Pp. 131- 148 In: J.D. Proctor (Ed.) *Envisioning Nature, Science & Religion*. Templeton Foundation Press, West Conshohocken, Pennsylvania. 371p.

ENDURING METAPHYSICAL IMPATIENCE?

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Entangled Nature

The foregoing chapters of this volume should be sufficient to convince the reader that both the concept of nature, as well as whatever visions of physical reality it might occasion, are exceedingly intricate. It follows, then, that virtually any particular description of the world is going to encompass elements that overlap those of parallel narratives. Furthermore, points of contact are likely to fall along a spectrum from agreement to dissonance, with any degree of nuance possible in between, The operative word here might be entanglement in the sense that, more often than not, it is impossible to parse out what belongs properly to one narrative and not to another. In the light of ineluctable entanglement, the two predominant discourses on reality, science and theology, are thus irreversibly entangled - so much so that, in retrospect, suggestions, such as that of Stephen Jay Gould, to

dissect the two approaches into "nonoverlapping magisterial authorities"[1] now seem to ring hollow.

This nature of things notwithstanding, the complex world is replete with those who wish to behold reality through the lens of fundamentalism, be it of the scientific or religious ilk. On the religious side, one finds a spectrum of opinions that would place the authority of Scripture over that of scientific theory. These run the gamut from the “young earth creationists," who believe that the universe was created in six days several thousand years ago, and who seek physical evidence to refute evolutionary theory, to the neocreationist[2], who couch their views on the origins of the world in mostly scientific terms, but who give priority to supernatural explanations over natural ones. On the scientific side, one finds militant naturalists like Richard Dawkins[3], who ascribe ultimate agency in living systems to genetic material, or Daniel Dennett,[4] who underscores the mechanical and reductionist nature of living dynamics to the exclusion of any other natural forms of causality.

Fundamentalists, by their very nature, are impatient with such ambiguities as entanglement might entail and go Gould one further by insisting that their particular minimalist description trumps all others. With respect to the disciplines of science and religion, theologian John Haught has labeled this impulse to "seize the territory of the other" as "metaphysical impatience,"[5] and innumerable examples of such attempts have characterized the past three hundred years.

Enlightenment Naturalism

During the nineteenth century, enormous advances were made in the basic sciences of physics and chemistry, and the nascent fields of geology, paleontology, ecology, sociology, and anthropology came into their own. Much of what was being discovered, however, was deeply unsettling to those religious believers who held to a literal interpretation of Judaeo-Christian Scriptures:

The Earth was old by all reckoning - millions and billions of years, rather than the six thousand or so indicated by Scripture, Humans did not appear suddenly out of clay, but most likely evolved from apelike ancestors. Bread could not appear ex *nihilio*. The literal interpretation of Scripture was in full retreat, and naturalists, such as Thomas Huxley, gave full pursuit.

The materialist view of nature had been given considerable momen-

tum by the development of mechanics during the eighteenth century in the wake of Newton's *Principia*.[6] By the beginning of the nineteenth century, the ground rules for science had taken form as a tacit but widely held set of metaphysical assumptions. These assumptions were strictly materialist, possibly for two reasons:

1. Emerging scientists were eager to divorce themselves from anything that might encroach upon the transcendental, lest they appear heterodox and fall victim to the power to ostracize still wielded by clerics in many areas.
2. There had long existed an underground community of closet materialists who were eager to undermine clerical power by obviating the metaphysical assumptions that supported it - literally wanting to "seize" the clerical domain.

The metaphysic that evolved in the wake of Newton was thus heavily skewed toward the material and bore little resemblance to the beliefs of the man who initiated the revolution.[7] Five basic postulates have been identified that supported the mechanical/material approach to nature.[8]

I. Newtonian systems are causally *closed*. Only mechanical or material causes are legitimate, and they always co-occur. Other forms of action are proscribed, especially any reference to Aristotle's "final," or top-down causality.
2. Newtonian systems are *atomistic*. They are strongly decomposable into stable least units, which can be built up and taken apart again.
3. Newtonian systems are *reversible*. Laws governing behavior work the same in both temporal directions. This is a consequence of the symmetry of time in all Newtonian laws, but in addition Aemalie Noether[9] demonstrated that symmetry in time and the notion of conservation in general are virtually equivalent.
4. Newtonian systems are *deterministic*. Given precise initial conditions, the future (and past) states of a system can be specified with precision.
5. Physical laws are *universal*. They apply everywhere, at all times and scales.

Even those readers having only a passing familiarity with science will probably have noted that, since early in the nineteenth century, several of these five tenets have already faced serious challenges. Soon after Laplace[10] had exulted in the power of Newtonian laws, Sadi Carnot[11] was expositing the irreversible nature of many physical processes. Earlier, Georges Buffon[12] had suggested that earth developed over a series of epochs and that history has a place in science. Later, Georges Cuvier[13] would assert that some species had gone extinct over the ages, and Charles Lyell[14] would pronounce that observable contemporary processes were adequate to explain geological history. It remained, however, for Lyell's close friend and colleague, Charles Darwin.[15] to anchor history (irreversibility) into science through his abstract dynamic of descent with modification under natural selection. Then, early in the twentieth century, relativity and quantum theories called both universality and determinism into serious question.

The erosion of the Newtonian worldview notwithstanding, some of its postulates continue to hold sway in various fields of endeavor, and almost every contemporary scientist clings to at least one or more of the tenets. Thus it is that closure is strictly enforced in the neo-Darwinian scenario of evolution. As noted above in reference to Daniel Dennett, contemporary evolutionary theory remains scrupulous in making reference to only material and mechanical causes.[16] Atomism (reductionism) still dominates biology - witness the preponderance of molecular biology today. A substantial fraction of scientists even continue to deny the reality of chance in the world. If only the depth and precision of one's observation were not so limited, they maintain, one could, in principle, predict what appear to be random behaviors. Finally, science was obviously viewed as universal and exhaustive by Stephen Hawking[17]and his colleague Carl Sagan when they impatiently wrote that there is “nothing left for a Creator to do."

Intelligent Design?

For decades following Darwin, some thinking religious were content to reply to scientific challenges by affirming the deeper "mythical” truth of scriptural accounts of miracles. Then the 1960s ushered in many challenges directed against cultural institutions, and science was not exempted. Members of the burgeoning postmodernist movement, such as Thomas Kuhn,[18]

and Paul Feyerabend[19] questioned the privileged position of science. Suddenly, science no longer seemed as absolute and free of belief as many had assumed. Data could no longer be considered independent of the normative presuppositions of the investigator acquiring them. The "disinterested observer" of Newtonian wisdom turned out to be a chimera. These challenges had little impact on the more literal believers in scientism, many of whom simply ignored the criticisms, hoping they would go away. E.*O.* Wilson,[20] for example, in his best-seller *Consilience*, takes but a few paragraphs to dismiss the entire postmodern critique out of hand.

Emboldened by the vulnerabilities exposed in the once-sacrosanct bastion of science, some theists have attempted to turn the tables and seize back some of the territory they have lost over the past three centuries, Prominent in the public eye today are the proponents of "inte1ligent design" (ID), who accept evolution through descent and most of the genetic theory that accompanies neo – Darwinism.[21] Key to the ID argument is the notion of "complex specified information" (CSI), which proponents claim is conserved and cannot be created via the mechanisms permitted under neo-Darwinism. Failing an explanation for such "irreducible complexity:' advocates of ID ascribe the exquisite complexity in many biotic forms to the intelligence of a transcendental designer - a Creator.

Reactions to ID have been interesting, The consensus from the scientific community has been straightforward and, not too infrequently, derisive and vituperative. This is another “god-of-the-gaps" argument, it is proclaimed. Science is an ongoing and evolving enterprise; just because there are gaps in our ability to explain natural phenomena, there is no reason to believe that, given time, they will not be filled by lawful explanation. That is, ID is a prime example of metaphysical impatience.[22] The intensity of emotion that sometimes accompanies this declaration possibly derives from an insecurity on the part of the critics, owing to the circumstance that ID *does* appear to put its finger on a gap. The tendency when a community is under siege is to brook no dissent. Thus, some conscientious agnostics are currently the targets of enmity from fellow scientists of an orthodox bent for the dissidents' effrontery in claiming that neo-Darwinism is seriously incomplete.[23] Somehow, neo-Darwinism is deemed exempt from positivist scrutiny.

None of which is to imply that ID has been welcomed by most theologians, many of whom regard the notion of *design* as an inadequate metaphor

for creation. Still, possibly out of a recognition that the proponents of ID have done more homework in philosophy than have their counterparts in the scientific community, the reaction from theologians has been a bit more nuanced, A major stumbling block for some theists is that following the ID argument in its entirety leads one too far down the strongly mechanical pathway of neo-Darwinism. Others worry that ascribing gaps entirely to the Divine opens further the Pandora's Box of Theodicy. Finally, some simply agree with the scientists that ID represents metaphysical impatience.[24]

And so the pendulum continues to swing, causing the more thoughtful or contemplative on either side of the debate to ask whether any relief is possible from having to endure episodic outbursts of impatience, Does any alternative middle metaphysical ground exist that could accommodate the aspirations of both the theist and the metaphysical naturalist without serving as a launching pad for seizing the intellectual domain of the other? Is there no perspective on nature that will allow both parties to abstain from derision and respect the intellectual position of those with whom they disagree? Perhaps, ironically, a more considered and thoughtful critique of ID could help point the way to such a common ground,

Information Arising

As noted above, a key element in the ID argument derives from information theory. William Dembski[25], for example, cites a familiar result from information theory to the effect that the complexity inherent in any distribution, when compared to any reference distribution, can be cleanly parsed into two components - one representing an ordered complexity, and the other a residual, unorganized complexity. Dembski calls the first component “complex specified information" (CSI), and maintains that this term is conserved, Furthermore, ID holds that there is an irreducible component of CSI that conventional evolutionary mechanisms cannot explain, so that it must be specified by an outside intelligence - hence ID.

Leaving aside the specifics of Dembski's claim that CSI is conserved in ontogeny/phylogeny, it is important to note that the information-theoretic term representing CSI is *not* regarded as conserved in many other applications, One early description of how such order might increase in generic, self-organizing systems was Ilya Prigogine's "order through fluctuations"

narrative[26]. Prigogine considered a metastable system that was poised at a "bifurcation" point between two possible states, at least one of which was tacitly assumed to be more ordered. Which state the system eventually came to occupy was considered to be determined by a simple, generic chance perturbation to the metastable configuration.

Perhaps a more didactic example of how information can increase by chance is provided by the concept of autocatalytic selection, which is believed to occur in a variety of living systems[27]. By catalysis is meant that one particular process tends to augment another. In ecology, for example, the growth of a submerged plant (first process) might provide more leaf area upon which more colonies of diatomaceous algae (commonly referred to as “periphyton") can grow (second process). By autocatalysis is meant a concatenation of catalytic processes that loops back upon itself. For example, the growth of periphyton just mentioned might provide more food for very small herbivorous aquatic animals, collectively called "zooplankton," that feed upon them (third process). In one common family of submerged aquatic plants, called Bladderworts (genus *Utricularia*), interspersed among the plant leaves are small "utric1es" that function as traps for the zooplankton, providing extra nourishment for the plant that started the catalytic chain. Thus the growth of *Utricularia* augments itself indirectly.[28]

The key attribute of such "causal circuits" was expressed by Gregory Bateson[29] in his observation that random events impinging upon causal circuits result in nonrandom effects, 'The bias induced by causal circuits by way of autocatalytic action is easy to describe. If there is some chance change in the behavior of any participating process, and if that change either makes that process more sensitive to catalysis by its immediate antecedent in the loop, or a better catalyst of the subsequent one (or if both conditions pertain), then the catalysis will propagate around the cycle and the process that was changed will receive greater support from its antecedent neighbor. Conversely, if the change either makes the process less sensitive to catalysis by its antecedent or a poorer catalyst to the next member, the process in question will receive diminished catalysis from its immediate antecedent. The dynamics naturally provide a bias, an asymmetry or a "selection" that favors any changes that contribute to enhanced autocatalysis. Using the same information-theoretic decomposition cited by Dembski, I[30] showed how autocatalytic action serves to augment the "ordered

complexity" term (CSI) as it applies to the structure of networks of feeding exchanges among ecosystem components,

The bottom line is that, even if the proponents of ID are correct in their assertion that neo-Darwinian dynamics cannot resolve all CSI, it remains possible (and even likely) that self-organization theory is capable of doing so. Dembski's assertion would then stand as an example of metaphysical impatience.

Irreducible Complexity Redux

Such criticism notwithstanding, Dembski possibly does science a service when he focuses upon the parsing of complexity into organized and disorganized components, if only because the term complementary to CSI (the one that Dembski neglects) is rarely emphasized in most scientific discourse.[31] That term may be called *residual chance*, and, appearances to the contrary, chance has never rested comfortably within science. In that context, it should be noted that Darwin's theory had atrophied significantly by the turn of the twentieth century, eclipsed at the time by developmentalist theories.[32] The evolutionary waters had been muddied by Gregor Mendel's observation that changes in the characteristics of succeeding generations of pea plants were discrete, chance events, rather than continuous. It was not until Ronald Fisher and Sewall Wright copied the earlier probabilistic arguments of Ludwig von Boltzmann and J. Willard Gibbs and demonstrated how chance could be incorporated into the evolutionary scheme that a renaissance in Darwinian thought occurred. Their 'grand synthesis" effectively put the genie of chance back in its bottle and made the living world look regular and predictable - at least to a statistical degree.

The question few have bothered to ask is this: How far can probability theory go in resolving the complementary component that represents "disordered complexity"? Is it conceivable that Dembski focused on the wrong term, and that he might have better spent his time attending to any irreducible complexity within the second term of his decomposition? One notable physicist who pursued this line of inquiry was Walter Elsasser.[33] Elsasser argued that nature is replete with one-time events-events that happen once and never occur again. Accustomed as most investigators are to regarding chance as simplistic, Elsasser's claim sounds absurd. That

chance is always simple, generic, and repeatable is, after all, the foundation of probability theory. Elsasser, however, used combinatorics to demonstrate the overwhelming likelihood of singular events. H e reckoned that the known universe consists of somewhere on the order of 10^{85}simple particles. Furthermore, that universe is about 10^{25} nanoseconds in age. So at the outside, a maximum of 10^{110} simple events could possibly have transpired since the Big Bang. Any random event with a probability of less than 1 in 10^{110} of recurring simply won't happen. Its chances of happening again are not simply infinitesimally small; they are hyper-infinitesimally small. They are physically unreal.

That is all well and good, one might respond, but where is one going to find such complex chance? Those familiar with combinatorics are aware, however, that it doesn't take an enormous number of distinguishable components before the number of combinations among them grows hyperastronomically. As for Elsasser's threshold, it is reached somewhere in the neighborhood of seventy-five distinct components. Chance constellations of eighty or more distinct members will not recur in thousands of lifetimes of the universe. Now it happens that ecologists routinely deal with ecosystems that contain well over eighty distinct populations, each of which may consist of hundreds or thousands of identifiable individual organisms. One might say, therefore, that ecology is awash in singular events, They occur everywhere, all the time, and at all scales.

None of which is to imply that each singular event is significant. Most simply do not affect dynamics in any measurable way; otherwise, conventional science would have been impossible. A few might impact the system negatively, forcing the system to respond in some homeostatic fashion. A very rare few, however, might accord with the prevailing dynamics in just such a way as to prompt the system to behave very differently. These become incorporated into the material workings of the system as part of its history. The new behavior can be said to "emerge" in a radical but wholly natural way that defies explanation under conventional assumption.

Less Contentious Ground?

Because singular events do not recur, they elude treatment by conventional probability theory, They represent true gaps in the causal fabric of

the natural world. No longer is it accurate to depict reality as an unbroken continuum. Nature is causally porous at all levels (and not just among the netherworld of quantum phenomena).[35] Furthermore, when radical chance is combined with autocatalytic selection, it becomes possible to identify inherently nonmechanical, natural phenomena.[36] Ecosystem dynamics arising from such a combination turns each of the five Newtonian postulates on its head. To wit:

1. Ecosystems are *open* to the influence of contingency and nonmechanical agency. Spontaneous events may occur at any level of the hierarchy at any time, and they may propagate either up or *down* the causal hierarchy.
2. Ecosystems are not deterministic machines; they are *contingent* by nature.
3. The realm of ecology is *granular,* rather than universal. Models of events at any one scale can explain matters at another scale only in inverse proportion to the remoteness between them. Obversely, selection at other levels circumscribes the domain within which irregularities and perturbations can damage a system. Chance does not necessarily unravel a system.
4. Ecosystems, like other biotic systems, are *historical.* Irregularities (simple or complex) often degrade predictability into the future and obscure hindcasting. Time takes a preferred direction, or *telos,* in ecosystems-that of increasing autocatalysis.
5. Ecosystems are *organic* in composition and behavior. Communication among elements of an organic system results in clusters of mutually reinforcing configurations within which components grow successively more interdependent. Hence, the observation of any component in isolation (if still possible) reveals regressively less about how it behaves within the ensemble.

While this alternative metaphysic might not be hailed as good news by some, it should be remembered that irreducible chance is a necessary and ready cofactor in natural creation. It represents nature at its most fecund - what Stuart Kauffman called the ”expanded dimensionality of the adjacent possible"[37] Freedom and flexibility are expanding in nature faster than law can account for outcomes. Hitherto, development has been regarded as a

monistic tendency, centered on organized complexity. The Darwinian narrative hinted at a different dynamic, which, under the ecological perspective, now reveals itself as a full-blown dialectic between agonistic tendencies. On the one hand is the inexorable drift toward disorder and decay. On the other is the anabolic drive toward ever more harmonious and efficient autocatalytic configuration.[38] The Hegelian nature of the confrontation becomes manifest as soon as one realizes that any system too weak in either tendency falls into jeopardy. Systems that are insufficiently coherent and robust risk displacement by others that are better organized; those that are too tightly constrained around their most efficient performance become "brittle,"[39] unreliable, and vulnerable to collapse.[40]

So it would seem that Dembski and colleagues have been looking in the wrong place for irreducible complexity. Not all gaps in nature are for want of lawful theories (new forms of which are continually arising). Rather, some gaps appear as necessary elements of the ontic landscape. To paraphrase John Polkinghorne, Ted Davis writes, "'Ihere are gaps and there are gaps"[41] By the former he meant phenomena that remain to be explained by natural science. By the latter, he indicated the *necessary* openings in nature, like those posited by Heisenberg with his Uncertainty Principle, or those indicated by Elsasser with his notion of radical chance. As Polkinghorne put it, "Those gaps must be intrinsic and ontological in character." The former likely will be filled in due time; it is simply *irrational*, however, to believe that all the latter will ever be closed.

A Necessary Patience

Properly considered, irreducible disordered complexity serves as an opaque epistemological "veil of ambiguity" that precludes metaphysical impatience. At first glance, those opposed to naturalism might object, noting that the scenario of autocatalytic selection bears a marked resemblance to Darwinism in that description remains entirely within the realm of the natural, and that a key role is played by blind chance. Because the ecological narrative does not stray from the natural, many agnostics can support it in good faith (despite the derision they might thereby incur from fellow materialists of a more fundamentalist mind-set). But the use of the word *blind* is a legacy of old habits. Simple, generic chance could be nothing else but

blind; however, there is simply no reason whatsoever to expect that complex chance always will be isotropic and adirectional,

Even when the complex event in question exhibits no sign of asymmetry or order, it does not preclude the possibility of its corresponding in some significant way with an extant configuration of processes so as to give rise to a meaningful, irreversible change in dynamics. By way of analogy, the protein arrangements on the exterior of a microbe or the nucleotide sequence of an arbitrary strand of DNA, by themselves, exhibit no hint of order or direction, but when either the former comes into proximity with a microphage having a lock-in-key complementary surface arrangement or the latter encounters the network of cytoplasmic reactions, very significant and decisive consequences ensue.

And so the materialist can continue to assume that no agency whatsoever lies behind complex chance, It remains a complete dead end, (There are even many instances, as when the event in question leads to extremely deleterious consequences, in which the theist might also want to adopt this same position.) But the theist who does not preclude the possibility of epimaterial action finds more than ample "wiggle room" for agency to pass into the natural realm - call such agency immanent divine action, Design, Spirit, or whatever. The effects of a radical chance event cannot be distinguished from arbitrary action.[42] Nor must such action occur at a point-source opening, as would be characteristic of a “tinkerer" at work in the subatomic netherworld.[43] Complex ontic gaps exist everywhere, at all levels of the complex realm, and provide sufficient causal porosity to allow for compounded and coordinated actions broad in scope. Immanent divine action cannot be rationally proscribed.

Of course, the same veil of ambiguity that precludes the exclusion of further agency also frustrates any attempt to ascertain that numinous action is at work. Reality extant as a sample of one makes any conclusive test impossible. The veil of ambiguity renders metaphysical impatience otiose!

An Ecological Pathway

It was suggested above that the Newtonian metaphysic did not arise out of a neutral political and social context. As a methodological tool, however,

it has served admirably in elucidating the workings of simple systems and has heralded a stream of impressive advances that have made life materially more bearable. At the same time, however, the bias toward minimalism has, according to Gregory Bateson[44] impeded access to the sacred. Going even further, there is reason to question whether the Newtonian strictures might be obscuring a fuller vision of purely natural phenomena. Hence, both the scientific and spiritual dimensions of humanity might be favored by the adoption of a less restrictive metaphysic, like the one suggested here by ecology.

It bears mention in passing how the ecological metaphysic mitigates some of the ostensible conflicts between science and theology that at times may have prompted the temptation of metaphysical impatience.[45] While *free will* was an outright impossibility in a Newtonian world, it presents no enigma within the ecological worldview, where features can emerge quite naturally. This metaphysic accommodates contingency and in granularity it highlights the looseness among the several layers of phenomena that separate the firings of neural synapses from those higher-level, slower cognitive functions directly involved in decision making. In addition, top-down influence is not excluded from system dynamics.[46] The flexibility in the fabric of causality that could open it to immanent divine action provides hope for those who offer prayers of supplication. While the problem of *theodicy* will likely continue to haunt the believer, acknowledging the potential that petty evils can have for natural creative processes helps to mitigate somewhat the paradox of evil in a providential world.[47]

Ardent admirer of Newton though he was, Darwin envisioned nature as an "entangled bank,"[48] a notion that was truly prophetic in its pointing beyond Newtonian metaphysics. Unfortunately, it is little noted how Darwin's emphasis on process can open one's eyes to the fact that not all order and pattern in the world are the immediate consequence of physical laws. As Karl R. Popper has suggested,[49] no one should remain satisfied with the narrow conception of physical force, and science is compelled to entertain more general “propensities" that enfold radical chance into their operation. As a consequence, the world no longer appears as a rigid hegemony of physical laws. Against the background of a flexible, fecund, but organized reality, the fundamentalist/minimalist vision of nature, wherein science and religion remain fully separable and autonomous, takes on vanishing credibility.

Our ever-growing awareness of an entangled nature forces, in its turn, an ongoing conversation between naturalist and theist. In fact, the metaphor of the ecosystem dynamic as a dialectic[50] can provide a useful simile for human dialogue to imitate: Advances in science and theology often will be out of phase with each other, resulting in real or apparent conflicts. With sufficient patience, however, the hope remains that, at deeper levels, the two endeavors cannot help but richly inform each other.[51]

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Robert E. Ulanowicz. Entangled Nature The foregoing chapters of this volume should be sufficient to convince the reader that both the concept of nature, as well as whatever visions of physical reality it might occasion, are exceedingly intricate.Â Robert E. Ulanowicz. tum by the development of mechanics during the eighteenth century in the wake of Newton's Principia.6 By the beginning of the nineteenth century, the ground rules for science had taken form as a tacit but widely held set of metaphysical assumptions. Robert E. Ulanowicz. Position / Profile Information. Areas of Interest/Research. Theoretical Ecology, Ecological Network Analysis, Information Theory in Ecology, Metaphysics of Ecology, Dialogue between Science & Religion. Background. B.E.S. 1964 Johns Hopkins Ph.D. 1968 Johns Hopkins Professor Emeritus Univ. Robert R ChristianDistinguished Research Professor of Biology, East Carolina UniversityVerified email at ecu.edu. Donald L. DeAngelisU. S. Geological SurveyVerified email at usgs.gov. Felix MÃ¼llerUniversity of KielVerified email at ecology.uni-kiel.de. Robert CostanzaProfessor and VC's Chair in Public Policy, Crawford School, The Australian National UniversityVerified email at anu.edu.au.Â Robert Ulanowicz. University of Florida, Dept. of Biology. Verified email at umces.edu - Homepage.