Naturalism—as *Religion*, within *Religions*, without *Religion*

with Willem B. Drees, "Naturalism and Religion: Hunting Two Snarks?"; Ursula W. Goodenough and Jeremy E. Sherman, "The Emergence of Selves and Purpose"; Matthew D. MacKenzie, "Spiritual Animals: Sense-Making, Self-Transcendence, and Liberal Naturalism"; Curtis M. Craig, "The Potential Contribution of Awe and Nature Appreciation to Positive Moral Values"; Mark E. Hoelter, "Mysterium Tremendum in a New Key"; Charles W. Fowler, "The Convergence of Science and Religion"; Todd Macalister, "Naturalistic Religious Practices: What Naturalists Have Been Discussing and Doing"; Paul H. Carr, "Theologies Completing Naturalism's Limitations"; James Sharp, "Theistic Evolution in Three Traditions"; Alessandro Mantini, "Religious Naturalism and Creation: A Cosmological and Theological Reading on the Origin/Beginning of the Universe"; and Willem B. Drees, "When to Be What? Why Science-Inspired Naturalism Need Not Imply Religious Naturalism."

THE EMERGENCE OF SELVES AND PURPOSE

by Ursula W. Goodenough and Jeremy E. Sherman

Abstract. We first consider the concept of emergent properties and constraint-based emergent dynamics, and present a model, based on such dynamics, of the origin of life from nonlife and the subsequent selection and evolution of variant lifeforms. We then explore the concept that each lifeform is a self, engaged in self-maintenance, self-repair, self-protection, and self-reproduction, leading to the endowment of each self with systems of purpose, awareness, attunement, and meaning assessment. Finally, we apply these understandings to humans and suggest their implications for our religious and ecological orientations.

Keywords: constraint; emergence; religious naturalist; self

The religious naturalist seeks, and finds, religious resources in the natural world. In this article, adapted from a presentation offered at the 2021 IRAS conference on Star Island (https://starisland.org/program/iras/), we first consider the concept of emergence (Goodenough and Deacon 2007) and then the emergence of life from nonlife on our planet (Deacon and

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 ISSN 0591-2385

Sherman 2008), a foundational occurrence in the natural world. We then develop the concept that each living being is a self, based on the reasoning articulated by Deacon (2012) and distilled by Sherman (2017), and explore the implications of that understanding.

Emergence

Emergence is a noun with many definitions and usages (https://en.wikipedia.org/wiki/Emergence). Our understandings and usages can be summarized as follows.

We can start with materialism. For the materialist, nothing exists on the planet except matter and its chemical interactions, driven by the laws of physics. That said, stable relationships between these materials often generate what are called emergent properties—"something else from nothing but." Water is nothing but an oxygen atom and two hydrogen atoms adopting a V-shaped configuration, but when many such molecules are frozen, they form an open lattice with the emergent property called buoyancy—ice floats. A crystalized mineral displays the stable emergent property called its hardness. And so on.

Materials may also generate something-else-from-nothing-but due to their dynamics rather than their fixed and stable properties. In such emergent dynamical systems, the materials interact with one another through time in a sequence, in a regularized/ordered fashion. Regularized dynamics can occasionally be found in nonlife, an example being a whirlpool, but they are abundant in lifeforms. Importantly, they are not added to matter. Rather, they are generated by the lifeforms themselves, bottom-up. They arise from matter.

The maintenance of dynamic order requires work, whereas it takes no work to generate disorder; it happens spontaneously. Present-day organisms perform countless regularized activities that require work—eating, photosynthesizing, metabolizing, negotiating the environment, and reproducing. These activities cease when an organism dies, and it quickly becomes maximally disordered even though all of its constituent materials are still present. Lifeforms perform work to generate and maintain their order, and from such emergent dynamics new phenomena emerge.

Since all modern lifeforms share common ancestry, the core question becomes: How was the original lifeform constituted such that its affairs were regularized such that it kept on living rather than succumbing to irregularity and dissipation? How did life itself emerge?

Model for The Origin of Life

Deacon calls the original lifeform an autogen, without specifying what materials it was made of or what it looked like. Once such an autogen showed up, then its particularities would be expected to evolve,

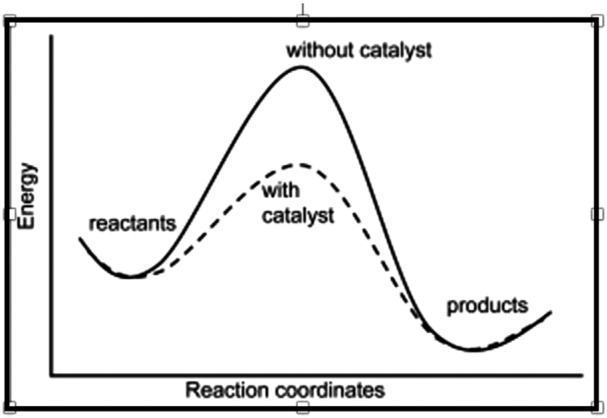

Figure 1. Chemical Reaction without and with a Catalyst.

eventually assuming the familiar features of present-day lifeforms with proteins, DNA, lipid membranes, and so on. The hard part is explaining how the first lifeforms were initiated and propagated in the first place.

All scenarios for the origin of life assume that the early planet was replete with carbon-based molecules, perhaps forged in deep-sea vents using hydrothermal energy or in shallow ponds using solar energy. These "primordial soup" molecules have the potential to associate with one another to form larger molecules, but such reactions require a large energy input and hence occur infrequently. As shown in Figure 1, the presence of a chemical entity called a catalyst has the effect of bringing molecules together and hence lowering this energy requirement and rendering such reactions more probable.

Deacon suggests that the first step in autogen formation is the establishment of an autocatalytic cycle wherein catalysts are continuously generated. Such a cycle is diagrammed in Figure 2, where A catalyzes (+) the adoption of constrained relationships between rectangular soup molecules such that they form B; B catalyzes (+) the adoption of constrained relationships between triangular soup molecules such that they form C; and C catalyzes (+) the adoption of constrained relationships between ovoid soup molecules such that they form A, completing and reinitiating the cycle. The catalytic properties of the soup molecules emerge as a consequence of the constrained shapes they adopt when interacting with each other.

An obvious problem with such a cycle is that the reactants and products would likely diffuse away from one another and hence the cycle would dissipate. This problem is solved in the arrangement diagrammed in Figure 3. In this case, A and B soup molecules, with distinctive shapes, form a third shape (C) when their relationship is catalyzed (red diamond)

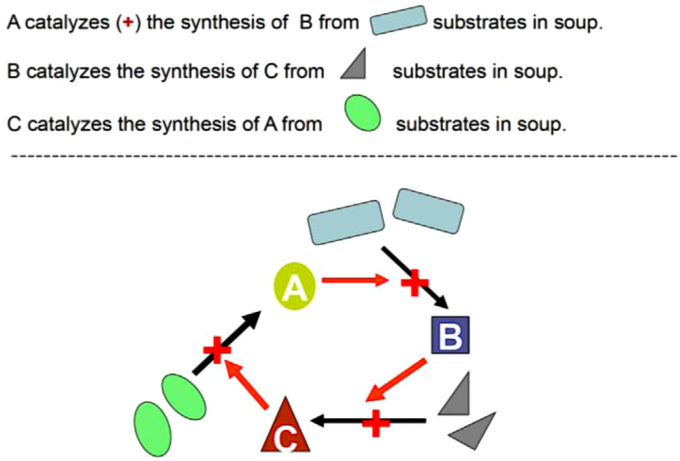

Figure 2. Autocatalytic Cycle (Something Else) using "Primordial Soup" Molecules (Nothing But) of the Early Earth. [Color figure can be viewed at wileyonlinelibrary.com]

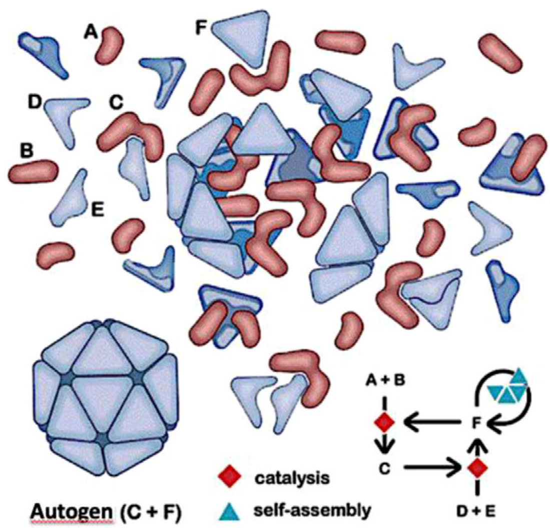

Figure 3. Autogen Enclosing its Autocatalytic Cycle. [Color figure can be viewed at wileyonlinelibrary.com]

by F; C, in turn, is able to catalyze the relationship between soup molecules D and E to form shape F, completing and reinitiating the cycle. What is added is that F has two functions: Not only does it serve as a catalyst; it also assembles into a shell/container within which the C catalysts are sequestered. Soup molecules cannot penetrate or leave the shell and hence the cycle comes to a halt—the autogen is "dormant," akin to a seed or spore—but should a dormant autogen subsequently fall apart in a soup-rich environment, the cycle would start up and more C and F would be generated. Moreover, in a second round of shell assembly, there might be enough C and F produced to assemble two autogens instead of one. That is, the autogen would engage in reproduction—a trait found in all living creatures.

Such a scenario is also poised to foster autogen evolution. An autogen that breaks up may reassemble to form a shell that contains not only C but also other soup components—we can call them G and H. The presence of internal G and H may confer the shell with novel properties—it might, for example, facilitate the assembly/disassembly process—the result being an autogen that reproduces more rapidly than its forebears or contemporaries whenever G and H are included.

In sum, the autogen is envisioned to sustain cycles of autocatalyis and assembly/disassembly that reinforce one another to generate the autogen, cycles that are driven by catalyzed shape-shape interactions between molecules. An autogen reproduces by breaking up and reassembling with the potential to form two copies of itself, and it has the capacity to evolve by encapsulating different subsets of components or by changing the shapes of its catalysts.

Natural selection, meanwhile, is "blind" to the components of the autogens—the nothing-buts—and instead acts on the something-elses generated by the parts: autogens with different capabilities and reproductive strategies. In the same fashion, natural selection does not "see" the DNA, proteins, and so on of modern-day organisms; it acts on their ability to flourish and reproduce in a given environmental context.

A key feature of the autogen, and of life in general, is that its dynamics operate by subtraction. When cycles are patterned and regularized, this minimizes the occurrence of less-regular possibilities. Hence, autogens and subsequent lifeforms are not just any chemistry. They are highly constrained chemistry, chemistry restricted to the emergent dynamics of regenerative interactions that keep the lifeforms alive. The law of entropy describes what happens in the absence of constraint—the general tendency toward irregularity or mixed-upness. In lifeforms, constraints emerge from catalyzed interactions and favored shape-shape interactions that progressively reduce these possible alternatives. The reduction of most of the possible paths makes some paths probable.

Constraints and their resultant absences are fully natural—they are emergent from material interactions and they act on material interactions—but they are not the materials themselves. Hence the materialist's mantra—nothing exists except matter and its movements—is amended by constrained/regularized dynamics, manifested most dramatically in lifeforms. By constraining material interactions, lifeforms generate both order and novelty.

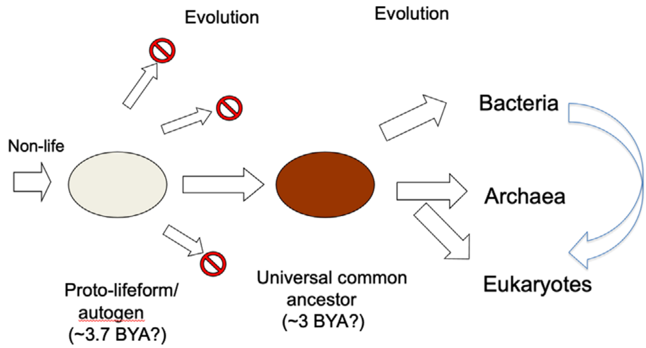

Figure 4. Nonlife to Modern Life with Proto-Life Intermediates subject to Natural Selection and Elimination. [Color figure can be viewed at wileyonlinelibrary.com]

Figure 4 diagrams how this has all played out. A form of proto-life emerged from nonlife, the autogen model being an example of how this could have happened. Once such an entity came into being, variant versions would arise and be subjected to natural selection, the dynamic we call evolution, with most failing to "make the cut." The three supergroups of modern organisms—the bacteria, archaea, and eukaryotes—clearly share a common ancestor since they share numerous genes and metabolic pathways. Hence, one lineage among these variants can be said to have given rise to the universal common ancestor of all modern life.

All Beings Are Selves

We can now consider an important concept, which is that every organism on the planet, now and throughout the billions of years of biological history, is in fact a self—an entity capable of doing self-directed work, self-regenerative work, by itself and for itself. Most selves are unicellular, but some, like us, are multicellular, the result of a collaborative project undertaken by many types of differentiated cells (e.g., liver, leaf) that collectively generates a single self.

A foundational feature of all selves, be they unicellular or multicellular, is that they have aims; they embody teleology. Nonselves have no aims. A rock does not aim, does not endeavor, does not try to roll down a hill or undergo erosion; it just happens. By contrast, a self generates constraints that channel energy into work that regenerates these selfsame constraints. The self is the emergent outcome of what Deacon calls teleodynamics.

Each self has a goal—to stay alive. Hence, the advent of selves marks the advent of purpose, not only on Earth but anywhere in the universe where selves come into being.

Another key feature of selves and their aims is that they are not deterministic. They operate by manipulating probabilities, likelihoods.

Engineers carefully design machines with constraints, like gears, valves, and brakes, that guarantee that the machine "works like clockwork." We would quickly regret buying a car whose operation is based on continuously countering the probability that it will fall apart. As selves have evolved, they have acquired genetic redundancies that buffer uncertain outcomes—if system X falters, system Y can hopefully take up the slack until X regenerates. But clocks we are not.

Two activities combine to maximize the telos of the self. The first, self-repair, serves to replace components of the system as they are metabolized or degraded or lost. Self-repair entails obtaining sources of energy and materials from the environment and utilizing them to build or rebuild what is required for the cycles to continue.

Importantly, sooner or later dissipation is bound to prevail in any given self; hence the capacity to reproduce can be considered a long-term strategy for self-repair.

The autogens modeled in our figures obtain their primordial-soup resources solely by chance, but any autogens that are "choosy"—any with the capacity to recognize and selectively obtain needed resources, such as sequestering G and H in our earlier example—will obviously function more effectively and be more likely to continue living. A familiar term for this choosiness capability is awareness, which might have started out as a crude ability to bind to a useful external molecule, but has evolved into something highly refined, a condition that we can call attunement. All present-day selves are highly attuned to the environments that they inhabit, aiming to find what they need and ignoring most everything else.

Not ignored, however, are features of the environment that threaten the self's integrity, generating awareness systems in the service of self-protection. Hence, early choosy autogens came to embody a system of evaluation: sugar in the environment is good, so facilitate its uptake; a metal that blocks metabolic cycles is bad, so prevent its uptake. All selves aim to avail themselves of the good and protect themselves from the bad. Their telos is embedded in values.

Value systems entail interpretation. A sugar-rich circumstance is interpreted as good, a toxic-metal-rich circumstance as bad. Hence, the choosy autogen, and all subsequent selves, can be said to not only be aware of value-laden externalities but also to interpret them, to find meaning in them. We humans are so awash in our language-based systems of interpretation that we need reminding that we possess a specialized, albeit deeply powerful, version of what all selves possess: the ability to ascertain meaning.

A third feature of all selves is reproduction. While an original autogen might have been able to maintain itself but not generate additional versions of itself, and might have hung around for a while, it would eventually succumb to the second law, and that would be the end of that idea.

Any additional versions of itself would enhance the aim of staying alive by generating more selves with that aim and providing fodder for the selection of additional adaptive traits. Indeed, as noted earlier, reproduction and self-repair can be thought of as kindred activities.

We saw in considering Figure 3 that autogens capable of reproduction can be modeled to break up and reassemble, but during the evolution of the lineage leading to the universal common ancestor (Figure 4), the project was offloaded onto RNA and DNA genomes that encode and direct the parameters for self-generation, self-repair, and self-protection, and it is genomes that now move through time.

So selves with goals, purposes, and values emerge from self-imposed and self-maintained constraints on dynamic possibilities. Selves transform the universal dynamics of "cause-and-effect" into the life-based dynamics of "means-to-ends."

Selves in Communities

Let us quickly correct any misunderstanding that selves are go-it-alone entities. The original autogen most certainly was, since by definition it inhabited a sterile planet. But as selves multiplied and evolved, their environments came to include other selves—of their own kind and other kinds—that both enable and disable their flourishing. Many of these relationships entail communication, leading to the evolution of myriads of pheromones and quorum sensors and alarm calls and the like; trees use fungal mycorrhizal networks to spread information; and many animal lineages have come up with hierarchical social systems, including our own.

Hence, the goal of a self is not only to be fit, and hence stay alive, but also to fit in, to flourish in an ecosystem. Our present-day planet is teeming with the interrelationships and the interdependencies of selves.

Human Selves

Lastly, we can consider the human. Figure 5 illustrates our recent family tree, where the time scale is in millions rather than billions of years: We are very recent.

Deacon offers a bold claim in his book *The Symbolic Species* (1997): "Biologically we are just another ape; mentally we are a whole new phylum of organism." Our most important new trait is the use of a communication system called symbolic language, allowing us to develop and transmit cultural ideas and practices. These traits are of central importance to our lives and our religious lives, and much remains to be understood about how they operate. At this juncture, however, the concept to take in is that for the naturalist, these human-specific traits are quintessentially emergent. They are constructed bottom-up, making use of ancient protein

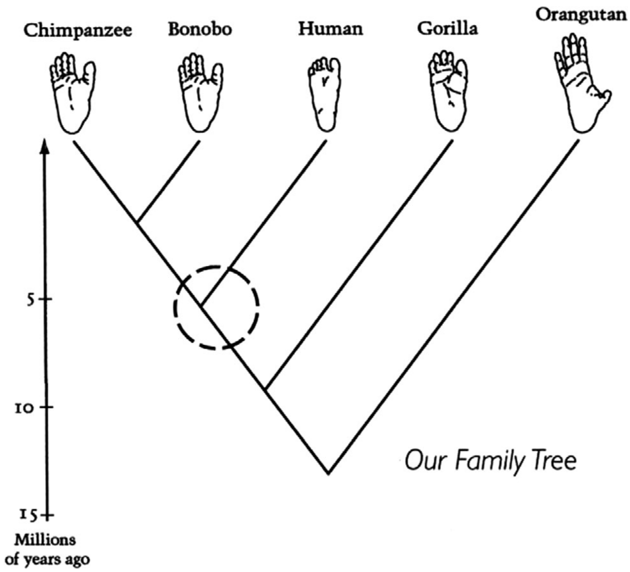

Figure 5. Evolutionary History of the Freat Apes. Circle is the common ancestor of chimpanzees, bonobos, and humans. (From Goodenough, *The Sacred Depths of Nature*, 1998)

families that are deployed in novel patterns and temporal sequences, and then deeply influenced by environmental contexts.

What is particularly interesting about the course of human evolution is that it has entailed the coevolution of three emergent modalities—the brain, symbolic language, and culture—each feeding into and responding to the other two and hence generating complex patterns and outcomes (Deacon 1997). One example is the coevolution of brains and language. As children's brains began to acquire the capacity to learn and use symbolic languages, symbolic languages evolved so as to ever more readily be learnable by children's brains, which, in turn, evolved to better learn and use the new versions of symbolic languages, and so on. A second example is that the languages themselves are not inborn, like an alarm call, but rather acquired via culture; during human evolution, the responsibility for language transmission was off-loaded onto the cultures humans construct. Once language-based culture became critical to hominid life, it effectively became an artificial niche to which hominid brains had to adapt, much as beavers have had to adapt to the aquatic niche beavers create.

Symbolic languages generate stories, narratives, many of which are propagated via cultural transmission along with language. We also think in private narratives and remember using private narratives, leading to the construction of a narrative self, often called consciousness or self-awareness. It has an autobiography, a personality, goes to sleep at night and wakes up in the morning. Naturalists recognize that our narrative selves are fully dependent on our material selves, but they feel immaterial, a point we will return to shortly.

Absent from this account of human evolution are such standard milestones as upright posture, opposable thumbs, and tool use. While these showed up along the way and are important to who we are, their acquisition can be readily modeled using standard paradigms from vertebrate embryology. By contrast, our emergent mentalities to date lack coherent reductionist explanations, even if most neuroscientists are confident that such explanations are forthcoming. Moreover, identifying the parts will be the first step and not the final explanation: making sense of self-awareness will also entail an elaborate synthesis to discern its emergent dynamics.

Importantly, when the details become available, they will in fact have no impact on our experience of being self-aware beings, any more than our understanding of oxytocin's participation in romantic attachment impacts on our experience of being in love. Reductionist understandings of how minds work are fascinating, but they are also irrelevant to what it is like to be minded and experience feelings. While we do not know what it is like to be a bat (Nagel 1974), we know what it is like to be a human self, and it entails a whole virtual realm that does not *feel* material at all.

The beauty of the emergentist approach to human mind is that it suggests that to experience our experience without awareness of its underlying mechanism is exactly what we should expect from an emergent property. The outcome has been given reverent names, like spirit or soul, names that conjure up the perceived absence of materiality. But we need not interpret this as evidence of some parallel transcendental immaterial world. We can now say that the experience of soul or spirit as immaterial is simply a reflection of the way the process of emergence distances each new level from the details below.

What we have offered here is a plausible account of our origins based on naturalist perspectives, an account with which naturalists resonate and that religious naturalists revere and celebrate. Its salience, for us, is that it links human lifeforms with all lifeforms, present and past, in our shared selfhood, our shared purposefulness, our shared interdependence, and hence points directly to environmental and social and religious agendas that augment planetary flourishing.

For some readers, and for billions on the planet, other accounts hold sway. Importantly, if we are joined in a river cleanup project with people who are so engaged because the river and its creatures are the Lord's creation, or because the river is inhabited by supernatural spirits, that is fine with us. We are all engaging our religious sensibilities in doing what is important. We share a common purpose.

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