PERSPECTIVES on Science and Christian Faith

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In This Issue …

"The fear of the Lord
is the beginning of Wisdom."
Psalm 111:10

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Perspectives on Science and Christian Faith

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Natural Evil and the Love of God

James C. Peterson

If one is convinced by the extensive evidence that God chose an evolutionary process to create the world, suffering and death have always been part of God's good creation. But would that be a *good* creation? Would such be consistent with Genesis 3 and Romans 8, to have death precede the presence and sin of human beings? Is suffering from the beginning among God's creatures consistent with the Apostle John's proclamation that God loves the cosmos that he has made?

These questions are felt acutely. Readers of this journal saw Wilton Bunch's article on such challenges last September. Christopher Southgate carried forward the conversation in the December issue, and Denis Lamoureux in the March issue after that, the most recent. Our former ASA president, Keith Miller, published as well in *PSCF*, a trenchant analysis entitled "'And God Saw That It Was Good': Death and Pain in the Created Order" (63, no. 2 [2011]: 85–94). Indeed, Miller has continued to pursue this important conversation and recruited James Stump to help. Their encouragement and expert review spurred three articles in this issue. Those are by John Wood, R. J. Berry, and George Murphy.

Specifically, Wood explains how "living systems are animated at every level by mortality." Death is essential to life and ecology as we know them. With such in mind, Berry walks us through the last one hundred years of how we have read Genesis 3 and Romans 8. Then Bethany Sollereder argues that death and other evolutionary suffering can actually reveal God's love, and Murphy that such natural evil is a necessary consequence of the way God has chosen for creation to fulfill his purpose. For Murphy, chaotic phenomena are part of God's good creation.

Moving on to our Communications section, there we find chronicles of two groups of ASAers, each working to provide a new book to help Christians better understand the best of science and their Christian faith. One introduces astronomy; the other, the formation of the Grand Canyon. This issue closes with our book reviews that, as always, insightfully alert readers to a wide range of new works.

Tolle lege. Tolle lege. ✞

James C. Peterson, *editor*

John R. Wood

Article

An Ecological Perspective on the Role of Death in Creation

John R. Wood

"The large fish eat the small fish; the small fish eat the water insects; the water insects eat plants and mud." –Chinese Proverb[1]

"The young lions roar for their prey, seeking their food from God." –Psalm104:21 (ESV)[2]

"Life matters. Death matters. Both rely on one another." –Scott Peck[3]

"… the final word of evolutionary biology always seems to come to this: death is the engine of nature." –Paul Santmire[4]

"Truly, truly, I say to you, unless a grain of wheat falls into the earth and dies, it remains alone; but if it dies, it bears much fruit." –John 12:24 (EVS)[5]

Death is pervasive in ecological relationships. Living systems are animated at every level by mortality, cessation, and endings. Nothing in ecology makes sense apart from death. Through long and often personal association, it is difficult for us to see death as anything but evil. If death is present, then something must be wrong. Yet this primarily moral and emotional judgment does not adequately represent our understanding of the ecological role of death in biotic systems. Death animates living systems at every level so that without death there is no community, no ecosystem, no biosphere as we know them. Recent theoretical and empirical work, particularly in aquatic ecology, has focused on the role of programmed cell death (PCD) in regulating population and community structure. Ecologists are now linking the smallest cellular events, genetic and physiological, with planetary biogeochemical processes. Researchers tracking the origin of predation have taken a turn into deep time and the symbiotic origin of cell organelles, asking if they are seeing the roots of multicellularity in death. This understanding of life will continue challenging conventional views of Genesis linking sin and the Fall to bodily death and complex ecological processes.

Opening to Death

Life dominates planet Earth, shaping its form and processes at every scale. Single-celled organisms link the rocks and the oceans together, with atmospheric processes providing the means for renewing and sustaining life in the biosphere. A living fabric drapes the geological bones of every landscape, even to the depths of the oceans. And it is not just multicellular plants, but wherever there is free water much of this living tissue is in the form of biofilms. We are learning that these complex associations form a thin film over all but the driest or most dynamic exposed surfaces.[6] Biogeochemical cycles supply the chemical building blocks for life. These complex elemental and molecular exchanges are mediated by a myriad of microbial species. Single-celled organisms are so pervasive that the fingerprint of living processes is virtually everywhere. There is evidence for a biogenic graphite signature in rocks dating back

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3.7 billion years.[7] And with new remote sensing tools we can identify the light back-scatter from photosynthetic microbes on Earth. This is also a promising way to search for a biosignature in deep space.[8] In the ecological sciences, a newly integrated view of life is linking the smallest organisms to planetary ecological processes. Yet, surprisingly, this emerging new view of life is based squarely upon death and dying. Death is a pervasive phenomenon in ecological relationships. The ecological services of living systems are animated at every level by mortality, cessation, and bodily or physical endings.[9] Our challenge is to find a comprehensive theory of death to encompass these observations.

It is surprisingly difficult to find the word "death" in the index of ecology or conservation biology books. It is seldom listed separately, perhaps because the effects of death are pervasive, present in nearly every other subject. One finds detailed coverage of physical disturbances and other mortality mechanisms (e.g., predation, trophic cascades, and population regulation). But there is little coverage of any attendant definitional issues for death. The brute fact of a physical ending is seemingly self-evident. James Carey, a pioneer in the field of biodemography, and specializing on insect models for aging, comments "that [although] death is one of the most mysterious and inexorable problems in biology. There is little direct coverage in basic biological science and textbooks seldom contain any reference to death or dying."[10]

In the source book *Keywords in Evolutionary Biology*, for instance, "predation" and "extinction" are listed, but not "mortality" or "death."[11] This lack of detailed attention to death means that it remains undertheorized in biology.[12] Life scientists may simply be reflecting a more generalized societal discomfort with death.[13] But environmental ethicist Holmes Rolston III suggests that at least part of the reason may lie in the simple avoidance of the challenging philosophical questions raised by evolutionary theory and the associated mechanisms of biotic death. As he says,

> Biology in the last half-century has not been particularly comfortable with the word "struggle" which has largely disappeared from biology texts, being replaced by the notions of "adaptedness" and "fittedness." Still, plenty of "struggle" remains in biology (although the switch in emphasis is revealing), and when philosophical participants find that they themselves have ascended via this struggle, they are confronted with the question whether such a struggle can be meaningful.[14]

The advent of evolutionary theory and its putative mechanisms of natural selection and sexual selection confront us with the challenge of physical death and the meaning of life. The hypothetico-deductive approach of the Darwinian method, as Michael Ghiselin points out, has been a robust success.[15] And as such, it is a challenge to many-received ideas across a wide range of social, philosophical, geological, and, we can add, theological domains. The mechanism of struggle, loss, and death that is so vital to evolutionary theory, Keith Miller says, serves "as an unnecessary stumbling block to a productive engagement of both science and faith."[16]

Rolston, in his chapter "The Life Struggle," shows that questions in evolutionary theory can actually enhance our understanding of God's good earth.[17] We could gain much by applying these new findings on the ecological functionality of death to the stewardship of the earth. The emerging creation-care discourse has necessarily invoked the negative aspects of human actions as a destructive agent of ecosystem change or loss.[18] But it has also taken Job's view of awe and wonder at the dangerous behemoth.[19] In contrast to the traditional view, this literature has also emphasized the fundamental goodness of God's creation in all of its operations, even those involving pain and death.[20] We circle the questions of biotic death, pain, and life in a troubling dance, looking for clarity. The range of answers that we have available through the traditional view of death[21] seems to me theoretically unsatisfactory and is increasingly polarizing.[22] Perhaps a closer look at the phenomenology of biotic mortality through an ecological lens will give us some new insight.

To appreciate the pervasiveness of death in ecology let us start by considering how the end of life animates the entire range of ecological relationships. Population ecologists, trying to understand the regulatory mechanisms in the ebb and flow of populations and communities, mathematically model death in what are called "loss processes."[23] The famous Snowshoe Hare-Canadian Lynx (SSH-CL) predator-prey cycles have been described with linked population equations.[24] The customary view of this species pair is that a proficient predator will regulate the prey in a cyclically balanced fashion.[25]

Yet close analysis shows that more than simple predation is going on. Numerous biotic (competitive) and abiotic (physical) factors are interacting to regulate these populations. We typically think of predator-prey interactions resulting in the demise of prey in a dramatic chase that ends in a cloud of dust, blood, and gore. Predation on this view is a winner-take-all exchange in which the prey species is the loser. But the ecological action of death is considerably more complex.[26] In the classic SSH-CL cycle, the synchronizing mechanism remains elusive. Grouse are an alternate prey item. And the buds, seeds, and twigs of understory shrubs are browsed by both the hares and birds. This nonanimal death also has a regulatory influence. Plants can be predators too: carnivorous plants dominate in nitrogen-poor habitats such as acid bogs in the Boreal Forest or high on the table-like "Tepuis" of Venezuela in South America.[27] Ecologists conclude that death shapes ecosystem processes in a much wider array of feeding (trophic) relationships than that typically imagined as one animal eating another.

In the broadest sense, plant-feeding herbivores (such as bison, elk, antelope, and elephants), fish grazing on phytoplankton, or parasites invading hosts are all forms of predation.[28] But the predator does not need to kill outright in order to have an impact. The mere threat of death is also a population-regulating mechanism. Described colorfully as "landscapes of fear," the indirect or nonconsumptive effects of the threat of predation are increasingly recognized as important determinants of ecosystem structuring.[29] The prey item is not consumed, but simply alters its behavior in the presence of the perceived risk of predation. A classic case of predator-induced stress is the reintroduction of wolves into Yellowstone National Park. The activities of this top-level predator influence species at multiple levels in what is called a "trophic cascade" throughout the food web. The fear that wolves engender is sufficient to prevent elk from freely browsing on aspen trees as they once did near streams. Reduced browsing by the elk releases aspen growth, which in turn has an influence on beaver populations, and so on.[30] In the end, as ecologist Paul Colinvaux pointed out bluntly in his text, "all population control is by death," either by outright mortality or starvation, or by the failure to reproduce.[31]

Ecologists describe the significant biological features in the life cycle of an organism as its life history.[32] Detailed life history studies have shown that there is an energetic cost to these prey responses. The measurable effect of predator presence on reproductive output is one influence on Darwinian fitness.[33] The fear of death response happens in aquatic systems as well as terrestrial ones. Small minnows, or "bait fish," will bulk up around the pectoral fins if they detect the odor plume of a predator.[34] The energy cost of doing so is measurable for vertebrates and invertebrates alike. Water fleas (Daphnia), a common zooplankton in lakes, go through a seasonal cycle of body forms called "cyclomorphosis." In the presence of chemicals released by predators, each generation grows energetically expensive spines called "helmets."[35] Back on the land, entomologists have noticed that tree leaves will toughen, becoming distasteful after the plant has been fed upon by herbivorous insects.[36] And trees are said to "talk" to one another via the volatile chemical signals released when a herbivorous insect begins feeding. So a variety of ecological life history strategies, from outgrowing a predator to becoming distasteful, are deployed in the face of death. Population regulation by predation and stress are not the only death-mediated mechanisms that are structuring the biodiversity of ecosystems.

A World Shaped by Dying

Today there is an abundance of new research in ecological studies on death, senescence, and the process of dying. Yet biological death remains a profound mystery to us. Through long and personal association, it is difficult for us to see death as anything but evil—so much so that we might easily pass over the ways that physical mortality has been shaping the form and functioning of the biosphere. It would be difficult for an ecologist to imagine the overall appearance of a prairie landscape, for instance, without death operating in that ecosystem. The influence begins at the lowest structural levels. Cell mortality is a normal developmental component of life-forming processes, eliminating abnormal cells, deleting structures, and shaping tissues.[37]

These processes then scale upward. Ultimately death is expressed in the maintenance of every biotic community, providing structural integrity and vital ecosystem services.[38] The vascular systems of plants, for example, are composed primarily of nonliving

tissues. These dead cells are essential for conducting water and nutrients to the heights of redwood trees. The points and incised margins of leaves are complex functional surfaces shaped by death. These finely divided forms develop from undifferentiated lobes when embryological cells die leaving a gap between the outwardly growing outer surfaces. Likewise programmed-cell demise is at work with flower formation and the fall of deciduous leaves.[39] On the plant surface, protective bark layers form from dead or dying cells, analogous to the keratin-filled cells of our own skin. In the fall of the year, wonderful displays of color and leaf-drop are mediated in a genetically regulated process called programmed cell death (PCD).[40] PCD is expressed through a variety of biochemical pathways defined generally as either regulated cell death (apoptosis) or unregulated (necrosis). And the force of programmed mortality is at work at the community and ecosystem levels too.[41] Yet our cultural ambivalence with death can lead us to overlook the vital functional and structural roles that disturbance-mediated death plays in the biosphere.[42]

On land, physical disturbances, such as fire, shape forest ecosystems. But, for over half a century, best management practices effectively suppressed wildfires and other ecological disturbance agents, such as floods, whenever possible. But excluding all death-dealing ecosystem disturbance agents is widely recognized as poor management practice. We are now beginning to learn how to live adaptively with fire by accepting this necessary mortality as a sign of ecosystem health.[43]

In the ocean, the riot of color and swirling behavior among species in a coral reef community is mediated by complex interactions of physical, chemical, and behavioral processes shaped by death. Among the web of trophic relationships are the interesting coral-feeders (e.g., parrot-fish, filefish, and puffers).[44] These herbivores consume coral in copious amounts extracting the algal and coral polyp nutrients. Their finely divided feces rains down a white cloud forming sand grains that accumulate in many places, including the tropical white sand beaches we find so attractive.[45] Without this constant cropping, the algae would overgrow the reef, dramatically altering its structure and community composition. In every kingdom and domain of life, we find that the genetic program of death operates.

Contemporary views of living systems from cells to ecosystems are increasingly focusing on death and death-like processes. Seemingly every taxonomic level is represented in our emerging understanding of PCD.[46] Ecologists have discovered that PCD has regulatory influence on carbon flow through food webs, and in overall ecosystem structure, particularly in marine ecosystems. Cyanobacteria, better known as blue-green algae, are some of the smallest photosynthetic organisms in the ocean. They make up the base of the food pyramid, converting carbon dioxide into plant tissue and playing key roles in biogeochemical cycles and, ultimately, in regulating Earth's climate. Over the last three decades, we have gained deep insights into the detail of how death, mediated through PCD and the associated genetic pathways, is central to the function and structure of the entire biosphere.[47]

Then, at an entirely different scale, we find another kind of death study giving insight into the colony dynamics and behavior of social insects. Ant and honey bee workers can detect the "sweet smell of death" on a dead or moribund nest mate. At death, the suite of chemical signals associated with life begin to dissipate. This triggers the living to engage in life-conserving housekeeping actions, removing the dead to the refuse heap. And painting a live nest mate with a coat of specific fatty acids elicits a quick ride outside.[48]

Finally, there has been a surge of research on death assemblages in conservation biology that are just now beginning to emerge.[49] It is as if to advance the study of life it is necessary to look carefully at death. In an imaginary world without death there would be few of the many biological distinctions that we take for granted as fundamental to living systems. D'Arcy Thompson's classic study *On Growth and Form* delightfully details the physical rules of shape and form.[50] In an imaginary world without death, all that he describes and all that we observe simply disappear, to be replaced by mineral mechanics. There would be no cell shape, no tissue or texture to living systems. The shape of trees and forest stands, the mix of grassland species on the prairie, the shimmering blue depths of the open ocean, and the riot of color in a coral reef would not be the same. Without the formative mechanism of mortality through which ecological processes occur, we cannot describe the shape, or the behavior, or the system functioning of

the biosphere. Nothing in ecology makes sense apart from the operations of physical death.

What Is Death?

Ecological textbooks, as we said, show little awareness of death per se and seldom address the definitional issues associated with the term that crop up in the medical sciences. But biological mortality, even in ecology, is not so simple; there are varieties of death. In simplest terms, biological death is the act of being killed and the end of life for an organism. More technically, we speak of death as the ceasing to be a self-organized entity.[51] The body may remain, but the capacity for change is missing. Death is sometimes described as the loss of life. And medically, it has been marked by the irreversible cessation or stoppage of the heart, brain activity, or respiration. In science, physical or biological death is a normal process of the contingent, material world.

In some settings, death is characterized as a fundamental force or agent of change. Thus, ending is thought to be necessary for change and renewal to occur.[52] There are many kinds of endings that occur in nature. Biotic life is constituted of events and ends through a myriad of contingent processes.[53] Atoms end in the light-matter quantum exchange of radioactive decay. Molecules end in metabolic respiratory pathways. Cells end with necrosis and PCD, both vital homeostatic processes that ensure the good health of organisms and of ecosystems. Tissues end by replacement, most interestingly in a complex program of dissolution and regrowth called "metamorphosis."[54] Ecologically, species and biotic communities come to an end point in extinction and successional change over time. The arrow of time mediates these endings we commonly label "death."

However, death itself does not have agency. Physical death is not a force like gravity. Rather, it is a condition that results from the power, action, or change mediated by some agent during the course of life. Or put another way, death is an outcome of the lack of life. In these definitions, it is already clear that death is less a discrete event and more a process. And this insight presents life scientists a problem in specifying precisely when death has occurred for a biotic entity.[55]

This complexity arises in ecology too, from our inability to unequivocally identify organisms as individuals with a distinct end point. Without this precision, we cannot say when, or if, an organism has died. The discrete, unitary organisms we encounter every day (e.g., a dog, a cat, or a bird) are only one of two fundamental body forms in nature.[56] Many species, including plants, fungi, and social organisms, live as modular units of a collective, sometimes designated a "superorganism." This presents a challenge for population ecologists tracking the mortality of living units. For example, the typical cluster of aspen trees is a "clone." The founding unit that develops from seed is designated a "genet." The genetically identical shoots that grow to form the stand of trees are called "ramets." But what is the age of this group and when does this clone die? Is it the death of the genet or of the several offshoots that count? And symbiotic relationships push the boundaries of the individual into even fuzzier conceptual and terminological territory.[57] On close examination, we are finding that there is a relational character to living systems that does not sit easily within commonsense platonic categories of discrete individuals.[58]

Careful observers had known from antiquity that there were inherent mechanisms operating to limit the growth and development of plants and animals. The beginnings for a theoretical framing of death came in the eighteenth century with experiments by Linnaeus and his students on the potential consequences of uninterrupted plant growth. "A single plant," he wrote, "if left unchecked by animals, could cover and envelop our entire globe."[59] And Malthus and Darwin, following him, both knew that death was the necessary twin of life. This is perhaps best illustrated by the famous last paragraph of *The Origin of Species*. In it, Darwin explicitly names the agency of death operating as part of a complex system that is naturally selected to sustain life.

> Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.[60]

With Darwin, ecologists have a useful theory explaining new species development. It provides a

mechanism for competitive exclusion and physical or reproductive death.[61]

Death then is axiomatic in the theoretical underpinnings of evolutionary theory, framing key questions in ecology. The so-called "Copernicization" of death is not rejecting Darwin, but suggesting that a more comprehensive theory of death is needed.[62] To better understand death, it may be necessary to examine what is living versus what is merely material and, hence, dead. At the outset of the modern discipline of biology, organisms were defined by their intentionality, their telos. Kant delimited living organisms from mere machine "tools," using the term "self-organized" to indicate their intentionality.

However, as Evelyn Fox Keller shows, since the advent of cybernetics in the 1940s this definition has become problematic. She proposes that we "drop the question of intentionality for living entities and focus instead on agency."[63] Making this move changes the focus for the definition of life to power, action, or change. And now we have a clear link between life and death, in which the lack of agency is defining.

Biology is centered entirely on the study of life and life-like processes; therefore, biologists have defined life by a series of functional properties that we all memorized in high school biology. For most biologists, these functional definitions of living systems seem adequate for our work. But this approach is problematic for philosophers. In a detailed and highly personal accounting, analytical philosopher Fred Feldman undertakes a search for robust definitions both of life and of death. He concludes that "in spite of its magnificent pedigree and its popularity, the life-functional approach to the analysis of life is unsuccessful."[64] In the end he says that "life is a mystery." Nor is he sanguine that we can do any better in precisely defining death.[65] Life and death circle one another in an endless cycle as Steven Peck and the wise Preacher (*Koheleth*) in Ecclesiastes both claim.[66]

From a different disciplinary direction, organic chemist Addy Pross claims greater certainty about his theory of the origin of life, but he also alludes to some mystery, or at least ignorance, as life emerges from lifeless matter. He proposes that a unification of Darwinian theory and the chemical theory of evolution must take place for an "integration that forms the basis of the theory of life."[67] Unfortunately, Pross says little specifically about death. But any integrated theoretical framing of life linking chemistry with evolutionary theory will need a complementary theory of death. We are left then, from both philosophical and biochemical directions, with the theoretical mystery of biotic life and death. We currently lack a means of effectively connecting these two phenomena into a satisfactory theoretical framework. The call by André Klarsfeld and Frédéric Revah for a comprehensive theoretical reframing of death is important to biologists.[68] A deeper insight into the theoretical place of death in ecology may open new avenues for investigating the course of life on Earth than that currently available in the neo-Darwinian synthesis.

From Definition to Meaning

Two aphorisms from Claude Bernard, a founder of modern physiology, sum up a paradox of biotic existence. "Life is creation," he said, and in challenge to the vitalism of the day, "Life is death."[69] Mechanistic theory is conclusive, and we no longer assert a vital force or élan for life. In our attempts to understand life, we are closing in on the goal of producing it artificially and/or identifying it in deep space.[70] But the challenging question is, how will we know it should life appear on the lab bench or even in deep space?[71] Research in ecology, biochemistry, and astrobiology is testing the adequacy of our theoretical understanding of both life and death. Is there an essence to life that links to death? In the end, we simply cannot say that there is one thing that unequivocally defines either end of this wonderful continuum of life that we find ourselves within. How interesting! So I am simply going to continue using each term as if we all understood exactly what is meant by them. And, if Feldman is correct, life and death do form identifiable ontological categories.[72] But it all depends upon how the question is approached.

This illustrates what I take to be the central challenge in speaking about the place of death in ecology. We often take hold of the wrong end of such questions. Asking "when were you born?" or "when did she die?" are relatively straightforward questions to answer. But actually these questions lack the necessary precision for all but the most ordinary examination. If we go further and try to exert the full force of our analytical methods to bring precision to our understanding, the questions escape our empirical grasp. The answer that we actually want cannot

be found in the empirical-theoretical facts of the matter. No amount of scientific exactitude will explain the meaning of human death, the necessity of suffering among creatures, and the putative silence of God in the face of relentless human interrogation. The Creator will not be justified to the creature; and as George Murphy details, the triune God remains wonderfully hidden in plain sight, having become a creature and submitting to these same creaturely limits, including death on the cross.[73] Here is where we must begin our humble inquiry of faith in order to understand death. For as Job discovered in his day, it is in the silence of faith before the Creator that, after all, the answer lies.[74]

The approach to meaning in death that recommends itself to me is much like that found in Robert Farrar Capon's description of how everything was created in his short essay "Let Me Tell You Why."[75] He starts by describing a fanciful party where God decides to make the world. The scene is closer to what might happen by a gathering of artists, rather than by a sovereign royal ruler.[76] And he ends saying,

> It is, I grant you, a crass analogy; but crass analogies are the safest. Everybody knows that God is not three old men throwing olives at each other. Not everyone, I'm afraid, is equally clear that God is not a cosmic force or a principle of being … Accordingly, I give you the central truth that creation is the result of a Trinitarian bash, and leave the details of the analogy to sort themselves out as best they can.[77]

We can scarcely do better in talking about the meaning of death.

Ecologists sometimes say the first rule of ecology is "eat and be eaten," and the aphorism is affirmed in numerous biblical texts. This observation and its ambiguity are captured wonderfully by Annie Dillard in an incident with a mosquito feeding on a copperhead snake.

> Is this what it's like, I thought then, and think now: a little blood here, a chomp there, and still we live, trampling the grass? Must everything whole be nibbled? Here was a new light on the intricate texture of things in the world, the actual plot of the present moment in time after the fall: the way we the living are nibbled and nibbling—not held aloft on a cloud in the air but bumbling pitted and scarred and broken through a frayed and beautiful land.[78]

That food is derived by the consumption of living tissue is our descriptive position. The Bible places eating into the economy of God saying, "He provides food for the cattle and for the young ravens when they call" (Ps. 147:9). And the wonder of God's hand in predation is acknowledged in Psalm 104:14, "The lions roar for their prey and seek their food from God." So death in biotic systems has always been seen as a normal part of nutrition and life in God's kingdom.

Ecological Applications of Death to Creation Care

The ecological retheorizing of death that I propose may yield insights into creation care. First, this view supports the theological assertion that biotic death was present from the beginning and is inherently part of the goodness of creation.[79] Second, the land, as scripture calls the biosphere, is a gift. And biotic death is a part of that gifting to which we need to open our hands and gratefully receive it. This does not mean that we actively seek out death, but we no longer fear it either. Third, the fruitfulness of creation is necessarily balanced by endings. While this imperative is intuitively obvious, the mechanism of death still troubles us deeply.[80]

Fourth, a flourishing creation, our stewardship charge, depends on better understanding dying.[81] The ecological rethinking of death that I am advocating opens new insights into biotic functionality and shalom—the biblical concept of the flourishing of all creation.[82] Could it be that the groaning of creation is not primarily from physical death, but from the dislocation of relationships caused by human sin? Restoring those ruptures in relationship of humans to God, and of humans to the creatures is, as Middleton says, what we are interceding for and actively working to accomplish.[83] The lesson of creation care is that the redemptive concern for people requires that we also care for the earth.[84] And that this is possible in the presence of death. Mortality is not an optional, embarrassing, or inconvenient truth, but integral to the order of creation. It is as necessary to life as is the law of gravity. Dying is how our bodies—and likewise all those organismal bodies upon whom we depend for human flourishing—work.

Fifth, we know that our traditional view of death has contributed to an "ecological blind spot" for many in

the evangelical church.[85] The linking of missions and creation care at the 2012 *Lausanne Global Consultation on Creation Care and the Gospel* is a welcome and exciting sea change in this thinking.[86] Sixth, lament may be the response that will transcend the evil we perceive and bring us hope. Differing varieties of theodicy, Celia Deane-Drummond says, address evil in three forms—natural, moral, and, she suggests, *anthropogenic* evil.[87] Although the available theodicies may be inadequate, she says that the "*attempt* to consider theodicy" is still worth doing.

I agree that the full answer to the problem of death will not likely lie in a more detailed theodicy. We need to explore other ways forward. The "grief work" that Walter Brueggemann recommends is both a hopeful sign and, as he says, our prophetic task.[88] The human community faces stark choices that are as old as the covenant announced by Moses in Deuteronomy 30:15–18.[89] Brueggemann says that we can have

> Either ideology or realism;
> Either denial or grief;
> Either despair or hope.[90]

And scientific realism, including embracing the reality of biotic death, is required to address "both methodological and substantive challenges to Christian theology," says Arthur Peacocke.[91] Embracing the reality of biotic death is a vital step on the path to reimagining our relationship to the natural world.

Seventh, the concept of biophilia, our innate creaturely affinity for nature, can give us insight into the paradox of love and relationship lying at the heart of creation. I suggest that understanding biophilia helps us understand who we are, biophysically and spiritually.[92] It links us to our calling as stewards made in the image of God. In spite of all our passion for utilitarian efficiency, and the stewardship failings that ensue, we humans deeply love this biodiverse world.[93] As N.T. Wright suggests, we were created in love, in a relational world. And "love freely given creates a context for love to be freely returned."[94] The world, he notes, has been "created good but *incomplete*."[95] Biological dying is a necessary correlate in the story of a free and contingent universe. But physical death is not the only story.

Why Study Death? A Speculative Postscript

Having a clearer understanding of the "telos of death" as it operates in creation is vital. Ecologist Jeff Schloss gives carefully nuanced accounts for the question of death and predation in ecology. "While death is not necessary for life," he says, "the possibility of death is necessary. So constitutive for life is the possibility of not-being that its very being is essentially a hovering over this abyss, a skirting of its brink."[96] In the beginning God's spirit creates life. I wonder if physical death is not simply assumed in the biblical account of life giving, particularly in Genesis 1 where the abundance of life is springing forward. Can we conceive any functioning ecosystem, under any of the range of suggested time frames (days to millennia to billions of years), functioning without organisms dying? Not under any ecological conditions that we have experienced or theorized. Furthermore, throughout the scriptures, physical death is often linked to flourishing. The metaphors of "pruning," of "dying daily," and of saying that "unless a seed dies it abides alone" all seem to point to physical death as a normal end.[97]

What is life? What is death? We still do not know with precision, and we may never. The gift from God of the biosphere in all its complex ecological processing includes death. In *Nature Reborn*, Paul Santmire gives a clear-eyed account of the ambiguities of both gospel and nature with respect to death. We Christians, he says, "are unable to deny death. A religion that has a crucified Messiah as its fulcrum hardly permits that."[98] So can we find a better vision of death in science and in theology? Can we, he wonders rhetorically, embrace the ecology of death? Yes, it is possible, and I believe that we must do so.

The nexus of ecological relationships is part of our spiritual as well as our physical inheritance. Seeing the land as gift and death as integral to that gift is the way forward.[99] We need to regain the sense of land that Moses laid out in Deuteronomy.[100] It is a sense that the prophets and psalmist praised; and that the wisdom writers declared as a good gift from God our Creator, and it included dying.

Ronald Osborn, in his recent account of *Death before the Fall,* challenges the static reading of scripture which fails to account for the dynamics of death in creation.[101] What are we to make of this flourishing

of life so deeply tied to death?[102] There is a Christian path toward the ecology of death that we have not taken. It was embodied by the Celtic saints and also in the thought of Saint Francis of Assisi.[103] Perhaps as the mystic Francis recognized nearly eight hundred years ago, ecologists are right to welcome "sister death" as an integral part of creation's processes. This understanding of life will continue challenging conventional views of Genesis. One implication of this new complementarian view is that if death is the engine of nature, then life is the fuel. ✞

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Several years ago Keith Miller invited a group of scholars to try whether we could write something new on the subject of death in our disciplinary area. Thanks Keith! And I appreciate the insightful comments that he and the anonymous reviewers made to improve this paper. My good friend David Mahan provided detailed and insightful comments. King's colleagues Harry Cook, Doug Harink, Steve Martin, and Darcy Visscher have been my conversation partners at various stages in the development of this work. The King's University provided professional support for a study leave for which I am grateful. And my wife Cathy has been a constant and careful reader as well as a great encourager along the way. Thanks everyone!

Notes

[1]Charles Elton, "The Animal Community," *Animal Ecology* (Chicago, IL: University of Chicago Press, 2001), cited by Elton at the start of chapter 5.

[2]The Psalmist is perhaps speaking descriptively rather than normatively here—or perhaps not. See verse 27 in Psalm 104 of Calvin's *Commentaries*, http://www.studylight.org/commentaries/cal/view.cgi?bk=18&ch=104.

> *All these wait upon thee* The prophet here again describes God as acting the part of the master of a household, and a foster-father towards all sorts of living creatures, by providing liberally for them. He had said before, that God made food to grow on the mountains for the support of cattle, and that sustenance is ministered to the very lions by the hand of the same God, although they live upon prey.

And later (verse 29)

> … the Psalmist asserts, that *if God hide his face they are afraid*; and, secondly, *that if he take away their spirit they die, and return to their dust* … The amount of what is stated is, that when we see the world daily decaying, and daily renewed, the life-giving power of God is reflected to us herein as in a mirror. All the deaths which take place among living creatures, are just so many examples of our nothingness, so to speak; and when others are produced and grow up in their room, we have in that presented to us a renewal of the world. Since then the world daily dies, and is daily renewed in its various parts, the manifest conclusion is, that it subsists only by a secret virtue derived from God.

Charles H. Spurgeon, in his commentary on Psalm 104:29, is more direct in saying that this death related to eating is from God.

> Note here that death is caused by the act of God, "thou takest away their breath"; we are immortal till he bids us die, and so are even the little sparrows, who fall not to the ground without our Father.

And a parallel comment regarding scavengers is made in Psalm 147:9 (ESV): "He gives to the beasts their food, and to the young ravens which cry."

[3]Steven L. Peck, "Death and the Ecological Crisis," *Agriculture and Human Values* 27 (2010): 105–109.

[4]H. Paul Santmire, *Nature Reborn: The Ecological and Cosmic Promise of Christian Theology* (Minneapolis, MN: Augsburg Fortress, 2000), 94. Two iconic stories illustrate the range of emotive power Santmire's observation elicits. In a letter to Asa Gray, May 22, 1860, Charles Darwin recounts his consternation "that a beneficent & omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of caterpillars."

In the second story, Annie Dillard describes walking along the edge of an island in a stream "mainly to scare frogs" when she notices a small green frog.

> He didn't jump; I crept closer. At last I knelt on the island's winter killed grass, lost, dumbstruck, staring at the frog in the creek … And just as I looked at him, he crumpled and began to sag … being sucked dry by a giant water bug … I stood up and brushed the knees of my pants. I couldn't catch my breath. (Annie Dillard, *Pilgrim at Tinker Creek* [1974; New York: Harper Collins, 1998], 7–8)

[5]In John 15:1–27, we find a related agricultural metaphor in the vinedresser pruning away moribund or nonproductive branches.

[6]Steven L. Percival et al., "Introduction to Biofilms," in *Biofilms and Veterinary Medicine,* ed. Steven L. Percival, Derek C. Knottenbelt, and Christine A. Cochrane (New York: Springer, 2011): 41–68, doi:10.1007/978-3-642-21289-5_2.

[7]Yoko Ohtomo et al., "Evidence for Biogenic Graphite in Early Archaean Isua Metasedimentary Rocks," *Nature Geoscience* 7, no. 1 (2014): 25–28.

[8]William B. Sparks et al., "Detection of Circular Polarization in Light Scattered from Photosynthetic Microbes," *Proceedings of the National Academy of Sciences of the United States of America* 106, no. 19 (May 12, 2009): 7816–21.

[9]The terminology of death is challenging as we use one word for a complex of meanings. Theologian Gordon J. Spykman has helpfully emphasized that "dualist views of human nature also create insuperable dilemmas, not to mention needless complications" for both end of and beginning of life issues. Gordon J. Spykman, *Reformational Theology: A New Paradigm for Doing Dogmatics* (Grand Rapids, MI: Wm. B. Eerdmans, 1992), 242. In this article, I simply focus on physical or biological death and will not attempt to untangle this theological complex. Getting a better understanding of the biological meaning of death may yield useful insights into what is meant variously by metaphysical death.

[10]James Carey, "Biology of Death," *The Evolution & Medicine Review* (July 4, 2008), https://evmedreview.com/biology-of-death-2/#more-83.

[11]Evelyn Fox Keller and Elisabeth A. Lloyd, ed., *Keywords in Evolutionary Biology* (Cambridge, MA: Harvard University Press, 1992).

[12]André Klarsfeld and Frédéric Revah, *The Biology of Death: Origins of Mortality,* trans. Lydia Brady (Ithaca, NY: Cornell University Press, 2004).

[13]Especially pertinent on this point is Philippe Ariès, "Forbidden Death," chap. 4 in *Western Attitudes toward Death: From the Middle Ages to the Present*, trans. Patricia M. Ranum (Baltimore, MD: The Johns Hopkins University Press, 1974), 85–107.

[14]Holmes Rolston III, *Science and Religion: A Critical Survey*. (Philadelphia, PA: Temple University Press, 1987), 133–34.

[15]Michael T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley, CA: University of California Press, 1969).

[16]Keith B. Miller, "'And God Saw That It Was Good': Death and Pain in the Created Order," *Perspectives on Science and Christian Faith* 63, no. 2 (2011): 85–94.

[17]Rolston III, "Life: Religion and the Biological Sciences," chap. 3 in *Science and Religion*, 81–150.

[18]There is a richly textured literature of Christian concern for the care of creation, including the classic, and my beginning place, Loren E. Wilkinson et al., *Earthkeeping in the Nineties: Stewardship of Creation* (Grand Rapids, MI: Wm. B. Eerdmans, 1991).

[19]For example, see Calvin DeWitt, *Caring for Creation: Responsible Stewardship of God's Handiwork* (Grand Rapids, MI: Baker Books, 1998); and Fred Van Dyke et al., *Redeeming Creation: The Biblical Basis for Environmental Stewardship* (Downers Grove, IL: InterVarsity Press, 1996), 47–51, 114.

[20]Robert James Berry, ed., *The Care of Creation: Focusing Concern and Action* (Leicester, UK: Inter-Varsity Press, 2000), 177–83. See also the remarkably clear and early linking of ecological death to the goodness of creation by Loren E. Wilkinson, "A Christian Ecology of Death: Biblical Imagery and the Ecologic Crisis," *Christian Scholar's Review* 5 (1976): 319–38. And the equally emphatic early statement made by Wesley Granberg-Michaelson in *Worldly Spirituality: The Call to Take Care of the Earth* (San Francisco, CA: Harper & Row, 1984), "The creation lives, at all levels, through the giving up of life" (p. 203). However, there are authors who remain within the traditional framings. See, for example, Laura Yordy, "Biodiversity and the Kingdom of God," chap. 8 in *Diversity and Dominion: Dialogues in Ecology, Ethics, and Theology*, ed. Kyle S. Van Houtan and Michael S. Northcott (Eugene, OR: Wipf and Stock, 2010), 166–90; especially p. 175.

[21]See, for example, the entry Rupert E. Davies, "Death," in *The Zondervan Pictorial Encyclopedia of the Bible*, vol. 2 (D–G), ed. Merrill C. Tenney and S. Barabas (Grand Rapids, MI: Zondervan, 1975/1976), 70–72.

[22]By traditional, I mean the theological consensus that has emerged from the influence of early twentieth-century fundamentalism. As N.T. Wright, in *Surprised by Hope: Rethinking Heaven, the Resurrection, and the Mission of the Church* (New York: HarperCollins, 2008), has noted, "Christian thought has oscillated between seeing death as a vile enemy and a welcome friend" (p. 15). For an entrance into this extensive literature, see Mark Noll, "Thinking about Science," in *The Scandal of the Evangelical Mind* (Grand Rapids, MI: Wm. B. Eerdmans, 1994), 177–208; and Ronald E. Osborn, *Death before the Fall: Biblical Literalism and the Problem of Animal Suffering* (Downers Grove, IL: InterVarsity Press, 2014). I appreciate Osborn's winsome approach and also that of Richard A. Young, *Healing the Earth: A Theocentric Perspective on Environmental Problems and Their Solutions* (Nashville, TN: Broadman & Holman, 1994), 142–47. Although I agree with much that Young writes, he does have a more traditional discussion of death which he acknowledges most ecologists (including this one) would disagree with.

[23]Biology students are often surprised to learn in the population ecology unit that a primary analytic tool, the life table, is actually keeping track of deaths in the population. It becomes common place to speak of mortality curves, k-value analysis (killing power), and the co-evolution of predator-prey relationships. All of these are mediated by death processes.

[24]This textbook example can be found in Robert L. Smith and Thomas M. Smith, *Ecology and Field Biology*, 6th ed. (San Francisco, CA: Benjamin Cummings, 2001), 188–91.

[25]See Daniel B. Botkin, *The Moon in the Nautilus Shell: Discordant Harmonies Reconsidered* (Oxford: Oxford University Press, 2012).

[26]This typical telling of predator-prey cycling is not a full treatment of the complexities of population regulation by death. For an alternative account of population cycles, see Dennis Chitty, *Do Lemmings Commit Suicide? Beautiful Hypotheses and Ugly Facts* (Oxford: Oxford University Press, 1996). And there are numerous specialty texts on prey response to predation, e.g., Tim Caro, *Antipredator Defenses in Birds and Mammals* (Chicago, IL: University of Chicago Press, 2005).

[27]Botanical carnivory occurs in a mixed group of flowering plants forming a common "ecological niche" with nearly 600 species distributed today on every continent except Antarctica. For details, see Aaron M. Ellison et al., "The Evolutionary Ecology of Carnivorous Plants," *Advances in Ecological Research* 33 (2003): 1–74.

[28]A predator typically kills its prey and consumes it whole or in parts. The strategy used is a size dependent and/or social response to the food item. Many plant feeders consume only a portion of the living tissue. They are called "grazers" if feeding on nonwoody tissues of grasses and broad-leaved plants (the forbes), or "browsers" when feeding on woody shrubs or trees. Since they kill the food, these primary consumers are classified broadly as plant predators. In the insects, there is a functional feeding group called "parasitoids" that slowly consume the prey item, ending by killing the host. This is the feeding strategy of the ichneumonid wasp that so troubled Darwin's sensibilities. Close analysis of the various families of microhymenoptera reveals thousands of such species in habitats from mountain tops to jungle canopies and even aquatic ponds and streams. Yet the insects do not have it all their own way. Look up examples of zombie fungi (*Cordyceps,* for example) for a glimpse into the coevolutionary world of predator-prey contests. The entire new field of ecological chemistry, pioneered by the late Thomas Eisner, is filled with complex examples of the signal-response relationships that characterize tropic relationships. See Thomas Eisner, *For Love of Insects* (Cambridge, MA: Belknap Press, 2005). For further details on the definition of predation, see Peter Price et al., *Insect Ecology: Behavior, Populations and Communities* (Cambridge: Cambridge University Press, 2011), 269.

[29]John W. Laundré, Lucina Hernández, and Kelly B. Altendorf, "Wolves, Elk, and Bison: Reestablishing the 'Landscape of Fear' in Yellowstone National Park, USA," *Canadian Journal of Zoology* 79 (2001): 1401–9; Evan L.

Preisser, Daniel I. Bolnick, and Michael F. Benard, "Scared to Death? The Effects of Intimidation and Consumption in Predator-Prey Interactions," *Ecology* 86, no. 2 (2005): 501–9.

[30]Andy P. Dobson, "Yellowstone Wolves and the Forces That Structure Natural Systems," *PLoS Biology* 12, no. 12 (2014), e1002025, doi:10.1371/journal.pbio.1002025.

[31]In addition to predation, he lists six forms of death that regulate population numbers. "Perhaps the commonest form of 'death' is not being born at all because of the stress of competition." The failure to find a mate is an equally effective form of biological death as is that of carnivory or the death which results from starvation, malnutrition, parasitic disease, or accident. P. Colinvaux, *Ecology 2* (New York: John Wiley & Sons, 1993), 201–202.

[32]Roger J. Lincoln, G.A. Boxshall, and P.F. Clark, *A Dictionary of Ecology, Evolution and Systematics* (Cambridge: Cambridge University Press, 1982).

[33]Stephen Stearns, *The Evolution of Life Histories* (Oxford: Oxford University Press, 1992); Barney Luttbeg and Jacob L. Kerby, "Are Scared Prey as Good as Dead?," *Trends in Ecology and Evolution* 20, no. 8 (2005): 416–18.

[34]Stanley Dodson, "Predator-Induced Reaction Norms," *BioScience* 39, no. 7 (1989): 447–52.

[35]Stanley Dodson, *Introduction to Limnology* (Boston, MA: McGraw Hill, 2005), 172–76. Predation is only one of the numerous biotic forces shaping biological communities. Cooperation is another. Theories of community assembly also entail abiotic disturbance and stochastic processes. In the end, as Colinvaux in *Ecology 2* says, population regulation is by some form of biotic death (p. 201).

[36]For a detailed discussion of the chemical defenses of plants (called allelopathy), see Price et al, *Insect Ecology*, 492–501.

[37]Eric H. Baehrecke, "How Death Shapes Life during Development," *Nature Reviews Molecular Cell Biology* 3, no. 10 (2002): 779–87.

[38]Joshua S. Madin et al., "Mechanical Vulnerability Explains Size-Dependent Mortality of Reef Corals," *Ecology Letters* 17 (2014): 1008–15.

[39]Arunika H.L.A.N. Gunawardena, John S. Greenwood, and Nancy G. Dengler, "Programmed Cell Death Remodels Lace Plant Leaf Shape during Development," *The Plant Cell* 16, no. 1 (2004): 60–73; Pyung O. Lim, H.J. Kim, and H.G. Nam, "Leaf Senescence," *Annual Review of Plant Biology* 58, no. 1 (2007):115–36.

[40]The concept of programmed cell death (PCD) is both complex and rapidly developing. First described in the nineteenth century, its significance was not fully appreciated. It emerged again in animal development studies in the 1990s and is vital across molecular, developmental, medical, and ecological fields. For an introduction to the terminology, see Martin Raff, "Cell Suicide for Beginners," *Nature* 396 (1998): 119–22; and Alexei Degterev and Junying Yuan, "Expansion and Evolution of Cell Death Programmes," *Nature Reviews Molecular Cell Biology* 9, no. 5 (2008): 378–90.

[41]For example, Daniel J. Franklin, Corina P.D. Brussaard, and John A. Berges, "What is the Role and Nature of Programmed Cell Death in Phytoplankton Ecology?" *European Journal of Phycology* 41 (2006): 1–14; Jakob Pernthaler, "Predation on Prokaryotes in the Water Column and Its Ecological Implications," *Nature Reviews Microbiology* 3, no. 7 (2005): 537–46; Jerry F. Franklin, H.H. Shugart, and Mark E. Harmon, "Tree Death as an Ecological Process," *BioScience* 37, no. 8 (1987): 550–56.

[42]On this cultural reluctance, see Colin Tudge, *The Engineer in the Garden: Genes and Genetics – From the Idea of Heredity to the Creation of Life* (New York: Hill and Wang, 1993), 347–48. On the economic and ecological benefits of disturbance, see Johan Colding, Thomas Elmqvist, and Per Olsson, "Living with Disturbance: Building Resilience in Social-Ecological Systems," chap. 7 in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, ed. Fikret Berkes, Johan Colding, and Carl Folke (New York: Cambridge University Press, 2003), 163–86.

[43]For example, see J. Boone Kauffman, "Death Rides the Forest: Perceptions of Fire, Land Use, and Ecological Restoration in Western Forests," *Conservation Biology* 18, no. 4 (2004): 878–82.

[44]Patrick L. Osborne, *Tropical Ecosystems and Ecological Concepts* (New York: Cambridge University Press, 2000); Maurice Schwartz, "Carbonate Sandy Beaches," chap. 10, in *Encyclopedia of Coastal Science,* ed. Maurice Schwartz (Dordrecht, The Netherlands: Springer Science & Business Media, 2005), 218–20.

[45]Peter W. Glynn, "Bioerosion and Coral-Reef Growth: A Dynamic Balance," in *Life and Death of Coral Reefs*, ed. C. Birkeland (Dordrecht, The Netherlands: Springer Science & Business Media, 1997), 68–95.

[46]On the role of programmed cell death in bacterial biofilm formation and quorum sensing, see Maureen A. O'Malley and John Dupré, "Size Doesn't Matter: Towards a More Inclusive Philosophy of Biology," *Biology and Philosophy* 22, no. 2 (2007): 155–91.

[47]Kay D. Bidle, "The Molecular Ecophysiology of Programmed Cell Death in Marine Phytoplankton," *Annual Review of Marine Science* 7 (2015): 341–75.

[48]Dong-Hwan Choe, Jocelyn G. Millar, and Michael K. Rust, "Chemical Signals Associated with Life Inhibit Necrophoresis in Argentine Ants," *Proceedings of the National Academy of Sciences of the United States of America* 106, no. 20 (2009): 8215–55.

[49]Susan M. Kidwell and Adam Tomasovych, "Implications of Time-Averaged Death Assemblages for Ecology and Conservation Biology," *Annual Review of Ecology, Evolution, and Systematics* 44 (2013): 539–63.

[50]D'Arcy Thompson, *On Growth and Form*, an abridged edition, ed. J. T. Bonner (Cambridge: Cambridge University Press, 1961).

[51]The term "self-organization" is first applied in relation to living beings by Kant. Evelyn Fox Keller, "Ecosystems, Organisms, and Machines," *BioScience* 55, no. 12 (2005): 1069–74.

[52]Klarsfeld and Revah, *The Biology of Death*.

[53]"Every form of life we know or can imagine is sustained by this fountain of energy; remove death, and the fountain dries up" (Wilkinson, *Christian Ecology of Death*, 321).

[54]Michael Buszczak and William A. Segraves, "Insect Metamorphosis: Out with the Old, In with the New," *Current Biology* 10, no. 22 (2000): R830–33, doi:10.1016/S0960-9822(00)00792-2.

[55]For a popular exposition of the fuzzy line between life and death, and the processes leading to death, see Dick Teresi, *The Undead: Organ Harvesting, the Ice-Water Test, Beating-Heart Cadavers – How Medicine Is Blurring the Line between Life and Death* (New York: Pantheon Books, 2012).

[56]There is no single definition for a biological organism. See John W. Pepper and Matthew D. Herron, "Does Biology Need an Organism Concept?," *Biological Reviews* 83 (2008): 621–27, Table 1 "Terms referring to variants of the organ-

ism concept" in which as many as twelve terms have been proposed, each a distinct organism concept.

[57]For an extended discussion of this challenge, see Stephen Jay Gould, "The Meaning of Individuality and the Expansion of the Darwinian Research Program," in *The Structure of Evolutionary Theory* (Cambridge: Harvard University Press, 2002), 597–612.

[58]This raises the foundational question of the best way to characterize organisms. Should they be thought of as autonomous individual entities, the most common concept in models of evolution—just an individual? Or as communities of being, ensembles of interacting species suggested by new research on biofilms, the human microbiome, or the evolution of mitochondria and other cell organelles from once free-living organisms? For entry into this literature, see John Dupré and Maureen A. O'Malley, "Varieties of Living Things: Life at the Intersection of Lineage and Metabolism," *Philosophy and Theory in Biology* 1 (2009): e003, doi:10.3998/ptb.6959004.0001.003; Betsey Dexter Dyer, "Symbiosis and Organismal Boundaries," *American Zoologist* 29, no. 3 (1989): 1085–93.

[59]Klarsfeld and Revah, *The Biology of Death,* 5.

[60]Charles Darwin, *On the Origin of Species*, 1st edition, accessed via The Project Gutenberg EBook of *On the Origin of Species* by Charles Darwin (1859), 459.

[61]Evolutionary theory also explains cooperation and altruism, especially in social species. The effective "death" here is mediated through and compensated for in mating systems such as haplo-diploidy, in which forgoing reproduction has a clear advantage for sister workers, or in the act of near-kin adoption. See, for example, Edward O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, MA: Harvard University Press, 1980).

[62]Klarsfeld and Revah, *The Biology of Death,* 1, 3, 6.

[63]Fox Keller, *Ecosystems, Organisms, and Machines*, 1073.

[64]Fred Feldman, *Confrontations with the Reaper: A Philosophical Study of the Nature and Value of Death* (New York: Oxford University Press, 1992), 71.

[65]Ibid. On death Feldman says,

> So, though death looms large in our emotional lives, though we hate it, and fear it, and are dismayed by the thought that it will someday overtake us and those we love, we really don't know precisely what death is. The Reaper remains mysterious. (p. 69)

[66]Peck, "Death and the Ecological Crisis," 108; e.g., Ecclesiastes 1:4, 11; 3:18–21; and 12:1–7 (ESV).

[67]Addy Pross, *What is Life? How Chemistry Becomes Biology* (Oxford: Oxford University Press, 2012), 161–62.

[68]Klarsfeld and Revah, *The Biology of Death.*

[69]Quoted in ibid., 10. However, Bernard's views on human-induced animal death and suffering are not helpful. See Brian Klug, "Can We See a Moral Question about Animals?," chap. 17 in *Animals on the Agenda: Questions about Animals for Theology and Ethics,* ed. Andrew Linzey and Dorothy Yamamoto (Urbana, IL: University of Illinois Press, 1998), 206–15.

[70]In addition to the theory by Pross, *What is Life?*, we have the empirical work of synthetic genomics by Craig Venter, for example, as discussed in Daniel G. Gibson et al., "Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome," *Science* 329, no. 5987 (2010): 52–56.

[71]Andrew Wilson, ed., *Exobiology in the Solar System and the Search for Life on Mars: Report from the ESA Exobiology Team Study 1997–1998* (Noordwijk, The Netherlands: European Space Agency, 1999).

[72]The challenge also appears in defining ecosystems and communities. Trying to specify the difference between living and nonliving material is challenging in any but the simplest of pathways as nutrients cycle in and out of biotic and abiotic compartments. See Timothy F.H. Allen and Thomas W. Hoekstra, *Toward a Unified Ecology* (New York: Columbia University Press, 1992), 45–47.

[73]George L. Murphy, *The Cosmos in the Light of the Cross* (Harrisburg, PA: Trinity Press International, 2003).

[74]See the delightful new commentary on the Book of Job by Lindsay Wilson, *Job* (Grand Rapids, MI: Wm. B. Eerdmans, 2015). The central issue, she says, "is not suffering but rather faith" (p. 352).

[75]Robert Farrar Capon, *The Romance of the Word: One Man's Love Affair with Theology* (Grand Rapids, MI: Wm. B. Eerdmans, 1995), 176–77.

[76]See J. Richard Middleton, "Imaging God's Primal Generosity," chap. 7 in *The Liberating Image: The* Imago Dei *in Genesis 1* (Grand Rapids, MI: Brazos Press, 2005), 271–98. Middleton provides a more typical academic account of these contrasting metaphors that nevertheless illustrates a fresh hermeneutical approach to the creation story.

[77]Capon, *The Romance of the Word*, 177.

[78]Dillard, *Pilgrim at Tinker Creek*, 230.

[79]The death that entered with the sin of Adam and Eve was relational separation from God and consequently from the creation. Robert J. Berry explores this thesis in detail in "Did Darwin Dethrone Humankind?," in *Darwin, Creation and the Fall: Theological Challenges,* ed. Robert J. Berry and T.A. Noble (Nottingham, UK: Inter-Varsity Press, 2009), 63–69. For an early use of the term "creation care" and the presence of physical death in the Garden of Eden, see Ron Elsdon, *Bent World: A Christian Response to the Environmental Crisis* (Downers Grove, IL: InterVarsity Press, 1981), 104.

[80]This deep ambiguity is perhaps best and elegantly articulated by Dillard in "Fecundity," chap. 10 in *Pilgrim at Tinker Creek,* 161–83.

[81]Wilkinson, *Christian Ecology of Death*, 320. The role of death in our care for creation is explored in part by Denis Edwards in *How God Acts: Creation, Redemption, and Special Divine Action* (Minneapolis, MN: Fortress Press, 2010).

[82]Humans have power and agency for good or ill. See, for example, Middleton's description of the flood as a restorative measure for shalom, to inhibit human violence to each other and the earth in *Liberating Image*, 220–21.

[83]He speaks of it as our human vocation as the *imago Dei* in God's world (Middleton, *Liberating Image*, 90).

[84]In John R. Wood and S.C. Bouma-Prediger, "Seeking Shalom," chap. 10 in *Living the Good Life on God's Good Earth*, ed. David S. Koetje (Grand Rapids, MI: Faith Alive, 2006), 79–83, we said, "The vision of all things in right relationship [shalom] is itself rooted in our understanding that God is a God of relationship." We are beginning to appreciate that biotic death is a necessary part of that flourishing.

[85]According to Davis, we have had an ecological blind spot in recent systematic theology. He argues that "deficiencies in the doctrines of creation and the atonement in evangelical theological systematic theology textbooks" help explain the uneven response to environmental issues. John J. Davis, "Ecological 'Blind Spots' in the Structure and Content of Recent Evangelical Systematic Theologies," *Journal of the Evangelical Theological Society* 43, no. 2 (2000): 273–86.

[86]Lowell Bliss, *Environmental Missions: Planting Churches and Trees* (Pasadena, CA: William Carey Library, 2013).

[87]Celia Deane-Drummond, *Eco-Theology* (London: Darton, Longman & Todd, 2008), 114–29.

[88]Walter Brueggemann, *Reality, Grief, Hope: Three Urgent Prophetic Tasks* (Grand Rapids, MI: Wm. B. Eerdmans, 2014). Although there is much to lament, collectively we do not seem to feel much sense of loss even in the face of the ongoing mass extinction of species. See Richard Bauckham, *Living with Other Creatures: Green Exegesis and Theology* (Waco, TX: Baylor University Press, 2011), 213–17. Here he affirms the charge by Edward O. Wilson, in *The Future of Life* (New York: Alfred A. Knopf, 2002), that humanity has become a "serial killer of the biosphere" (p. 94).

[89]Deuteronomy 30:15–20 (ESV): "See, I have set before you today life and good, death and evil. If you obey the commandments of the Lord your God that I command you today, by loving the Lord your God, by walking in his ways, and by keeping his commandments and his statutes and his rules, then you shall live and multiply, and the Lord your God will bless you in the land that you are entering to take possession of it. But if your heart turns away, and you will not hear, but are drawn away to worship other gods and serve them, I declare to you today, that you shall surely perish. You shall not live long in the land that you are going over the Jordan to enter and possess. I call heaven and earth to witness against you today, that I have set before you life and death, blessing and curse. Therefore choose life, that you and your offspring may live, loving the Lord your God, obeying his voice and holding fast to him, for he is your life and length of days, that you may dwell in the land that the Lord swore to your fathers, to Abraham, to Isaac, and to Jacob, to give them."

[90]Brueggemann, *Reality, Grief, Hope*, 161.

[91]Arthur Peacocke, *Evolution: The Disguised Friend of Faith?* (Philadelphia, PA: Templeton Foundation Press, 2004).

[92]John R. Wood, "Biophilia and the Gospel: Loving Nature or Worshipping God?," chap. 8 in *Living in the LambLight: Christianity and Contemporary Challenges to the Gospel,* ed. Hans Boersma (Vancouver, BC: Regent College Publishing, 2001), 153–76.

[93]For more on the problem of human independence, death, and creation care, see the entries for these terms in Wesley Granberg-Michaelson, *Ecology and Life: Accepting Our Environmental Responsibility* (Waco, TX: Word Books, 1988).

[94]Wright, *Surprised by Hope,* 102.

[95]Ibid., italics added.

[96]Jeffrey P. Schloss, "From Evolution to Eschatology," in *Resurrection: Theological and Scientific Assessments*, ed. Michael Welker, Ted Peters, and Robert J. Russell (Grand Rapids, MI: Wm. B. Eerdmans, 2002), 61. Also see Schloss's three-part contribution "Evolution, Creation, and The Sting of Death: A Response to John Laing," Parts 1, 2, and 3, blog entry, *The BioLogos Forum: Science and Faith in Dialogue*, August 10–12, 2012, http://biologos.org/blogs/archive/evolution-creation-and-the-sting-of-death-a-response-to-john-laing-part-1, http://biologos.org/blogs/archive/evolution-creation-and-the-sting-of-death-part-2, and http://biologos.org/blogs/archive/evolution-creation-and-the-sting-of-death-part-3.

[97]John 15:1–2, Luke 9:23, and John 12:24.

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[98]Santmire, *Nature Reborn*, p. 95. He also asks,

> Is it really possible for us to embrace the ecology of death? Is it spiritually realistic to aspire to encounter nature untamed, unpacified, and unromanticized, with all its ambiguities and its death-driven violence, as a gift from the giver of every good and perfect gift, as a tabernacle of the most high, and thereby to be able to embrace nature spiritually, as a world charged with the glory of God, overflowing with blessings, beauty and goodness? (p. 95)
>
> That is what the classical Celtic saints did. And that is why we need them as our mentors today: so that, having confronted the stark reality of death in nature, our spirituality will sustain, not undermine, our theology of nature. (p. 96)

[99]Walter Brueggemann, *The Land: Place as Gift, Promise, and Challenge in Biblical Faith*, 2nd ed. (Minneapolis, MN: Augsburg Fortress, 2002).

[100]With respect to our wanton destruction of the biosphere, few have noticed the significance of the setting of Deuteronomy 30 cited above. Moses explicitly calls on "heaven and earth to witness against you today." The entire creation is portrayed as standing within the royal court as witnesses against one species, humanity, the only species gifted with the *imago Dei*. We might have formerly read these words as a mere metaphorical flourish, a quaint cultural turn of phrase perhaps. But I wonder. Today we are living in what has been called the Anthropocene Age. Thus, invoking the agency of creation in testimony as Moses does here seems eerily prescient. See Richard Monastersky, "Anthropocene: The Human Age," *Nature* 519, no. 7542 (2015): 144–47.

[101]While his main focus is on the consequences of a "plain reading" or "literalism" and on biblical interpretation, Osborn also lays out a positive case for reading scripture in light of evolutionary accounts of death. Whether he is entirely successful or not is less important than that he clearly points out that the old wineskins of interpretation will not hold up to what has been called "the Copernicization of death." Osborn, *Death before the Fall*.

[102]Animal welfare is a closely related topic. There have been attempts to explain animal death and suffering that rely on the Cartesian mind-body dualism and Descartes's theory that animals are mere machines, and that their death or pain is no more significant than breaking a rock or a machine. Snoke takes this approach to maintain the significant difference between humans and animals. I agree that a robust theory of death will necessarily incorporate human uniqueness. David Snoke, "Why Were Dangerous Animals Created?," *Perspectives on Science and Christian Faith* 56, no. 2 (2004): 117–25. But this approach to predation is not the same as an ecological theory of death. It is based on a stark human-animal dualism that was contested by philosophers even as it was being proposed, and it seems to undercut the motivation of animal care embodied in antivivisection legislation. For the history and a theological review of human-induced animal pain, suffering, and death, see Donna Yarri, *The Ethics of Animal Experimentation: A Critical Analysis and Constructive Christian Proposal* (Oxford: Oxford University Press, 2005).

[103]H. Paul Santmire, *The Travail of Nature: The Ambiguous Ecological Promise of Christian Theology* (Philadelphia, PA: Fortress Press, 1985); and Wright, *Surprised by Hope*, 16–17.

Natural Evil: Genesis, Romans, and Modern Science[1]

R. J. (Sam) Berry

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Paul's reference to a "frustrated" and "groaning" creation in Romans 8:19–23 clearly refers to the "Fall" described in Genesis 3. How should we understand Genesis 3? Traditionally it has been used to explain the presence of disease and disaster in this world, but the historicity of the Genesis Fall account is frequently doubted on both anthropological and genetic grounds. Moreover, it is not directly referred to elsewhere in the Bible. The Romans 8:19–23 passage is not easy to understand. It makes the best sense if it is regarded as the climax of God's work as described in Romans 5–8, complementing the completeness of Christ's work set out explicitly in Colossians 1:17–20. Both the Genesis and Romans passages emphasize the relationship of God to creation. Concentrating on Genesis 3 at the exclusion of Romans 8 is to lose the relevance of God's plans for us, not least his commands to care for his creation. This article explores the connection of the two passages and their relevance to modern life and practice.

David Hull, in his review of Phillip Johnson's *Darwin on Trial,* writes,

> What kind of God can one infer from the sort of phenomena epitomised by the species on Darwin's Galápagos Islands? The evolutionary process is rife with happenstance, contingency, incredible waste, death, pain and horror … He is certainly not the sort of God to whom anyone would be inclined to pray.[2]

Hull raises what is probably the most difficult question to those looking in at the Christian faith. Is the God of the Bible worth belief?

In his much-quoted Hulsean Lectures, Norman Williams puts it:

> Perhaps the gravest of the intellectual difficulties which restrain men of thoughtfulness and goodwill from giving their allegiance to the Christian faith is that which inheres—not in any one article or detail of our religion, not in its doctrines of the Triune being of God, or of the two natures of Christ, not in Atonement, miracles, sacraments, or eschatology—but in the fundamental assertion that "God is love."[3]

Can the God worshipped by millions of Abrahamic faith believers be reconciled with the "God of the Galápagos"? The God described in scripture is clearly one who controls the natural world, even if some of the events recorded can be "explained" by naturally occurring events. The plagues in Egypt (Genesis 7–10) could be an ecological progression—although the deaths of the non-Israelite firstborn do not easily fit such an interpretation. It has been suggested that "the Lord [who] drove the sea away with a strong east wind all night long and turned the seabed into dry land" (Exod. 14:21) may have used a rare meteorological event combined with a fortuitous landslide—although the miracle here was essentially one of timing. But a plausible mechanism for a miracle does not invalidate divine action.[4] Jesus

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himself builds on Psalm 104 when he declared that God "feeds them [the birds]" and "clothes the grass in the fields" (Matt. 6:26, 30). Not only that, we are told "even the wind and sea obey him" (Matt. 8:27). Barnabas and Paul assured the credulous Lycaonians that "the living God … sends you rain from heaven and the crops in their seasons" (Acts 14:15–17).

Some disasters can fairly be attributed to human failings (think of the man who built on sand in Matt. 7:26 or the foolish virgins in Matt. 25:1–13), but it is stretching credulity to suggest they all disasters are the direct result of incompetence. The thousands who died in the Lisbon earthquake in 1755 or the one in Haiti in 2010 or that in Nepal in 2015 may have suffered as a result of living in weak houses on tectonic fault lines, but they cannot be directly blamed for their fate. Many cancers have an environmental cause (such as smoking or ingesting asbestos), but others are clearly the result of "chance" genetic changes. Is the world intrinsically unsafe? Can all of our problems be put down to an act of disobedience in a Middle Eastern Eden long ago? Such was the "traditional" interpretation, and it is still held by many Bible believers despite the evidence of massive earth movements long before humans appeared on Earth, of diseased dinosaurs, and of no detected discontinuity in the fossil record before and after humans appeared. As Hull and Williams have pointed out in their different ways (see previous page), this disjunction between older understanding and newer discoveries has led many to reject the authority of the Bible and often religious faith altogether.

One way forward is to jettison the Bible account in Genesis 3 as pure fantasy. A not uncommon judgment is that of Patricia Williams:

> both the literal and liberal interpretations of the narrative of Adam and Eve have collapsed. The reputed historicity [of Adam and Eve] conflicts with well-established scientific theories … Science says the claim liberal theology inherited from literalism, that we are alienated and exiled is false … [but] the concept of alienation is recent. It arrived with agricultural surpluses and class distinctions about ten thousand years ago … Jesus shows that we are not alienated from God, but live in God's presence.[5]

This is a gross travesty of Jesus's teaching, never mind his atoning death, and includes an illegitimate assumption that we learn from "well-established scientific theories" about God's involvement with his creation. This is a category mistake.

Probably the most frequent approach is to treat the Fall as "myth." Unfortunately, the word is popularly misunderstood as meaning simply "a story that is false." Because of this, it seems best to avoid the term altogether and accept Howard Marshall's judgment that myth is "a confusing and slippery term in theology; it is used in so many ill-defined ways by individual theologians, that it would be no bad thing if its use were prohibited."[6]

Do the stories in Genesis 2 and 3 have any grounding in history? If we are to be faithful to the findings of geologists and palaeontologists, we cannot claim that there were no "natural disasters" before the advent of humankind.[7] In particular, there must have been deaths of both individuals and groups before humanity appeared. Once there were dinosaurs; now there are no dinosaurs. Does it help to interpret the account as nonliteral (which does not mean untrue)? The common Hebrew word for man is "*ish*" but another word (*'adam*) is used instead in Genesis 1–5 (34 times). It is often assumed that *'adam* is used in Genesis 2 and 3 because of a word play with "*adamâ*," the ground. The man Adam was created from the *adamâ* and will return to the *adamâ*. On six occasions an individual ("Mr. Adam") is clearly meant (4:21, 25; 5:1, 3, 4, 5), but here *'adam* is not preceded by the definite article. In other words, when the text speaks of "Adam," it almost always means "humankind," implying the earthy one, *'adamâ*.

This imputation is fine and internally consistent for the Genesis account, but it fails to account for the main thrust of biblical theology. Can there be any link between an improving ape (an "*'adamâ*") and human sin? The Bible describes sin as rebellion or missing the mark. It is difficult to discern any meaning to this if we are apes on a (presumably upward) trajectory toward humanness. The Bible account of humanness is of repeated failure and apostasy, redeemed only by God's coming in Christ and reconciling humankind through the cross; the Christian gospel is that the relationship between Creator and creation can be restored, but this possibility necessarily presupposes that there was a relationship requiring repair. This seems very different from the evolutionary picture of "a great ape trying to make good."

"A great ape trying to make good" is essentially the secular understanding of the human story. This was set out by the Cambridge theologian F. R. Tennant in his Hulsean Lectures in 1902[8] and accepted by many of his successors. Tennant argued that the idea human beings could be held responsible by their Creator for an original sin committed at some point in the distant past was rendered impossible by knowledge about the evolution of living things in general and the origin of humankind in particular. He claimed that the Augustinian notion that some kind of inherited flaw or stain had been passed on by generation from our aboriginal ancestors was fatally undermined because it involved a Lamarckian theory of acquired inherited characteristics. For Tennant, this negated the idea that sin had somehow entered the human condition at a specific moment in history. The reality of sin was all too plain; notwithstanding, it was a mistake to think of it as having come about because of a fall from a state of original righteousness. Rather, it was part and parcel of the way our species had evolved from its animal ancestry.

The same theme was propounded even more strongly by N. P. Williams in his Bampton Lectures of 1924. He asserted that the only thing modern knowledge permits us to affirm about our first parents

> is not a Fall but a failure—a failure to "move upward, working out the beast," a failure to rid themselves of the anachronistic "ape and tiger" strain in their blood, a failure to emancipate themselves from the fatal flaw of deficiency in "herd-instinct" or gregarious feeling, the flaw of which their developing intellects had made them progressively conscious.[9]

Probably the most influential advocate of this approach was Ernest Barnes, Fellow of the Royal Society, Fellow of Trinity College Cambridge (where he taught the geneticist R. A. Fisher), and then Bishop of Birmingham from 1924 to 1953. In his Gifford Lectures, Barnes wrote,

> Within the last four centuries the old Jewish cosmology has vanished. Science has created an entirely different picture of the nature and duration of the Universe. The single act—or week—of "Creation" is replaced by a process of unimaginable extent … Man is the outcome of Nature's processes … I postulate that there is a certain community of nature between God and man, that all human minds are reproductions "in limited modes" of the Divine Mind, that in all true human thinking there is a reproduction of the Divine thought; and, above all, that in the highest ideals which the human conscience recognizes there is a revelation of the ideal eternally present in the Divine Mind.[10]

In a widely reported Westminster Abbey sermon, Barnes quoted from the Presidential Address of the anatomist Arthur Keith to the British Association for the Advancement of Science, declaring that

> the story of Adam and Eve is reduced to the status of folklore, and the horrible theory of the propagation of sin, reared on the basis of the Fall by Augustine, could be rejected … Biology showed that much that is evil in man's passions and appetites is due to natural instincts inherited from his animal ancestry. Man is not a being who has fallen from the ideal state of innocence: he is an animal slowly gaining spiritual understanding.[11]

In light of this sort of rhetoric, it is not surprising that conservative Christians reacted against any belief in human evolution, and, more damaging, came to view the whole science-faith debate as dangerous. No wonder the Adventist George McCready Price was wont to proclaim, "No Adam, no Fall; no Fall, no Atonement; no Atonement, no Savior."[12]

The problem with all this is that there is no evidence whatsoever of humankind "getting better." Peter Bowler has documented the fate of the widespread assumption from the late nineteenth century that accepting a reconciliation of evolution with faith automatically meant that we are part of a divinely planned evolutionary progression.[13] Bowler's analysis is as follows:

> Liberal thinkers were convinced that they could make common cause with a science that had turned its back on materialism. [But this] exposed cracks that had only been papered over in the earlier negotiations [i.e., in the immediate post-*Origin* years]. If Christians accepted that humanity was the product of evolution—even allowing the process could be seen as the expression of the Creator's will—then the whole idea of Original Sin would have to be reinterpreted. Far from falling from an original state of grace in the Garden of Eden, we had risen gradually from our animal origins. And if there was no Sin from which we needed salvation, what was the purpose of Christ's agony on the cross? Christ became merely the perfect man who showed us what we could all hope to become when evolution finished its upward course.[14]

But as Bowler points out, unfortunately for this interpretation,

> the economic depression of the 1930s and the rise of Fascism and Nazism in Europe drove home the message that there was something deeply flawed in the moral state of the West. Secularists turned to Marxism as a way of saving the idea of progress, but to many religious people it seemed the liberals' optimistic hopes of perfecting humanity were misguided … Neo-orthodoxy transformed the churches in the late 1930s and 1940s … Karl Barth called for a return to the traditional vision of humanity as proclaimed in the Gospels: Human nature is deeply troubled because we have become alienated from God, and only His grace can save us … [But] neo-orthodoxy didn't want an alternative view of creation or a return to the argument from design—it just wasn't interested in science.[15]

A Historic Adam?

The idea that a Mr. Adam ever existed is almost universally rejected outside very conservative circles. The inference that the species *Homo sapiens* is wholly derived from a single person or couple (or even a small number of individuals) is both genetically implausible and lacks any palaeoanthropological evidence.[16] However, this genetical argument is irrelevant if we take seriously the Bible description of humanness. Genesis 1:27 portrays humanness as a specific act of God, while Genesis 2:7 describes it as a divine in-breathing into an already existing entity.[17] In other words, a work of God is differentiated from "an ape on the way up" into an "imaged-beast"; this "imaged-beast" can be called *Homo divinus*, differing and distinct from the biological species *Homo sapiens* by the possession of God's image. There is no reason to assume that it would be anatomically or genetically changed. The terminology of *Homo divinus* was suggested by John Stott.[18] For some, this name is an unnecessary confusion, but for many it is a useful clarification.[19]

If the image is confined to humankind as Genesis 1:26, 27 seems to make clear, it must have been "introduced" at some time in history (I use "introduced" without intending any implication about mechanism; it was a transforming event rather than an addition).[20] The conventional assumption is that humanness appeared as an emergent character involving self-consciousness or self-knowledge.[21] The essential point is that it must have happened in time. Claims have been made that it was coincident with burying the dead or with including grave goods with the dead, or with the appearance of cave paintings, but these are no more than guesses.[22]

What is the "image"? Expositors of Genesis 1 commonly associate it with the practice of conquerors leaving a statue ("image") of themselves in conquered cities to remind the inhabitants of their authority.[23] For Middleton,

> the *imago Dei* designates the royal office or calling of human beings as God's representatives and agents in the world, granted authorized power to share in God's rule or administration of the earth's resources and creatures.[24]

This calling (or function) can also (and perhaps more usefully) be described as our transformation into body-soul unities—which is, of course, our creation as human beings in the fullest sense, as *Homo divinus* rather than *Homo sapiens*. For Chris Wright,

> The expression "in our image" is adverbial (that is, describes the way God made us), not adjectival (that is, as if it simply described a quality we possess). The image of God is not so much something we possess, as what we are. To be human is to be the image of God.[25]

"Image" should not be confused with the notion of "soul," which is an unhelpful assumption of dualism.[26] Claus Westermann expresses "image" as effecting kinship: "The relationship to God is not something which is added to human existence; humans are created in such a way that their very existence is intended to be their relationship to God."[27]

Dermot McDonald argues similarly. After an extensive review of the scriptures, he concluded that image should be taken as indicating "sonship":

> Man's chief end is to glorify God. Such was God's intention for the man he made. But man could only respond to the divine desire in so far as he reflected God's glory. And it was in him so to do because he was created in the image of God with the gift of sonship … All men are in the image of God by reason of an original creative sonship through Adam.[28]

Middleton sees our role as "representing and perhaps extending in some way God's rule on Earth through the ordinary communal practices of human sociocultural life,"[29] which is not very different from

C.F.D. Moule's conclusion, "the most satisfying of the many interpretations, both ancient and modern of the meaning of the image of God in man is that which sees it as basically responsibility."[30] John Walton summarizes the image as four-fold: the role and function that God has given humanity; the identity we have as human beings; our task to represent God in this world; and to indicate the relationship God intends for us.[31]

The personal nature of the image is emphasized by the language of Genesis 1:26, "let *us* make human beings," whereas all the other acts of creation are the results of an impersonal fiat, "let there be." It is implied also by the incident of Adam and Eve trying to hide from God (Gen. 3:8, 9). All this strengthens the idea that God's image in us is about relationship—to God, to other humans, and to the rest of creation. Such a functional understanding of God's image accords both with the Genesis texts and the need to incorporate Paul's teaching on Christ as the image of God (2 Cor. 4:4; Col. 1:15), not least our destiny to share Christ's image (Rom. 8:29).[32] It also implies that the result of the disobedience in the garden was a breaking or interruption of that relationship.[33] Terence Fretheim suggests that we should express the Fall as a falling "out" or "apart," the result of mistrusting God and wanting autonomy from him.[34]

An important inference from emphasizing that our humanness is a relationship bestowed by God and not an "addition" to an existing prehuman, is that its spread is also a divine act, and can be reasonably assumed to have spread to all individuals of the species alive at the time. In other words, neither our "image" nor, by implication, any sort of "original" sin depended on longitudinal transmission like a genetic trait, but solely depended on the sovereign will and action of God. John Walton calls this "radiate transmission," using the analogy that opening a door to a sealed source of radiation results in the entire area and population being irradiated.[35]

These considerations all support the idea that the Genesis "Fall" can best be seen as essentially a break in relationship between Creator and creature. This is more in accord with the understanding of the Eastern Church than the Western. For Augustine and the Western Church which has largely followed him, Adam and Eve were conceived as perfect before they "fell." In contrast, the Eastern tradition deriving from Theophilus of Antioch and Irenaeus was that God gave humanity divine grace to progress toward full union with the Creator. As the first humans developed self-awareness, they became aware of God's call and his demands on them. In other words, as *Homo sapiens* became *Homo divinus,* they were for the first time able to respond—to obey or disobey. James Barr suggests that the Genesis 3 story can best be read not as one of lost immortality, but of a lost *chance* for immortality.[36] It is possible to understand it as "the coming of age of an ape on the way up," but also as the very different idea of an emerging consciousness being challenged at some stage by God's implanted image. Only the second interpretation seems to accord with the subsequent history of humankind. Humanity's being is affected—deprived of life—because we are deprived of communion with God.[37] The Fall was not the cosmic explosion described in Milton's *Paradise Lost*, but anarchy produced by the disordered relationships between the sexes and with the nonhuman creation.[38]

Adam and Humanity

God's "imaging" of *Homo sapiens* and the subsequent disobedience of *Homo divinus* must have taken place after the emergence of *Homo sapiens* as a species, sometime in the last 200,000 years or so. There are no direct references to the "Fall" in the Old Testament after Genesis 3 (and the word "Fall" is not even used there), but human rebelliousness is described throughout scripture (and its effects throughout secular history). The only specific description of the events of Genesis 3 is in Romans 5:12–19 (also 1 Cor. 15:21), which compares "the one man through whom sin came into the world" with the saving grace of the "one man, Jesus Christ."

Is it legitimate to understand the "one man" of Romans 5 as indicating a group which disobeyed in the early stages of humanness? Presumably Paul thought of Adam as a man who lived in history just as he probably regarded the earth as flat and bounded above by a firm roof. It could be argued that because of this he had no reason or comprehension not to compare one individual ("the first man," Adam) with another individual, Jesus Christ. But such an imputation of Paul's limitations may be wrong. In his commentary on Romans, Leon Morris writes:

> the one man [Adam] is very important and underlies the whole discussion. Twelve times in verses 12–19 we have the word *one*; repeatedly Paul refers to the

> one man Adam (and to one sin of that one man) and opposes to him (and it) the one man Jesus Christ (and his one word of grace). The one man and his sin and the one Savior and his salvation are critical to the discussion. [Notwithstanding, he warns that] Paul's argument in Romans 5 is very condensed and in all translations and comments we must allow for the possibility that Paul's meaning may at some point be other than we think.[39]

Stott enters no such caveat. He writes:

> Scripture clearly intends us to accept their [Adam and Eve's] historicity as the original human pair: the biblical genealogies trace the human race back to Adam, Jesus himself taught that "at the beginning the Creator made them male and female" and then instituted marriage, Paul told the Athenian philosophers that God had made every nation from "one man," and in particular, Paul's carefully constructed analogy between Adam and Christ depends for its validity on the equal historicity of both.[40]

John Collins also opts for their historicity. He reviews recent interpretations, although depending strongly on N.T. Wright, who seems less dogmatic.[41] John Walton argues that Adam and Eve can be regarded as archetypes for humanity, and that Romans 5:12–14 "affirms the reality of sin and death entering human experience in an event and therefore implies a historical Adam."[42]

Other conservative commentators take a more nuanced view. James Dunn writes:

> Paul's theological point [in Romans 5 does not] depend on Adam being a "historical" individual or on his disobedience being a historical event as such … The effect of the comparison between Adam and Christ is not so much to historicize the original Adam as to bring out the individual significance of the historic Christ.[43]

F.F. Bruce takes a step further back. He comments on Romans 5:12 ["It was through one man that sin entered the world and through sin death, and thus death pervaded the whole human race"]:

> It is not simply because Adam is the ancestor of humankind that all are said to have sinned in his sin (otherwise it must be argued that because Abraham believed God all his descendants were automatically involved in this belief); it is because Adam *is* humankind.[44]

Peter Enns is unequivocal. He has written,

> One can believe that Paul is correct theologically and historically about the problem of sin and death, and the solution that God provides in Christ without also needing to believe that his assumptions about human origins are accurate. The need for a savior does not require a historical Adam.[45]

The best we can conclude is that there is no consensus among commentators, even those who firmly hold to the inspiration and authority of scripture.[46]

How does the current condition of humankind relate to the Genesis story? Derek Kidner in his commentary on Genesis is clear:

> the unity of mankind "in Adam" and our common status as sinners through his offence, are expressed in scripture not in terms of heredity (Isa. 43:27) but simply in terms of solidarity. We nowhere find applied to us any argument from physical descent, such as that of Heb. 7:9, 10 (where Levi shares in Abraham's act through being "still in the loins of his ancestor"). Rather, Adam's sin is shown to have implicated all men because he was the federal head of humanity, somewhat as in Christ's death "one died for all, therefore all died" (2 Cor. 5:14) … After the special creation of the first human pair clinched the fact that there is no natural bridge from animal to man, God may have now conferred his image on Adam's collaterals to bring them into the same realm of being. Adam's "federal" headship of humanity extended, if that was the case, outwards to his contemporaries as well as onwards to his offspring, and his disobedience disinherited both alike.[47]

Adam (and Eve) disobeyed God, resulting in their original and intended relationship being fractured (they "died"),[48] and this affected all other members of the species by divine fiat.

Kidner's interpretation is not universally accepted. Henri Blocher discusses the issue at length and concludes that "the decisive consideration when we search for the rightness of the "fact" [of being born sinners] remains the headship or capitate structure—the organic solidarity of the race, the spiritual dimension of humanity's oneness."[49] He accepts that his view might differ from the "current headship solution," although he clearly does not reject the concept.

Paul on Genesis 3

Is a historical Adam anything more than a possible interpretation—a way out for conservatives? Romans 5:12–19 certainly implies the existence of a "Mr. Adam." But this implication is strengthened when we take it in the fuller context of Paul's argument in Romans 5–8, which summarizes the whole history of God's dealing with his creation and of his patient and gracious ordering despite humankind's repeated disordering.

Genesis 1–3 is a vignette of a disorder-reorder cycle in which the intended integration of humans with the whole creation gives way to dislocation and fracturing of that integration. The cycle is repeated with the Noah story and then by the Babel episode. The history of Israel then continues with a seemingly endless procession of rebellion and failure, followed by God's saving deliverance. The climax comes, of course, with God coming in the person of Jesus Christ and is completed in his redeeming death and clinching resurrection. All this is recapitulated in Romans, beginning with a rehearsal of human disobedience (1:18–32), followed by recalling the covenant and God's promises, and culminating in chapters 5–8. Chapter 6 tells of God's people passing through the waters (baptism, in parallel with crossing the Red Sea, *q.v.* 1 Cor. 10:2) and being freed from slavery (as they had been from Egypt). The final consequence is described in Romans 8:19–28, which clearly refers to the origin and pervasiveness of disorder.

The effects of Adam's disobedience are said to be that the created universe was "made subject to frustration" (Rom. 8:20) and is "groaning as if in the pangs of childbirth" (v. 22). It is undeniably a difficult passage and most expositors do not help much,[50] but it is a key one—perhaps *the* key one—in the present context. James Dunn points out that, at one level, it "recalls the extent to which believers continue to be thoroughly bound up with creation, and that precisely as part of and not despite the process of salvation."[51] Dunn comments,

> The point Paul is presumably making, through somewhat obscure language, is that God followed the logic of his proposed subjecting of creation to man by subjecting it still further in consequence of man's fall, so that it might serve as an appropriate context for fallen man.[52]

Kidner supports Dunn's interpretation when he contrasts the pre-Fall situation with our present existence:

> Leaderless, the choir of creation can only grind on in discord. It seems from Romans 8:19–23 and from what is known of the prehuman world that there was a state of travail from the first which man was empowered to "subdue" until he relapsed into disorder himself.[53]

Charles Cranfield has used the same analogy with a powerful and often repeated *reductio ad absurdum* argument:

> What sense can there be in saying that the "subhuman creation—the Jungfrau, for example, or the Matterhorn, or the planet Venus—suffers frustration by being prevented from properly fulfilling the purpose of its existence?" The answer must surely be that the whole magnificent theatre of the universe, together with all its splendid properties and all its life, created for God's glory, is cheated of its true fulfilment so long as man, the chief actor in the great drama of God's praise, fails to contribute his rational part. The Jungfrau and the Matterhorn and the planet Venus and all living things too, man alone excepted, do indeed glorify God in their own ways; but since their praise is destined to be not a collection of individual offerings but part of a magnificent whole, the united praise of the whole creation, they are prevented from being fully that which they were created to be, so long as man's part is missing, just as all the other players in a concerto would be frustrated of their purpose if the soloist were to fail to play his part.[54]

Henri Blocher makes essentially the same point:

> If man obeys God, he would be the means of blessing the earth, but in his insatiable greed … and in his short-sighted selfishness, he pollutes the earth and destroys it. He turns a garden into a desert (cf. Rev. 11:18). That is the main thrust of the curse of Genesis 3.[55]

Richard Bauckham points out that the word translated "groan" (Rom. 8:22, 23) may mean "mourn," linking it with the language used by the prophets about the repeated rebellions of God's people, rather than a single disobedience in Eden. He argues that the phrase "the creation was subject to futility (or frustration)" (Rom. 8:20) probably refers to the ecological degradation described by the prophets, when they spoke of the earth mourning, the soil losing its

fertility, plants withering, animals dying (Isa. 22:4, 33:9; Jer. 4:28, 14:4, 23:10; Hosea 4:3; Amos 1:2; Joel 1:10–12, 17–20). Furthermore, it helps to recognize the way that "frequently in the Bible, language of divine judgment describes the way acts have consequences in this world. Disruptions of the created order of things cause further disruption that rebounds on the perpetrators."[56] While Bauckham is correct to insist that Romans 8:18–23 refers to more than Genesis 3, his arguments also strengthen the importance of the events portrayed in Genesis 3.

The "Fall" is not primarily about disease and disaster, nor about the dawn of self-awareness. Rather, it is a way of describing the fracture in relationship between God and the human creature made in his image.[57] The rupture means that we rattle around in our space, as it were, producing disorder within ourselves, with our neighbors, and with our environment (human and nonhuman). This will continue until our relationship with God is restored and we become "at peace with God through our Lord Jesus who has given us access to the grace in which we now live; and we exult in the divine glory which is to be ours" (Rom. 5:1, 2)—words which condition and explain the state of nature which Paul uses later in the same passage (Rom. 8:19–21).

The Romans 8 passage makes it clear that our calling is not simply to ourselves and our current neighbors, or even to our children and grandchildren, but to the whole future of creation. In Francis Bridger's words,

> We are called to be stewards of the earth by virtue not simply of our orientation to the Edenic command of the Creator but also because of our orientation to the future. In acting to preserve and enhance the created order, we are pointing to the coming rule of God in Christ … The knowledge that it is God's world, that our efforts are not directed toward the creation of an ideal utopia but that we are, under God, building bridgeheads of the kingdom serves to humble us and to bring us to the place of ethical obedience.[58]

In contrast, Martyn Lloyd-Jones seemed to regard the passage as wholly apocalyptic.[59]

Tom Wright makes essentially the same point:

> Paul is talking [in Rom. 8:18–21] about the glory which he says is to be revealed "to us" (v. 18). What he means by that is instantly explained and unpacked in the next few verses. The whole creation, the entire cosmos, is on tiptoe with expectation for God's glory to be revealed to his children. "Glory" is not simply a kind of luminescence, as though the point of wisdom were that we would eventually shine like electric lightbulbs. "Glory" means, among other things, rule and power and authority. As other writers (notably Saint John the Divine) make clear, part of the point of God's saving of his people is that they are destined not merely for a relaxing endless holiday in a place called "heaven," but that they are destined to be God's stewards, ruling over the whole creation with healing and restorative justice and love.[60]

In the Noachian covenant (Gen. 9:8–17), God explicitly includes "all creatures" alongside Noah and his family. Indeed, there is a strong case that God first covenanted with creation itself when he established order in it, long before humans appeared on the scene (Jer. 33:25: "These are the words of the Lord: If there were no covenant for days and night, and if I had not established a fixed order in heaven and earth, then I could spurn the descendants of Jacob and of my servant David"). He renewed his covenant repeatedly throughout history—with Abraham, Jacob, Moses, David, culminating with Jesus the Christ. The God of Creation and the God of Redemption are one and the same (Rev. 4:6–11). As David Fergusson puts it,

> Creation can only be understood from the perspective of redemption. There is too much wastage, pain and untimely death to make this view possible apart from a particular conviction about the meaning of Christ's death and resurrection.[61]

For Oliver O'Donovan,

> The redemption of the world, and of mankind, does not serve only to put us back in the Garden of Eden where we began. It leads us on to that further destiny to which, even in the Garden of Eden, we were already directed.[62]

Richard Bauckham insists,

> Salvation is not the replacement but the renewal of creation. God's purpose in history and in the eschatological future does not abstract humans from nature, but heals the human relationship with nature.[63]

Robert Murray concludes his examination of the "cosmic covenant" by asking, "Have theologians betrayed the Bible's message?" He is clear that

> the Bible teaches us that neither sin nor salvation are affairs merely between us as individuals and

> God; sin entails alienation from our nature which relates us to God's other creatures, while salvation entails our re-integration in a vaster order of harmony which embraces the whole cosmos, as we may interpret Paul's tersely expressed vision in Romans 8.[64]

Tom Wright describes Romans 8:18–28 as

> one of the most central statements in the New Testament about what God intends to do with the whole cosmos. [T]he matter is set out quite clearly … Paul's whole argument is that the renewal of God's covenant results in the renewal of God's creation.[65]

Conclusion

Where does all this get us in trying to understand natural disasters? Some of these can certainly be attributed to human actions. Former British Government Chief Scientific Adviser John Beddington has warned of the "perfect storm" approaching from climate change and our growing requirements for energy, food, and clean water as the world population climbs toward nine billion—all factors dependent on or caused by human action.[66] Geologist Bill McGuire has spelled out how a changing climate can trigger earthquakes, tsunamis, and volcanic action.[67] Pests and parasites may afflict us, but they are not themselves the result of our sin. We have Jesus's own authority that those who died when the tower in Siloam fell were not greater sinners than others (Luke 13:3–5).

We have to face the reality that suffering is a central thread in scripture—perhaps particularly in the New Testament where we read of the sufferings of Christ and of those who follow him (2 Cor. 1:5; Phil. 1:29, 3:10; Heb. 2:10, 5:8). There is no magic way or hidden knowledge to escape the way the world is, but there is a sure support and promise for the way we are called to live.

Peter Enns regards

> the general scenario that Paul is laying out [in Rom. 8:18–27] is one of perseverance of hope, by the Spirit, in a state of suffering, a suffering that causes groaning—so much so that the Spirit himself joins along … These sufferings seem to be connected in some way to the believer's "obligation" to resist the "sinful nature" and the cosmic grains of "frustration" and "bondage to decay" to which it has been subjected (vv. 20–21). In other words, the sufferings Paul refers to likely have some connections to the "decay" of creation, one of its manifestations being the daily struggle to resist being controlled by the sinful (i.e., preconversion) nature.[68]

When Paul looked back at Genesis 3, he recognized suffering (Rom. 8:22–23) but also a present hope: God's kingdom *has* come; it is not a distant possibility. Our challenge is to get right the relationship between present and ultimate hope. Tom Wright comments that Paul's assurance of the future in Romans 8:19–21 is based on two things,

> the biblical promise of new heavens and new earth (Isa. 65:17, 66:22) and the creation story in which human beings, made in God's image, are appointed as God's stewards over creation. Putting the picture together, in the light of the way the created order is out of joint, and the clear biblical and experiential belief that the human race as a whole is in rebellion against God, Paul saw … the answer, if the creator is to be true to the original purpose, is for humans to be redeemed, to take their place at last as God's image-bearers, the wise steward they were always meant to be. Paul sees that this purpose has already been accomplished in principle in the resurrection of Jesus, and that it will be accomplished fully when all those in Christ are raised and together set in saving authority over the world (see 1 Cor. 15:20–28).[69]

This is where our pains and uncertainties come together with God's work in creation and redemption.

To recapitulate:

1. Science excludes a single progenitor (or pair) for humankind, beyond reasonable doubt.
2. We are distinct from the apes/early hominins through being "in God's image." The essence of this is that we [should] have a relationship with God.
3. This relationship implies that we are accountable to God; otherwise it is meaningless.
4. Our "imaging" must have occurred in time; it could be described as "pre-Adam" becoming "Adam." Stott's suggestion of *Homo sapiens* becoming *Homo divinus* is conceptually helpful.
5. God's intended (or "primal") plan of relationships fractured through our free choice. Consequently, we are at the mercy of outside

forces in our relationships to God, to each other, and to the rest of God's creation—which is urgently waiting for us to take our rightful place in God's plan.

6. These relationships are repairable only through Christ's atoning work. That is completely uncontentious. ✞

Notes

[1]Some of the material in this article has appeared in R.J. Berry, "This Cursed Earth: Is 'The Fall,' Credible?," *Science & Christian Belief* 11, no. 1 (1999): 29–49; ___, "Eden & Ecology: Evolution & Eschatology," *Science & Christian Belief* 19, no. 1 (2007): 15–35; ___, "Adam or Adamah?," *Science & Christian Belief* 23, no. 1 (2011): 23–48. Bible quotations are from the Revised English Bible.

[2]David L. Hull, "The God of the Galápagos," review of Phillip Johnson's *Darwin on Trial* (Washington, DC: Regnery Gateway, 1991), *Nature* 352 (1991): 485–86.

[3]N.P. Williams, *The Ideas of the Fall and of Original Sin* (London: Longmans, Green and Co., 1927), 3.

[4]R.J. Berry, "What to Believe about Miracles," *Nature* 322 (1986): 321–22; D. Wilkinson, *When I Pray, What Does God Do?* (Oxford: Monarch, 2015).

[5]Patricia Williams, *Doing without Adam and Eve: Sociobiology and Original Sin* (Minneapolis, MN: Fortress Press, 2001), 199–200.

[6]H. Marshall, "Myth," in *New Dictionary of Theology*, ed. S.B. Ferguson, D.F. Wright, and J.I. Packer (Leicester, UK: Inter-Varsity Press, 1988), 449. Marshall suggests four different and more rigorous ways of treating the Genesis 3 account: (1) an explanation of how sin and disobedience came into the world; (2) an expression of the present fallen state of humankind—"our" plight in the form of a story; (3) a poetic description of the human predicament, with symbolism capable of further re-interpretation; or (4) a story whose actors include God and a serpent who miraculously speaks.

[7]D.A. Young, *Christianity and the Age of the Earth* (Grand Rapids, MI: Zondervan, 1982); D.R. Montgomery, *The Rocks Don't Lie* (New York: W.W. Norton, 2012); M.J.S. Rudwick, *Earth's Deep History* (Chicago, IL: University of Chicago Press, 2014).

[8]F.R. Tennant, *The Origin and Propagation of Sin* (Cambridge, UK: Cambridge University Press, 1902), 35–37; J.W. Chappell, "Rethinking the Historical Fall in the Light of Evolution," *Science & Christian Belief* 25 (2013): 131–54.

[9]N.P. Williams, *The Ideas of the Fall and of Original Sin,* 517.

[10]E.W. Barnes, *Scientific Theory and Religion* (Cambridge, UK: Cambridge University Press, 1933), 2–3.

[11]E.W. Barnes, *Should Such a Faith Offend?* (London: Hodder & Stoughton, 1927), 311.

[12]See, for example, George McCready Price, *Predicament of Evolution* (Nashville, TN: Southern Publishing Association, 1925), chapter 13. Intriguingly, Price drew his quote from British atheist Robert Blatchford, in *God and My Neighbour* (London: Clarion Press, 1903),

> Accepting evolution, how can we believe in a Fall? When did man fall? Was it before he ceased to be a monkey, or after? Was it when he was a tree man, or later? Was it in the Stone Age, or the Bronze Age, or the Age of Iron? And if there never was a fall, why should there be any atonement? (p. 159)

[13]P.J. Bowler, *Reconciling Science and Religion: The Debate in Early Twentieth Century Britain* (Chicago, IL: University of Chicago Press, 2001); ___, *Monkey Trials and Gorilla Sermons* (Cambridge, MA: Harvard University Press, 2007).

[14]Bowler, *Monkey Trials and Gorilla Sermons*, 187.

[15]Ibid.

[16]D.R. Alexander, *The Language of Genetics: An Introduction* (West Conshohocken, PA: Templeton Press, 2011); C. Stringer, *The Origin of Our Species* (London: Allen Lane, 2011); F.J. Ayala, "Human Evolution: Whence and Whither?," in *Evolutionary Biology: Conceptual, Ethical, and Religious Issues*, ed. R. P. Thompson and D. M. Walsh (Cambridge, UK: Cambridge University Press, 2014), 13–28.

[17]Genesis 2:7 emphasizes the uniqueness of the human creation; it says nothing about the image. Notwithstanding, "this verse matches and completes the classic 1:27" (D. Kidner, *Genesis,* Tyndale Old Testament Commentary [London: Tyndale Press, 1967], 60).

[18]J.R.W. Stott, *Understanding the Bible* (London: Scripture Union, 1972), 63.

[19]For example, G. Finlay, "*Homo divinus*: The Ape That Bears God's Image," *Science & Christian Belief* 15 (2003): 17–40; G. Finlay, "Human Genomics and the Image of God," Faraday Paper no. 14 (Cambridge, UK: Faraday Institute, 2009); D. Venema, "Genesis and the Genome: Genomics Evidence for Human-Ape Common Ancestry and Ancestral Hominid Population Sizes," *Perspectives on Science and Christian Faith* 62, no. 3 (2010): 166–78.

[20]Allan Day, in "Adam, Anthropology and the Genesis Record," *Science & Christian Belief* 10 (1998): 115–43, complains that imputing a specific act of God implies "semi-deism."

[21]For example, C.S. Lewis, in *The Problem of Pain* (London: Geoffrey Bles, 1940), wrote,

> For long centuries, God perfected the animal which was to become the vehicle of humanity and the image of Himself … Then in the fullness of time, God caused to descend on this organism, both on its psychology and physiology, a new kind of consciousness which could say "I" and "me," which could look upon itself as an object, which knew God, which could make judgements of truth, beauty and goodness. (p. 68)

[22]J.W. van Huyssteen, *Alone in the World?* (Grand Rapids, MI: Eerdmans, 2006).

[23]G. von Rad, *Genesis*, rev. ed. (Philadelphia, PA: Westminster, 1972), 60: "Just as powerful kings, to indicate their claim to domination, erect images of themselves in the provinces of their empire where they do not personally appear, so man, is placed upon earth in God's image as God's sovereign emblem"; see also, E.C. Lucas, *Can We Believe Genesis Today? The Bible and the Questions of Science* (Leicester, UK: Inter-Varsity Press, 2001), 175. Richard Middleton, in *The Liberating Image: The* Imago Dei *in Genesis 1* (Grand Rapids, MI: Brazos, 2005), suggests that the statues were more usually those of a god rather than the king himself, but this does not change their emblematic status (p. 26).

[24]Middleton, *The Liberating Image*, 27

[25]C.J.H. Wright, *Old Testament Ethics for the People of God* (Leicester, UK: Inter-Varsity Press, 2004), 119.

[26]There is a growing literature on the proper understanding of the soul. See W.S. Brown, N. Murphy, and H.N. Malony, eds., *Whatever Happened to the Soul? Scientific and*

Theological Portraits of Human Nature (Minneapolis, MN: Fortress, 1998); M. A. Jeeves, *From Cells to Souls – and Beyond* (Grand Rapids, MI: Eerdmans, 2004); J. B. Green and S. L. Palmer, eds., *In Search of the Soul: Four Views of the Mind-Body Problem* (Downers Grove, IL: InterVarsity Press, 2005); M. A. Jeeves, ed., *The Emergence of Personhood: A Quantum Leap?* (Grand Rapids, MI: Eerdmans, 2015).

[27]C. Westermann, *Genesis 1–11: A Continental Commentary*, trans. J. J. Scullion (London: SPCK, 1984), 158.

[28]H. D. McDonald, *The Christian View of Man* (London: Marshall, Morgan & Scott, 1981), 40.

[29]Middleton, *The Liberating Image*, 60.

[30]C. F. D. Moule, *Man and Nature in the New Testament: Some Reflections on Biblical Ecology* (London: Athlone, 1964), 5. For the working out of this responsibility, see R. J. Berry, ed., *When Enough Is Enough: A Christian Framework for Environmental Sustainability* (Nottingham, UK: Apollos, 2007).

[31]J. H. Walton, *The Lost World of Adam and Eve: Genesis 2–3 and the Human Origins Debate* (Downers Grove, IL: InterVarsity Press, 2015), 42.

[32]C. E. Gunton, *Christ and Creation: The Didsbury Lectures, 1990* (Carlisle, UK: Paternoster, 1992), 99–100; R. S. Briggs, "Humans in the Image of God," *Journal of Theological Interpretation* 4 (2010): 111–26.

[33]The image was not obliterated by the "Fall" (Gen. 9:6). In *Genesis 1–11*, Westermann comments, "It is not a question of a quality in people but of the fact that human beings can have a history with God. The image and likeness of God are only there in the relationship between God and the individual" (p. 468).

[34]T. E. Fretheim, *God and the World in the Old Testament: A Relational Theology of Creation* (Nashville, TN: Abingdon, 2005), 468.

[35]J. H. Walton, "A Historical Adam: Archetypal Creation View," in *Four Views on the Historical Adam*, ed. S. N. Gundry, M. Barrett, and A. B. Caneday (Grand Rapids, MI: Zondervan, 2013), 106.

[36]J. Barr, *The Garden of Eden and the Hope of Immortality* (Minneapolis, MN: Fortress, 1992).

[37]T. A. Noble, "Original Sin and the Fall," in *Darwin, Creation and the Fall: Theological Challenges*, ed. R. J. Berry and T. A. Noble (Nottingham, UK: Apollos, 2009), 99–129.

[38]J. J. Bimson, "Reconsidering a Cosmic Fall," *Science & Christian Belief* 18, no. 1 (2006): 63–81.

[39]L. Morris, *The Epistle to the Romans* (Leicester, UK: InterVarsity Press, 1988), 228.

[40]J. R. W. Stott, *The Message of Romans: God's Good News for the World* (Leicester, UK: Inter-Varsity Press, 1994), 163.

[41]C. J. Collins, *Did Adam and Eve Really Exist? Who They Were and Why You Should Care* (Wheaton, IL: Good News Publishers, 2011), 87 ff. N. T. Wright has written "Do We Need a Historical Adam?" in *Surprised by Scripture: Engaging Comtemporary Issues* (New York: HarperOne, 2014), 26–40. Wright is somewhat equivocal on historicity. He writes,

> Just as God chose Israel from the rest of humankind for a special, strange, demanding vocation, so perhaps what Genesis is telling us is that God chose one pair from the rest of early hominids for a special, strange, demanding vocation. This pair (call them Adam and Eve if you like) were to be the representatives of the whole human race … The point of it all is vocational: if we can study Genesis and human origins without hearing the call to be an image-bearing human being renewed in Jesus, we are massively missing the point. (pp. 37–39)

[42]Walton, "A Historical Adam: Archetypal Creation View," 106; Walton, *The Lost World of Adam and Eve,* 100–101.

[43]J. D. G. Dunn, *Word Bible Commentary* 38A: *Romans 1–8* (Dallas, TX: Word, 1988), 272, 290.

[44]F. F. Bruce, *Tyndale New Testament Commentaries,* vol. 6, *Romans* (Leicester, UK: Inter-Varsity Press, 1963), 130.

[45]P. Enns, *The Evolution of Adam: What the Bible Does and Doesn't Say about Human Origins* (Grand Rapids, MI: Brazos, 2012), 143.

[46]Gundry, Barrett, and Caneday, eds. *Four Views on the Historical Adam*.

[47]Kidner, *Genesis*, 30, 29.

[48]Adam and Eve were told that they would "die" if they ate the fruit of a particular tree (Gen. 2:17); the New Testament describes those not "in Christ" as dead (e.g., Eph. 2:1; Col. 2:13; 1 John 3:14). It is wrong to equate the death so described as physical death. Mark Worthing ("The Christian Doctrine of the Fall in the Light of Modern Science," in *Festschrift für Hans Schwarz*, ed. D. Ratke [Frankfurt: Peter Lang, 1999]) writes,

> The point of the Fall is that spiritual death became a part of our human reality as a result of human disobedience to God. While, theologically speaking, there are undeniable links between spiritual and physical death, there is no reason to insist that the death that entered the world through human sin must also have been physical death as such. The problem here is not with the Fall itself but with an overly idealised view of the original state. With regard to the problem of competition, pain, difficulties associated with growth and development, there need be no insurmountable conflict between contemporary evolutionary theory and the Christian doctrine of the Fall.

[49]H. Blocher, *Original Sin: Illuminating the Riddle* (Leicester, UK: Apollos, 1997), 129.

[50]N. T. Wright, in *New Heaven, New Earth* (Cambridge, UK: Grove Booklet B11, 1999), notes that the Romans passage is

> regularly marginalized in mainstream Protestant interpretations of Romans. If you insist on reading Romans as a book about how human beings "get saved," in the sense of "going to heaven when they die" you will find that these verses function as a kind of odd, apocalyptic appendix. That in consequence is how the tradition has often regarded them, both in the "radical" scholarship of Lutherans like Bultmann and Käsemann and in the "conservative" readings of much evangelical scholarship. (p. 12)

[51]J. D. G. Dunn, "Spirit Speech: Reflections on Romans 8:12–27," in *Romans and the People of God*, ed. S. K. Soderlund and N. T. Wright (Grand Rapids, MI: Eerdmans, 1999), 88.

[52]Dunn, *Word Bible Commentary* 38A: *Romans 1–8,* 487.

[53]Kidner, *Genesis,* 73.

[54]Some observations on Romans 8:19–21, in *Reconciliation and Hope: New Testament Essays on Atonement and Eschatology Presented to L. L. Morris on His 60th Birthday*, ed. R. Banks (Grand Rapids, MI: Eerdmans, 1974), 227.

[55]H. Blocher, *In the Beginning: The Opening Chapters of Genesis* (Leicester, UK: Inter-Varsity Press, 1984), 184.

[56]R. Bauckham, *The Bible and Ecology: Rediscovering the Community of Creation* (London: Darton, Longman & Todd, 2010), 92–100.

[57]Bimson, "Reconsidering a Cosmic Fall."

[58]F. Bridger, "Ecology and Eschatology: A Neglected Dimension," *Tyndale Bulletin* 41 (1990): 290–301.

[59]D. M. Lloyd-Jones, *Romans. Exposition of Chapter 8:17–39: The Final Perseverance of the Saints* (Edinburgh: Banner of Truth, 1975).
[60]N. T. Wright, "Jesus Is Coming—Plant a Tree!," in *The Green Bible* (London: Collins, 2008), I-74–I-89.
[61]D. Fergusson, *The Cosmos and the Creator* (London: SPCK, 1998), 87.
[62]O. M. T. O'Donovan, *Resurrection and Moral Order: An Outline for Evangelical Ethics* (Leicester, UK: Inter-Varsity Press, 1986), 55.
[63]Bauckham, *The Bible and Ecology*, 150.
[64]R. Murray, *The Cosmic Covenant: Biblical Theories of Justice, Peace and the Integrity of Creation* (London: Sheed & Ward, 1992), 165.
[65]N. T. Wright, *Romans and the People of God*, 12.
[66]J. Beddington, "Perfect Storm," a speech given at a UK government conference, Sustainable Development UK 09, March 19, 2009, in Westminster [London], http://www.gren.org.uk/resources/Beddington'sSpeechatSDUK09.pdf.
[67]B. McGuire, *Waking the Giant: How a Changing Climate Triggers Earthquakes, Tsunamis, and Volcanoes* (Oxford: Oxford University Press, 2012).
[68]P. Enns, *Ecclesiastes* (Grand Rapids, MI: Eerdmans, 2011), 190.
[69]N. T. Wright, "The Letter to the Romans," in R. W. Wall, J. P. Sampley, and N. T. Wright, *The New Interpreter's Bible*, vol. 10: *Acts, Romans, 1 Corinthians* (Nashville, TN: Abingdon Press, 2002), 596.

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Ethical Aspects of Development and Application of New Technologies in the Context of Globalization

University of Žilina, Slovak Republic

September 8–9, 2016

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Bethany Sollereder

Evolution, Suffering, and the Creative Love of God

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In 1859 Charles Darwin uncovered, in The Origin of Species, *a world that evolves on the basis of natural selection. The natural world is competitive, violent, and careless of the amount of suffering it produces. Yet, Christian theologians identify God as the creator of the evolutionary process. This raises serious theological questions, including "Why would a good God ordain a process that necessarily involves pain, suffering, and death for so many creatures?" This article will explore the theological implications of evolutionary suffering, and begin to ground a theology of evolutionary creation in the love and work of God.*

In 1859, Charles Darwin proposed, in *The Origin of Species,* a radical new idea for how life developed into its various forms. Instead of a comfortable, well-designed world in which everything was specially designed, Darwin proposed a world full of conflict in a cut-throat race for survival. The happy theological systems developed by theologians such as William Paley in his 1802 *Natural Theology*, in which every creature was specifically designed for a harmonious place in nature, were shattered. Theologians were left trying to find a solution to the question of how the good God of love could create through such a violent, competitive, and often ruthless process as evolution.[1] Today, we are still wondering, still working out the implication of Darwin's theory for theology and how we understand the nature and the love of God in light of a creation "red in tooth and claw."

The question of nonhuman animal suffering has, in the last decade, become a topic of increasing interest. The publication in 2008 of the first two book-length treatments of the problem, Michael Murray's philosophical *Nature Red in Tooth and Claw* and Christopher Southgate's theological *The Groaning of Creation,* opened space and set a foundation for a growing discussion.[2] The expanding literature has recently been joined by Nicola Hoggard Creegan's *Animal Suffering and the Problem of Evil*, Trent Dougherty's *The Problem of Animal Pain*, and Ronald Osborn's *Death before the Fall*.[3]

This article will be structured around three questions: What (really) is the problem? Who is to blame? and What is God going to do about it?

What (Really) Is the Problem?

The first distinction to make before we can start in earnest is to distinguish between moral and natural evil. Moral evil—the actions and consequences of sinful action in the world—raises different theological questions and is beyond the scope of this article. Therefore, although the current ecological crisis and modern farming practices cause untold suffering to creatures around the world, I will not investigate them here. To narrow the scope still further, I will not deal

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with human suffering at all, even when that suffering is caused by natural disasters or other natural evils. Humans have unique abilities to respond to suffering in ways unavailable to the nonhuman world, ways that allow for different sorts of justification for human sufferings. We might, for example, say that suffering opens an opportunity for us to draw close to God, or to be transformed by suffering into more-Christ-like forms.[4] Suffering in the nonhuman or prehuman animal world raises unique questions because these justifications are not available, nor can we depend on the free will defense that suffering is due to human evil (a point I will explore later in greater detail).

So, let us begin with the most important question, as Austin Farrer asks: "Poor limping world, why does not your kind Creator pull the thorn out of your paw?"[5] Could God have created a world without the harmful elements of natural disasters, predation, suffering, and death? The answer, if we believe in an omnipotent God, must be "yes." Yet we must also ask, "at what cost?" If we remove these elements of creation, what else is lost?

First, if we conceived of God intervening and preventing all harm that might occur, the logic of a physical universe would soon disintegrate, since nothing could be depended upon to happen. If I jumped from a high tree and a great feather pillow appeared to catch me, or if, when I tripped over a stone, it turned into a marshmallow so that I would not stub my toe, the universe would stop being a place where I could make causally effective decisions, because I would rely upon these interventions continually. Nor could I understand the outcome of my actions.[6]

Quite apart from the necessity for physical regularity (also known as "nomic regularity"), many of the aspects of life that we find so deeply disturbing actually provide necessary functions without which life would be impossible. They are "package deals."[7] Let us take two examples: earthquakes and pain.

Geology: Plate Tectonics and the Renewal of the Earth

Most people are familiar with the basics of plate tectonic theory: the continents and the oceans are all founded upon great plates that make up the earth's crust. When two plates run into each other, one is pushed under, over, or alongside the other causing earthquakes and volcanic activity.[8] We are also familiar with the devastating side effects of these processes, such as the tsunamis they often instigate. Whether it was the 2004 Indian Ocean tsunami, or the Japanese earthquake that caused the Fukushima disaster, we know how destructive plate movement can be.[9] The toll on human and nonhuman life can be extremely high. However, the more information that scientific investigation uncovers, the more we find that these destructive processes are absolutely necessary to life. We can see this in at least three ways.

First, the active recycling of carbon dioxide into the atmosphere through plate subduction leads to a stable temperature and the primary necessity for life: liquid surface water. It is thought that the "one-plate" nature of Mars is one of the main reasons that, although there is evidence of liquid water in the early Martian history, water has not remained; thus life has not had a chance to develop there.[10]

Second, the release and recycling of greenhouse gases such as carbon dioxide into the atmosphere is only helpful if the gases are then trapped near the planet's surface, allowing the surface to retain heat. Earth's magnetic field wards off "a potentially lethal influx of cosmic radiation and solar wind 'sputtering'"[11] that would slowly disintegrate the atmosphere, as it has done on Mars, once again not allowing for the possibility of liquid water. Those same cosmic rays and radiation would also soon extinguish life, if they were to reach the earth's surface.[12] Thus, we are provided an important protective shield by the same processes that drive plate movement.

Finally, the processes of plate tectonics help maintain a stable surface temperature by using up heat produced by the earth's radioactive core and mantle. The importance of the heat used up in tectonic processes is amply demonstrated by its absence on Venus. On Earth, the production and subduction of plates uses at least 90% of the heat produced by the earth's interior radiation. Venus, lacking plate recycling, loses its heat only through mantle plumes[13] and delamination.[14] Since these processes are not nearly as efficient as Earth's tectonic processes, the surface temperatures soar to an average of near 500 °C.[15] At its most extreme, this heat conduction through the crust can cause the surface of the planet to melt (named, understatedly, as a "resurfacing event") as apparently happened on Venus about a billion years ago.[16]

These are some examples of why plate tectonic movement is necessary to the maintenance of life. While earthquakes and tsunamis can have devastating effects, the processes that cause them are absolutely essential to life. As John Lynch asked, "Which would you rather have, a bursting planet or an earthquake here and there?"[17] It seems that there is no other choice if we are to have a rocky planet in a physical universe like ours.[18]

Pain

We might think that a good God should have created a world without pain. However, we find that if we are to live in physical, mobile bodies, we cannot do without pain. There are some who are born without the ability to feel pain, and their life expectancy is hugely reduced; they face massive daily challenges because they do not naturally learn how to avoid injury.[19]

Another example of life without pain is the experience of leprosy patients. When the bacteria *Mycobacterium leprae* invades the body's nerves, the body's defensive response causes inflammation. Unfortunately, nerves are covered tightly within a lipid-protein sheath which does not allow room for swelling. As the pressure increases within the sleeve, the blood supply, which runs alongside the nerves, is cut off, causing the cells to die.[20] Once dead, the nerves do not regenerate and can no longer send pain signals to the brain. All the well-known symptoms of leprosy, such as fingers "falling off," are a result of this inability to feel pain—not as a direct result of the bacterial infection itself. In fact, because the nerves never recover their ability to send pain signals to the brain, the debilitating effects of the disease continue forever, even after the leprosy infection is cured.

The inability to feel pain is not (as the Superman movies would have us believe) the fodder of legends, but the stuff of nightmares. Paul Brand, who spent his life in the vanguard of leprosy research and treatment, was one of the first to discover that it was the painlessness which caused subsequent injury to the patients, not the disease itself. While trying to track each and every injury his patients received, he found that some were waking up in the morning with pieces of fingers and toes mysteriously missing or with large ulcers. For a while, Brand worried that the myth of leper's "bad flesh" might indeed be true. What else could explain these wounds appearing overnight? Finally, he posted an overnight guard and the mystery was solved:

> In the middle of the night a rat climbed onto the bed of a fellow patient, sniffed around tentatively, nuzzled a finger, and, meeting no resistance, began to gnaw on it. The lookout yelled, waking the whole room and scaring away the rat. At last we had the answer: the boys' fingers and toes had not dropped off—they were being eaten![21]

Pain protects us in ways of which we are very rarely conscious. Furthermore, if pain nerves are severed, the ability to feel pleasure is equally impeded. Slowly, those who lack the ability to feel pain begin to regard the offending limb as a mere tool or even a burden. With neither pain nor pleasure, the sense of personal ownership is lost. The body becomes a prison instead of being a gift. Soon, the body is no longer seen as intrinsically part of being human. The body, considered to be of no consequence, is treated either with extreme asceticism (it is evil, and should be heeded as little as possible) or with extreme hedonism (it is temporary, and thus bodily actions have no impact on the eternal soul).[22] Neither of these reflects the Christian understanding of the body, which views the body as an intrinsic part of being human. Since pain plays an important part in claiming ownership of and living well in our bodies, it helps us to be fully human.[23]

The deep irony is that the more we avoid pain, the more we are unable to deal with the small remnants of pain that we do experience. Paul Brand, after a lifetime of working in India and the United States, reflects,

> The average Indian villager knows suffering well, expects it, and accepts it as an unavoidable challenge of life. In a remarkable way the people of India have learned to control pain at the level of the mind and spirit, and have developed endurance that we in the West find hard to understand. Westerners, in contrast, tend to view suffering as an injustice or failure, an infringement on their guaranteed right to happiness.[24]

Pain, once accepted, can become a great ally. If it is rejected, it can tyrannize lives, keeping people from the very happiness that they feel can only come about through its absence.[25]

I have used only two examples to show how the harms of the world are constitutively linked to the goods—are "package deals"—in our lives.[26] Many

more could be found. Even Farrer, who started our enquiry by asking why God does not pull the thorn from the paw of creation, goes on to answer his own question:

> But what sort of a thorn is this? And if it were pulled out, how much of the paw would remain? How much, indeed, of the Creation? What would a physical universe be like, from which all mutual interference of systems was eliminated? It would be no physical universe at all. It would not be like an animal relieved of pain by the extraction of a thorn. It would be like an animal rendered incapable of pain by the removal of its nervous system; that is to say, of its animality. So the physical universe could be delivered from the mutual interference of its constituent systems only by being deprived of its physicality.[27]

The very harms we hate and fear often produce the skills and goods we value. Evolutionary history has shown how the devastations of the past—such as the great extinction events and the development of predator-prey relations—have generated immense amounts of biodiversity and physical values. In the poetic words of Holmes Rolston, the "cougar's fang has carved the limbs of the fleet-footed deer."[28] In light of Farrer's question and the innumerable creative possibilities opened by natural evils, we might be tempted to join with Kierkegaard in saying: "With the help of the thorn in my foot, I spring higher than anyone with feet in the best condition."[29]

In summary, when we ask "What (really) is the problem?" we must conclude that it cannot rest on the mere *existence* of natural disasters or pain or predators. All of these are necessary to the existence of a good and flourishing world with sentient animals. The problem instead revolves around the issues of the extreme suffering of individual creatures, particularly those multitudes of nonhuman animals whose lives are cut off in infancy before they have had any chance to flourish and whose experience of life is predominated by pain, suffering, and neglect.[30] The problem of extreme suffering is further sharpened by the fact that the traditional explanations for human suffering do not apply. We cannot use a free-will defense because nonhuman creatures do not sin. Nor can we use a "vale of soul-making" argument—that the experience of suffering forms robust souls—for nonhuman animals because it does not seem to be the case that they can draw close to God in any willful way in response to suffering.[31] Without these traditional arguments, the comprehensibility of their suffering becomes extremely opaque.

Furthermore, the arguments that the "greater good" is being served by suffering (such as nomic regularity) only take us so far, and it is not usually any consolation to the individual that their life serves a greater purpose if it entails the complete loss of their own chance of flourishing. The white pelican is a species often held up as an example of suffering for the "greater good" because its reproductive cycle involves laying two eggs with the strategy of only raising one chick. The second chick, sometimes called the insurance chick, is pushed out of the nest by its older sibling, only to be ignored by its parents until neglect or a passing predator brings its untimely death.[32] In a small minority of the cases, the first chick dies from some cause and the second is raised, ensuring that at least one offspring will continue into adulthood in each reproductive cycle. How can we think theologically about that second chick whose life is characterized almost entirely by neglect, suffering, and an early death? The rest of this article will focus on this theological development.

Who Is to Blame?[33]

I wrote above that we cannot use the free-will defense because nonhuman creatures do not sin. However, throughout most of Christian history, the free-will defense was used to explain nonhuman suffering by rooting the existence of natural evil in human sin. Calvin, for example, wrote,

> For it appears that all the evils of the present life, which experience proves to be innumerable, have proceeded from the same fountain. The inclemency of the air, frost, thunders, unseasonable rains, drought, hail, and whatever is disorderly in the world, are the fruits of sin. Nor is there any other primary cause of diseases.[34]

However, there is an insurmountable chronological difficulty with this approach: death has been present as long as there has been life, for over three billion years. Predation dates back to the Cambrian period 350 million years ago. Dinosaurs had cancer. Paleontological discoveries show that violence and disease abounded long before humans were around to sin. While humans *are* currently wreaking ecological havoc on the world due to our greed and consumerism, most nonhuman suffering has happened independently of human action. There

have been a few attempts to save the appearances of a theology that maintains both the long history of violence in nature and the full blame of humans for its existence. The most notable of these is by William Dembski, who argues that we should understand the effects of human sin to have been retroactively applied to the creation from the beginning of time.[35] However, a God who would inflict untold suffering on billions of nonhuman animals over millions of years, without any good emerging out of it for the creatures themselves (and only a very indirect benefit for humans[36]), is morally repulsive.[37]

The majority of theologians find the chronological problem of prehuman animal suffering compelling enough to look elsewhere for explanation. How else can we account for the suffering in the evolutionary story? Taking their cue from the traditional story that suffering is a result of sin, several theologians have proposed a prehuman moral agent who could have inflicted such devastation on the world: Satan.

C.S. Lewis wrote in his early work that in light of the long history of nonhuman animal suffering,

> It seems to me … a reasonable supposition, that some mighty created power had already been at work for ill on the material universe, or the solar system, or, at least, the planet Earth, before ever man came on the scene … If there is such a power, as I myself believe, it may well have corrupted the animal creation before man appeared.[38]

Michael Lloyd, Gregory Boyd, Paul Griffiths, and Nathan O'Halloran have all joined Lewis in affirming a Satanic origin for natural evil.[39] While appealing, the solution raises many more issues than it solves. First, God in scripture regularly claims the creation, even the violent creation, as God's own work. In Genesis 1, in Job's divine speeches, and in Psalm 104 (to name a few), the uncontrollable, unpredictable, and even violent nature of the world is held forth as evidence of God's power.[40] Second, God calls the completed creation "very good." If the nonhuman creation was utterly corrupted at some early stage, we might expect divine warning to show up in the human commission in Genesis 1. Instead, we find God approving of creation, calling it "very good," and blessing it. Even if it was not a finished project, we have no evidence that it was corrupted. Finally, we have noted that it is the very competitiveness and strife of the evolutionary process that pressures it into such wonderful creativity. Many of the values of creation are directly attributable to the harms that cause them to arise. If Satan was the originator of the cougar's fang, we would also have to attribute the elegance and speed of the deer to Satan's creative powers, since they directly result from the fang. In the end, we would be left wondering what precisely was left of creation that could be attributed to God.

So, we are unable to point to humans or Satan (or other shadowy spiritual figures[41]) for the existence of natural evil. The responsibility, then, must fall squarely on God's shoulders. God, it seems, has chosen to use an evolutionary process to create the world even though it is replete with suffering, death, and extinction. Why?

Some, as we noted above, have suggested that it is to make a realm in which creatures' choices are truly effective, making things such as physical planning and, more importantly, morality, true possibilities.[42] Others, such as Christopher Southgate, have suggested that evolution involving death, pain, and predation is the only way to develop creaturely selves in a physical environment without constant intervention.[43] It is the "only way" to make a world that makes itself; a world that produces novel and complex creatures. The argument could even be pushed to say that evolution is not only the sole available option to fill the earth, but perhaps it is also the only way to give rise to beings that will one day populate heaven.[44]

From another perspective, I think that there is something of the creativity and respect of love in the evolutionary narrative. Love, by its very nature, will not control the beloved.[45] Where we see controlling behavior in the guise of love, such as a parent who dominates every aspect of their child's life, we recognize that what we see is not, in fact, love, but some form of fear or will to exert power disguised as love. Love allows the other to be him or herself. So when we think about God creating the world in love, we should not be surprised that God gives created beings significant freedom with real consequences. This is a different kind of "only way" argument: it is not rooted in the constraints of physics, the laws of nature, or the limits of physical possibilities,[46] but it emerges out of the necessary self-limitations of love.[47] As John Polkinghorne has argued, God—out of love—made a world with free process, which also means that not every result of the process is the result of divine design.[48] Just as we might intentionally bring a child into the world but then not support some of his or her actions in life, so too, God brought

the world into being but did not specially design, for example, the parasitic Ichneumon wasp whose larvae eat their way out of the bodies of living caterpillars.

However, by limiting the scope of God's design in the world, we wield a double-edged blade: we must say also that God did not specially design the softness of rabbit's fur, the cooperation of symbiotic life, or the grandeur of mountains. Both the attractive and the horrific are results of the same good: free process. The orca who plays with the seal pup, skinning it alive, is expressing its freedom and is being true to its nature as much as the doe who nuzzles her fawn.

Yet, even with the acknowledgment of great freedom, it still seems that a heavy weight of responsibility for the suffering that results from evolution rests on God. If God gives creatures such terrible power that results in so much suffering—power ultimately rooted in God's choice to create a wildly free world—it leads naturally to our third question.

What Is God Going to Do about It?

God's response to the suffering of the nonhuman world can be thought of in three ways: companioning, luring, and redeeming.

Divine Companioning

As the Creator and Sustainer of all life, God is intimately involved in the life of every organism, companioning each creature as it walks, flies, swims, or crawls through life. When Holmes Rolston III reflected on the evolutionary process, he said, "If God watches the sparrow fall, he must do it from a very great distance."[49] But, along with Jay McDaniel and others, I think that this is completely wrong.[50] In every instance, God is with each creature: inspiring its every breath, constantly giving it the power to be, and accompanying it through life. This also means that whenever any creature suffers, God suffers with it, feeling the full extent of its pain.[51] We may think this is a rather impotent response, since God's presence does not seem to lessen any creature's pain, but it does mean that no animal suffers and dies alone, and that God does not volunteer the creation for suffering which God will not also experience.[52]

The difference between Rolston's conception of a distant God and the immanent God of McDaniel is illustrated vividly in the 2001 movie *Shrek*, when Lord Farquaad decides to send knights to rescue the princess Fiona.[53] As he stands on a high balcony looking down at the brave knights, he says, "Some of you *may die* … but that is a risk *I* am willing to take." If God does not somehow suffer with those who suffer, then God becomes a distant Lord Farquaad, willing to send the innocent to the slaughter for the realization of God's own purposes. Instead, we must envision God as the one who walks with, who grieves with, and who comforts a suffering creation. And perhaps it does make a difference: a newborn baby is comforted by a mother's presence long before abstract concepts of "self" or "love" are thought of. So too, the prerational creation may be comforted by God's presence in their suffering, even if they cannot recognize God as its source.

Instead of a distant Lord Farquaad, then, our picture of God's companioning is similar to that of a historical midwife accompanying the labor pains of creation. The midwife cannot take away the pain of the mother, nor even significantly lessen it, but instead she accompanies, encourages, embraces, and sits in solidarity with the suffering (and sometimes dying) mother. Better yet, to adopt a possibly scandalous image from Lady Julian of Norwich, God is the mother who is painfully laboring to bring forth creation.[54] God does not take away creation's pain,[55] but God's presence in creation helps us accept the suffering of creation, even if God's presence does not necessarily alleviate creation's pain or brutality.

Divine Lure

I think that God is also present in what many process theists would call a divine lure to the good. It is an action that complements divine companioning and understands God as active in influencing (though not determining) the outcomes of creation. Now, for process thinkers who embrace panpsychism or panexperientialism,[56] God lures all entities toward good and harmonious relationships: for them, evil occurs only when and where the actual entities of creation choose to resist that divinely inspired call toward the good—choosing violence and conflict instead.[57]

I am not as confident as these thinkers that predator-prey relationships ought not to exist or that a natural process such as an earthquake is a result of the resistance of earthly entities to the lure of God toward the good. I would not want to extend the call of God or the ability to respond to God so far down the scale of being, yet I do think that there is a sense in which all living creatures are called by God into participation

in the gift of life, into their own unique place in the history of the world.

Each creature's life and death ripples out into the ongoing streams of existence. God calls creatures toward participation in life, and as Southgate proposes, toward moments of creaturely self-transcendence.[58] In nonhuman animals, this self-transcendence may mean the moment of trying a new food source, or pushing one's physical abilities to a new limit, or developing a new tool. In humans, it may mean all these things as well as the lure toward love and conscious relationship with God. The lure of God toward life means that creatures will continually become more complex and that the interrelationships between various life forms will become more elaborate. It is the pattern that we have seen throughout evolutionary history: prokaryotic cells become eukaryotic, single-celled organisms join colonies, colonies become multicellular organisms, organisms specialize into diverse and complex organisms, which in turn promote complex ecological relations. Even when cataclysmic devastations threaten to wipe out life on Earth, each time life has bounced back and displayed even more diversity and complexity than before. The divine lure means that all animal suffering will be drawn toward good ends.

Still, we must keep a single-minded focus on the fact that the experience of life is often, in Thomas Hobbes's vivid words, "Solitary, poor, nasty, brutish, and short" for many of life's participants. There is a need for something more than simply pointing out that life's overall arc is toward richer interrelationship. How are we to account for the suffering of the individual? We come, then, to the possibilities of redemption.

Divine Redemption

It is in redemption more than in any other doctrine that the possibility for explaining the suffering of individuals arises. I propose three different models: immediate, eschatological, and dual-aspect.

Immediate redemption

The first type of redemption, advanced by Holmes Rolston III, is redemption played out immediately in the lives of others: that is, because of the way ecosystems work along with the exchange of life and death, the death of a creature is never wasted.[59] Most of the lives cut short are brought to an end because they are eaten by something else—the lives lost are directly involved in the flourishing of another. Even when they are not directly eaten, the energy and materials stored in their bodies are eventually recycled and reused by other organisms. How are the evils of death and painful suffering accounted for? According to Rolston, when we take the story of ecosystems and translate it "into theological terms, the evils are redeemed in the ongoing story."[60] Wherever we see harmonies in nature, balanced ecosystems, or the development of new and more complex species, we see a sort of redemption for the creatures who died, because that reality could never have happened without their death. Still, this model is a little hard on the individuals who experience no redemption in and of themselves.

Eschatological redemption

A second type of redemption is what Jay McDaniel calls "Pelican Heaven": the idea that the nonhuman individuals who have never had a chance to flourish will be redeemed by a new life in heaven where they will be able to experience all the things that they could not have here.[61] New life is not only for humans, but also for all sentient creatures who have interests in pleasure and pain avoidance—essentially, those with a sense of self. For McDaniel, however, this heaven is particularly for those who have lost the chance to flourish here on Earth.[62] Pelican Heaven is a compensation for when the risk of a free creation causes an unjust amount of suffering for an individual.

Now, there is little in the history of theology or philosophy to directly endorse the idea of a heaven for nonhuman animals. The Bible contains a few hints that the redeemed world order will include more than simply humans: Isaiah 11 includes all sorts of animals, from wolves and leopards, to cows and lambs, in its vision of the peaceable kingdom. Romans 8 describes the whole creation being set free from the bondage to decay, caught up in redemption with humans. Also, on the topic of nonhuman resurrection, opinions of theologians have varied throughout time. Aquinas did not think that animals had the capacity for life beyond physical death.[63] John Wesley not only included the nonhuman creation in the resurrection, but thought that nonhuman animals would also have increased cognitive capacities (on the level of human intelligence) so that they could experience resurrected life and praise God with self-awareness.[64] While there may not be direct scriptural warrant for the resurrection of the nonhu-

man creation, I think that reflection on the nature of the love and generosity of God would tip the scales toward affirming the resurrection of the nonhuman creation. After all, because of the great power of God, there can be no worries that there would not be enough resources or space in the new heavens and new earth to accommodate the whole of the nonhuman creation. And if God's love and care extends beyond the human creation, as the divine speeches in Job and Psalm 104 strongly argue, then it is hard to imagine God simply abandoning so much of creation to annihilation or nothingness.

Dual-aspect redemption

So far, the models of redemption have polarized redemption into being either immediately present as in Rolston's ecological model, or distantly eschatological, as in McDaniel's Pelican Heaven. A third model combines the insights of both these models into a dual-aspect redemption. Rolston focused on the fact that suffering is often generative and life giving for those beyond the sufferers themselves. McDaniel proposed that even nonhuman individuals will have a place in the new creation. The idea I propose is that the story of each creature, both in its flourishing and in its suffering, is combined with all the other narratives of creation in such a way as to make an overarching narrative that reflects back to the glory and honor of the individual.

The image I use for redemption is that of a photo mosaic. Most of us have seen the computer-generated images in which a picture is made up of hundreds or thousands of pixels, each of which is a full picture itself. Our lives, and the lives of all living creatures, are like those pixel-pictures. Each is a whole in itself, unique and necessary. No other picture could bring the exact arrangement of light, shadow, and color that each picture contributes. God arranges the stories one against another in order to bring out larger redemptive patterns: an image of universal harmony. Nor is the construction limited to two levels: each smaller picture could itself be a mosaic, and each pixel of that smaller picture a mosaic as well, and so on. We end up with what Eleonore Stump calls "nested fractal narratives," a pattern in which each scale of measurement contributes to all the other levels, and where self-similar patterns (of redemption) appear at each level.[65] And because each pixel or narrative is a necessary component of the whole, the beauty, harmony, and glory of the whole reflects back onto each individual part.

The photo mosaic of nested fractal narratives holds together two major theological emphases: freedom and meaning. Each creature's life is a photograph, full of its own meaning, open to the creature's own contribution. This differentiates my model from a basic mosaic or a tapestry model, in which the component pieces do not hold any meaning on their own.[66] (A thread is much like any other thread, and a small piece of colored stone does not tell much of a story until it is part of the mosaic.) Creatures build their own life stories in freedom, with their own meaning in light of their environments and relationships, but the final arrangement of those pieces in the great mosaic of redemption comes from God. That great picture will pick up the photographs that creatures have made with their lives—and is thus responsive to the freedom of creation—but it will also arrange them in a new and unforeseen pattern, making new and positive meanings out of old, and sometimes extremely negative, events. The new creation is an act of *creation*. There is no preset pattern that things have to accommodate to fit into a predetermined pattern. Rather, the multileveled, nested, fractal narratives of Earth's history grow and are responded to by God in redemption.

What sort of example might illustrate the concept of nested fractal narratives? We might think of dinosaurs.[67] Sixty-five million years ago a meteorite hit the Yucatan peninsula, causing widespread climate change to which the dinosaurs could not adapt. They went extinct. Yet, the ecological niches freed by the extinction of the dinosaurs were soon taken up by one of the most entrepreneurial forms of life: mammals. One branch of those mammals evolved into humans. Eventually humans began to compose music, create art, and build flying machines. How does this link back to the dinosaurs? Depending on how we build our narrative structure, we can see direct links between the extinction of dinosaurs and the soaring music of Bach and Mozart. Without the extinction of the dinosaurs, the universe may never have produced violin concertos or cello suites. I propose that in the new creation, the glories of human achievement will be reflected back on those nonhuman individuals who suffered and died and went extinct and thus made human achievements possible. The individual will have a share in the glory of the whole to which they contributed, however distantly, and this new meaning for the individual will contribute to the beauty of the whole picture. Perhaps, as Wesley imagined, this sharing in glory will require

an increase in the capacities of creatures so that they can receive the gift of redemption fully.

An analogy to the concept of later works reflecting on previous lives may be found at the end of Hebrews 11. The writer, after listing the long line of "heroes of the faith," goes on to say, "Yet all these, though they were commended for their faith, did not receive what was promised, since God had provided something better so that *they would not, apart from us, be made perfect*."[68] The writer then launches into "Therefore … let us also lay aside every weight and the sin that clings so closely, and let us run with perseverance the race that is set before us …"[69] followed by the instructions on righteous living. There is some implication that without the present race being run well by the first-century hearers, the saints of the past cannot be made perfect.

The stories of the ancient heroes of the faith are somehow completed by the ongoing stories of God's people. I would extend the same idea to all of creation: all of creation is completed by the ongoing history of the universe. God—both in the ongoing narrative of living organisms, and also eschatologically in the final wrapping up of all things—will so arrange the narratives of pleasure and suffering, of loss and fulfilment, that each life will contribute to the fullness of every other life in such a way that redemption will be found everywhere. Even in the hardest cases of seemingly senseless suffering, we can listen to what Thomas Merton said, "The grace of Christ is constantly working miracles to turn useless suffering into something fruitful after all."[70] In the redemptive work of God, all the suffering that occurred because of the freedom given in love will be healed and clothed in glory.[71]

Divine companioning, divine lure, and divine redemption represent just three of many possible ways in which God is active in the world; three possible ways in which God takes responsibility for and responds to the suffering of creation. There may be many more. In light of biblical descriptions of divine action, which stretch from creation to Incarnation, from wrestling with Jacob in the mud to empowering servants to speak boldly, it would seem a false step to limit the ever-surprising God to one or two courses of action. The character of divine action can be more precisely defined: God acts in perfect love. What that looks like in practice, however, will be as unique as the creature who is loved.[72]

Conclusions

We have come a long way in a short time. We began by asking what the problem of nonhuman animal suffering really is. We saw that pain, suffering, and natural disasters are necessary parts of the "package deal" of creation. The most difficult case was refined to the individual whose life was cut off before any significant flourishing could be had, or when a life was full of nonbeneficial pain. The problem was made more difficult in the case of the nonhuman animal which could not avail of the classic argument that death and suffering are a result of sin, nor could suffering be a pathway to greater union with God.

Our second question asked who is to blame for such a state of affairs. For biblical, philosophical, and chronological reasons, we saw that neither human sin nor demonic forces could explain nonhuman suffering satisfactorily. God, then, must be recognized as responsible for the groaning of creation.

In answer to our third question of how God is at work responding to the suffering of creation, we explored the concepts of divine companioning, divine lure, and the work of redemption. Redemption was seen to incorporate both immediate and eschatological elements, and the image of a fractal mosaic was used to illustrate how the life of a seemingly inconsequential part of creation contributed to the larger-scale patterns of redemption, and how the glory of the whole is then reflected back onto the individual.

All of these considerations need to be held together when we theologically evaluate a circumstance of nonhuman animal suffering. We can find, to our surprise, that even the competitive, violent, and suffering world of Darwinian evolution can reveal the love and grace of God. ✞

Notes

[1]For those interested in some of the theological responses in Darwin's day, see Bethany Sollereder, "The Darwin-Gray Exchange," *Theology and Science* 8, no. 4 (2010): 417–32.

[2]Michael J. Murray, *Nature Red in Tooth and Claw: Theism and the Problem of Animal Suffering* (Oxford: Oxford University Press, 2008); Christopher Southgate, *The Groaning of Creation: God, Evolution, and the Problem of Evil* (Louisville, KY: Westminster John Knox Press, 2008).

[3]Nicola Hoggard Creegan, *Animal Suffering and the Problem of Evil* (Oxford: Oxford University Press, 2013); Trent Dougherty, *The Problem of Animal Pain: A Theodicy for All Creatures Great and Small* (New York: Palgrave Macmillan, 2014); Ronald E. Osborn, *Death before the Fall: Biblical Literalism and the Problem of Animal Suffering* (Downers Grove, IL: InterVarsity Press, 2014).

[4]Eleonore Stump's *Wandering in Darkness: Narrative and the Problem of Suffering* (Oxford: Clarendon, 2010) is a good example of a Thomist theodicy that argues human suffering is allowable along these lines, as well as the classic soul-making argument advanced by John Hick in *Evil and the God of Love* (Houndmills, UK: Palgrave Macmillan, 2007).

[5]Austin Farrer, *Love Almighty and Ills Unlimited: An Essay on Providence and Evil* (London: Collins, 1962), 51.

[6]Philip Clayton and Steven Knapp, *The Predicament of Belief: Science, Philosophy, Faith* (Oxford: Oxford University Press, 2011), 47. C.S. Lewis and Michael Murray also point out that there would be no place for moral development, since people could never make effective choices to hurt one another. However, this is of major benefit to human beings only, and does not tell us why (without gross anthropocentrism) God would have subjected billions of nonhuman animals to pain and suffering. C.S. Lewis, *The Problem of Pain* (New York: HarperOne, 1996), 24; Murray, *Nature Red in Tooth and Claw*, 130–65.

[7]Niels Gregersen, "The Cross of Christ in an Evolutionary World," *dialog: A Journal of Theology* 40, no. 3 (Fall 2001): 197–99; Denis Alexander, *Creation or Evolution: Do We Have to Choose?* (Oxford: Monarch, 2008), 279–80; see also the discussion on constitutive good-harm analyses in Christopher Southgate and Andrew Robinson, "Varieties of Theodicy: An Exploration of Responses to the Problem of Evil Based on a Typology of Good-Harm Analyses," in *Physics and Cosmology: Scientific Perspectives on the Problem of Natural Evil*, ed. Nancey Murphy, Robert J. Russell, William R. Stoeger, SJ (Vatican City: Vatican Observatory Foundation, 2007), 67–90.

[8]James Monroe and Reed Wicander, *The Changing Earth: Exploring Geology and Evolution* (Belmont, CA: Thomson Brooks/Cole, 2006), 28.

[9]A note is in order about the word "destructive." In this case, I mean destructive from a biocentric point of view. Plate movements cause damage and death to living organisms. Geologically, however, volcanic activity is constructive, as are plate boundaries where mountains form (though these orogenic events destroy the previously existing environment).

[10]Wanda L. Davis and Christopher P. McKay, "Origins of Life: A Comparison of Theories and Application to Mars," *Origins of Life and Evolution of the Biosphere* 26 (1996): 67–69. None of the other terrestrial planets have plate tectonics.

[11]Peter Ward and Donald Brownlee, *Rare Earth: Why Complex Life is Uncommon in the Universe* (New York: Copernicus, 2004), 194.

[12]Ibid., 212–13.

[13]Mantle plumes are "stationary columns of magma, originating deep within the mantle … [which] slowly rise to the surface to create volcanoes" (Monroe and Wicander, *The Changing Earth*, 48).

[14]Delamination is a process by which the bottom of the lithosphere sinks into the mantle.

[15]Kent C. Condie, *Plate Tectonics and Crustal Evolution*, 3rd ed. (Oxford, UK: Futterworth-Heinemann, 1997), 234. There are other reasons for the high surface temperature, but lack of heat recycling is thought to be a main contributing factor.

[16]Ward and Brownlee, *Rare Earth*, 215.

[17]John Joseph Lynch, SJ, "In Defense of Earthquakes," quoted in Eric R. Swanson, *Geo-Texas: A Guide to the Earth Sciences* (College Station, TX: Texas A&M University Press, 1995), 74.

[18]There are, of course, many who want to speculate about whether we could imagine a universe with completely different physical properties, dimensions, and so on, in which a different combination might allow for the same values with less suffering. However, these speculations are largely unhelpful. First, they can never account for every variable, and often (as with earthquakes) we might try to eliminate one variable only to find that many other variables are connected in ways that we did not anticipate. Before we knew the benefits of plate tectonics, earthquakes seemed an unnecessary evil, easily speculated out of existence with great benefit. Since we do not have a full understanding of this universe, it is unlikely that we will be able to speculate constructively about other possible universes, though some have tried. See examples in Robert John Russell, "Physics, Cosmology, and the Challenge to Consequentialist Natural Theodicy," in *Physics and Cosmology*, 109–30. Second, such speculation serves as a distraction from more fruitful work on tangible elements of theodicy. There is no way to prove or disprove another possible physical configuration, and it can be used as an evasion of the issues. Better, then, to deal directly with the universe we know.

[19]Known as congenital insensitivity to pain, or congenital analgesia, the condition is due to a specific genetic mutation. James J. Cox et al., "An *SCN9A* Channelopathy Causes Congenital Inability to Experience Pain," *Nature* 444 (December 14, 2006): 894–98.

[20]Paul Brand and Philip Yancey, *The Gift of Pain: Why We Hurt & What We Can Do about It* (Grand Rapids, MI: Zondervan, 1993), 152.

[21]Ibid., 127.

[22]Both of these were found in ancient Greek thought, among the Stoics and the Epicureans respectively. The Gnostics, another philosophy which competed with early Christianity, sought to escape the body and the flawed material creation, deeming them to be the results of the creation attempts of a lesser god (demiurge).

[23]It is interesting to note that if the lepers in the Gospel accounts had real leprosy (and not simply any sort of skin disease), then Jesus's healing actually restored their ability to feel pain.

[24]Brand and Yancey, *Gift of Pain*, 187–88.

[25]This does not mean that there is no gratuitous or unnecessary pain in the world. There is, as I go on to note.

[26]See note 7 above for more scholarship on this concept.

[27]Farrer, *Love Almighty and Ills Unlimited*, 51.

[28]Holmes Rolston III, *Science and Religion: A Critical Survey* (West Conshohocken, PA: Templeton Foundation Press, 2006), 134.

[29]Søren Kierkegaard, *Journals and Papers*, quoted in Abraham Sagi, *Kierkegaard, Religion, and Existence: The Voyage of the Self* (Atlanta, GA: Rodopi B.V., 2000), 106–107.

[30]Southgate, *Groaning of Creation*, 48–50.

[31]For the classic statement of the vale of soul-making argument, see Hick, *Evil and the God of Love*.

[32]Jay B. McDaniel, *Of God and Pelicans: A Theology of Reverence for Life* (Louisville, KY: Westminster/John Knox Press, 1989), 19–21.

[33]For those theologians objecting right now: I realize that this is the wrong question. Sometimes even the wrong question can get you to the right place, as I think happens here.

[34]John Calvin, *Commentaries upon the First Book of Moses Called Genesis* (1554) in *Calvin's Bible Commentaries: Genesis,* Part 1, trans. J. King (1847; Forgotten Books,

2007), 113, http://www.amazon.co.uk/Calvins-Bible-Commentaries-Genesis-Forgotten/dp/1605062359.

[35]William Dembski, *The End of Christianity: Finding a Good God in an Evil World* (Nashville, TN: B&H Publishing, 2009).

[36]Dembski argues that the benefit granted to humans is that the corruption of the world teaches them of their own need for salvation.

[37]For a further critique, particularly of the anthropocentrism of the approach, see Christopher Southgate's review of *The End of Christianity* by William A. Dembski, in *Reviews in Science and Religion* 60 (November 2012): 43.

[38]Lewis, *The Problem of Pain*, 138.

[39]Michael Lloyd, "Are Animals Fallen?," in *Animals on the Agenda*, ed. Andrew Linzey and Dorothy Yamamoto (London: SCM, 1998), 147–60; Gregory Boyd, *Satan and the Problem of Evil: Constructing a Trinitarian Warfare Theodicy* (Downers Grove, IL: InterVarsity, 2001); Gregory Boyd, "Evolution as Cosmic Warfare: A Biblical Perspective on Satan and 'Natural Evil'," in *Creation Made Free*, ed. Thomas Oord (Eugene, OR: Wipf & Stock, 2009), 125–45; Paul Griffiths, "Impossible Pluralism," *First Things* (June/July 2013): 44–48; Nathan W. O'Halloran, SJ, "Cosmic Alienation and the Origin of Evil: Rejecting the 'Only Way' Option," *Theology and Science* 13, no. 1 (2015): 43–63.

[40]See Terence E. Fretheim, *Creation Untamed: The Bible, God, and Natural Disasters* (Grand Rapids, MI: Baker Academic, 2010).

[41]Celia Deane-Drummond, "Shadow Sophia in Christological Perspective: The Evolution of Sin and the Redemption of Nature," *Theology and Science* 6, no. 1 (2008): 13–32.

[42]See note 6 above.

[43]Southgate, *Groaning of Creation*, 29.

[44]Ibid., 90. This claim helps deal with the question, "Why didn't God just make heaven first?"

[45]W. H. Vanstone, *Love's Endeavour, Love's Expense: The Response of Being to the Love of God* (London: Darton, Longman, and Todd, 1977), 45–49.

[46]Southgate, *Groaning of Creation*, 47–48.

[47]I certainly want to invoke all the notions of kenotic creation advanced by Jürgen Moltmann, Ian Barbour, Keith Ward, and the many other authors contained in the volume *The Work of Love: Creation as Kenosis*, ed. John Polkinghorne (Grand Rapids, MI: Eerdmans, 2001).

[48]John Polkinghorne, *Science and Providence: God's Interaction with the World* (West Conshohocken, PA: Templeton Foundation Press, 1989), 77. This is where, once again, the notion of blame fades away.

[49]Rolston, *Science and Religion*, 140.

[50]McDaniel, *Of God and Pelicans,* 19–20.

[51]For a philosophical and theological defense of God's ability to suffer, see Paul S. Fiddes, *The Creative Suffering of God* (Oxford: Clarendon, 1988), 46–76.

[52]See Christopher Southgate, "Does God's Care Make Any Difference? Theological Reflection on the Suffering of God's Creatures," in *Christian Faith and the Earth: Current Paths and Emerging Horizons in Ecotheology*, ed. Ernst M. Conradie, Sigurd Bergmann, Celia Deane-Drummond, and Denis Edwards (London: Bloomsbury T&T Clark, 2014), 110–12.

[53]*Shrek*, directed by Andrew Adamson and Vicky Jenson (Glendale, CA: DreamWorks, 2001), DVD.

[54]Julian of Norwich, *Revelations of Divine Love* (New York: Penguin Classics, 1998), chapter 57. Cf. Marilyn McCord Adams, "Julian of Norwich: Problems of Evil and the Seriousness of Sin," *Philosophia* 39, no. 3 (2011): 445.

[55]I intentionally use "does not" rather than "cannot" here. It is not that God lacks the power to act, as process theists or as Thomas Oord would claim. I think that God does not regularly do so because those interventions would destroy the integrity of the "otherness" of creation. I have no problem, however, with God doing so on occasions when such action is deemed necessary by God, although I do not think that there are such occasions in the nonhuman world. I therefore do not ascribe to the "not-even-once" principle of Philip Clayton and Stephen Knapp.

[56]Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues* (San Francisco, CA: HarperCollins, 1997), 288; David Ray Griffin, *God, Power, and Evil: A Process Theodicy* (Louisville, KY: Westminster John Knox Press, 2004), 248–49; David Ray Griffin, "Panexperientialist Physicalism and the Mind-Body Problem," http://www.anthonyflood.com/griffinpanexperientialism03.htm.

[57]John B. Cobb Jr. and David Ray Griffin, *Process Theology: An Introductory Exposition* (London: Westminster Press, 1976), 53. "Actual entities" in process thought, however, are not individuals in the usual sense, but rather are processes, or occasions.

[58]Southgate, *Groaning of Creation*, 62–66.

[59]Holmes Rolston III, "Does Nature Need to be Redeemed?," *Zygon* 29, no. 2 (June 1994): 205–29.

[60]Ibid., 213.

[61]McDaniel, *Of God and Pelicans,* 41–47.

[62]Christopher Southgate agrees, and says that the problem is lessened for creatures who do not suffer. Those creatures might still have eternal life, but not as a type of compensation. Southgate, *Groaning of Creation*, 84–85.

[63]Paul Griffiths, "What Remains in the Resurrection? A (Broadly) Thomist Argument for the Presence of Nonhuman Animals in Heaven" (Aquinas Lecture, Blackfriars, Cambridge, January 31, 2013).

[64]John Wesley, "The General Deliverance: Sermon 60," http://www.umcmission.org/Find-Resources/John-Wesley-Sermons/Sermon-60-The-General-Deliverence.

[65]Stump, *Wandering in Darkness*, 219–26, 466–67.

[66]Augustine, for example, used the idea of a mosaic. Philip Tallon, *The Poetics of Evil: Toward an Aesthetic Theodicy* (Oxford: Oxford University Press, 2012), 125.

[67]See a longer treatment in Bethany Sollereder, "The Purpose of Dinosaurs: Evolutionary Extinction and the Goodness of God," *The Christian Century* 130, no. 20 (2013), http://www.christiancentury.org/article/2013-09/purpose-dinosaurs.

[68]Hebrews 11:39–40, NRSV. Italics mine.

[69]Hebrews 12:1, NRSV.

[70]Thomas Merton, *No Man Is an Island* (Tunbridge Wells, UK: Burns & Oates, 1955), 80.

[71]Nor do I think that the redemption will be limited to those creatures who suffer. Redemption happens because "all things" are created by Christ, held together by him, and reconciled to God through him (Col. 1:15–20). I think that the new creation will include all creatures who are loved by God … which would be all creatures.

[72]In describing divine action, then, our compassionate imagination—rather than our logic—may be the more reliable guide.

George L. Murphy

Necessary Natural Evil and Inevitable Moral Evil

George L. Murphy

The question of why bad things happen to creatures of a supposedly beneficent and all-powerful God has been a challenge to Christian thought in modern times. Scientific knowledge makes an appeal to effects of a primordial human sin a very unconvincing response. Here we distinguish between natural and moral evil and proceed on the basis of a theology of the cross. The hiddenness of God's activity in the world suggests that God has given creation its own functional integrity, so that God will not intervene miraculously to avert all danger from creatures. Thus natural evil is, in a sense, necessary. In addition, evolution of intelligent life will result in creatures who, in theory, could trust and obey God but who will inevitably fail to do so. God shares with creation in paying the price for creation of such a world by choosing to be vulnerable to its suffering.

A fundamental aspect of the Christian doctrine of creation is set out in the first creation account of Genesis (1:1–2:4a). This text repeatedly states that aspects of the world which God created are "good," and the story of God's work concludes by saying that God saw everything that he had made to be "very good." First Timothy 4:4a affirms this: "For everything created by God is good, and nothing is to be rejected."

The Issues

Human experience of bad things happening in the world—the sufferings caused by disease, storms, and fatal accidents along with the harm that people do to one another by their choices—immediately raises questions about this claim of creation's goodness. Is the way creation is described in the Genesis account consistent with these realities?

And there are further questions. The Bible pictures God's ongoing involvement with creation after the initial creation. We are not given a deistic picture of a clockmaker God who once created the cosmic machinery and then lets it run on its own, but of a creator who is active in the world that he created. In fact, the picture is not just of sporadic divine interventions in the world but of a God who is involved in everything that happens. Creation includes both the originating *creatio ex nihilo* and the ongoing *creatio continua*. Does this then mean that God not only created a world in which bad things take place, but that he also actually causes those things to happen?

It is now common to distinguish between "natural evil" and "moral evil." The first includes all the bad things that can happen to creatures in the natural world, such as diseases, storms, earthquakes, and attacks by animals, as well as smaller accidents such as tripping and falling. These things happen, not because some moral agent intends harm to another

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-person but because they are simply "out there" in the world. They affect not just humans but other animals as well, and, in fact, even the inanimate and inorganic features of the world. Natural evil, in the last analysis, infects all of nature.

"Moral evil," on the other hand, includes all the bad things that we, as rational animals, do. We can damage or destroy other humans, nonhuman animals, and, as the rise of ecological awareness in the past century has shown us, inanimate and inorganic parts of creation. These things do not "just happen," but they take place because people want them to happen, allow them to happen by culpable negligence, or bring them about as collateral damage in the process of getting what they want.

While it is helpful to distinguish between these two types of evil, we need to remember that in some cases both the forces of nature and human action or inaction combine to bring about evil effects. The problems caused by climate change, for example, are due in part to human activity and are exacerbated by denial of the problem by some people in positions of power. The assassination of Abraham Lincoln could not have taken place if the natural processes of an explosion exerting a force on a projectile in a gun had not functioned.

For about the first sixteen hundred years of the Christian era, it seemed easy to explain why bad things happen. As the third chapter of Genesis tells the story, Eve and Adam chose to disobey God and became sinners. This came to be seen in the Christian tradition as something that affected not only all their descendants but nature as well. There was thought to be a straightforward causal connection between the fall of humanity, which brought moral evil into the world, and a cosmic fall which brought natural evil. Acceptance of this connection meant that disease, storms, and other dangers of the natural world, while troubling, were not a theological puzzle. Thus there was not much need of theodicy, an attempt to reconcile belief in divine justice and beneficence with the experience of evil in the world.

This began to change with the rise of modern science and the Enlightenment with its openness to questioning of traditional beliefs. A catastrophe like the Lisbon earthquake of 1755, in which tens of thousands of people died, raised obvious questions about divine justice, even for those who held to the idea of a cosmic fall. Biblical criticism and the scientific study of human origins challenged belief in the historical accuracy of the Genesis accounts of the creation of humanity and its Fall. While older discussions of evil by Augustine, Leibniz, Voltaire, and others are of value, we need to look at the topic here with particular attention to both theological and scientific concerns.[1]

The Genesis accounts of creation and of the earliest human sins continue, of course, to be essential theological statements about the world and the human condition. But critical biblical scholarship indicates that we cannot consider them to be straightforward "history as it really happened."[2] And what we know of human evolution requires that we reconsider traditional ideas about human origins. In particular, genetic evidence now points very strongly to a minimum human population of at least 5,000 individuals at any time in history.[3] Thus a primordial sin by a single couple who were the ancestors of all of us can no longer be maintained as historical fact.

What Genesis says about human sin as refusal to trust and obey God, and the consequences of sin in destroying relations with God, other humans, and the natural world continues to be true. A doctrine of original sin, in the sense that all people begin life in a sinful condition (technically, "original sin originated"), can still be maintained.[4] But since the first humans were the product of a long evolutionary history that in some ways would have encouraged competitive and selfish behaviors, the idea of an initial state of "original righteousness" is implausible. Thus modification of the idea of a historically first sin ("original sin originating") is needed, and the traditional explanation for moral evil needs revision.

There is abundant evidence that there were creatures, including our prehuman ancestors, who were living, suffering, and dying, for millions of years before humans came on the scene. Thus a direct attribution of natural evil to the effects of human sin is highly implausible. From the beginning, the universe had the potential for these things to happen. God apparently created a world in which creatures would suffer and die, and in which some of that suffering and death could be caused by the choices of morally responsible beings. We have noted that there are connections between natural evil and moral evil, but the former cannot be seen as an immediate cause of the latter.

My relatively modest goal here is to provide some understanding, in light of the Christian faith, of why these evils should exist. I make no claim of a complete explanation, for there is a senseless aspect of evil, of what has been called "a mythopoeic lie."[5] In addition, I am not attempting to give a justification for the reality of evil on the basis of philosophical arguments or natural theology, but I am presenting an explicitly Christian theological argument. Our task will require discussion of some important theological topics before we address the issues of natural and moral evil explicitly.

The God Who Acts in the World

The long history of the world's natural catastrophes and the considerable amount of truth in Gibbon's characterization of human history as "little more than the register of the crimes, follies, and misfortunes of mankind"[6] raise obvious questions about the claim that all creation is good. Attempting to answer these questions has been the task of theodicy, an effort to, in Milton's phrase from the beginning of *Paradise Lost*, "justify the ways of God to men."

But who is this God whose ways are to be justified? The influence of Hellenistic philosophy on the development of Christian theology has meant that for much of Christian history God was thought to be absolutely immutable and impassible, unable to be influenced by anything that happens in the world. God could and did act in the world, but there could be no "back reaction" of the world upon God. In particular, God could not be brought to suffer by anything that creatures do. Thus, in any discussion of suffering that took place in the world, God was exempt.

A few of the church fathers did express different views.[7] Perhaps the most interesting is the third-century bishop Gregory Thaumaturgus, who argued that there is a sense in which the impassible God can be passible.[8] God indeed cannot be forced to suffer contrary to the divine will, but God can *choose* to be affected by some other agent. This means that God could choose to share in the sufferings of creatures.

But the most significant move in this direction is Martin Luther's theology of the cross, set out in his theses for the Heidelberg Disputation of 1518. Here Luther distinguished between two types of theologians. The first is the theologian of glory.

> That person does not deserve to be called a theologian who looks upon the invisible things of God as though they were clearly perceptible in those things that have actually happened (or have been made, created).[9]

What is in view here is a claim to know who God is (and not just that there is a God) from knowledge of the world. A comparison of Luther's Latin text of this thesis with the Vulgate shows that he is referring to Paul's words in Romans 1:20. As Paul goes on to argue in Romans, people misunderstand evidence of God in the world and construct idols. They may be the kinds of visible images that Paul mentions, but they can also be more subtle projections of the kind of God we would be if we were God. And since we would rather not suffer, it is easy for us come to the idea of a God who is absolutely impassible.

The theologian of the cross, on the other hand, while not ignoring the world, starts at a different place, Golgotha.

> That person deserves to be called a theologian, however, who comprehends the visible and manifest things of God seen through suffering and the cross.[10]

Luther then says in his argument for this thesis, "For this reason true theology and recognition of God are in the crucified Christ."[11] That is where knowledge of God should begin. We may then look for the presence and activity of this God in the world, knowing that the God we seek is the one revealed most fully in the crucified and risen One.

Luther held formally to the traditional idea of divine immutability and impassibility. "God in his own nature cannot die,"[12] but the union of divine and human natures in the Second Person of the Trinity meant that suffering and death could be attributed to that person. Luther pushed these ideas to their limit, speaking of "a dead God,"[13] and a Lutheran Good Friday hymn of the seventeenth century could say "God himself lies dead."[14]

These ideas were taken up in the twentieth century by several theologians. Kazoh Kitamori wrote about "the pain of God," while Eberhard Jüngel spoke of God's unity with perishability revealed in the cross,

and Jürgen Moltmann distinguished between a simplistic idea of a "death of God" and "death in God," God taking the experience of death into Godself.[15] The claim that God can choose to share in the suffering of creatures and, in fact, does so will be accepted in the following discussion.

How then should we think of this God acting in the world? A number of different theologies and models of divine action have been proposed.[16] If God is indeed most fully known in the crucified Christ, then it makes sense to think of divine action in the world as having the pattern that we see in Christ.[17]

We begin with the belief that God is active in the world, and we can use a quite traditional idea to speak of this. God works with creatures, cooperating with them in their actions, so that both God and creatures are causes of everything that happens. This can be described in scholastic terms as the Primary Cause acting through secondary causes. In more picturesque terms we can say that God works with creatures as a human worker does with tools.

It is important to understand that what is presented in the previous paragraph is an analogy. God is not an entity within the world on the same level as other entities, and the "cooperation"—literally, "working with"—of God and created things cannot be described in the same way as the interaction of a charged particle and an electromagnetic field can be described. Theology is not physics. And while God does not make use of intelligent agents in the way that a mechanic uses a screwdriver, language like that in a prayer attributed to St. Francis, "Make me an instrument of your peace," is not uncommon in the Christian tradition.

But the regularity of natural processes which makes possible the successes of scientific study shows that God does not use these tools in arbitrary ways. (We should not, however, rule out rare instances of divine action that do not accord with our laws of physics. These are best understood as God's use of possibilities inherent in the basic pattern of creation that we have not yet discovered.[18]) Our experience shows us that, if we are to speak of God acting in the world, we have to say that God normally acts in accord with patterns that we try to approximate by our laws of physics. In other words, God limits activity to what is within the capacity of created things.

In doing this, God conforms activity in the world to what is revealed in Christ, who "emptied *(ekenōsen)* himself, taking the form of a slave, being born in human likeness" (Phil. 2:7). This "emptying," or kenosis, means that the one who "was in the form of God" (Phil. 2:5) limited himself to the conditions of existence of a human in a particular time and place and culture. God's limitation of divine action to the capacities of creatures has this same character. Just as God seems to be absent in the event of the cross—for nothing looks less like our ideas of God than a man dying a humiliating and painful death—God's action in the world is hidden from scientific investigation. What we observe is not God but the instruments that God uses.

Kenosis does not mean that God is absent or inactive in some situations. God is everywhere present and working, but limits that work to the capacities of creatures. Thus the integrity of creatures is respected and scientific study of the world is made possible. This does, however, have a dark side which we need to consider.

The Goal of Creation

What does God intend to accomplish with all this work? Science, which gives us detailed knowledge of how things behave in the universe, can tell us nothing about any ultimate purpose or goal or "point" to it all. If God's activity in creation is hidden from scientific observation, it is hardly surprising if the goal of that activity is also concealed. Yet we can speak about it theologically.[19]

Scripture does not go into detail about God's plan for creation, but it is not entirely silent. There is a significant hint in the first creation story. There the creation and blessing of humanity on the sixth day are very important but the story is not finished at that point. This is clear from the commands to "be fruitful and multiply" and "subdue" the earth, commands that would make no sense if everything were in a perfect condition. Creation is intended to develop in the course of time.

The conclusion of the story is the seventh day and God's rest "from all the work that he had done" (Gen. 2:2). This does not mean that God has been idle ever since—Jesus reminded his hearers that

"My Father is still working, and I also am working" (John 5:17). It points instead to the ultimate fulfillment of creation, the Great Sabbath.[20] The Sabbath is a weekly reminder of that future when all things will be as God intended. That is why stories about Jesus healing people on the Sabbath play an important role in the gospels—it is precisely the right time for such things to take place.[21] They are signs that God's final future was breaking into history.

When we look at current scientific knowledge about the history of the universe and of the earth and life on it, we find a picture that is consistent with the idea of a creation intended to evolve.[22] The way in which this development takes place, however, seems to be a major cause of the evils that we have discussed, something that may be disquieting.

Thus we need to look at a second biblical way of talking about God's purpose for creation. Ephesians 1:10 speaks of God's "plan for the fullness of time, to gather up all things in him [Christ], things in heaven and things on earth." Pointing in the same direction is the Christ hymn of Colossians (1:15–20) in which "all things" are said to have been created "for him." Since in this latter text the reconciliation of all things with God is brought about through the cross (v. 20), it is clear that the emphasis is on the incarnate Christ, the Son of God who became a participant in the evolutionary process and, siding with outcasts and the oppressed, got killed as a result.

The cross of Christ is where we see most clearly the suffering of God with creation, but it is not the only place in the biblical story in which this is seen. In the flood story, for example, we are told that when God saw the wicked behavior of humans, "it grieved him to his heart" (Gen. 6:6). It is quite arbitrary to dismiss such biblical statements as figurative while insisting that the few texts that speak of divine immutability be taken as strictly literal.

The Necessity of Natural Evil

Natural evil—that creatures should suffer pain, loss, and death simply because of the operation of physical processes in the world and not because of any choices by other creatures who are moral agents—is not necessary in the sense that such things would have to happen no matter what. If A is true then B necessarily follows—but A need not be true. If you are going to cook dinner in your kitchen, it is necessary to turn on the stove—but you could eat your food raw. If you drop a ball, it will fall to the floor—but you do not have to drop it.

God would not have had to create a world at all. God could have made a world of particles obeying Newton's laws of motion in which living things would not have come into being. The creator could have brought into being the kind of perfect world that "young earth creationists" imagine—a world intended to remain static, for what is perfect could only change for the worse. Or God could intervene in our world every time there was a possibility of a creature coming to harm. But the world we inhabit is obviously not like any of those.

The fact that we can understand the development of the universe from the big bang onward, geophysical history and biological evolution in terms of natural processes, without reference to God, means (always within the context of Christian faith) that God has created a world with its own "functional integrity"[23] that can develop in relative autonomy. Things that happen in the world take place with divine cooperation, but the world is not simply an extension of God. For, as Athanasius wrote,

> God is good, or rather is essentially the source of goodness: nor could one that is good be niggardly of anything: whence, grudging existence to none, He has made all things out of nothing by His own Word, Jesus Christ our Lord.[24]

The fact that God allows creation to "be itself," acting in accord with the properties with which he has endowed created things and their patterns of interaction by virtue of the kenotic limitation of divine action, is what makes the world comprehensible to rational minds. By working in this way, God allows us to live in the world as adults, able to understand the world on its own terms and to make plans for the future. And the regularity of natural processes that results from the limitation of divine action to the rational patterns God has established is what makes scientific understanding of the world possible.

Lest this sound too anthropocentric, we should realize that other creatures depend on regularities—which plants are good to eat and which are not, prey and predator habits, and so forth—in order to survive. It does not matter that animals may have no intellectual understanding of these regularities.

If a plant were nutritious one day and poisonous the next, some herbivores would be in trouble.

So there are certainly beneficial aspects of the limited way in which God works in creation. But there is a dark side to it as well. Bad things happen to creatures, and God does not act in violation of what we describe as the laws of physics to stop them. Earthquakes and volcanoes result from the dynamics of the earth's tectonic plates and upper mantle. The development of life on earth and its evolution through natural selection have given rise to infectious organisms and predator-prey relationships. The mechanics and thermodynamics of the planet's atmosphere produce violent storms. All of these phenomena and more can mean suffering and death for living things.

Particular storms, development of cancers, and other natural evils would not have to happen. Their origins lie in the realm of chaotic phenomena whose consequences do not follow in a deterministic manner—the butterfly effect in connection with the weather is a classic example. Chaos theory tells us that there is some flexibility in the linkage between events, and God has some freedom to determine the course of action without any "violation" of the laws of physics. But in an evolving biosphere on a dynamic planet, some cancers, some storms, and some earthquakes will occur. As a consequence of the way God has chosen for creation to move toward its goal, natural evil is necessary. It is part of the natural world that we inhabit.

The fact that creation has been given freedom to develop in accord with the character with which God has endowed it has been called by John Polkinghorne "the free process defense" against criticisms for the natural evil that occurs in the world.[25] This is a parallel to the way in which human freedom to choose has often been used to justify the creation of a world in which moral evil is a possibility.

That is certainly not a proof, in any strict sense, that God is justified in creating such a world, and whether or not it will be a convincing apologetic argument will depend on the interests and concerns of those to whom it is addressed. In any case, the free process defense is best presented in connection with a theology of the cross. There is a price to be paid for the freedom of creation, and God shares in paying that price.

The Creator is not an absolute monarch who forces creatures through millions of years of struggle, suffering, and dying without being affected by those things. Instead, the one through whom all things were created "was made flesh," and became a participant in creation to the extent of suffering and dying a painful death. ("Flesh," *sarx*, is a way that the Bible often refers to humans in their weakness and vulnerability.)

The passion and death of Jesus Christ, and indeed his whole life of sharing in the human condition, was more than God's temporary stratagem. If, as Luther said, "true theology and recognition of God are in the crucified Christ," then the passion shows us the character and typical *modus operandi* of the divine. God did not first feel the world's pains when Jesus was nailed to the cross. "The compassion of human beings is for their neighbors," the Book of Sirach (18:13) says, "But the compassion of the Lord is for every living thing."

We can even suggest that God would not have created the kind of universe we inhabit without intending to share in its sufferings and eventually to become a participant in it. Surely God knew the kinds of things that could happen in a world given freedom to develop! Ninian Smart and Steven Konstantine express this in untraditional language as part of their enterprise of using concepts of other world religions to present a Christian theology:

> But the Christian God is not a blissful God, or rather she is not a wholly blissful God. There is always the thought of the bodhisattva: that we cannot remain purely happy knowing that other beings suffer. We cannot be happy until all are happy. That bodhisattva sentiment would itself cast a shadow on the light of bliss. It therefore figures that the Bodhisattva God would not create a cosmos, however glorious, unless she herself were willing to suffer: and that would mean entering this very cosmos. So theism already impels us towards that vision of the suffering servant.[26]

This is already implied in two New Testament texts. First Peter 1:19–20 and Revelation 13:8 speak of Christ as the sacrificial lamb destined (respectively) before or from "the foundation of the world."[27] Not only the incarnation but also the cross was part of God's plan from the beginning.

The Inevitability of Moral Evil

Things change when moral agents, humans, come into being through the evolutionary process. But before we consider moral evil, we should note two things about this transition.

To begin with, we should remember that while we are often concerned with the evil effects that our choices can have on other creatures, moral agency should be understood in the context of what we may call theological agency. Sin is, first of all, a matter of relationship with God rather than with other creatures. That is why the First Commandment comes first and is the way Paul speaks about the problem of sin in Romans 1: Failure to acknowledge God as creator has as its consequence all the bad things people do to one another.

In addition, humans are still part of the natural world. Things that operate according to the laws of physics, our brains, are involved in the choices we make—whether moral, immoral, or indifferent. And whatever our views on free will may be, the physical operations of our brains, like all other things that happen in the world, take place with divine cooperation.

The question with which we have to deal here is, why did the earliest humans, hominids who had become theological and moral agents, choose to behave in sinful and immoral ways? Was this really just another example of natural evil, something written into our DNA as a result of natural selection?

The ancestors of those first humans would have been members of their species who were most successful in competition with others for food, breeding opportunities, escape from predators, and other survival needs. They could not be called "immoral" because they killed, deceived, were sexually promiscuous, and did other things that would be wrong for their human descendants. But the first humans would have had strong propensities for the same types of behavior because those behaviors had made possible many generations of evolutionary success. That is how natural selection works, and while natural selection is not the whole story of evolution, it is at least a significant part of it.

This is not purely theoretical. Studies of our closest primate relatives show that they behave in ways that are consistent with what natural selection leads us to expect.[28] There are many examples of cooperative behavior among other primates but also many examples of actions that would be considered immoral if humans did them.

We can think of the first humans as at the beginning of a road along which God wants to lead them and their descendants to fully mature humanity and complete fellowship with God. In principle, they can follow that road but it will not be easy. They have inherited traits that enabled their ancestors to survive and pass on their genes, traits that tend to produce behaviors beneficial for the individual and close relatives rather than for the larger community God intends. (In the following, I will simply call such behavior "selfish.") As evolutionary biologist Ernst Mayr put it bluntly, "Altruism toward strangers is a behavior not supported by natural selection."[29]

But selfish behaviors were not hardwired into genes because, in spite of some popular expositions, behaviors are not coded for that directly in DNA. Even language of a gene for some physical condition such as cancer is inaccurate because what is involved is generally a gene whose presence means that there is an increased probability of the disease. Inherited tendencies toward selfish behavior would, however, have been very strong. Although today our hereditary tendencies for these behaviors are often augmented by cultural conditioning to "look out for number one," we are not compelled to act in accord with those tendencies. "My genes made me do it" is always an overstatement.

Nevertheless, tendencies toward immoral and sinful behavior would have been very strong for the first humans, and in the course of time, the chances of always resisting temptation would have become increasingly slight. In the language of Reinhold Niebuhr, sin was not "necessary" but it was "inevitable."[30]

This distinction may seem slight but it is important both for scientific and for theological reasons. In the first place, it keeps us from being beguiled by the "gene myth,"[31] the idea of strict genetic determinism. In addition, while God certainly knew that sin would indeed be inevitable in the kind of world he created, sin cannot be attributed directly to God.

The inevitable sins of the earliest humans eventually resulted in a situation in which all people from birth

would live in a culture of estrangement from God. That culture, together with continuing hereditary tendencies toward selfish behavior, is responsible for the universal problem of sin, and is the reason why God needed to act to save us in Jesus Christ. An understanding of the atoning work of Christ that coheres with the evolutionary picture that has been sketched is not our task here, but I have dealt with the subject in another place.[32] It must suffice to say that the central feature of God's work of new creation, turning creation back toward the goal God intends, is the destruction of idolatrous faith and creation of genuine faith in the true God through the death and resurrection of God incarnate. ✞

Notes

[1]A collection of writings on the subject by authors ranging from Plato to the twentieth century is Mark Larrimore, ed., *The Problem of Evil: A Reader* (Malden, MA: Blackwell, 2001).

[2]E.g., Gerhard von Rad, *Genesis: A Commentary*, rev. ed. (Philadelphia, PA: Westminster, 1972); Claus Westermann, *Genesis 1–11: A Commentary* (Minneapolis, MN: Augsburg Fortress, 1984).

[3]E.g., David Wilcox, "Finding Adam: The Genetics of Human Origins," in *Perspectives on an Evolving Creation*, ed. Keith B. Miller (Grand Rapids, MI: Wm. B. Eerdmans, 2003), 250–52; Dennis Venema and Darrel Falk, "Does Genetics Point to a Single Primal Couple?," blog entry, April 5, 2010, *Biologos,* http://biologos.org/blog/does-genetics-point-to-a-single-primal-couple#.

[4]George L. Murphy, *Models of Atonement: Speaking about Salvation in a Scientific World* (Minneapolis, MN: Lutheran University Press, 2013), chapter 4.

[5]F. Staudenmeier, "*eine dichtende Lüge,*" quoted in Georges Florovsky, *Creation and Redemption,* vol. 3 of Collected Works of Georges Florovsky (Belmont, MA: Nordland, 1976), 50.

[6]Edward Gibbon, *The Decline and Fall of the Roman Empire*, vol. 1 (New York: Random House, n.d.), 69.

[7]Joseph M. Hallman, *The Descent of God: Divine Suffering in History and Theology* (Minneapolis, MN: Augsburg Fortress, 1991).

[8]Gregory Thaumaturgus, "To Theopompus, on the Impassibility and Passibility of God," in *The Fathers of the Church*, vol. 98 (Washington, DC: The Catholic University of America Press, 1998), 152–73.

[9]The Heidelberg theses are found in *Luther's Works* 31 (Philadelphia, PA: Fortress Press, 1957), 37–70. I quote from Gerhard O. Forde, *On Being a Theologian of the Cross: Reflections on Luther Heidelberg Disputation, 1518* (Grand Rapids, MI: Wm. B. Eerdmans, 1997), 72.

[10]Ibid., 77.

[11]Ibid., 80.

[12]Martin Luther, "On the Councils and the Church," in *Luther's Works*, vol. 41 (Philadelphia, PA: Fortress Press, 1966), 104.

[13]Ibid., 103.

[14]For discussion see Eberhard Jüngel, *God as the Mystery of the World: On the Foundation of the Theology of the Crucified One in the Dispute between Theism and Atheism* (Grand Rapids, MI: Wm. B. Eerdmans, 1983), 64.

[15]Kazoh Kitamori, *Theology of the Pain of God* (Richmond, VA: John Knox Press, 1963); Jüngel, *God as the Mystery of the World*; Jürgen Moltmann, *The Crucified God: The Cross of Christ as the Foundation and Criticism of Christian Theology* (New York: Harper & Row, 1974).

[16]For a survey of views of divine action, see Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues* (San Francisco, CA: HarperCollins, 1997), chapter 12.

[17]For the following, see George L. Murphy, "God's Action in the World," chap. 6 in *The Cosmos in the Light of the Cross* (Harrisburg, PA: Trinity Press International, 2003), 74–92.

[18]Ibid., 88–91.

[19]George L. Murphy, "Divine Action and Divine Purpose," *Currents in Theology and Mission* 36, no. 1 (2009): 32–38.

[20]Westermann, *Genesis 1–11*, 177.

[21]A. G. Hebert, *The Throne of David* (London: Faber and Faber, 1941), chapter 6.

[22]See the essays in Miller, ed., *Perspectives on an Evolving Creation*.

[23]Howard J. Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8, no. 1 (1996): 21–38; George L. Murphy, "Chiasmic Cosmology and Creation's Functional Integrity," *Perspectives on Science and Christian Faith* 53, no. 1 (2001): 7–13.

[24]Athanasius, "On the Incarnation of the Word," in *The Nicene and Post-Nicene Fathers*, 2nd ser., vol. 4 (Grand Rapids, MI: Wm. B. Eerdmans, 1978), 37.

[25]John Polkinghorne, *Science and Providence: God's Interaction with the World* (London: SPCK, 1989), 66–67.

[26]Ninian Smart and Steven Konstantine, *Christian Systematic Theology in a World Context* (Minneapolis, MN: Fortress Press, 1991), 205–206.

[27]G. B. Caird, *The Revelation of St. John the Divine* (New York: Harper & Row, 1966), 168, makes the case for the translation "the lamb slaughtered from the foundation of the world" (cf. KJV and NRSV margin) in Revelation 13:8.

[28]E.g., Richard E. Leakey and Roger Lewin, "Murder in a Zoo," chap. 16 in *Origins Reconsidered: In Search of What Makes Us Human* (New York: Doubleday, 1992), 278–94; Carl Sagan and Ann Druyan, "Gangland" and "Mortifying Reflections," chaps. 14 and 15 in *Shadows of Forgotten Ancestors* (New York: Random House, 1992), 257–92.

[29]Ernst Mayr, *What Evolution Is* (New York: Basic Books, 2001), 259.

[30]Reinhold Niebuhr, *The Nature and Destiny of Man* – Vol. 1, *Human Nature* (New York: Charles Scribner's Sons, 1964), 150.

[31]Ted Peters, *Playing God? Genetic Determinism and Human Freedom* (New York: Routledge, 1997).

[32]Murphy, *Models of Atonement*.

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At *The Crossroads of Science and Faith:* An Astronomy Curriculum

Susan D. Benecchi, Gladys V. Kober, and Paula Gossard

"Astronomy compels the soul to look upwards and leads us from this world to another."
–Plato, The Republic

Inspiration and Vision

When I (Susan) was a child, my parents handed me a flashlight at the Grand Canyon, expecting me to light their path. Instead I pointed it upwards, asking them to identify the stars in the sky. I can't recall a time when I was not interested in studying the heavens, and although I grew up in a Christian home, my parents did not dissuade me from doing so. They encouraged my interest in math and science while also affirming God's sovereignty. I never questioned the integration of my faith with my study of astronomy, as I always viewed my interpretation of the world around me through the lens of God as the Creator. Unfortunately, this is not the experience of many children in Christian homes today.

After completing my doctorate in planetary astronomy and becoming a research scientist, professor, and mother, I became even more sensitive to the influence that parents and communities have on their children. This is obviously good; however, as children age it is important for them to learn how to evaluate for themselves the information they encounter in the world around them instead of avoiding the tough questions. It is easy to fall into the trap of teaching children *what* to think, instead of training them *how* to think based on a set of biblical principles. My search for training resources found them inadequate, especially when it came to science.

A few years after I finished graduate school, one of my graduate advisors contacted me about a new online homeschool program, Freedom Project Education (FPE), which was looking for a physics teacher who was willing to include a discussion of faith as part of the curriculum. Although my free time was limited, I was intrigued and ended up taking the position, offering one course a semester.

The first year I had three students; the next year, ten; and the following year, thirteen. Using Adobe Connect as our "classroom," I spent a few lectures each semester talking with my students about worldview and how it influences or colors our understanding of everything else in life. Each student had a microphone, enabling discussion. I assigned my students a project each semester that required them either to investigate the worldview of scientists or to critically analyze specifically chosen science fiction books that integrated a particular worldview with physics- or astronomy-related content. I also required them to identify their own worldview, to determine whether their worldview agreed with or differed from that of the book, author, or scientist, and to critically discuss the various perspectives. My students wrote papers and presented their work to the class in an oral presentation. (They submitted their slides to me, and I put them in control of the "classroom." They are not seen, but are heard by their fellow classmates. After the presentation, the students ask questions.) The feedback I received from my students and their parents was very positive. I was especially thrilled when a student told me during online "office hours," that he had never really considered God, and that the project had encouraged him to think more seriously about his life convictions.

Susan Benecchi *earned her PhD in planetary astronomy at MIT. She is a Senior Scientist at the Planetary Science Institute and an instructor with Freedom Project Education.*

Gladys Kober *earned an MA in astrophysics in Brazil and was on the staff of the Planetarium of Rio de Janeiro. She is now a data analyst in astronomy at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and an adjunct faculty member at Montgomery College.*

Paula Gossard *is a professor of science and science education at Cairn University. She has a MEd from George Mason University, and earned her PhD at the University of Southern Mississippi.*

At about the same time, I was contacted by Gladys Kober about providing an interview concerning the new textbook, *The Crossroads of Science and Faith: Astronomy through a Christian Worldview* (figure 1), that she and Ashley Zauderer had started working on. They had found my contact information through a Christian astronomers' mailing list to which we all belonged. I provided the interview, but also commented to them that I would love to be more involved with the project if they were interested; we also discovered that we were all located in the Washington, DC, area. Gladys and I met at a local coffee shop, and she shared with me their vision for the textbook and the special concerns they hoped to address. I was thrilled, since it was a dream of mine from childhood to be involved in such a publication.

A Calling for Gladys

Some time earlier, Gladys had been introduced to Ashley through a mutual friend; they began working together, presenting workshops for homeschool moms about how to relate scientific discoveries in astronomy to the Christian faith. The workshops were well received, but the same question arose repeatedly: where is the textbook to help us teach this material? At the time, it did not occur to Gladys that she would be inspired to write a textbook; however, it was not long before God began to lay the foundation for the project.

Gladys is from Brazil and travels there yearly to visit her family. Brazil is a country where few books are available about science and faith, and even fewer are written in the native Portuguese language. Gladys had been involved in getting Fred Heeren's book *Show Me God*[1] published in Portuguese; she began to wonder about publishing other such books. However, based on her previous experience of the significant investment in time required to get one book translated (contacting the author and publisher, translating the book, making sure that all technical terms had been correctly translated, and then producing the final product), she considered whether it might not be easier to write similar books directly in Portuguese. Feeling convicted about the idea, she said a simple prayer:

> God, writing a book is an enormous investment of time, and I don't feel this is my gift. There is no way I will attempt to write a book, unless you are very clear that this is what you want me to do. The only

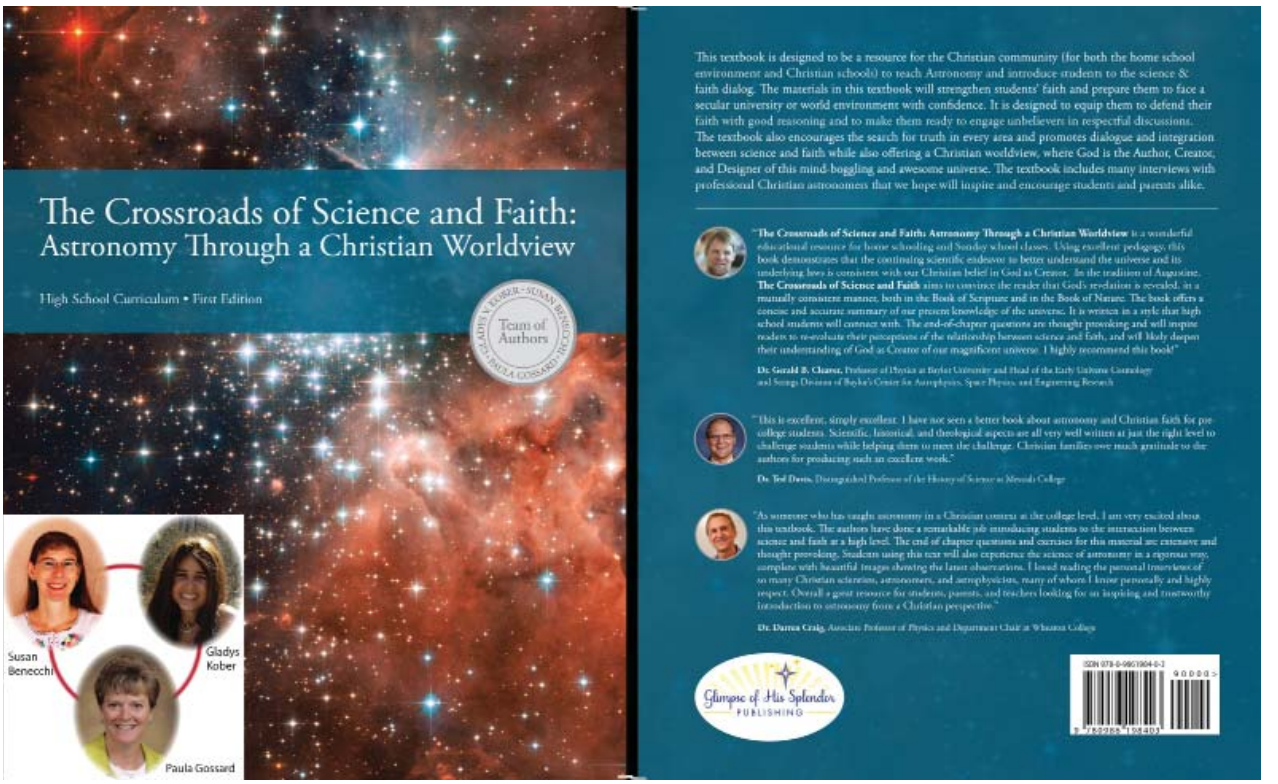


Figure 1. Textbook cover with inset of photos of the co-authors. The first printing was in March 2015. This one-year curriculum contains two parts. Part I is an introduction to the science and faith dialogue. Part II focuses on astronomy as a scientific discipline.

> way I would invest so much time in writing a book is if I'm sure it is from you.

While Gladys was in Brazil feeling God's conviction to work on a book, a friend in the US was praying for her, and felt strongly that God was telling her to contact Gladys about writing an astronomy textbook in English for homeschoolers. They met when Gladys returned to the USA, and the coincidence was too great to ignore. Although it was not what Gladys had in mind, the more she thought and prayed about it, the more it made sense. The homeschool moms had been asking her for such a textbook. Knowing that she had the gift of teaching, she reasoned that writing a textbook was really an extension of her teaching expertise; thus, the textbook project was born. Although the project took 4–5 years to complete, she realizes, in retrospect, that when the journey is long, if the vision is from God, he will give the strength and motivation to keep moving forward despite times of discouragement. Gladys testifies that "when God calls, he equips and provides all the help we need."

The Textbook

We felt a strong calling to help parents bridge the gap between science and faith. The textbook has a dual focus. The first part focuses on science/faith issues. We introduce students to a wide variety of worldviews, with the aim of helping students to identify their personal worldview. We discuss the search for truth from both a scientific and a religious perspective, with the desired outcome that students would understand the importance of dialogue and integration between the two, instead of conflict or independence (figure 2).[2] The section also provides a guide for helping students to develop logical arguments while avoiding common logical fallacies, enabling them to examine and defend their personal faith and worldview with sound reasoning. In addition, it provides students with tools to better relate their beliefs to what they learn about science.

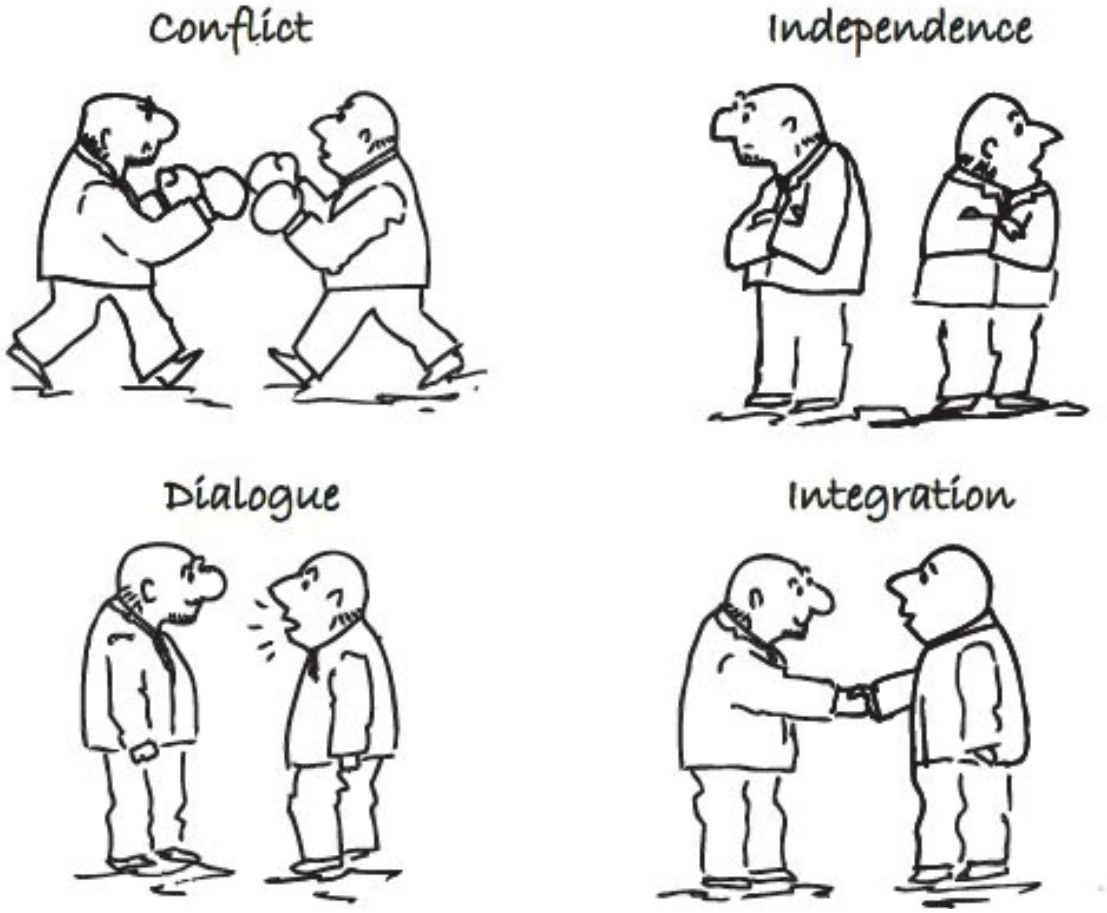


Figure 2. Barbour's four views (Conflict, Independence, Dialogue and Integration) that categorize relationships between science and faith. Our aim is that students, and Christians in general, move from viewing modern scientific inquiry and faith as either in conflict or independent from each other, to viewing them as partners for dialogue and integration.

The second part of the book presents the discipline of astronomy through a typical scientific understanding. The unique part of this section is the inclusion of interviews with professional astronomers who also hold a Christian worldview. The interviews include a combination of personal testimonies plus advice for students who might be interested in pursuing careers in astronomy or other science, technology, engineering, and math (STEM) fields. Many of these same professionals reviewed our chapters for scientific accuracy. When Gladys shared this vision with me, I was very interested and immediately began working on the astronomy chapters.

As an astronomer, I focused on reviewing and writing a few of the astronomy chapters. Gladys then met Paula Gossard, a Christian professor of science and science education, at an American Scientific Affiliation (ASA) annual meeting, and Paula was brought on board to edit and improve the science/faith chapters.

Gladys and I tried to meet monthly to discuss our progress, although we never set a specific deadline for completing the book. We had also decided to self-publish because we wanted to define the content of the book instead of being beholden to a particular textbook company's desires.

We view that parents are looking for curricula that will help their children to become mature adults, adhering to the faith of their upbringing, and that will teach them how to discuss their beliefs in relation to many current scientific discoveries. To add to a perceived polarization of science and faith, a few scientists have included an atheistic worldview along with their teaching of science as if it were part of science itself. As a result, many parents avoid materials they consider controversial, and students later come to believe that they must choose between science and their faith.[3] The keys to bridging this gap are professional astronomers who hold to a Christian worldview and who can speak both languages, understanding the complexities of both communities.

The role of science educators should be to teach science and to help students to recognize different worldviews, but not to impose their own personal worldview on their students. Science is well received by Christians when it is presented not as a threat to faith, but rather as a complementary way to understand God, leading to a more integrated view of reality. We determined that the book should provide students with the following:

1. An understanding of the relationship between faith and science with the goal of helping students to identify and integrate their own worldview;
2. Accurate astronomical information;
3. Inspiring testimonies and advice from professional astronomers who have wrestled with science/faith issues and have found a coherent relationship between the two;
4. Exercises to encourage precise thinking about faith and science and how they interact.

In the summer of 2014, we recognized that the book was close to completion. Knowing that homeschoolers are most likely to adopt new curricula at the beginning of a school year, we set a goal of going to press early in 2015 so that we could market the book for the 2015–2016 school year. We found a local printer in Baltimore and planned to debut the textbook at two homeschool conventions: (1) The Midwest Homeschool Convention, April 9–11, 2015, in Cincinnati, Ohio (figure 3) and (2) the local

Figure 3. Gladys presenting our textbook at the Midwest Homeschool Convention, April 9–11, 2015, in Cincinnati, Ohio.

Maryland State Home School Curriculum Fair, April 24–25, 2015. Gladys attended the first and we both attended the second.

As self-publishers, it was gratifying to see the proof copy of the textbook at the end of March 2015, although I think we were surprised at the thickness of the book. In November 2015, I presented the textbook at the Education session of the Division of Planetary Sciences meeting with excellent feedback from the professional astronomy community. We would like to present it at many more education material and homeschool conventions, but our resources are limited.

In the 2016–2017 school year, I will be using our textbook as the basis for my online homeschool astronomy class with FPE.

We have provided evaluation copies of the textbook to various homeschool materials distributors, to pastors, and to leaders of scientific organizations with faith-related components. In addition, Paula hopes to have the textbook evaluated and potentially supported by Veritas Press as part of her work of developing scientific curriculum for them. Gladys has engaged a number of churches to provide seminars for local congregations. We hope that this textbook will be a resource to help parents who hold tightly to particular ideologies to be less closed to current scientific discovery and more excited about how new discoveries can bolster and enable their faith. We also think that the first part of the book is appropriate for lay people in churches, for pastors, and for seminary students who are interested in science, but are intimidated about how it might affect their faith or ministry opportunities.

More information, sample chapters, and order information for the textbook can be found at: http://www.GlimpseofHisSplendor.com/. ✞

Notes

[1]Fred Heeren, *Show Me God: What the Message from Space Is Telling Us about God*, 2nd rev. ed. (Wheeling, IL: Day Star Productions, 2004).
[2]Ian G. Barbour, *When Science Meets Religion: Enemies, Strangers, or Partners?* (New York: HarperCollins, 2000).
[3]David Kinnaman, *You Lost Me: Why Young Christians Are Leaving Church … and Rethinking Faith* (Grand Rapids, MI: Baker Books, 2011).

ASA Members: Submit comments and questions on this communication at www.asa3.org→FORUMS→PSCF DISCUSSION.

"For the perishable must clothe itself with the imperishable, and the mortal with immortality." –1 Cor. 15:53

Premeeting Workshops

offered at the

2016 ASA Annual Meeting

Azusa Pacific University
Azusa, California

July 22, 2016

Five Online Sunday School Lessons on Science and Religion

Denis Lamoureux, Facilitator
Associate Professor of Science & Religion
St. Joseph's College, University of Alberta

This morning workshop is an overview of introductory topics in science and religion that can be used in Sunday schools. Lessons include (1) Beyond the "Evolution" vs. "Creation" Debate, (2) Ancient Science in the Bible, (3) Intelligent Design: Delusion or Divine Revelation? (4) Galileo the Theologian, and (5) Darwin's Religious Beliefs. The five lessons are online with four hours of audio-slides lectures, handouts, discussion guides, and reading material: http://www.ualberta.ca/~dlamoure/sswl.html.

Genomic Biotechnologies in Medicine—What Can Be Done, and What Should Be Done?

Douglas Lauffenburger, Facilitator
Professor of Biological Engineering
Massachusetts Institute of Technology (MIT)

This afternoon workshop will describe the state of, and expectations for, biotechnologies aimed at addressing medical problems in the post-genomic era. Examples include pre-natal genome sequencing, CRISPR-based genome editing, stem cell programming, and gene drive-mediated modulation of environmental pathogens. The ongoing advances in capabilities of these emerging technologies, as well as their continuing technical challenges, will be described, along with an outline of potential ethical, social, and spiritual implications for discussion.

Register at
www.asa3.org

Carol A. Hill

How the Book, *Can Noah's Flood Explain the Grand Canyon?*, Came to Be

Carol A. Hill

This is the story of how the book The Grand Canyon, Monument to an Ancient Earth: Can Noah's Flood Explain the Grand Canyon?, *ed. Carol Hill, Gregg Davidson, Wayne Ranney, and Tim Helble (Grand Rapids, MI: Kregel Publications, 2016), ISBN-13: 978-0825444210, came to be published and how the American Scientific Affiliation (ASA) and others supported its publication.*

The Meeting

Five years ago at the October 2010 meeting of the Geological Society of America (GSA) in Denver, Colorado, Carol Hill and Gregg Davidson were presenting in different GSA sessions and happened to sit next to each other at a restaurant. Carol had never met Gregg before, but as fellow geologists "shop talk" was easy, and soon the topic turned to the Grand Canyon. It was then that Carol expressed her vision to Gregg about publishing a book for the lay public as to why the young earth creationist (YEC) position of "flood geology" (FG) cannot explain the Grand Canyon.

Flood geology is the global-flood position in which almost all sedimentary rock on planet Earth is considered to have been deposited in the single year of Noah's flood. Carol was skeptical that such a book would ever be published as it seemed to fall in "no-man's land," where it was too religious to interest secular publishers, and too science-focused or controversial for Christian publishers. But when Gregg mentioned he had experience with micropublishing companies that handled science-scripture books of this nature, Carol jumped at the opportunity and the two agreed to look into the matter.

The Authors

Carol immediately began thinking about possible authors for the different geologic topics that would need to be covered. She felt that the authors of these chapters should be picked—not on the basis of their being Christians or non-Christians—but on their professional expertise both in the Grand Canyon and elsewhere, and on their experience in dealing with YECs. The first geologist that came to mind was Wayne Ranney, whom Carol had worked with in the Grand Canyon since 2000.[1] She knew that Wayne was an excellent writer for the lay public, having published *Carving Grand Canyon*, which in its two editions has sold more than 30,000 copies.[2]

The next person Carol contacted was Steve Moshier of Wheaton College, with whom she had worked in 2003–2004 on

Carol A. Hill *has been working in the Grand Canyon for over seventeen years and has published articles on the geology of the canyon in* Science, Geomorphology, Journal of Hydrology, *and* Geosphere. *Her specialty is caves and karst, and she is the author of* Cave Minerals of the World, Geology of Carlsbad Cavern, *and* Geology of the Delaware Basin. *She has been featured on* NOVA *and on* Naked Science, *a program of* National Geographic. *Carol is a Fellow of the American Scientific Affiliation and has written a number of articles for* Perspectives on Science and Christian Faith.

an ASA science book project that was not completed, and in 2009 on a *Perspectives on Science and Christian Faith (PSCF)* critique of flood geology and the Grand Canyon.[3] Steve was an excellent resource on the various sciences such as stratigraphy, but especially valuable was his knowledge of how young earth creationism fits historically with modern geology. Just the person we needed!

Then Carol thought of Ken Wolgemuth, with whom she had worked in 1990 and 1999 when publishing two papers for the *American Association of Petroleum Geologists* (AAPG) *Bulletin*.[4] Since Ken had supervised book publications for the AAPG, he would be an excellent resource person for managing our book. Also, Ken had founded Solid Rock Lectures (SRL) in 2008 for the purpose of reaching seminary students—one of the prime target audiences for the book—so this was another definite plus.

Roger Wiens was another who quickly came to mind. Roger is the principal investigator of the *Curiosity* Rover ChemCam project on planet Mars, and had in 1994 prepared an online article, *Radiometric Dating: A Christian Perspective,* that was posted on the ASA website.[5]

Carol also knew of two other possible authors from their articles in *PSCF:* Joel Duff and Tim Helble. Joel is a biologist, not a geologist, but his paper on the lack of fossil pollen in *any* of the rocks in the Grand Canyon was important evidence against the tumultuous global flood model of FG.[6] Tim Helble was an extremely important "find." Not only had Tim worked as a hydrologist for NOAA (National Oceanic and Atmospheric Administration) and had published in *PSCF*,[7] but he had also tracked the flood-geology literature for over 30 years. This expertise was invaluable to the rest of us with less knowledge about the claims of FG, and Tim's knowledge base eventually became the core of our book's Reference section. In addition, Tim was both an experienced cartographer and an excellent photographer who had recently retired; so with these qualifications, he became our photographic/illustration editor.

Wayne Ranney also became a photo editor since he had contacts with a number of professional Grand Canyon photographers, and because he had amassed a large personal photo collection over his 30 years of working in the canyon.

This cohort of authors was an excellent start, but we still had not identified anyone to cover the important fields of paleontology and structural geology. Carol remembered reading Davis Young and Ralph Stearley's book *The Bible, Rocks and Time*,[8] and so she contacted Ralph, paleontologist at Calvin College, who agreed to be involved in the project. In addition, Wayne suggested David Elliott of Northern Arizona

Photo credit: Wayne Ranney

Ooh-Aah Point, Viewpoint from the South Kaibab Trailhead

University to be the author of a trace-fossil chapter (trace fossils are things such as footprints and burrows). Dave's specialty is reptile and arthropod footprints in the Coconino Sandstone (again, another person much needed!); along with our botanist Joel Duff, we now had three on board in the fossil department.

The last author to be contacted, Bryan Tapp, a structural geologist at the University of Tulsa, was suggested by Ken Wolgemuth, and together they authored the two chapters on plate tectonics and structural geology. The addition of Bryan fixed the "Canyon's eleven."[9] As we later came to realize, these authors seemed providential because they all turned out to be perfect for the job.

The Philosophy

Carol and Gregg felt that setting a "philosophical" basis for the book was important for establishing its overall purpose and construction; therefore, before writing even began, they discussed the "mindset" of YEC/FG and the best way to challenge flood geology with the facts of modern geology. Young earth or flood geology adherents often claim that we are all looking at the same data but that our different worldviews cause us to "see" the data as evidence for vastly different and conflicting processes. The underlying assertion is that we are all practicing good science, but are arriving at different interpretations of the data because of the biblical or humanistic "glasses" each person wears. Gregg and Carol decided that, since flood geologists argue that their *geologic* interpretations *are* in fact testable by scientific investigation, we would do what other scientists do with controversial subjects: we would evaluate each FG claim on its *scientific merit* while keeping in mind the cultural context of the biblical flood story.

The next philosophical issue to be addressed by our enlarging author group was, How confrontational should we be with flood geologists? "Debates" between modern geologists and flood geologists notoriously generate more heat than light, and our intent was for our book to be a true exposition of the science involved—not a book that would generate angry, reactionary responses from many of the people it was intended for. The scriptural passage that seemed to best fit this issue was "Speak the truth in love" (Eph. 4:15), and that is what we tried to do: be as irenic as possible while presenting the geologic evidence that denied the FG position of a young earth and global flood.

After deciding on a respectful, yet truthful, approach, now came the hard task of deciding how to present evolution. Evolution is a confrontational subject in some Christian churches, and even the mention of the "E-word" can be divisive between Christian believers. And divisiveness was not what any of the "Canyon's eleven" wanted! We wanted our readers to come to our book with open minds on the subject of evolution. Ralph Stearley was especially helpful in this regard, as he had taught paleontology at Calvin College for many years and knew how to present this tough topic. After much deliberation, we decided to let the data of biostratigraphy stand on its own; that is, the amazing order to fossils in geologic strata is an empirical and noncontroversial fact which has been reified by thousands of amateur rockhounds as well as by professionals. Fossils also elegantly testify

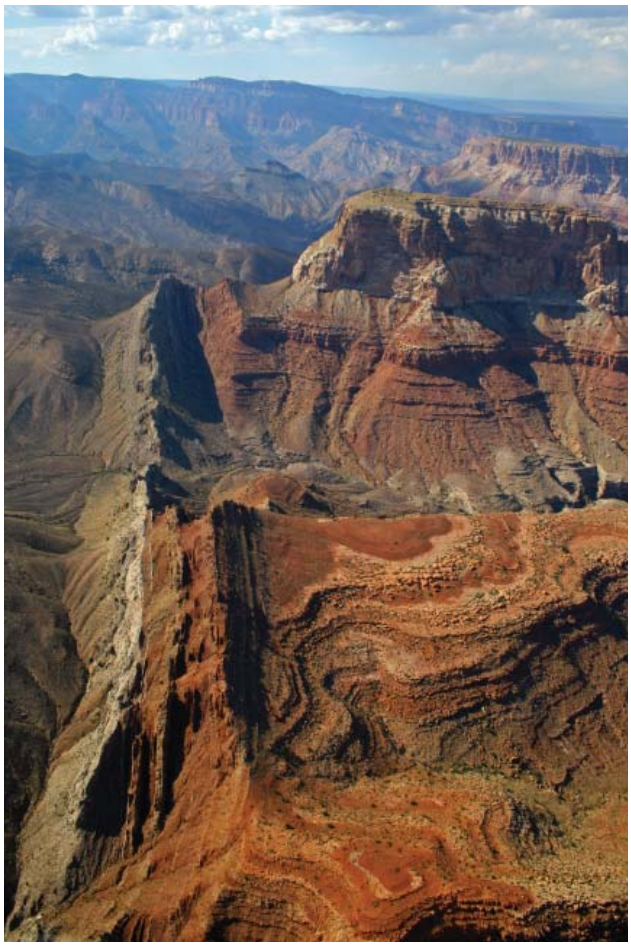


Photo credit: Wayne Ranney

Aerial View of Butte Fault

to a long sequence of ancient environments and ecological communities—not to a single, one-size-fits-all catastrophe as per a global flood geology model. The best way to proceed, we felt, was to keep our focus on the plain, empirical record of fossil occurrences; respond firmly to some sad half-truths perpetuated in the flood geology literature about the fossil record; and allow the wonderful, providentially guided history of life to speak for itself.

Surmounting the next hurdle was to prove especially difficult: how to maintain a lay-reader level of writing for all twenty chapters written by eleven different authors. Geologists are not well known for their ability to write simply for a lay audience, but rather for expounding on their different areas of expertise in geologic terms. Providently for us, in Gregg Davidson we had exactly the right person to perform this difficult task. Gregg knew how to make scientific language easy to read and, as a result, the transitions from idea to idea and chapter to chapter flow flawlessly. This was extremely important because our goal was not just to challenge the precepts of flood geology, but to teach the various disciplines of modern geology simply and understandably so that lay persons could judge for themselves why flood geology presents insurmountable problems to a logical interpretation of the natural world.

Photo credit: Bronze Black

Fossil Corals and Bryozoans in the Redwall Limestone

The Funding

The hardest problem we faced was funding. What would it take to get the attention of a publisher that could reach the Christian community, our primary audience? A normal synopsis of the book? No! A preliminary layout of a book containing many professional color photos that could potentially be sold at the Grand Canyon with its more than 5 million visitors a year?[10] Yes! The question then was, How do we raise the money for this initial lay out? Again providentially, we had Ken's expertise with AAPG publications and oil-industry contacts, which enabled him to invite contributions to this important public education effort. Most geologists have heard about YEC and flood geology, and knowing how it degrades geological education, many of those approached by Ken expressed their appreciation that we had taken on this project.

Another source of funding came through the John Templeton Foundation to BioLogos,[11] with the specified intent of exploring and promoting the intersection of science and Christian faith. In 2012, BioLogos received a large grant from Templeton and, in turn, BioLogos awarded smaller grants to various applicants and organizations, among which were three of our book's authors: Gregg, Ralph, and Steve. These awards and interactions with people from the John Templeton Foundation and BioLogos contributed both intellectually and financially to our Grand Canyon book project.

As well, the American Scientific Affiliation has played a significant role in supporting the publication of our Grand Canyon book—in ways both subtle and financial. By "subtle" it is meant that we all gain from our membership in the ASA by obtaining intellectual and theological knowledge, companionship, and people contacts. Specifically for this book, Carol's ASA contacts (direct or indirect) with Steve Moshier, Ken Wolgemuth, Roger Wiens, Gregg Davidson, Joel Duff, Tim Helble, and Ralph Stearley were invaluable in identifying the right coauthors. ASA Executive Director Randy Isaac was especially helpful in that he provided valuable conceptual sup-

port and encouragement for the project. Financially, the ASA has supported this book by a generous contribution to its publication. As mentioned earlier, in 2003–2004, Steve and Carol were involved in an ASA education project that was not completed. Funds unused and some of the content for this effort were made available for the publication of our book.

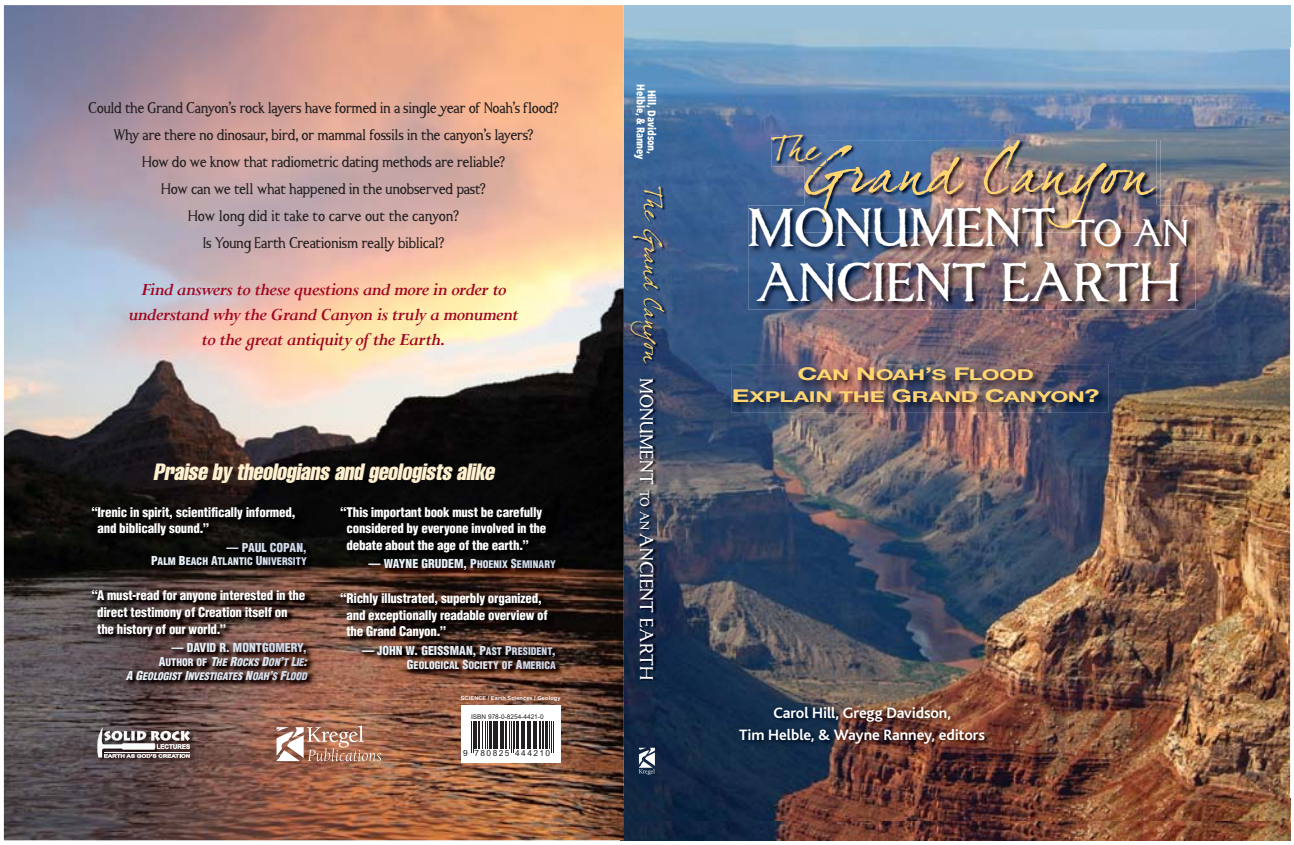
The Publisher

From the beginning of the project, we desired to have a Christian publisher in order to reach our primary audience. However, to be thorough, Ken and Gregg pursued secular, association, university, and Christian publishers for several years by writing and visiting with publishers (with rough drafts of the book in tow) at meetings of the Geological Society of America and the Evangelical Theological Society. Ultimately, Kregel Publications accepted the book for publication, and we were overjoyed! We were also blessed that Kregel selected a layout artist who lives in Tulsa where Ken lives, one who had years of experience doing geology books. All authors have graciously agreed that Solid Rock Lectures will be the copyright holder, and royalties are assigned to SRL for marketing and for continuing its outreach to seminaries and the Christian community. For each of us "Canyon's eleven," it has been a labor of love to promote sound biblical and scientific understanding.

The Purpose

We could not envision the overall purpose of our book when we began; rather, it evolved over time as the authors settled into their subjects, as editing of the chapters progressed, and as the photos began to enhance and enliven the writing of the text. The purpose of the book, as we might define it now, includes the following major goals:

- Explain to lay persons in simple terms that they can understand, why Noah's flood—as portrayed by flood geology—cannot explain the Grand Canyon or any other geologic landscape.
- Teach the basic principles of geology to lay persons by drawing them into the Grand Canyon using the most beautiful photos possible.
- Teach why flood geology is *not* science.
- Use our book as a beginning geology textbook in secular and Christian colleges and universities in order to educate students as to how modern geology differs from flood geology.



- Use our book in seminary workshops to equip future pastors to deal with science/scripture issues.
- Provide our book as a training aide for teachers and others who want to know exactly what YEC/FG are claiming, in order to be able to talk knowledgeably to classes, groups, family, and friends.

The Book

In September of 2016 there is another GSA meeting in Denver. The completed book, six years earlier only envisioned by Carol and Gregg, will now be available—and not only at this meeting, but also at other geological meetings. The book arrived at eight Grand Canyon Association bookstores in time for the 2016 spring influx of visitors. It is now available on Amazon.com and other online venues.

Can Noah's Flood Explain the Grand Canyon? is 240 pages long and is filled with professional photographs, all in full color. Most important, all eleven authors believe that we have honestly tried to explain why the YEC/FG interpretation of planet Earth's age at only 6,000 years old, and of Noah's flood as global in extent, is fallacious—it is *not* supported by the geologic evidence found in the Grand Canyon or anywhere else on Earth.

Why does it matter who is right and who is wrong? We end our book with this answer: *"Truth always matters!"* ✞

Acknowledgments

The author would like to acknowledge the hard work and dedication of all of the coauthors of this Grand Canyon book. Without each one of them and their expertise, this book would not have been possible. She would also like to thank Gregg Davidson, Ken Wolgemuth, Steve Moshier, and Ralph Stearley for their helpful reviews of the manuscript. We (all of the authors) thank Bronze Black and Susan Coman for their "long-suffering" in dealing with the many changes in layout that this book underwent over many months. We also thank the ASA, BioLogos, and the John Templeton Foundation for their financial and administrative support. Finally, we would like to thank Dennis Hillman and others of Kregel Publications for their enthusiastic willingness to publish this book.

Notes

[1]C. A. Hill and W. D. Ranney, "A Proposed Laramide Proto-Grand Canyon," *Geomorphology* 102 (2008): 482–95.
[2]W. D. Ranney, *Carving Grand Canyon* (2005; Grand Canyon, AZ: Grand Canyon Association, 2012), 160 (1st ed.) and 190 (2nd ed.).
[3]C. A. Hill and S. O. Moshier, "Flood Geology and the Grand Canyon: A Critique," *Perspectives on Science and Christian Faith* 61, no. 2 (2009): 99–115.
[4]C. A. Hill, "Sulfuric Acid Speleogenesis of Carlsbad Cavern and Its Relationship to Hydrocarbons, Delaware Basin, New Mexico and Texas," *American Association of Petroleum Geologists Bulletin* 74, no. 11 (1990): 1685–94; C. A. Hill, "Reevaluation of the Hovey Channel in the Delaware Basin, West Texas," *American Association of Petroleum Geologists Bulletin* 83, no. 2 (1999): 277–94.
[5]R. Wiens, "Radiometric Dating: A Christian Perspective," (2002), http://www.asa3.org/ASA/resources/Wiens.html.
[6]R. J. Duff, "Flood Geology's Abominable Mystery," *Perspectives on Science and Christian Faith* 60, no. 3 (2008): 166–77.
[7]T. K. Helble, "Sediment Transport and the Coconino Sandstone: A Reality Check on Flood Geology," *Perspectives on Science and Christian Faith* 63, no. 1 (2011): 25–41.
[8]D. A. Young and R. F. Stearley, *The Bible, Rocks and Time: Geological Evidence for the Age of the Earth* (Downers Grove, IL: InterVarsity Press, 2008), 510.
[9]Term coined by Davis Young in his endorsement of our book.
[10]According to the National Park Service's latest figures, about 5.5 million people visited Grand Canyon National Park in 2015, https://irma.nps.gov/Stats/SSRSReports/Park Specific Reports/Recreation Visitors By Month (1979 - Last Calendar Year)?Park=GRCA.
[11]BioLogos is a Christian foundation which is dedicated to faith-science dialog and which promotes the theology of "evolutionary creation," the unifying theme of which is that God used evolution and common descent as his tool to carry out the creation of all life.

ASA Members: Submit comments and questions on this communication at www.asa3.org→FORUMS→PSCF DISCUSSION.

Biology

THE ALTRUISTIC BRAIN: How We Are Naturally Good by Donald W. Pfaff. New York: Oxford University Press, 2015. 312 pages. Hardcover; $27.50. ISBN: 9780199377466.

The Altruistic Brain offers an antidote for the assumed selfishness of human nature common in the biological sciences by describing the neural brain mechanisms predisposed for creating trust and empathy in human relationships. Its author, Donald W. Pfaff, is a neuroscientist at Rockefeller University in New York who has investigated neural processes involved in numerous types of behavior and is now turning his attention to altruism. His altruistic brain theory (ABT) is primarily a result of his own interaction with the evolutionary and neuroscientific literature. It reflects his belief that neuroscience now offers a comprehensive perspective on the neural circuits of the human brain that explains altruistic and prosocial behavior in the human species.

His theory describes a five-step set of neural processes through which persons act benevolently toward others. In step one, the altruistic action is unconsciously represented to the person prior to the action being carried out based on the neural process of corollary discharge. Corollary discharges are copies of neural signals sent by the brain and spinal cord to the muscles that also go to sensory systems "so that the brain knows what is about to happen" (p. 55). In step two, the person who will benefit from the altruistic act is represented in the visual cortex either as the actual person currently being seen or as a generic person representing a large group of persons; this representation is based on current evidence of the neural systems involved in visual processing. In step three, the images of the recipient of the benevolent action and the self are merged through a variety of neural processes such as increased "excitatory inputs delivering the neurotransmitter acetylcholine" as well as the functional properties of mirror neurons (pp. 87–88). In step four, the outputs of steps one and three arrive at the prefrontal cortex, which evaluates the moral significance of the potential action, and because of the merger that happens in step three, the other is seen as the self which increases the likelihood of the action. In step five, the action is carried out using basic motor control mechanisms.

Pfaff presents several lines of corollary evidence for ABT that are interesting for those not acquainted with the literature. He argues that the biological basis for concern for others lies in human sexuality and parenthood. There is evidence for this thesis especially in regard to attachment theory, which is foundational for certain types of concern for others. Sexuality may be a more difficult argument to support, given the ways in which mate selection and retention strategies are not necessarily concerned with the well-being of the other; a more nuanced account using contemporary evolutionary psychology would have been helpful. Pfaff cites several current research projects exploring moral behavior including Joshua Greene's work using fMRI analysis of ethical decisions, Michael Tomasello's work with moral behavior in children, and the role of oxytocin in generosity from Paul Zak. Much of this research contributes to a broader understanding of the role of various neural mechanisms in altruistic acts. However, this research does not necessarily support ABT directly; rather, it shows that certain brain mechanisms are important for altruism more generally.

Although ABT is based on neuroscience, the theory is highly speculative regarding the moral and altruistic aspects of the mechanisms employed during benevolent actions. Most of the mechanisms are not directly altruistic in any straightforward way; they are the same mechanisms that would be operative during any type of behavior. Most of the steps of ABT are plausible but not directly tested empirically on actual persons who are performing moral actions. Rather, the theory is given as a possible explanation for various moral behaviors. This is the major drawback of the book.

Although the author often claims that his theory is scientific, there is not enough evidence to fully endorse ABT as the underlying process involved in altruistic behavior. There is some evidence in social neuroscience of the importance of representing the other, which fits ABT's step three, but nothing conclusive. Social and affective neuroscience has explored many of the neural mechanisms involved in empathy and compassion, but no comprehensive theory similar to ABT has emerged. In fact, Pfaff's theory does not interact with several contemporary perspectives in social and affective neuroscience such as those of Ralph Adolphs, Tania Singer, Claus Lamm, or Christian Keysers. Pfaff focuses more on general neural systems rather than testing these neural systems during moral or social behaviors. He does little to interact with contemporary moral psychology as well. This is a consequence of his thoroughly reductionist approach, which argues that if we just understood the altruistic brain mechanisms, moral actions would easily follow.

According to Pfaff, these altruistic brain mechanisms provide the basis for a new scientific theory of altruism that can be used to encourage more benevolent behaviors among humankind. "If we understand how the brain works, we can design a rational system of ethics having more predictable outcomes, consistent with an actual human nature undistorted by outmoded ideologies" (p. 4). Pfaff argues that several philosophical

positions on human nature are not based on the data provided by neuroscience. This is particularly interesting in his critique of Patricia Churchland, who has done considerable work in relating neuroscientific research to several problems of human nature in philosophy. His dismissal of her work seems to indicate a deficiency in his understanding of relating the complexities of human nature to the neural mechanisms of the human brain, especially since Churchland and Pfaff seem to be involved in similar projects. Pfaff is also interested in replacing religious and theological positions that focus on human selfishness and wants to demonstrate that persons are "wired for goodwill" (p. 5).

In Pfaff's view, if a neural explanation of altruism can be described, it is no longer necessary to assume a role for religion in moral formation. If persons knew that they were "wired" for goodness, they could use this knowledge as a basis for changing their behaviors. "A kid could simply say 'I'm good and I know it,' that is, my brain naturally and instinctively produces my good behavior; any other type of behavior would seem unnatural and self-defeating" (p. 163). Statements such as this one indicate a naïve optimism that is present throughout his work without any real engagement with the obvious counterarguments that make his theory highly unconvincing. Pfaff's work demonstrates a cursory reading of the philosophical and psychological sources on human nature that would dispute his claim. His assumption of an easy inferential leap from neural mechanisms to humans "wired for goodwill" masks a multitude of historical, philosophical, and psychological problems with his theory.

Although Pfaff's theory is based on neuroscience, he draws from several areas to support his theory, including sociology, political science, and economics. In his final chapter, he proposes two primary strategies for allowing the altruistic brain circuits to function as they were designed: " … we treat concerns over moral behavior as we would a problem of public health" and "the empowerment of women, lessening the effect of testosterone-driven behavior in society" (p. 251). Both of these suggestions seem plausible at the practical level, but it remains unclear whether ABT theory requires these kinds of solutions; persons who do not adhere to ABT could still endorse them. Is the solution really decreasing "testosterone-driven behavior" or is it decreasing dominant social structures and violence? There is no real evidence to demonstrate that focusing on neural structures involved in altruism will provide a better foundation for morality—as opposed to religion or philosophy.

Philosophers and theologians have often offered more positive perspectives on the altruistic aspects of human nature in comparison to a "selfish gene" perspective. However, whether someone is thought to be good because they have a soul or an altruistic brain, the difficulties that often accompany and cause negative social behavior cannot be overcome so simply, because morality is more than neural function. It is a consequence of multiple layers of causative effects at several levels within the hierarchy of science, including economic, cultural, familial, and psychological. Pfaff offers many interesting descriptions of current research in cognitive neuroscience, which will be of interest to persons not familiar with the field, and his emphasis on the positive aspects of human nature is a welcome change from evolutionary accounts that emphasize human self-interest. However, his theory of how altruism works based on several brain mechanisms requires additional empirical support to be accepted as an accurate description of the more empathetic, benevolent, and compassionate aspects of human nature.

Additionally, Pfaff makes the mistake of assuming that science is self-interpreting. He assumes that properly interpreted neuroscientific research leads directly to conclusions about its moral, philosophical, and theological relevance. Pfaff's theory contains many philosophical assumptions that are not "in the data" themselves, but part of a larger philosophical and at least partially antitheological worldview that goes largely unacknowledged. From a Christian perspective, I think this is the larger problem with the work. Although the science is at times very interesting, the philosophical and theological assumptions are not sufficiently discussed to allow the Christian theist to interact with the material in a critical way. For Christians interested in learning some of the perspectives in evolutionary science and neuroscience on altruism, this may be a helpful read, but for those wanting a more nuanced approach to how this area of science impacts morality and theology, a different source would be required.

Reviewed by James Van Slyke, Assistant Professor of Psychology, Fresno Pacific University, CA 93702.

EDUCATION

MAPPING YOUR ACADEMIC CAREER: Charting the Course of a Professor's Life by Gary M. Burge. Downers Grove, IL: InterVarsity Press, 2015. 138 pages, bibliography, index. Paperback; $14.60. ISBN: 9780830824731.

Gary Burge has provided a valuable resource to those of us whose vocation is that of university or college professor. Drawing on decades working as a college professor, Burge has written a wise and easy-reading book full of sage advice for university faculty. Although professors are well prepared in their chosen disciplines, without a wise mentor, they are often unaware of the patterns that accompany the typical academic career.

Burge identifies the three primary "stages" of development in a scholar's career as follows (p. 23): Cohort 1 is made up of people who have finished their terminal degree and are working toward tenure (typically ages 28–38). Cohort 2 represents midcareer faculty who have been tenured or promoted and have acquired job security (typically ages 34–55). Cohort 3 represents senior faculty near the end of their careers (typically ages 50–70).

Burge identifies some of the most common opportunities and risks that are present within each cohort. The book is replete with stories of professors that exemplify certain patterns found within each of the cohorts (albeit with the disclaimer that the personal details have been changed). The characteristics he describes ring true to me, as I could frequently picture faculty I have encountered along the way who reflect several of the postures and situations he describes.

Burge identifies the traits of cohort 1 as core identity formation, developing peer relationships as well as student and college validation. He identifies the classic risks to this cohort as failures in teaching or scholarship, failing to assimilate into institutional mission and culture, being influenced by cynical peers, anxiety and loss of confidence, and failing to cultivate friendships. Burge wisely emphasizes the importance of a good mentor for those in this cohort. He also acknowledges some of the unique issues that can arise for women in academics. He identifies the primary goal for professors in cohort 1 as finding "security," whether that be in tenure or in a multi-year contract.

Cohort 2 professors are marked by growing maturity and confidence. Burge identifies the traits for this cohort under the categories of developing as a teacher, evolving scholarship, and "finding your voice." The risks he identifies for this stage include the cessation of professional development, egocentric behavior, and institutional dissonance. He also mentions issues that can arise with "hero development," when certain professors are elevated by the college as marquee faculty while other faculty begin to feel less valued and excluded from the "inner ring." Ultimately, he identifies the main goal for cohort 2 to be a sense of well-being, success, and ongoing validation.

Burge suggests that the main question characterizing cohort 3 is "will I find significance?" Some of the traits he discusses in this cohort include core identity issues, competency, and becoming a mentor or sage. He also talks about the importance of "embracing descent" as we end our careers and enter the last stage of life. Some of the pitfalls he identifies for this cohort include disengagement or disinterest, self-absorption, reclusive behavior, and technology anxiety. Burge also describes the issue of the perpetual adolescent faculty member who never grows up—socializing with students as if they were one of them and dressing like a nineteen-year-old. He reminds us that students are seeking faculty to be friendly adults, not friends. He concludes that faculty in this cohort should endeavor to end well, content with our contributions and a sense that it has all been worth it. The chapter includes an addendum with some practical advice about retirement.

Burge's references draw heavily from the field of psychology as well as reports, journals, and books on higher education. Burge is insightful in how he maps general principles in adult developmental stages onto the career trajectory of a professor. One thing that I found disappointing was the minimal time spent discussing a Christian perspective on the vocation of a professor. I suppose I was expecting more theological insights on vocation from Burge, a professor of New Testament at Wheaton College. While he does reference a few resources on the vocation of a Christian scholar, these could have been woven much more explicitly into the insightful discussions throughout the book.

As a midcareer professor who recently faced unexpected twists and turns in my career, I found the book quite helpful. Some of the opportunities and situations he described are ones that seemed to speak to me directly. I could imagine this book being one of the resources in a new faculty orientation program. In addition to new faculty, I suspect many faculty from other cohorts may find this a helpful resource as they reflect on their own academic careers.

Reviewed by Derek Schuurman, a cohort 2 professor who is currently a visiting Associate Professor of Computer Science Computer Science at Dordt College, Sioux Center, IA 51250.

Ethics

BEYOND THE ABORTION WARS: A Way Forward for a New Generation by Charles C. Camosy. Grand Rapids, MI: Eerdmans, 2015. 207 pages. Hardcover; $22.00. ISBN: 9780802871282.

In *Beyond the Abortion Wars*, Catholic ethicist Charles Camosy (Fordham University) looks unflinchingly at the apparent impasse in the US abortion debate between "pro-choicers" and "pro-lifers," and as a solution proposes what he calls the Mother and Prenatal Child Protection Act. Camosy takes the concerns of opposing camps seriously, gleaning insights and skewering falsehoods wherever they occur, and he finds large swathes of common ground that respects both women and their unborn children. In spite of occasional shortcomings in Camosy's arguments, I agree with reviewers who deem this short six-chapter book a "must read."

Chapter one discerns common ground between the pro-choice and pro-life camps by examining US abortion rates and public opinion on abortion. It turns out that merely 2% of America's 1.2 million yearly abortions are due to the hard cases of rape, incest, or when a mother's life is threatened, whereas the remaining 98% are "qualitatively different," that is, as Camosy later argues, they are due to the very real inconvenience/burden of raising a child. (This inconvenience includes the shocking fact that 90% of children diagnosed with Down syndrome are aborted.) Significantly, polls reveal that many pro-choicers wish to restrict abortion in large measure, many pro-lifers are inclined to permit abortion in the hard cases, and both camps want to reduce social pressures on women to abort. In sum: "Though some find themselves on the extremes of the debate, more are in the complex middle"—a complex middle protective of women *and* prenatal children.

Camosy also shows that important US demographics favor this complex middle. More women than men are against legalized abortion. Hispanics (a majority ethnicity in California and growing in Texas and elsewhere) tend to be more pro-life than pro-choice. And the vast majority of Millennials are "trending" in the pro-life/pro-women direction. Contrary to abortion polarizations presented by popular political and news narratives, the "actual facts on the ground" are amenable to a more restrictive abortion policy protective of mothers and their unborn children. Camosy finds this hopeful. I do too.

Chapter two addresses the moral status of the unborn: what, or who, is the fetus? Camosy makes it clear that contemporary science—embryology, fetology, and biology—informs us that the human fetus is, in fact, a human being. The fetus is a genetically distinct, self-governing dynamic entity/individual organism that belongs to the human species. It is not feline or canine; it is human. It is not a cat or a dog; it is a human being. It is not a kitten or a puppy; it is a child. In addition, Camosy rightly points out, "it is simply biologically incorrect to say that [human fetuses] are 'mere tissue' or 'part of their mother.'" To pro-lifers, this is well known. For at least some pro-choicers and for newcomers to the abortion discussion, these facts need to be made clear. (In my native Canada, the Criminal Code mistakenly states that prior to birth the fetus is not a human being.)

Camosy also addresses the important objection that the unborn child, though a human being, is not a "person." That is, the unborn human being lacks some specific developmental feature which confers the right to life. But, as Camosy well argues, this approach to personhood is problematic. The allegedly decisive features fail because they weaken the personhood of many human beings who clearly already have the right to life. For example, if self-awareness and ability to make moral choices are the crucial criteria of personhood, then the right to life of newborn infants as well as sleeping, stunned, or mentally disabled persons is jeopardized. As a result, the equality in equal rights gets ungrounded. Or, if a "low" trait such as the capacity to feel pain is chosen, then, oddly, personhood gets conferred on rats and mice. Camosy's solution is to ground the equality of equal rights in the capacities to know and love (which fits well with the theological notion of being made in the image of God). Helpfully, Camosy sets out a distinction between "the potential to become a human being" (a potential that does not yet have these capacities to know and love, i.e., sperm and egg prior to fertilization) and "the potential for a human being to become" in its subsequent developmental stages (a potential that does have the capacities to know and love, i.e., the union of sperm and egg). Camosy acknowledges that fertilization involves a process; therefore there is some gray area in which Camosy wisely urges caution.

In chapter three, Camosy makes a case for permitting abortion in the few-but-difficult cases, for instance, when pregnancy threatens the mother's life or is a result of rape. Here Camosy's arguments seem weak. He distinguishes between "direct abortion," wherein the aim is to kill the fetus/child, and "indirect abortion," wherein the aim is to refuse aid to the fetus/child, when one has no duty to aid, and so death is a foreseen but unintended result. He also distinguishes between the fetus's "formal" innocence and "material" innocence: the fetus may lack responsible agency (and thus have formal innocence) but be a threat causally (and thus not lack material innocence). For Camosy, these distinctions allow him to hold to the moral principle that "it is always wrong to aim at the death of the innocent" yet permit abortion to save the mother's life or, in the case of rape, cease to aid via an indirect abortion (here Camosy permits the abortifacient RU-486). The terms "direct" and "indirect" are a bit confusing (most abortions are pretty direct, it seems to me), but we can let that pass as Camosy's prerogative in setting out stipulative definitions. Nevertheless, serious problems remain. Doesn't the duty to aid a vulnerable person accrue to us—especially parents—from the very personhood of the unborn? And doesn't abortion violate this duty, intrinsically?

For Camosy's argument to work, the unborn person's alleged lack of "material innocence" requires an equivocation on the notion of innocence in the moral principle that "it is always wrong to aim at the death of the innocent." But, surely, the relevant notion of innocence in the moral principle is wholly "formal." A better way is to recognize the truth that abortion is an evil. Abortion destroys an innocent who is not a responsible agent and clearly is not at all morally ("formally") respon-

sible for its material/causal threatening to the mother in the first place. I sympathize with permitting abortion as "self-defense" if the unborn's continued life materially threatens the mother's life. Still, even in this hard case, the unborn remains a person who is the epitome of innocence and vulnerability and whose deliberate destruction is wrong. So, *contra* Camosy, I think the above moral principle is violated when an abortion occurs to save a mother's life, but this abortion may (i.e., perhaps) be justified, if justified at all, as a lesser of two evils. A case-by-case assessment would be needed. Also, in the case of rape, it seems odd and unjust to punish an innocent for his/her violent conception by another party. It may be politically prudent to permit abortion in the hard cases in order to gain restrictions for the 98% of abortions (I understand and favor this), but we should also continue to think carefully about the lives of all innocents—for their sake and for the sake of truth.

Camosy addresses the challenge of public policy on abortion in chapter four. He argues that the criminalization of abortion in general need not lead to increased deaths of women due to illegal "back alley" abortions because abortion has become a relatively safe procedure (due to advanced medical technology) and there is evidence that previous high estimates of such abortions were fabricated (as admitted by ex-abortionist Dr. Bernard Nathanson, cofounder of the National Abortion Rights Action League). Moreover, because law serves as a teacher, public policy restrictions on abortion can encourage a culture (as illustrated in Ireland and Poland) in which prenatal children are protected, women seeking abortion are not punished as murderers, and illegal abortion providers are, for the sake of political prudence, found "guilty of something less than felony murder."

In chapter five, Camosy argues that "we should consider both prenatal children and their mothers as vulnerable populations," but, and significantly, current abortion "choice" favors neither. As mentioned, over 1.2 million prenatal children are killed annually in the US, whereas only 2% are due to the hard cases. But evidence also shows that large numbers of post-abortive mothers face guilt and increased health problems. Moreover, pregnant women face immense social pressures to "choose" abortion without real options to handle the inconvenience/burden associated with child-rearing. These pressures arise not only from the boyfriend/husband, parents, family, and friends, but also from larger social structures. Significantly, Camosy argues, workplaces are geared to treating all employees as men. Here all of us should take note: "Our social structures force women to choose between (1) honoring their roles as the procreators and sustainers of the earliest stages of human life and (2) having social and economic equality with men." To protect prenatal children and their mothers, Camosy rightly argues, we should protect them from this dilemma.

In the last chapter and conclusion, Camosy proposes, as a way forward, his Mother and Prenatal Child Protection Act. This act would protect the vast majority of prenatal children, allowing abortion in the small percentage of hard cases; as well, it outlines support for women to enable them to keep and raise their babies. Readers from all political stripes, whether "pro-choice" or "pro-life," should consider Camosy's proposal. If the proposal does not end the abortion wars, it may at least reduce the number of casualties.

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CHRISTIAN BIOETHICS: A Guide for Pastors, Health Care Professionals, and Families by C. Ben Mitchell and D. Joy Riley, MD. Nashville, TN: B&H Publishing, 2014. 207 pages. Paperback; $24.99. ISBN: 9781433671142.

Patients, their supporters, and their caregivers are regularly confronted with new ethical issues or new variations of older ones in the light of new medical technologies. A variety of professionals and academics engage in bioethical reflection, expressing their views through the language of their own expertise. Gifted professionals with differing expertise do a valuable service to nonprofessionals by translating and articulating those reflections and positions into language and themes helpful to nonprofessionals directly affected by these issues. *Christian Bioethics* is cowritten by a theologian and a physician who directs a center for bioethics and culture. Organizing most chapters according to a specific case, the authors lead the reader through multidimensional aspects of each case as they apply to more general ethical concerns and realities. In so doing, they open up these dimensions by showing how Christian theology, ethics, and modern medical science interplay in real-life decisions that need to be made in clinical medicine.

All but the first two chapters are grouped following the rubric of Nigel Cameron wherein he distinguishes bioethical issues as those involved in taking life, making life, or remaking/faking life. In an effort to appeal to a broad target audience, including pastors, family members, chaplains, physicians, students, and patients, the authors' case-focused approach risks losing "the roots that sustain the trees" by giving less attention to the underlying beliefs and theories that ground ethical reflections and decisions in their clinical situations. The authors are attuned to this risk to some extent, providing, in very basic terms, their worldview-level starting points. Both authors are committed to the basic

Christian beliefs codified in the Apostles' Creed. They affirm a Christian worldview that envisions the world as God's world, all aspects of which are intercompatible including faith and science and their expression in theology and medicine. The discussion section of most chapters is written as a dialogical exchange between the authors, a method that gives some down-to-earth character to the book but sometimes disrupts the flow of the reading when topics change from medical to theological and back. Each chapter also has excellent leading questions listed after the case. These are helpful starters for reflection and discussion about the case and about the authors' interpretive details that follow each case.

The first chapter highlights key historical elements of biomedical ethics, starting with the role of the Hippocratic Oath in ancient Greece up until the present. The authors make important points about the transformation of the Oath into Christianized versions and into gutted, secular versions that reflect modern medical allowance for practices forbidden in the Oath. While mentioning claims that the Oath was likely influenced by polytheistic Pythagoreans, they fall short of acknowledging further suggestions by scholar Ludwig Edelstein and by Cameron that Pythagorean ideals may have characterized a reform movement against common practices of abortion, suicide, and having sexual relations with patients. In addition, the authors note covenantal aspects in the relations between the Oath-taker and his mentor, but they do not mention the contrasting codal nature of specified prohibitions. This distinction is important since ethical guidance for modern medical practice also tends to emphasize codal "dos and don'ts" rather than relational aspects that form the ethical core of practice. A number of formative twentieth-century bioethicists from different Christian traditions are also highlighted. However, the reader may have difficulty understanding why some positions of professed Christians may resonate more with biblical themes and teaching than others, due to the short text devoted to each bioethicist. For example, the authors allude to the important influence of Joseph Fletcher's thinking on contemporary changes in the Hippocratic Oath. However, his situationalist approach also contributed to a paradigm shift in bioethical thinking, deemphasizing the influence of basic ethical beliefs while attaching greater importance to individual conditions and contingencies of bioethical situations. The authors conclude by favoring the covenantal approach of William F. May and the virtue ethics of Edmund D. Pellegrino and David C. Thomasma, positions strongly supported and promoted by this reader as well. However, they could have given more substance to the cases and discussions by including more intentionally the impact of these favored approaches on their own positions in the chapters.

Chapter 2 brings the basic premises of the book and the perspectives of the authors into sharper focus, perspectives grounded in biblical hermeneutics. They review popular views on the role of scripture in ethical reflection, themselves understanding the Bible as "canonical revelation of God's commands and Christian virtues." But they also rightly appreciate additional interpretive nuances for gaining insights from scripture for ethics. Citing Kyle Fedler, they note that scripture is diverse in its historical and cultural contexts, and in its literary character. Laws and commands under the old covenant must always be interpreted in the light of the new covenant which fulfills the former. The chapter concludes with very helpful suggestions on fostering good communications between patient, caregiver, and support persons and on using good analytical judgment in making medical decisions. The authors point out that, if needed, ethical committees and consultants are available in most care centers today to assist in making difficult decisions.

The remaining six chapters deal with cases involving a broad range of topics including abortion, end-of-life decision making, assisted reproductive technologies, organ donation, cloning, and technologies applied to transhumanist aspirations of life extension and immortality. In chapter 5, the authors present the science of reproductive methods in terms understandable to most laypersons and pastors. Here they weave in their own views as well, such as their nonendorsement of freezing surplus embryos after in vitro fertilization. The chapter on cloning and hybrids is laid out with similar detail and care, though the discussion of triple genetic parenthood among embryos created to prevent mitochondrial disease may not, despite the authors' laudable efforts, be appreciated fully by laypersons due to complicated subject matter. It was disappointing that induced pluripotent stem cell technology—and its theological and ethical implications—was not discussed as a possible alternative to embryonic stem cells for developing therapeutic biological therapies; it received only a fleeting mention in chapter 2. This relatively new technology involves the formation of cells that have many molecular and physiological qualities of embryo-derived stem cells but are developed through the dedifferentiation of mature, adult cells. Such cells are very promising as sources of biological therapies but, for many Christians, are associated with fewer, if any, ethical concerns compared to the stem cell derived from the destruction of human embryos.

While there is a growing number of books on bioethical topics now available for use in Bible studies and other discussion groups, I think this is a particularly well-organized book with a more focused application of the evangelical perspective of the authors than other books

of its kind. The authors do a commendable job in leading their target audience of mainly nonprofessionals into topics whose technical and biological complexities are made far more understandable through the authors' sensitivities and interpretive skills. They show how scripture and science are complementary, yet both need to be understood and their nuances appreciated by Christians in order to develop biblically informed approaches to contemporary bioethical issues in the light of new technologies that affect medical care.

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History of Science

FOUR REVOLUTIONS IN THE EARTH SCIENCES: From Heresy to Truth by James Lawrence Powell. New York: Columbia University Press, 2015. 384 pages. Hardcover; $35.00. ISBN: 9780231164481.

In *Four Revolutions,* James L. Powell describes the very human process of introducing new ideas and the winnowing that occurs before general acceptance. Powell is a very accomplished geoscientist whose credentials include presidencies of Oberlin College, Reed College, and Franklin and Marshall College. He served at the request of both Ronald Reagan and George H.W. Bush on the National Science Board. Powell is a geochemist by academic training from a doctorate from MIT. He writes very well, and at a level suitable for science-literate high school graduates. The book's four sections cover the ideas of deep time, continental drift and plate tectonics, meteorite impacts (structures and ecological effects), and climate change. In each case, a compact but salient history is given, along with the names of key thinkers and the dates of importance.

In the initial section on time, we encounter the roots of the humorous (if one has a sense of humor), trite disregard that physicists, in particular, have for geology. Most attribute this disciplinary disdain to Ernest Rutherford, late in the nineteenth century. However, it actually goes back at least as far as the 1860s, when Lord Kelvin vilified the lack of temporal precision in geological arguments. Kelvin's 1868 "assault," in Powell's words, was rebutted by the then-current president of the Geological Society of London, T.H. Huxley: "Mathematics may be compared to a mill of exquisite workmanship, which grinds your stuff to any degree of fineness; but nevertheless, what you get out depends on what you put in …" Huxley also wisely stated that, "It is the customary fate of new truths to begin as heresies."

Powell continues to entertain us with tales of the efforts of succeeding geologists, physicists, and geochemists to extract Earth ages from geological materials and processes. Approximations of earth age were scattered from hundreds of thousands to billions (from Kelvin's student John Perry) of years. The advent of using radioactivity as a clock for elapsed geologic time gave the scientific community one of its true pioneers and enduring stars, Arthur Holmes. Beginning about 1908, he developed a grand array of hypotheses and brilliant time-related concepts, wedding radiometric age determinations with observed geological phenomena. In my mind, Holmes became academically immortal when he published the geology text, *Principles of Physical Geology* in 1944, a text that has never been surpassed in scope or insight. After Holmes, various researchers extended the early techniques, producing more and more sophisticated estimations of geologic time. More recent studies have really only refined the excellent foundation established after Holmes. Note that among his other accomplishments was an amazing explanation for global tectonism, a "preview" of the greater confirmation of plate tectonics in the 1960s.

Part II of the book brings global tectonic ideas into a historical context. Early world maps constructed from ocean navigation inspired conjecture about the apparent fit of coastlines, Africa into South America as a prime example. This puzzle-piece matching remained whimsy until the early 1900s. The book gives us a summary of how science is a purely human enterprise, and ideal explanations are arrived at despite many limitations of methods.

Sin, though not explicitly stated, plays a big role throughout Powell's book, in exhibiting how personalities are barriers to intellectual progress. In the case of Alfred Wegener, astronomer turned atmospheric researcher and geology "amateur," there was demonstrated bitter opposition to his (and others') concept of continental drift, for both good and bad reasons. Wegener's publications from just before and after World War I, proposed many interesting and plausible explanations for the existence of joined continents in the past. Some scientists were immediately in agreement, but other prominent geologists and physicists were not only opposed, but rudely so. Ego, perhaps jealousy, the lack of collegial connectedness (not a geologist), and probably Wegener's German nationality all slowed the acceptance of the mega hypothesis. Some of US geology's biggest "guns," such as Stanford's Bailey Willis, were brutal in countering Wegener and the concept.

Powell writes of additional pros and cons, believers and unbelievers, concerning the mobile earth, but the Wegener episode is the most significant story until the early 1960s. A wonderful boom in post-war (WWII) technology and exploratory spirit built the background

for elevating the continental drift idea into plate tectonics as the geoscience paradigm. Many innovations, including paleomagnetism, sonar mapping, K-Ar geochronology, and submersible ocean-floor vehicles enabled the development of a plausible mechanism for "drift" beyond Wegener's "guess" and Holmes's 1929 almost-correct idea (p. 98).

The third topic (Part III), meteorite impact structures, was initially controversial because such features, as we now acknowledge them, were originally proposed as "crytoexplosives," a blast of igneous origin up from deep below. The counter interpretation of "astroblemes" or extraterrestrial impacts came from careful observation of Earth structures (notably by the USGS luminary Eugene Shoemaker and maverick Robert Dietz) in comparison with those discovered on the moon in the space race days (mid- to late-1960s). Back in 1933, Columbia University's Walter Bucher had followed the lead of G.K. Gilbert, essentially attributing all crater features as volcanic. The book goes on, as in the earlier sections, to show how the old and stubborn hypotheses were worn away by multiple lines of evidence. The stage was then set for a bigger revelation to hit in the 1980 *Science* article "Extraterrestrial Cause for the Cretaceous-Tertiary Extinction" by the Alvarez father and son team. Some researchers still have doubts, but the data in support of a meteorite impact of grand proportion in the Yucatan vicinity has grown to general acceptance as explanation for the close of the Mesozoic. Powell hides little of the rancor involved in opposition to the hypothesis. The sin of pride is all too evident among academic scholars.

As the final section, Part IV brings what I perceive as Powell's main interest into focus. His heading, *Global Warming*, is chosen instead of climate change. That in itself is telling. For the first time, the book covers a controversy significant beyond the scientific. This issue continues to rage today in the public realm, even though its great support from qualified scientists establishes the key hypothesis as firmly as any of the others described. Powell begins this section by introducing us to the brilliant G.S. Callendar, engineer and amateur meteorologist from the UK. His intuition and calculations involving the atmospheric system led to the first correct correlation between CO_2 abundance and temperature regulation in 1938. Svante Arrhenius, who won the Nobel Prize in Chemistry, 1903, had already played with the same idea. Neither the modest engineer nor the famous chemist was much remembered as the significance of an altered atmosphere became a huge ideological battleground.

Powell leads readers carefully through the ups and downs of technical advances in understanding the relationship between human activity, especially the burning of fossil fuels, and the effect on climate systems. Warming is but one result of the extremely rapid (in geological reference) disturbance of the linked atmospheric-oceanic mega-system. Unlike the other three "revolutions," that of global climate change is still developing, trying to overcome opposition from political and vested economic interests (not scientific opposition). There is strong scientific support for the conclusions of the Intergovernmental Panel on Climate Change. Plainly, human beings have caused to increase and continue to increase the amount of atmospheric "greenhouse" gases, such that Earth's climate is growing hotter, less predictable in terms of weather events, and more prone to spawn events of greater severity with risk to life and property. This last of four revolutions needs everyone's attention and willingness to act for reversing destructive lifestyles.

I am aware of many books that seek to popularize the stories behind great scientific advances. Powell's book is comprehensive but not overly long. It probes the personalities involved but without sensationalism. I learned many details that contributed to my understanding as an earth scientist, and am certain that others, scientists or not, will gain interesting and useful insights in the reading. I would recommend the book for general interest as well as a potential asset for a seminar course emphasizing the history of geologic thinking.

Reviewed by Jeffrey Greenberg, Professor of Geology, Wheaton College, Wheaton, IL 60187.

Mathematics

MATHEMATICS WITHOUT APOLOGIES: Portrait of a Problematic Vocation by Michael Harris. Princeton, NJ: Princeton University Press, 2015. xxii + 438 pages, with endnotes, bibliography, and index. Hardcover; $29.95. ISBN: 9780691154237.

Why should we encourage people to study mathematics, and why should scarce resources be allocated for mathematical research? Should mathematics be pursued because it provides a theoretical core for technological applications that make our lives easier and better, the Golden Goose argument? But while abstract theories may one day become practical (number theory gave us modern cryptography, the basis for secure online transactions), there is no guarantee that they will ever lay such an egg. Nor is this the express motivation given for the work pure mathematicians do. Furthermore, mining mathematics for commercial possibilities can be harmful instead of beneficial—recall the crash of 2008 engineered by greedy risk-takers wielding mathematically based financial instruments. (Harris was warned away from indicting the quants who promoted the widespread use of derivatives, but chapter 4 lays out

the arguments against them as described in the mathematical press.)

Is mathematics rather to be valued because it provides access to absolutely true knowledge? The notions of truth and certainty, however, are no longer considered central to mathematics. Are arcane results in abstract algebra or topology true, or do they merely follow logically from the axioms and definitions we have chosen? Mathematicians still believe that they are exploring something meaningful, and they want their concepts to carve mathematical reality at its joints, but that reality is taken by many to be socially constructed by experts rather than given in any independent sense.

If we cannot appeal to the Greek ideals of the Good or the True as the ultimate rationale for mathematics, what about Beauty? Do mathematicians create mathematics because they find it beautiful? This ploy likely strikes nonmathematicians as odd—where is the beauty in long division or fraction calculations or in factoring polynomials? Yet those involved in mathematics, especially at more advanced levels, do experience beauty in the simplicity and elegance of certain proofs and in the unexpected ways seemingly disparate ideas combine to produce significant connections and generate meaningful insights. In fact, beauty was G.H. Hardy's main justification for doing mathematics in his well-known booklet *A Mathematician's Apology* (1940).

Readers who pick up Harris's *Mathematics without Apologies* (hereafter: *MWA*) will immediately recognize the allusion to Hardy's classic. While the title's use of negation rightly leads us to expect that Harris will take a somewhat different approach to answering "Why mathematics?," each book is, as C. P. Snow noted in his foreword to Hardy's work, "the testament of a creative artist." In Harris's case, the term *testament* may connote a more settled form than he would prefer. As he says in the preface, "this book pieces together fragments found in libraries, in the arts, in popular culture, and in the media, to create a composite picture of the mathematical vocation." Harris wants to give the reader a sense of what it is like (for him) to be a mathematician in the early twenty-first century. His area of specialty, for which he was awarded a prestigious Clay Research Award in 2007, is in a part of number theory connected to abstract algebra: in 2001, he and a colleague proved the local Langlands conjectures for certain general linear groups. As you might expect, little of this can be explained in a work aimed at the general reader, as *MWA* is. Harris attempts, nevertheless, to discuss key aspects of number theory (solving polynomials in two variables) that underlie his work, presenting this in a series of five interspersed chapters titled *How to Explain Number Theory at a Dinner Party*. He undoubtedly succeeds better here with a mathematically trained reader than with his partly fictitious performing artist, but the mathematical community might benefit from more mathematicians explaining the basics of their research work to the public, at least to their colleagues in academia.

In chapter 9 Harris describes the creative process that produced some of his mathematical results. In addition to talking about the sequence of events, collaborators, and mathematical ideas that moved him away from the topic of his doctoral dissertation into the area in which he contributed to the Langlands program, he describes how a number of key ideas came to him and were further clarified over time, beginning with a mathematical dream that activated his unconscious in an unusual way. Readers familiar with Hadamard's pioneering 1945 *Essay on the Psychology of Invention in the Mathematical Field* will find this autobiographical narrative quite fascinating, as I did.

MWA is a wide-ranging idiosyncratic nonapology for mathematics. A whole chapter is devoted to "An Automorphic Reading of Thomas Pynchon's *Against the Day* (Interrupted by Elliptical Reflections on *Mason & Dixon*)," and Harris also discusses a number of films (e.g., *A Beautiful Mind* and *Pi*) and plays (e.g., *Proof*) that touch on mathematics. These references exhibit the author's familiarity with literature and art and allow him to discuss the extent to which mathematics might be an art as well as or instead of a science. Harris also riffs on various themes (oh, yes; he explores connections between mathematics and music, both classical and rock) pertaining to the sociology and morality of knowledge, philosophy of mathematics, foundations of mathematics, history of mathematics, Eastern metaphysics, twentieth-century Russian mysticism (the mathematical "name-worshippers"), the etymology and significance of words such as *charisma* and *tricks* for mathematical practice, and more. Other reviewers have termed his treatment of such matters "erudite," but Harris insists his approach is more personal than scholarly.

Before I summarize his nonapology for mathematics, I would like to make a few comments about foundations and philosophy of mathematics, which may be of interest to readers of this journal. Given Harris's background in category theory, one might expect him to promote Homotopy Type Theory (Voevodsky's Univalent Foundations of Mathematics) as an alternative contemporary foundation for mathematics. He says only a few things about this in the book, explaining on the book's companion website, https://mathematicswithoutapologies.wordpress.com/, that he is not well versed in homotopy theory. But he does entertain the possibility (pp. 65, 219) that this may eventually become a new implicit foundation of mathematics

by providing the conceptual tools and a unifying language for talking about and organizing a broader range of mathematical matters than the present set-theoretic foundation does.

Standard logical Foundations of mathematics (Harris capitalizes this to suggest imperial overreach) was the central focus of Philosophy of mathematics (ditto) for about the first half of the twentieth century. In the last quarter or so of the century, however, philosophy of mathematics (lowercase) has begun to take greater notice of mathematics as it is actually practiced by mathematicians. Harris terms this the philosophy of mathematical practice, and he clearly appreciates what has been accomplished here by Imre Lakatos, David Corfield, and others. Some see this new trend as turning away from Platonism in mathematics and toward postmodernism; not all readers will find this development as welcome as Harris does. Harris thinks philosophy/foundations of mathematics should not be so focused on truth or epistemology or on trying to construct the firm bedrock for grounding all of mathematics. Mathematics is a fully human activity done collectively under the elite leadership of those who have earned their charismatic stripes through successfully introducing and pursuing significant research programs. As such, it is a fallible and not fully rational enterprise, involving ethical motivations, conjectures, and intuitions about dimly perceived realities; disruptive shifts in focus and methodology; changing connections to what is considered central; and so on. Proof and rigor still have a place in confirming mathematical intuitions, but they should not be viewed as the essence or main task of mathematics.

MWA is not Harris's first attempt at answering "Why mathematics?": his twelve-page essay in the highly regarded *Princeton Companion to Mathematics* (2008) under this title introduced some of the same themes. *MWA* greatly expands these ideas within the context of a personal portrait of a working mathematician. And while *MWA* may not be a conventional apology for the existence of mathematics, it does explore why people do it, most pointedly in chapter 10. Mathematics, Harris says, is a free creative activity, subject only to certain social constraints as a tradition-based/tribal activity and (eventually) to the strictures of logical consistency and proof. It may lead to practical applications (one of the reasons why mathematicians should still be employed by universities), but mathematical research is best pursued as a "relaxed field"—for its own sake, unconstrained by utilitarian demands, akin to play. The clearest thing one can say about why mathematicians do mathematics is simply that they experience deep pleasure in uncovering abstract patterns and in solidifying intuitions about conceptual entities that intimate (are "avatars" of) still further realities to be explored. On this note, Harris's nonapology elaborates and refines Hardy's apology in the context of contemporary research mathematics.

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ORIGINS

A NEW HISTORY OF LIFE: The Radical New Discoveries about the Origins and Evolution of Life on Earth by Peter Ward and Joe Kirschvink. New York: Bloomsbury Press, 2015. 400 pages. Paperback; $10.97. ISBN: 160819907X.

A New History of Life is a natural history that stands out because of its large timescale (4.567 billion years, to be precise) and broad intended audience. Overall, it delivers on the promise of its title adjective, describing new findings and hypotheses connecting paleontology and geology, and offering genuine but grounded scientific speculation for future work. For the general reader, it provides a wealth of new information, but because its overall scientific narrative lacks momentum and internal connection, it may be most appropriate for a scientifically literate audience.

It is impressive to watch the authors address the central challenge of this genre, which I have faced myself in my writing for a general audience: How do you filter oceans of information and translate it into general terms? Ward and Kirschvink set up their filter by emphasizing physical evidence, and rocks and bones in particular. Their geological and paleontological emphasis gives this story a different tone and tempo than other natural histories that start with the Big Bang (physics) or the characteristics of life (biology). My own discipline, chemistry, is not as deeply integrated as a result—here, chemistry plays a role in dating the rocks and bones, and in transforming the environment, but the authors focus their attention on the change and flow of continents (and other aspects of geology) and body plans (developmental biology).

The flip side of the authors' emphasis is their de-emphasis. They deemphasize evidence from genetic clocks and other results from molecular biology, leading them to a chain of reasoning that is mostly geological in nature. For example, they favor a very late evolution of water photosynthesis. Personally, I trust the genetic clocks that show how many forms of photosynthesis, including water photosynthesis, evolved much earlier than Ward and Kirschvink allow. But this is a moot point—a few hundred million years one way or the other does not change the story much for the general reader.

A New History of Life reads at the level of an undergraduate science text. Ward and Kirschvink recount

the back-and-forth narrative of scientific discovery and rebuttal as hypotheses are set forward and discarded. If the reader already understands how science works, these sections depict the drama of science in enjoyable detail. Sometimes the details seem superfluous, as when some sections list other scientists in the field but without enough detail to make them distinct characters. A surprising number of the images in the book depict scientists working in the field, but they do not convey much information to the nonspecialist.

The scientific detail is both an advantage and disadvantage. For example, the first chapter is all about geological nomenclature, which is too dry for a general reader. Throughout the book, the authors provide precise biological and geological terms for organisms and places, but a better description of these would make the story more relevant. A photo of a fossil skull is not clearly connected to the chapter around it, and lists of details on dinosaur names and the shapes of lagoon habitats provide detailed "dots" of data, but they do not seem connected.

At such points, the book becomes more like a required course assignment than the flowing story it could be. On page 80, the authors write, "We apologize for the complex chemistry necessary in the preceding section. But to get this story right requires complexity." If this statement had been placed before the section it described, the general reader would read that section differently—as it is, it amounts to locking the barn door after the horse is gone.

These narrative nits having been picked, this book is indeed new and interesting, both substantial and helpful for the prepared reader. In the chapters on the origin of life, the authors focus on the "RNA world" hypothesis, and include new findings that support this hypothesis, such as the nucleotide synthesis discovered half a decade ago by Sutherland and colleagues, but fail to cover recent experiments that point to "metabolism-first" explanations. The "new" hypothesis in this section is that life started on Mars, which is interesting and possible, but given the difficulties and distances, more speculative than other new proposals in the book.

Another "new" hypothesis the authors develop in several places is that major events such as the Cambrian explosion and particular extinctions were started by "true polar wander" events. One true polar wander event coincided with the Cambrian explosion, but my enthusiasm is tempered by the fact that there have been thirty or so of these events throughout history, which is a number large enough that the timing may be more coincidence than cause. A graph of the thirty events would have addressed my own skepticism but was not included.

The hypothesis I am most attracted to appears throughout the book, but may have been deemphasized by the authors because it is not all that "new." Ward and Kirschvink frequently allude to the power of oxygen, both at and after the Cambrian explosion. They connect oxygen to animal diversification and extinction more intimately than any other general text, and oxygen's influence is found in nearly every chapter. This is an exciting and intriguing thread to follow throughout the narrative, but it could have been emphasized more.

Curiously, in a section on dinosaur morphology, they downplay the power of oxygen. On page 266, they begin a paragraph with the statement, "No evolutionary history can ever be pinned on one factor." The paragraph ends, "Nevertheless, oxygen levels must have played a part." This apparent underselling of the organizing chemical power of oxygen brought to my mind the stories of how Einstein resisted the Big Bang because of its implication that the universe had a beginning. But, as is common for popular science, philosophical and theological implications are kept implicit.

Another major theme of this book that is powerful (but not really new) is the generative power of past extinction events. As Ward and Kirschvink put it, "Over and over, however, it really looks like a dominant theme in the history of life is that times of crisis promote new innovation." Many scientists from many fields, including myself, have converged on this finding, and it deserves to be repeated many times. What does that tell us about what kind of universe we call home?

The authors close the book by extrapolating the billion-year trends of change in carbon dioxide and oxygen levels into the distant future. This is an obituary for the future earth in which CO_2 runs slowly out of the atmosphere like air running out of a balloon.

In a book that tends to avoid large metaphors, this section stands out: "The fate of the nautilus is a metaphor for all animal life. Sooner or later evolution, competition, and the natural changing of our Earth and sun as they age will make any body plan obsolete." The authors describe a bleak future that gives the sense of the universe running down and flickering out, which is accurate as far as science goes, but philosophically and theologically truncated.

In summary, this book is an excellent example of recent evidence in the history of life, with special emphases on geology and paleontology. Anyone with an interest in those two sciences will find new ideas and directions in these pages. The most powerful conclusions—the emerging consensus on the driving role of oxygen and the creative power of even the most devastating extinctions—give a sense of the vitality of life and the

orderliness of creation that is somewhat at odds with the deflating final chapter. Here, new evidence is presented well, and its ultimate implications are left for the reader to ponder.

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Philosophy & Theology

STATE OF AFFAIRS: The Science-Theology Controversy by Richard J. Coleman. Eugene, OR: Cascade Books, 2014. xii + 272 pages. Paperback; $32.00. ISBN: 9781625647016.

If the title of Richard Coleman's first book at this intersection, *Competing Truths: Theology and Science as Sibling Rivals* (Bloomsbury, 2001), highlighted the contrasts but worked toward synthesis, the main title of the present book, almost fifteen years later, suggests a *status quaestionis*, but actually urges that whatever synthesis might be previously either promoted or achieved is premature given the disparate methodologies. Perhaps this is in part because in the intervening period, Coleman's *Eden's Garden: Rethinking Sin and Evil in an Era of Scientific Promise* (Rowman & Littlefield, 2007) scrutinized the sciences from a theological vantage point and observed that scientific inquiry, no less than any other human venture, is not less susceptible to overreaching in its pursuit of inquiry and knowledge, and hence he has become much more sanguine and realistic about the scientific enterprise. *State of Affairs* thus suggests that while the value of science should not be underestimated, we ought not to overlook the differences between it and the theological disciplines.

Now Coleman is advocating neither the classical "conflict" thesis nor the two-truths or independence model of more recent provenance. Instead, he engages more specifically and most extensively with what he calls the movement of "new rapprochement" (NR) between theology and science represented in the last generation by the contributions of Ian Barbour, Arthur Peacocke, and John Polkinghorne, among others. Coleman's argument is that NR, while helpful in various respects, also has been too accommodating to science, its constraints and empirical methods, and thereby has both minimized theology's distinctiveness and subjected its work to scientific frameworks and presuppositions. Along this latter route, theology subordinates its task of clarifying the deposit of revelation to that of "keeping up with the sciences" (my colloquialism), so to speak, and thereby forgets its prophetic stance of readiness to confront critically the shortcomings inherent in all human undertakings.

Note that Coleman writes not as a scientist for scientists but as a theologian for his peers. From my own vantage point as a theologian looking to engage the sciences, I am grateful for this timely reminder about the differences between both endeavors. Yet insofar as the modern sciences are driven in principle by the quest for ever-expanding knowledge, they have threatened, if not dethroned, theology from her status during the medieval period as "queen of the sciences." Hence, if science can overreach, part of the question is whether theology has its own realm and, if such, is anything less than all-there-is. It should not be surprising that if the extent of science's reach is contested even among those working in that arena, the scope of theology—for example, whether it concerns the existential depth of the human experience or the eschatological horizon of the cosmos or the transcendent dimensions of the world, or any and everything at all!—might itself not be amenable to clear definition. The extent to which theologians disagree about these matters will incline them to engage with Coleman's thesis divergently.

In the end, what Coleman wants, charitably put, is for theologians to take a more appropriately disputational, even prophetic approach to the sciences, with such contesting and disrupting capacities understood as theology's gift to scientific inquiry. Yet as the scientific method is itself designed to continually question what we know, theologians do not have a corner on the disputational market. This is not to say that theologians ought not to pose hard questions to science, or even that theology might not make a difference in the scientific domain. It is to say that the stance recommended by Coleman might be less confrontational than intimated. Here the carefully developed proposals over the last two decades plus those of Robert John Russell—to whom Coleman refers in passing on a few occasions but does not engage in any depth—deserve to be carefully studied.

Coleman's constructive way forward is complicated on two fronts: first, by the long history of fundamentalist, creationist, and intelligent design voices that understand themselves as disputational interventions vis-à-vis the sciences; and second, by the fact that in the twenty-first century, Christian theology's voice in the religion-science interface is one among other religious traditions engaging and even challenging the sciences. So the question is how to promote a disputational stance that is constructive for the wider conversation (as opposed to being merely reactive as on the former trajectory) and that is distinctive in a pluralistic world (as opposed to being perceived as merely attempting to get a leg up in a crowded field). When understood diachronically and historically in light of the last millennium of Christian theology's love-hate relationship with the sciences, the question can be expanded: what kind of theology or theological method can be an appropriate "queen"—on the one hand, being bold and prophetic while on the

other hand, also humble in recognizing its self-limitations (limitations that are pertinent to all human efforts, which Coleman grants: p. 245) vis-à-vis other bodies of knowledge?

My own proposal (developed elsewhere) has been that such a theological approach should be distinctively pneumatological, following out of the Day of Pentecost metaphor that understands the many tongues inspired by the Spirit as also heralding the witnesses of the many faiths and the many scientific disciplines. This allows both the possibility of honest engagement with others from the standpoint of difference and also the capacity to receive from them in turn. If this is correct, then the way forward involves an enrichment of NR, not its curtailment, and this itself might open up to a healthier, even if no less controversial, "state of affairs" for the next generation of theology's engagement with the sciences.

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TECHNOLOGY

THE WAR ON LEARNING: Gaining Ground in the Digital University by Elizabeth Losh. Cambridge, MA: The MIT Press, 2014. 240 pages, notes. Hardcover; $32.95. ISBN: 9780262027380.

The battle lines are being drawn with faculty and students on opposing sides. Students are armed with weapons of mass distraction—cell phones, social networks, and all sorts of digital media at their fingertips. Faculty members are ready to fight back with PowerPoint slides, online quizzes, and plagiarism detection software. But are these truly the forces in opposition in higher education today? That is the central question within Elizabeth Losh's *The War on Learning: Gaining Ground in the Digital University*.

One does not need to look far to find examples of how educational technologies are being deployed throughout higher education. From classroom response systems ("clickers") to flipping the classroom (i.e., moving the lecture portion to video viewed outside of class time), from social media back-channels in large lecture courses to Massive Open Online Courses (MOOCs), there is a wide array of technologies being implemented in universities today. Some faculty members decry these as mere novelties, or even as impositions signaling the end of academia as we know it; others embrace these types of innovation as the salvation of higher education in a world where the stuffy stodginess of the Academy is becoming less relevant to the needs and interests of the students it is purported to serve.

The truth is perhaps—as it so often lands—between these poles. And while arguments about the value and impact of technology integration can be made across the spectrum, for those striving to teach Christianly in higher education, or even articulate a distinctively Christian approach to tertiary education, we need to recognize the competing worldviews of both poles. Thus, we must explore the contrasts of the philosophical and the pragmatic, the historical and the contemporary in university culture. And, most of all, we must wade into the murky middle ground where overlapping and contrasting interests are most likely to come into conflict.

This messy intersection of the historic Academy and the digitally infused twenty-first-century life is home territory for Losh, who serves as director of the Culture, Art, and Technology Program at Sixth College at the University of California, San Diego. This innovative program sits at the intersection of historic liberal arts academia and contemporary media and technology. The Culture, Arts, and Technology Program is a required interdisciplinary course sequence for first-year students at Sixth College; it might best be described as a "digital humanities" program, aimed at developing research, writing, and communication skills in the context of twenty-first-century digitally enhanced culture. Among her research interests, Losh lists media theory, digital rhetoric, democracy and media culture, and critical theory. In *The War on Learning*, she draws these interest areas together in an examination of contemporary academic culture in higher education.

Her opening chapters are expository, and concern the nature of today's university students and how their attitudes and practices stand in contrast with the mindsets of college faculty and administrators. Faculty may eye students as "cheaters" or "hackers"; this attitude prompts, at best, a defensive posture on the part of instructors and, at worst, a mindset of "get them before they get us." As Losh puts it, "This book explores the assumption that digital media deeply divide students and teachers and that a once covert war between 'us' and 'them' has turned into an open battle between 'our' technologies and 'their' technologies" (p. 25). And it certainly seems that these two groups might be "at battle" in a high-tech arms race in the classroom, but Losh calls into question what battle is truly being fought. She argues that "each side is not really fighting the other … both appear to be conducting an incredibly destructive war on learning itself by emphasizing competition and conflict rather than cooperation" (p. 26).

It is through this lens that Losh goes on to examine a variety of technological interventions in higher education, offering illustrations of real-life tales of technology integration gone wrong. She uses these vignettes of failure to provide commentary on the context of the

innovation; she also critiques the assumptions being made about the students, the instructors, the technologies, the nature of learning, and the view of education as exemplified in each example. Specifically, she devotes a chapter to exploring each of the following educational technologies: online lecture videos, course podcasting, open courseware, plagiarism-detection software, widespread distribution of handheld devices (e.g., tablet computers) to students, and the gamification of education.

Her final chapter, "Gaining Ground in the Digital University," provides direction and encouragement for the future. Here Losh provides helpful principles to guide effective pedagogy and decision making, such as, "The Golden Rule should dictate decisions about instructional technology" (p. 224), meaning that faculty should not subject students to pedagogies or technologies that they themselves would not like to have used "against them." Likewise, she suggests that "old" technologies still matter, and she cites a digital rhetoric specialist who lists "paper, crayons, scissors, tape, the Web, their smartphones" as essential tools for teaching computational media (p. 229). It is encouraging that Losh admonishes faculty and administrators that, when considering which technologies to implement, "the novelty should have worn off. The worst reason to implement a new instructional technology is because it is new" (p. 236).

Overall, Losh meets the objective she provides in the introduction: "This book tells the story of initiatives that fail because they treat education as a product rather than a process" (p. 8). Her storytelling and analysis of how and why things went wrong emphasize this point, and invite the reader to consider application to his or her own institution. *The War on Learning* would be valuable reading for all university personnel who have a hand in technology decision making—from administrators, to faculty members, to instructional designers, to those providing technical support. Losh's work gives much fodder for discussion among university personnel who are considering various technologies as part of their own teaching and learning environment.

For Christian educators, there is much wisdom that can be gleaned here, although Losh is not writing for a distinctively Christian audience. If education is not primarily about information, but rather about formation, as James Smith indicates in *Desiring the Kingdom* (Baker Academic, 2009), the way we teach students truly matters. The technologies we select, and the way we integrate them with the pedagogies we practice, will have an impact on this formation. Educational technologies, like all tools, are not neutral; they in fact embody a worldview in their design. Carefully considering the fit of a particular tool with one's preferred pedagogy, and its harmony with one's beliefs about teaching and learning is the first step in improving our use of educational technologies. Rather than acting as combatants in a war on learning, perhaps faculty and students can collaborate to explore how technology can be used in ways that improve both teaching and learning.

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