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Microbial rights for a planetary age

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ABSTRACT

While microbes have primarily been viewed as pathogens, contemporary microbiome science and microbial ecology increasingly emphasize their non-pathogenic and symbiotic roles in shaping ecosystems and the health of all life forms. In doing so, they advance more nuanced understandings of the complexity of inter-related biological worlds. Yet, as scientific conceptions shift toward relational, functional, and ecological approaches in microbiology, this transformation has yet to be reflected in international legal frameworks governing interactions among humans, microbes and their environments. In response, we propose two post-anthropocentric approaches to microbial rights: Rights *to* Microbes, advocating for the protection of microbial functions instrumental for the survival of all life forms; and Rights *of* Microbes, which calls for recognizing the intrinsic and relational values of microbes as integral to planetary processes, and as deserving of rights in and of themselves. We explore the respective potentials of both approaches as different ways of prioritizing microbial rights.

1. Introduction

A change has been underway in scientific approaches to microbes — the microscopic organisms that include viruses, bacteria, yeast, protists, and many fungi. Microbiome studies, a relatively new field of biology, has been indexing an epistemic shift away from the anti-microbial mindset of 19th century bacteriology towards a symbiotic view of human-microbial relations (Bosch and McFall-Ngai, 2011; Gilbert et al., 2012; McFall-Ngai et al., 2013; Bapteste et al., 2021). These developments are fusing multiple subfields of biology (Bordenstein and Theis, 2015; Theis et al., 2016), contesting the pillars of evolutionary theory (Roughgarden et al., 2018), and prompting a reconsideration of what constitutes a healthy human microbiome (Joos et al., 2025) and a healthy built environment (Bosch et al., 2024).

With this turn towards post-Pasteurian thought (see Table 1 for key terms and descriptions), the field of microbiome studies is positing a more nuanced view of the complexity of inter-relational biological worlds (Zengler and Zaramela, 2018; Haraoui, 2022) and a recalibration of prevalent antibiotic modes of managing non-human life (Paxson, 2008; Lorimer, 2020). This greater appreciation for the symbiotic roles of microbiota — or communities of microbes — is also influencing disciplines beyond the life sciences, sparking conversations related to

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Table 1
Key terms and descriptions.

Pasteurianism	A biomedical paradigm emphasizing microbes as pathogens to be eliminated for health and hygiene.	Post-pasteurianism	A perspective recognizing microbes as essential ecological partners, emphasizing balance over eradication.
Anthropocentrism	A human-centered worldview where humans are considered separate from and superior to nature.	*Post-anthropocentrism*	A perspective that de-centers humans, recognizing interdependence with more-than-human life and the abiotic world.
Symbiosis	An intimate and long-term interaction between species, which may be mutualistic (where all species benefit), commensal (where some species benefit without affecting the other), or parasitic (where some species are harmed).	*Probiotic*	A microorganism that provides a health benefit to the host, such as to gut health and immune function.
Microbiota	The community of microbes — bacteria, archaea, viruses, protists, and some fungi — in or on a host, forming part of the holobiont.	*Microbiome*	The complete genetic content of the microbiota.
Holobiont	A biological unit composed of a multicellular host (the macrobe) and its associated symbiotic microbial communities (microbiota).	*Hologenome*	The combined genetic content of a host and its microbiota.

microbes' fundamental roles to ecologies (Averill et al., 2022), architectural design (Colomina and Wigley, 2020, 2025), linguistics (Höll and Bossert, 2022), and philosophy, including conceptions of selfhood and what it means to be human (Thomas, 2014; Ironstone, 2019; Morar and Bohannan, 2019).

The post-Pasteurian turn in microbiology, however, has yet to leave its mark on the international legal frameworks that govern human, microbial and ecological relations. Microbial life underpins all forms of life on Earth (Zwart, 2010; Falkowski, 2015; Sessitsch et al., 2023). Yet, microbes are largely treated as passive subjects to regulation and excluded from traditional conceptualizations of legal personhood or the rights associated with it. Policy institutions are beginning to question the exclusion of microbes from biodiversity and conservation efforts (Claerhoudt, 2024), a shift that has led the International Union for Conservation of Nature's (IUCN) Species Survival Commission to establish a Microbial Conservation Specialist Group (Gilbert et al., 2025b). Such developments signal the need for a "new era of microbial governance" (Kirchhelle, 2025), with some scholars contending that microbes should take center-stage, since biodiversity preservation and restoration efforts cannot succeed without them (Gilbert et al., 2025a).

With these developments in mind, what would microbial rights attuned to 21st-century research in the life sciences look like? How to legislate, constitutionalise, and litigate in ways that reflect the principles of post-Pasteurian approaches to understanding the world? On 3 March 2025, we convened an interdisciplinary workshop to unpack the questions that emerge at this intersection of post-Pasteurian microbiology and post-anthropocentric international law. Experts in microbiology, conservation, political science, international law, the humanities, anthropology, and sociology met to consider whether and how international law can recognize a legal status for the planet's microbes (Rivarola Ghiglione, 2025). Arising from these discussions, we propose two post-anthropocentric approaches for microbial rights. We have called these the Rights *to* Microbes (RtM) and the Rights *of* Microbes (RoM) approaches (Fig. 1).

By the RtM approach, we mean recognizing that the protection of the instrumental and life-sustaining functions of microbes is a matter of preservation of all forms of life. RtM calls for existing rights-based frameworks to be extended to consider microbial rights. By the RoM approach, we mean recognizing the intrinsic and relational values of microbes, including but also independent of their direct and instrumental relationships to humans, animals, plants, and the environment. Even as RoM builds on calls emerging from Rights of Nature movements, the approach to RoM advanced here does not argue for microbes to be added to the roster of living entities afforded individual rights. Rather, RoM privileges the relational values that microbial communities enable, making in-roads into rethinking conventional framings of legal rights through the lens of relationality.

Drawing on a growing scholarship on post-anthropocentric approaches to human-microbial relations in international law (Pereira et al., 2020; Cañada et al., 2022; Alves et al., 2023), we begin by making the case for a legal status for microbes in international legal frameworks. Rather than presenting the RtM and RoM approaches as mutually exclusive options, we propose and explore the respective potentials of both approaches as different ways of prioritizing microbial rights.

2. The case for a legal status for microbes

Charles Cockell has argued for some time that microbes, as the base for all food chains and major biogeochemical cycles, deserve to be afforded special ethical status and therefore rights (Cockell, 2004, 2005, 2011, 2016). Microbes are indispensable for life on earth, from the survival of humans, animals, and plants to the functioning of life-sustaining ecosystems and planetary biogeochemical cycles (Falkowski, 2015; Sessitsch et al., 2023). The Great Oxidation Event, enabled by the photosynthetic capacities of cyanobacteria more than two billion years ago, brought fundamental change to the Earth's biochemistry, leading to the formation of the ozone layer and setting the stage for the evolution of aerobic life (Margulis and Sagan, 1997). Furthermore, representing a substantial proportion of Earth's biomass (Bar-On et al., 2018), microbial life accounts for over 90% of all species on Earth and harbors the greatest share of genetic diversity on the planet (Locey and Lennon, 2016). Research in the life sciences has been showing how microbes can form intricate, interdependent communities, called microbiota (Bordenstein and Theis, 2015; Theis et al., 2016). Microbiota and their microbiomes — their genetic content — suffuse living and non-living matter and are the fundamental building blocks for life; they have conditioned and enabled the existence of all other forms of life (Dupré, 2007).

These developments contribute to reconsiderations of human exceptionalism — that human beings are the foremost life-form on Earth (Ironstone, 2019). Rather, the world can be seen as pre-eminently microbial (Zwart, 2010), and humans exist within, and in constant relationship with, a largely microbial world (Haraway, 2008; Brives et al., 2021). Such a conception of biology dislodges human beings from the centre of planetary-scale biological organization. Just as the Copernican revolution overturned 16th-century astronomy by displacing Earth from the centre of the cosmos, contemporary microbiology suggests that

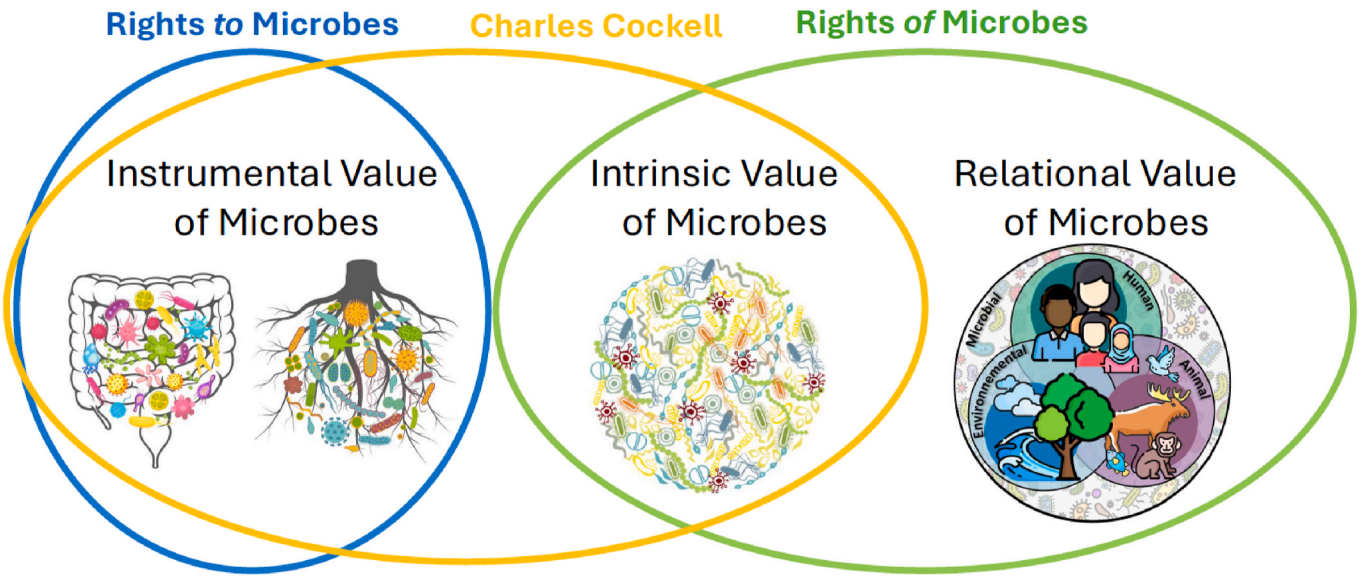

Fig. 1. Depiction of different value perspectives as they relate to microbial rights. Charles Cockell has argued for the rights of microbes based on microbes holding intrinsic and instrumental value (2004, 2005, 2011, 2016). The Rights *to* Microbes (RtM) approach supports microbes' instrumental value for entities with intrinsic value, namely multicellular living organisms and ecosystems. The Rights *of* Microbes (RoM) approach proposed here rather makes the case for the intrinsic and relational values of microbes.

microbes, rather than humans, lie at the centre of planetary biological organization.

As understandings of human-microbial relations change, institutions may face new challenges and be presented with new intellectual alliances. This is within a historical context of international legal frameworks that have long viewed humans as being the central subjects around which environments, ecologies, and non-human beings are objectified (Jones, 2021). The International Health Regulations, first adopted in 1969, were founded with a pathogenic view of microbial worlds, driven by the experience of smallpox eradication and the intent to control the global spread of infectious diseases (WHO, 2008). International Environmental Law (IEL) — the body of treaties, principles, customs, and laws developed since the mid-20th century — has largely overlooked microbes (Gillespie, 2013; Maljean-Dubois, 2024). Currently, international legal frameworks – used in this article to refer specifically to frameworks that govern human-microbial relations (WHO, 2011, 2025) and ecological-microbial relations (UN, 1992; CBD, 2000; FAO, 2001; CBD, 2011; WIPO, 2024) – attend to microbes only insofar as they constitute a biosecurity threat or natural resources to be harnessed, such as for the production of antibiotics or for use in biochemical processes such as industrial fermentation (Landecker, 2019, 2023).

The One Health approach is a prime example. The global health responses to the emergence and spread of zoonotic diseases (such as SARS, H5N1 and H1N1 influenzas, and COVID-19) laid bare the limitations of anthropocentric models of health in international law. In response, the One Health model has been presented as a corrective to tackle human, animal, and environmental health on a single front (Fernandez Diaz et al., 2025), drawing global health closer to worldviews that many Indigenous communities had already long espoused (Redvers et al., 2022). More recently, this model has been taken up by the combined quadripartite efforts of the World Health Organization (WHO), the Food and Agricultural Organization of the United Nations (FAO), the World Organization for Animal Health (WOAH) and the United Nations Environment Programme (UNEP). The One Health model has been making important strides in integrating historically disparate areas of work under a single umbrella. Critics of One Health, however, are already showing how it continues to maintain an anthropocentric bias, where more-than-human health is only recognized insofar as it has bearing on human health. As such, One Health has yet to reach its promissory potential as an "ethically bolder" (Coghlan et al., 2021) and more broadly inclusive model of health (Sariola and Gilbert, 2020; Kamenshchikova et al., 2021; Cañada et al., 2022; Braverman, 2023; Mbũgua, 2024). This orientation is reflected in the treatment of microbes within One Health, where the emphasis on antimicrobial resistance, zoonoses and pandemics reinforces a framing of microbes almost exclusively as threats to global biosecurity.

Given the foundational roles of microbes for planetary life, there have been vocal proponents for giving microbiota further consideration in One Health (Trinh et al., 2018), though Cañada and colleagues (2022) argue that a shift in the fundamental units of analysis is needed: firstly, moving away from the individual- or species-level analysis and towards thinking of microbial communities and ecology as a whole and, secondly, recognizing microbes as central actors within this broader ecology. Such considerations have been the main contention of Rights of Nature (RoN) movements which have, since the 1970s, argued for recognizing the intrinsic values and inherent rights of natural entities. The pursuit of RoN, defined by Alves and colleagues (2023) as "the idea that the whole biosphere, meant as the place in which life can happen, is endowed with natural rights," have historically been advanced by Indigenous peoples and environmental advocates (Jones, 2021). One argument for RoN is that human life is entirely dependent on nature, and working towards healthy ecosystems and human societies entails viewing nature not as a set of resources to be exploited but as having rights in and of itself. RoN is increasingly recognized as a legal tool to protect nature, and ultimately to protect human life in harmony with nature. Over the past two decades, numerous countries have enacted or are considering national laws recognizing RoN. These legislative efforts, enforced by governments and upheld in courts, seek to provide legal protections to such natural entities as rivers, forests and other ecological systems (Eco Jurisprudence Monitor, n.d.; Jones, 2021). Despite this global interest, RoN have yet to be adopted in international law (Jones, 2024).

Considering the above, novel approaches are needed to clarify the legal status of microbes in international legal frameworks. In the next section, we consider the relationships between values, ethics and rights that can underpin different conceptualisations of microbial rights. Bossert and Höll (2025) have outlined a non-exhaustive list of microbial

values — including such considerations as their aesthetic, transformative, existence, and religious or spiritual values — that fall broadly under three value categories: the instrumental, intrinsic, and relational values of microbes (see Table 2). Value relationships form the bedrock for developing microbial ethics — the guardrails for "what social practices are morally right or wrong concerning the microbial world" (Bossert and Höll, 2025, p. 811). To account for different configurations of these relationships, we propose two approaches to microbial rights: RtM and RoM. These approaches foreground distinct ways of valuing microbes, shaping how their legal status might be conceived, and how rights-based governance could be constructed.

3. Rights *to* microbes

The preamble to the Constitution of the World Health Organization and Article 12 of the International Covenant on Economic, Social and Cultural Rights enshrine an aspirational definition of the right to health, namely that all human beings are entitled to the highest attainable standard of health (WHO, 1946; UN, 1966). If research in the life sciences is showing that human and planetary health are inextricably tied to the health of microbial communities, which legal principles apply for their protection?

We propose the Rights *to* Microbes (RtM) as a rights-based approach for such a purpose. By the RtM approach, we mean recognizing that the protection of the instrumental life-sustaining functions of microbes is a matter of the preservation and protection of all planetary life. RtM includes both the rights of humans, non-human living organisms *and* the planet to the microbial communities they need to survive and thrive. The RtM approach builds on a new lexicon emerging from the life sciences, that of the *holobiont* — a biological unit composed of the individual 'host' (the multicellular organism, e.g., the human) and its associated microbiota (the community of symbiotic microbes, e.g., the human gut microbiota) (see Table 1). The *holobiont* recognizes that multicellular living organisms cannot exist in isolation of their associated microbiota, which play life-sustaining roles in physiology, behavior, and reproduction (Collins et al., 2012; Cryan and Dinan, 2012; Ezenwa et al., 2012; Hooper et al., 2012; Tremaroli and Bäckhed, 2012; Johnson and Foster, 2018). The human gut, for example, is estimated to maintain persistent symbiotic relationships with hundreds to thousands of bacterial species (Rosenberg, 2024), where microbial symbionts maintain necessary synergisms across human and more-than-human life cycles (Gilbert et al., 2012; McFall-Ngai et al., 2013).

Derived from the Greek word *holos* — meaning 'whole' — *holobiont* captures how different macroscopic and microscopic living organisms constitute a single biological unit, one that is being postulated as a new basic unit of biological organization (Guerrero et al., 2013; Bordenstein and Theis, 2015). This emerging lexicon is not merely a "semantic upgrade" (Bordenstein, 2024). It is meant to capture a more nuanced understanding of the complexity of intertwined biological worlds. The concept of the holobiont very adequately demonstrates one key point: all living organisms depend on synergistic microbes to survive.

Table 2
Microbial values.

Instrumental values of microbes	A direct, material benefit of microbes to living organisms. This includes, for example, the fermentative capacities of microbes, which underpin the production of food, medicine and a wide range of essential industrial processes.
Intrinsic values of microbes	A value that microbes have *in and of themselves*, regardless of their direct and material relationships with other beings. Human beings and the environment are considered to have intrinsic value, as enshrined in the Universal Declaration of Human Rights for the former and biodiversity treaties for the latter (UNGA, 1948; UN, 1992). Cultural heritage, peace and Indigenous ways of life and traditional knowledge are often also framed as having intrinsic value that go beyond any economic or scientific utility (UN, 1992; UNESCO, 2003; OHCHR, 2007; WIPO, 2024).
Relational values of microbes	The value ascribed to a relationship rather than to specific individuals. Thinking of microbes relationally means focusing on the ongoing communication between microbes, other organisms, and the environment, emphasizing the importance of preserving their interactions rather than the physical presence of individual species.

For decades, microbiologists have raised concerns about the changing composition and diversity of microbiota in industrialized societies (Gillings and Paulsen, 2014). Dysbiosis — disruptions in microbial diversity and equilibria leading to pathological states — has been associated with a wide array of ecological and biological disturbances in agro-industrial settings (resulting from antibiotic use in meat production, and the clearing of native forests for logging, which alters soil microbiota), and to shifts in human social practices (increasing urbanization, high rates of Caesarean sections, and the use of antibiotics in human health) (Boyd, 2001; Sonnenburg and Sonnenburg, 2019; Byers et al., 2020). In humans, dysbiotic states have been linked to diabetes, asthma, obesity, depression, multiple sclerosis, Parkinson's, Alzheimer's, autism, autoimmune diseases including ulcerative colitis, Crohn's disease and lupus (Ironstone, 2019; Sariola and Gilbert, 2020; Betran et al., 2021; Campbell et al., 2022; Tanabe et al., 2022; Haraoui and Blaser, 2023). Research on dysbiosis highlights the fundamental roles of microbes for the survival and flourishing of planetary life.

Mobilizing theories of the holobiont in the life sciences, the RtM approach sees microbes as holding instrumental value necessary for multicellular organisms and the environment to exist, survive, and thrive. RtM advocates for the protection of the instrumental and life-sustaining functions of microbes as a matter of preservation of all forms of life. Through this formulation, the RtM approach challenges long-standing anthropocentric views in international legal frameworks where the protection of human life has too often been at the expense of more expansive understandings of health, including the health of non-human life, ecosystems, and the planet. Working within existing bodies of international law, RtM can already extend from existing legally codified rights such as the Right to Health (Article 12 of the UN Covenant on Economic, Social and Cultural Rights), the Right to a Healthy Environment, and the Rights of Future Generations. It can also join the ongoing efforts to bring human, animal and environmental health within the remit of a single One Health model and enable an extension of existing conservation and biodiversity frameworks to microbes.

The RtM approach faces significant challenges. Existing tools from biodiversity and conservation paradigms can be used to identify microbial species that serve as keystone species — those with a disproportionately large impact on the survival and flourishing of non-microbial life (Banerjee et al., 2018). Cockell and Jones (2009), however, have outlined the complexities of integrating microbes into existing biodiversity and conservation efforts, which focuses on species-specific conservation. Microbial evolution and distribution, they argue, may be better preserved through ecological niches rather than traditional species-centered approaches, where emphasis rests on the preservation of microbial diversity and microbes' functional capacities.

In this vein, RtM may be less a focus on conserving the compositions of microbial communities, but rather a shift towards legally recognizing and protecting the keystone *functions* of microbes that act as ecosystem engineers, exerting significant influence within ecological systems. Comparable shifts are underway in macrobiology[1] with the rise of functionalist approaches to conservation, captured in enthusiasm for rewilding, conservation, and restoration of ecosystem services (Rewilding Europe, n.d; Svenning et al., 2016; Lorimer, 2020). Such a functionalist approach to the conservation and protection of microbes

[1] O'Malley and Dupré (2007) have used 'macrobes' and 'macrobiology' as terms that encompass all non-microbial multicellular life.

constitutes a challenge not only for conventional biodiversity frameworks but an epistemological problem for the life sciences as well (Leuzinger and Rewald, 2021; Rodrigues, 2025).

Despite these difficulties, the RtM approach helps advance efforts to consider a legal status for microbes as having value beyond human health. It recognizes that healthy microbial communities are instrumental for all forms of life. Even as inroads can already be made for the rights *of* humans *to* symbiotic microbes within existing international legal frameworks, important strides will be required for RtM to reach its fuller more-than-human and planetary potential. As the foundation of all food chains and major biogeochemical cycles, the protection of the life-sustaining functions of microbes is a matter of the self-preservation of planetary life. Microbial functions necessary for human and more-than-human life alike would still merit full legal protection under international law.

4. Rights *of* microbes

Whereas the RtM approach falls short of recognizing microbes as possessing intrinsic value – that microbes have value *in and of* themselves – the Rights *of* Microbes (RoM) perspective advances a broader ethical stance. It affirms both the intrinsic and relational worth of microbial communities, encompassing but also extending beyond their instrumental connections to humans, animals, plants, and ecosystems. Building on relational understandings of the interconnectedness of all forms of life, we propose RoM as an approach that privileges the intrinsic values of microbes and the relational values that microbes enable — what is valuable here is not the individual microbes, but rather the relationships between them, with other living organisms, and with the planet at large.

RoM emerges from the recognition that current conceptions of the holobiont often treat microbiota as something of an appendage to multicellular living organisms, the 'hosts'. Flemming and Wuertz (2019) have estimated that the vast majority of the planet's microorganisms are 'free' microbial cells or ecological communities that exist irrespective of multi-cellular living hosts and inhabit deep oceanic and continental subsurfaces, upper oceanic sediment, the soil and the oceans. Most microbes, then, are not part of a holobiont, and theories of the holobiont may sometimes overlook the sheer vastness of microbe-to-microbe interaction within networked and interconnected microbial communities (Morar and Bohannan, 2019; Haraoui, 2022; Sessitsch et al., 2023). An exclusive focus on multicellular organisms may be too narrow to address the complexities of microbial rights; instead, microbes may require a broader and more inclusive framework within a wider environmental ethics (Wienhues, 2022). In this vein, the RoM approach is post-anthropocentric in that these relational values may be independent of microbes' direct relationships with human beings. Even further, these relational values can also be independent of microbial relationships with animals, plants and the environment, as in the case of relationships between microbes themselves.

Furthermore, the holobiont has been largely conceptualized as being composed of physical (cellular) and genetic interactions in the contact zones where macroscopic and microscopic organisms meet. Many industries today are engaged in efforts to find gene- or species-specific 'magic bullets' for diseases of dysbiosis, with probiotics for the gut microbiota and the soil being prime examples (Oviatt, 2023). Such efforts, however, risk positing a kind of microbial determinism, similar to claims of genetic determinism that the Human Genome Project sparked in the 1990s and 2000s (Parke, 2021). A genome-centered agenda is unable to account for instances where the same genetic sequences can be involved in multiple functions or where changes in genetic expressions occur. Instead of seeing the holobiont as a cellular-genetic entity, it is also possible to think of the holobiont as a *functional-metabolic* system (Haraoui, 2022; Schäfer et al., 2023). Microbes exchange information through metabolites and it is primarily through such metabolites that microbes speak (Krautkramer et al., 2021). Thinking of microbes relationally entails thinking about the constant signalling and communication that is taking place between microbes themselves, with human and non-human animals, and with the environment at large (Hey, 2019, 2021). RoM argues that it is these relational dynamics that should be the focus of legal protection, not merely their cellular presence.

As such, the RoM approach sees microbes differently than RtM: from a microbial perspective, it is impossible to partition microbial and macrobial worlds. Once the relational value of microbes is recognized, what novel legal theory or theories of rights need to emerge as a result? Acknowledging the relationality between humans, non-human animals and the environment reveals the capacity of "environmental constituents, including microbes, to dictate relationships between physical and biological entities" (Bader et al., 2023, p. 1771). Such a conception is in line with Indigenous approaches calling for the decolonization of microbiome research (Redvers et al., 2020; Warbrick et al., 2023; Silk et al., 2024).

The RoM approach partly follows from RoN by approaching the world as constituted through more-than-human networks of relations, in which jurisprudence is Earth-centered, relational and grounded in complex ideas of reciprocity, responsibility, obligations and care – frameworks in which biospheric values are inseparable from human values (Gratani et al., 2016; Redvers et al., 2022; Bader et al., 2023). However, RoM differs from RoN by resisting the impulse to simply extend rights to a new domain: that of microbes. Rather than simply arguing that microbes should have individual rights, RoM acknowledges their intrinsic value while emphasizing how microbes suffuse living and non-living matter and constitute the fundamental building blocks of planetary life. In this sense, RoM privileges the relational values enabled by microbial life (Bossert and Höll, 2025), opening new avenues for rethinking conventional framings of legal rights from the lens of relationality (Roncancio, 2020), and microbial relationality in particular.

With such a relational view in mind, what is implied by arguments to give rights to relationships rather than to entities or individuals? Rather than equipping nature with rights that are in conflict with other rights-holders, Jones (2021) argues for a RoN approach that emphasizes rights in relational terms, shifting the application of international law towards the preservation of these relations and therefore reconsidering how law and legal relationships are presently conceived. The subject/object binary of international law — where complex subjects are rendered bounded individual unities — has long prioritized human needs (Naffine, 1997, 2003; Grovogui, 2011; Strobeyko, 2022). The RoM approach contributes to re-aligning priorities towards the realities of how complex ecologies work — through interconnectedness and interdependence. This would necessarily broaden the constituents of international law towards the more-than-human networks of relationships that would altogether constitute the focus of legal protection (Jones, 2021). RoM emphasizes how human-made systems need to be re-oriented to be in line with the multi-relational dimensions of planetary life, rather than towards its domination (Davies, 2022).

In these ways, the RoM approach advocates for microbial communities' right to flourish as a matter of non-human and multispecies justice. In entering a "new era of microbial governance" (Kirchhelle, 2025), scholars have begun interrogating different ways of accounting for microbes in non-human and transitional justice frameworks (Rekers and Marinova, 2025; Varadan et al., 2025). Multispecies justice – which rethinks the subjects of justice through adopting relational ontologies that correspond to "the actual ecological array of relationships that sustain life" (Celermajer et al., 2021)– is not meant to privilege non-human justice at the exclusion of human injustices. Rather than simply expanding political subjectivity beyond the human, multispecies justice is also about the organic alliances that both human and ecological communities forge in resisting structural, systematic, and historical violence (Chao and Kirksey, 2022). The RoM approach invites such an approach to multispecies justice when extended to microbial communities, including commensal and symbiotic microbiota. Where the RtM approach may advocate for using scientific knowledge to better

modulate human, microbial, and ecological relations, the RoM approach redirects attention away from narrowly interventionist approaches and toward more expansive ways of situating rights in relation to microbial life. It therefore advocates for attenuating and reducing the global processes that are destructive to planetary life — including the Earth's symbiotic and life-sustaining microbial communities.

5. Conclusion

Étienne Balibar (2009) has argued that human rights are not natural pre-existing attributes of living beings. Rather, rights are constructed through political action against exclusionary institutional and epistemic violence, and especially after long periods of violations. As such, rights-based approaches are part of an ethical renewal that follows from rupture – mechanisms for restoration after violation (Worms, 2010). Microbial rights invite a discussion on how international legal frameworks may need to change after a long period of such a rupture in human-microbial relations. We argue that it is imperative for international legal frameworks to recognize new microbial values, ethics and rights: ones that go beyond treating them as pathogens to be controlled and eradicated or natural resources to be extracted and exploited. As our understanding of the complex ecology of the world deepens, a new consensus may need to be reached on the legal status of microbes.

Recognizing more-than-human entities and investing in RoN approaches are not a panacea. Research is underway on how RoN policies can have adverse and unintended consequences — sometimes even displacing historically vulnerable communities or undermining Indigenous worldviews that do not easily adapt to neoliberal legal frameworks (Rivarola Ghiglione, 2023). RoN approaches have also been critiqued for re-centring humans (Tănăsescu, 2020) who, after all, have to represent nature, be that through the hearing of evidence as in Ecuador, or through a guardianship model as in Aotearoa New Zealand (Jones, 2021). Still, the anthropocentric premise of planetary biological organization is being altered by contemporary scholarship in microbiome science and microbial ecology. Legal ontologies, built on scientific understandings of the world, will need to adapt accordingly. The RtM and RoM approaches proposed here pose fundamental challenges to the prevailing anthropocentrism of international legal frameworks, move beyond RoN, and are intended as invitations to broader discussion and deliberation.

Working from ‘microbes upwards’, more detailed research and analysis are needed to determine how each of these approaches align with or challenge international law, policy and practice. Following the national and regional gains made by Indigenous perspectives and RoN movements, this includes foregrounding relational conceptions of the interdependencies among human, non-human, microbial and planetary life at national and regional levels. A new interdisciplinary field of post-human legal microbiology may be emerging, one that combines advances in microbiology with legal theories emphasizing humans' embeddedness within ecological relations. As both a research and policy domain, such a field can take concrete steps towards unpacking what microbial relationality means and entails as well as rethinking microbial governance from a relational perspective. On the international stage, new institutional arrangements dedicated to the protection and conservation of microbial ecosystems may be required (Fernandez Diaz et al., 2025), whether through reconsidering existing frameworks as part of a RtM approach or through new instruments such as a Declaration on the Rights of Microbes within a RoM framework. The Right to a Healthy Environment, which currently promotes the rights of humans to have a healthy environment, can include the right of non-human living organisms and the planet, itself, to be healthy to begin with. The Rights of Future Generations, which currently focuses on future human generations, could also be broadened to the rights of non-human future generations, including those of microbes (Jones, 2025).

Beyond that, sectors such as nutrition, agriculture, and medicine can gain new dimensions towards the betterment of human, non-human and planetary life. Entire industries would need to be fundamentally altered if we are to become attentive to how human activities affect and transform microbial communities. Microbes, like nature, can be afforded the right not only to be preserved, but also the right to flourish. International law, rather than objectifying nature and enabling its extraction, may be transformed into a governance system that would enable such a flourishing to take place.

CRediT authorship contribution statement

Anthony Rizk: Writing – review & editing, Writing – original draft, Conceptualization. **Emily Jones:** Writing – review & editing, Conceptualization. **Anne Saab:** Writing – review & editing, Conceptualization. **Adam Strobeyko:** Writing – review & editing, Conceptualization. **Niko Soininen:** Writing – review & editing, Conceptualization. **Gian Luca Burci:** Writing – review & editing, Conceptualization. **Davina Höll:** Writing – review & editing, Conceptualization. **Leonie N Bossert:** Writing – review & editing. **Catherine Larose:** Writing – review & editing, Conceptualization. **Kate Brown:** Writing – review & editing. **Frédéric Keck:** Writing – review & editing, Conceptualization. **Jamie Lorimer:** Writing – review & editing, Conceptualization. **Louis-Patrick Haraoui:** Writing – review & editing, Writing – original draft, Conceptualization.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

No data was used for the research described in the article.

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