Chapter 9

Distributed Identity

Human Beings as Walking, Thinking Ecologies in the Microbial World

Wesley J. Wildman

1 Concentrated Identity versus Distributed Identity

In this chapter I shall question prevalent assumptions about the metaphysical unity and organizational simplicity of human identity. I also aim to contribute an insight in support of a cluster of views—somewhat underexplored in the West until recently—that affirm the *distributed identity* understanding of human nature. Distributed identity views regard human identity as complex and distributed in a variety of neurological, biological, social, ecological, cultural, and axiological systems. The distributed identity viewpoint contrasts with what I shall call the *concentrated identity* viewpoint. Most traditional religious anthropology has regarded human nature and thus human identity as *ontologically simple and unified* in some important sense—as concentrated in something neatly intelligible rather than distributed across and within complex systems.

The near-universal human experience of conscious awareness appears to be a key factor in producing significant consensus on the concentrated identity viewpoint across most of the world's philosophical and religious traditions. Most people's conscious awareness is the focal point for interpreting both self and environment, the hub about which the swirling worlds of self and other turn. Concentrated identity viewpoints typically borrow their gleaming simplicity from the ontological purity and epistemological privacy of conscious thought. The so-called problem of other minds is based on the sharp contrast between the potent immediacy of our internal self-awareness and our inescapable dependence on behavior, communication, and physiological cues to penetrate the conscious awareness of other beings.

Religious anthropologies for the most part have rooted human identity in the ontological simplicity of immediate self-awareness.

Sometimes the rooting of concentrated identity viewpoints in the ontological simplicity of immediate self-awareness produces metaphysical hypotheses that crystallize human identity as a precious jewel-like entity—a soul or a *jīva*. This occurs in Descartes's view of the human being as a nonphysical soul controlling a physical body. It also occurs in Hindu transmigration theory in which a *jīva* (disembodied soul) persists across many embodied lives. In both cases, human identity derives fundamentally from the nonphysical soul, which is the seat of conscious awareness, survives death, and precedes birth. Even in physicalist-emergentist frameworks, which reject the possibility of disembodied consciousness, it is possible to support concentrated identity viewpoints. In such cases, human identity is rooted in the achieved emergent features of the human person, such as moral character or creativity or spiritual capacity, all of which crucially involve conscious awareness. Hybrid viewpoints, including some resurrection frameworks within the Abrahamic traditions, affirm nonphysical souls but also insist that souls cannot exist in disembodied form. This ties human identity to the embodied consciousness of the integrated body-soul complex rather than to the disembodied soul or the soulless body.

These are all variations on the theme of concentrated identity. Each view conceives human nature to be ontologically simple and unified in an important sense—as simple and unified as the feeling of subjective self-awareness. Importantly, these views have significant payoffs in ethics and theology. Concentrated identity viewpoints lend themselves to straightforward moral application by securing the dignity of each individual human being and furnishing moral norms for governing human societies. They also lend themselves to a distinctively personalist view of human nature, and thus of whatever powers underlie the universe's creation of personal beings such as ourselves. To put it in a way that personalist theists often have, God must be at least as personal as the persons that God creates.

Like the concentrated identity viewpoint, the distributed identity viewpoint has enjoyed a long history, though it has always been a minority opinion, dwarfed in popular support by the masses of believers in immortal souls and the simplicity of human consciousness. The idea of distributed human identity has also been elaborated in a variety of ways, and in diverse philosophical and religious traditions. I sketch two of these briefly here before taking up the particular approach of this chapter.

First, classical expressions of Indian Buddhist philosophy—for example, in Nāgārjuna and Bhāvaviveka within the Madhyamaka school of Mahāyāna Buddhist philosophy—treat human identity as having no own-being (no *svabhāva*), which is to say no ontological standing independently of reality as a whole. This doctrine, known as *anātman* (Sanskrit) or *anattā* (Pali), departs from the regnant *jīva* theory of South Asian philosophy. It is an important implication of the Buddhist *pratītya-samutpāda* cosmology, according to which everything arises in intricate dependence upon everything else, and nothing has self-standing being. In the terms of Western relational metaphysics, if we distinguish between internal relations that are constitutive of the identity of a thing and external relations that are incidental, the *anattā* view asserts that there are no internal relations and that human identity arises fortuitously as a tumbling-together of external relations. Buddhists holding this view used meditation to explore the nature of human identity so understood, and indeed their meditation exploits were partly responsible for the emergence of this view of human nature. Based on this line of experience and reasoning, Indian Buddhists built consensus around the conclusion that human beings are bundles of ontologically ungrounded relational characteristics; that consciousness is varied and often fragmented, and perception often unreliable; that suffering arises from attachment to the misleading appearances of conventional reality, including the appearance of ourselves to ourselves; that human identity as constructed evasively and in the grip of delusions of conventionality; and that the cessation of suffering, and indeed the highest spiritual liberation, is possible only by learning to see ultimate reality in and through its conventional appearances, which in this instance involves seeing no-own-being within the all-too-seductively-independent appearances of human identity. This view diverged sharply from regnant Brahmanic and also popular views of human identity as ontologically simple and unified.

Second, in the modern West, the analytic tradition of psychology springing from Sigmund Freud postulates unconscious and subconscious processes, motivations for behaviors of which we are completely unaware, physical manifestations of deeply buried psychic conflicts, and a world of nearly untraceable but extremely powerful psychological dynamics beneath the surface of conscious awareness. Medicine has discovered the placebo effect and is beginning to trace the causal pathways associated with mind-body influences such as the role of emotion in stimulating the sympathetic and parasympathetic nervous systems. Psychologists have documented the species-wide flaws in our perceptual and cognitive systems, indicating uneven development of our conscious cognitive powers. Neuroscientists have analyzed the brains of human and other animals, demonstrating just how much gets done without conscious awareness, and making many striking discoveries. For example, our brains have circuitry supporting more than one type of attention, all operating simultaneously. We appear to make decisions quite some time before we become consciously aware of having done so. And our brains are built for sociality to such a degree that without social connections it is impossible for anything resembling what we think of as a human being to arise within nature.

All of these recent discoveries about the neurology and psychology of human beings press against the consensus view of human nature as ontologically simple and unified, just as

Buddhist philosophy of two-and-a-half millennia ago pressed against the Brahmanic consensus of an eternal *jīva* governing conscious awareness and migrating through a host of embodied lives. And the distributed identity view is only gaining in persuasiveness. For example, new communication technologies form human identity and relationships in ways that are profoundly differently than in the past, and it is the networked vision of distributed identity rather than the abstract concentrated identity viewpoints that best fits these new realities.

This chapter argues that human nature is far from ontologically simple and unified. Ancient Buddhist philosophy and contemporary scientific insights play complementary roles in pointing us in another direction. We might point in the same direction by appealing to a number of aspects of the human condition, such as evolution, groups, justice, brains, language, cognition, emotion, meaning, bodies, sex, food, family, technology, economy, and dozens of other themes—all supportive of the distributed identity viewpoint. For the purposes of this chapter, I shall focus on what must surely be one of the most neglected themes in religious anthropology: human beings in the context of the microbial ocean that births, supports, threatens, and reabsorbs them. The microbial ocean is somewhat neglected even within the biological sciences themselves, much to the chagrin of microbiologists. Against extant ancient and modern forms of the distributed identity viewpoint, this chapter offers a portrayal of human beings as an *ecology of organisms*—that is, not just *in* an ecology but also *as* an ecology. The corresponding challenge is not uniquely to ontologically dualist notions of the human person; as noted above, physicalist views also often oversimplify the distributed complexity of human identity due to excessive deference to the seeming simplicity of emergent features of human beings, such as conscious self-awareness.

Just as the concentrated identity viewpoint has natural ethical and theological implications, so does the distributed identity viewpoint. To draw these out, I shall ask what the ecological character of human identity tells us about human nature. I shall also ask what the dawning human understanding of and technological control over the microbial ocean might portend for the theological meaning of human identity. Human identity increasingly appears to be constructed in a host of culturally distinctive and individually creative ways, but always as a corporate venture involving a veritable host of living organisms in mind-bogglingly complex arrays of networked relationships of mutual dependence.

2 The Microbial Ocean

In areas of the world with high standards of public health and good medical care, it is now widely known that indiscriminate use of antibiotics can accelerate the reproduction of "super-bugs" that are resistant to antibiotics. We are taught to wash our hands after visiting the bathroom, and also after moving through public places, especially when a contagious disease is known to be spreading through the population. We know we should cover our mouths when we sneeze, shower regularly, observe the expiry dates on the food we buy, and be careful whom we kiss. But these are merely droplets from the salty spray of the microbial ocean's waves as they crash against the shores of our experience. This ocean remains uncharted, except in a few convenient havens, and even there we usually only have mere sketches. Its sheer vastness in time, space, complexity, and contextual variation beggars the imagination. Microorganisms dominate the evolutionary story of life on Earth—they dominate in terms of length of temporal extent, importance for development of cellular mechanisms from metabolism to reproduction, diversity of species, and sheer numbers of life forms.

An organism is a living entity. A microorganism, or microbe for short, is an organism that is too small to be seen by the human eye. Microorganisms were discovered with the invention of the microscope in the late seventeenth century. Since that time, microbiologists have worked out increasingly intricate classification systems for microorganisms. Shockingly, the discovery of entirely new realms of microorganisms is still common, such is their diversity and the difficulty of finding and studying them. Their morphology is relatively simple, in the sense that many are unicellular and some have few or no organelle substructures such as a nucleus. But their diversity and metabolic complexity is unmeasured, and their ability to evolve quickly through horizontal forms of gene sharing makes them the high-speed engine evolution. From this perspective, multicellular organisms such as plants and animals seem to be spectacular compilations of the biochemical themes already laid down and explored in every conceivable variation within the world of microorganisms, like an "evolution's greatest hits" album. Unicellular microorganisms were the only forms of life on Earth from roughly 4 billion years ago until a relatively recent half-billion years ago, when simple multicellular animals emerged, many of them still microorganisms.

Microorganisms are living entities, according to the generally accepted criteria for life: independent metabolism and reproduction. Viruses are not cells, and need the cellular machinery of another organism for metabolism and reproduction, so they are generally deemed nonliving, though they do have genetic material and do evolve. The concepts involved in the definition of life are blurry in application. For instance, the meaning of "independent" is problematic. Some microorganisms need other microorganisms to reproduce and to carry out some metabolic functions, and so are not completely independent. The obvious example is sexual reproduction but there are other examples: some species must cooperate for movement, feeding, or thermal regulation. For my purposes, precision is less useful than appreciation of the diversity of microorganisms and vagueness of descriptive categories used to classify them. We can include nonliving viruses as honorary residents of the microbial ocean. In addition to viruses, there are protists (which are eukaryotes, cells with a nucleus) as well as bacteria and archaea (two branches of the family monera, which are prokaryotes, or cells without a nucleus).

The proportion of bacteria and archaea that have been named and studied is negligible—a mere 5,000 out of millions of species. Only 300 of the 500 species of bacteria found in the human mouth have been named and described.[1] Despite the morphological similarities already noted, microorganisms vary tremendously in size and shape, mobility and metabolism. They show ample evidence of horizontal gene transfer, whereby chunks of foreign genetic material are absorbed and then passed on to new generations. Bacteria reproduce asexually, which means that the offspring have the same genome as the parent. But even this is an approximate statement, as cell division is not reliable, some genes are transferred between bacterial cells, and even genetic recombination (a crucial phase of sexual reproduction) can occur in bacterial cell division. All of these features make bacteria incredibly flexible; they mutate fast, toss genetic material back and forth, and multiply quickly in a reckless exploration of the vast space of genetic possibilities. Less is known about the way archaea reproduce but they seem to have about the same degree of evolutionary agility.

Bacteria and archaea use a wide variety of energy and metabolic mechanisms, many of which are quite different from those in animals. Some species of bacteria and archaea synthesize organic compounds (autotrophs) and others absorb organic compounds by consuming other organisms (heterotrophs). Some species derive energy from light, others from processing organic molecules, and yet others from processing inorganic molecules. The biochemical pathways involved in producing energy are also diverse, involving many different kinds of chemicals and producing many different chemical products. For example, some generate energy from methane and oxygen, producing carbon dioxide. Others generate energy from ammonia and oxygen, producing nitrogen-oxygen compounds, while yet others take hydrogen and carbon dioxide into methane, or hydrogen and sulfates into hydrogen sulfide.

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[1] See Scott Freeman, *Biological Science* (Upper Saddle River, NJ: Prentice Hall, 2002), 484; much of the information that follows can be found in this book, or in any other elementary textbook covering the subject.

Only one metabolic pathway for energy production took off in animals but numerous alternative pathways were explored in the world of bacteria and archaea, and these alternatives are still ecologically crucial today.

To appreciate the importance of these alternative forms of metabolism, consider that the Earth's oxygen atmosphere is a direct result of ocean-borne cyanobacteria using photosynthesis to produce oxygen. Prior to about two billion years ago, the halfway point in the history of life on Earth, there was no free oxygen, but after that time, oxygen was freely available, first in the oceans, and eventually in the atmosphere. This is a crucial point in evolutionary development because oxygen-based metabolism produces far more energy than other types. Higher-pitched metabolisms allow for more complex creatures, so it is at this time that multicellular organisms such as algae, some of which were macroscopic, first appeared. This, then, was the era in which microorganisms first produced macroorganisms, and the key was the creation of free oxygen by means of cyanobacteria and photosynthesis. Human beings owe the possibility of their high-metabolism existence to those bacteria.

Another example of the ecological and evolutionary importance of bacteria and archaea is nitrogen fixation. This process is carried out by diverse species of bacteria and archaea, and is crucial for making organic nutrients available to plants and animals. No nitrogen fixation means no energy, which in turn means no fish in the rivers, no plants in the earth, and no food for land animals. We can see the importance of this in polluted rivers. On the one hand, if the bacteria and archaea needed for nitrogen fixation are killed by pollutants running into rivers, the organic chemicals needed to sustain river plants and animals are not produced, leading to disaster. On the other hand, ammonia-based fertilizers are sprayed onto crops with noticeably increased yields, because the nitrogen feeds microorganisms needed to convey nitrate compounds to plant roots. But the nitrates also run off into rivers. Once in the rivers the ready supply of nitrates cause vast numbers of cyanobacteria to bloom, and these in turn become food for oxygen-consuming heterotrophs. The result is that all the oxygen in the river is used up and there is a dead zone for river plants and animals. This example also serves to show that human beings deploying technologies affecting bacteria and archaea routinely underestimate the complexities involved and sometimes produce ecological disasters.

The microorganisms among the eukaryotes are mainly protists, which are all eukaryotes that are not green plants, fungi, or animals; there are also microscopic plants, fungi, and animals, however. The protists are diverse, though not as varied as bacteria and archaea. They survive by eating smaller organisms, especially bacteria; by scavenging nutrients from dead organisms; through parasitic or mutualistic relationships with other organisms; or through photosynthesis. Some use tails (flagella) or hairs (cilia) or protuberances (pseudopodia) to move and hunt and scavenge, while others sit still and wait for food to come floating or crawling by. Some reproduce asexually as bacteria do while others reproduce sexually. Some can use both means of reproduction depending on environmental conditions.

Microbiologists can determine the character of the first eukaryotes after the common ancestor with archaea by looking at the oldest eukaryotes in the fossil record. These were single-celled organisms with a cytoskeleton and a nucleus but lacking the cell wall that later was to become vital for giving structure to multicellular eukaryotes. The endosymbiosis theory proposes that these early eukaryotic cells absorbed bacterial cells, which survived as energy-producing mitochondria rather than being consumed.[2] This symbiotic event happened around two billion years ago, in the era that saw large quantities of free oxygen produced by cyanobacteria. The same endosymbiotic event prior to that era would not have been fruitful because mitochondria use oxygen to produce energy. In the presence of oxygen, however, mitochondria were able to supply high levels of energy that could support previously

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[2] See Lynn Margulis, *Symbiosis in Cell Evolution: Life and Its Environment on the Early Earth* (New York: W. H. Freeman, 1981), who made this older idea prominent.

impossible levels of metabolic activity, in return for protection. It was a happy symbiotic arrangement. The same theory is also used to explain the appearance of photosynthesis in eukaryotes, as protists absorbed photosynthetic bacteria. There is compelling biochemical, structural, and genetic evidence to support these endosymbiotic theories of how eukaryotes obtained the mechanisms for supplying their vast energy needs. Thus protists, and all other surviving eukaryotic organisms from microscopic unicellular creatures to human beings, were from the beginning hybrids made from vastly different elements in the microbial ocean.

Protists affect ecology on much the same scale that bacteria and archaea do. The key here is the sheer numbers of protists. There can be millions of protists in a cup of pond water. The oceans are full of protists from large kelp forests to microorganisms, particularly near the surface where photosynthesis is possible. And this is vital for the Earth's carbon cycle. Carbon moves around quickly in the oceans because of the feeding patterns of protists and bacteria. In this process, it is absorbed into the shells of protists that, upon dying, sink to the ocean floor, gradually forming limestone sediments. This oceanic carbon sink is about 50 percent responsible for the reabsorption or fixing of atmospheric carbon dioxide, one of the main gasses implicated in global warming.

We are also tracking the roles of nonliving viruses in the microbial ocean. Viruses are the original parasites, in the sense that they cannot reproduce or carry out any important metabolic functions without using the machinery of a host cell. So they invade cells, hijack cellular mechanisms, reproduce themselves, and spread in search of new hosts. They possess genetic material in the form of amazingly diverse DNA or RNA genomes, reproduce in host cells at a fearsome pace because they are relatively simple, and use gene sharing and genetic recombination to evolve rapidly, allowing them to adapt efficiently to an ever changing environment. They are orders of magnitude more numerous than bacteria, archaea, and protists in many habitats, such as ocean waters. For every kind of microorganism that evolution has produced, and for every kind of cell in every animal, fungus, green plant, and macroscopic protist—that is, for every kind of life form on the Earth—there are viruses that can invade and exploit the internal metabolic capacities. In particular, viruses can invade virtually every kind of cell within the human body.

It is not easy for a virus to infect a host cell, particularly in a multicellular organism. There are cell membranes and often cell walls to contend with, and in sufficiently complex organisms there are also flexible immune system hunters that gobble up most viruses they encounter. Invasion is possible when there is a perfect fit between the virus and a protein in a cell membrane, so that the virus can simulate another chemical and gain entrance to the cell under false pretenses. Once inside, coopting a cell's metabolic and reproductive services is comparatively unproblematic.

3 Humans in the Microbial Ocean

Understanding the all-pervading nature of the microbial ocean can leave the impression that we ought to construct human identity as a highly evolved organism constantly under attack from a veritable multitude of merciless microorganisms. This is a fundamentally misleading way of looking at human life in the microbial ocean but let's give this view its due before moving beyond it.

While no archaea are known to cause disease in human beings, a few species of bacteria do. Considering how many species of bacteria there are, it is surprising that so few cause disease. Bacteria-based diseases and conditions include acne, cholera, diphtheria, dysentery, ear infections, eye infections, food poisoning, genital tract infections, gingivitis, gonorrhea, leprosy, meningitis, plague, pneumonia, scarlet fever, sepsis, strep throat, syphilis, tetanus, tooth decay, tuberculosis, typhoid fever, and urinary tract infections. These diseases work in many different ways, from consuming cells for bacterial food to producing poisons that kill other cells. A very few protists also cause diseases in human beings, including amoebic dysentery, Chagas disease, Chlamydia, some forms of coronary heart disease, diarrhea, malaria, paralytic shellfish poisoning, reproductive tract infections, sleeping sickness, spotted fever, and typhus. In immune-compromised people such as AIDS patients, protists cause diseases and infections of the nervous system, digestive system, and respiratory system. And protists can wipe out other food sources, which is how the Irish potato famine in 1845–1847 not only killed one million Irish but also brought Irish culture to many parts of the world as two million Irish emigrated in search of food for themselves and their children. A very few viruses cause dangerous diseases in human beings, including adenovirus, dengue, ebola, encephalitis, Epstein-Barr, erythrovirus, hantavirus, hepatitis, herpes, HIV, influenza, measles, pappiloma, polio, rabies, rotavirus, rubella, smallpox, variola, West Nile, and yellow fever.

On this basis, we might feel justified in concluding that we should think of ourselves as perpetually under attack and our very existence constantly imperiled by invisible, mindless viruses and life forms with which no negotiation and no truce is ever possible. But the sheer number of microorganisms with which we live in harmony staggers the mind. All of these health problems, and others such as chronic inflammation that may be due to a variety of microorganisms, are extremely minor side effects (relatively speaking) of what amounts to an almost miraculous equilibrium relationship between human beings and the microbial environment. Negotiation with the microbial enemy might be impossible but our bodies and their symbiotic relationships with microorganisms and viruses express billions of years of biochemical harmonization.

We can observe around us the feedback cycles that establish this equilibrium. The most virulent strains of microorganisms and viruses tend to kill their hosts before they can pass to a new host, while less virulent strains survive in their host for long enough to be passed on, so environmental conditions will determine whether virulent strains will be able to survive. In particular, if public health is poor in densely populated areas—say, if human excrement finds its way into drinking water—then virulent strains will easily thrive because they can find new hosts easily. This is how deadly forms of dysentery operate. Where public health is good, by contrast, the virulent forms die off because they never find new hosts, and the inconvenient but not deadly milder forms are the only ones that can survive. In this way, bacterial realities set the conditions within which it is adaptive to worry about the purity of food and anything else with which we come into contact. This probably explains the origin of purity rules and regulations in all human cultures. It probably also describes the origins of purity-based moral judgments, which are side-effects of an adaptive cognitive feature of human beings and other animals—side-effects that are massively extended into cultural and religious practices where they no longer serve the original biological point. The harmonizing mechanisms that produce the miraculous equilibrium that is human life are therefore both biological and cultural in character.

The harmony among organisms that is human life goes still deeper than this. Some viruses are essential for organism survival, such as the so-called endogenous retrovirus whose immune-system depressing features allows embryos to be implanted in the uterine wall of many mammals, including human beings, without being attacked. All larger organisms, including human beings, benefit from symbiotic arrangements with thousands and probably millions of distinct species of microorganisms. Symbiotic relationships on this massive scale are absolutely necessary for human survival. Researchers in the Human Microbiome Project have discovered over 100,000 genetically distinguishable microorganisms living in and on the largest human organ, namely, the skin. There is an even larger number of species of microorganisms living in a lining up to several millimeters deep throughout a healthy human gut. These microorganisms perform numerous valuable functions from synthesizing chemicals to fermentation, and from training the immune system to inhibiting the growth of pathogens. There are upwards of ten times as many such organisms as there are cells in the entire human body. Among its other virtues, breast feeding is the main way that this beneficial gut flora is established early in human life. Every external part of the human body is covered with microorganisms and every internal part sustains symbiotic relationships with them. Microorganism-based disease is extremely rare relative to these facts of human life harmonized within the microbial ocean.

In fact, it appears to be deeply misleading to think of human beings, or any complex organism, as a distinct species independent of environmental factors such as the microbial ocean. Human beings are a walking, feeling, thinking superorganism, an entire mobile ecology of organisms. The Gaia Hypothesis speculatively supposes that the entire ecosphere is a superorganism.[3] In the case of human beings, the parallel superorganism claim is easier to establish. There is no longer any question that we are superorganisms, profoundly dependent on an astonishingly complex ecology of microorganisms, including bacteria, archaea, and protists, and even viruses.

In accord with what was said above about harmonizing mechanisms being both biological and cultural, it is important to note that microorganisms and viruses are also of enormous importance in human economies. Human adventures in the microbial ocean have not always worked out well. For example, scientists have speculated that it was probably careless handling of a dead primate carrying one form of the HIV virus—perhaps consuming an infected chimpanzee for food without thorough cooking—that allowed it to cross to human beings. There are similar stories to be told about human technological explorations of the microbial ocean: the desire to master the environment is virtually unstoppable and we

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[3] See James E. Lovelock, "A Physical Basis for Life Detection Experiments," *Nature* 207, no. 7 (1965): 568–70; for more recent works, see Fritjof Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor, 1997); Stephan Harding, *Animate Earth: Science, Intuition, and Gaia* (White River Junction, VT: Chelsea Green Publishing, 2006); James E. Lovelock, *Gaia: A New Look at Life on Earth* (New York and Oxford: Oxford University Press, 2000); Lynn Margulis, *Symbiotic Planet: A New Look at Evolution* (London: Weidenfeld & Nicholson, 1998).

often forge ahead heedless of danger. For the most part, however, technological deployments of, and interventions in, the microbial ocean have been fruitful. Microorganisms such as eukaryotic yeast fungi have been used for centuries in fermentation and baking—imagine human life without bread, cheese, or wine! Bacteria have been successfully used for waste processing, from the remediation of oil spills to the treatment of raw sewage. Microorganisms are increasingly important in industry where they are used to produce pure chemicals, to manufacture numerous products, to derive minerals in mining refinement processes, and to manage industrial waste. In the latter case, research efforts strive to find microbial processes that can reduce harmful environmental toxins to chemicals that can safely be reused or released into the environment.

Microorganisms also appear in more speculative technological ventures. For example, they are used in agriculture as targeted solutions to infestation problems, with the aim of killing only unwanted insects while leaving the plants, other insects, and human beings unharmed. In biotechnology they are used to produce medicines from insulin for treating diabetes to the antibodies used in vaccines. These and many other applications of microbiology inevitably depend on knowledge of possible side-effects that we simply do not possess. The biochemical interactions between a microorganism and a wild environment are incalculable. Experiments do not necessarily manifest the relevant features in a detectable or timely way. This is why vaccines and biological pest control are such controversial technologies, with both being blamed for larger waves of human suffering such as rising rates of autism and cancer. The evidence for these kinds of negative side-effects is merely circumstantial, which frustrates those trying to get government agencies to take more seriously the environmental risks of biotechnological adventures in the microbial ocean.

In medicine, defanged and reengineered viruses are used as delivery vehicles to insert segments of genetic material into target cells. The long-awaited targeted treatments for diseases such as cancer, which we dream of as replacements for indiscriminately destructive chemotherapies and radiology treatments, depend on technologies such as these. But it is clear neither that *only* the targeted cancerous cells would be affected, nor that the proteins produced after the genetic material is delivered would have no unplanned effects. Other medical technologies such as xenotransplantation—the use of organs from nonhuman animals in human beings—are extremely valuable from a short-term health point of view but may also unleash viruses or microorganisms that are harmless in the source environment but eventually harmful in the target environment. The HIV virus is a classic example of this kind of viral threat; though it was not medical technologies that caused that virus to jump species, it might have been, and something like this could still happen. The military applications of such technologies in any number of forms are especially worrying.

Just as there is virtually no end to the microbial ocean, including the world of viruses, so there is no end to the potential technological uses to which creative and mischievous human beings can apply the special powers of microorganisms and viruses. Unfortunately, in this area as in some others, our ability to devise novel interventions in the microbial ocean far outstrips our understanding of the emergent interactive effects of our interventions in real environments. Science fiction literature and film have been quick to point this out. In Francis Lawrence's film *I Am Legend*, one of three films based on Richard Matheson's 1954 novel of that name, a very minor event produces a deadly plague that destroys almost all human life in a variety of ways. In John Wyndham's *Day of the Triffids*, a few superficially unlinked events produce a massively amplified effect, wiping out most of humanity. Almost every zombie film and book is premised on scientific carelessness in relation to the microbial ocean and waste chemicals that might affect it. The target in all cases is human arrogance and greed in the face of necessary ignorance, taking dangerous steps for attractive economic reasons that really should only be taken with much more complete knowledge already in hand or as calculated gambles in circumstances of great desperation.

4 Human Identity in Microbial Perspective

This quick survey of the microbial ocean and the human form of harmonization within it has far-reaching implications for any philosophical or theological interpretation of human identity in biological and technological perspective. In a religious naturalistic framework, these implications also impact theological reflection on the nature of ultimate reality, though I will not be discussing that here.[4] Philosophers and theologians have barely begun to explore these issues. The first step in appreciating the implications, surely, is to know what they are. Here we have yet another reason to think that philosophical and theological work might be advanced with sound science education. The second step is to recognize that, at the most general level, knowledge about the microbial ocean challenges *concentrated identity* views of the human person and adds new insights that decisively support *distributed identity* interpretations of human life. This alone should cause every philosopher and theologian to pause the next time they find themselves called upon to characterize human identity.

We have seen that every large organism is a stunningly complex ecology of organisms whose viability represents a kind of negotiated settlement between the fortuitously enabling features and the mindlessly destructive properties of the microbe-dominated environment. The negotiated settlement crafted through evolutionary adaptation sometimes breaks down, bringing disease and untimely death. Most of the time, however, it works well enough to allow hours or months or decades of healthy life activity, depending on the species. Human beings can count on optimal adult function for several decades—more when sound public health practices allow us to keep at bay the parts of the microbial ocean to which we are poorly

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[4] See Wesley J. Wildman, *Science and Religious Anthropology: A Spiritually Evocative Naturalist Interpretation of Human Life*, Ashgate Science and Religion Series (Aldershot, UK: Ashgate, 2009).

adapted, thereby delaying the inevitable microbial reclaiming of our bodies as their adaptive harmonies yield to the chaos of sickness, decrepitude, and death.

This entails that sickness, decrepitude, and death are natural parts of human life. Contrary to the teachings of some religions, these less desirable aspects of life are not penalties for sin, though they can be the results of foolish choices surrounding food, behavior, and technology. Nor are they things to be escaped, in the way suggested by the legendary encounters with sickness, decrepitude, and death spurred the young Buddha's quest for enlightenment. But they are not pleasant, either. The fact that the superorganism ecology of the human person can sustain dynamic balance within the microbial environment for a few decades is a stunning achievement of the evolutionary process. It gives us time to contribute to the building of cultures and to lay down treasured memories. Equally importantly from a religious point of view, this dynamic balance creates opportunities for us decide how we will regard the ultimate reality manifest in and through the wealth of our life experiences. This evolutionarily negotiated window of high functioning allows us to dispose of our lives creatively, for the sake of projects larger than ourselves. We can bend our superorganism minds to the purposes of self-cultivation, responsibility, and harmony, and we can learn to accept our actual life context. Or we can frantically throw our energies about in self-dissolution and crazed denial. Or we can focus our efforts in acts of great selfishness and violence, powered by displaced fury at our life situation.

We do all this together, in groups, of course. We narrate our existential situation to one another using the symbolic resources sequestered in sprawling wisdom traditions. We rehearse the importance of the fundamental moral and spiritual choices that we face. We deploy technologies of healing and compassion to bring comfort in the face of trouble and where possible to restore optimal functioning when it is compromised. We handle cognitive dissonance between the world as we narrate it and the world as we encounter it by adapting our stories and technologically taming the parts of the world that we can manage. But mostly we live beneath sacred canopies that remain invisible to us and whose functional parameters we do not readily grasp. We cosmologize the narratives inspiring those sacred canopies, inscribing their core assumptions on the vague universe so as to make our cultural and religious narrations unquestionable, and thus all the more comforting and potent. This enables us to hold off awareness of anomic chaos.[5]

This socially networked process of moral and religious exploration is not mere delusion. Mechanisms of social control and self-deception are increasingly obvious once we learn to identify them. But much more is going on here than merely management of terror in the face of anomia. We sincerely engage the spiritual depths of nature through our moral and religious exertions, through our religious narrations and moral legislations, and by means of technological marvels and healing methods. This is human life—it is spiritually charged with luminous possibilities of authenticity and engagement with ultimacy. We dance out all of these options in the company of story-telling companions along the knife edge of transient dynamic stability that is biological evolution's gift to us. Beset on all sides by mindless microbial consumption and also enabled by microbial ecologies to which we are beautifully adapted, we claim a few decades from anomic chaos and flourish with emotional intensity, intellectual curiosity, spiritual meaning, and moral creativity.

Human identity is distributed in vastly complex and intricately interacting neurological, biological, social, ecological, cultural, and axiological systems in mostly harmonious ways. Sometimes the harmony breaks down in one or another respect, and we suffer, but even our suffering depends on the underlying superorganism harmony continuing in almost all respects. Ultimately the harmonies of human identity disintegrate into chaotic sounds, which finally

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[5] This encapsulates the sociology of knowledge as presented in Peter L. Berger, *The Sacred Canopy: Elements of a Sociological Theory of Religion* (Garden City, NY: Doubleday, 1967).

yield to the silence of nothingness. But it is precisely this ultimate fate, and our awareness of its looming shadow, that marks our identity as precious and propels us to seek justice for those whose lives are miserable and short. The miracle of human life as a dynamic superorganism equilibrium within the microbial ocean is intellectually fascinating, to be sure. But it is also exquisitely, painfully, unbearably beautiful—even when it goes awry, and even when it ends.