for much earlier and targeted therapies or control measures, thereby minimizing loses, animal suffering, and therapeutic antibiotic usage.[3] These practices will also increase the safety of our food supply. For example, "smart" hog facilities monitor microbiomes for changes that indicate the presence of *Salmonella*, which allows for quick identification and treatment.

Applying Microbiome Science to Food Science and Safety

Microbiome data can contribute to food safety from farm-to-fork. As noted above, the same "smart" hog farm technology that is used to detect microbiome changes indicating the presence of pathogens could be connected to an integrated data communication and management system to increase traceability of contaminated products. One such example of this integration can be found in Box 4-4 of the *Breakthroughs* report.[4] Additionally, as we learn more about the human gut microbiome, omics technologies can be leveraged to further understand individual perceptions of food and flavor, and in turn the drivers of food choice. Finally, microbiome science can bring us closer to truly personalized nutrition that takes into account individual preferences as well physiological factors.

Supporting a Healthy Soil Microbiome

Microbes play a critical role in the functioning of soils. We know very little about the bacteria and fungi that interact intimately with plants, yet we do know that they play a central role in plant nutrient uptake.[5] Support is needed for discovery research and its application for crop and soil health and ecosystem services. ASM encourages further research on soil health, both the fundamental aspects of the interrelations between the biological chemical and physical aspects of the soil, and how the soil microbiome could be enhanced. For example, manipulating the soil microbiome for reduced nitrous oxide

[3] Ibid, p. 47.
[4] Ibid, p. 62.
[5] Ibid, p. 74.

emissions could increase nitrogen use efficiency. Or increasing soil carbon sequestration through crop and soil management that enhances the soil microbiome and its processing of carbon.

Coordinating Microbiome Research

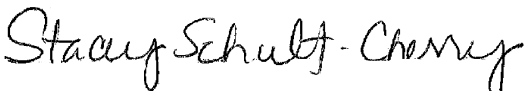
As we move toward greater consensus on and communication concerning policy changes in areas such as antimicrobial stewardship, microbiome science will be an integral part of a One Health approach to antimicrobial resistance. Microbiome research has experienced lagging federal investment, and the amount of federal funding for agricultural microbiomes collectively across all plant and animal species is much smaller than for human microbiomes. Successfully leveraging the scientific opportunities presented by the microbiome requires a robust and sustained federal investment in microbiome research and development—far beyond what has been envisioned to date. Transdisciplinary efforts focused on obtaining a better understanding of the various agriculturally relevant microbiomes and the complex interactions among them would create opportunities to modify and improve numerous aspects of the food and agricultural continuum.

We strongly encourage the USDA to recommit to the objectives of the Interagency Microbiome Strategic Plan released in April 2018. This plan, developed by the federal Microbiome Interagency Working Group, recognizes the need for better coordination of microbiome research among federal agencies, and between agencies and both non-federal domestic and international microbiome research efforts. We must move away from our current "siloed" approach to agency investments in this area and build a true interagency mechanism for research on the microbiome. Research agencies should be encouraged to share their results and make existing or needed microbiome data, analytics, technology platforms, and expertise publicly available across the federal government and among academic research institutions, national laboratories, and industry. An intragovernmental approach is essential.

Finally, ASM also strongly supports implementation of policies that will facilitate the translation of basic research findings to real world, scalable market-based solutions. This will require federal incentives for the continued refinement of technologies, and policies that promote the commercialization of these technologies. USDA should follow the recommendation of the House Appropriations Committee to develop a strategic plan for the Agriculture Advanced Research and Development Authority, as authorized in Section 7132 of the 2018 Farm Bill. In developing the Agriculture Innovation Agenda, USDA should consider how AGARDA can work in collaboration with ongoing research programs operating in ARS and the National Institute of Food and Agriculture (NIFA) to support innovative applications of microbiome research and antimicrobial stewardship.

ASM and its members look forward to next steps in this endeavor and stand ready to assist you. If you have any questions or would like to further discuss these comments, please contact Allen Segal, ASM Director of Public Policy and Advocacy, at asegal@asmusa.org or 202-942-9294.

Sincerely,



Stacey Schultz-Cherry, Ph.D.
Chair, Public and Scientific Affairs Committee
American Society for Microbiology