DOES A BIOLOGIST NEED A SOUL?

William E. Carroll

"Why Nothing Is Truly Alive" is the provocative title of an essay in the *New York Times* on March 12, 2014. The author, Ferris Jabr, an associate editor of *Scientific American*, begins with a reflection on large, machinelike moving statues, made with "intricately conjoined plastic tubes, wood and sails, and flexible legs, statues which lumber across the landscape of the Netherlands." The Dutch artist, Theo Jansen, calls his creations "Strandbeest" and identifies them as "new forms of life." Jansen says his goal is "to put these animals out in herds on the beaches, so they will live their own lives."[1] In his essay Jabr comments that on encountering these strange creations, he has been led to conclude that Strandbeesten "are no more or less alive than animals, fungi, and plants. In fact, nothing is truly alive."

According to Jabr, the sciences cannot tell us what life is. Textbooks will list characteristics that offer ways to distinguish the living from the nonliving, but Jabr cites examples such as highly organized crystals that grow and replicate their structures, or certain computer programs, now known as "digital organisms," that reproduce and evolve. He also points to viruses that hijack cells to make copies of themselves. After citing such examples, Jabr tells us that, at best, life is only a "concept, not a reality."

> Not only is defining life futile, but it is also unnecessary to understanding how living things work. All observable matter is, at its most fundamental level, an arrangement of atoms and their constituent particles. These associations range in complexity from something as simple as, say, a single molecule of water to something as astonishingly intricate as an ant colony. All the proposed features of life—metabolism, reproduction, evolution—are in fact processes that appear at many different regions of this great spectrum of matter. There is no precise threshold.

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Jabr ends his essay with a peroration to the Dutch machine-statue: "Watch a Strandbeest's sail undulate in the wind, its gears begin to turn, its legs bend and extend in sync over and over—so dauntless, so determined. It does not matter whether the magnificent entity is alive or not. Just look at it go." Of course it does matter whether machines are alive or not. There really is a difference between the living and the nonliving. The world in which we live cannot simply be described as a "great spectrum of matter."

Attempts to dissolve the distinction between living and nonliving entities are not new, but recent developments in the natural sciences continue to keep these attempts in play. Seven years ago the journal *Nature* featured special stories about "synthetic biology," the science that seeks to construct life from a wholly artificial genome made by DNA synthesis technology. In a lead editorial in that journal, we find the following comment about life:

> There is a popular notion that life is something that appears when a clear threshold is crossed. One might have hoped that such perceptions of a need for a qualitative difference between inert and living matter—such vitalism—would have been interred alongside the pre-Darwinian belief that organisms are generated spontaneously from decaying matter. Scientists who regard themselves as well beyond such beliefs nevertheless bolster them when they attempt to draw up criteria for what constitutes "life." It would be a service to more than synthetic biology if we might now be permitted to dismiss the idea that life is a precise scientific concept.[2]

Doubts about the distinctiveness of living things *precisely as living* have currency, in part, because of the persistence in modern science of various materialist, mechanist, and reductionist accounts of living and nonliving entities: indeed, of the elimination of any real, qualitative distinction between the living and the nonliving. As Rodney Brooks, director of the Artificial Intelligence Laboratory at MIT, claims: evolution has shown us that we are nothing more than "a highly ordered collection of bio-molecules." Living bodies are nothing more than masses of biomolecules, machines that act according to a set of specific rules having their foundation in physics and chemistry. Every feature of living things can be described in terms of molecular interactions.[3]

Brooks and many others move quickly from the insights of evolutionary biology that describe the origins and developments of living things in terms of purely physical processes (e.g., genetic mutations and natural selection) to the conclusion that living things are nothing more than a particular collection of material phenomena. E. O. Wilson, in *The Social Conquest of the Earth* (2012), notes that advances in the natural sciences, especially evolutionary biology, "are now sufficient for us to address in a coherent manner the questions of where we came from and who we are."[4] Living beings, as Paul Churchland tells us, "are the wholly physical outcome of a purely physical process [evolution]. . . . We are creatures of matter. And we should learn to live with that fact."[5] For Churchland, the notion of some "immaterial soul" as an explanation for human consciousness and cognition is a relic from a less enlightened age; it is a "myth, false not just at the edges, but to the core."[6]

Although references to a soul often seem limited to traditional accounts of human souls, these discussions concern the broader

topic of how to understand what it means to be alive. The "soul" as the principle of life in any living thing has also been used with respect to plants and animals, as a way to distinguish them from inanimate things. Hence, one could speak, as Aristotle does, of souls of plants, souls of animals, and souls of human beings. Each of these different kinds of soul is the source of the distinctive kinds of life that plants, animals, and human beings manifest.

Rejection of the idea of human souls is connected to the wider rejection of any fundamental, distinguishing characteristic of living things. For those scientists and philosophers who embrace some form of materialism there is a strict disjunction: either we explain the living in terms of material, mechanically operating constituents, or in terms of some mysterious spiritual substance, some vital force. There is no substitute for materialism but magic; for there is no philosophical position other than materialism that is compatible with the science of biology. This is true, so the argument goes, because this mysterious substance, this vital force, yields itself even in theory to no method of investigation; it must be cast aside, with the result that one is left with the inevitable conclusion that there is nothing more to living beings than their material parts.

An example of the identification of "soul" with some form of spiritual force—and, hence, its rejection—can be seen in the analysis of Sean Carroll, a physicist at the California Institute of Technology. In an essay in *Scientific American* (May 23, 2011), with the title "Physics and the Immortality of the Soul," Carroll notes:

> Very roughly speaking, when most people think about an immaterial soul . . . they have in mind some sort of blob of spirit energy that takes up residence near our brain, and drives around our body like a soccer mom driving an SUV. The questions are these: what form does that spirit energy take, and how does it interact with our ordinary atoms? Not only is new physics required, but dramatically new physics. Within Quantum Field theory there can't be a new collection of "spirit particles" and "spirit forces" that interact with our regular atoms, because we would have detected them in existing experiments.

But, Carroll queries, even if we were to discover such spirit particles, empirical evidence for the existence of an immaterial soul, how is such spirit energy to interact with us?

Contemporary physics has an elaborate equation, known as the Dirac equation, that "tells us how electrons behave in the everyday world." To capture such complex behavior in a single equation merits the equation's being reproduced here, even if it is beyond the understanding of the average reader:

$$i\gamma^{\mu}\partial_{\mu}\psi_{e} - m\psi_{e} = ie\gamma^{\mu}A_{\mu}\psi_{e} - \gamma^{\mu}\omega_{\mu}\psi_{e}$$

The details are not important: "the two terms on the left are roughly the velocity of the electron and its inertia—coupled to electromagnetism and gravity, the two terms on the right." Carroll tells us that if one were to believe in an immaterial soul, then one would have to conclude that "this equation is not right." There would have to be, he thinks, a new term that represents how this soul would interact with electrons.

Even to entertain such a question is foolish; for once you begin to consider the question of the soul's interacting with physical phenomena, "the choice you are faced with becomes clear: either overthrow everything we think we have learned about modern physics, or distrust the stew of religious accounts /

unreliable testimony / wishful thinking that makes people believe in the possibility of life after death." Carroll broadens his critique to any attribution of "soul" to plants and animals. Biologists, aware of the long history of evolution, find no point at which organisms stopped being describable "purely as atoms interacting through gravity and electromagnetism."

Sean Carroll is correct in noting that theories and techniques of modern science provide no space, as it were, for immaterial principles in the explanation of nature. To ask for empirical confirmation of what, in principle, is not subject to empirical observation makes no sense. There is, however, a broader question that needs to be addressed: whether the modern natural sciences, in principle, exhaust what reason can tell us about the natural order. To speak of the proper domain of scientific investigation, and, indeed, of the proper understanding of what constitutes the natural sciences, is to enter the realm of philosophical analysis. A kind of a priori philosophical commitment to the view that living things are nothing more than the arrangement of material parts is just that, an initial commitment that is not a conclusion based on empirical evidence. It is a way of understanding the world on the basis of which one functions as a scientist. But the philosophical analysis that concludes that we must choose between materialism and some form of vitalism is based on a limited understanding of the options.

As the quotation from *Nature* indicates, there are many who, by accepting a form of materialism and reductionism—that is, by insisting that living things are nothing more than the sum of their physical components—conclude that a question such as "What is life?" is, at the very least, not a biological question, and probably is best rejected as a question without content. So we hear that one ought to resist using the term *life* to describe what is merely a highly sophisticated movement of matter. In an important sense, according to such a view, *life*, as something other than matter in motion, does not exist.

Life, however, is more resilient than attempts to eliminate it as a category of scientific discourse, not to mention as a feature of nature! Natural philosophy is the discipline that helps us to understand what it means for something to be alive and can allow us to criticize various versions of mechanism, materialism, reductionism, and theories of emergence. Natural philosophy is, in a sense, a more general analysis of nature and its principles than what any of the individual empirical sciences offer. Natural philosophy is not the collection of the conclusions of the various sciences; rather, it reflects deeper (and in some sense more abstract) questions about change, time, the reality and nature of physical beings, and also how to understand distinctions between living and nonliving bodies.

Among contemporary philosophical reflections that challenge a reigning materialist understanding of nature and human nature, Thomas Nagel's critique in *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False* has been the focus of considerable attention. Nagel's work challenges the very assumptions about science that Sean Carroll finds nonnegotiable. Nagel thinks that in principle the contemporary natural sciences are incapable of providing an adequate account of nature and human nature. His emphasis is on mind and consciousness, but ultimately he challenges the metaphysical presuppositions that reduce explanations of nature to exclusively material categories. Nagel's analysis is mostly a negative critique, but he does suggest the outlines of expanded natural sciences that

include some form of natural teleology but without any reference to God.

In addition to Nagel's negative critique, there is among biologists and natural philosophers a view of life that emphasizes not so much the material components but rather a specific form or structure that is the source of the organization of matter. Life, in the view of these thinkers, is not merely the sum of specifically determined material parts, such as, for example, specific molecules like DNA, or proteins, or particular chemical elements such as carbon. Accordingly, since structure is the key to life, it would be possible, at least in theory, to fabricate life on the basis of a different material substrate—that is, to apply a special structural form to other material elements: to create "artificial life."

Although there is some attraction to an emphasis upon relationality (among material components) as a way to understand life, there is a danger in making relation itself the primary feature of the world of the living (or of the inanimate world as well). This emphasis on relations and structure does reflect the dynamic, interdependence of living things and of their material makeup, yet it seems counterintuitive to deny that various entities are prior to the relations that exist in and among them.

A little more than a decade ago an American microbiologist, Carl Woese, wrote a provocative essay in the journal *Microbiology and Molecular Biology Reviews*. In "A New Biology for a New Century," Woese argues that contemporary biology is somewhere between its "reductive molecular past and its holistic future" and is, correspondingly, in need of a new guiding vision. According to Woese, biologists have come increasingly to realize the limits of the reductionism that accompanied the rise of molecular biology. Although such reductionist biology played an important role in our understanding of nature, it is clear, Woese argues, that "knowing the parts of isolated entities is not enough." Or, as he puts it, "molecular biology could read the notes in the score, but it could not hear the music."

Woese thought that reductionist presuppositions, which have underpinned much of molecular biology, represent a kind of philosophical albatross that results in a "biology that operates from an engineering perspective, a biology that has no genuine guiding vision!" A heavy price was paid for molecular biology's obsession with metaphysical reductionism. It "stripped the organism from its environment; separated it from its history, from the evolutionary flow; and shredded it into parts to the extent that a sense of the whole—the whole cell, the whole multicellular organism, the biosphere—was effectively gone." Today biology must face the great "nonreductionist" topics that molecular biology has left untouched, and they are all part of one master theme: the nature of complex organization. For Woese, the release of biology "from the intellectual shackles of mechanism, reductionism, and determinism" constitutes a turning point within the discipline. There is a new emphasis on dynamic systems and "holistic, 'non-linear,' emergent biology."[7]

When we say that the difference between the components of a system and the system itself is the organization of the components into a system, we need to pay attention to what we mean by "organization." The components of a system have a new relation to one another, a relation that did not exist prior to the system. The essential point, neglected by reductionist habits of thinking, is that these relations are not mental fictions, projections, or interpretations; they are objectively real, just as real as the parts, which they relate to each other. We need to be careful to

distinguish between "mental relations" that result from a merely conceptual comparison of objects and "real relations" (e.g., cause and effect) founded in some extramental connection between the related parts.

Woese's general criticisms of the inadequacies of materialist and reductionist accounts in biology are shared by many modern biologists. When the late Ernst Mayr, surely one of the leading biologists of the last century, looked at the differences one finds in nature, from the lowest and simplest physical entities to the highest and most complex animals, he spoke of "emergence": at higher levels of organization and complexity, new properties emerge that are not found at the lower and simpler levels.[8] Mayr calls our attention to an insuperable problem for those who advocate biological reductionism: namely, living organisms possess properties that are very different from those of the nonliving constituents of the organisms; and organisms are not mere aggregates of their parts and constituents, but are and act as unified wholes. Nevertheless, if we were to have posed the question of reductionism to Mayr, he, along with many other contemporary biologists, would affirm that there is nothing more to living things—indeed, to all things—than their material constituents.

There continue to be attempts like Mayr's to reject a particular type of reductionism while at the same time affirming a materialist or physicalist understanding of living things. According to the theory of emergence, a "higher level property" such as consciousness is said to be "emergent" when it is irreducible to the sciences that study the material constituents from which the property ultimately derives. The properties characteristic of living beings, precisely as living, emerge from the material constituents, but these emergent properties are not reducible to the constituent elements.

Additional support for the view that living beings are "new, non-reducible realities" can be found in the work of those scientists, like Stuart Kauffman and others, who now recognize that the behavior of large and complex systems cannot be adequately described in terms of their own component parts alone, and think that they need to augment their reductionist methods with analyses of "information-bearing patterns."

Contrary to the naive materialism of some thinkers, contemporary developments in the biological sciences reveal a more profound understanding of the natural order: a search to understand the "more than" material components to which the evidence of the natural sciences points. This quest underlines, I think, the reflections of those who refer to "non-reductive physicalism," emergent monism, and the like.

I am not persuaded, however, that these various accounts offer an adequate foundation in natural philosophy or metaphysics for providing an explanation of life. Theories of emergence can only affirm, but not explain, the activity that proceeds from the whole, precisely as the whole. So long as emergence remains unable to account for what makes the whole to be the single entity it is—and thus the source of its characteristic activities—the tendency will be to fall back into a form of reductionism, attributing to the parts a more fundamental reality than the whole.

Certainly many biologists do not accept an epistemological reductionism of biology to physics and chemistry. But most biologists do accept a kind of ontological reductionism according to which living things are nothing more than a complex ordering of material components. Indeed, there is a tension between a pervasive commitment, on the one hand, to "physicalism"—that "physical

facts" account for *all* the facts—and, on the other hand, to the realization that biological properties and processes have an appropriate autonomy of their own, and hence are not reducible to chemical and physical ones.

There are, of course, different ways in which the term *reductionism* is used. Often the distinction is made between the reduction that applies to beings themselves (ontological reductionism) and the reduction that applies to the methods, concepts, terms, and theories of the sciences (methodological or epistemological reductionism). A popular view is to say that all living beings are nothing but their chemical and atomic makeup, but not to think that this fact means that explanations or methods of investigation in biology can be replaced by or reduced to explanations in physics and chemistry: that is, to be an ontological reductionist but not a methodological reductionist. Daniel Dennett, the philosopher who wrote *Darwin's Dangerous Idea*, calls this a distinction between being a good reductionist [ontological] and a greedy reductionist [methodological].[9]

This commitment to good reductionism versus greedy reductionism is logically possible, however, only if one is not a realist. A realist is someone who thinks that our knowledge of nature, for example, captures what nature really is like. So, if ontological reductionism is correct, it *should* be possible to reduce the terms and theory of the more complex science to those of the more basic science; that is, if it is the case that the terms of science really apply to nature. If, however, one is a nominalist or a nonrealist in scientific epistemology, one will hold that science is not about things but about terms, concepts, and propositions. For such a nominalist it might seem logically possible that the terms of the more complex science cannot be reduced to those of the more basic science, even though the complex realities themselves can be reduced to the more basic realities.[10]

I think this is the case with those who speak about emergence and yet remain reductionists; they tend to refer to "concepts" needed to describe an emergent level of reality as being specific to that level, and maintain that these concepts "are not logically reducible" to the concepts used to describe the "constituent parts." Arthur Peacocke, the late British chemist and Anglican theologian, offers a version of what he calls "emergent monism," which, he says, is

> an ontologically reductionist [view], in the sense that everything can be broken down into fundamental physical entities and no extra entities are to be inserted at higher levels of complexity. . . . Such a *monistic* view of the constitution of all entities in the universe, including living organisms and human beings, does not mean that all in the long run is to be explained by fundamental physics. . . . The concepts needed to describe and understand each emerging level in the hierarchy of complexity are specific to and distinctive of these levels. Moreover, it is often the case that such concepts are not logically reducible to those used to describe their constituent parts. . . . When this is so and, in particular, when causal efficacy can be attributed to the way "wholes" influence the behavior of the "parts," then we are justified in asserting that a new kind of reality has emerged at the higher level of complexity. . . . Life is emergent from the physicochemical, the psychological from the neurological, and personhood from the human-brain-in-the-body—all are levels of reality.[11]

So if, for example, we take the *term* "cell" as a part of biological science, the

term cannot be reduced to the *terms* of chemistry or physics—and this must be so for those who reject as false methodological reductionism—and yet, if the cell itself (as it exists in nature) really is reducible to chemical or physical entities—and this must be so for those who affirm that ontological reduction is true—then it cannot be the case that the biological *term* "cell" really denotes the actual reality that is a cell. Methodological antireductionism (embraced by most biologists) can only be compatible with ontological reductionism (also embraced by most scientists) if science is not founded on the way things really exist.

The claim about biological terms is supposed to be a nominalist claim, that is, a claim about discourse rather than about things. The claim about ontological reduction, however, *is* intended to be a claim about things: the claim that ontological reduction is true is the claim that *in reality* what we call biological entities are only physical and chemical entities. Hence, we have a logical inconsistency: if one wishes to claim the compatibility of ontological reduction with methodological antireduction, one can only do so by being a realist and a nominalist, a realist when speaking of ontological reduction but a nominalist when speaking of methodological antireduction. One must claim simultaneously that terms like "cell" do and do not denote real things.[12]

In this tradition, Nancey Murphy, an American philosopher and theologian, has developed a theory called "non-reductive physicalism" as a way to understand human nature.[13] She distinguishes "methodological reductionism," a strategy of analyzing a thing to be studied into its parts, from "causal reductionism," which is the view that the behavior of the parts of a system determines the behavior of all higher-level entities in the system—the view that all causation is "bottom up." Applied to the specific area of studies of consciousness, "non-reductive physicalism" denies the existence of a nonmaterial entity, the mind (or soul), but does not deny the existence of consciousness. Consciousness and religious awareness are emergent properties, and they have top-down causal influence on the body. What Murphy and others are keen to avoid is any kind of dualism that treats the mind or soul as a separate, distinct entity, on the one hand, and the kind of reductive or eliminative materialism that denies the reality of human consciousness and freedom, on the other.

In addition to the tension between methodological antireductionism and ontological reductionism, there is a broader question with most forms of ontological reductionism. Such reductionism is frequently mechanistic, with living organisms seen as complex machines, and the entire evolutionary history viewed as a mechanical, algorithmic process.[14] As we think more about what life is, we need to look at the claim that compares living things to complex machines; it is a claim that is inextricably tied to ontological reductionism. If living things are no more than highly complex machines, then it would be a mistake to look for some fundamental difference between life and nonlife; to quote Jabr, whom I mentioned at the outset, nothing would be alive. Any kind of soul, as a distinguishing feature of the living, would be superfluous.

There certainly is a comparison to be made between machines and organic bodies, for the mark of the organic body, as distinct from the inorganic, is the fact of spatially distinguishable organs, as compared to natural inorganic bodies that are uniform and have parts only in the sense that one part may be quantitatively (and somewhat arbitrarily) marked off from another. Both

the machine and the living body, therefore, are characterized by a spatial order among really different parts.

The heart must be really separate from and in a certain spatial relationship to the lungs, just as in an automobile the fuel pump must be separate from the carburetor. Also, a machine bears a resemblance to a living organism insofar as a machine, like an organism, performs functions as a whole that are greater than those of the parts. The machine, like the plant or animal, seems to be greater than the sum of its parts, and a machine can only perform its function if its parts have the proper order.

In spite of these similarities, however, living organisms differ, irreducibly, from machines. Living organs are not machine parts. Organs are produced simultaneously with the whole organism and develop while the organism is growing; mechanical parts, on the other hand, are made separately from the whole machine and in independence from the rest of the machine. The function of living organs is determined precisely by the organism as a whole, that is, from within; whereas the function of mechanical parts is always somewhat arbitrary, as new functions can be found for old parts. The order of the parts of a machine is determined from without.

Another example concerning the inadequacy of a mechanist/reductionist account of nature is the contrast between reproduction and physical and chemical changes. In physical changes, new physical properties come into existence. In chemical changes, new chemical substances, new compounds, for example, come into existence. Reproduction, however, cannot be classified in either of these ways. The change that is cell division, for example, terminates neither in the modification of a physical property nor in a new chemical compound with a new set of properties. The two daughter cells resulting from mitosis are qualitatively alike and individual members of the same species. The activity that produces this effect does not fall into the categories of physical or chemical change.

Physical and chemical changes are indeed involved in reproduction, and an adequate scientific account must include them; nevertheless, reproduction is not reducible to physical and chemical changes; it has an autonomy and identity of its own. Reductionism, of course, must deny such autonomy, and in so doing would have to deny a real distinction between biology, on the one hand, and chemistry and physics, on the other.

The reality of reproduction as a change distinct from chemical or physical change is evident in the larger animals. Reproduction is an instantaneous change, in that there is no intermediate state between not being a certain individual living thing and being that thing. There is never a partial or incomplete living organism, some "thing" which develops over time into a particular organism, the offspring of other organisms. Whenever the change that is reproduction occurs, for example in mammalian reproduction, there is a new mammal, which then grows and develops into an adult. Reproduction terminates in the coming into existence of a new member of a given species, not in some "reality" that is only partially a something.[15]

All this argues for not speaking of living things as machines. Here we must enter the arena of natural philosophy to address the question of the kind of causality living things exercise and then the kind of unity living things have precisely as living things. These are questions that are crucial for contemporary biological theories that speak of emergent properties and top-down causality—of the causality of the whole as distinct from the causality of the constituent parts.

Living things exhibit what philosophers call "immanent causality" as well as "transeunt" (or "transient") causality, whereas nonliving things exhibit only transeunt causality. Edward Feser and David Oderberg have written persuasively about these two different categories of causality. Transeunt causal processes, the only kind of processes in which nonliving things engage, have as their effects that which exists external to the cause. One example of this type of causality is when physical bodies in motion produce effects in other physical bodies. Such causal action is not directed in itself to the good or the perfecting of the cause producing the effect. Those causal processes specific to living things produce effects that "terminate within the cause and aim at the good or flourishing of the cause—even if these immanent causes may also have effects outside the cause. For example, an animal's digesting of a meal is a causal process that tends to the good or flourishing of the animal itself (though it also has by-products external to the animal, such as the waste products the animal excretes)."[16]

I have already mentioned reproduction as a feature characteristic of living things. In terms of immanent and transeunt causal activity, we can say that reproduction is an internal process that the organism implements to produce offspring. The organism requires external sources of energy to carry out those internal processes, such as nourishment and reproduction, in which it engages. Sometimes reproduction is asexual, and the change occurs wholly within an individual organism. In other cases reproduction is that which occurs "within" a reproductive pair.

As David Oderberg notes: "reproduction is not something done to an organism; it is something the organism does."[17] Thus Oderberg can conclude that "life is the natural capacity of an object for self-perfective immanent activity. Living things act *for* themselves in order to *perfect* themselves, where by perfection I mean that the entity acts so as to produce, conserve, and repair its proper functioning as the kind of thing it is."[18] Living things, as living, are simply constituted in such a way—it is their nature—to act in the ways characteristic of being alive and of being a certain kind of being.

In speaking of living things as possessing the causal agency of acting as immanent causes, we need to guard against the temptation to think that it is sufficient simply to list the essential properties of living things that distinguish them from machines: to think, for example, that a living thing is to be understood as a cluster of these properties. It is true that we should begin an examination of life in terms of these essential properties, but we need to go further, to see the unity of a living thing, a living thing that possesses certain essential properties or capacities.

It is precisely in discussing the unity of a living thing that we can benefit from natural philosophy in the tradition of Aristotle and Thomas Aquinas. This natural philosophy has much to offer contemporary biology, especially as this biology seeks to find an understanding of living things that is not encumbered by mechanistic and materialistic preconceptions. We have an example of such attempts at "liberation biology" in various theories of emergence. The call that Carl Woese and others have made for deeper reflections about the foundational principles of biology, and, in Woese's words, the need for a new guiding vision in biology can be addressed, I think, by looking to philosophical principles that inform the thought of Thomas Aquinas. Thomistic natural philosophy can help, for example, with the "more is diffrerent" description that is at the heart of these theories.

First of all, this "more" is obviously not the material "more," nor a mere rearrangement of existing parts. If it were, the "more" would not really be different. But a new kind of entity does emerge as a result of this "more." Thomistic natural philosophy can help us to understand the emergence of the new entity while avoiding the problems inherent in affirming simultaneously ontological reductionism and methodological antireductionism. It is here, I think, that discussions of the soul can play a crucial role. The discussion comes about because we need to speak of the unifying principle that makes the whole living thing to be the whole that it is—a unifying principle "more than" the sum of the constituent material parts.

First, a brief comment about what Thomas Aquinas, following Aristotle, does *not* mean by a soul. It is not a separate spiritual or immaterial substance that is somehow added on to a thing that makes the thing to be alive. Living things are not two substances—soul and body—joined together. Thomas would reject any form of dualism that would deny the fundamental unity of a living thing. Nor is a soul, as Thomas sees it, some "vital" principle, some enigmatic spiritual force inside living things. Neither dualism nor vitalism survives the challenges of philosophical reflection or empirical observation. Since both dualism and vitalism are rejected for various reasons, the default position seems necessarily to be some form of materialism. Yet, as we have seen, biological discoveries call into question the adequacy if not the intelligibility of materialism.

What opponents of dualism and vitalism often do not see is that Thomas Aquinas offers an alternative view of nature and human nature that would fully honor the discoveries of contemporary science while avoiding the errors of materialism and dualism, and that Thomas's philosophy offers a way of accounting for the "more" in nature that modern science recognizes.

For Thomas, the actuality or form of the whole entity is different from the matter that makes up the thing. It would be insufficient merely to inquire of a natural substance what it is made of, just as it would be incomplete to inquire of a natural substance only what it is as a whole. As a way to understand the reality of natural entities and as a necessary way to make change intelligible, Aristotle and Thomas think that one must recognize that all natural entities are composites in the sense that the matter of the composite is different from the whole unit. To express this composite nature of all natural substances, they say that all natural substances are composed of matter and form.

Matter and form are not two *things* but two explanatory *principles*—real but not independently existing things. It would never be possible, in the physical world, to have an instance of matter existing by itself without form, nor of form existing by itself without matter. Form and matter are not two constituents of a thing, but are, rather, two ways according to which the reality of the natural substance must be understood if it is to be understood completely. "Matter" in this context ought not to be confused with Descartes's understanding of "matter" as a *res extensa*, an extended thing. For Aristotle and Thomas, "matter" is not a thing at all.

To speak of form and matter, act and potency, substance and accident, or to distinguish among fundamentally different kinds of change, substantial and accidental, is to enter a philosophical world that many find alien or perhaps hopelessly out-of-date. It may well be that, in the *final* analysis, an Aristotelian and Thomistic natural philosophy cannot be reconciled with the discoveries of contemporary science. But judgments

about what is the case in the "final analysis" require that there be considerable initial analyses.

To think of the composite, inanimate or animate, in reductively material terms is simply to fail to think of the whole reality. It is important here to reflect on what it means for a natural entity—in biology, a living entity—to be the one thing that it is: and how, thus, to account for this unity. To understand the causal activity of a living organism, as proponents of emergence wish to do, one needs first to establish that the whole organism exists as something more than an incidental arrangement of parts. It is precisely here—in understanding the way in which an organism is a unity—that the Thomistic idea of soul is so important. By seeing living things as unified entities, with their own proper intrinsic principles, rather than as a conglomeration of discrete parts, we can understand that they are real causes of what they do, and that they are not simply pushed and pulled about by extrinsic forces.

It is possible to hold that nothing enters into the makeup of the living thing except its chemical components but that nevertheless the living thing is more than an aggregate of its material constituents. Indeed, to hold that it is more is in keeping with the scientific evidence. At all levels of nature, elements, chemical compounds, plant life, animal life, human life, we find that natural units manifest, *as whole units*, properties that are not found in the material constituents of the whole. The chemical element has properties not found in the electron, proton, or neutron by itself; the chemical compound has properties not found in the chemical elements; and the living thing has properties not found in the chemical compounds of which it is composed.

Water, for example, is composed of hydrogen and oxygen, yet the properties of water are radically different from those of its constituent elements. All this is familiar to those who speak of emergent properties and nonreductive physicalism; the difference is, however, that Aristotle and Aquinas have a more comprehensive philosophy of nature, which can make sense of these phenomena. For them the actuality or form of the whole entity is different from the matter that makes up the thing. It would be insufficient merely to inquire of a natural substance of what it is made, just as it would be incomplete to inquire of a natural substance only what it is as a whole.

Thomas would agree that the constituents of living things are just the material components and nothing but these components that scientists tell us about. But such an analysis avoids the larger question of what a living thing is. To give an adequate answer to this question, one must include not only the material constituents but also the reality of the whole. And the term that has been traditionally used to account for the reality of the whole is the term "soul." If we want to give an answer to the question of what is life, and this question is really one in the philosophy of nature, and not a question for the specialized techniques of biological research, then the answer must include the whole reality of life: it must include the constituents and the whole.[19]

To speak of the soul as though it were a mere epiphenomenon of nature, an emergent property, does not allow it to be the informing principle of a living being—something required for an adequate understanding of what it means to be a living being. Without some informing principle—a substantial form, that is—we do not have the kind of unified reality necessary for a living being to be an individual living thing. Emergent properties may indicate the existence of the soul; they are not substitutes for it—for that

single unifying principle that is the source of the unity of the living being precisely as living.

The soul is "that by which" a living thing is the unified living thing that it is. The soul is not a "what"; it is "that by which." A "that by which" is a real principle that is an essential source of the actuality of a thing. There are different "that by whiches"—different informing or actualizing principles—for the different kinds of things that exist. Hence, water, for example, has its proper form, its proper actualizing principle, which is distinct from the material components of water.

Living things, precisely because they are alive, have characteristic actualizing principles, the traditional term for which is *soul*. Hence, vegetables have souls, dogs have souls, and human beings have souls. As vegetables, dogs, and human beings differ from one another in important ways, so, too, do their souls, their actualizing principles. That there must be such actualizing principles follows from the need to account for the unity of each natural substance. In order for a natural substance to be, to exist, it must have a unifying, actualizing principle, what Thomas calls a "form." And the term traditionally used for the form, the actualizing principle of living things, is *soul*.

The analysis Aristotle and Thomas offer of the human soul is an integral part of their explanation of living things that is itself part of an even broader understanding of the distinction between form and matter, the coprinciples of all physical reality. That the rational soul is the informing principle of each human being follows from their view that each individual substance, inanimate and animate, must have an informing principle, and that the differences among informing principles are correlative to the differences among existing substances.

Soul (*psyche* or *anima*) is the term used to indicate the form of a living thing. We might remember here a famous remark by Aristotle: "There is no part of an animal which is purely material or purely immaterial."[20] A soul is not some outer shell or structure; it is an intrinsic determining principle, an expression of the fact that the whole is a new reality, not reducible to its material components. Soul is not something added to, or that falls inside, or is united to a physical thing. Soul is what makes a living being the kind of living thing it is, and a human soul makes one a human being

All this is necessary if we want to be philosophers of nature, but suppose we simply wish to be biologists? Does the biologist qua biologist, that is, as an empirical scientist involved in observations and drawing some conclusions from these observations, require the notion of the soul for his biological research? Not necessarily. One may study living things, how they function, of what they are made, how they differ in kind, how they evolve, and so forth, without raising the specifically philosophical question of what life is. In fact, the cellular biologist, for example, examines cells separate from the multicellular organisms in which they are primarily found.

It requires a huge philosophical leap to claim that one can fully explain or understand the organizational properties of the whole, whether the whole be the multicellular organism, or the cell, or its chemical components, in terms of the material conditions to which each has been reduced. A major problem presented by the success of the reductionist program in biology is the subtle, or perhaps not so subtle, shift from a research methodology to a set of claims about biological reality. All reductionist investigations involve an abstraction from the whole; an abstract world is not a false

world, but neither is it identical with the world itself.

A biologist will have a perfectly good working definition of life to enable him to do his work—he can recognize living things—but he need not have a precise philosophical definition of life. It would be a great mistake, however, to suppose that because the biologist does not, for his day-to-day work, require the philosophical notion of the soul, therefore the soul is not real. A biologist may not need to declare himself, pro or con, on the existence of the soul, but once he has done so he has begun to make a philosophical rather than a biological pronouncement—and it is precisely such a pronouncement that ontological reductionism makes when it denies the reality of the soul.

If a biologist wishes to think philosophically, he should realize, with the help of Thomas, that the terms in which ontological reduction are usually put require that he choose between vitalism and reductionism, but that these are not the only possible choices. With Thomas, the biologist turned philosopher should reject both vitalism and ontological reductionism. As biologist he knows that the living whole is more than its chemical constituents; as a philosopher in the tradition of Thomas he would know that this something more can be made intelligible nondualistically with Thomas's understanding of the soul as substantial form.

Note the question in natural philosophy: What is it that makes the living body *just the sort of body it is*? The answer is the soul. Biologists may very well be content to say that living beings are what they are and do what they do because they have the sorts of bodies they have; they may not wish to ask the further question of why the living body is just such a body. The answer to that question is the soul, and nothing about the science of biology requires the gratuitous philosophical reductionism insisted upon by those who cling to an exclusively physicalist or materialist explanation of life.

To speak of the soul of a living thing allows us to begin to understand the difference between life and nonlife and to understand the way in which a living substance is one thing and not a kind of atomistic conglomeration of distinct parts. It is a unity that is an essential prerequisite for any living organism's being what it is, possessing the characteristics, properties, and capacities that it has, and thus acting in the ways that it does. In short, without a soul, there is no living thing and no science of biology—and, of course, no biologist. ✝

1 http://www.youtube.com/watch?v=MYGJ9jrbpvg
2 *Nature*, June 27, 2007.
3 Rodney Brooks, *Flesh and Machines: How Robots Will Change Us* (New York: Pantheon Books, 2002), 172–73.
4 E. O. Wilson, *The Social Conquest of the Earth* (New York: Liveright, 2012), 10.
5 Paul Churchland, *Matter and Consciousness* (Cambridge, MA: MIT Press, 1984), 21.
6 Paul Churchland, *The Engine of Reason, the Seat of the Soul. A Philosophical Journey into the Brain* (Cambridge, MA: MIT Press, 1995), 17.
7 Carl Woese, "A New Biology for a New Century," *Microbiology and Molecular Biology Reviews* (June 2004): 173–86.
8 Ernst Mayr, *Towards a New Philosophy of Biology: Observations of an Evolutionist* (Cambridge, MA: Harvard University Press, 1988).
9 Daniel Dennett, *Darwin's Dangerous Idea: Evolution and the Meaning of Life* (New York: Simon and Schuster, 1995), 81–82.
10 I owe this insight to discussions with Professor Steven Baldner of St. Francis Xavier University, Nova Scotia, Canada.
11 Arthur Peacocke, "The Challenge and Stimulus of the Epic of Evolution to Theology," in *Many Worlds: The New Universe, Extraterrestrial Life, and the Theological Implications*, ed. Steven Dick (Philadelphia: Templeton Foundation Press, 2000), 93. [bold-face emphasis added]
12 I am indebted to Professor Steven Baldner of St. Francis Xavier University for many discussions on the inconsistencies between methodological antireductionism and ontological reductionism.
13 See, for example, Nancey Murphy, *Bodies and Souls, or Spirited Bodies?* (Cambridge, UK: Cambridge University Press, 2006).
14 In the criticism of mechanism as an adequate natural philosophy for living things, I have relied, in part, on the excellent analysis of Richard Connell, especially his *Substance and Modern Science*.
15 I am indebted here, as well, to discussions with Professor Steven Baldner concerning the differences between machines and living things.

16 David Oderberg as cited on the blog site of Edward Feser: http://edwardfeser.blogspot.com/search?q=Oderberg&max-results=20&by-date=true.
17 David Oderberg, *Real Essentialism*, (New York: Routledge, 2007), 179.
18 Ibid., 180.
19 These questions, of course, have their roots in the recognition that there is a radical difference between the living and the nonliving. Once you grant the intelligibility of this distinction, then you must recognize that the actuality of the living is different from the actuality of the nonliving, even though we would all recognize that the matter of the living and the nonliving is fundamentally the same. It is obvious that no materialist can affirm that there is a fundamental difference between life and nonlife, since only the reality of form allows for such a real distinction. The recognition of the radical difference between the living and the nonliving is a philosophical recognition, but as I say in the text there is no good reason for a biologist to adopt the philosophical position of reductionism, materialism, and mechanism, and every good reason to adopt the principles of the natural philosophy of Thomas Aquinas.
20 Aristotle, *Parts of Animals* 1.3, 643a24–6.