Microbes and Climate Change: A Research Prospectus for the Future
Journal of Industrial Microbiology and Biotechnology

Editor-in-Chief: Yi Tang

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Newsworthy

Congress Passes Spending Package with Cuts to Science

Last week, legislators passed a six-bill spending package with bipartisan support providing significant funding cuts or nearly flat budgets for most science agencies in fiscal year (FY) 2024.

The “minibus,” which was passed more than 5 months into FY 2024, included the Interior-Environment, Energy-Water, Agriculture, Commerce-Justice-Science, Military Construction-Veterans Affairs, and Transportation-Housing and Urban Development spending bills. Science related highlights from the $459 billion package include:

The National Science Foundation (NSF) received a notable funding cut of 8.2 percent relative to its total budget of $9.9 billion in FY 2023. In total, lawmakers provided $9.06 billion for the science agency, of which $7.2 billion (-8.3 percent) was allocated for its Research and Related Activities account. The NSF allocation falls $2.3 billion short of President Biden’s request and $6.6 billion below the CHIPS and Science Act authorization for FY 2024.

The Department of Energy (DOE) Office of Science was among the few agencies that received a slightly increased budget in FY 2024, although the boost does not allow DOE to keep up with inflation. The office will receive $8.24 billion in total, a small increase of 1.7 percent over FY 2023. Much of that increase will go to Basic Energy Sciences, which received a 3.6 percent bump. The Biological and Environmental Research account will receive $900 million, resulting in a 1 percent cut. Budget for the Advanced Research Projects Agency-Energy (ARPA-E), which supports high risk high reward research, will shrink by 2 percent.

The National Oceanic and Atmospheric Administration was allocated $6.3 billion, a small increase of nearly 2 percent over FY 2023. However, the agency’s Office of Oceanic and Atmospheric Research saw its funding drop from $687 million in FY 2023 to $656 million.

The National Aeronautics and Space Administration received a 2 percent budget cut overall, with its Science account shrinking by 6 percent to $7.3 billion.

The National Institute of Standards and Technology will see its overall budget slashed by 10 percent to $1.46 billion, while funding for its Science and Technical Research and Services account will increase from $953 million in FY 2023 to $1.080 billion in FY 2024.

The Environment Protection Agency’s budget will shrink by roughly $1 billion dollars (or 10 percent) to $9.2 billion, with its Science and Technology account receiving a 5.5 percent cut to $758 million.
The U.S. Geological Survey received a nearly 3 percent reduction in its budget. Overall, the agency will receive $1.45 billion, of which $300 million (-2.5 percent) will be directed to its Ecosystems Mission Area.

Other Interior agencies will also see their budgets shrink. The National Park Service received $3.3 billion (-4.3 percent), the Bureau of Land Management was funded at $1.4 billion (-5.4 percent), and the U.S. Fish and Wildlife Service received $1.7 billion (-3 percent).

Overall research funding at the U.S. Department of Agriculture will remain flat at $3.5 billion. The Agriculture Research Service will receive a small increase of 1.4 percent to $1.84 billion, while the National Institute of Food and Agriculture will get a 1.3 percent cut to $1.7 billion. The Agriculture and Food Research Initiative will be funded at $445 million, roughly $10 million below the FY 2023 enacted level.

The Smithsonian Institution will receive $1.1 billion, nearly 5 percent below FY 2023. The salaries account for the National Museum of Natural History will receive level funding of $55.2 million.

The Coalition for National Science Funding (CNSF) - an alliance of over 140 professional organizations, scientific societies, universities, and businesses that advocate for NSF - expressed disappointment over the FY 2024 funding for NSF and called on Congress to allocate more resources to the Commerce-Justice-Science spending bill in future appropriations cycles to allow the agency’s budget to grow. CNSF, also urged lawmakers to include NSF funding in any supplemental packages focused on defense and national security.

Lawmakers are now racing to finish and pass the remaining six appropriations bills that fund the rest of the government, including the National Institutes of Health, by the March 22 deadline. The White House released the President’s budget request for FY 2025 March 11.
**NSF Releases Updated Scientific Integrity Policy**

On February 12, the National Science Foundation (NSF) issued its revised scientific integrity policy, in response to a 2021 presidential memorandum (https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/memorandum-on-restoring-trust-in-government-through-scientific-integrity-and-evidence-based-policymaking/) urging science agencies to strengthen their integrity policies.

NSF last updated its scientific integrity policy in 2019. The latest version (https://www.nsf.gov/pubs/2024/nsf24007/nsf24007.pdf) aligns with the National Science and Technology Council’s (NSTC) Framework for Federal Scientific Integrity Policy and Practice (https://www.whitehouse.gov/wp-content/uploads/2023/01/01-2023-Framework-for-Federal-Scientific-Integrity-Policy-and-Practice.pdf), released last January, and adopts the following definition of scientific integrity provided by the NSTC:

“Scientific integrity is the adherence to professional practices, ethical behavior and the principles of honesty and objectivity when conducting, managing, using the results of and communicating about science and scientific activities. Inclusivity, transparency and protection from inappropriate influence are hallmarks of scientific integrity.”

The updated policy also provides additional information on the specific roles within NSF responsible for upholding scientific integrity, specifies the scope of the policy’s applicability, and outlines the measures to be taken in case of non-compliance or allegations of scientific misconduct.
Newsworthy

Senate Confirms Assistant Secretary of Defense for Science and Technology

The Senate has confirmed Dr. Aprille Joy Ericsson as the inaugural Assistant Secretary of Defense for Science and Technology. With three decades of experience at the National Aeronautics and Space Administration (NASA), Ericsson most recently served as the New Business Lead at the Goddard Space Flight Center. President Biden nominated her for the position in September 2023.

Ericsson's responsibilities will include overseeing the Small Business Innovation Research (SBIR) program and shaping policies affecting defense STEM workforce, labs, and test infrastructure, with a focus on four of the 14 technology areas considered critical by DOD, namely quantum science, advanced materials, biotechnology, and next-generation wireless networks.

This appointment is part of a Department of Defense (DOD) reorganization, replacing three deputy chief technology officer roles with equivalent assistant secretary positions that require Senate confirmation. The nominees for the other two assistant secretary positions are yet to be announced.

Open Call: SIMB is seeking a new Editor in Chief for SIMB News

The term of the current SIMB News Editor-in-Chief, Melanie Mormile, is concluding as of August 2024. We thank Melanie for her service to the Society. SIMB is actively seeking a new Editor-in-Chief (EIC) for SIMB News through an open call to the SIMB membership. All are welcome to apply.

How to apply/Process:

Provide a letter of intent that includes some ideas you would bring to SIMB News as EIC along with a CV to the Publication Committee Chair, Hal Alper (halper@che.utexas.edu). All applications will be reviewed by the Publication Committee to select the next EIC who will overlap on 2 issues with the current EIC.
James M. Tiedje, Mary Ann Bruns, Arturo Casadevall, Craig S. Criddle, Emiley Eloe-Fadrosh, David M. Karl, Nguyen K. Nguyen, and Jizhong Zhou

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Climate change is the most serious challenge facing humanity. Microbes produce and consume three major greenhouse gases—carbon dioxide, methane, and nitrous oxide—and some microbes cause human, animal, and plant diseases that can be exacerbated by climate change. Hence, microbial research is needed to help ameliorate the warming trajectory and cascading effects resulting from heat, drought, and severe storms. We present a brief summary of what is known about microbial responses to climate change in three major ecosystems: terrestrial, ocean, and urban. We also offer suggestions for new research directions to reduce microbial greenhouse gases and mitigate the pathogenic impacts of microbes. These include performing more controlled studies on the climate impact on microbial processes, system interdependencies, and responses to human interventions, using microbes and their carbon and nitrogen transformations for useful stable products, improving microbial process data for climate models, and taking the One Health approach to study microbes and climate change.
Introduction

Climate change is now widely recognized as the most serious contemporary challenge for humanity. Indeed, a new report from the Intergovernmental Panel on Climate Change (IPCC) states that the situation has grown even worse, with 3.3 billion of the world’s population highly vulnerable to climate change, and that current unsustainable development patterns are increasing exposure of ecosystems and people to climate hazards (1). We can engage in solutions to change from the current trajectory as individuals, as action leaders for society, and as microbiologists with domain expertise. Microbes have prominent roles related to climate change. They produce and consume the three dominant gases that are responsible for 98% of the increased warming: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

While microbes are sources of these gases as part of natural processes, some of their recent increase is due to changes in human activities that result in microbes having more access to carbon and nitrogen that they convert into these three products. Our actions can be to understand and then implement practices that mitigate microbial activities to decelerate the production of these gases, such as reduced soil tillage, or use microbes to repurpose waste carbon or nitrogen into useful and stable products.

Fortunately, microbes also consume these three gases and do so when their growth conditions favor the use of these gases as resources, namely, photo- or chemoautotrophic growth (cyanobacteria, algae, nitrifiers), methanotrophy (methane oxidizers), and nitrous oxide reduction (denitrifiers). The environmental conditions and interactions of these microbes, often influenced by humans, determine whether they carry out production or consumption of these gases. In some cases, we can manage conditions to favor microbial consumption of these gases.

Microbes that produce and consume these gases live in so many different habitats, and these habitats have very different spatial scales and process times, making it a challenge to quantify their contributions and changes in response to environmental conditions, e.g., warming, storms, and drought. Three ecosystem types pose three distinct assessment and management challenges: terrestrial, ocean, and urban. Improved measurements and models are keys to determine greenhouse gas (GHG) fluxes in these different systems, at different scales, and their patterns of change in response to human actions.

Beyond microbes’ direct role with GHG, other microbes with pathogenic potential respond to climate change by having their ranges extended via insect vectors, flooding, or severe storms, and hosts affected by heat or drought may become more vulnerable, whether they be human, animal, or plant. Among the complex climate change phenomena are cascading effects that can be difficult to manage or even predict. For example, a severe storm from more extreme weather can cause sewage overflow that disperses and mixes pathogens and problematic antibiotic resistances into waterways, which can greatly expand the pathogenic microbes’ range and their chance for horizontal gene exchange. This can result in multidrug-resistant pathogens reaching drinking water, food crop irrigation, or swimming beaches.

Interdependent Dynamic of Climate Change and Microbes in Different Ecosystems

Terrestrial environments

Although soil microbes play vital roles in regulating Earth’s climate by controlling the turnover of soil organic matter (SOM), the largest organic carbon pool in the terrestrial biosphere, our understanding of how climate change affects soil microbes and how they regulate Earth’s climate is very limited (2). Various studies based on topsoil demonstrate that climate warming leads to divergent succession of grassland microbial communities, accelerates microbial temporal scaling, reduces microbial diversity, increases network complexity and stability, stimulates soil respiration and SOM decomposition, lowers respiratory temperature sensitivity, and shows no effects on soil carbon storage (3–9). Despite these core discoveries, it is not clear whether such experimental observations are broadly applicable to other terrestrial biomes and over longer ecological time.

From both theoretical and empirical perspectives, it is expected that the impacts of climate change on soil microbes would vary substantially across different ecosystems, primarily due to the huge spatial heterogeneity of terrestrial ecosystems in climate, plant diversity and composition, soil physics, chemistry, soil microbial community composition and structure, and
evolutionary history. We also hypothesize that the effects of climate change on soil microbes will not show a linear increase or decrease over longer ecological times because ecosystems under natural settings are complex, their responses are nonlinear, and their dynamics are time dependent.

To search for general patterns of the feedback responses of microbes to climate change, microbe-centric, multifactor climate change experiments under realistic field settings are urgently needed across various ecosystems on different continents. This is because manipulated experiments are the most effective way to separate the effects of climate change factors from confounding environmental variations and allow us to quantify the responses and feedbacks of terrestrial ecosystems to anthropogenic perturbations (10). Although many manipulated climate change experiments in different ecosystems are available, they have been conducted at single sites and thus represent responses under only one set of site conditions. Also, nonsystematic soil sampling has been carried out in the majority of these sites because such experiments are often established as plant centric, which restricts destructive soil sampling. Consequently, information on the temporal dynamics of microbes in response to climate change is rarely available. Such microbe-centric experiments would allow us to examine the responses of different soil microbes (e.g., bacteria, archaea, fungi, protists, and viruses) and microfauna in both topsoil and subsoil to multiple climate change factors (e.g., warming, elevated CO2, drought, increased precipitation, nutrient addition, and their interactions). Such experiments would also allow us to collect systematic time-series soil samples (e.g., initially, weekly, monthly, seasonally, and yearly) and associated ecosystem process data (e.g., plant productivity, soil respiration, soil carbon dynamics, and nutrient status). These data are essential for advanced mathematical tools (e.g., generalized Lotka-Volterra modeling, empirical dynamic modeling, and deep learning) to predict their nonlinear dynamics and disentangle the underlying community assembly mechanisms, particularly the biotic interactions among different microbes, kingdoms (e.g., plants, soil fauna, and microbes), and their importance to ecosystem functioning.

To reduce experimental cost, such microbe-centric experiments should be leveraged with existing infrastructures such as university research stations, the National Ecological Observatory Network (NEON), and Long-Term Ecological Research (LTER), the last two of which are U.S.-based, continental-scale, complementary ecological research sites (11). Also, a global consortium should be established to coordinate research efforts by having identical/consistent experimental treatments, sampling protocols, and measurements (11, 12).

Finally, with reliable long-term systematic data on microbial dynamics and relevant ecosystem functional processes from representative ecosystems and environments worldwide, consensus patterns and possible general rules on the feedback responses of microbes to climate change can be obtained. Such information can
be incorporated into terrestrial ecosystem models and/or Earth system models (ESMs) to scale our understanding from individual sites to regional, continental, and global (6, 13).

Ocean environments

The global ocean covers ~70% of the planet to an average depth of 4,000 m. Oceanic habitats are physically and chemically diverse, with greater than 50 biomes from the tropics to the poles and from the sunlit surface layer to the dark abyss (14). Each biome supports a unique microbe-based ecosystem that forms a complex adaptive system (15), with emergent processes and services that are inextricably linked to habitat variability. With nearly 4 billion years of evolutionary history, oceanic microbes have adapted to a constantly changing planet and have developed physiological plasticity and resiliency that may confer some protection against human induced climate change. However, the current rates of climate change resulting from heat-trapping greenhouse gases are higher than at any other time in Earth’s history and, therefore, represent a great threat to the microbial inhabitants of the sea.

Oceans play a critical role in global climate dynamics. They absorb >90% of the heat accumulating in the atmosphere and have absorbed ~25% of the excess carbon dioxide since the industrial revolution, the latter leading to ocean acidification. A warmer, more stratified ocean also leads to deoxygenation, and all three threats are consequences of excess carbon dioxide emissions from human activities (16). In addition, enhanced stratification will accelerate the pace of future warming. In the past century, and especially in the past two decades, marine heat waves have been observed with increasing frequency and duration in all major ocean basins (17, 18), and they are expected to increase due to anthropogenic climate change. These prolonged periods (months) of anomalously high sea surface temperature over large regions (thousands of kilometers) have led to mass mortalities of marine life, including photosynthetic microorganisms. Rapid habitat changes, like those resulting from marine heat waves, may threaten global biodiversity and force oceanic habitats into alternate, less desirable ecosystem states with a lower overall resiliency for future change.

Because the ecological impacts of ocean warming and acidification are essentially irreversible on time scales of centuries (19), there is a scientific imperative to develop a comprehensive understanding of microbes and climate change. Due to its global expanse, most of the ocean is relatively inaccessible, so direct measurements of climate change impacts on microbial processes are limited to only a few long-term ocean observatories (20) that will facilitate a more comprehensive understanding of climate change microbial oceanography. These open-ocean sentinels provide the observational data sets that are required for the unambiguous detection of climate change impacts and for the development of Earth system models to predict the state of future oceans. New biogeochemical models will need to consider the resiliency of diverse microbial communities, as well as the interactions of multiple drivers, to accurately predict the impacts of climate change. In this regard, observations and perturbation experiments using natural microbial communities are essential since unispecies laboratory studies will never capture the adaptation and evolutionary potentials of sea microbes (21). Detailed studies of the microbial ecology of marine
heat waves would be an excellent component of this future research prospectus.

Finally, the relatively new discipline of intervention ecology is based on the premise that humans may be able to alter the direction of climate change to facilitate the restoration of natural ecosystems currently under threat (22). A recent National Academies report on the feasibility, cost, and potential impacts of ocean-based carbon dioxide removal provides a basic research blueprint for the restoration of marine ecosystems and the services they provide (23).

**Urban environments**

The rise of megacities with large carbon footprints is a driving force for feedback loops that exacerbate the negative impacts of climate change, such as disease outbreaks. An attractive economic response is conversion of greenhouse gases into feedstocks within a circular economy, where resources recovered from waste become feedstocks for renewable energy and valuable products. Waste streams are also an information resource that can be recovered, deciphered, and used to inform public health decisions.

(i) **Managing landfill methane emissions**

As endpoints for municipal solid waste, landfills must be designed and vigilantly monitored to prevent the escape of methane. Monitoring and up-to-date models are needed to ensure that rates of methanogenesis do not exceed the rates of methane oxidation. Aboveground methanotrophic bioreactors can potentially convert recovered methane into valuable products, such as single cell protein or bioplastics, while also generating methanotrophic biomass that can be incorporated into landfill cover soil. Challenges to the design and operation of such bioreactors are mass transfer limitations due to the low solubility of methane and oxygen, safe management of methane/oxygen mixtures, and provisions for heat management (24).

(ii) **Sequestering carbon via methane**

In urban environments, organic carbon is transported via sewers and trucks to wastewater treatment facilities and landfills, respectively. Humans and domestic animals produce vast quantities of fecal matter, projected to be 4.6 gigatons of dry waste globally/year by 2030, with animals producing six times that of humans (25). Other urban carbon streams include food waste (~0.5 gigatons of carbon [GtC]/year) and paper/cardboard wastes (0.2 GtC/year). Assuming that collection of these streams and their conversion to methane (waste organic composition: 50% carbon, 80% biodegradable, 90% converted to methane) yields 2.2 GtC as CH4 per year. The potential for carbon sequestration from such streams by pyrolytic conversion of methane to elemental carbon is thus on par with NOAA estimates of the global carbon land sink (2.6 GtC/year) ([https://gml.noaa.gov/outreach/behind_the_scenes/gases.html](https://gml.noaa.gov/outreach/behind_the_scenes/gases.html)). Recent advances in anaerobic secondary treatment of wastewater have demonstrated a net energy-positive operation in temperate climates (26). Central to this technology is the retention of acetoclastic methanogens attached to activated carbon particles and the use of ultrafiltration membranes to filter water and retain organic particles for hydrolysis and production of additional methane. Even more methane can be produced by feeding hydrogen and CO2 to hydrogenotrophic methanogens. The combination of high-rate methanogenesis and methane pyrolysis could enable recovery of carbon as graphene for a diverse range of applications in urban environments (27).

(iii) **Nitrous oxide mitigation**

Nitrous oxide is a potent greenhouse gas and the most significant ozone-depleting agent in the stratosphere. Under aerobic conditions, it is a by-product of ammonia oxidation mediated by ammonia-oxidizing archaea and bacteria. Under denitrifying (anoxic) conditions, N2O is produced by coupling NO reduction to oxidation of electron donors, such as Fe (II), sulfide, and sulfur, and organics. Research is needed to identify and quantify N2O production and consumption mechanisms within critical environments (estuaries, soils, landfills, and wastewater bioreactors). In conventional wastewater treatment plants designed for N removal, peak N2O emissions occur in low-oxygen transition regions. Strategies are needed to mitigate these emissions and to ensure reduction to N2. Possible solutions could include stripping of dissolved N2O into the gas phase and its use as a co-oxidant with O2 of biogas methane. Another strategy is to provide
electron donors sufficient for efficient denitrification and to ensure that species expressing N2O reductase are present. Potentially valuable metrics would include the relative ratios of gene expression for NO reduction to N2O (qnor + cnorB) (28) and for N2O reduction to N2 (nosZ) (29). To prevent N2O emissions, replacement of conventional aerobic treatment systems with energy-efficient anaerobic systems could enable the beneficial use of the effluent ammonia as fertilizer, offsetting demand for the Haber-Bosch process.

(iv) Information from wastewater

Climate change and its associated heat, flooding, diminished water quality, and disease vectors can bring increased disease transmission, particularly in densely populated environments. Monitoring of pathogens in domestic wastewater, as revealed by the COVID pandemic, is proving to be a valuable tool for monitoring disease transmission. Genetic tracking of SARS-CoV-2 and its variants correlates well with clinical data. Such monitoring can potentially enable early detection of bacterial or viral disease outbreaks, enabling better informed and more timely decision-making. Antibiotic resistance genes (ARGs) can also be measured. For pathogens and ARGs, climate change is thus a “threat multiplier” that drives dispersal of both pathogens and ARGs (30). Research is needed to determine how effective and extensive pathogen surveillance can be in managing disease outbreaks, including those driven by climate change.

Climate Change and Microbes in Public Health

Microbes are much more adaptable and opportunistic than we humans. As microbes respond to climate change, their invisibility in our daily lives obscures their potential to increase the cost and burden of infectious and chronic diseases. Although the vast majority of bacteria, viruses, and fungi do not cause disease, climate change has led to geographic shifts of all organisms, resulting in unprecedented interactions among hosts, vectors, and microbes. Warmer temperatures, droughts, and weather extremes have led to the emergence of new pathogens, such as Candida auris, which may have become thermally adapted for growth in the human body (31). Other fungi previously thought to be nonpathogenic are now increasingly implicated in the incidence of fungal diseases that are antibiotic resistant and highly invasive (32).

Warmer temperatures affect the densities of airborne microbes and can accelerate their long-distance transport (33). Higher temperatures and environmental stresses can also alter human and animal physiologies and defenses against pathogens. Skin and gut microbiomes may become less protective. Exposures to zoonotic pathogens from wildlife, termed “spillover,” carry an additional risk of “spillback,” where the pathogen is reintroduced from humans to animals and undergoes mutations to pose new disease threats. Interactions between microbes and weakened hosts may induce bacteria to switch from “normal” to “persister” subpopulations as a “bet-hedging” strategy, resulting in antibiotic resistance or niche expansion (34). Diverse pathogenic microorganisms possess genetic elements that can be exchanged to increase infectivity and facilitate colonization of new niches. Increased monitoring and research on pathogen responses to climate change and their impacts on host-pathogen interactions will be crucial for mitigating climate change impacts on public health.

Greater public awareness of microbes’ opportunistic adaptability should lend more urgency to efforts to combat climate change. Better public understanding of the linkage between climate change and health threats could be assisted by the promotion of pathogen surveillance. Wastewater surveillance systems, such as those used to detect COVID-19, could continue to be enhanced. Real-time water or air monitoring programs for infectious agents could also be planned for implementation when climate models predict regional temperature shifts. A recent report by the IPCC now states with “high confidence” that climate-sensitive aquatic pathogens like Vibrio spp. have increased regional risks of water and foodborne disease. Data and documentation from surveillance efforts, which enabled the development of tools like the Vibrio Map Viewer in response to the northern expansion of Vibrio in Atlantic waters, will enable federal agencies to provide stronger guidance and early warnings of public health threats.

Publicity and outreach about the human microbiome could spur promotion of public awareness of microbial health threats from climate change (35). Education and research based on a more holistic, “One Health” way of thinking could help people acknowledge microbial threats and apply this knowledge to public health surveillance and
protection. Explicit inclusion of “microbes” in definitions of “One Health,” for example, would affirm the need to recognize microbes as integral components of our environment and forces to be reckoned with. Currently, no common definitions of “One Health” include the word “microbes” (36). Perhaps they should, so that microbial awareness can be sustained to keep public health protection as fundamental motivation for combating climate change.

Microbes in Models: Bridging the Gap Through Innovation

Metagenomics and other omics technologies hold wide potential to provide the necessary data inputs to inform climate models and pathogen surveillance efforts under global warming scenarios (37). The recovery of microbial genomes directly from a given environment through large-scale sequencing has provided a sweeping view into microbial diversity and functional potential (38, 39). However, this potential has yet to be translated into applications for climate science and addressing the pressing impacts of climate change. To facilitate this translation, bold and innovative actions are needed to expand the toolkit of high-throughput measures of microbial functions and metabolic rates in situ, to develop and advance mathematical modeling with considerations of microbial scale, and to fundamentally shift data infrastructure and data sharing practices to holistically support rapid dissemination, use, and knowledge extraction from microbiome data.

Metabolic dynamics and phenotypic properties of microbial communities are poorly understood. This knowledge gap has limited the incorporation of microbial parameters into climate models, despite microbes’ mediation of key steps in all biogeochemical cycles. An understanding of how microbes actively cycle nutrients, interact across species, and respond to disturbances (e.g., fires or extreme weather events) could offer insights into quantifying metabolically relevant features. New molecular assays to measure metabolic rates in situ and in high-throughput resolution could transform how we monitor microbiomes. Similarly, new experimental and statistical approaches to associate genomes from microbial isolates to community-level metabolic phenotypes hold the potential to leverage metagenome data to infer dynamic processes (40). Further, hypothesis-driven, mechanistic studies will support a predictive understanding of how microbes impact ecosystem processes beyond a descriptive framework (41).

The scale at which microbes operate presents another challenge for climate modeling. Microbes naturally function at the submicrometer scale yet collectively are estimated to contribute over 90 GtC (42). There is a pressing need to develop a theoretical framework and mathematical techniques to explicitly associate spatial, temporal, and phylogenetic factors with microbial scale and community assembly. Microbial community assembly is understood to be a mix of deterministic processes (e.g., selective pressures imposed by abiotic and species interactions) and stochastic processes (e.g., neutral dispersal, colonization, or extinction events), with different mechanisms dominating at different scales. Developing new mathematical techniques to delineate processes impacting assembly and scale will enable translation of microbial metabolic dynamics to ecosystem and global models. Furthermore, these new mathematical techniques can inform what microbiome measurements are necessary for long-term environmental monitoring, thereby forming a set of “microbial indicators” of climate change.

Paramount to advancing innovative new tools is the critical need for data infrastructure and support for open data sharing practices. Long-term research programs have made significant environmental monitoring investments, including the U.S. Department of Agriculture (USDA) Long-Term Agroecosystem Research (LTAR) Network, the National Science Foundation (NSF) LTER Program and NEON, the Department of Energy (DOE) Next-Generation Ecosystem Experiments (NGEE)-Arctic and Spruce and Peatland Responses Under Climatic and Environmental Change (SPRUCE), and the International Consortium of Ocean Observatories (Ocean Sites). All of these research programs include microbiome measurements and experimentation, yet the lack of coordination for standardized methods and data streams across these facilities presents unnecessary barriers to integrate across studies and ecosystems. An immediate path forward would be to create a framework for coordinated microbiome protocols and data sharing infrastructure, analogous to what was established as part of the international, multidisciplinary Tara Oceans project (43). By taking swift and immediate action to standardize
microbiome data generation, the research community can more readily provide the necessary data inputs for climate models. A data-driven approach and robust shared data infrastructure will advance integration of microbes into climate models, providing improved climate projections and potentially new mitigation strategies that will invariably benefit society.

**Conclusion**

There is overwhelming evidence that microbes contribute to climate change. Perhaps the clearest example of how microbial life contributes to atmospheric changes was the oxygenation of our atmosphere in the early epochs of Earth’s geologic history. Today, microbes continue to be the major players in ongoing atmospheric changes at all levels, including terrestrial, oceanic, and urban areas. From the warmth of cow rumen to the melting soils of permafrost regions, the symbiotic coral system in the oceans, and the carbon wastes of our cities, microbial metabolism is producing and absorbing gases that can affect climate. Hence, microbial contributions to the carbon flows to and from the atmosphere must be considered in all models of climate change. The microbial world could become a critical ally in the efforts to ameliorate the consequences of human emissions of GHGs, since it should be possible to promote changes in microbial activities in some or maybe many environments to consume more and produce less gases that contribute to the warming of the atmosphere.

The trio of relationships between microbes, climate change, and human well-being is in need of more research and collaboration across the disciplines to address complex issues. As microbes adapt to a warming world, they can have direct effects on human well-being through altered patterns of host-microbe interactions, changed microbial biogeography, and altered terrestrial, aquatic, and urban microbiology. It is important that we move beyond the descriptive and correlational studies of microbiomes. Instead, the field needs more statistically defensible, hypothesis-driven, mechanistic studies to advance our understanding of the roles of microbes in climate change and their responses to environmental drivers, whether they be natural or by human intervention. Because the GHGs have different residence times in the atmosphere, heat trapping capacities, and amenability to (microbial) interventions, perhaps this should be considered in setting research priorities (44). The research community needs innovative tools, resourceful research networks and infrastructures, integrated climate models, and interoperable data and framework to advance our knowledge (45). Moreover, efforts to inform policies and educate the public need to take place concurrently to increase awareness and gather support (45). As an example, the American Academy of Microbiology is leading the effort in building a 5-year scientific portfolio to focus on these important aforementioned issues. Consequently, microbiologists must redouble efforts to tackle multiple fronts to ensure that all discussions about climate change include the contributions of microbial life to these processes.

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Recap of 2023 Recent Advances in Fermentation Technology (RAFT® 15)

by Kat Allikian, Program Chair

It was a privilege to work with so many industry experts to create the program for RAFT® 15, and I am thrilled that the conference went so well. Devastatingly, during my journey to Florida, I contracted a very mild case of COVID despite faithfully masking and was consequently asked not to attend. I am still heartbroken to have missed the conference. Sessions conveners, exhibitors, and attendees alike have relayed their positive impressions of RAFT® 15.

Over 300 registrants from industry, academia, and government gathered in Naples, FL for RAFT® 15, a great showing only one year after the delayed (and hurricane-plagued!) RAFT® 14. Nearly one third of the attendees travelled internationally, making RAFT® 15 a truly global conference.

Dr. Christopher Guske of D2 Biotech Consulting kicked off RAFT® 15 with the keynote address. He shared lessons learned, insights gained, and even a bit of prognostication from over three decades of experience in industrial fermentation and biotechnology.
The program consisted of six scientific sessions: “Next generation strain design: Looking beyond the lab;” “PAT for process insight, improvement, and automation;” “Process modelling for fermentation understanding and control;” “Scaling: Up and down and back again;” “Sustainability in fermentation;” and “The interplay between upstream and downstream processing.” In addition, two poster sessions gave attendees the opportunity to engage in in-depth discussions with presenters and one another. Our round table discussion on “Net Zero: How the Fermentation Industry Gets There” was expertly convened and moderated. The topic was timely, after a year of record-breaking heat across the globe.

The RAFT® 15 exhibition hall was sold out, with over 40 vendors and service providers on hand to discuss their products and services with attendees. Six exhibitor showcases highlighted new technologies through focused presentations.

RAFT® 15 was possible only because of the support and work of so many organizations and people. I am very thankful to our sponsors for their support of RAFT 15: Ohly, Corteva Agrisciences, the Bioexpression and Fermentation Facility at the University of Georgia, Kuhner Shaker, and BioP2P Network. I give deep thanks to the SIMB team – particularly Tina Hockaday, Haley Cox, and Jennifer Johnson – who worked so diligently to make RAFT® a success. I could not have asked for a better team of session conveners, who leveraged their collective experience to bring together highly informative speakers from across the fermentation space. And finally, I am truly grateful to Daniel Dong, RAFT® 15 Program Co-Chair, for his support developing and running RAFT® 15.

Fermentation is a field that will keep growing in importance and complexity, and I have no doubt that the RAFT® conference series will continue to serve a vital role in our industry. Keep an eye out for information about RAFT® 16, which will be held in 2025 and for which Daniel Dong will serve as Program Chair.
46th Symposium on Biomaterials, Fuels and Chemicals (SBFC)

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Premeeting Workshop
Saturday, April 27, 2024
Bioprocess Analysis using Design of Experiments
Organized by Marcello Fidaleo

2024 Program

PROGRAM CHAIR

KEVIN SOLOMON, UNIVERSITY OF DELAWARE
2024 PROGRAM CO-CHAIR
BEN WOOLSTON, NORTHEASTERN UNIVERSITY

PAST PROGRAM CHAIR
CARRIE ECKERT, OAK RIDGE NATIONAL LABORATORY

KEYNOTE SESSION
The Bioenergy Research Center (BRC) program’s mission is to break down the barriers to actualizing a domestic bioenergy industry. The centers—each led by a DOE national laboratory or top university—take distinctive approaches toward the common goal of accelerating the pathway to improving and scaling up advanced biofuel and bioproduct production processes. We’ll hear from leaders of the four centers on recent accomplishments and discoveries.

MODERATOR: BRIAN H. DAVISON, CHIEF SCIENCE OFFICER, CENTER FOR BIOENERGY INNOVATION (CBI)

Keynote Speakers:
» Gerald Tuskan, Director and Chief Executive Officer, Center for Bioenergy Innovation (CBI)
» Timothy Donohue, Director, Great Lakes Bioenergy Research Center (GLBRC)
» Blake Simmons, Chief Scientific and Technology Officer, Joint BioEnergy Institute (JBEI)
» Andrew Leaky, Director, Center for Advanced Bioenergy and Bioproducts Innovation (CABBI)

TOPIC AREA 1
Biofuels, Bioproducts, and Synthetic biology

Topic Area Chairs:
Laura Jarboe - Iowa State University
Charles Foster - DSM
Rebecca Mickol - US NRL

SESSIONS:
» Lessons learned translating across scales: Panel discussion
» Evaluating the potential of emerging organisms
» Metabolic engineering for stable and robust microbial cell factories
» Adventures along the acetyl-CoA superhighway
» Holistic approaches to economic viability

TOPIC AREA 2
Alternative feedstocks and biosynthetic materials

Topic Area Chairs:
Ben Woolston - Northeastern University
Coralie Backlund – BETO

SESSIONS:
» Organic waste valorization
» Plastic deconstruction
» C1 metabolism
» Bio-based materials: New performance/process-advantaged biomaterials
» Bio-based materials: Engineered living materials

TOPIC AREA 3
Engineering and deconstruction of biomass

Topic Area Chairs:
Mike Ladisch - Purdue University
Lynn Wendt – INL

SESSIONS:
» Engineering bioenergy crops
» Biomass/lignin deconstruction
» Biomass active enzymes and cell free systems
» Integration and scale up for lignocellulosic biomass bioconversion

**SPECIAL TOPIC**

**Defining a New Vision for the Bioeconomy: The Funding Impact of New Reports**

Session Convener: Jay Fitzgerald – DOE-BETO

**SBFC Awards**

**Charles D. Scott Award**

An individual for outstanding research contributions in biotechnology for the production of fuels and chemicals.

» 2024 Recipient: Huimin Zhao, University of Illinois at Urbana-Champaign (UIUC)

**Bioeconomy Leadership Award**

An organization that has significantly advanced the development of a renewable resource-based fuels and chemicals economy.

» 2024 Recipient: LanzaTech

**Diversity Travel Awards**

» Emily Aicher, Purdue University
» Daniela Ruiz, Texas A&M University

**Student Poster Award**

Winners will be judged and selected onsite
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Boston, MA

August 4–7, 2024
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Registration and Housing
Registration Open: Early Deadline April 29
Housing Open: Rate $229 +taxes/fees
Abstract Submission Open: Contributed Deadline May 13

Premeeting Workshops
Sunday, August 4, 2024
Class sizes are limited, reserve now while there’s space!
» Fermentation Basics: Organized by Tim Cooper
» Bioprocess Analysis using Design of Experiments: Organized by Marcello Fidaleo
2024 Program

Program Chair

JOHN H. EVANS, VICE PRESIDENT, AB MAURI

Keynote Speaker

KIRSTY SALMON, VICE PRESIDENT FOR ADVANCED BIO AND PHYSICAL SCIENCES FOR LOW CARBON ENERGY, BP

Biocatalysis Sessions

TOPIC CHAIRS:
Aditya Kunjapur, University of Delaware
Ning Sun, Lawrence Berkeley National Laboratory
Ross Thyer, Rice University

» Cell-free and orthogonal biocatalysis
» Depolymerization and valorization of alternative feedstocks
» Enzyme engineering: strategies & applications
» Biocatalysis at scale
» Frontiers of chemistry

Cell Culture & Fermentation Sessions

TOPIC CHAIRS:
Chris Stowers, DSM-Firmenich
Keerthi Venkataramanan

» Challenges and successes in scale-up and scale-down of fermentation and downstream processing
» Unconventional biomanufacturing using alternative feedstocks and cell free systems
» Advancements in process development for biopharmaceuticals
» Applications of data analytics to accelerate fermentation and cell culture
» Advances and challenges in live microbes as products

Environmental Sessions

TOPIC CHAIRS:
Joshua Elmore, Pacific Northwest National Laboratory
Kirsten Hofmockel, Pacific Northwest National Laboratory
Kate Zhalnina, Lawrence Berkeley National Laboratory

» Genetically modified microbes in complex environmental and human microbiomes
» Sustainable biological production of inorganic materials
» Microbial nutrient cycling in agriculture and anthropogenic waste processing

Metabolic Engineering Sessions

TOPIC CHAIRS:
Nikhil Nair, Tufts University
Carrie Eckert, Oak Ridge National Laboratory
Jay Huenemann, Corteva Agriscience

» Synthetic biology in metabolic engineering
» Valorizing non-carbohydrate feedstocks
» Computational and systems approaches
» Biosynthesis I (commodity chemicals & biomaterials)
» Biosynthesis II (specialty chemical & food ingredients)

Natural Products Sessions

TOPIC CHAIRS:
Wenjun Zhang, UC Berkeley
Jason Crawford, Yale University
Giovanna Aita, Louisiana State University

» Modern natural product discovery
» Enzymology in natural product biosynthesis
» Synthetic and systems biology of natural products
» Mode of action of natural product
» Informatics and data science for natural products research

Special Sessions
meetings

» Formulations 1: Recent science and technology advancement in bioformulation
» Formulations 2: Bioformulation for product development
» Getting “it” out: Downstream processing in biomanufacturing
» The global bioethanol industry: Present and future technology
» JIMB Session

Awards and Nominations

Honors and awards are open for applications and nominations! All entry and/or nomination deadlines is April 10, 2024.

For full details, go to: https://www.simbhq.org/annual/awards/

» Charles Porter Award: This award recognizes meritorious service to SIMB
» Charles Thom Award: Honor researchers for their exceptional merit in their field
» Diversity Travel Award: Apply for yourself to be recognized and ease travel costs
» Early Career Award: Distinguish and encourage young investigators
» SIMB Fellowship Status: Special grade of SIMB membership
» Waksman Outstanding Teaching Award: Recognize the important role of educators and allow SIMB to help support their endeavors

Promotional Opportunities and Career Fair

Want to support the SIMB Annual Meeting and promote your company? Here are ways to engage with Annual Meeting attendees:

» Exhibit booths are available to be booked:
  https://www.simbhq.org/annual/exhibitsponsor/
» Career Fair on Monday, August 5, with dedicated space to either look at reach the your next star employee:
  https://www.simbhq.org/annual/career-fair/

» Sponsorship and online or print advertisement opportunities to increase visibility and awareness of your organization or product
  » https://www.simbhq.org/annual/exhibitsponsor/sponsorship/
  » https://www.simbhq.org/annual/exhibitsponsor/advertising/
1st Connecting Microbiome Communities (CMiC)

Wyndham San Diego Bayside
San Diego, CA

November 3–6, 2024
www.simbhq.org/cmic

Submission Deadlines
Abstract submissions will open in April
Registration will open in May

Program Chair
ELISHA M WOOD-CHARLSON, LAWRENCE BERKELEY NATIONAL LABORATORY

Program Co-Chair
NIGEL MOUNCEY, DOE JOINT GENOME INSTITUTE
2024 Program and Sessions

Biodiversity and Ecology of Microbial Communities
Session Conveners: Jen Martiny, Ying Wang

Decoding Structural and Functional Processes of Microbial Communities
Session Conveners: Ann Gregory, Ariane Peralta

Bioinformatics and Machine Learning for Microbiome Data Science
Session Conveners: Maria Sardi, Ben Tully

Engineering Microbiomes for Health, Agricultural, and Industrial Applications
Session Conveners: Jan Claesen, JP Dundore-Arias

Harnessing Microbial Diversity for a Sustainable Bioeconomy: Opportunities and Challenges
Session Conveners: Myunghee Kim, Nigel Mouncey

Microbiome Policy, Advocacy and Regulation to Advance Microbiome Research and Development
Session Conveners: Efrain Rodriguez Ocasio, Amalia Corby, Andrew Bartko

Additional Information
Tabletop exhibits, sponsorships, and program advertisements will be available in the coming months.

Questions?
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Biocivilisations: A New Look at the Science of Life
Predrag B. Slijepčević
Forward by Vandana Shiva
2023
ISBN 978-1-64502-138-4 (paperback)
Chelsea Green Publishing
White River Junction, Vermont

Spending time with this book brought me to share a conclusion with Vandana Shiva, Biocivilisations is a brilliant book. This book provides a way for people to get out of the trap developed through anthropocentric arrogance. It also leads the reader to understand the intelligence of living systems, the complex network of life, and our need to respect the biosphere in which we arose. Predrag Slijepčević works toward the concept that biology is a civilizing force based on developments including symbiogenesis, epigenetics, biosemiotics, Gaia theory, and autopoiesis. This book presents a definite challenge – are humans the apex of evolutionary processes or what is our true position in the network of life? Do people need to become more aligned with their surroundings to save our planet? How much more do we need to learn about our own stream of life before we can begin to understand the other possible streams/biospheres?

Part I, Beyond Humans, starts with How to Build a Biocivilisation (Chapter One) which presents the concept of biocivilisations in broad terms and argues against the mechanistic view of life. In Against Mechanism (Chapter Two), Slijepčević introduces the key principles of non-mechanistic biology which include universal flux (panta rhei), agency (purpose and desire), symbiosis (living together), and mind (hyperthought). What keeps all biocivilisations together is Gaia, the unification of these four principles. This chapter basically presents the process of life. Pride and Prejudice (Chapter Three) uses the principles in the previous chapter to lay the groundwork for understanding the concept of biocivilisations. This chapter covers concepts such as all organisms are natural agents with cognitive capacities; all species are equal; sentience and consciousness are features of all organisms; and replaces anthropocentrism with understanding the
place of people in the world. It points out how the outlooks of mainstream science and biocivilisations differ.

Part II is Brave New World which starts with Civilising Force (Chapter Four). This Chapter pushes people to decentralize humanity and to discover the wisdom of the parallel worlds that surround us. To do this requires orderliness and using state-of-the-art techniques to investigate the past and to develop a complete view of reality. This may help us correct the present and project the future. Communicators (Chapter Five) covers the wisdom of non-human communicators reliant upon by the Kingdoms Bacteria, Protoctista, Fungi, Plantae, and Animalia. Note: all lack human-like planning skills but are successful engineers. Concepts in this Chapter cover local as well as global mechanisms including quorum sensing, volatile organic compounds, pheromones, touch, sound, electrical impulses, and biosemiotics (communication with signs) which combine to provide continuous communication. Biosemiotics are the default mechanism. Chapter Six, Engineers, can lead to thoughts of blueprints thus limiting the organisms involved to humans. Considering heterogeneities such as temperature, humidity, pheromones, sound frequencies, and nutrient concentrations are cues for including a broader scope of organisms and their orientations. Chapter Seven, Scientists, combines molecular gastronomy and evolutionary epistemology as examples of the naturalization of science. Evolutionary epistemology includes the principles that evolution is a cognitive process, organisms are knowledge systems, and all forms of knowledge are interchangeable. The chapter incorporates the concept that all organisms, including slime molds, have their own forms and practices of science. These principles have led to comparisons of cybernetics with autopoiesis, Darwinism with Lamarkism, and human science with Gaian science (hyperthought) along with examinations of human intelligence and the future of science. Chapter Eight, Doctors, moves to naturalising medicine starting with acknowledging the primacy of microbes in all aspects of life. It covers the relationship between evolution and medicine; the principle of self-preservation; the presence of immunity in bacteria, plants, and
animals; and the existence of self-medication in animals. These lead to looking at the role of human medicine in naturalized medicine and how wide-spread naturalized medicine is. Artists are covered in Chapter 9. Recognition that non-human organisms can be artistic has been recognized by many scientists. As examples, feathers, songs, and nests can attract mates. Flowers can attract pollinators. Males are producers of the strategies while females are the evaluators. A number of these rely on biosemiotics and subjective aesthetic communication. This chapter covers Gaia containing creative forces and evaluators; being autopoietic through biotic art; manifesting the art of symbiosis; being indeterministic; and being creative. Chapter Ten, Farmers, covers the meaning of agriculture in the context of biocivilisations. A broad array of agricultural practices fall within this category. Animal husbandry includes humans raising cattle, poultry, fish, rabbits, and rodents. In the area of biocivilisations, ants can herd and protect aphids; the amoeba *Dictyostelium discoideum* forms a symbiotic relationship with the bacterial genus *Burkholderi*; and the soil fungus *Moricella crassipes* farms and harvests the bacteria *Pseudomonas putida*. Leaf cutter ants have interacted with the fungal genus *Leucoagaricus* approximately 50 million years. These are complex interactions required for the survival of the organisms involved.

Part III, Looking Forward, starts with chapter 11, How to Swim the River of Life? This Chapter outlines arguments that help us see ourselves different light – not anti-modernist or anti-technological or anti-scientific. These arguments are intended to demechanise biology and to improve our integration into the river of life. The final chapter, Equality in Diversity, covers how biocivilisations might be reconciled with mainstream science and how The Third Way is an alternative to the mainstream science of life.

*Biocivilastions* is an intriguing book that will be of interest to people in many areas of science while challenging many historical concepts.
Upcoming SIMB Meetings

**APR. 28–MAY 1, 2024**
46th Symposium on Biomaterials, Fuels and Chemicals
Westin Alexandria Old Town • Alexandria, VA
www.simbhq.org/sbfc

**AUG. 4–7, 2024**
74th SIMB Annual Meeting and Exposition
Sheraton Boston Hotel • Boston, MA
www.simbhq.org/annual

**NOV. 3–6, 2024**
Connecting Microbiome Communities
Wyndham San Diego Bayside • San Diego, CA
www.simbhq.org/cmic

**JAN. 5–9, 2025**
Natural Product Discovery and Development in the Genomic Era
Manchester Grand Hyatt • San Diego, CA
www.simbhq.org/np

**MAY 5–8, 2025**
47th Symposium on Biomaterials, Fuels and Chemicals
The Pfister • Milwaukee, WI
www.simbhq.org/sbfc

**JULY 27–30, 2025**
75th SIMB Annual Meeting and Exhibition
Hyatt Regency San Francisco • San Francisco, CA
www.simbhq.org/annual

Upcoming Industry Meetings

**JULY 14–19, 2024**
GRC Microbial Stress Response
Mount Holyoke College • South Hadley, MA
www.grc.org/microbial-stress-response-conference/2024

**AUG. 19–23, 2024**
19th International Symposium on Microbial Ecology
Cape Town, South Africa
isme19.isme-microbes.org/isme19-program

**JUL. 27–AUG. 1, 2025**
GRC Natural Products and Bioactive Compounds
Proctor Academy • Andover, NH
www.grc.org/natural-products-and-bioactive-compounds-conference/2025/
Placement Activities Planned for SBFC 2024

The 46th Symposium on Biomaterials, Fuels and Chemicals Meeting will be held at the Westin Alexandria Old Town in Alexandria, Virginia. The Meeting will be April 28–May 1, 2024. The Placement Committee is planning casual gatherings to make job postings available, to discuss career options, to review resumes and to answer questions. With the permission of the attendees involved, resumes will be made available (upon request) to companies/institutions/laboratories involved in the meeting.

All Meeting attendees are welcome to attend these casual gatherings. SIMB members representing the Placement Committee, the Board of Directors, and other SIMB committees have been invited to participate and to provide suggestions. If you are interested, bring your questions, your resume, and job postings. We will meet 30 minutes prior to the opening session of the Meeting. We will also meet during all the coffee breaks. These times were selected to avoid conflicts with the program. Other times can be arranged. Grab a cup of coffee and join us. All the gatherings will occur at the Placement Booth which will be located near the Registration Booth.

More information on SIMB career opportunities can be found on the SIMB website at www.simbhq.org

Please feel free to contact us if you have any questions:

» Elisabeth Elder, Placement Committee (elisabeth.elder@gsw.edu)

» Lisa Lee, Placement Committee (l.lee@procelys.lesaffre.com)

» Sarita Chauhan, Placement Committee (sarita.chauhan@gea.com)
| SIMB Committee                  | Chair                    | Email                       | Term expires | Members                                                                 | Staff liaison            |
|---------------------------------|--------------------------|-----------------------------|--------------|-------------------------------------------------------------------------|--------------------------|
| Annual Meeting 2024             | John Evans               | commssimb2024@gmail.com     | 2024         | See Program Committee Online                                           | Tina Hockaday            |
| Archives and 75th Anniversary    | Debbie Chadick           | chadickdebbie@gmail.com     | 2025         | Joan Bennett, Kristien Mortelmans, Erick Vadamme                        | Jennifer Johnson, Haley Cox |
| Audit Committee                 | Debbie Yaver             | dyaver@naturesfynd.com      | 2027         | Tim Davies, Laura Jarboe                                                | Haley Cox                |
| Awards/Honors                   | Jennifer Headman         | jennifer.headman@poet.com   | 2026         | Raj Boopathy, Stephanie Gleason, Thomas Klasson, Sara Shields-Menard, Rajesh Sani, Shawn Nelson | Haley Cox                |
| Corporate Affairs               | Steve Van Dien           | svandien@persephonebiome.com| 2024         | Yoram Barak, Andreas Schirmer, Jonathan Sheridan                       | Jennifer Johnson, Haley Cox |
| Diversity, Equity, and Inclusion| Sheena Becker            | sheena.becker@corteva.com   | 2024         | Noël Fong, Sara Shield Menard, Laura Jarboe, Felipe Sarmiento, Vanessa Nepomuceno, Ganesh Srim, Efrain Rodriguez-Ocasio | Haley Cox                |
| Education and Outreach          | Noel Fong                | nfong@nucelis.com           | 2024         | Katy Kao, Elizabeth Orchard, Torben Bruck, Neal Connors, Mark Blenner, Ian Wheeldon, Laura Jarboe, Benjamin Philmus, Linnea Fletcher | Haley Cox                |
| Elections                       | Kristien Mortelmans      | kristien.mortelmans@sri.com | 2026         | Melanie Mormile                                                         | Jennifer Johnson          |
| Ethics Committee                | Thomas Klasson           | thomas.klasson@usda.gov     | 2025         | Noël Fong, Scott Baker, Susan Bagley                                   | Haley Cox                |
| Finance Committee               | Katy Kao                 | kao.katy@gmail.com          | 2026         | Michael Resch, Nigel Mouncey, Elisabeth Elder, Ramon Gonzalez, Debbie Yaver, Dick Baltz | Haley Cox                |
| Investment Advisory             | Dick Baltz               | rbaltz923@gmail.com         |              | George Garrity                                                          | Haley Cox                |
| Meeting Sites                   | Haley Cox                | haley.cox@simbhq.org        |              | BOD and meeting chairs                                                  |                         |
| Membership-individual            | Allen Lee                | ls1@usf.edu                 | 2025         | Jason Booc, Eric Young, Qing Sun, Ryan Tappel, Shuai Qian, Casey Hooker, Biki Kundu, Efrain Rodriguez-Ocasio | Jennifer Johnson          |
| Nominations                     | Noel Fong                | nfong@nucelis.com           | 2024         | Richard Baltz, Susan Bagley, Adam Guss                                  | Haley Cox                |
| Placement                       | Elisabeth Elder          | elisabeth.elder@gsw.edu     | 2026         | Lisa Lee, Sarita Chauhan                                                | Jennifer Johnson          |
| Planning                        | Ramon Gonzalez           | ramon@mojabi.com            | 2024         | In Development                                                          | Haley Cox                |
| Publications                    | Hal Alper                | halper@che.utexas.edu       | 2025         | Ramon Gonzalez, Melanie Mormile, Yi Tang, Ben Shen                      | Haley Cox                |
| JIMB                            | Yi Tang                  | yitang@g.ucla.edu           | 2025         | JIMB Editors                                                            | Haley Cox                |
| SIMB News                       | Melanie Mormile          | mmormile@imst.edu           | 2024         | Kristine Mortelmans, Elisabeth Elder, Leo H. Liu                        | Katherine Devins          |
| Science Policy and Advocacy Committee | Nigel Mouncey            | njmouncey@gmail.com         | 2024         | Efrain Rodriguez-Ocasio, Tae Seok Moon, Thomas Alexander, Charles Isaac | Haley Cox                |
| Presidential Ad Hoc Committees  |                         |                             |              |                                                                        |                         |
| Student/Postdoc/Early-Career     | Nigel Mouncey            | njmouncey@gmail.com         | 2024         | Noel Fong, Haley Cox, Michael Resch, Md. Azizul Haque, Sora Yu, Jay Huenemann, Allen Lee, Blake Rasor, Eric Eke, Aditya Kunjapar, Guangde Jiang, Bhargava Nemmaru, Lydia Rachbauer | Haley Cox                |
| SIMB Foundation Development     | George Garrity           | garrity@msu.edu             | 2024         | In Development                                                          | Haley Cox                |

### Special Conferences

| Event                               | Chair                      | Email                     | Term expires | Staff Liaison |
|-------------------------------------|----------------------------|---------------------------|--------------|--------------|
| S8FC 2024 Chair                     | Kevin Solomon              | kvs@udel.edu              | 2024         | Tina Hockaday |
| Past Chair                          | Carrie Eckert              | eckertca@ornl.gov         | 2024         |              |
| Co-Chair                            | Ben Woolston               | b.woolston@northeastern.edu | 2024         |              |
| CMIC 2024 Chair                     | Elisha                     |                           | 2024         | Tina Hockaday |
| Co-Chair                            | Nigel Mouncey              | njmouncey@gmail.com       | 2024         |              |
| Natural Products 2025 Chair         | Yi Tang                    | yitang@g.ucla.edu         | 2025         | Tina Hockaday |
| Co-Chair                            | Alessandra Eustaquio       |                           | 2025         |              |
| Co-Chair                            | Bradley Moore              |                           | 2025         |              |
| Co-Chair                            | Jaclyn Winter              |                           | 2025         |              |
| RAFT® 2025 Chair                    | Daniel Dong                | Daniel.Dong@dsm.com       | 2025         | Tina Hockaday |
| Past Chair                          | Kat Allikian               | kat.allikian@southpacificsera.co.nz | 2025         |              |
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