Sustainable Microbiology, 2026, **3**(3), qvag030
https://doi.org/10.1093/sumbio/qvag030
Published: 23 July 2026
Meeting Report

SUSTAINABLE MICROBIOLOGY OXFORD

Community Dynamics in a Changing World: highlights from the 1st Puerto Rico & Caribbean Microbiome Symposium and vision for a new microbiome hub

Filipa Godoy-Vitorino *

Department of Microbiology and Immunology, School of Medicine, University of Puerto Rico, San Juan, PR 00926, United States
*Corresponding author. Department of Microbiology and Immunology, School of Medicine, University of Puerto Rico, San Juan, PR 00926, United States. E-mail: filipa.godoy@upr.edu

Abstract

The Puerto Rico Center for Microbiome Sciences (PR-CMS) seeks to become a leading hub for multiomics research and host–microbiota symbiosis in the Caribbean. As part of this effort, PR-CMS organizes an annual symposium that convenes international leaders, regional experts, and the local scientific community to address key challenges in microbiome science. The 1st Microbiome Symposium of Puerto Rico and the Caribbean, titled "Community Dynamics in a Changing World," took place in San Juan in February 2026. The event brought together more than 200 participants, including researchers, trainees, and stakeholders from clinical, environmental, computational, and translational fields. Topics highlighted the role of microbiomes in human health, disease, biodiversity, and ecosystem resilience, covering host–microbiome interactions, cancer, infectious diseases, diet–immune dynamics, environmental microbiology, and bioinformatics. Through keynote talks, invited presentations, and student research, the symposium emphasized integrating multiomics, data science, and translational approaches. It strengthened collaborative networks locally and globally, positioning PR-CMS as a regional leader in microbiome innovation. This meeting report also emphasizes the vision and mission of the PR-CMS as a new regional and global hub for the study of biodiversity.

Sustainability statement

The Puerto Rico Center for Microbiome Sciences champions UN Sustainable Development Goal 4: Quality Education by driving scientific training and workforce development throughout Puerto Rico and the Caribbean. The Center organizes an annual symposium that connects students and established investigators through mentorship and multiomics research. These initiatives empower the regional scientific community, fostering a sustainable and inclusive biomedical ecosystem. By promoting interdisciplinary knowledge exchange in host–microbiota studies, the Center effectively strengthens local capacity, expands research opportunities, and creates a vibrant future for Caribbean scientists through its dedicated, innovative, and highly impactful regional scientific academic leadership efforts.

Keywords microbiome, disease processes, ecology, environmental microbiology, diversity

Introduction

Microbiome science at the center of a new biological paradigm

Biological science is undergoing a profound paradigm shift. For much of modern history, organisms were studied as discrete units, with emphasis placed on their genomes, physiology, and interactions with the environment. However, advances in sequencing technologies and computational biology have revealed that no organism exists in isolation (Handelsman et al. 1998, Handelsman and Wackett 2002). Instead, all living systems are deeply intertwined with microbial communities that influence nearly every aspect of life, and we know that microbiotas are transferred from mother to offspring through holobiont generations (Rosenberg and Zilber-Rosenberg 2013, Dominguez-Bello et al. 2019, Reynoso-García et al. 2022).

The microbiome—defined as the collective genomes and functions of microorganisms inhabiting a given environment—has emerged as a central concept in biology and is even considered another organ in humans (Baquero and Nombela 2012). Microbes regulate immune development, modulate metabolism, shape

Received: 12 May 2026. **Revised:** 4 July 2026. **Accepted:** 7 July 2026

behavior, and influence evolutionary trajectories. In ecosystems, microbial communities drive nutrient cycling, maintain soil fertility, and sustain biodiversity. The study of the human microbiome has rapidly transitioned from a specialized area of research into a central pillar of modern medicine. Over the past decade, global investment in microbiome research has surpassed $1.2 billion, with an expected growth by 2030 of $2.2 billion, fueled by a combination of public funding initiatives and significant venture capital directed toward biotechnology innovation (Research 2025). This rapid growth is reflected in market projections, with the human microbiome sector expected to expand from USD 209 million in 2023 to USD 1 370 million by 2029, representing a compound annual growth rate of 31.1% (Domingues et al. 2023, Marketsandmarkets 2026). At the same time, microbiome-based innovations are emerging as key drivers of sustainability across environmental and food systems. In environmental remediation, engineered microbial communities are increasingly being harnessed to degrade persistent pollutants, including plastics and heavy metals, offering greener and more sustainable alternatives to traditional chemical treatments (Maglione et al. 2024). In parallel, advances in microbial fermentation are transforming food production, with the sector projected to reach a market value of $47 billion by 2035 as industries transition toward circular economy models to meet the rising global demand for protein (Zhang et al. 2026). Beyond clinical applications, microbiome engineering is fundamentally reshaping how we interact with our environment. By leveraging microbial communities, we are moving toward a future where toxic synthetic chemicals in agriculture, horticulture, and aquaculture are replaced by sustainable biological alternatives and revealing new therapies. Small molecules play a critical role in mediating and supporting host adaptation. With the development of advanced computational tools capable of predicting the functional outputs of complex microbial communities from their metagenomes, an expanding array of novel compounds has been identified within the human microbiota. Many of these molecules exhibit drug-like properties, highlighting their significant potential for therapeutic applications. Large-scale human microbiome datasets are revealing the mechanisms behind microbiome–host interactions, driving faster development of targeted microbiome therapeutics for diseases ranging from *Clostridioides difficile* infection to atopic disease and cancer (Whitaker et al. 2025, Editorial 2026). Recent breakthroughs in microbiome science are leveraging Artificial Intelligence (AI) to shift the field from descriptive observation to predictive disease modelling. By analyzing complex, multiomics data, AI models can now accurately anticipate ecological shifts and forecast health outcomes (Yu et al. 2026, Zhou and Zhao 2026). Recently, researchers using artificial recurrent neural networks, demonstrated that single-celled *Escherichia coli* do not merely react to their immediate surroundings but actively integrate their environmental history across multiple timescales to predict and tune future growth. This novel mathematical work establishes a new conceptual foundation for understanding non-neuronal intelligence and suggests that a bacterium's history of past stress could fundamentally dictate how it responds to future antibiotic treatments (Kratz et al. 2026). Despite all these advances, microbiome, bioinformatics, and AI research has been disproportionately concentrated in resource-rich regions, leaving significant gaps in our understanding of microbial diversity in underrepresented areas such as the Caribbean (Godoy-Vitorino 2025a,5). Puerto Rico occupies a distinctive position at the intersection of biological diversity and public health need, making it an especially compelling setting for microbiome research. The island's tropical ecosystems, ranging from coastal mangroves and karst forests to agricultural and urban landscapes, harbor a rich and largely uncharacterized microbial diversity with implications for both environmental resilience and bioremediation. At the same time, Puerto Rico faces a disproportionate burden of non-communicable diseases, including obesity, diabetes, and cancer, conditions increasingly understood to be shaped by the human microbiome (Godoy-Vitorino et al. 2026). This dual reality, extraordinary ecological richness paired with significant health disparities, underscores the urgency of building local capacity to study microbial communities across both environmental and clinical contexts. Furthermore, the population of Puerto Rico, with its unique genetic admixture and distinct cultural and dietary practices, presents an underexplored context for understanding how host–microbiome interactions vary across populations, a gap that limits the generalizability of microbiome science derived largely from studies in the continental United States and Europe. Addressing this gap requires not only scientific investment but also the development of a regional research infrastructure capable of sustaining long-term, interdisciplinary inquiry. It is within this context that the establishment of the Puerto Rico Center for Microbiome Sciences (PR-CMS) takes on particular significance, as detailed further below. Puerto Rico, therefore, offers an unparalleled opportunity to expand microbiome research into new frontiers. Recognizing this opportunity, the National Institute of General Medical Sciences (NIGMS) funded the establishment of the COBRE PR-CMS (https://cobremicrobiomepr.com/), based at the University of Puerto Rico School of Medicine in San Juan, Puerto Rico. The Center was established within the Department of Microbiology and Immunology, building on the efforts of a leading microbiome researcher in Puerto Rico, the PI of the Center, Dr Godoy-Vitorino. Details of the Center grant award are available in NIH reporter—https://reporter.nih.gov/search/I3UKXrnHPEqfFe8MLESMUA/project-details/11019159#description. This initiative established a collaboration with the Department of Anatomy and Neurobiology to strengthen cross-departmental efforts at the UPR School of Medicine, and aims to build research capacity, foster interdisciplinary collaboration, and develop a diverse workforce equipped to tackle the challenges of microbiome science, especially with faculty that never used microbiome as part of their research agenda. The Center aims to advance our understanding of microbial systems across a diverse array of scientific questions essential for developing sustainable, science-driven solutions to pressing global and regional challenges. The Center integrates basic, clinical, environmental, and computational microbiome sciences, providing state-of-the-art infrastructure, bioinformatics support, and training opportunities for researchers at all career stages.

The PR-CMS: vision, mission, and impact

The COBRE PR-CMS is therefore designed to serve as a transformative platform for microbiome research in Puerto Rico and the Caribbean (Fig. 1). Its overarching vision is to establish the region as a leader in microbiome science by integrating cutting-edge technologies with local expertise and global collaborations. Central to this vision is the recognition that microbiome science is in-

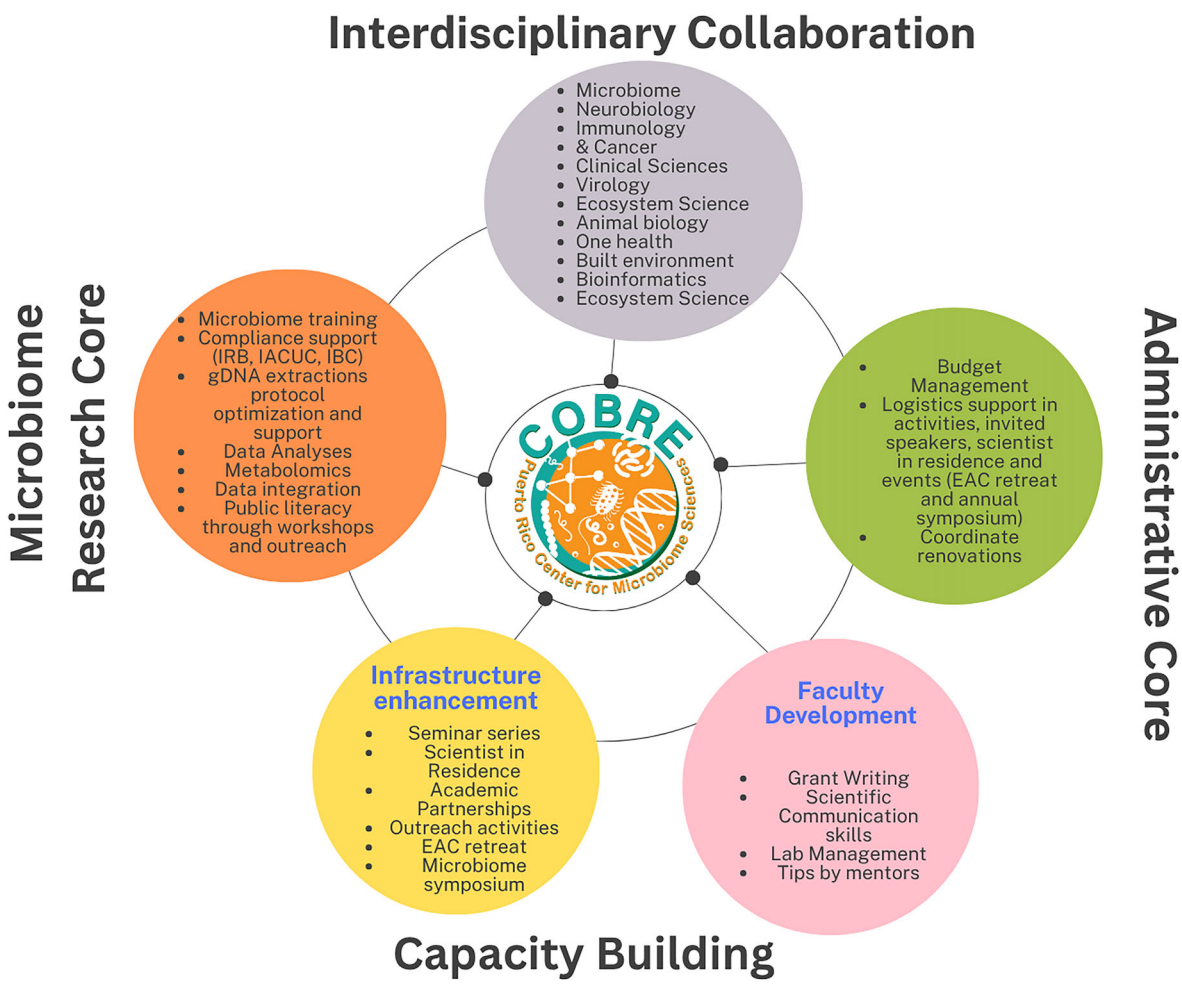

Figure 1 Schematic representation of the organizational structure and collaborative framework of the PR-CMS (COBRE). At the center is the COBRE hub, which integrates interdisciplinary research areas including microbiome science, neurobiology, immunology and cancer, clinical sciences, virology, ecosystem science, animal biology, One Health, the built environment, and bioinformatics.

herently interdisciplinary. It requires the convergence of microbiology, genomics, bioinformatics, ecology, medicine, and public health. The PR-CMS therefore seeks to create a collaborative ecosystem that bridges these disciplines and fosters innovation. It is committed to advancing microbiome research while strengthening the scientific workforce through inclusive participation across career stages, gender, ethnicity, socioeconomic background, and geographic representation, in alignment with UN Sustainable Development Goals such as SDG 4 (Quality Education—offering new training capacity through its specialized research core), Established during the summer 2025, the Center is in its early developmental stages through the support of early career faculty, graduate and undergraduate students not initially exposed to the microbiome field. The mission of the PR-CMS is to build a sustainable research infrastructure that enables investigators to explore microbiome science in diverse contexts, including human health, environmental systems, and industrial applications.

Key objectives include:

- Enhancing research capacity through state-of-the-art infrastructure.
- Supporting innovative research projects focused on microbiome science.
- Training a new generation of scientists in microbial ecology and bioinformatics.
- Promoting interdisciplinary collaboration and knowledge exchange.

The center will be uniquely positioned to address the gap between technological advancements in microbiome research and their accessibility to researchers in Puerto Rico, as it is establishing its first core lab and already supporting researchers with data production and analyses.

A central component of the PR-CMS mission is to advance research on host–microbiome interactions and their role in health and disease, particularly in the context of regional health disparities. Puerto Rico faces a high burden of chronic and noncommunicable diseases, starting from one of the highest BMI ranks in the US jurisdictions (Krueger et al. 2014), including cancers (Ortiz et al. 2010a, 2010b, Miller et al. 2018, Rivera-Gaston et al. 2024), diabetes (Burrows et al. 2017), cardiovascular disease (Perez et al. 2024), and neurological disorders (Sepulveda-Rivera et al. 2025). By investigating microbiome-driven mechanisms underlying these conditions, the Center seeks to generate knowledge

that can inform prevention strategies, diagnostics, and targeted interventions. At the same time, PR-CMS promotes research on environmental and tropical microbiomes, recognizing the importance of microbial communities in ecosystem resilience, biodiversity, and climate adaptation.

Equally important is the Center's commitment to workforce development and education. Through mentorship programs, pilot project funding, and collaborative networks, PR-CMS supports early-career investigators in their transition to independent research careers. The establishment of a Microbiome Research Core and a Research Support Core ensures access to advanced technologies, multiomics approaches, and data science tools, enabling high-quality, reproducible research. By fostering microbiome literacy and interdisciplinary training, the Center contributes to building a diverse and sustainable scientific workforce in the region. The goals and impact of PR-CMS are exemplified and amplified through the organization of the 1st Microbiome Symposium of Puerto Rico and the Caribbean, titled "Community Dynamics in a Changing World" (Godoy-Vitorino et al. 2026, May 21). This scientific meeting served as a celebratory platform for the Center's mission, showcasing ongoing research and strengthening collaborations among local and international scientists.

Microbiome science as a framework for biodiversity research

Traditional approaches to biodiversity have largely focused on macroscopic organisms. However, microbial life represents most of the biological diversity on Earth. Microorganisms are fundamental to ecosystem function, influencing processes such as nutrient cycling, carbon sequestration, and energy flow. Microbes are now recognized as a vital part of nature conservation, and this effort reflects a truly collaborative and forward-looking vision. To ensure inclusive participation, we are expanding our network through member nominations, open calls via IUCN and MCSG, and a strong commitment to language access, regional balance, and the inclusion of early-career researchers and traditional knowledge holders. We are mapping global microbial ecosystems at risk, developing Red List criteria tailored to microbial life—focusing on resilience and ecological function—and highlighting innovative conservation actions such as coral restoration and soil microbiome rewilding. Together, these steps mark an important milestone in bringing microorganisms into the global conservation agenda (Gilbert et al. 2025).

The PR-CMS aligns microbiome science in Puerto Rico with these international efforts as a center of biodiversity research, which emphasizes the study of microbial communities across environments. This includes human-associated microbiomes, environmental microbiomes, and host-associated systems in animals and plants. The Center's priorities are closely aligned with the NIH Unified Strategic Plan, emphasizing key research areas such as the integration of artificial intelligence and advanced computational models, the advancement of translational studies using clinical biorepositories, and the development and application of innovative model organisms. We welcome studies focused on microbiome research at the interface of health and disease, across both human and animal biological systems. While early microbiome studies focused on describing microbial communities, the field is now moving toward understanding the mechanisms underlying host–microbe interactions. This shift is essential for translating microbiome research into clinical and environmental applications.

The PR-CMS emphasizes mechanistic studies that explore:

- How microbial communities influence disease progression.
- The role of microbiomes in immune regulation.
- Interactions between diet, environment, and microbial composition.
- Microbiome-based therapeutic strategies.

Puerto Rico's microbiome efforts have been slim and have come from very few researchers' labs, mostly concentrated at the UPR School of Medicine. The PR-CMS draws on these characteristics to carry out research with both local relevance and global significance. By concentrating on populations that are frequently underrepresented in biomedical research, the Center helps build a more comprehensive understanding of microbiome science. The Center for Microbiome Sciences is significant in that it strengthens microbiome research capacity in Puerto Rico, offering targeted support to meritorious projects, enhancing local research infrastructure, and creating new opportunities for faculty whose research had not previously advanced into this field. The CMS is expected to expand UPR's capacity to conduct world-class, cutting-edge metagenomic research by providing outstanding core services and carrying out innovative research projects. In turn, this will support career growth and development for faculty, students, postdoctoral researchers, residents, and even senior investigators who are new to metagenomics, enabling scientific discovery through training and research collaboration.

The first microbiome symposium: a landmark event

The First Microbiome Symposium of Puerto Rico and the Caribbean, held on February 28, 2026, marked a historic milestone in the region's scientific development. Hosted by the PR-CMS, the symposium brought together researchers, students, and international experts under the theme*: "Community Dynamics in a Changing World."* The symposium achieved a level of participation that can only be described as remarkable, signaling a robust and growing interest in the field of microbiome science. With a final count of over 200 attendees, the event served as a high-density hub for networking and knowledge exchange. The scale of engagement was further evidenced by the 85+ poster presentations which provided researchers with a platform to present and discuss their findings in a direct, peer-to-peer format.

In addition to traditional poster sessions, the symposium incorporated alternative presentation formats, including 12 flash talks and elevator pitches, which required participants to condense complex data into concise, focused narratives. This range of programming was supported by broad institutional representation, with more than 40 Principal Investigator (PI) laboratories participating. This level of involvement reflects the progress made by the Puerto Rico Center for Medical-Environmental Microbiome Research (PR-CMS) toward its objective of establishing a cohesive and collaborative scientific community. The collaborative scope of the First Microbiome Symposium of Puerto Rico and the Caribbean was reinforced by the diversity of institutions represented. Attendees came from a range of organizations, including

multiple campuses within the University of Puerto Rico system, to exchange insights and contribute to a shared scientific environment. This cross-institutional participation supported connections across academic and organizational lines, contributing to a broader research network centered on microbiome science.

Furthermore, the symposium was instrumental in connecting local researchers to global networks, effectively positioning Puerto Rico as an emerging hub for innovation. The breadth of this network was evidenced by the participation of 27 institutions globally, including 14 from Puerto Rico and 11 from the United States, such as the NIH and USDA. The inclusion of international co-authors from countries like Germany and the Netherlands further highlighted the broad collaboration between island-based researchers, U.S. universities, and international research laboratories.

The program for the symposium was intentionally diverse, designed to reflect the inherent interdisciplinarity of modern microbiology. By bridging the gap between human health and environmental microbiology, the event provided a comprehensive overview of how microbial communities influence nearly every facet of life. The agenda was anchored by a variety of presentation styles, ranging from high-level keynote lectures and invited talks to student presentations.

Four central themes emerged as the pillars of the scientific discourse:

- Early-life microbiome development, exploring the foundational stages of microbial colonization with a keynote lecture by Distinguished Professor and Henry Rutgers Professor of Microbiome and Health at Rutgers University Dr Maria Gloria Dominguez-Bello, where she also serves as Professor of Anthropology in the School of Arts and Sciences. Her work bridges microbiology, medicine, anthropology, and urban studies to understand how the human microbiome develops and how modern lifestyles shape microbial ecosystems critical to health. She went beyond cataloging microbial diversity to understanding the Ecological Network Balance Index (ENBI), a new metric by her team that distinguishes health from disease by evaluating how entire bacterial communities compete and cooperate rather than focusing on individual microbes (Corral Lopez et al. 2026). This approach, exemplified by the ENBI, highlights how community-level dynamics—not individual taxa—may better distinguish health from disease.
- Computational approaches to microbiome analysis, highlighting the essential role of bioinformatics and big data in deciphering complex biological systems with a talk by Professor Keith A. Crandall, founding Director of the Computational Biology Institute at the George Washington University, who studies the computational biology, population genetics, and bioinformatics of a variety of organisms, from crustaceans to agents of infectious diseases.
- Diet–microbiome interactions, which examined the critical link between nutrition and internal microbial ecosystems through a talk by Dr Ana Maldonado-Contreras, a clinical translational researcher and Assistant Professor in the Department of Microbiology at UMass Chan Medical School. Her research centers on understanding how diet shapes the human microbiome and how these diet–microbiome interactions influence inflammation and disease.
- Microbial ecology and biodiversity were highlighted through a short talk by Dr. Natalie M. Meléndez-Vázquez, a local microbiologist and postdoctoral fellow at the Center for Collaborative Research in Health Disparities (CCRHD–RCMI), University of Puerto Rico–Medical Sciences Campus. She discussed the role of the microbiota in cancer therapy and women's health as part of the Godoy lab core goals. The session also featured additional short talks and elevator pitches exploring the environmental and health implications of microbial life across diverse systems, including model organisms such as mice and flies, as well as turtles and humans.

At the heart of the symposium was a dedicated focus on the next generation of researchers. Student participation was not merely a secondary feature but a central element of the event, with trainees presenting research that spanned a vast array of topics. These presentations showcased both the breadth and depth of microbiome science, proving that student researchers are conducting high-level work that significantly contributes to the field's advancement. A roundtable on the future of microbiology, moderated by Dr. Filipa Godoy-Vitorino, including leading experts Maria Gloria Dominguez-Bello, Keith Crandall, Ana Maldonado-Contreras, Janet Jansson, and Martin J. Blaser—among the most highly cited researchers in microbiome science. The panel examined key studies shaping the field and emphasized a shift from simply cataloging microbial diversity to understanding microbial interactions and cooperative networks. Discussion highlighted the critical impact of early-life microbial diversity on metabolic and immune development, while acknowledging significant gaps that remain in fully understanding these processes. Looking ahead, the panel underscored the importance of integrating longitudinal sampling and standardized dietary data into clinical research and practice. They concluded that the next frontier lies in precision nutrition and mechanism-driven therapies, advancing from associative studies to a causal understanding of host–microbe interactions, and noted Puerto Rico's strong potential to become a hub and epicenter for microbiome research in the Caribbean.

The meeting also successfully highlighted and celebrated student achievement, with strong support from the Puerto Rico Society for Microbiologists (PRSM). Several trainees were recognized for outstanding scientific contributions through awards supported by both local and international organizations. In partnership with Applied Microbiology International, PRSM awarded complimentary memberships to students delivering the top oral and poster presentations. These memberships provide access to global scientific networks, professional development opportunities, and key research resources, supporting the advancement of early-career scientists. A notable strength of the event was the broad participation of trainees, who presented research spanning human health and environmental microbiome science, underscoring the field's interdisciplinary scope. In addition to recognizing current excellence, the symposium honored the historical foundations of microbiology in Puerto Rico by paying tribute to Dr. Américo Pomales-Lebrón, a pioneering scientist, chair of the Microbiology Department of the UPR School of Medicine and founding PRSM member whose work in infectious diseases helped shape the field on the island. In his honor, the PR-CMS presented a monetary award for the best overall oral student presentation. This recognition both commemorated his legacy and reinforced a

commitment to fostering the next generation of microbiome researchers, positioning Puerto Rico as an emerging leader in the field.

Conclusion

The establishment of the PR-CMS and the resounding success of this inaugural symposium marks a transformative moment for scientific discovery in the region. By integrating biodiversity research with host–microbe interaction studies and prioritizing trainee development, the Center has created a vital model for building scientific capacity in Puerto Rico. The insights gained from this meeting demonstrate that microbes are essential allies in global sustainability and that through continued collaboration and innovation, we can address critical challenges in human health, environmental protection, and food security.

Through keynote lectures, oral presentations, and poster sessions, the meeting highlighted the breadth of microbiome science—from clinical applications and cancer research to environmental microbiology and computational analysis. Importantly, it fosters cross-disciplinary dialogue and encourages the integration of diverse perspectives, reflecting the collaborative ethos of PR-CMS. Together, the COBRE PR-CMS and its associated scientific meeting embody a sustainable model for advancing microbiology research. By integrating infrastructure development, education, collaboration, and translational science, the Center not only addresses local health and environmental challenges but also contributes to global efforts in sustainable microbiology. Recent scientific meetings and symposiums—including international sustainable microbiology workshops and the 1st Microbiome Symposium of Puerto Rico and the Caribbean (2026)—highlight the increasing importance of microbiome science in advancing sustainability and innovation.

Looking toward the future, we are pleased to establish the Microbiome Symposium of Puerto Rico and the Caribbean as a recurring cornerstone of the region's scientific community. Beginning in 2026, the symposium will be held annually during the first week of December for an initial five-year period. This sustained commitment will provide a stable and inclusive platform for the dissemination of cutting-edge research, the strengthening of regional and international collaborations, and the continued development of scientific capacity in microbiome studies. By fostering interdisciplinary dialogue and supporting emerging investigators, the symposium will build on the legacy of excellence established by prior generations while adapting to the evolving challenges of the field. We anticipate that this growing community will play a central role in advancing microbiome science and positioning Puerto Rico and the Caribbean as key contributors to global research efforts.

Acknowledgments

The author sincerely thanks Applied Microbiology International for generously several sponsoring membership awards, and the Puerto Rico Society of Microbiologists (PRSM) for providing cash awards and membership to support student presentations at this event. We also express our gratitude to the sister university centers for their invaluable support in disseminating the event and fostering community engagement: the COBRE Center for Cancer Health Disparities (CePCHE), the COBRE Puerto Rico Center for Neuroplasticity, the Puerto Rico Idea Network of Biomedical Research Excellence (PR-INBRE), the Alliance for Clinical and Translational Research (Alliance), the Research Centers in Minority Institutions (RCMI), and the Puerto Rico E-RISE "Blueprint of Life." During the preparation of this work, the author used Claude Version 1.18286.0 to correct grammatical and typographical errors.

Author contributions

Filipa Godoy-Vitorino (Conceptualization [lead], Funding acquisition [lead], Project administration [lead], Resources [lead], Software [lead], Supervision [lead], Visualization [lead], Writing – original draft [lead], Writing – review & editing [lead]).

Conflicts of interest

The author declares no competing financial interests that could influence the work reported in this paper. She declares she is the organizer of the event and the principal investigator of the COBRE PR-CMS.

Funding

This article and the event were supported by the Institutional National Institute of General Medical Sciences of the National Institutes of Health (NIGMS-NIH) PR-CMS, award #1P20GM156713.

Data availability

Data sharing is not applicable to this article as no new datasets were generated or analyzed during the current study.

References

[Editorial] Culturing microbiome therapeutics with big data. *Nat Biotechnol* 2026;**44**:161–2. https://doi.org/10.1038/s41587-026-03036-0.

Baquero F, Nombela C. the microbiome as a human organ. *Clin Microbiol Infect* 2012;**18**:2–4. https://doi.org/10.1111/j.1469-0691.2012.03916.x.

Burrows NR, Hora I, Geiss LS *et al.* Incidence of end-stage renal disease attributed to diabetes among persons with diagnosed diabetes—United States and Puerto Rico, 2000–2014. *MMWR Morb Mortal Wkly Rep* 2017;**66**:1165–70. https://doi.org/10.15585/mmwr.mm6643a2.

Corral López R, Bonachela JA, Dominguez-Bello MG *et al.* Imbalance in gut microbial interactions as a marker of health and disease. *Science* 2026;**391**:890–5. https://doi.org/10.1126/science.ady1729.

Domingues C, Cabral C, Jarak I *et al.* The debate between the human microbiota and immune system in treating aerodigestive and digestive tract cancers: a review. *Vaccines (Basel)* 2023;**11**:492. https://doi.org/10.3390/vaccines11030492

Dominguez-Bello MG, Godoy-Vitorino F, Knight R *et al.* Role of the microbiome in human development. *Gut* 2019;**68**:1108–14. https://doi.org/10.1136/gutjnl-2018-317503.

Gilbert JA, Peixoto RS, Scholz AH *et al.* Launching the IUCN Microbial Conservation Specialist Group as a global safeguard for

microbial biodiversity. *Nat Microbiol* 2025;**10**:2359–60. https://doi.org/10.1038/s41564-025-02113-5.

Godoy-Vitorino F, Méndez-Lázaro P, Bolaños-Rosero B *et al.* Environmental exposures, microbiome dynamics and chronic disease risk in climate-vulnerable regions: interdisciplinary perspectives from Puerto Rico. *Front Public Health* 2026;**14**:1807779. https://doi.org/10.3389/fpubh.2026.1807779.

Godoy-Vitorino F, Stewart L. The first microbiome symposium of Puerto Rico and the Caribbean—new success for the COBRE Center for Microbiome Sciences. *Themicrobiologist*. UK: Applied Microbiology International Magazine, 2026. https://www.the-microbiologist.com/careers/-the-first-microbiome-symposium-of-puerto-rico-and-the-caribbean-new-success-for-the-cobre-center-for-microbiome-sciences/8972.article

Godoy-Vitorino F. Strengthening integrative microbiome research through regional leadership. *Int J Environ Res Public Health* 2025;**22**:1322. https://doi.org/10.3390/ijerph22091322.

Godoy-Vitorino F. Solutions to expand microbiome sciences in the Caribbean region: an insider's perspective. *Trends Microbiol* 2025a;**33**:475–8. https://doi.org/10.1016/j.tim.2024.12.005.

Handelsman J, Rondon MR, Brady SF *et al.* Molecular biological access to the chemistry of unknown soil microbes: a new frontier for natural products. *Chem Biol* 1998;**5**:R245–249. https://doi.org/10.1016/S1074-5521(98)90108-9.

Handelsman J, Wackett LP. Ecology and industrial microbiology: microbial diversity—sustaining the Earth and industry. *Curr Opin Microbiol* 2002;**5**:237–9. https://doi.org/10.1016/S1369-5274(02)00331-4.

Kratz JC, Wang H, Si F *et al.* Multi-timescale adaptation and emergent learning in single bacterial cells. *PRX Life* 2026;**4**:14. https://doi.org/10.1103/5zbg-8vll

Krueger PM, Coleman-Minahan K, Rooks RN. Race/ethnicity, nativity and trends in BMI among U.S. adults. *Obesity (Silver Spring)* 2014;**22**:1739–46. https://doi.org/10.1002/oby.20744.

Maglione G, Zinno P, Tropea A *et al.* Microbes' role in environmental pollution and remediation: a bioeconomy focus approach. *AIMS Microbiol* 2024;**10**:723–55. https://doi.org/10.3934/microbiol.2024033.

marketsandmarkets Markets and Markets Human Microbiome Market—Global Forecast to 2029. https://www.marketsandmarkets.com/Market-Reports/human-microbiome-market-37621904.html (4 July 2026, date last accessed).

Miller KD, Goding Sauer A, Ortiz AP *et al.* Cancer statistics for Hispanics/Latinos, 2018. *CA Cancer J Clin* 2018;**68**:425–45.

Ortiz AP, Hebl S, Serrano R *et al.* Factors associated with cervical cancer screening in Puerto Rico. *Prev Chronic Dis* 2010a;**7**:A58.

Ortiz AP, Soto-Salgado M, Calo WA *et al.* Incidence and mortality rates of selected infection-related cancers in Puerto Rico and in the United States. *Infect Agent Cancer* 2010b;**5**:10. https://doi.org/10.1186/1750-9378-5-10.

Pérez CM, López-Cepero A, Almodóvar-Rivera I *et al.* Cardiovascular health among young men and women in Puerto Rico as assessed by the life's essential 8 metrics. *J Am Heart Assoc* 2024;**13**:e035052. https://doi.org/10.1161/JAHA.124.035052.

Research GV. Microbiome Analysis Market Size, Share & Trends Analysis Report, by Product & Services, by Technology, by Application, by End Use, by Region, and Segment Forecasts, 2025–2030. 2025. https://www.grandviewresearch.com/industry-analysis/microbiome-analysis-market-report (4 June 2026, date last accessed).

Reynoso-García J, Miranda-Santiago AE, Meléndez-Vázquez NM *et al.* A complete guide to human microbiomes: body niches, transmission, development, dysbiosis, and restoration. *Front Syst Biol* 2022;**2**:951403. https://doi/org/10.3389/fsysb.2022.951403

Rivera-Gastón FA, Umpierre-Catinchi S, Ramos-Cartagena JM *et al.* Treatment interruptions and mortality among Puerto Rican women with gynecologic cancers in Puerto Rico after hurricanes Irma and Maria: a retrospective cohort study. *Disaster Med Public Health Prep* 2024;**18**:e105. https://doi.org/10.1017/dmp.2024.108.

Rosenberg E, Zilber-Rosenberg I. *Microbiotas are Transmitted Between Holobiont Generations. The Hologenome Concept: Human, Animal and Plant Microbiota*. Cham: Springer, 2013. https://doi.org/10.1007/978-3-319-04241-1

Sepúlveda-Rivera V, Olivieri-Henry G, Morales-González H *et al.* Gut microbiota distinguishes aging hispanics with Alzheimer's disease: associations with cognitive impairment and severity. *Sci Rep* 2025;**15**:28505. https://doi.org/10.1038/s41598-025-13262-2.

Whitaker WR, Russ ZN, Stanley Shepherd E *et al.* Controlled colonization of the human gut with a genetically engineered microbial therapeutic. *Science* 2025;**389**:303–8. https://doi.org/10.1126/science.adu8000.

Yu W, Qu H, Wang S *et al.* From microbiomes to predictive ecosystems: challenges and opportunities in artificial intelligence-based approaches. *Lancet Microbe* 2026:101428. https://doi.org/10.1016/j.lanmic.2026.101428.

Zhang Y, Ishikawa M, Jiang N *et al.*. Fermentation-based strategies for the feed industry: nutritional augmentation, environmental sustainability. *Fermentation* 2026;**12**:103.https://doi.org/10.3390/fermentation12020103.

Zhou T, Zhao F. AI-empowered human microbiome research. *Gut* 2026;**75**:1432–46. https://doi.org/10.1136/gutjnl-2025-335946.

Received: 12 May 2026. **Revised:** 4 July 2026. **Accepted:** 7 July 2026