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The Entropic God: Christian Theology Confronts the Second Law of Thermodynamics

In the complicated—and frequently contentious—dance between science and religion in the West, evolution tends to get the spotlight. Darwin’s theory of how life began on Earth has stirred ideological debate for centuries, some religious scholars finding it irreconcilable with an Abrahamic view of creation while others embrace it as a rich source of theological insight. In our quest to better understand our origins, however, another scientific idea has played just as critical a role, while being much harder to classify as ally of either the atheist or the believer. In the 1860s, entropy—the second law of thermodynamics, which states that “systems in nature move spontaneously from order to disorder, from lesser to greater randomness”—planted the seeds for what would later become the Big Bang theory, Georges Lemaître’s groundbreaking claim that the universe has a definite beginning (Hiebert 1051). At the time of its introduction, Big Bang cosmology was a boon for theologians seeking to push back against the infinite past suggested by previous Aristotelian frameworks, as well as the steady-state models of the universe commonly defended by atheists. However, the fact that entropy is at the heart of Lemaître’s theory also cast long shadows of doubt over traditional Christian ideas such as resurrection, Earthly renewal, and God’s very nature as an omnipotent, omnibenevolent being. If the universe is destined to end in a state of final, ultimate disorder—if the systems of nature necessarily increase in randomness over time—can we call this world the work of a wise and loving Creator? As it turns out, any kind of teleological understanding of reality struggles under the weight of entropy, not just those predicated upon a particular religious idea. Upon closer examination, however, the many-faceted entropy debate in Christian religious studies reveals patterns and progressions that may help move us toward a more integrated theological take on this natural

law. After all, if the latest science is correct in positioning entropy as one the fundamental principles that makes life possible, it deserves to be at the center of any postmodern understanding of God.

Of course, there are far more religious angles on entropy than just those proffered by Christian thinkers. Jewish philosophers have engaged the topic through the traditional practices of midrash and aggadah—writings that explore contemporary questions of ethics or theology through creative approaches to biblical narrative and tradition (Elbaum). Hindu and Buddhist thinkers, meanwhile, have embraced the concept with considerably less consternation than Western faiths, being home to spiritual metaphors that see all organisms as “necessarily—even marvelously and gloriously—impermanent” (Barash). Many volumes could be written on this topic inclusive of every world religion. However, I will focus this small effort on Christian theology, as—for better or worse—philosophies derived from Christianity continue to have an outsized impact on the Western milieu in ways that make an honest, careful assessment of such topics feel especially critical.

Before we examine the scholarship surrounding Christianity and entropy, it’s important to first define the term as we will be using it, especially considering the myriad ways it has been deployed since its introduction. When Rudolf Clausius coined the term “entropy” in 1865, it simply denoted “the energy unavailable for work production ... which necessarily increases over time in any closed system,” based on his observation that systems in nature cannot “run” in perpetuity (i.e. produce work) without receiving a steady supply of energy from outside themselves (Sanzo). The directionality constraint embedded in this law—that energy irreversibly decreases in an isolated system, and cannot regenerate itself alone—explains phenomena as seemingly ordinary as a hot beverage cooling when left at room temperature, or a sand castle

eroding when exposed to the elements: without applying an external energy source to keep these systems in order (e.g. to keep the coffee hot, or the sand castle intact), they inevitably revert to a state of equilibrium that Hermann von Helmholtz famously called “eternal rest” (Kragh, “Pierre Duhem” 383). Already, we can see the eschatological import of this theory taking root in Helmholtz’s haunting statement, though it will branch in some surprising ways in the century and a half that follow. For our purposes, however, the main view that interdisciplinary studies of entropy reference is the broader understanding offered by the statistical-mechanical model, which was introduced by James Clerk Maxwell in 1867. Maxwell argues that if thermodynamics is ultimately grounded in atomic theory, then entropy “[can] only have a statistical validity” (Maroney). Granted entrance into the world of statistics, entropy enjoys a more widely applicable definition as the increasing disorder within closed systems of any kind, both natural and human-made. This is the chief view that we will see cropping up in theological discussions of the second law.

Despite how influential the statistical model of thermodynamics has been on other disciplines, from economics to sociology and beyond, debate about entropy’s significance in contexts outside of its thermodynamic origins sometimes generates concern in the scientific community. For this reason, it’s perhaps best to register a caveat about entropy discourse within the scope of religious studies—a field long divorced from science. As David Bradnick points out, “some maintain an underlying universal principle of entropy while others merely see it as a term with analogous applications but no ontological connectedness between disciplines” (69). Suffice to say, the way entropy is translated into the language of other disciplines can quickly become clumsy. Many take issue with the attempt to bring it into conversation with theological concerns at all. Unfortunately, as we shall soon see, entropy has been wrapped up in Christian-based

ideologies almost from the moment it was introduced, and has yet to break free from them entirely. Despite our best efforts, it seems we cannot avoid turning science into philosophy; Western society has been shaped by such dubious extrapolations since the Enlightenment, sometimes consciously (as in the case of social Darwinism) and more often subconsciously. Precisely because of this fact, I believe it's to our benefit to better understand these entanglements, as this paper seeks to do in its broad review of relevant scholarship. Keeping science and theology separate may be a noble intellectual exercise, but in everyday life, they never seem to stay neatly within their assigned rhetorical bounds. The more aware we are of just how deeply both languages underwrite our assumptions about the universe, the better equipped we'll be to unravel those same assumptions and—I hope—identify more coherent, constructive ways of exploring the points where each set of metaphors intersect.

One such intersection occurred almost as soon as Maxwell introduced his statistical formulation of entropy in the early 1860s, foreshadowing the substantial amount of pseudo-religious baggage that entropy would come to bear within a Western worldview. After synthesizing his own findings with those of his peers, physicist William Thomson (better known as Lord Kelvin) associated the “dissipation” of energy in a closed system with waste and unproductivity, thereby attaching what Kameron Sanzo calls “a cosmological, Judeo-Christian reading” to the concept—a distinctly Victorian association that still exists today. As far as Thomson was concerned, if “the world and its irreversible processes were getting less and less productive ... it was up to man ... to direct each transfer of energy in the most useful, work-extractive manner possible” (Sanzo). Thomson's ideological framing of entropy provoked a cascade of responses, some arguing for a scientific materialism free from such connotations while others leaned hard into the religious implications of Thomson's perspective—that mankind

has a divine task to carry out as warden of the fallen Earth in order to ultimately escape entropy. This early debate is but one way that, as Irwin Hiebert writes, “[the] first and second laws of thermodynamics have been used, affirmed, rejected, manipulated, exploited, and criticized in order both to further and to censure religion,” but we will find it looming large in the background of every perspective that follows (1049). To help us more easily track the threads of argument as they emerge, disappear, and re-emerge throughout the years, I have organized them into three main categories: those that contest the second law’s relevance to Christianity outright, those that attempt to “troubleshoot” it by answering its questions in the context of traditional doctrine, and those that embrace entropy as vital to a new paradigm of Christian faith.

Contesting Entropy: As Irrelevant to Christian Theology

After the initial discovery of the second law in the mid-1800s, some scholars pushed back against the idea that entropy has any meaningful role to play in a Christian worldview. This perspective may not seem controversial now, but Hiebert reminds us that up until the mid-nineteenth century, “nature was regarded as the most positive foundation for belief in the Deity ... in fact, [it was] considered a more acceptable foundation than theology, which had caused persecution, war, and hostility since the Reformation” (1046). Rejection of this longstanding trust in natural theology—the belief that one’s understanding of God can only be deepened by scientific study—did not happen overnight, but entropy was a key catalyst in the disentanglement.

If William Thomson’s ideological conclusions about the second law triggered concern about the extent to which science and theology should overlap, this was nothing compared to the flurry of debate that followed Hermann von Helmholtz’s 1854 address in Königsberg, Germany,

where he was the first to consider what the second law might mean for the universe as a whole. Helmholtz's logic regarding what would soon be referred to as "cosmic entropy" is straightforward: If the energy in a closed system is destined to become irreversibly degraded and therefore unable to produce mechanical work, then the universe must likewise one day reach a state of equilibrium where "all possibility of a further change would be at an end, and the complete cessation of all natural processes must set in" (Helmholtz 18-45). The apocalyptic implications of Helmholtz's "heat death" claim were philosophically unavoidable; alongside the host of questions raised by Charles Darwin's *On the Origin of Species*, published in 1859 (shortly after Helmholtz's address), cosmic entropy contributed to deep and growing rifts in the once-amiable relationship between science and religion. Not just the origins of humankind, but the ultimate destiny of the cosmos now seemed in question. In his article "The Uses and Abuses of Thermodynamics in Religion," Hiebert provides a glimpse of the breadth of questions that occupied religious scholars for decades to come in light of cosmic entropy:

Was it consistent with God's goodness to annihilate creation through the heat-death? What meaning could be attached to any values—in the mind of God—when man's history on earth was terminated? ... Would real existence reside solely in God when only dead brute matter remained in the world? If so, how could God's will and purpose be exercised at all? ... If creation was one of the symbols of the Creator, then in what way might an eternity of pessimism and doom represent an appropriate image of creation? Did "God," indeed, have any meaning in a universe that was not an abode for conscious life? And why would God create in order to destroy? (1069-1070)

The fundamental nature of these concerns—especially their bearing on traditional Christian understandings of God as an all-powerful, loving, perfect Creator—makes it easy to see how entropy’s cosmic implications contributed to increasing tensions between scientific and religious paradigms in the West. If the second law supports the Christian belief in a finite world that began at a point of maximum order (i.e. low entropy), it also apparently denies the possibility of any ultimate, final order. To resolve such paradoxes, Christian physicists such as Robert Millikan supported steady-state models of the universe that rejected entropy as a macro-factor in cosmic systems, exhibiting instead “a metaphysical preference for God to be continuously creating rather than, as it were, winding up the universe at the beginning and letting it run down” (Holder 43). In this view they were, ironically, in the company of atheist-leaning scientists like Hermann Bondi, Thomas Gold, and Fred Hoyle, who preferred the steady-state model partly because (to their mind) it did not lend as much credence to traditional Christian doctrines of creation, instead positing an eternal, cyclical cosmos (Holder 42). In short, pushback against entropy’s relevance to a Christian worldview came from both religious and nonreligious corners based on a similar fear: that nature might be fundamentally flawed. Either God the Watchmaker left a bug in the system—a design defect that undermines our trust in the divine plan—or the supposedly infinite, uncreated universe cannot sustain herself in perpetuity, and evolution itself is doomed to a final failure.

With so much at stake, it’s understandable why other scientist-theists responded by denying the relevance of science to religion at all, a movement that historian Helge Kragh investigates in his 2008 book *Entropic Creation: Religious Contexts of Thermodynamics and Cosmology*. Under the twin pressures of entropy and evolution, natural theology soon fell out of vogue as the “independence thesis”—the conviction that science and religion should not

intersect, since they describe two different realities—gathered support (Gyekye 4). At the beginning of the twentieth century, one of the leading proponents of the independence thesis was French physicist and devoted Catholic Pierre Duhem, whose views exemplify how uncomfortable some religious scientists were with entropy being used as a theological argument at all.

In the early 1900s, Duhem famously argued against universal principles derived from the second law and their religious implications, going so far as to reject Maxwell's statistical view of entropy outright. An antiatomist who denied the existence of atoms and subatomic particles as real entities, Duhem's philosophy of science was "radically antimetaphysical," as Kragh puts it: a view that got Duhem in hot water with some of his fellow Catholics ("Pierre Duhem" 382, 391). At a time when Christians generally "looked with sympathy to the cosmological claims of thermodynamics," Duhem agreed with materialists and atheists who asserted the second law might be valid only for finite collections of bodies, or might just as easily suggest that the entropy of the universe increases endlessly without limit (Kragh, "Pierre Duhem" 384, 388). More to the point, he found it "absurd ... to question [thermodynamics] for information concerning events which might have happened in an extremely remote past, and absurd to demand of it predictions of events a very long way off" (Duhem 301). This assertion was rooted in Duhem's ideological insistence that physical theories are semantic in nature, "mathematical representations rather than explanations," and therefore "noncosmological and ... irrelevant to religious faith" (Kragh, "Pierre Duhem" 391-392). In this way, Duhem's stance is emblematic of the later neo-Thomist movement in Catholic philosophy, which deliberately avoided the use of scientific concepts in apologetics and likewise hesitated to ascribe proof of God to the second law (Hiebert 1046). Ultimately, entropy was far from a slam dunk for Duhem and other theists,

who resisted not just its theological implications but its theoretical import for other sciences, as well. By contesting the relevance of entropy to a broader understanding of the universe, Duhem and religious scientists like him attempted to close the door on any theological discussion it might engender altogether.

They did not quite succeed. Although the entropic creation argument cooled as a topic of interest after World War I, the second law went on to inform Georges Lemaître's Big Bang theory, published in 1931, which was of great interest to theists (Kragh, *Entropic Creation*, 193). Although Lemaître was also Christian—a Catholic priest, in fact—he nonetheless hesitated to link his theory with the doctrine of creation, to little avail; others made the link for him. With some notable exceptions (such as Millikan), the ideological battle over an entropically governed, expanding universe versus a steady-state, cyclical cosmos continued to largely delineate theists from atheists in the scientific community throughout the first half of the twentieth century, even as the independence thesis gained ground (Holder 40). Neither side was able to entirely escape certain philosophical preferences and consequences undergirding their arguments. For steady-state advocates, the idea of a universe rigged to hinder productivity and progress proved a tough pill to swallow no matter the source of one's teleology (evolution or creation); for Big Bang adherents, the disorderly downsides of entropy are either a difficult fact of nature (among atheists) or a theological puzzle to be solved (among theists). In the next section, we will more closely examine how the latter stance has evolved.

Troubleshooting Entropy: As a Negative Force to be Reconciled with Christian Theology

Thanks to the strong philosophical bent of early entropy discourse, the second law of thermodynamics still finds it difficult to shake an overall negative connotation even today, long after its impact has been solidified in fields as diverse as biology, information theory, weather science, and telecommunications. As William Thomson encouraged us to so long ago, we seem to persist in associating entropy with waste and decay, resisting its trend toward disorder wherever we find it—and we truly find it everywhere. Robert M. Wald, a leading expert on modern physical cosmology and thermodynamics, suggests that to reach a full understanding of the entropic behavior of the universe will require a more complete scientific picture than we have at our disposal currently, but at the same time he trusts that “in (quantum) general relativity, some notion of entropy will exist and the basic form of the laws of thermodynamics will survive” (396). If the second law does retain its form in both macroscopic and microscopic contexts—as appears to be the case, albeit in ways we haven’t fully unpacked yet—then we have a universal principle on our hands after all, much to Pierre Duhem’s frustration. It’s therefore important to take all of its implications seriously, not just the ones that serve our worldview. Leimaître’s dramatic vision of the building blocks of matter bursting into existence from a timeless prior state is only one half of the story; the inevitable decay of the universe’s myriad systems is the other. Several Christian scholars who have braved the muddy waters of science-faith discourse since the beginning of the twenty-first century have succeeded at taking entropy’s significance seriously, but their tendency has been to view entropy not as a law God established for the good of the world, but as an unfortunate consequence of a fallen creation.

In fact, among scholars who explore science’s compatibility with the Christian faith, entropy is most popularly understood as a direct result of the Fall: the moment in Genesis when Adam and Eve disobey God. Theologically speaking, this is when sin first enters the world,

which “has served as the traditional theological response for the decomposition and ruin found in nature and subsequently other systems” (Bradnick 68). Entropy, in this view, is the natural trace of that moral shift, a corrupted pattern of reality in which the original order and goodness of creation are compromised. In his article “Entropy, the Fall, and Tillich,” David Bradnick examines arguments made by P.R. Masani and Robert John Russell on the metaphysics of entropy as a metaphor for sin. Masani claims that the fall of humanity through Adam and Eve is “an evolutionary consequence of the fall of nature,” which occurs first on a thermodynamic and anthropogenetic level (75). Instead of humanity precipitating the Fall, “entropy and evolution within the cosmos create an environment that begets the Fall,” and in this way the event is attributed to purely naturalistic forces. Robert John Russell disagrees with Masani’s rendering of entropy as a morally neutral force preceding an immoral response on the part of humanity, instead asking whether “the evils common to our species” might be correlated with evils embedded in the whole of nature, such as natural disasters and the suffering of all forms of conscious life (Bradnick 75). In other words, perhaps Adam and Eve’s choices in the Garden of Eden did not just “curse” themselves, but nonhuman life as well, and this curse is expressed as entropy. Along these same lines, Bradnick invokes Paul Tillich, for whom “the symbol of Adam before the Fall expresses the essential freedom and boundless possibilities for humanity and creation” before sin splits, distorts, and limits the existential nature of the world (Bradnick 77). Bradnick uses Tillich’s lens on the Fall to propose a correlation between entropy and sin in which “entropy exposes the limitations placed upon the ability of a system to evolve and the number of possibilities that can be actualized,” and “human sin and amoral ‘evils’ are thoroughly entangled, arising out of the universal condition of existence” (*ibid*). In short, Bradnick agrees with Tillich that the Fall represents a fundamental estrangement of the world’s true nature from

its current existential form, but takes the idea one step further by directly linking this estrangement to entropy (78). If creation has unlimited potential, then the second law straightjackets that potential. Once again, entropy is presented as a hindrance to the world's full flourishing—it is even scapegoated as “sin” or an effect of sin to theologially explain the tendency of natural systems to dissolve into disorder. Entropy is not God's fault, insist Bradnick, Masani, and Russell: God is still a God of order and goodness. It is humans who have condemned the world to a perpetual struggle against chaos.

Italian physicist and theologian Emanuele Ciancio develops this sin-entropy connection still further by considering how “time irreversibility”—a phenomenon linked to thermodynamics—might divide the timeless age of harmony in the Garden of Eden from the age of human history (498). Since entropy is, scientifically speaking, what causes time to flow in a single direction—enabling us to distinguish “before” from “after”—it is linked to evil in Ciancio's theology, which he defines as “our inability to distinguish between two realities at a level that is deeper than the surface of (moral or natural) phenomena” (499). Since this “inability to distinguish” is what makes time flow from past to future from our perspective, for Ciancio this means that “evil is what makes human history irreversible,” and it is God's redemption that “[breaks] the entropic destiny of mankind, thus breaking the inevitable flow of time” (498, 499). Ciancio therefore correlates order (i.e. states of low entropy) not just with goodness, but with eternity as well. Time's arrow is another limitation linked to the entrance of evil into the world. In this way, Ciancio's view dovetails with those of Masani, Russell, and Bradnick, who likewise understand entropy as a metaphysical problem that God will one day help the world overcome.

If time's irreversibility is a result of entropy and sin, what are we to make of the apparent good that has come of this limitation in our human experience? After all, time's arrow is what

allows for change and growth, and also gives rise to tools like language and story, which are inextricable from our very understanding of God. Matthew Z. Fisher highlights this paradox in his 2015 dissertation when he reminds us that heaven—as understood in traditional Christian theology—is an “anentropic” reality that we can conceive of only through entropic means; we can imagine what it might be like to live in a world without disorder, but in truth we have never experienced anything close to such a state. As he writes, “entropy becomes a problem for the psychic system as soon as the psychic system understands that its very identity is dependent on the teleodynamic maintenance made possible by the entropy dynamic of human physiology” (Fisher 106). How can we describe a God or reality free from entropy when it is the very force that underlies our meaning-making methodologies? Fisher concludes that ideas like the eternal soul, an “anentropic” heaven, and a changeless God can be inferred and intuited, but “cannot be communicated save through semiotic structures provided by the entropic condition,” and this is the beginning of apophatic theology—a form of thinking that approaches God by negation, speaking only in terms of what God is *not* rather than making positive statements about who God *is* (Fisher 317). Although he acknowledges the contradictions inherent to any theology arising from our entropic condition that seeks to “protest against finitude,” Fisher still identifies the spiritual dimension of our being, and of God’s reality, as “ontologically other” than the entropic (270). The second law and its functions are therefore still framed as a barrier to the entropy-free state we long for and hope to find in God, even though God transforms and sacralizes our timebound existence through structures like language and story that are ultimately entropic.

Over the years, methods of theologically “troubleshooting” entropy like those explored above have drawn this elusive scientific principle into a mostly productive dialogue with Christian thinking. I say “mostly” because some creationists have taken less productive

positions: for example, Dr. Henry Morris, founder of the Institute for Creation Research, infamously asserted in the 1970s that the second law of thermodynamics is not just “evil” but also disproves or contradicts evolution; however, his argument was predicated on a misunderstanding of entropy (Patterson 245). I have deliberately left out the positions of Christian thinkers who eschew physical evidence or ignore longstanding theoretical arguments when constructing their theologies, as this makes the task of the theologian genuinely interested in reconciling faith and science harder than it needs to be. In general, by positioning the second law as a scientific expression of the effects of sin—embedded in nature ever since the Fall—many Christians have discovered a way to acknowledge this crucial scientific theory without threat to traditional doctrine. In such frameworks, God is absolved of responsibility for the steadily increasing disorder in the universe.

Embracing Entropy: As a Doorway to Divine Possibility

While the sin-entropy correlation is theologically convenient, as scientific knowledge of the second law continues to advance, dismissing entropy as an “undesirable” force in the world has become increasingly difficult. In the mid-twentieth century, physicists observed that in simple models, systems of interacting particles actually escalate entropy generation in order to increase the number of possible paths each particle can take—a behavior known as *entropy maximization* (Jaynes 623). Now understood to be a trait of all nonequilibrium (i.e. living) systems, entropy maximization is a tactic that “[keeps] open the largest number of options for how ... particles might move subsequently,” suggesting that systems of nature experience “a kind of urge to preserve freedom of future action, and ... this urge guides its behavior at any moment” (Ball). In light of these observations, it is not unreasonable to say that many higher-

entropy (i.e. disordered) systems enjoy *greater freedom* compared to lower-entropy (ordered) systems. In fact, the more well-adapted an organism is to its surrounding environment, the greater its capacity to withstand higher degrees of entropy—and the more flexible and resilient it is as a result. This is a major reason why today, scientists understand the second law to be one of the primary principles that makes adaptation and evolution possible, as well as the smaller cycles of life we observe daily on our planet (DiRocco, “Paleopsychology” 83–85). How might Christian theology engage this more positive entropic paradigm—one where a simple one-to-one sin-entropy correlation no longer seems sustainable?

South African theologian Klaus Nürnberger responds by decoupling entropy from evil altogether, instead positioning the second law as a methodology that God uses to preserve free will and generate new possibilities in the world. In his article “Eschatology as a Manifestation of Human Uniqueness,” Nürnberger explores Christian eschatology as a horizon opened up by the cooperation between human and divine agency—and underwritten by entropy. He reminds us that “faith is built on the underlying intuition or notion that reality is not closed in upon itself, as naturalism has it, but open towards a transcendent Source and Destiny with whom it is possible to communicate on personal terms” (Nürnberger, “Eschatology as Manifestation” 3). Reality in Nürnberger’s view is an open system, one where our relationships with each other, with God, and the world—giving and receiving energy in a great web of being—are what enable us to cooperatively grow toward the “Destiny” God has in store for us. Entropy in this reading offers us an imperative, a crucial reason to maintain our connections with God and others: because in an isolated system that holds itself separate, entropy can only increase. Richard J. DiRocco puts this imperative another way: “When a living being comes into thermodynamic equilibrium with its surroundings it is dead ... exemplified by the cooling of a dead body and its ultimate decay

into [its] constituent atoms ... With respect to its impact on life, therefore, entropy may be viewed as the most fundamental source of what Darwin referred to as ‘selective pressure’” (83). This “pressure” to be relational and “open,” generated by entropy, starts to feel less like something humans accidentally introduced into the world and more like the way a God of love might *de facto* operate. Like the three fundamental particles inside of an atom, forever giving and receiving energy, perhaps relationality is simply the fuel God’s universe runs on.

Probing this connection between entropy, relationality, and free will, both Nürnberger and DiRocco articulate theologies of entropy that are decidedly nondual. For Nürnberger, God is “the Source of the entropic process as much as of the evolutionary process because one cannot function without the other ... God builds up and dismantles; gives life and takes life; empowers and disempowers; hardens hearts and renews hearts” (“Eschatology as Manifestation” 4). In this sense, both the negative and positive functions of entropy are divinely ordained, each with a different role to play. DiRocco takes a similar tack when he highlights the benefits of entropy maximization in light of God-guided evolution: “It is remarkable that the destructive and disorganizing action of entropy provides the means by which protective mechanisms that defend life against entropy’s deleterious effects are selected for transmission to succeeding generations” (83). In DiRocco’s account as well, entropy is both life-threatening and life-giving, and it is only through experiencing disorder that life dynamically learns ways to resist it. This perspective sparks new questions about theodicy. For example: If we consider death the ultimate disordering, what if the only way to “defeat” it is to experience it, as Christ did, and trust that rebirth will happen afterward—as it does throughout the rest of the cosmos? After being broken down into its “constituent atoms,” as DiRocco says, perhaps each passing form gives way for new life and

new arrangements of order to emerge. Is entropy an enemy or helper in this scenario? The two roles seem increasingly inextricable from each other.

In fact, the pattern of life, death, and rebirth—order, disorder, and reorder—generated by the second law begins to look less and less like a limitation, even under the supposed tyranny of time's arrow. NIST scientist George Saridis emphasizes this connection between entropy and possibility when he writes: “Even though the arrow of time points forward, the theory of chaos provides new situations which gives hope for alternatives [to] thermal death ... Is there a conflict of the concept of entropy with God? I do not believe so since it provides alternate solutions that we witness in life. Chaos expresses an optimistic answer” (7). Chaos as optimism may sound new and surprising to Christian minds that have so long associated order with goodness, and God with perfection. But if we truly believe in a God who cares about the freedom and agency of created things, some amount of disorder in the universe becomes an imperative. Gary Patterson agrees, writing that the “essence of entropy is the multitude of possibilities that God has given us in this world. In a world of no entropy, there are no possibilities, except for one ... the promise of God is that the macroscopic end is predictable, even though steps along the way may be on a more chaotic path” (248). Just as the uncertainties of quantum physics resolve on the level of classical physics, so the chaos of entropy resolves over time as life emerges again and again from the decay of death. Patterson concludes by asserting that theology can only gain from taking into account the “God-given” entropy of the universe. Here, chaos is characterized not just as optimism, but as a divine gift.

If we embrace the idea that entropy is divinely instituted, however, can we still call God perfect? Nürnberger addresses this ontological concern in his 2012 response to Robert John Russell, where he considers God in terms of transformation rather than perfection:

God may indeed be perfect, but the emphasis in the Bible lies on the reliability of God's creative and redemptive intentions. It has a pastoral rather than an ontological meaning ... There is a difference between (a) the biblical proclamation of divine omnipotence as the pastoral reassurance that a loving God is in charge of a desperate situation, (b) a scientifically informed assumption that all energy found in the universe ... is the power of God, and (c) the concept of omnipotence as an idealized abstraction from actual experiences of power—which has been variously critiqued by Feuerbach, Marx, Nietzsche, and many others. (Nürnberger, “Eschatology and Entropy” 976)

According to this passage, our very definitions of power must change if we are to properly understand God as the source of the entropic process—which turns out to be a “creative and redemptive” process. If we view “all energy found in the universe” as “the power of God,” forever seeking new avenues and emerging in new forms, then divine perfection is found in God's boundless creativity, which meets no dead end in the universe. For Nürnberger, God's power is the power of resurrection, redemption, and transformation: three activities made possible by entropy's steady breakdown of systems into their raw components, and life's steady repurposing of those same components. It is Christ, after all, who says in Revelation 21:15: “Behold, I am making all things new” (ESV)—and science tells us nothing new can be made without entropy. By refusing to saddle the second law with the weight of sin and instead viewing it as a catalyst, scholars like Nürnberger, DiRocco, and Patterson help us entertain the idea that entropy might not just be a natural law, but a divine one as well.

Toward an Integrated Theology of Entropy

As we look back at the many ways theologians have engaged the scientific concept of entropy, a fascinating pattern emerges that looks rather entropic on its own. At the beginning, theists seized upon the second law as proof that the universe began at a point of perfect order. But as the eschatological implications of this same position begin to sink in, entropy was rejected by some Christians as a cosmic pattern at all—a rejection that contributed to the eventual dissolution of the relationship between science and religion. As Christian scholars continued to wrestle with entropy over the years, this frustrating theory frequently took the form of sin and evil, a correlation rooted in William Thomson’s original framing of the second law as a source of “waste” and “unproductivity.” But just as Christians were about to bury entropy’s complications by attributing them to original sin—thereby blaming the second law for the limitations, suffering, and death in the world—new scientific ideas like entropy maximization emerged, which made it impossible to ignore entropy’s role as a source of freedom and new possibilities, as well.

Today, it seems that any honest Christian theology of entropy must embrace the continual dissolution and reordering of how we understand God. If we think of God as moving us “towards life and against death, towards construction against destruction, towards evolution against entropy,” as Nürnberger writes, at what point does this movement land us in a static situation rather than a dynamic one (“Eschatology as Manifestation” 13)? What if we are meant to accept and endure death as Christ did, trusting the inevitable reordering process that awaits us on the other side? What if real evil, both in nature and in us, is not the tendency of systems towards dysfunction, but resistance to change and stagnation? Is there such a thing as excessive order rather than excessive disorder? After all, if “a projected heat death due to entropy does not square with the promise of resurrection and new creation,” neither does a world in which the second law does not exist, and we are not free (Peters 31).

Accepting entropy as a divine law encourages us to consider new definitions of omnipotence, omnibenevolence, and perfection. Just as Christ commands us to forgive “not seven times, but seventy-seven times,” so God’s power in us—defined here as that of love and fundamental relationality—enables us to embrace chaos as optimism, death as rebirth, and disorder as a realm of limitless potential (Matthew 18:22, ESV). Within such a paradigm, entropy strikes me as an incredibly valuable way to engage theodicy seriously without compromising God’s ability to overcome it. Christian doctrine impresses upon us that even Christ’s death on the cross was not a defeat, but a new beginning; so is life in an entropic universe, where matter and energy is only ever repurposed, never destroyed. The God of the Bible is one who consistently uses the shattered pieces of the past to create new things in the world and in human lives, empowering us to grow from our mistakes and reap good from bad situations. Entropy suggests this may be the very same method by which God shepherds atoms and organisms, stars and solar systems. There would truly be no reason to fear such a universe, as God tells us (“fear not” and “be not afraid”) over one hundred times in the Bible.

Job 34:14–15 states: “If [God] should set his heart to it and gather to himself his spirit and his breath, all flesh would perish together, and man would return to dust” (ESV). If entropy, like breath, consists of an inhale and an exhale, each as vital and necessary as the other, then maybe we can finally dispense with analyzing elements of this process as “good” or “bad” and instead simply trust its integrated role as an endlessly generative engine of new life—forever transforming what is dead or dying in us, and in the cosmos. If the tangled systems of reality can be reordered—redeemed—over and over again, offered up as the building blocks of perpetual creation, then perhaps entropy might best be understood as the scientific definition of grace.

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