



Gut Microbiome Care as a Gateway to Mental Well-being and Theological Restoration

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Abstract

Recent research has highlighted the profound connection between the gut microbiome and overall human health, particularly its impact on mental well-being. The potential of “psychobiotic” interventions to foster resilience and emotional stability is especially promising. Methodologically, this article offers a philosophical–theological exploration that interprets current microbiome research in dialog with Christian theological sources, emphasizing how human–microbe symbiosis shapes both mental health and theological understandings of the human person. The intricate relationship between the microbiome, mental health, and brain function, in turn, affects spirituality and challenges anthropocentric notions of human identity. Certain anthropological and theological perspectives suggest that the gut microbiome can be viewed as a divine gift that enhances human flourishing through symbiosis. Within this framework, the human person appears as a *holobiont*—a composite of body, soul, and microbial life—created for communion with God and others. As steward and priest of creation, the human–holobiont is called to actively participate in the divine work of creation and redemption through relational communion with others, including fellow humans, the natural environment, and the microbiota. Integrating scientific insights with theological reflection, this article proposes that microbiome care contributes not only to mental well-being but also to spiritual restoration and ecological ethics. A non-egocentric eco-Christological ethic could thus honor microbiome care as integral to human personhood and divine relationship, fostering harmony between humanity, creation, and the divine.

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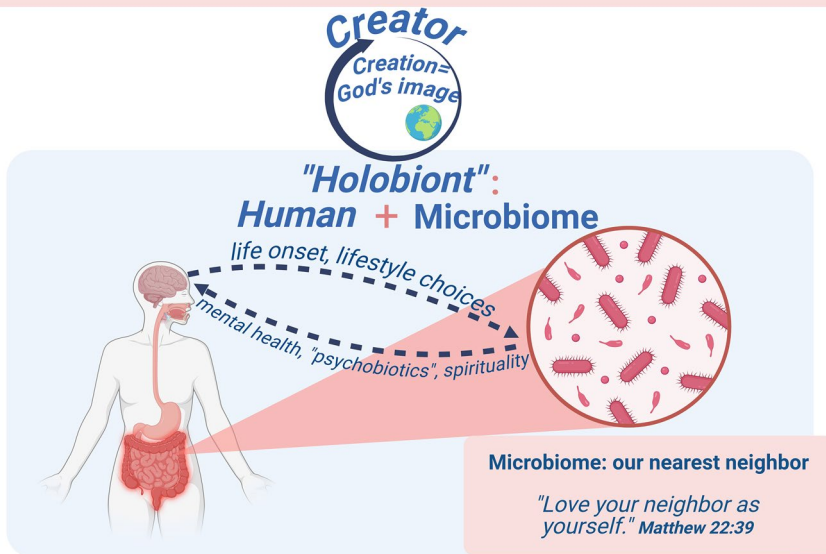
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Graphical Abstract

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Keywords Microbiome · Theology · Anthropology · Ecology · Symbiosis · Mental health

Introduction

The gut microbiome, comprising hundreds of trillions of bacteria primarily residing in the large intestine, plays a crucial role in human health. Almost 90% of our body cells belong to our commensal microbiome which seems to overturn the long-standing anthropocentric assumption of an independent human identity and physiology (Gilbert et al., 2018). The emerging concept of humans as “holobionts”/super-organisms—that is, composite organisms formed by host and microbiota—suggests that we are interconnected with our microbiota, which affect various physiological processes, such as metabolism, immune response, and cognition, by impacting gene expression, neurodevelopment, brain function, and nutrient absorption (Postler & Ghosh, 2017; Simon et al., 2019; Zhu et al., 2010).

Formed over several years from birth, the gut microbiome is shaped by factors such as lifestyle, genetics, socio-cultural environment, and (intra- or extra-uterine) environment, resulting in a unique microbial profile for each individual (Ma et al., 2024). Despite the rapid growth in microbiome research, a deeper understanding remains limited, and scientists face challenges in defining a “healthy” microbiome and distinguishing correlation from causation. Nonetheless, microbial diversity has

been consistently correlated with human health outcomes (Hou et al., 2022; Papazoglou, 2023), which shapes new frontiers for the clinical practice of the personalized medicine era.

Despite the rapid growth of microbiome research, little attention has been given to its theological implications (Gilbert et al., 2018; Hill, 2020). This leaves a gap in understanding how emerging biomedical insights might reshape conceptions of human identity, personhood, and spiritual life. At the same time, theological anthropology has traditionally emphasized the soul or mind, often neglecting the body's microbial dimensions that science now shows to be central for health and cognition (Rees et al., 2018; Zizioulas, 1992). Bridging these domains matters for at least two reasons: First, it enriches theological reflection by situating the human person within a symbiotic and ecological framework (Davison, 2020; Dietert & Dietert, 2024); and second, it offers biomedical discourse a broader interpretive horizon, highlighting the spiritual and ethical stakes of microbiome care (Kunnen & Carlson, 2017). Addressing this gap, the present article brings microbiome research into conversation with Christian theology to explore its implications for mental well-being, personhood, and ecological ethics.

Therefore, the aim of our work is to briefly present the significance of preserving a healthy gut microbiome composition for mental health. We will then assess the importance of human–microbiome symbiosis through a more ontological approach given the potential implications of this burgeoning field on the traditional ideas of human personhood. Finally, we will also point out some practical ways of symbiosis and future directions based on the theoretical evidence emerging during the last two decades.

Methodological Approach

This article adopts a philosophical–theological approach, engaging microbiome research not to provide new biomedical findings but to interpret its implications for theological anthropology, spiritual practice, and ecological ethics. The method is therefore synthetic and interdisciplinary; recent scientific studies are reviewed to establish the biomedical context, and these findings are then placed in dialog with biblical, patristic, and systematic theological sources. The goal is not a systematic review of the microbiome literature, but a constructive exploration of how emerging biomedical insights may reshape Christian conceptions of personhood, sacrament, and stewardship. To ensure clarity for an interdisciplinary audience, the key terms used throughout the manuscript are defined in Table 1.

Gut Microbiome and Mental Well-being

The Human Microbiome Project has yielded several psychoneuroimmunological pathways mediating the gut–brain communication, which include immunological (cytokines), endocrine (hypothalamic–pituitary–adrenal [HPA]), and neural (vagus) pathways often activated by produced neurotransmitters (Huttenhower

Table 1 Table of key terms used throughout the manuscript

Term	Definition (simplified)
Holobiont	Composite organism consisting of a host and its associated microbiota
Solobiont	View of the human as an isolated, autonomous organism, without considering microbial symbiosis
Psychobiotics	Probiotic, prebiotic, or synbiotic interventions that positively influence mental health via the gut–brain axis
Symbiosis	Close and sustained interaction between species; here, mutualism between humans and microbes
Eco-Christological	A theological approach emphasizing the role of Christ and creation within ecological interdependence
Perichoretic	Theological term describing the mutual indwelling of the three persons of the Trinity

et al., 2012). The enteric nervous system [ENS] and the human gut contain a massive number of neurons constituting the “second brain”, which is in communication with the central nervous system [CNS], the “first brain”. Notably, this crosstalk functions bidirectionally (top-down and bottom-up information flows); the gut microbiome affects CNS function, and the CNS affects the microbiome composition (Manco, 2012).

Host’s mental health as expressed in lifestyle choices can actively influence the “second brain” in the gut, potentially improving overall mental and physical resilience (Delanote et al., 2024; Xiong et al., 2023). The gut microbiome composition can also affect brain chemistry and behavior independently of the autonomic nervous system, gastrointestinal-specific neurotransmitters, or inflammation, illustrating the feedback loop of the gut–brain axis (Bercik et al., 2011). Alterations in our “second brain” reciprocally impact our “first brain” and our conscious or subconscious choices (e.g., free will, self-awareness, personality traits, and emotional states) (Hill, 2020). Microbiota are primarily involved in stressor-induced immunoenhancement, pain modulation, control of background emotions and other homeostatic functions (Rhee et al., 2009). Intestinal dysbiosis might increase inflammation and disrupt neurotransmitter production, thereby shaping dysfunctional neurological processes and contributing to psychiatric disorders, such as depression and anxiety (An et al., 2024; Du Toit, 2019; Kolobaric et al., 2024). In contrast, a well-balanced microbiome enriched with beneficial bacteria-through diets high in probiotics, prebiotics, and synbiotics-can have positive effects on mental health (i.e., reduced stress responses and greater emotional stability) (Shoubridge et al., 2022; Zhao et al., 2023). These “psychobiotic” interventions promote anti-inflammatory effects, enhance production of neurotransmitters like serotonin, and improve gut barrier integrity (Basso et al., 2022). Hence, preserving gut microbiome diversity could act as a gatekeeper for mental health, safeguarding against disruptions that may lead to mental disorders.

Gut Microbiome and Theological Restoration

As Rees et al. recently noted, the emerging body of research connecting microbiome with mental health and brain function (that is with what theological anthropologists would call “the mind”) has profound implications for how we define the human self (Rees et al., 2018). From a more theological perspective, several theories have been presented depicting the gut microbiome as a God’s gift warranting human’s attention (Table 2). As summarized in Table 2, these perspectives range from Eucharistic participation to eco-Christological views, and they highlight how patristic and contemporary thought converge in portraying the microbiome as integral to human personhood and divine communion.

Table 2 Interdisciplinary theological–ontological theories on the relationship between human host and the microbiome

Theory	Reference
1. Resurrection not only of an immaterial spirit but also of a transformed whole tangible body with its components	Malcolm, (2023)
2. Inter-dependence and inter-connection between hosts and microbiota; humans and microbes together embody God’s image more fully than sterile humans alone; holobiont vs solobiont; ‘Biological mutualism’ instead of competition & Resurrection of organisms as parts of inter-dependent communities	Davison, (2020); Dietert and Dietert, (2024); Janiga, (2023)
3. Work and participation of microorganisms for the preparation of the Eucharist and inter-individual exchange of salivary microbiota during the Holy Communion; After the prayer for Referring to God (the Eucharistic Prayer or the Anaphora), the material environment becomes a source of Life instead of death	Hill, (2020); Zizioulas, (1992)
4. Relational aspect of the inter-connection of environment with the human being via microbiota; Personhood as an “openness of being” (I am not complete in isolation); Persons in a community of species instead of individual species; Horizontal instead of vertical relationship with God; human relationality bears likeness to God’s relationality	Al-Attas Bradford, (2021); Dietert and Dietert, (2024); Malcolm, (2023)
5. Reflection of the perichoretic understanding of God as Trinity in the collective unity of diverse lives (own body, microbiome/ environment, and others); Our body (beyond our soul) as an image of God	Al-Attas Bradford, (2021); Zizioulas, (1992)
6. Steward-priest over Creation: Thanking God and referring to God the whole environment and microbiota to be completed; human as the free-willing connector between God and environment; God affirms that what God created is good, which means that biodiversity is also good	Hill, (2020); Zizioulas, (1992)
7. “Gut instincts” affecting free will and subconscious human thoughts; potential participation of the microbiota in the spiritual guidance of the human holobionts	Hill, (2020)

While much of Christian discourse historically emphasized the soul or mind, biblical and patristic sources also attest to the spiritual significance of the body, and even of the gastrointestinal tract. Scripture frequently highlights the “belly” as both a site of temptation and of grace: “their god is their belly” (Phil. 3:19) contrasts with Christ’s promise that “out of the believer’s belly shall flow rivers of living water” (John 7:38). Saint Paul further underlines that “your body is a temple of the Holy Spirit” (1 Cor. 6:19), affirming that the divine presence includes the physical dimension of human life. Patristic authors expanded this insight by reflecting on the role of digestion and moderation. John Chrysostom warned that “the belly is an untamed beast; if not held in check, it quickly drags us to slavery” (*Homilies on Matthew*, 55.3), while Basil the Great taught that “as much as you subtract from the belly, so much you add to the spirit” (*Homily on Fasting*, 1). Augustine, too, cautioned that “the bridle of the throat and belly must be held with a tight rein” (*Confessions*, X.31). These references show that early Christian thought did not neglect the gut but viewed it as integral to spiritual discipline and flourishing. This ascetical language reveals an early theological intuition that bodily regulation is not merely physiological but deeply tied to spiritual vigilance. In light of microbiome science, such patristic reflections can be re-read as anticipating the discovery that microbial imbalances contribute to mood, resilience, and behavior.

The person of Christ may be interpreted as encapsulating the concept of the human as a holobiont, a living system composed of Spirit (Soul) and Body, in which a diverse community of organisms dwells. This constructive lens highlights how Christ’s embodied existence affirms the theological significance of human biological interdependence. Based on an eco-Christological approach—interpreting Christ and creation within the ecological web of life—Christ’s resurrected and ascended Body reflects the essential role of the human body in its relationship with God and with all forms of life in creation (Janiga, 2023; Malcolm, 2023). Resurrection, therefore, involves not only the spirit but the transformation of the entire, tangible body, including its inter-dependent components (Malcolm, 2023). It appears that Jesus descended from heavens to communicate with humanity and creation, and after his Resurrection, to ascend again to the heavens together with humanity and creation, which exemplifies an inter-connected reality, where individuality is maintained as we are drawn into deeper, life-giving relationships with one another and the world around us.

The concept of ‘biological mutualism’ underscores the interdependence and inter-connectivity between hosts and their microbiota, suggesting that life thrives in symbiotic rather than in competitive relationships, where diverse forms of life (that is multi-species collectives) live together mutualistically, without mixing in a harmful way (Davison, 2020; Dietert & Dietert, 2024). Hence, humans and microbes together may be understood as more fully reflecting God’s image than a sterile, isolated view of humanity allows. This constructive proposal suggests that the *imago Dei* can be interpreted through relational interdependence (Dietert & Dietert, 2024). This relational aspect extends to the environment, where the person exists not in isolation but as part of a broader community (holobiont vs solobiont), reflecting a horizontal rather than a vertical relationship with God (Dietert & Dietert, 2024). In this

framework, personhood is presented as an "openness of being" in interdependence with all forms of life living concomitantly in this world (Al-Attas Bradford, 2021).

Moreover, the human being as a holobiont can be viewed metaphorically as reflecting the perichoretic relationality of the Trinity, where God exists in a dynamic, relational unity with the Son and the Holy Spirit (Al-Attas Bradford, 2021). Just as God is a community of three "persons" in perfect relationship, the human person might be similarly a community of diverse lives, with the unity of the body, microbiome, and environment reflecting the true image of God and God's own triune nature (Al-Attas Bradford, 2021). As Thomas Aquinas at his word, the best way to see a reflection of God is by looking at a whole collection of lives. Christ's perfect and perfecting humanity is not expressed in distance from other creatures, but in intimacy (Al-Attas Bradford, 2021).

The relational aspect of human personhood is emphasized in relationally oriented anthropology pointing that the human, as a holobiont, is not just a biological being but a free-willing connector between God and the environment, a mediator of the divine presence in the creation-world (Zizioulas, 1992). This relational understanding of humanity underlines that the fullness of human experience and communion with God can only be feasible through the active participation of the entire ecological and microbiological system in the life of the Church. Humans attempt to fully experience God through the sacraments, particularly the Eucharist; however, the co-participation of microorganisms might be required in this Holy sacrament as well (Hill, 2020). The work of microbes (such as yeast in the bread and bacteria in the wine) may be viewed as symbolically cooperating in the preparation of the Eucharistic elements. While the transformation into the Body and Blood of Christ is a mystery of divine grace, this metaphor highlights how microbial life can be understood as participating in the broader sacramental economy of creation (Hill, 2020). As the Bishop of Pergamon, John Zizioulas, explains, after prayer and invocation of God and particularly after the prayer for Referring to God (the Eucharistic Prayer or the Anaphora), the material world transform into a source of life rather than a source of death (Zizioulas, 1992). This underscores the integral role of the microbiome in both the embodied human experience and the sacramental life, suggesting that our participation in the divine is in intricate relationship with all forms of life (Kunnen & Carlson, 2017). In this way, the human as a steward-priest over creation not only mirrors the image of God but also participates in the divine work of creation and redemption through relational personhood (Zizioulas, 1992). In this sense, the human holobiont is also a microcosm in which the harmony of creation is enacted. The Eucharistic transformation of bread and wine, potentially mediated in part by microbial life, mirrors the larger vocation of humanity to sanctify and restore the natural world in its microbial as well as ecological dimensions.

Considering the above theories, advances in microbiome research bring us closer to a more holistic understanding of the human being, which, in turn, deepens our efforts to comprehend God's design. Our symbiotic relationship with microbes could be viewed as a form of spiritual guidance or healing (Hill, 2020). Therefore, caring for the human body and gut microbiome, through scientifically informed practices, may be constructively interpreted as an act of worship, symbolically restoring the human–God relationship (Kunnen & Carlson, 2017). Thereby, the humanity

can restore all relationships broken by the Fall and has been now redeemed through Christ's Resurrection and Ascension (Kunnen & Carlson, 2017). Perhaps, it is the practical fulfillment of the inspired command "Love your neighbor as yourself", where, under the view of the holobiont–human as the image of God, loving and caring for the microbiome (that is the neighbor within us) becomes an expression of love for God's image (yourself) and God.

The eco-Christological approach resonates closely with the modern *One Health* paradigm, which emphasizes the interdependence of human, animal, and environmental health within a shared ecosystem (Zinsstag et al., 2023). In Eastern Orthodox Christianity, September 1st has been designated as a day of prayer for the protection of the natural environment, reflecting an early theological acknowledgment of the integral relationship between ecological balance and human flourishing. This convergence suggests that theological anthropology, understood through the holobiont framework, can complement One Health discourse by extending care from the individual ("*prosopon*" = *person*) to the broader community of creation. If the microbiome reveals the human as already a "multi-species collective," then the One Health vision extends this relationality outward, situating humans, animals, and ecosystems within a larger, God-given web of symbiosis. In this way, microbiome care is not only a matter of personal well-being but also a model for ecological stewardship and public health, fostering harmony across the entire creation.

Practical Recommendations for Microbiome Care

Beyond the personal dimension of microbiome care, eco-Christological perspectives can also be extended toward population and ecological health frameworks. In this direction, no practical recommendations (Table 3) can be effectively implemented without first accepting the critical role of the microbiome in health and disease (both physical and mental). Table 3 summarizes these evidence-based strategies, which include birth practices, dietary patterns, fasting, sleep hygiene, and avoidance of unnecessary antibiotics. These measures highlight how daily practices can nurture microbial diversity and thus contribute both to physical well-being and to a theological ethic of stewardship.

From life onset, it is crucial to optimize conditions for microbiome diversity, particularly through vaginal delivery, which facilitates the mother-to-infant transfer of beneficial microorganisms (Yang et al., 2016). Early microbial exposure, facilitated by breastfeeding and skin-to-skin contact, also plays a key role in shaping the composition of infant's microbiome (Yang et al., 2016). Across the lifespan, maintaining a diet rich in diverse, unprocessed, plant-based foods, fiber, and lean proteins is essential to enhance microbiome diversity. Intermitent (or religious) fasting has also been shown to affect favorably microbiome composition and metabolic homeostasis (Papazoglou et al., 2022). However, fasting may not be universally safe. Individuals with underlying medical conditions (such as diabetes mellitus, cancer, chronic kidney disease, musculoskeletal injuries or cardiovascular disease), those taking medications (e.g., glucose- or blood pressure-lowering agents), pregnant or breastfeeding women, children

Table 3 Evidence-based strategies for supporting microbiota health

Strategies

1. Emphasize the **importance of understanding the role of microbiome** for a more conscious implementation of the following practical guidelines
2. Prioritize the health of the microbiome from the **onset of life**:
 - Optimize birth conditions (vaginal birth)
 - Support early microbial development with mother–infant interactions (breastfeeding and skin-to-skin contact)
3. Ensure the health of the microbiome throughout **all stages of life**:
 - Observe balanced and diverse whole-food diets (unrefined plant-based foods, fiber-rich vegetables, fruits, and lean proteins)
 - Choose sustainable and minimally processed foods, reflecting stewardship of creation
 - Limit consumption of processed and ultra-processed foods
 - Practice intermittent (or religious) fasting as a discipline for both health and spirituality, and seek medical consultation beforehand whenever appropriate
 - Maintain healthy lifestyle rhythms: optimal sleep hygiene, stress management (including Sabbath rest), and engagement in health-promoting behaviors
 - Participate in shared meals and integrate prayer into daily life
 - Offer gratitude for food (e.g., blessing of meals or saying grace)
 - Minimize microbiome disruptions by limiting unnecessary antibiotics, pharmaceuticals, and exposure to environmental toxins
 - Cultivate regular social interactions through physical contact and social bonding
 - Practice hospitality and fellowship as expressions of relational personhood

Bold names represent the main categories of recommendations: 1. understanding microbiome significance, 2. life onset, 3. lifestyle changes through various life stages

and adolescents, older adults, and persons with a history of eating disorders should consult a healthcare professional before initiating fasting practices. Medical evaluation helps ensure that fasting is undertaken safely while preserving its spiritual purpose. Beyond fasting, other religious practices may also align with microbiome care. Regular patterns of prayer and meditation can reduce stress responses, indirectly supporting gut microbial equilibrium (Sun et al., 2023). Shared community meals, especially in liturgical or fellowship contexts, promote dietary diversity and social connectedness, both of which are beneficial for microbiome health. Moreover, the theological ethic of stewardship extends to mindful food choices and ecological sustainability, suggesting that care for the microbiome is inseparable from care for creation itself. Additionally, optimal sleep quality, stress reduction, and enhanced social interactions seem to contribute to the maintenance of microbiome equilibrium. Finally, minimizing the use of antibiotics (e.g., through the Get Smart About Antibiotics program from the CDC) and minimizing the exposure to environmental toxins are critical for preventing microbiome disruptions, which underscores the need for an informed, evidence-based approach to self-care.

Future Directions Through Medical and Theological Perspectives

Future research in this emerging field faces significant challenges in understanding the mechanisms underlying microbiome assembly and function and, also, in establishing causative relationships between microbiome alterations and different diseased human phenotypes. Future studies should adopt pharmaceutical-grade rigor to validate microbial-based CNS therapeutics while addressing long-term mental effects of early life microbiota perturbations, such as those caused by antibiotics or cesarean delivery.

It is essential to educate believers, priests, and theologians about the salvational value of microbiome care, promoting the understanding of humanity as stewards of God's creation (Hill, 2020). Future theological studies could explore the microbiome as a divine gift, focusing on its theological significance. Interdisciplinary collaboration between theologians, microbiologists, and healthcare professionals could create integrated health models that incorporate microbiome care within spiritual practices. This could lead to community-based health initiatives, demonstrating how caring for the microbiome is a way to embody spiritual healing.

A critical challenge is fostering a respectful co-existence with microbial life, encouraging the development of 'microbial ethics'. Drawing from environmental and animal ethics, such an ethic would integrate medical responsibility (e.g., antibiotic stewardship, probiotic use) with environmental care, recognizing the interdependence of humans, microbes, and ecosystems. This approach could lead to a more inclusive understanding of non-human life forms and their essential roles in ecosystems, ultimately shaping a more holistic view of humanity's relationship with the microbiome and the broader creation. Finally, integrating microbiome care into a *One Health* framework may also provide practical avenues for interdisciplinary collaboration, linking personal health practices with broader ecological and public health initiatives.

Limitations

Although this article is not an empirical study, several limitations should be acknowledged. First, the proposed connections between microbiome research and theological anthropology are constructive and exploratory and, thus, should be received as speculative rather than definitive claims. Second, microbiome science itself is at an early stage, with many findings still limited to correlational data; future discoveries may alter or refine the interpretations offered here. Third, the theological framework employed is primarily Christian, with a particular emphasis on Eastern Orthodox sources, especially the relational anthropology of Metropolitan John Zizioulas and eco-Christological perspectives. While this focus offers rich insights, it does not exhaust the potential of Christian theology in engaging with microbiome science. Future work could fruitfully incorporate

perspectives from Roman Catholic traditions (e.g., Thomistic anthropology, Augustinian theology, or the ecological reflections of *Laudato Si'*) as well as Protestant voices. Such contributions would enrich the ecumenical breadth of dialog on the theological significance of the microbiome. Recognizing these limitations highlights both the provisional character of the present exploration and the need for further interdisciplinary, ecumenical, and cross-cultural engagement.

Conclusions

Given the early state of research, it is easy to both overestimate and underestimate the role of the gut microbiota in human (patho-) physiology. Nevertheless, it is increasingly clear that gut microbiome plays a (significant) role in our lives. Considering the critical importance of the microbiome–gut–brain axis and the potential mental health consequences of a disrupted microbiome, this article presented the spiritual and ontological dimensions of the human–microbiome symbiosis. By framing the human person as a *holobiont*—a composite of body, soul, and microbial life—this study proposes a theological anthropology that takes seriously the biological interdependence revealed by microbiome science. At the same time, it advances an eco-Christological ethic in which caring for the microbiome becomes part of Christian stewardship, extending love of neighbor to the microbial “neighbor within.” The ultimate aim is to highlight the significance of including the microbiome as a central topic in the agendas of both medical and theological communities. Bridging microbiome science and Christian theology could lead to a holistic vision of human personhood, health, and communion with God and creation. Co-existing with a fundamentally different non-human “neighbor” that originates from within us calls for a non-egocentric ethic, which embraces full respect for the entire environment as part of God’s design.

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Declarations

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