



Mini Review

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Spirituality in the Realm of the Microbes

Rodney R Dietert^{1*} and Janice M Dietert²

¹Department of Microbiology and Immunology, Cornell University, Ithaca, NY USA

²Performance Plus Consulting, Hereford, USA

*Corresponding author: Rodney R Dietert, Professor Emeritus of Immunotoxicology, Cornell University, Mailing address: c/o 10035 E. Tristan Dr., Hereford, AZ 85615 USA.

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Abstract

Earth is first and foremost a planet of microorganisms. They are the most widely distributed and prevalent lifeform on our planet. The microbes are cognitive, sentient, quantum, and exquisitely connected beings that inhabit virtually every niche above, on the surface of, and in the bowels of planet earth. Furthermore, they bind together virtually all of earth's complex natural life as holobionts where microbes are most often in the majority and are major controllers of life's functions across the lifespan. The idea of informative, informational, and even spiritual "gut instincts" invariably directs our attention to a region of the human holobiont body that is both open to the external environment and predominated by the gut microbiome. The well-functioning holobiont is a form of Self-Organizing Collective (SOC). No authority is required. In prior publications, we considered the significance of the wired and wireless-connected Internet of Microbes (IOM) as well as the tradition of ancient healing tools that were recently shown to affect both microbial populations and holobiont microbiomes. Here, we build upon this literature to consider not only hologenome theory and the ancestral and natural traditions that support humanity's wellbeing, but also primarily, human holobiont spirituality during our time in the realm of the microbes.

Keywords: Spirituality, Internet of Microbes (IOM), Microbiome, Hologenome, Gut instincts, Microbial realm

Abbreviations: IOM: Internet of Microbes; SOC: Self-organizing collective; NSAIDs: Non-steroidal Anti-Inflammatory Drugs

Introduction

For humans, our fundamental form is predominately microbial in nature [1]. Microbial cells are our body's slight majority and we carry an overwhelming majority of microbial genes [2,3]. This fact allows us to shift perspective from a pinnacle species that is separate from all other lifeforms on earth toward a distinctly grounded view that we as human holobionts are a microcosm of life on earth [1]. While a normal reaction to this 21st century change in understanding that we are not alone within our own body could be humbling, it is also massively uplifting to know that we have functional capacities greater than the sum of the parts and, in many cases, beyond our wildest dreams [4]. As human holobionts, when we honor, protect, and embrace our own body, we better connect with, benefit from, and honor life on earth.

This is a particularly important change in human understanding in part because how humans are viewed can fall into at least two different theological camps: the perfect single-species human or the intended multi-species human. The question within Christian theology appears to be: which human version is in the image of God? In one camp, humans could be routinely demonized by religious and other authorities when carrying a disease now known to occur as a result of infection (i.e., microbes as part of germ theory) [5]. Al-Attas Bradford [5] points out that demonizing microbes can provide religious comfort for this camp. Of course, the problem is that labeling humans with infections as having fallen from grace requires a lack of or incomplete recognition of current multi-species holobiont reality. As Al-Attas Bradford [5] points out, the single species camp perspective with demonized microbes is convenient because it avoids potentially reformative, science-meets-religion



changes concerning the historical image of God. Such a convenient attitude of demonized microbes even prevailed during the recent Covid-19 pandemic [6-10]. But according to Al-Attas Bradford [5] there is also a second pro-microbial Christian theological camp. An alternative view of humanity is that everyone is filled with microbes, in fact trillions of them, and that a holobiont-honored body connected with earth's other holobionts and vast microbial populations is quite acceptable. Of course, host resistance science suggests that holobionts with robust microbiomes are far more likely to avoid germ-produced infections through effective colonization resistance [11-13]. The question then is: will the ongoing microbiome revolution help to move beyond a theological dogma where "germs" are evil and sanitizers are our savior?

In this mini-review article, we discuss a variety of recent perspectives on various topics regarding humans with microbes (the human holobiont or human superorganisms) and focus on the spiritual implications of being mainly-microbial holobionts living in the realm of microbes. We conclude with a view that increased microbe-based holobiont functionality, spiritual awareness, and the pursuit of a seamlessly connected life are a core part of humanity.

Embracing and Utilizing the Cognitive, Quantum Nature of Our Microbes

Primarily during the past decade, several researchers described the remarkable functional capabilities of microbes such as bacteria. This was recently reviewed by us [4]. Bacteria and other microorganisms are sentient beings possessed with such traits as consciousness, cognition, memory, wired and wireless interkingdom connectivity, shape shifting, holding multiple quantum states, directed sensing and mobility, gene editing capabilities, and exquisite energy collection, transfer, and production capabilities as well as being masters of environmental sensing and chemical recycling. They are a front-line sensing and defense network for earth as well as for the human body. We previously discussed that going inside via meditation and other contemplative practices can enable us to

better connect with the Internet of Microbes via our own human microbiome [9]. This is not a new concept but rather can be traced back to ancient cultures and healing practices such as the Shamanic traditions of the Amerindians [14,15]. The fact that mindfulness meditation can produce a demonstrable shift in gut microbiome composition [16] reflects the power of our connection to our microbes, and the fact that we are functionally and possibly spiritually inseparable when whole. This raises the question how whole, human holobiont cognition, memories, communication, intuition, knowledge, and spiritual connection compares with that bounded by the limits of the previously-conceived, single-species human?

In fact, the idea of holobiont wholeness was presented by us in two early microbiome papers. The first paper argued that the best predictive biomarker surrounding birth (a biosemiotics indicator) of a baby's future health trajectory was a measure of microbiome completeness [17]. A second paper introduced the concept that a lack of effective seeding of the microbiome at birth was the equivalent of a birth defect [18], although a potentially correctable birth defect. In light of recent findings about microbe capabilities, failure in microbiome completeness might be expected to affect not only human functionality and wellness but also spiritual connectivity and intuitiveness.

Table 1 illustrates the interconnectedness between human holobiont existence, earth's microbial populations and functions, and human holobiont spirituality [1,5,9,10,14,15,19-49] (Table 1).

Table 1 illustrates the important evolution of thinking concerning not only the fundamental and remarkable nature of microbes, but also the emergence of a spiritual realization regarding the whole human. No longer will our microbes be excluded from theological considerations and spiritual contemplation. Instead, human holobionts in our full multi-species glory can even better walk the spiritual path in physical health and wellness and with full composite-mind contemplative awareness.

Table 1: Spirituality and Functionality Linked to the Microbes.

Features	References
Microbes are nature's most predominant communication network which has been referred to as the "Internet of Microbes"	[9,19,20]
Microbes are sentinel and sentient first-responders to environmental changes on earth.	[21-24]
The hologenome and Lamarckian effects of environmental microbes makes "nature" a co-equal parent of humanity.	[25]
The hologenomic reality of humans and our intelligent microbiomes means we are a composite mind driving biocivilizations.	[26-31]
Under the proper circumstance and as discussed by William Miller, Jr. and colleagues [32], holobionts form a Self Organizing Collective (SOC) intelligence that can produce: 1) a decentralized collective with 2) a lack of control authority and, 3) emergent crowd wisdom.	[32-34]
The concept of the eco-holobiont has been proposed to capture the open, interkingdom, external body, microbial loop that interacts with, informs, and modifies the human microbiome. The eco-holobiont is another way to view effects linked to the Internet of Microbes.	[35]
Evidence for the importance and power vested in the human holobiont can be found in Biblical and related ancient Hebrew text translations of Italian scholar, and former Vatican interlinear Bible translator, Mauro Biglino. The ritual treatments required for Enoch, Noah, and others to come into the presence of the Elohim were not simply symbolic but were procedures known for having "antibacterial, antimicrobial, and antiseptic properties." Microbiome stripping appears to have been a prerequisite.	[36 pp.109-112]
Electroactive microbes are the building blocks for integrative, complex bioelectrochemical systems.	[37]

The concepts of holobiont theology and symbiotic grace have entered the discussion of microbiome-inclusive theology.	[1,38-43]
Evidence suggests that our microbes are critical for allowing us to overcome fear and pursue a balanced, fruitful life	[10,44-46]
The suggestion has been made that social phenomena such as religious rituals and shamanic practices have a significant microbial component.	[14,15,47,48]
Al-Attas Bradford discusses the demonization of microbes (aka “the germ”) relative to Christian church history and theology and make several suggestions for the future. She suggests: 1) that a move away from the historic church framework of human mastery over animal and microbes should be a part of spiritual advancement and 2) that it is important to set aside the historic symbolism of “the germ” to better engage with and understand microbes themselves.	[5]
In his article asking the question “Can microbes save us from ourselves?”, Ken Rinaldo [2022] concludes that we must listen to the microbes since they can offer us not only technologies but also critical lessons that have been honed over time.	[49]

Figure 1 depicts the newly emerging concepts and language surrounding the realm of the microbes and human holobiont spirituality. Importantly, many different research disciplines have

contributed pieces to this view of human holobiont spirituality (Figure 1).

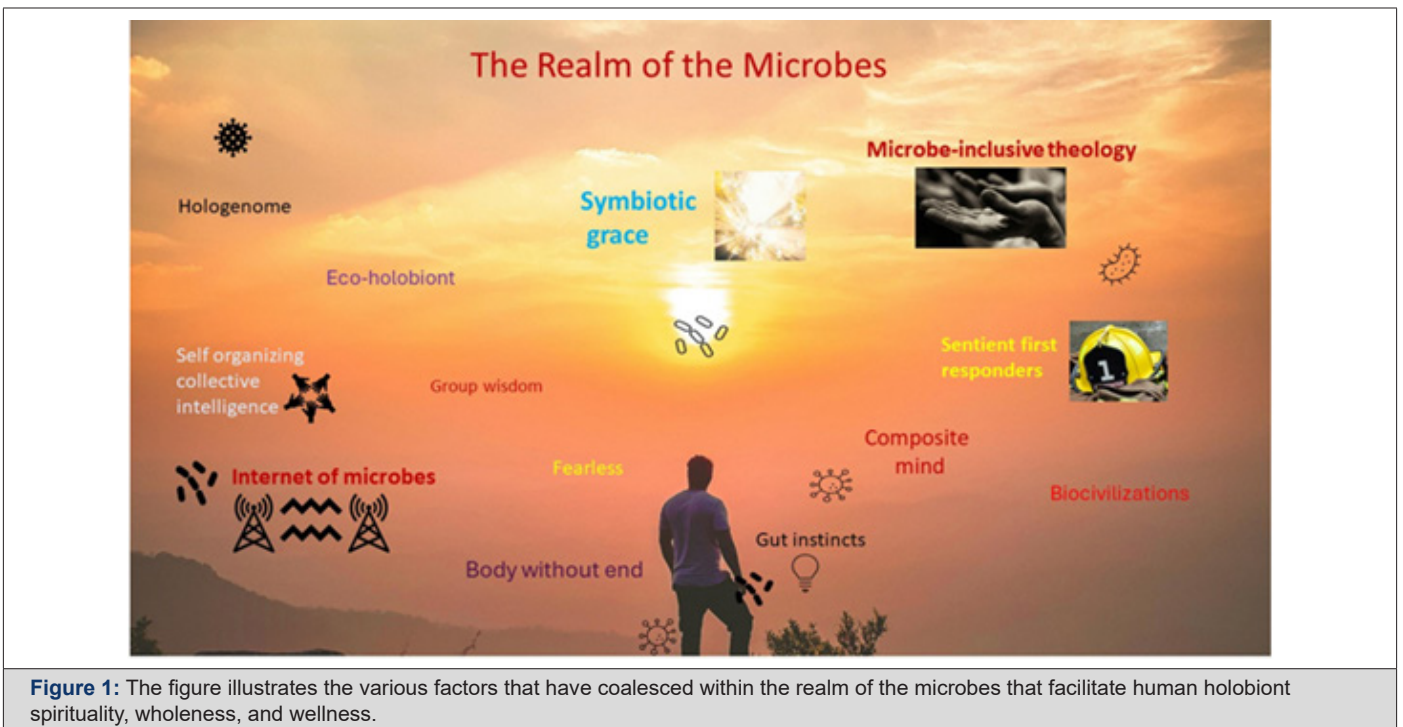


Figure 1: The figure illustrates the various factors that have coalesced within the realm of the microbes that facilitate human holobiont spirituality, wholeness, and wellness.

The Symbiont as the Image of God

Seeing spirituality arise from the physical union of otherwise sterile humans with co-partner microbes is not a hand waving exercise. It is the recognition that the creator God is much more than just sterile humans and many of God’s other creations can be found in the microbe-rich, multi-species us. Among the most comprehensive and persuasive tenets for a symbiotic image of God is made by Aminah Al-Attas Bradford, Ph.D. [39]. In her monumental work *Symbiotic Grace: Holobiont Theology in the Age of the Microbe*, Dr. Al-Attas Bradford makes a strong case for the holobiontic imago dei (image of God) where the imago dei and the microbiome are fully compatible. Several points from the monograph support this tenet:

- a. Our microbes make us human inside and beyond and bring more of God’s creations from nature into our bodies.
- b. Willingly accepting our microbes as part of us, rewrites anthropology shedding homogeneity, division and separation and embraces a multispecies plural way of being and knowing.

c. The image of God is great and needs to be that way. As a solobiont, single-species humans do not have the capacity to reflect the greatness of God that we must do since we are created in God’s image.

We need to be multitudinous. Al-Attas Bradford [39] goes on to discuss how the human holobiont microcosm is not bounded by skin meaning there is no longer an “I” and a “Thou.” She reminds us that there is no isolated self. We are essentially a fluid microcosm of nature with microbes entering and exiting and microbial genes flowing via a river running through us [39]. The monograph considers a myriad of benchmark historic theological thinking and shows how humans as a more comprehensive reflection of God’s creations across nature is consistent with much of the prior thinking. One of Al-Attas Bradford’s closing concepts is that holobiont theology has a huge silver lining: it has the capacity to “teach us to see ourselves as never just ourselves” [39]. Symbiotic grace is both a blessing and a reality in the realm of the microbes.

Other religious and scientific scholars have weighed in on the concept that the human holobiont exists because of a beneficial creative design process. How did ancient archaea contribute to present day eukaryotic cells as an institutionalized energy source, mitochondria? At least one key merger involved ancient archaea [50]. But it is interesting that the original events may have been between two different kinds of prokaryotes. *Romero, et al.*, [51] pointed to the Asgard superphyla of archaea as one of the prokaryote players in fusion and fission processes. Genetically robust prokaryotes appear to have nudged us along a eukaryotic-symbiotic timeline.

In his book *This Sacred Life* [52], Norman Wirzba discusses the fact that microbes make critical metabolites needed by human holobionts and that we, as holobionts, have been provided with an ecological pharmacy because of our microbial co-partners [52]. Our inherent multi-species nature allows us to ascend to new heights of form, function, and spirituality.

In the following sections, we describe the significant danger that has existed and continues to exist today concerning authority-promoted lifestyles, products, and activities that result in microbiome degradation and mind-body-spirit weakening.

Considering Microbiome Destruction as Separation from Spirit

In Isaiah 59 verse 2 of the Bible the idea of sin is introduced suggesting that iniquities can separate us from our God by building barriers that impair communication. This raises the possibility that microbiome depletion and degradation in the human holobiont as well as that in the surrounding environment (e.g., the urban built environment) may result in not only human mental and physical disruption/illness but also a loss of communication capacity via the IOM. In the book *The Human Superorganism* [1], one of this present article's authors (RRD) posed the question whether at some point, benevolent ancestral humans invited earth's microorganisms to become squatters in the body in forming the human holobiont or whether the reverse is true: microbes "created" a most wonderful vessel for their future, the human holobiont. This theme was also introduced in a comparison of the earth-connected human superorganism vs. the transhumanistic machine [53]. From this vantage point, the greatest sin might be the separation of the human holobiont from microbes and as an outcome, from both nature and each other. We become an island depleted both physically and in spirit when we are separated from microbes. This sheds new light on lifestyles. The reality is that until recently we humans were not generally aware of the importance of our microbes. The ongoing microbiome revolution including both microbiome first medicine as well as a return to natural healing strategies has elevated awareness of the significance of the human microbiome surrounding birth and early nurturing. The admonition from Jesus Christ presented in the Gospel of Matthew to come as little children to enter the realm of heaven may give us a new perspective with regard to the critical steps of seeding and feeding the newborn's microbiome.

A particularly intriguing part of Biblical history with microbiological implications has been discussed by prominent biblical scholar Mauro Biglino. As listed in Table 1, Chapter 6, section 5 of his book "Gods of the Bible" [36], Biglino covers the anointing pro-

cedures required for humans such as Enoch to come into contact with the Elohim. The procedures were quite detailed and had both bathing and scrubbing protocols plus various treatments with a list of quite specific amounts of particular herbs, chemicals, perfumes, and spices. Of note, the ancient text researcher concluded that these treatments were not ritualistic but rather were a practical antimicrobial protocol necessary to significantly deplete the human of holobiont-associated microbes. As discussed in the next section, human microbiome depletion did not end with direct human-Elohim interactions. Instead, it has been a major outcome of the past century of Westernized modern life (e.g., medical, pharmaceutical, agricultural, and chemical innovations.)

An Attack on the Human Holobiont and Ecological Microbes is an Attack on Humanity

If microbiome wholeness is both biologically and spiritually important, then it is important to consider precisely how humanity reached such a massive level of microbiome degradation. Importantly, it was not through what might be termed "informed consent." A lack of public microbiome education was a problem until recently, but a larger problem was the pursuit of microbiome destroying practices in most aspects of human life. A first red flag was presented by Dr. Martin Blaser [54] in his landmark book *Missing Microbes*. There, overuse of antibiotics was identified as a major issue [54]. But the reality is that the entire spectrum of institutional public health produced a primary outcome of microbial destruction [reviewed in 55]. As described by Dietert and Silbergeld [56], the fundamental problem was that safety testing as designed and regulated by the government was not designed to protect the microbiome [56], and there are many sources of authority-approved drugs and chemicals that can damage the microbiome [57]. The transgression by authorities ranged from purportedly safe and effective, approved common drugs that were subsequently shown to be microbial toxins (e.g., NSAIDs and proton pump inhibitors [58,59]) to the equally approved microbe killers among massively-distributed agricultural chemicals (e.g., pesticides [60]), processed food (e.g., food emulsifiers [61]), household chemicals (e.g., cleaning products and personal care products [62,63]) and infant products (bisphenol A in baby bottles and nipples [64,65]). A conclusion is that what might well be the greatest sin of erecting spiritual barriers was not a choice by humanity but rather was thrust upon an unsuspecting holobiont populace.

Conclusion

While there is much we are still learning about planet earth, it is clear that our planet is, above all, a realm of microorganisms. Microbes are the predominate planetary lifeform, and they are pervasive among more complex organisms (e.g., holobionts). For the newborn baby, a healthier life is one filled with majority microbial co-partners forming a SOC intelligence with tangible benefits, physiological systems programmed for effective function, longevity, colonization resistance that is our front line of defense, useful circadian clocks, and a capacity to overcome fear when needed. Ancient healing practices affect microbial populations. Sound, light, electric, and magnetic frequencies and fields affect the microbes. In reality they are our sentinels.

We are connected to earth's microbes in other holobionts and ecosystem communities via the IOM. The information flows microbially though nanowires and wireless communication. It is there for the taking once we are made aware of and focus on this network. When the spiritual meets the biological/microbiological, "gut instincts" can be seen as part of spiritual guidance for the human holobiont. Our immersion in microbes can be seen as a form of spiritual medicine [66].

As is shown in Table 1 and visually represented in Figure 1, the microbiome revolution has ushered in many changes in our perspectives regarding the human body and human functional and spiritual life. Part of this shift in perspective is not only viewing microbes as technology-laden, sentient, co-partner beings but also in recognizing microbes as central to humanity's divine connection to spirit. Theologians from many different backgrounds and faiths are now traveling the path of microbe-inclusive spirituality (Table 1). This is epitomized by the work of Dr. Amimah Al-Attas Bradford [39].

This mini-review article is intended to:

- a. Facilitate a deeper appreciation of humanity and its multi-species nature and
- b. Illustrate that as multi-species beings, we readily connect with spirit and grace thanks in large part to our microbes.

Author Contributions

R.R.D. performed much of the research for the table and the figure and drafted the first version of the manuscript. A portion of the spiritual-related research was contributed by J.M.D. who also edited the manuscript. Both authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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