Integrating microbiomes into One Health: insights from the 2025 One Health World Microbiome Partnership Summit

Lancet Microbe 2025
Published Online
https://doi.org/10.1016/j.lanmic.2025.101319

For more on the **WMP** see https://www.worldmicrobiomepartnership.org

For more on the **Summit** see https://www.avousledirect.net/one-health-world-microbiome-partnership-summit

Research across multiple disciplines is showing that microbial communities are crucial for many facets of health and resilience, from human, plant, and animal health to disease resistance, ecosystem adaptability, and planetary climate regulation. Recognising this importance, the World Microbiome Partnership (WMP) was launched to integrate microbiome science into global health, agricultural, environmental, and regulatory systems.[1] The One Health World Microbiome Partnership Summit, convened on June 20, 2025, under the High Patronage of French President Emmanuel Macron, brought together more than 40 leading microbiome experts and stakeholders from all sectors representing 16 countries and including a large online audience, with the goal of catalysing a coordinated, cross-sectoral microbiome research and innovation agenda aligned with One Health principles. Herein, we summarise the major themes and strategic recommendations that emerged from the Summit.

The Summit underscored the microbiome's transformative role in addressing many global challenges including emerging diseases, antimicrobial resistance (AMR), food insecurity, ecosystem degradation, biodiversity, and climate change. Further, because of the central roles of microbiomes in human health, agricultural and natural ecosystems, and the regulation of planetary climate, practical applications based on advances in the microbiome field are needed to support the UN's Sustainable Development Goals (SDGs).[2,3] Seven Working Groups proposed action plans, spanning science and policy, economy, and management. These plans included developing community resources, standardised tools and pipelines, and Findable, Accessible, Interoperable and Reusable (FAIR)-data[4] infrastructures and harmonising regulatory frameworks. The aim of the WMP is to ensure ethical and equitable stewardship of microbiome data, particularly in the Global South, to accelerate this field and its applications to support public policies and to position the WMP community as a central actor in global and planetary health governance.

In high-level remarks, leaders from France's premier research agencies (National Research Institute for Agriculture, Food and the Environment [INRAE], National Institute of Health and Medical Research [INSERM], and the Institut Pasteur), the Chinese Academy of Sciences, and the UN's One Health Quadripartite agencies emphasised the microbiome's strategic importance in One Health and sustainability. The leaders outlined key opportunities covering the following: translational microbiome research and inclusion of the microbiome in personalised health-care paradigms (Didier Samuel, INSERM); an understanding of cross-species microbial transmission in domestic and wild animal populations (Emmanuelle Soubeyran, World Organisation for Animal Health [WOAH]); incorporation of a microbial ecological perspective to address how diet, lifestyle, and environment modulate human–microbiota interactions (Yasmine Belkaid, Institut Pasteur); and, more broadly, integration of microbiome science into food safety, pathogen surveillance, and planetary health initiatives (George Fu Gao, Chinese Academy of Sciences).

Multiple speakers proposed collaborations with the WMP. For example, Professor Gao advocated for microbiome monitoring in early warning systems and environmental biosurveillance, suggesting a China–WMP collaboration. One Health Quadripartite representatives emphasised the contributions of microbiome to zoonotic disease prevention, food systems innovation, and AMR mitigation and welcomed opportunities for the development of a joint policy (Chadia Wannous, WOAH; Thanawat Tiensin, Food and Agriculture Organization; Couradeau and colleagues;[5] and Martiny and colleagues[6]). Further, the Chief Executive Officer of INRAE, Philippe Mauguin, called the microbiome a common good for humanity and stressed the need for open science, evidence-based frameworks, and inclusive stakeholder engagement across public, private, and civic sectors to ensure that microbiome advances serve humanity and the planet.

The first scientific session showcased three domains—the human microbiome, plant and animal microbiomes, and environmental microbiomes—highlighting how research findings are translated into real world and field applications. These presentations were developed

collaboratively with multiple speakers and highlighted the Summit's larger objective to incorporate different perspectives and encourage cross-sector interactions for addressing joint aims.

The long-term applications for the human microbiome field are in disease prevention and cures through microbiome modifications and in health maintenance as the personalised medicine field matures. All the speakers supported the 5P framework for health care, which includes prevention, precision, participation, personalisation, and population health. As concrete examples of microbiome applications for human health, the speakers presented evidence that: sustaining microbial compositional and functional diversity will be important for promoting human health across the life span (James Versalovic, Baylor College of Medicine, Houston, TX, USA); microbial metabolites play important roles in human immunity and host metabolism (Hiroshi Ohno, RIKEN Center for Integrative Medical Sciences, Yokohama, Japan); and metagenomic analyses of large cohorts have revealed the relative importance of specific bacterial taxa in human development early in life (Willem M de Vos, University of Helsinki, Helsinki, Finland and Wageningen University, Wageningen, Netherlands). Data from these kinds of studies could guide tailored population-specific treatments and interventions.

In the plant and animal microbiome fields, applications fall into two main areas: improving food safety and security through modern microbiome-based biocontrol practices and minimising unwanted environmental impacts through microbiome-based sustainable agriculture. The speakers offered several examples of such potential applications: microbial bioengineering approaches including microbial inoculation to modulate plant microbiomes to enhance host plant nutrient uptake and disease resistance (Carolee T Bull, Pennsylvania State University, University Park, PA, USA); microbial surveillance to predict and model zoonotic and anthroponotic pathogen transmission, drug discovery, and bioremediation (Rebecca M Stumpf, University of Illinois, Champaign-Urbana, IL, USA); microbial feed additives for livestock that improve ruminant feed metabolism and reduce reliance on antibiotics—the application of these additives could not only mitigate the spread of AMR but also reduce greenhouse methane gas emissions from livestock (Tim A McAllister, Agriculture and AgriFood Canada, Ottawa, ON, Canada); and advanced plant breeding practices that focus on modifying endophytic microbiomes (ie, microbial communities living within plant tissues) along with host genetics to disrupt plant pathogen lifecycles and improve crop resilience (Carolee T Bull). All these research advances could be developed for deployment in the field once regulatory approvals have been completed.

Further, ecosystem studies have shown that microbiomes are useful as both indicators of ecosystem health and as sentinels of ecosystem change. Examples of applications of microbiomes to address environmental issues provided by these speakers include: the potential for manipulating marine microbial communities to regulate nutrient cycling and subsequent carbon sequestration to mitigate climate change (Alice C Ortmann, Fisheries and Oceans Canada, Ottawa, ON, Canada); the use of metaomics pipelines that enable integrated analyses across global ecosystems to gain insights into the universal factors that regulate microbiomes and thus provide a basis for ecosystem restoration (Peer Bork, European Molecular Biology Laboratory, Heidelberg, Germany); and elucidating the role of diverse environmental factors—including pollutants, dietary patterns, stress, connection with nature, and social relationships—in shaping childhood microbial ecology and the development of subsequent non-communicable diseases, underscoring the connections between human health and the total environment (sometimes called the exposome[7]), and ultimately, highlighting the value of environment-based strategies for disease prevention and health promotion (Susan L Prescott, University of Western Australia, Perth, WA, Australia). The diverse examples in this session provided strong evidence for the readiness of microbiome advances to address many crucial issues confronting humanity.

The second scientific session of the Summit highlighted seven multidisciplinary WMP Working Groups that outlined strategies to develop community resources and data stewardship guidelines; harmonised science-based regulatory procedures and other essentials for accelerating the field, from science, policy, economy, and management perspectives; and proposed actions supporting microbiome innovation across various sectors (table). These groups emphasised that long-term success depended on collaboration, communication, and capacity building.

To foster this broader objective, the Working Groups are chaired by experts across various disciplines and will coordinate with other scientific networks and professional societies that are aligned with the SDGs (see appendix pp 2–4 in the Comment by Proctor and

See Online for appendix

	Co-chairs	Priority need for the field?	Proposed action plan
Human microbiome and public health targets	J Raes, KU Leuven; R Benamouzig, Assistance Publique–Hopitaux de Paris (APHP); and M Henn, Seres Therapeutics	Standardised human microbiome diagnostics, therapeutics, and links to non-communicable diseases	Develop a plan for a microbiome observatory for human health, which would integrate microbiome indicators for non-communicable disease monitoring, and include standardisation of diagnostics and longitudinal population studies
Microbiome technologies	E Holmes, Murdoch University; P Louis, University of Aberdeen; and N Segata, University of Trento	Scalable tools, analytics, and AI-assisted modelling to move beyond associations and catalyse cause-and-effect studies	Conduct a Round Robin analysis of specific datasets to identify the metadata that can be harmonised across datasets
Microbiome regulatory science and product development	C Sergaki, Medicines and Healthcare Products Regulatory Agency (MHRA); K Wannerberger, Ferring Pharmaceuticals; K Clement, French National Institute of Health and Medical Research (Inserm); and H Affagard, MaaT Pharma	Regulatory harmonisation and industry–academic partnerships to accelerate microbiome-based products	Develop a roadmap for microbiome-based product approval, including alignment between the EMA, FDA, and national regulators on safety, efficacy, and labelling standards
Agri–food systems and microbiomes	A Sessitsch, Austrian Institute of Technology; R Stumpf, University of Illinois; and F Fontaine, UN Food and Agriculture Organization (FAO)	An integrated microbiome stewardship approach in agri–food systems, highlighting the need for addressing crop resilience, soil carbon storage, livestock health, and production efficiency	Develop a roadmap that considers the interlinkages of microbiomes within integrated crop livestock–wildlife systems to address aspects of health, quality, and sustainability. Increased international collaboration and knowledge sharing, particularly to establish a common understanding on linking (eg, agro-management) practices with microbiome functions and sustainability
FAIR microbiome data	O Koren, Bar-Ilan University; L Zhao, Rutgers University; and S Pesant, European Bioinformatics Institute (EBI)	Interoperable, annotated, and accessible microbiome data repositories aligned with FAIR principles	Build an international open-access marine microbiome database, as a stress test of interoperability across platforms
Environmental microbiomes and climate change	E Rocke, University of Cape Town and R Knight, University of California San Diego	An integrated global network of environmental microbiome data for understanding the effect of climate change on microbiomes and for developing climate change mitigation strategies	Conduct gap analysis of environmental microbiome data, focusing on Tara Oceans datasets, particularly for the Global South, to identify the data needed for future research
Microbiome partnerships	J Sanabria, Universidad del Valle and T Makhalanyane, Stellenbosch University	Equitable and sustainable global partnerships expanding access to knowledge, skills, and research opportunities across the Global North and South. Cross sectoral cooperation enhancing microbiome's role in One Health	Develop microbiome ethics curriculum and modules for schools, universities, and postgraduate programmes as well as international workshops and certificate programmes; Promote student, researcher, and professional exchanges through fellowships, joint supervision, and placements; Through a global microbiome education and training network, coordinate balanced Global South participation, One Health alignment, and sustainability; Develop advocacy tools using key deliverables from other Working Groups, leveraging them to position microbiome among One Health priority topics
Ethics of microbiomes	De Montera, Catholic University of Lyon; M-H Parizeau, Université Laval; and H Zwart, Erasmus University	Ethical and interdisciplinary issues arising during WMP activities	Define microbiome care ethics within the One Health vision. Set up an interdisciplinary knowledge coalition to foster capacity building for new interdisciplinary research questions including humanities and social sciences, especially on microbiome-based food ethics

AI=artificial intelligence. EMA=European Medicines Agency. FAIR=Findable, Accessible, Interoperable, Reusable. FDA=Food and Drug Administration. WMP=World Microbiome Partnership.

Table: **WMP Working Group by topic, co-chairs, priority need for the field, and proposed action plan to address this need**

colleagues[1] for examples of these organisations). The Working Groups invite interested parties from across all sectors, disciplines, and regions to join them, or suggestions for other groups can be made through the WMP questionnaire. Additionally, a new Working Group on Ethics is available for participation.

As microbiome studies increase access to complex and large datasets for innovation and policy decision making, the scientific community has recognised that not only do we need to adopt FAIR-data principles (highlighted in talks by Liping Zhao, Rutgers University, New Brunswick, NJ, USA and Stephane Pesant, European Molecular Biology Laboratory, Cambridge, UK),[4] but that a person's right to control and access their own data and a country's sovereign right to the data of its own resources,[8] as articulated in the Convention on Biological Diversity and specifically in the Nagoya Protocol,[9] should also be recognised and integrated into WMP activities. The CARE principles of collective benefit, authority to control, responsibility, and ethics[10] provide important guidelines

For more on the **WMP questionnaire** see https://forms.fillout.com/t/j6minGYDNUus

for WMP efforts going forward, particularly when engaging with communities in the Global South (highlighted in talks by Emma Rocke, University of Cape Town, Cape Town, South Africa and Rob Knight, University of California San Diego, San Diego, CA, USA). As a foundation for this objective, an eighth Working Group on Ethics was established during the Summit (table).

For more on the **declaration** see https://worldmicrobiomepartnership.org/wp-content/uploads/2025/06/Paris-Declaration2025.pdf

The Summit concluded with a joint declaration endorsing microbiomes as central components of One Health responses to far-ranging issues, such as the increase in the incidence of communicable and non-communicable diseases, food systems instability, biodiversity loss, ocean degradation, and climate change. Four strategic priorities were adopted and will be incorporated into the action plans of all WMP Working Groups: to integrate microbiome perspectives into global One Health policy frameworks; to fast-track microbiome innovation via cross-sector and cross-domain research collaborations, regulatory harmonisation, and technology standardisation; to build ethical and equitable global networks, prioritising inclusion of the Global South; and to promote public and professional microbiome literacy through education and outreach activities. More specifically for the microbiome field, the Working Groups will address important topics, such as the need for microbiome observatories of various domains for long-term ecological and microbiome data collection, environmental health monitoring, and ultimately understanding the universal roles of microbial communities in these domains; the measures to preserve microbiome resources much as seed banks are used to preserve plant resources; and the need for, and access to, infrastructure, particularly for low-income countries.

For more on the **LinkedIn posts** see https://www.linkedin.com/company/world-microbiome-partnership/posts

For more on the **newsletter** see https://mailchi.mp/f88a9c9ddeea/welcome-to-the-1st-wmp-newsletter?e=d263ac76fa

The 2025 One Health WMP Summit marks a key inflection point in positioning microbiome science at the core of global One Health strategies and sets a new scientific and strategic baseline by bridging disciplinary divides and aligning microbiome research with global policy. Scientific insights ranged from mechanistic microbe–host studies to ecosystem-level interventions, but all agreed that challenges remain and should be addressed. An important goal in the field is to understand the relationship between the microbiome and health status of the system.[11] For example, in environmental microbiomes, it remains essential to identify the tipping points at which microbial activities shift from supporting ecosystem health and productive functions to driving system degradation or collapse, a key step in defining what constitutes a healthy microbiome across systems (highlighted in talks by Jeroen Raes, Catholic University of Leuven, Leuven, Belgium and Matt Henn, Seres Therapeutics, Inc, Boston, MA, USA). In addition, establishing global interoperable data standards and ensuring equitable access to microbiome innovations are crucial for microbiome innovations (highlighted in talks by Liping Zhao, Rutgers University, New Brunswick, NJ, USA; Elaine Holmes, Murdoch University, Perth, WA, Australia; and Nicola Segata, University of Trento, Trento, Italy). The WMP community aims to build on the momentum from the Summit through representation at upcoming international meetings (shared via WMP LinkedIn posts), a member newsletter, and the formation of the WMP Advisory Council to build global collaborations between like-minded networks and to provide opportunities for international funding for microbiome initiatives in research, training, and outreach. The optimal utilisation of the microbiome for practical applications will depend on sustained multistakeholder collaboration, regulatory harmonisation, inclusive innovation, and robust capacity building across all sectors, domains, and regions. In 2026, the WMP will expand its visibility through its Working Group activities and planning for the 2027 WMP Summit, which will be announced in spring 2026.

Members of the 2025 One Health World Microbiome Partnership Summit Writing Group are listed in the appendix (pp 1–3). LMP and KW declare that the opinions expressed in this document do not necessarily represent the position of the National Institutes of Health and Ferring Pharmaceuticals. The Medicines and Healthcare Product Regulatory Authority laboratories at South Mimms is part of an Arms Length Body of the UK Government. The views expressed in the publication are those of the author (CS) and not necessarily those of the National Health Service, Department of Health and Social Care, Arms Length Bodies, Department for Science, Innovation and Technology, or other government departments. All other authors declare no competing interests. LMP prepared the first draft. All co-authors have read, reviewed, and approved the final version. The Summit organisers would like to sincerely thank President Emmanuel Macron for his High Patronage of the One Health World Microbiome Partnership Summit. The World Microbiome Partnership is especially grateful to the following individuals for their recognition and support of the Summit objectives: Philippe Mauguin, President and Chief Executive Officer (CEO), National Research Institute for Agriculture, Food and the Environment (INRAE); Didier Samuel, Chairman and CEO, National Institute of Health and Medical Research (INSERM); Yasmine Belkaid, President, Institut Pasteur; George Fu Gao, Professor, Chinese Academy of Sciences; Thanawat Tiensin, Assistant Director General, Food and Agriculture Organization; Chadia Wannous, One Health Senior Specialist and World Organisation for Animal Health (WOAH) Global Coordinator; and Emmanuelle Soubeyran, Director General, WOAH. The Summit organisers gratefully acknowledge the following sources of support: Aprifel, BioGaia, Biose Industrie, Biosphera Université Paris Saclay, Danone, GMT Science, INRAE, Lesaffre, Opella, and Roquette. The authors acknowledge that ChatGPT was used to summarise the key points from transcripts of the Summit video presentations. These summaries were then used to prepare the draft manuscript by the co-authors without further involvement of any artificial intelligence tools.

2025 One Health World Microbiome Partnership Summit Writing Group
**Lita M Proctor*
lita.proctor@worldmicrobiomepartnership.org

National Institutes of Health, Bethesda, MD 20892, USA

1 Proctor LM, Dore J, Maguin E, Wannerberger K, Vincent C. A global partnership to advance the microbiome in human, plant, animal and planetary health. *Lancet Microbe* 2025; **6:** 101120.
2 Jansson JK. Microorganisms, climate change, and the Sustainable Development Goals: progress and challenges. *Nat Rev Microbiol* 2023; **21:** 622–23.
3 O'Toole PW, Paoli M. The human microbiome, global health and the Sustainable Development Goals: opportunities and challenges. *Nat Rev Microbiol* 2023; **21:** 624–25.
4 Wilkinson MD, Dumontier M, Aalbersberg IJ, et al. The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* 2016; **3:** 160018.
5 Couradeau E, Martiny JBH, Fontaine F, et al. Incorporating microbiomes into the One Health Joint Plan of Action. *mBio* 2025; **16:** e0145625.
6 Martiny JBH, Couradeau E, Fontaine F, Brechot C, Bonneville M, Callens K. Microbiomes should be incorporated into The One Health Joint Plan of Action. *Open Access Government* 2025; 53–55.
7 National Academy of Sciences, Engineering and Medicine. Microbiomes of the built environment: a research agenda for indoor microbiology, human health, and buildings. The National Academies Press, 2017.
8 Hudson M, Garrison NA, Sterling R, et al. Rights, interests and expectations: indigenous perspectives on unrestricted access to genomic data. *Nat Rev Genet* 2020; **21:** 377–84.
9 Convention on Biological Diversity. Nagoya protocol on access and benefit-sharing. https://www.cbd.int/abs (accessed July 10, 2025).
10 Carroll SR, Herczog E, Hudson M, Russell K, Stall S. Operationalizing the CARE and FAIR principles for indigenous data futures. *Sci Data* 2021; **8:** 108.
11 Gilbert JA, Lynch SV. Community ecology as a framework for human microbiome research. *Nat Med* 2019; **25:** 884–89.